Friends Creek Watershed

Resource Inventory & Plan

July 1, 2019

MACON COUNTY SOIL AND WATER CONSERVATION DISTRICT

Olson Ecological Solutions, LLC

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FRIENDS CREEK WATERSHED
RESOURCE INVENTORY AND PLAN
EXECUTIVE SUMMARY

Written by Angela Daily and Rebecca Olson

What is a Watershed??

A **WATERSHED** is a land area that channels rainfall and snowmelt to creeks, streams, and rivers, and eventually to outflow points such as reservoirs, bays, and the ocean. The size of a watershed is defined on several scales—referred to as its Hydrologic Unit Codes (HUC)—based on the geography that is most relevant to its specific area. A watershed can be small, such as a modest inland lake or a single county. Conversely, some watersheds encompass thousands of square miles and may contain streams, rivers, lakes, reservoirs, and underlying groundwater that are hundreds of miles inland. The largest watershed in the United States is the Mississippi River Watershed, which drains 1.15 million square miles from all or parts of 31 U.S. states and two Canadian provinces stretching from the Rockies to the Appalachians! Water from hundreds, and often thousands, of creeks and streams flow from higher ground to rivers that eventually wind up in a larger waterbody. As the water flows, it often picks up pollutants, which may have sinister effects on the ecology of the watershed and, ultimately, on the reservoir, bay, or ocean where it ends up. Not all water flows directly to the sea, however. When rain falls on dry ground, it can soak into, or infiltrate, the ground. This groundwater remains in the soil, where it will eventually seep into the nearest stream. Some water infiltrates much deeper, into underground reservoirs called aquifers. In other areas, where the soil contains a lot of hard clay, very little water may infiltrate. Instead, it quickly runs off to lower ground. Rain and snowmelt from watersheds travel via many routes to the sea. During periods of heavy rain and snowfall, water may run onto and off of impervious surfaces such as parking lots, roads, buildings, and other structures because it has nowhere else to go. These surfaces act as "fast lanes" that transport the water directly into storm drains. The excess water volume can quickly overwhelm streams and rivers, causing them to overflow and possibly result in floods. This plan will focus directly on the Friends Creek Watershed.
(**https://oceanservice.noaa.gov/facts/watershed.html**)

The primary objective of this Friends Creek Watershed Resource Inventory and Plan is to address the causes and sources of nonpoint pollution and improve water quality that are impairing the Friends Creek Watershed. Over a two-year planning process, Macon County Soil and Water Conservation District worked with stakeholders and consultants to inventory the resources of the Friends Creek watershed. These efforts assisted in address concerns, the creation of goals and objectives with measurable milestones, gave directions in the decisions of which best management practices (BMPs) would be most applicable to the watershed and acceptable for stakeholders. Such decisions can determine how the chosen BMPs would positively affect Friends Creek and its tributaries and how they would be implemented, educate stakeholders, and decide what education and monitoring efforts to continue in the future.

Identifying and Addressing Concerns of the Watershed

Friends Creek, like other Midwestern waterbodies, are subject to stormwater runoff from various land uses, carrying excess nutrients, sediment, and other pollutants from agricultural production practices, lawn care, and hard surfaces such as roads and rooftops from our urban landscapes that often cause impact our streams. For example, excess nutrients can cause algae blooms, sediment can decrease water clarity while also reducing stream capacity for carrying water, and pathogens such as E. coli can cause health risks to swimmers and pets. These factors can lead to restricting contact with the water, decreased scenic enjoyment, and diminished quality of wildlife habitat, among other issues.

Stakeholders came together to identify concerns deemed as priority within the watershed with nonpoint source impacts to water quality being the main concern. The plan will be designed to improve water quality by controlling nonpoint source pollution. During these discussions, concerns were identified for rural, in-town, and streambank areas. Concerns for both rural and residential areas included soil and fertilizer runoff from fields and animal waste runoff. Within the rural areas, tile runoff and loss of filter strips around waterways were issues. In town, stakeholders worried about petroleum product runoff from roadways, seepage of septic systems into waterways, and general drainage of low-lying areas. Along streams, identified issues were streambank erosion, water quality, stream capacity, sedimentation, aquatic habitat, stream channelization, and lack of vegetative cover next to streams and ponds. These concerns were supported by the results of a watershed inventory and will be addressed in the creation of the Friends Creek Watershed Plan.

Watershed Resource Inventory

The first step of the watershed planning process was assessing the existing conditions and features within the Friends Creek Watershed. Friends Creek is a large tributary to the Sangamon River located in Piatt, DeWitt, and Macon Counties just north of Decatur in East Central Illinois. It eventually drains to Lake Decatur. According to the Illinois Environmental Protection Agency (Illinois EPA) Integrated Water Quality Report and Section 303d List - 2018, it identifies Friends Creek (AUID IL_EV-02) as not an impaired stream, but identified the Sangamon River (AUID IL_E-95) as not supporting designed uses for aquatic life or fish consumption (Appendix B-2 Specific Assessment Information for Streams - 2018), and it identifies Lake Decatur (AUID IL_REA) as not supporting designed uses for aesthetic quality, fish consumption, or public water supply (Appendix B-3 Specific Assessment Information for Lakes – 2018). The identified of non-supporting of designed uses are caused by many factors, and the Illinois EPA identifies excess nutrients from agricultural runoff to be factors affecting Lake Decatur.

Once 92% prairie and 7% forest with less than 1% rivers and ponds, the watershed is now 90% farmland, 7% open space including forest and water bodies, and 3% developed towns and rural homes. When a raindrop hits a lawn, rooftop, driveway, or agricultural field, it picks up fertilizer, loose sediment, oil, pet and livestock waste, and other pollutants that used to be absorbed and filtered by prairie and forest native vegetation. In the current landscape, these pollutants may drop out along the way or enter the stream, depending on the lay of the land and obstacles encountered. To understand how the natural features of the watershed interact with stormwater and contribute to nutrient and sediment loading into the stream, it is important to understand the characteristics of soils, wetlands, topography, and floodplains.

Over half of this flat watershed is made up of hydric soils, historically developed under wetland conditions. Much of the wetland conditions have now been drained for agricultural production, while wetlands persist in less than 1% of the watershed. When these lands were wetlands, they held, absorbed, and filtered stormwater that now rushes through drain tiles and storm sewers to remove water from fields, roads, and homes as fast as possible. This increased flow velocity and quantity leads to a greater amount of surface water traveling more rapidly to the streams, which blows out stream banks and carries even more sediment, along with the nutrients trapped within it, downstream. A study of Friends Creek stream cross sections showed that although about 70% of the streams are stable or nearly stable, over half of them can only hold 45% of the stormwater flowing during a 2-year storm event, which has a 50% chance of occurring each year (Kinney, 2018). This excess flow leads to streambank erosion, as the stream tries to correct itself by becoming larger. A survey of streambank erosion within Friends Creek revealed that 15% of the streambanks are severely eroded and 14% are moderately eroded, mostly along the larger stems of Friends Creek and near its confluence with the Sangamon River. Fortunately, the majority of streambanks (71%) have slight or no erosion, mostly within the upper tributaries (Kinney, 2018). To further rush water away from active land uses, over half of the streams inventoried were channelized (41% high and 16% moderate channelization), according to a study by Olson Ecological Solutions conducted in 2018.

In addition to traveling through constructed drainages, water runs off the land's surface straight into the streams. If grassland or forest cover flanks the streambanks, as found along 62% of surveyed streams in the Friends Creek Watershed, this water is interrupted, slowed, infiltrated, and filtered before entering the stream, resulting in cleaner water and less water entering the stream more slowly. The remaining 38% of streambanks either have fair (17%) or poor (21%) vegetative cover, present as areas with less than 25 feet of proper vegetation, mowed grass, and bare ground such as cropland.

Considering its current land uses, Friends Creek Watershed is predicted to contribute almost 108,000 pounds of total nitrogen; 10,200 pounds of total phosphorous; 4,400 tons of sediment; and 100 million counts of pathogens each year to Friends Creek, some of which ultimately end up in Lake Decatur. It is estimated that Friends Creek Watershed is responsible for depositing 55% of Sangamon River's sediment (Kinney, 2018). The manner in which land within the Friends Creek Watershed is used can be improved to reduce the pollutant loading to Friends Creek and the streams and lakes below, especially within environmentally sensitive areas such as along streambanks, at the ends of tile lines, and flanking roads.

Goals, Objectives, and Measurable Milestones

Watershed stakeholders wish to reduce nutrient, sediment, and pathogen loading into streams. The overall objectives of the plan are to reduce nitrogen by 1,000 pounds/year, to reduce phosphorus by 500 lbs/year, to reduce sediment by 500 tons/year, and to reduce pathogens in complimentary amounts, with milestones that will be measurable over the five years of the plan. In order to achieve these objectives, the stakeholders, Macon County SWCD staff, and consultants considered best management practices that were both effective and likely to be implemented by watershed residents and producers.

Recommended Projects and Practices

Landowners within Friends Creek Watershed are proud of the conservation-minded practices already taking place within the watershed. A drive around the watershed will reveal conservation tillage, cover crops, and more. To further these efforts, we recommend focusing on best management practices that will target concerns identified by stakeholders and the inventory. Projects and practices can be implemented within the agricultural areas and towns within the watershed and along the banks of streams and ponds and in streams. Specifically, we recommend the following:

Recommended BMPs for Agricultural Areas

- Conservation tillage on crop fields (no till/strip till)
- Cover crops on crop fields
- Filter strips at edges of fields and along streams
- Nutrient management on crop fields

- Prescribed grazing for pasturelands
- Drainage water management such as end tile treatment and denitrifying bioreactors

Recommended BMPs for Residential and Commercial Areas and Roads

- Vegetated swales within the path of stormwater
- Rain gardens in low areas of lawns and business campuses
- Phosphorous-free fertilizer applied, if fertilizer is needed
- Septic system maintenance
- Pet waste management
- Native plantings in place of mowed grass wherever possible

Recommended BMPS for Streambanks, Shorelines, and In-Stream

- Vegetated filter strips within 50 feet of streams and ponds
- Stabilize severely eroding streambanks with stone toe protection or other constructed solutions throughout the watershed, with four high priority areas identified as site-specific projects
- Construct rock riffles within streams to stabilize streambeds and provide riffle and pool series

Implementing Recommended Projects

Addressing concerns, reaching goals, obtaining objectives, and achieving milestones come from the implementation of projects and practices within the watershed. Landowners need to recognize the positive impact implementation of the recommended projects and practices will bring and be willing to do what it takes to achieve the goals of Friends Creek Watershed!

The inventory combined with results of a survey of agricultural producers gave an idea of what projects and practices could realistically be achieved over time within the watershed. The survey suggested that 60% of producers were interested in installing filter strips and practicing conservation tillage and 40% of producers would like to install cover crops and improve nutrient management. If the percentage of land treated mirrored these results, we could potentially reduce 7% of the nitrogen and 9% of both the phosphorous and sediment loading into Friends Creek each year.

The work involved to achieve this scenario represents the participation of many agricultural producers and many years of education and implementation. Within the first five years, to meet the objectives within the life of this watershed plan, 20% of the watershed's landscape, both in town and rural areas, would need to be devoted to one best management practice to reduce phosphorous by 500 pounds per year and sediment by 500 tons per year. Nitrogen would be reduced by 1,000 pounds per year once 10% of the landscape was treated. Best management practices used to estimate these reductions were vegetated swales, conservation tillage, cover crops, nutrient management rain gardens and filter strips.

Educating Landowners

Since the recommended projects and conservation practices within this plan are solely up to the stakeholders to implement, it is critical to prioritize education and local engagement. Various groups have already initiated education and outreach efforts to encourage local participation. Landowners within the Friends Creek Watershed have outstanding resources available to them for education and technical support. Just one of those resources includes the Macon County USDA Office located in Decatur, Illinois, where multi-facets for educational and technical resources are housed under one roof.

These include the Macon County Soil and Water Conservation District (SWCD), Natural Resources Conservation Service (NRCS), and Farm Service Agency (FSA). These organizations offer many cost incentive programs available to landowners.

Monitoring

After completion of the Friends Creek Watershed Plan, monitoring and evaluation will be the responsibility of the Friends Creek Water Alliance. The Friends Creek Watershed Alliance is made up of stakeholders within Friends Creek Watershed. Monitoring and evaluation will be used to reflect the positive results of the adoption and implementation of this plan. The Friends Creek Watershed Alliance will meet annually to measure communication, review completed projects, present information and evaluate nutrients and sediment in Friends Creek, report new funding sources and programs, and evaluate the plan. A monitoring worksheet has been created by the alliance to be used in tracking BMPs within Friends Creek Watershed. The alliance will be responsible for its distribution, retrieval, and data compilation.

We are excited to continue learning, educating, implementing, and sharing information regarding the Friends Creek Watershed and the Friends Creek Watershed Plan. The Macon County SWCD will host updates to the Friends Creek Watershed Plan as well as a link to this plan on its website at http://www.maconcountyswcd.net/.

Section 1:
Friends Creek Watershed Resource Inventory

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Navigating the Watershed Resource Inventory

This Watershed Resource Inventory is a compilation of published maps and data, existing local information, and field surveys about the Friends Creek Watershed in central Illinois. Within the following pages, you will find detailed descriptions of this watershed's boundaries, drainage system, waterbodies, land uses and land cover, geology and climate, soils, and water quality. Chapter 1 discusses the watershed's boundaries including location and size, and it identifies the entities with jurisdiction over the land and waters within the watershed. Chapter 2 explains the drainage system's connectivity, spatial relationship, and flow and provides the locations of floodplain, wetlands, ponds, and basins, that affect water filtration and storage during storms. Chapter 3 illustrates the people's demographics, explains how they use the land, and maps the type of cover such as cropland, pasture, forest, low density residential towns, and open spaces. Chapter 4 talks about the general geology, topography, and climate of the area. Chapter 5 details the types of soil found in the watershed and how it relates to erosion, groundwater storage and transmission, and agricultural production. Chapter 6 provides an assessment of water quality including concerns expressed by the Illinois Environmental Protection Agency, results of field surveys of streams and basins, and estimations of annual pollutant loading according to the types of land uses in the watershed. Together, this collection of facts provides insight about the watershed pertinent to making decisions about how to protect and improve the quality of Friends Creek and its tributaries.

Acknowledgements

The Watershed Resource Inventory was initiated by efforts of Macon County Soil and Water Conservation District (SWCD), who worked with consultants and watershed stakeholders to collect existing information about the watershed's current conditions. In 2019, they partnered with Olson Ecological Solutions and Tallgrass Restoration to write the inventory.

The following individuals were instrumental in compiling this inventory:

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Pond and Basin Shoreline Survey by: Angela Daily, Macon County Soil and Water Conservation District

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LOCATION OF WATERSHED

The Friends Creek Watershed was located in Central Illinois, in a region called "The Heart of the Sangamon." The location can be observed in Figure 1 page 9. The watershed fell north and east of Decatur and due south of Clinton Lake. Illinois Highway-72 ran through the southern portion of the watershed. Illinois Route-10 ran east and west through the northern portion of the watershed. There were two incorporated towns within the watershed and one unincorporated community: Argenta, Weldon, and Lane. The village of Argenta was in the southern portion of the Friends Creek Watershed. The village of Weldon was located to the northeast of the watershed, within the Friends Creek Ditch Subwatershed. There was also the unincorporated community of Lane, which fell on the northwest boundary in the Kickapoo Creek Subwatershed.

The Friends Creek Watershed was part of the larger Sangamon River/Lake Decatur Watershed, which in turn was enveloped in increasingly larger watersheds. The Hydrologic Unit Code (HUC) system that defined these watersheds from largest to smallest included the Upper Mississippi Region (HUC 07), Lower Illinois (HUC 071300), and Upper Sangamon (0713006) watersheds.

WATERSHED SIZE

The Friends Creek Watershed was about 83,000 acres in size or 129.4 square miles, according to GIS analysis. Figure 2 page 10 shows the boundaries and aerial imagery of the entire watershed footprint. It was comprised of four HUC-12 level watersheds. The largest was Friends Creek Ditch in the northwest portion, which accounted for 35.6% of the watershed (see Figure 3 Page 11). Kickapoo Creek was the next largest, along the western edge, covering 31.8% of the watershed (see Figure 4 Page 12). Lower Friends Creek, also referred to as Village of Argenta, spanned 17.7% of the watershed in the southern portion, where Friends Creek split from the Sangamon River (see Figure 5 Page 13). The smallest HUC-12 watershed, called Middle Friends Creek in this report but also referred to as Headwaters or Shiloh Chapel, was located north central and covered the remaining 14.9% of land in the watershed project area (see Figure 6 Page 14).

GEOGRAPHIC BOUNDARIES

Watershed boundaries for the Friends Creek and its tributaries culminated at the confluence with the Sangamon River. The watershed lies directly south of Clinton Lake and northeast of Lake Decatur, into which the flow eventually drained.

WATERSHED JURISDICTIONS

The Friends Creek Watershed fell predominately in Macon and DeWitt Counties but also extended into Piatt County (see Figure 7 Page 15). Each of the counties governed portions of the watershed, separately responsible for zoning, planning, water quality protection, and nonpoint source pollution control. The largest percentage of this watershed belonged in DeWitt County (46.4%) with Macon County close to the same size (40.4%). Piatt County was the smallest portion of the watershed (13.2%). Within the counties, the watershed fell within ten townships (see Figure 8 Page 16). The largest townships in the watershed were Friends Creek Township in Macon County, which covered one-third of the entire watershed, followed by Creek and Nixon Townships in DeWitt County, each covering about one-fifth of the watershed. Texas Township in DeWitt County (36 acres) and Oakley Township in Macon County (82 acres) had the smallest areas included in the watershed. Refer to Table 1 Page 8 for more detail on counties and townships within the watershed.

On the local level, Macon County Soil and Water Conservation District was involved with maintaining water and soil integrity within the county.

On the State level, several entities helped to monitor the natural resources within the Friends Creek Watershed. The Illinois Environmental Protection Agency (EPA) worked to reduce water pollution from non-point sources through providing grants. The US Army Corps of Engineers, Rock Island District oversaw area permitting to maintain the integrity of the area's water features. Illinois Department of Natural Resources (IDNR) protected several environmental factors regarding water management, wildlife habitat, and natural areas. Their Office of Water Resources branch was tasked with water resource planning, navigation, floodplain management, and managing water supply and drought. Within this branch were two divisions: Capital Programs and Resource Management. The latter managed statewide dams and monitored flood conditions while the former regulated construction within waterways and floodplains. The Illinois Department of Transportation also complied with maintaining the Clean Water Act by managing stormwater runoff and avoiding wetland impacts caused by road development.

TABLE 1: COUNTIES AND TOWNSHIPS

Counties and Townships			
County	**Township**	**% Watershed**	**Acres**
DeWitt County	Creek Township	20.0%	16,590
	Nixon Township	19.2%	15,898
	DeWitt Township	7.1%	5,905
	Texas Township	0.04%	36
	County Total:	**46.4%**	**38,429**
Macon County	Friends Creek Township	33.3%	27,603
	Whitmore Township	4.1%	3,387
	Maroa Township	2.9%	2,431
	Oakley Township	0.1%	82
	County Total:	**40.4%**	**33,504**
Piatt County	Goose Creek Township	8.9%	7,364
	Willow Branch Township	4.3%	3,537
	County Total:	**13.2%**	**10,901**

FIGURE 1: FRIENDS CREEK WATERSHED LOCATION

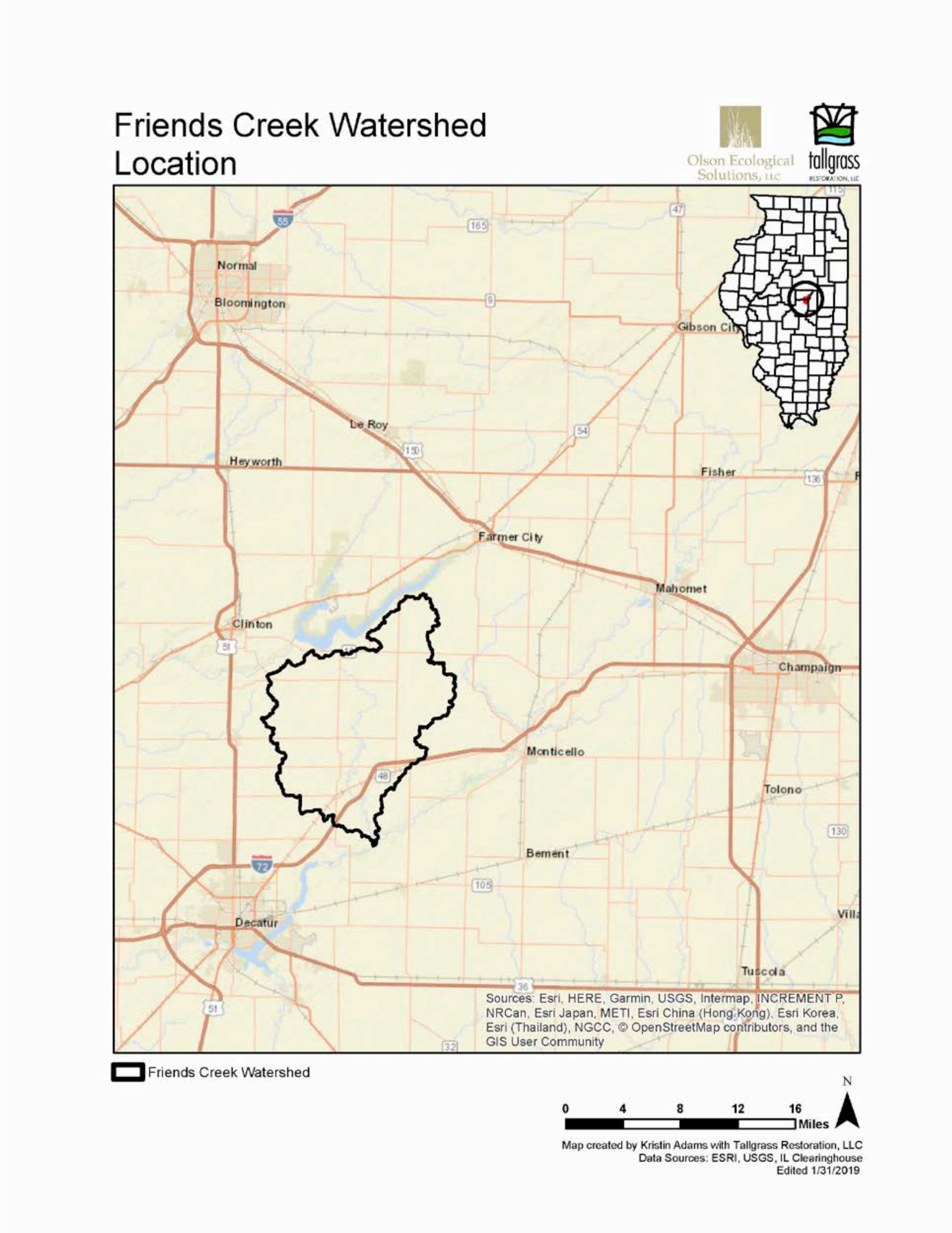


FIGURE 2: FRIENDS CREEK WATERSHED AERIAL

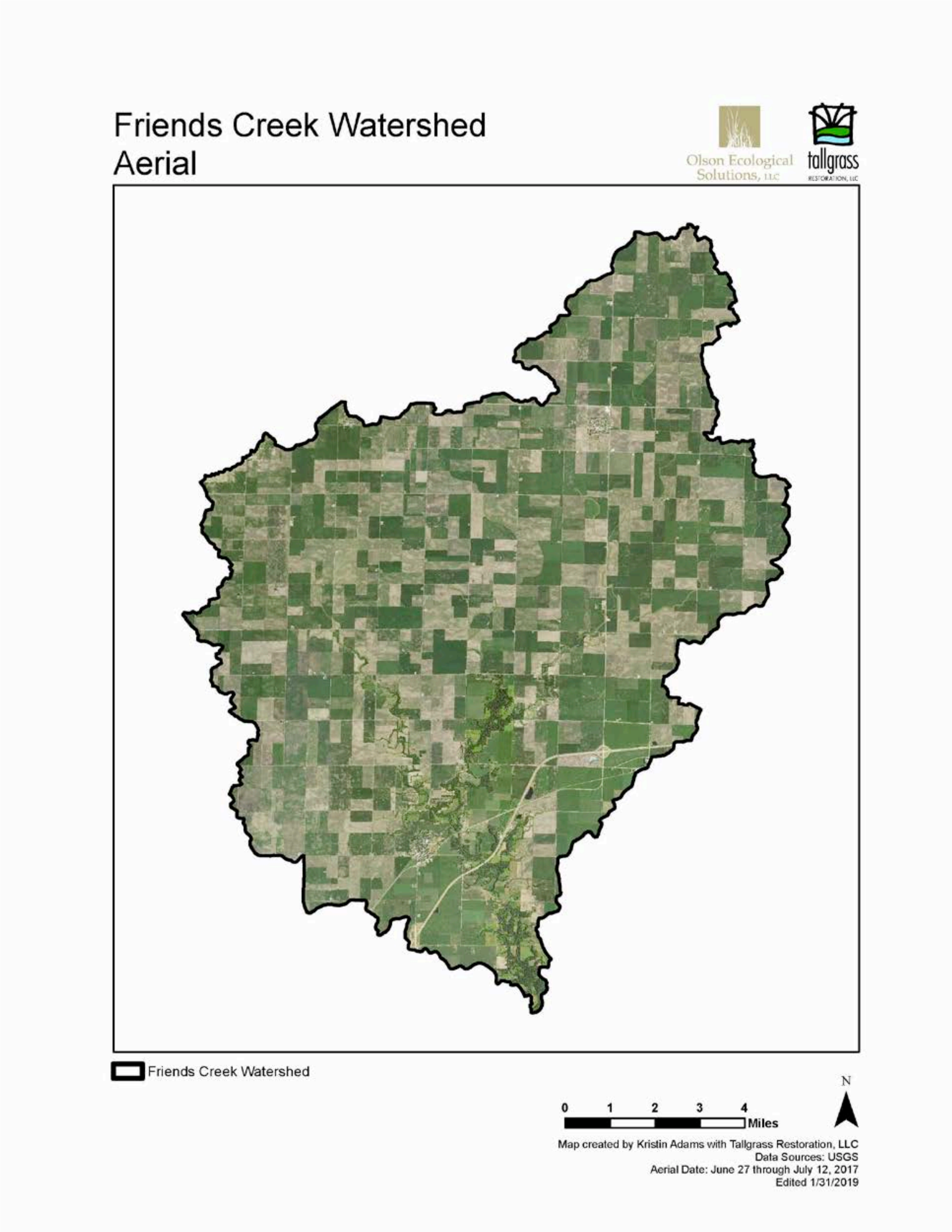


FIGURE 3: FRIENDS CREEK DITCH AERIAL

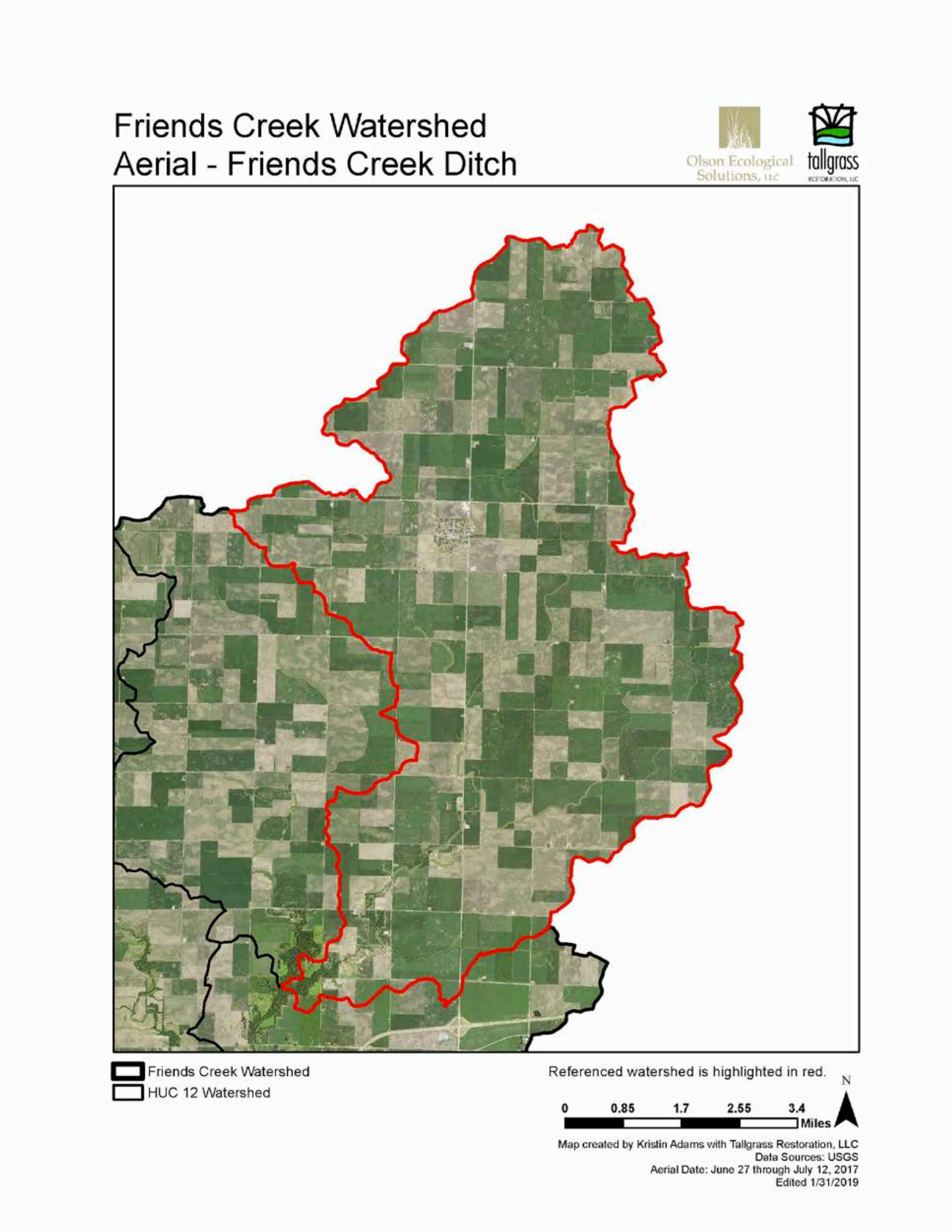


FIGURE 4: KICKAPOO CREEK AERIAL

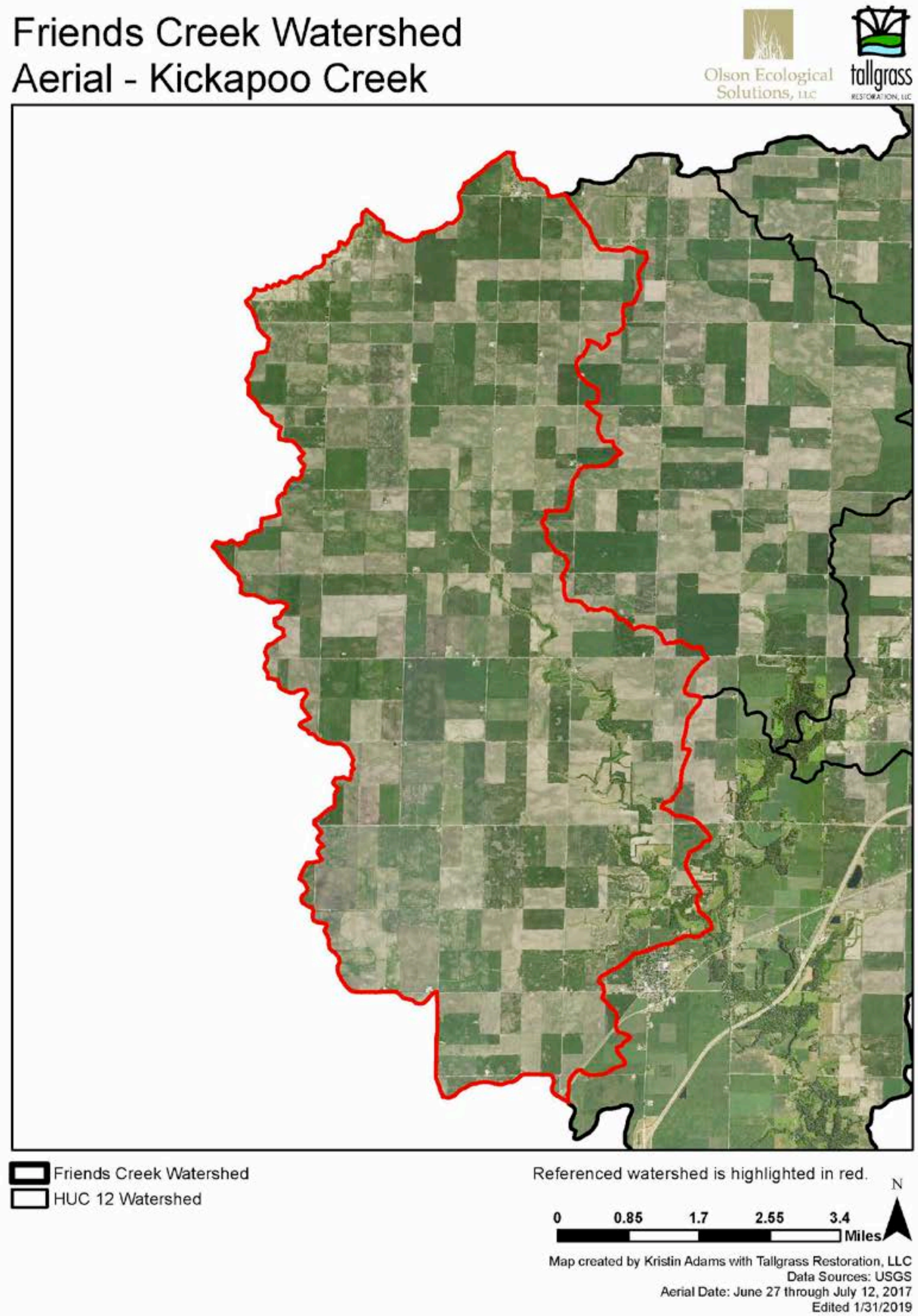


FIGURE 5: LOWER FRIENDS CREEK AERIAL

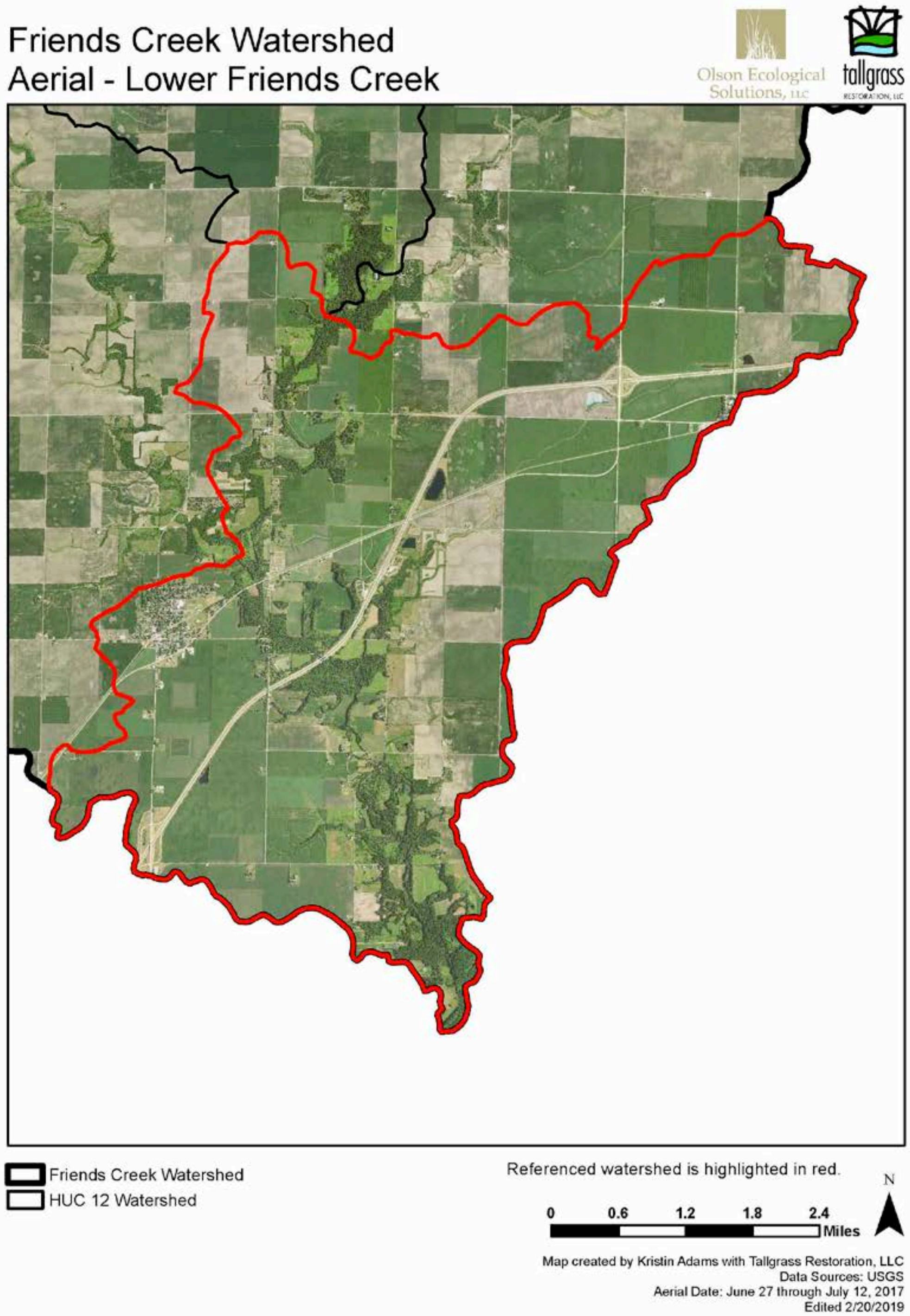


FIGURE 6: MIDDLE FRIENDS CREEK AERIAL

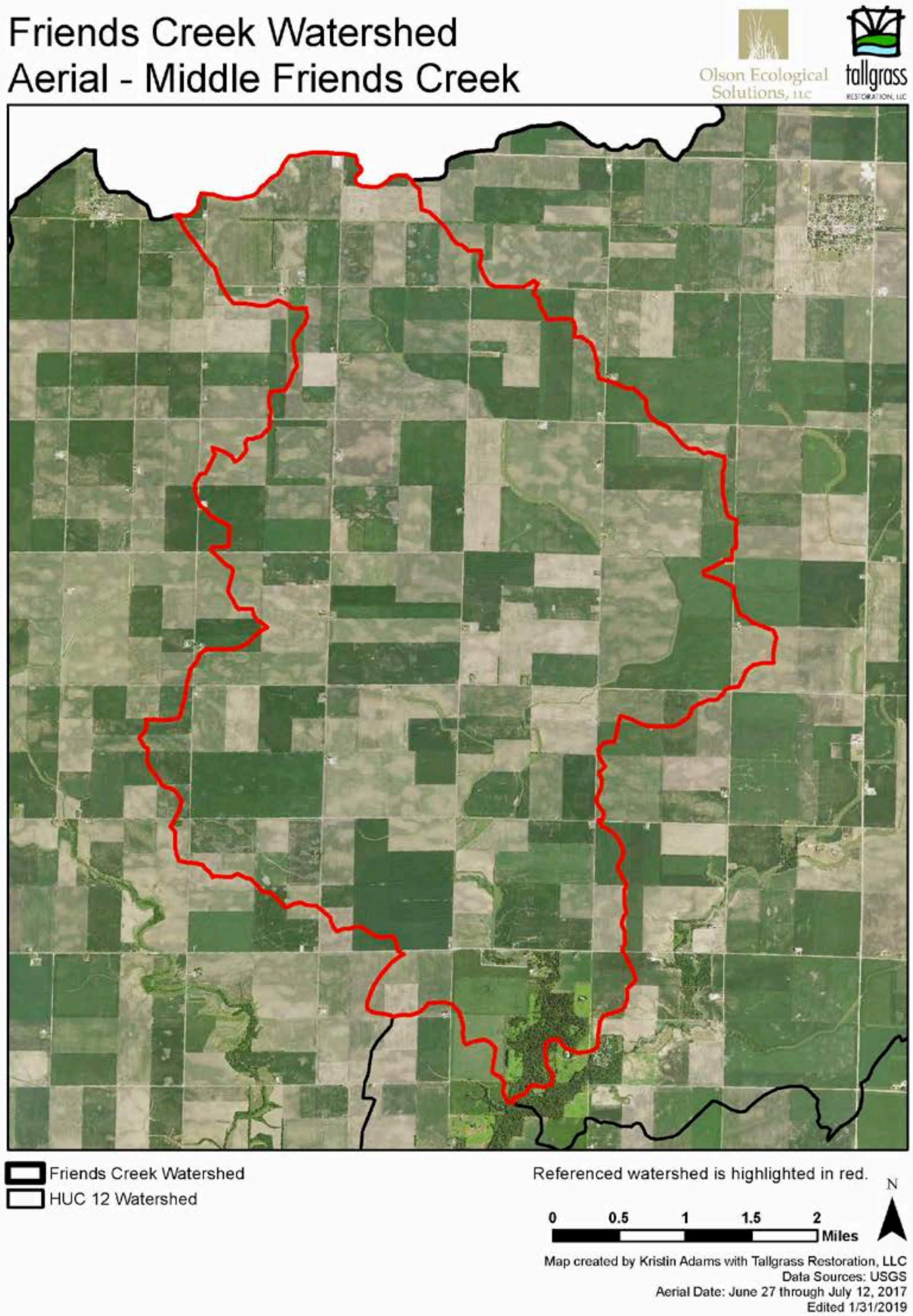


FIGURE 7: COUNTY LOCATIONS

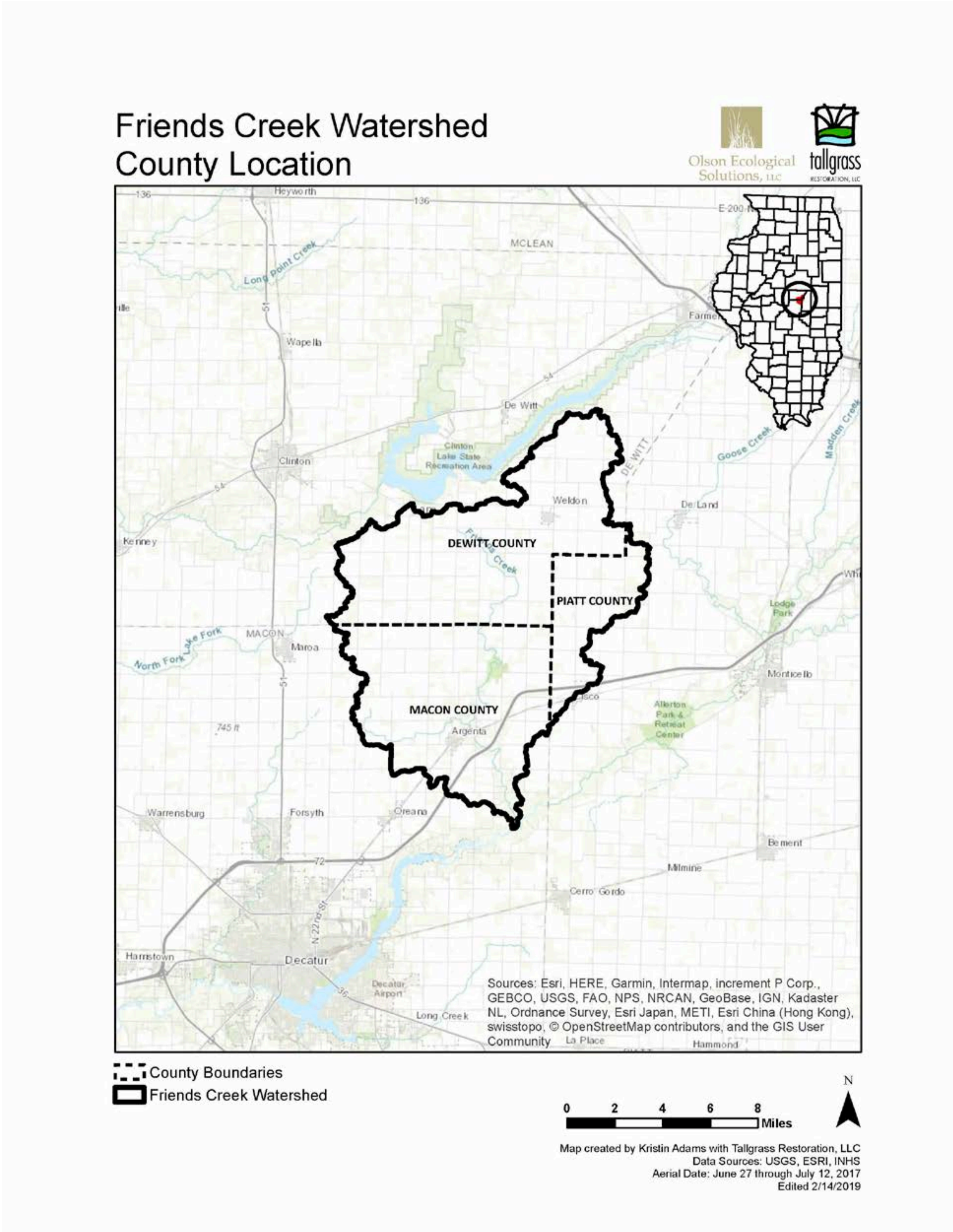
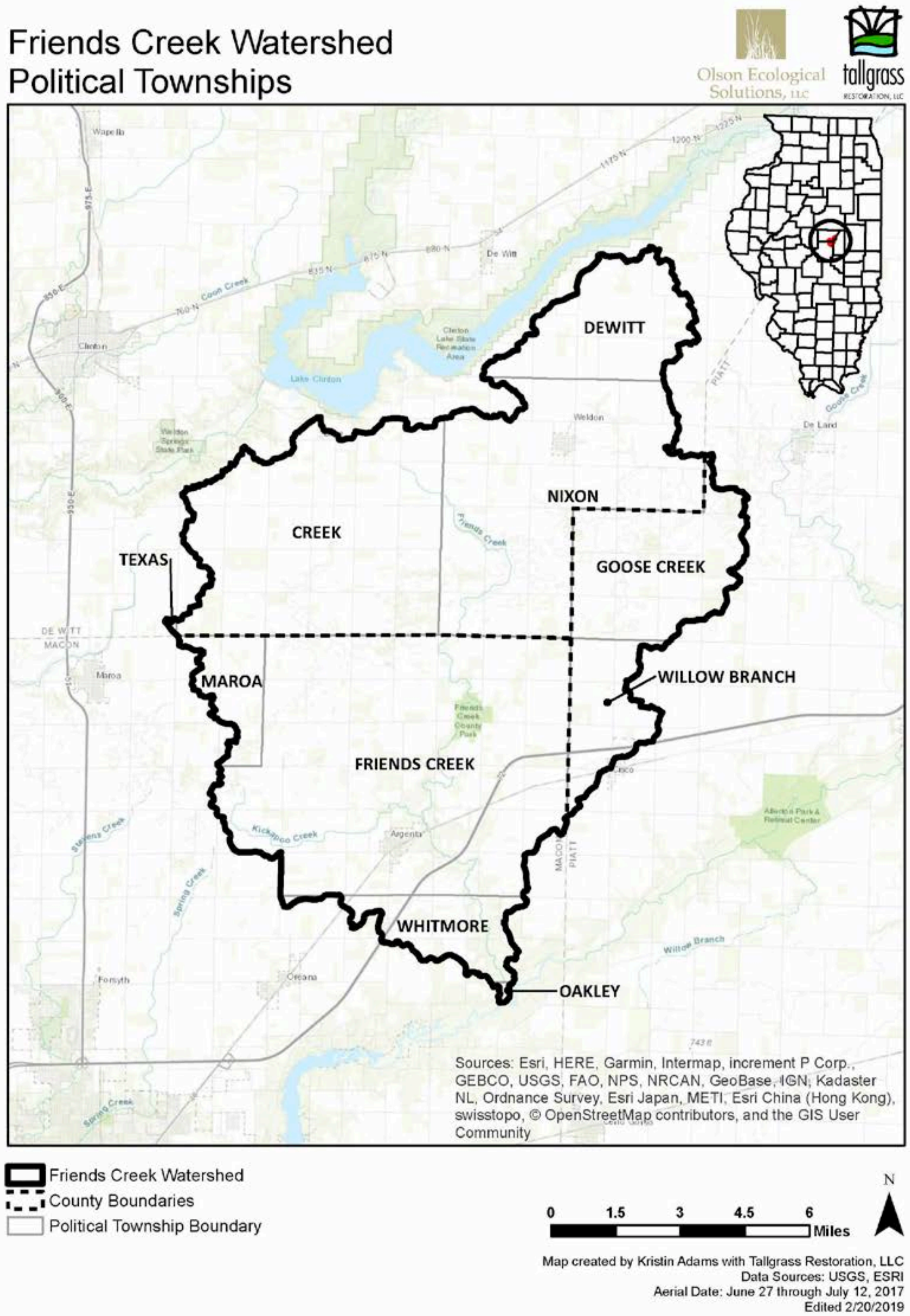


FIGURE 8: POLITICAL TOWNSHIPS



SECTION1, CHAPTER 2:
WATERSHED DRAINAGE SYSTEM AND WATERBODIES

The drainage system of the Friends Creek Watershed was defined through the connectivity and water flow from one watershed to another, from one stream to the next within the watershed, and through further dividing the watershed into smaller subwatersheds. The relationship of these watersheds and streams with their lakes, ponds, detention basins, flood zones, and wetlands provided a full picture of water flow through the watershed and beyond.

CONNECTIVITY AND WATER FLOW OF WATERSHEDS

The connectivity of Friends Creek and its tributaries was understood within the larger context of its water flow from its headwaters to the Gulf of Mexico. Friends Creek and its tributaries flowed into the Sangamon River, just north of Lake Decatur. The Sangamon River then curved northwest and joined the Illinois River near Beardstown, Illinois. The Illinois River flowed south, entering into the Mississippi River just north of St. Charles, Missouri. The Mississippi River traveled south, emptying from the state of Louisiana into the Gulf of Mexico (USGS StreamStats, 2012). According to the HUC (Hydrologic Unit Code) system, which organizationally divided larger drainage systems in the United States, the Friends Creek Watershed was nested within the larger watersheds named above as seen in Figure 9 Page 124 and Table 2 Page 20.

CONNECTIVITY AND WATER FLOW WITHIN FRIENDS CREEK WATERSHED

Water flowed within the Friends Creek Watershed primarily through a network of intermittent and perennial streams. Within the entire project watershed flowed 134.7 miles of stream: 67.4 miles were perennial and 67.3 miles were intermittent. The stream system within Friends Creek Watershed generally flowed south where it ran into the Sangamon River, which flowed southwest and directly fed Lake Decatur. The waterflow and stream data was a product of the National Hydrography Dataset created by US Geological Survey by using a digital elevation model (DEM) with assigned reach codes provided by the Environmental Protection Agency.

The Friends Creek Watershed encompassed four smaller HUC-12 subwatersheds within it: Friends Creek Ditch, Kickapoo Creek, Middle Friends Creek, and Lower Friends Creek. Water flowed from the three northern subwatersheds into the Lower Friends Creek Subwatershed as shown in Figure 10. The first of the three northern subwatersheds, Friends Creek Ditch, was named for the main irrigation ditch that received water from two main perennial streams and ran from the north to south of its subwatershed. Water left this subwatershed at its southern end and flowed into a stream segment of Friend Creek in the Lower Friends Creek Subwatershed. In the second northern subwatershed, Middle Friends Creek, a stream segment of Friends Creek began at the northern end and flowed south, also into the Lower Friends Creek Subwatershed. There was one perennial stream that branched from it and an intermittent stream that was unconnected to the main channel. The third northern subwatershed, Kickapoo Creek, was named for the stream segment of Kickapoo Creek that flowed through it from west to east, where it merged into Friends Creek stream, further south of where Friends Creek Ditch conjoined. There was a perennial stream that flowed from the north to south in the Kickapoo Creek Subwatershed. It flowed into the Kickapoo Creek stream before flowing into Friends Creek stream. Once the water discharged into Friends Creek within the Lower Friends Creek Subwatershed from the other three subwatersheds, the stream entered the Sangamon River at the southmost tip of Lower Friends Creek Subwatershed. A breakdown of the HUC-12 subwatershed acreages can be found in Table 3 Page 21.

SPATIAL RELATIONSHIP AND CONNECTIVITY OF PSEUDO-HUC-14 SYSTEM

There was no official assigned numbering system beyond the HUC-12 level. In order to illustrate the spatial relationship and connectivity within the Friends Creek Watershed, we applied a pseudo-HUC-14 level, within each of the HUC-12 subwatersheds, which can be observed in Figure 10 Page 25 and Table 3 Page 21. We used drainage basins defined by elevation as the principal factor in the breakdown into smaller watersheds. To do so, first a computer-aided watershed generator called BASINS divided the entire Friends Creek Watershed into smaller subwatersheds. Then using aerial photography and topographic maps, the boundaries were corrected to create the new pseudo-HUC-14 subwatersheds. Between Subwatershed 1 Friends Creek Ditch and Subwatershed 3 Lower Friends Creek, the drainage patterns and tile systems visible from aerial data were observed and the boundary was adjusted accordingly which accounts for the acreage discrepancy between the HUC-14 subwatersheds and the HUC-12 subwatersheds that they fall within.

The resulting 26 pseudo-HUC-14 subwatersheds were named numerically along with a correlating watershed name. Friends Creek Ditch Subwatershed was broken down into nine HUC-14 subwatersheds (1 Friends Creek Ditch, 2 Friends Creek Ditch, etc.), Middle Friends Creek Subwatershed was subdivided four times, Kickapoo Creek Subwatershed covered eight subwatersheds, and Lower Friends Creek Subwatershed had five subdivisions. We re-named two of the HUC-12 units to spatially describe their location in the watershed. Shiloh Chapel became Middle Friends Creek and Village of Argenta was referred to as Lower Friends Creek.

LOCATIONS OF WATERBODIES

Locations of waterbodies within the Friends Creek Watershed were determined by a combination of the national hydrography dataset, the national wetlands inventory, and reviewing aerial imagery. There were 48 total waterbodies located within the entire Friends Creek Watershed. Kickapoo Creek Subwatershed had a total of three waterbodies, while the remaining 45 ponds and basins were located in Lower Friends Creek Subwatershed. There were no ponds or basins in either Friends Creek Ditch Subwatershed or Middle Friends Creek Subwatershed. Most of the waterbodies were located near the stream system. The National Wetlands Inventory and the National Hydrography Dataset listed 22 of the same waterbodies. The largest waterbody was a 12-acre pond that adjoined a 6-acre pond located southeast of Illinois Highway 72 and north of the Route 48 underpass. There were 90 acres of ponds or basins within the entire watershed, including the waterbodies not readily visible from aerial imagery (see Figure 11 Page 26).

WETLANDS

Wetland data was collected from the National Wetlands Inventory (NWI) and in the form of color infrared imagery from 1985 using remote sensing technology mounted on aircraft to interpret soil moisture and saturation at a 1:58,000 scale. The NWI can be observed in Figure 12. This data referred to existing wetlands only. Areas that were historically wetlands and have wetland restoration potential were discussed below as hydric soils (see section1, chapter 5: Soils Page 45).

Several wetlands throughout the watershed were recognized by the National Wetlands Inventory, some of which were also discussed above as waterbodies. There were 209 wetlands throughout all of Friends Creek Watershed; 154 freshwater emergent wetlands and 55 freshwater forested/shrub wetlands. These were distributed throughout the Friends Creek Watershed as follows. There were 104 wetlands listed in Kickapoo Creek Subwatershed, 9 in Middle Friends Creek Subwatershed, 28 in Friends Creek Ditch Subwatershed, and 66 in Lower Friends Creek Subwatershed. One wetland extended into both Lower Friends Creek Subwatershed and Kickapoo Creek Subwatershed, and another wetland spanned Middle Friends Creek, Friends Creek Ditch, and Lower Friends Creek Subwatersheds. Wetlands had a mean size of 2.6 acres and total acreage of 53.8 acres throughout Friends Creek Watershed.

Wetlands were classed by their moisture regime and vegetative cover. All of the wetlands in the entire watershed were considered palustrine (P) systems. There were seven types of freshwater emergent wetlands in the watershed, only one having an unconsolidated bottom (UB) making it seem as though it was a pond. The other six emergent wetland types were considered to be in the "persistent" subclass (PEM1). The water regime was either flooded (A), seasonally flooded (C), or semi permanently flooded (F). Two of the wetland types had a special modifier that indicated that the wetlands were excavated by humans (x). One of the wetland types indicated that the wetlands was farmed (f).

All of the wetland types fell into the broadleaved deciduous subclass. There were five types of freshwater forested/shrub wetlands: three forested class (PFO) and two scrub-shrub class (PSS). These wetland classes were either temporarily flooded (A) or seasonally flooded (C). The most prevalent wetland type was a forested wetland, PFO1A, consisting of 327.7 acres (USFWS Services, 1996). In addition, one of the wetland types was indicated as having been excavated by humans (x) (see Table 4 Page 22).

FLOODZONES AND FLOODING FREQUENCY

Floodzones and flooding frequency combined explain the flooding patterns within the Friends Creek Watershed. The FEMA floodzone boundaries are shown in Figure 13 Page 28. Most of the watershed fell into the minimal flood hazard (X) category. Where there were floodzones, they were within the 100-year floodzone, which were areas having a greater than one percent chance of flooding in a year that was recorded as a Special Flood Hazard Area (A & AE) on the Flood Insurance Rate Map. There were no areas in the Friends Creek Watershed within the 500-year floodzone (B). The areas considered to be the 100-year floodzone according to FEMA data were located along Friends Creek and branching slightly west into Kickapoo Creek Subwatershed, and then slightly east into Friends Creek Ditch Subwatershed. They accounted for 4.4% of the entire watershed (3,623 acres) (see Table 5 Page 22).

We used "Web Soil Survey" to assess the flooding frequency of the watershed (2017), which sometimes overlapped floodzones but more often offered independent information. Web Soil Survey expressed flood frequency, displayed in Figure 14 Page 29, as one of the following classes: none, very rare, occasional, frequent, or very frequent. In this watershed, 96.6% of the land was considered to flood less than once in 500 years. A small amount of the watershed was considered to rarely flood, between 1-5% chance in any year. Only 3.2% was classified as a frequent flooding zone, described as more than 50% chance of flooding in any year, but less than 50% in all months within any year (see Table 6 Page 23). This classification fell only on land near the streams, with the greatest area congested in Lower Friends Creek Subwatershed, where Friends Creek stream flowed into the Sangamon River.

TABLE 2: HUC LEVELS

HUC for Friends Creek and Associated Watersheds		
HUC Level	**HUC Code**	**Watershed Name**
HUC-02	"07"	Upper Mississippi Region
HUC-04	“0713”	Lower Illinois
HUC-08	“07130006”	Upper Sangamon
HUC-10	“0713000603”	Friends Creek
HUC-12	“071300060301”	Friends Creek Ditch
	“071300060302”	Middle Friends Creek
	“071300060303”	Kickapoo Creek
	“071300060304”	Lower Friends Creek

TABLE 3: HUC-12 AND HUC-14 SUBWATERSHEDS

HUC 12 and 14 Subwatersheds					
Middle Friends Creek (MFC)					
HUC 12		**HUC 14 Label**	**% Watershed**	**Acres**
HUC Code:	071300060302	1 MFC	3.96%	3,282
Acreage:	12,314	2 MFC	3.91%	3,243
% Watershed:	14.87%	3 MFC	3.63%	3,011
		4 MFC	3.35%	2,779
		Total:	**14.87%**	**12,314**
Kickapoo Creek (KC)				
HUC 12		**HUC 14 Label**	**% Watershed**	**Acres**
HUC Code:	071300060303	1 KC	5.52%	4,573
Acreage:	26,348	2 KC	4.16%	3,448
% Watershed:	31.81%	3 KC	3.09%	2,558
		4 KC	3.40%	2,819
		5 KC	4.23%	3,505
		6 KC	2.44%	2,023
		7 KC	5.02%	4,155
		8 KC	3.95%	3,268
		Total:	**31.81%**	**26,348**
Lower Friends Creek (LFC)*				
HUC 12		**HUC 14 Label**	**% Watershed**	**Acres**
HUC Code:	071300060304	1 LFC	4.22%	3,492
Acreage:	14,658	2 LFC	3.28%	2,717
% Watershed:	17.70%	3 LFC**	4.62%	3,830
		4 LFC	3.07%	2,544
		5 LFC	2.63%	2,180
		Total:	**17.82%**	**14,764**
Friends Creek Ditch (FCD)*				
HUC 12		**HUC 14 Label**	**% Watershed**	**Acres**
HUC Code:	071300060301	1 FCD**	4.73%	3,918
Acreage:	29,513	2 FCD	3.80%	3,145
% Watershed:	35.63%	3 FCD	3.87%	3,202
		4 FCD	3.54%	2,934
		5 FCD	4.94%	4,088
		6 FCD	2.08%	1,724
		7 FCD	3.92%	3,250
		8 FCD	3.49%	2,894
		9 FCD	5.13%	4,251
		Total:	**35.5%**	**29,407**

*HUC 12 and HUC 14 acreage do not match. Explanation in report.

**HUC 14 subwatersheds effected by boundary determination.

TABLE 4: NATIONAL WETLANDS INVENTORY

National Wetlands Inventory		
Description	**Code**	**Acres**
Freshwater Emergent Wetland	PEM1Af	155.1
	PEM1Cx	4.2
	PEM1F	3.6
	PEM1C	3.5
	PEM1A	2.7
	PEM1Ax	1.0
	PUBGx	0.13
	Total:	**170.3**
Freshwater Forested/Shrub Wetland	PFO1A	327.7
	PSS1A	23.8
	PFO1C	12.9
	PSS1C	2.8
	PFO1Cx	0.9
	Total:	**368.1**
Freshwater Pond	PUBGx	69.4
	PUBGh	3.2
	PUBF	1.9
	-	0.7
	Digitized/NHD	15.3
	Total:	**90.5**
Riverine	R4SBC	135.4
	R2UBHx	89.6
	R2UBH	58.8
	R4SBCx	27.4
	R5UBH	18.8
	Total:	**330.0**

TABLE 5: FEMA FLOOD HAZARD

FEMA Flood Hazard			
Code	**Flood Zone Type**	**% Watershed**	**Acres**
X	Area of Minimal Flood Hazard	95.63%	79,210
A, AE	100 Year Flood Hazard	4.37%	3,623
	Total:	**100%**	**82,833**

TABLE 6: FLOODING FREQUENCY CLASS

Flooding Frequency Class			
Description	**Chance of flooding**	**% Watershed**	**Acres**
Very frequent	More than 50% in all months in any year.	0.00%	0
Frequent	More than 50% any year, but less than 50% in all months in any year.	3.23%	2,672
Occasional	Between 5-50% in any year.	0.00%	0
Rare	Between 1-5% in any year.	0.18%	145
Very rare	Less than 1% in any year.	0.00%	0
None	Less than once in 500 years.	96.60%	80,015
	Total:	**100%**	**82,833**

FIGURE 9: ASSOCIATED WATERSHEDS

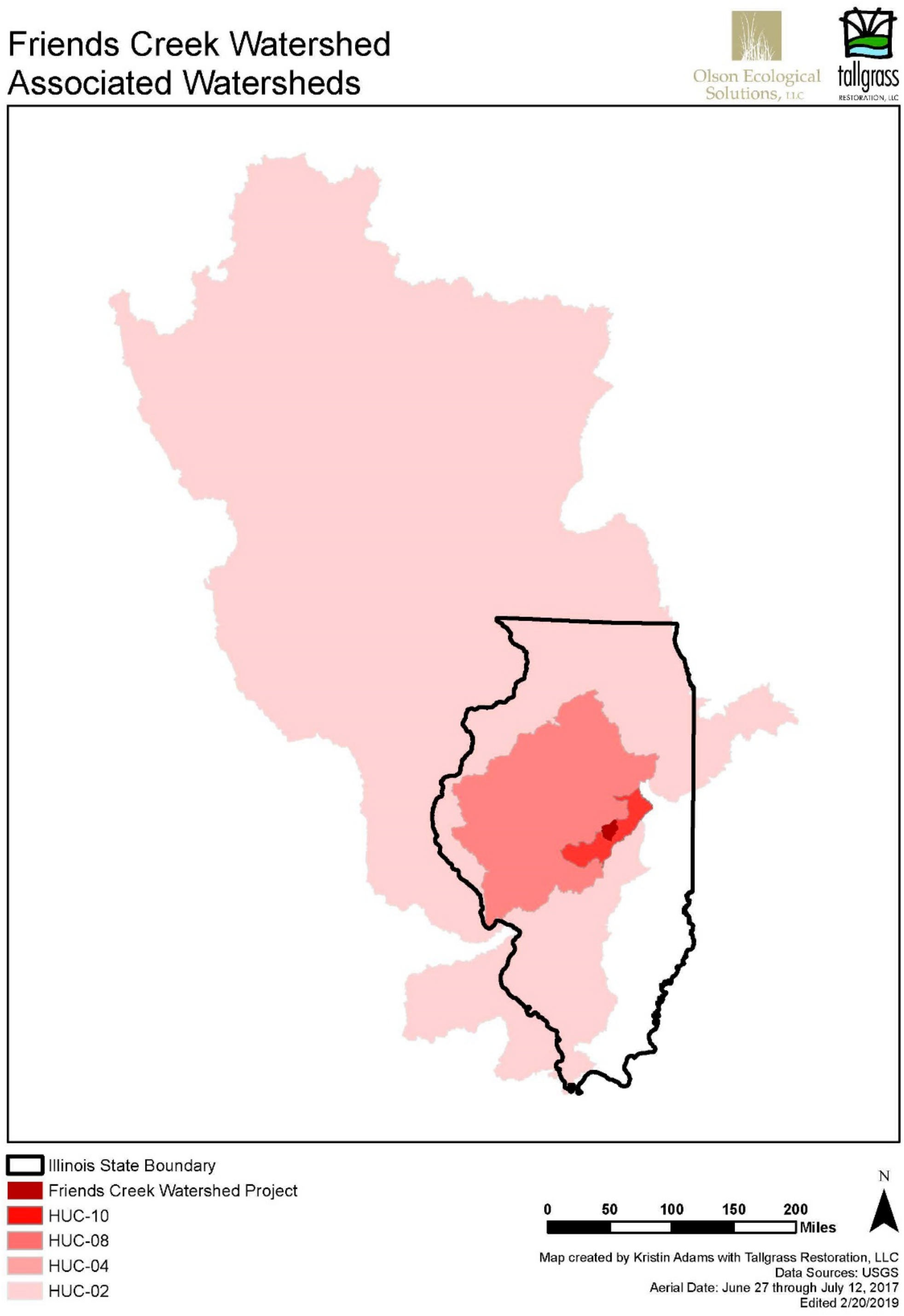


FIGURE 10: HUC-12 AND 14 BOUNDARIES

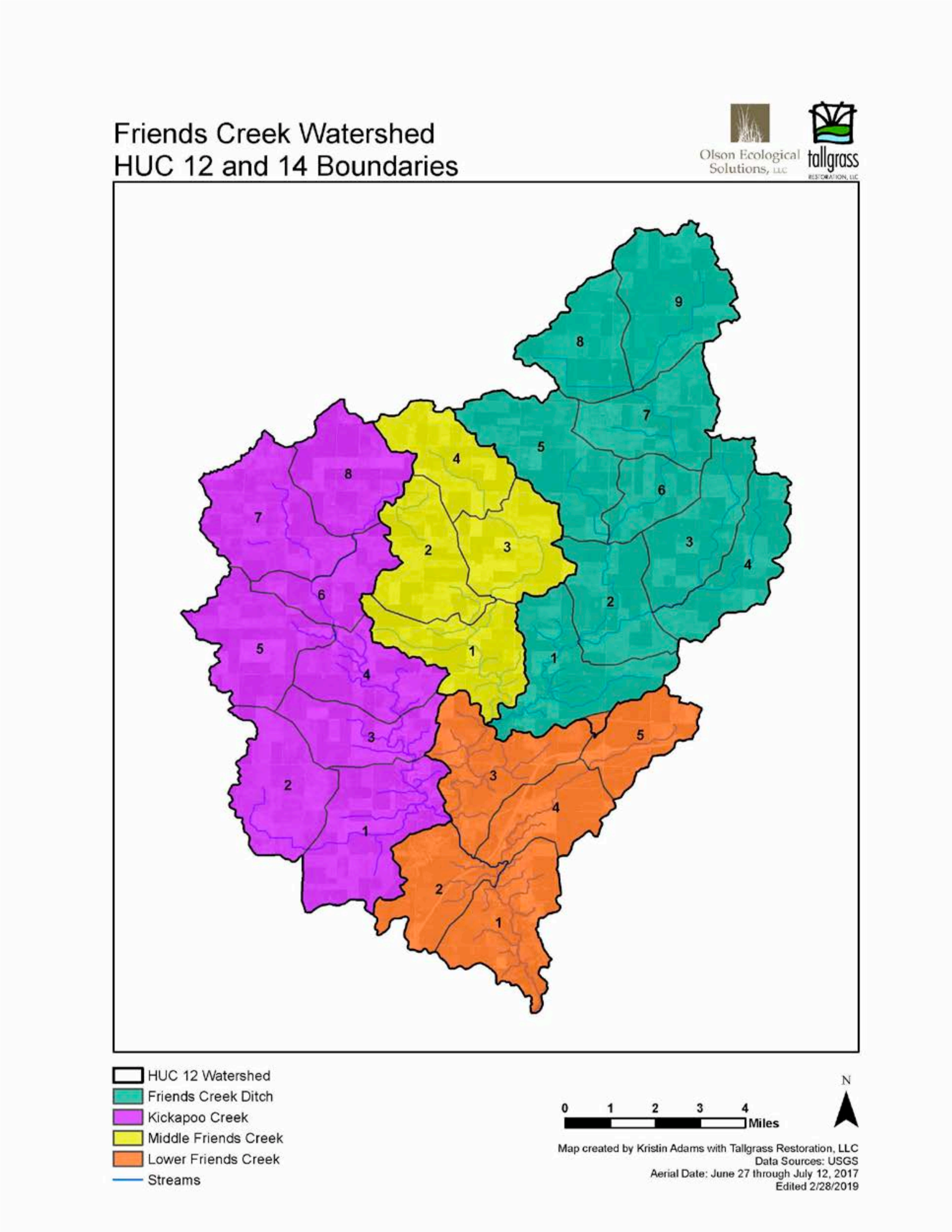


FIGURE 11: WATERBODY LOCATIONS

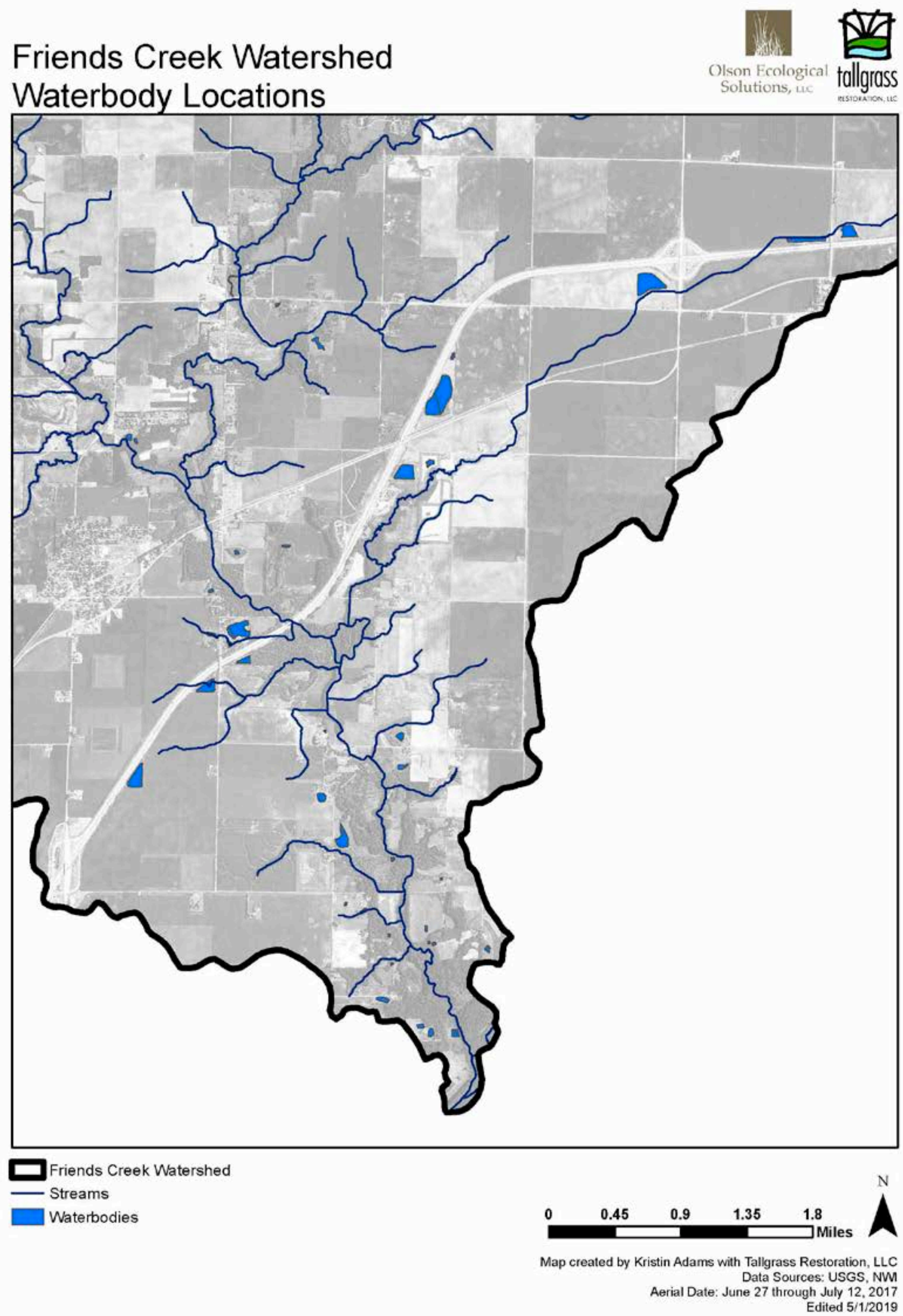


FIGURE 12: NATIONAL WETLANDS INVENTORY

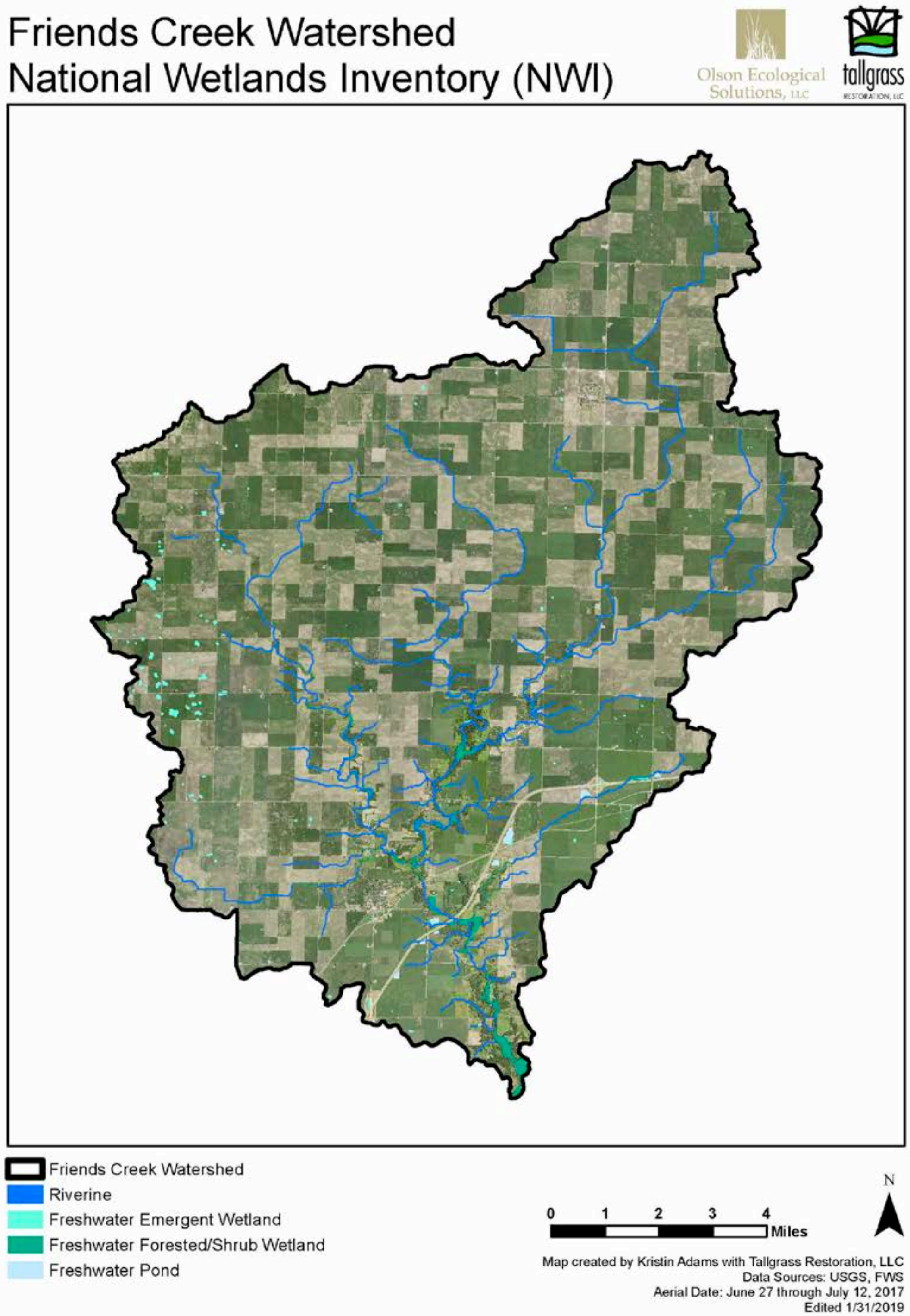


FIGURE 13: FLOOD HAZARD

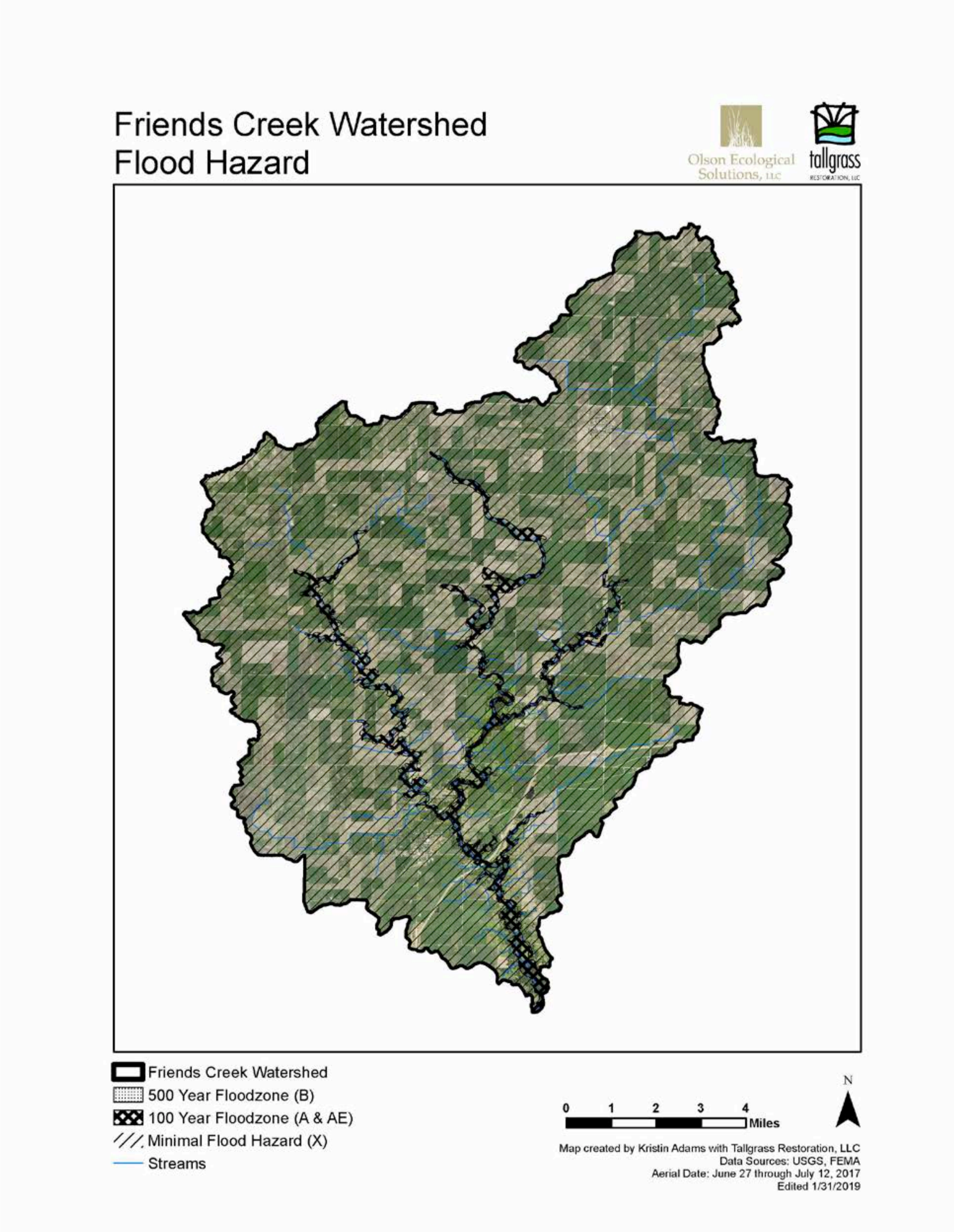
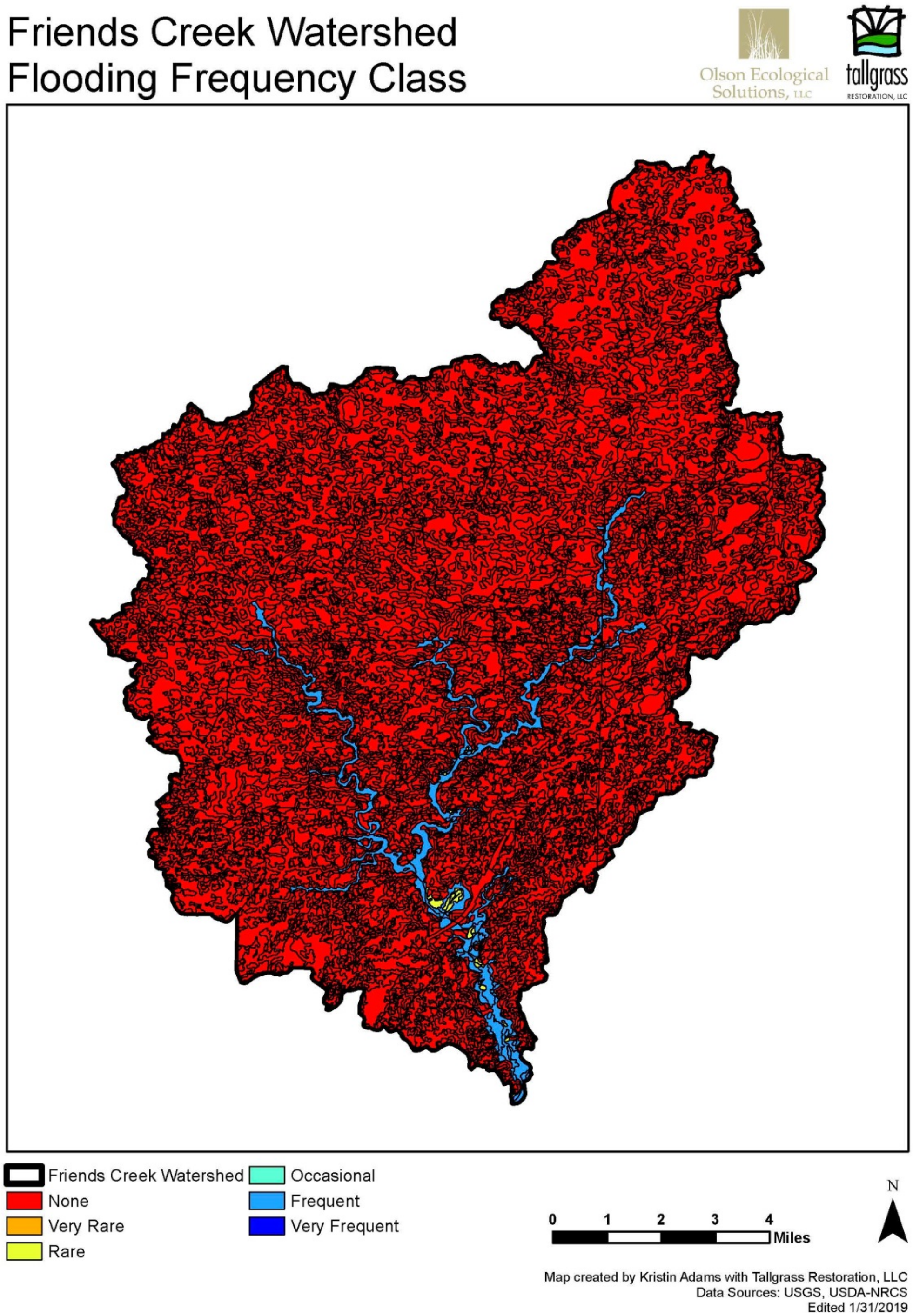


FIGURE 14: FLOODING FREQUENCY CLASS



SECTION 1, CHAPTER 3:
LAND USES AND LAND COVER

HISTORIC LAND COVER

Between 1804 and 1843, surveyors travelled across Illinois along the gridlines of the Public Land Survey to evaluate the landscapes and features in the state. These data were recorded in the form of notes which were drawn into map format in the 1960s. Although the maps are not an exact replication of the landscape during this time, they provide a general understanding of how the Friends Creek Watershed appeared during the pre-settlement era (see Figure 15 Page 36). The watershed was part of the Grand Prairie Division that covered a large portion of central Illinois, including 92% of the watershed that was considered to be prairie. Timber was found predominately along the Friends Creek stream corridor, covering about 7% of the watershed, with a few sections also appearing along the northern border (Illinois Office of Secretary of State, 1965). One lake and one pond were historically recorded within the entire watershed and the stream system recorded varied slightly from the current Friends Creek stream path. Combined, these water bodies covered less than 1% of the watershed (See Table 7 Page 31). Friends Creek Township was the first to be settled in Macon County in 1822 by George Friend (Hug, 1910).

CURRENT LAND USES AND LAND COVER

Land cover, the amount of the watershed covered by farmland, residential land, open space, and other land and water types, reflected the land use of the Friends Creek Watershed. Land use referred to how people used the landscape, whether for development, farming, conservation, or mixed uses. Land cover and land uses of the Friends Creek Watershed mirrored each other; therefore, they were used interchangeably for this inventory.

A land cover map of the Friends Creek Watershed was created in ArcMap based on the most recent aerial photography taken in 2015. The 2007 Illinois Cropland Data Layer (USDA NASS, 2008) provided information on a scale of 30-meter grids. This layer of information was corrected with a more accurate aerial photography. (The newer version, 2017 Illinois Cropland Data Layer, was not available at the time of the analysis.) Land cover for the Friends Creek Watershed and the 26 subwatersheds was reported in Table 8 Page 32.

Land cover in the Friends Creek Watershed was predominantly cropland, followed by open space and development. Cropland, which covered over 90 percent of the watershed, accounted for 74,604 of the watershed's 82,833 total acres. Open space collectively made up over seven percent of the land cover (5,992 acres), consisting mostly of grassland (3,584 acres), followed by forest (1,222 acres), water (707 acres), forested wetland (304 acres), and wetland (176 acres). Almost three percent of the watershed was developed (2,237 acres) with low, medium, and high density development.

Cropland with scattered low density development was spread throughout the Friends Creek Watershed, and much of the open space bordered the lower main stem of Friends Creek. Deciduous forests and grasslands were found in the riparian corridors at the confluences of Friends Creek Ditch, Middle Friends Creek, Kickapoo Creek, and Lower Friends Creek and extended down the main stem of Lower Friends Creek. Small wetlands and grasslands were scattered throughout much of the headwaters surrounded by row crops, and wetlands also occurred along roadsides. The two largest Villages of Weldon and

Argenta (medium density development) occurred in Friends Creek Ditch 7 Subwatershed and Lower Friends Creek 2 Subwatershed. Two smaller Villages of Lane and Cisco (medium density development) were located in Kickapoo Creek 8 Subwatershed and Lower Friends Creek 5 Subwatershed. Rural residential development (low density) mostly occurred within Friends Creek Ditch and Lower Friends Creek. See Table 9 through Table 12 Pages 32-34 and Figure 16 Page 37 for a complete overview of the land cover in each HUC-12 subwatershed.

PREDICTED FUTURE LAND USES AND LAND COVER

Most of the land currently held in farming practices were not anticipated to change drastically in the next decade. Demographic census data reported below, local knowledge, and the lack of published future land use plans supported this conclusion.

DEMOGRAPHICS

There were 415 blocks spanning ten block groups that fall within the Friends Creek Watershed as shown in Figure 17 Page 38. The data reported from these block groups reported a total population of 4,275 people as of the 2010 census with a median age of 45.75 years old. There were 1,801 housing units accounted for during the survey. The population was split almost evenly, with 81 more males than females (U.S. Census Bureau, 2012) The block group data was more specific to the watershed; however, census tracts were observed to estimate population growth and median household income. There were five census tracts that covered these block groups, with a majority of the watershed within Illinois Tract 17039971500 and Illinois Tract 17115003000. The current population for all of the census tracts involved in this watershed was 22,247 people and it was estimated to decline by 79 people by the year 2023, experiencing a growth rate of -0.07%. The median household income was predicted to be $60,127.00 (Esri, 2018). Table 13 Page 34 shows a comparison on the demographics and shows the relationship between the block groups and census tracts in the watershed.

TABLE 7: 1800'S HISTORIC LAND COVER

1800's Historic Land Cover			
Type	**Description**	**% Watershed**	**Acres**
Prairie	A large area of level or rolling grassland, generally treeless.	92.29%	76,447
Timber	A thick growth of trees, etc. covering a large tract of land.	7.30%	6,050
River	A natural stream of water.	0.38%	318
Lake	A large inland body of usually fresh water.	0.012%	10
Pond	A still body of water smaller than a lake.	0.010%	8
	Total:	**100%**	**82,833**

TABLE 8: LAND COVER FOR FRIENDS CREEK WATERSHED

Land Cover: Friends Creek Watershed		
Land Cover Type	Acres	%
Roads	640	0.77%
Low Density Urban	1,306	1.58%
Medium Density Urban	242	0.29%
High Density Urban	49	0.06%
Water*	707	0.85%
Forest*	1,222	1.48%
Forested Wetland*	304	0.37%
Grassland*	3,584	4.33%
Wetland*	176	0.21%
Cropland	74,604	90.07%
Total:	**82,833**	**100%**

TABLE 9: LAND COVER FOR FRIEND CREEK DITCH SUBWATERSHEDS

Land Cover: Friends Creek Ditch (FCD) Subwatersheds										
Land Cover Type	1 FCD		2 FCD		3 FCD		4 FCD		5 FCD	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Water	42.7	1.09%	49.7	1.58%	18.8	0.59%	10.8	0.37%	17.6	0.43%
Roads	2.0	0.05%	22.0	0.70%	2.0	0.06%	0.0	0.00%	76.2	1.86%
Low Density Urban	71.1	1.81%	41.8	1.33%	17.9	0.56%	15.5	0.53%	60.7	1.49%
Medium Density Urban	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%
High Density Urban	2.2	0.06%	0.0	0.00%	0.6	0.02%	0.3	0.01%	0.0	0.00%
Forest	98.7	2.52%	6.0	0.19%	0.0	0.00%	1.6	0.05%	0.6	0.01%
Grassland	253.2	6.46%	116.6	3.71%	46.6	1.46%	72.5	2.47%	74.9	1.83%
Wetland	2.0	0.05%	0.0	0.00%	0.0	0.00%	0.0	0.00%	1.6	0.04%
Forested Wetland	13.5	0.34%	0.6	0.02%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Cropland	3,432.0	87.61%	2,908.3	92.47%	3,115.8	97.32%	2,833.0	96.57%	3,855.6	94.33%
Total:	**3,917.4**	**100%**	**3,145.0**	**100%**	**3,201.7**	**100%**	**2,933.7**	**100%**	**4,087.2**	**100%**

Land Cover: Friends Creek Ditch (FCD) Subwatersheds (Con't)								
Land Cover Type	6 FCD		7 FCD		8 FCD		9 FCD	
	Acres	%	Acres	%	Acres	%	Acres	%
Water	27.7	1.61%	23.2	0.71%	1.1	0.04%	37.4	0.88%
Roads	3.5	0.20%	87.7	2.70%	33.9	1.17%	2.8	0.07%
Low Density Urban	13.5	0.78%	98.3	3.02%	35.0	1.21%	31.7	0.75%
Medium Density Urban	0.0	0.00%	86.9	2.67%	0.0	0.00%	0.0	0.00%
High Density Urban	0.0	0.00%	5.4	0.17%	0.4	0.01%	0.0	0.00%
Forest	0.0	0.00%	2.2	0.07%	0.0	0.00%	0.4	0.01%
Grassland	43.6	2.53%	84.1	2.59%	50.0	1.73%	101.0	2.38%
Wetland	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Forested Wetland	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Cropland	1,635.7	94.88%	2,862.3	88.07%	2,773.4	95.84%	4,077.0	95.92%
Total:	**1,724.0**	**100%**	**3,250.1**	**100%**	**2,893.8**	**100%**	**4,250.3**	**100%**

TABLE 10: LAND COVER FOR MIDDLE FRIENDS CREEK DITCH SUBWATERSHEDS

Land Cover: Middle Friends Creek Ditch (MFC) Subwatersheds								
Land Cover Type	1 MFC		2 MFC		3 MFC		4 MFC	
	Acres	%	Acres	%	Acres	%	Acres	%
Water	50.0	1.52%	13.9	0.43%	29.3	0.97%	15.7	0.57%
Roads	1.0	0.03%	2.0	0.06%	2.0	0.07%	24.0	0.86%
Low Density Urban	27.7	0.84%	29.3	0.90%	29.1	0.97%	42.0	1.51%
Medium Density Urban	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%
High Density Urban	0.0	0.00%	0.0	0.00%	0.8	0.03%	0.0	0.00%
Forest	131.5	4.01%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Grassland	146.4	4.46%	18.9	0.58%	43.5	1.44%	57.4	2.07%
Wetland	1.2	0.04%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Forested Wetland	11.2	0.34%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Cropland	2,912.8	88.76%	3,178.6	98.02%	2,906.0	96.52%	2,639.2	94.99%
Total:	**3,281.8**	**100%**	**3,242.7**	**100%**	**3,010.7**	**100%**	**2,778.3**	**100%**

TABLE 11: LAND COVER FOR LOWER FRIENDS CREEK DITCH SUBWATERSHEDS

Land Cover: Lower Friends Creek Ditch (LFC) Subwatersheds										
Land Cover Type	1 LFC		2 LFC		3 LFC		4 LFC		5 LFC	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Water	52.2	1.50%	23.4	0.86%	43.5	1.14%	45.8	1.80%	24.2	1.11%
Roads	11.1	0.32%	105.2	3.87%	44.5	1.16%	94.1	3.70%	80.5	3.69%
Low Density Urban	117.4	3.36%	187.3	6.89%	87.8	2.29%	32.5	1.28%	19.7	0.90%
Medium Density Urban	0.0	0.00%	119.0	4.38%	0.0	0.00%	0.0	0.00%	15.1	0.69%
High Density Urban	0.6	0.02%	18.6	0.68%	0.0	0.00%	5.2	0.20%	9.2	0.42%
Forest	340.1	9.74%	139.4	5.13%	203.0	5.30%	119.8	4.71%	0.0	0.00%
Grassland	600.2	17.19%	307.1	11.30%	484.2	12.64%	306.1	12.03%	151.6	6.95%
Wetland	5.8	0.17%	17.5	0.64%	0.0	0.00%	32.1	1.26%	21.5	0.99%
Forested Wetland	139.3	3.99%	33.2	1.22%	57.2	1.49%	8.8	0.35%	7.8	0.36%
Cropland	2,224.9	63.72%	1,766.5	65.01%	2,910.3	75.98%	1,899.7	74.67%	1,850.4	84.88%
Total:	**3,491.6**	**100%**	**2,717.2**	**100%**	**3,830.5**	**100%**	**2,544.1**	**100%**	**2,180.0**	**100%**

TABLE 12: LAND COVER FOR KICKAPOO CREEK SUBWATERSHEDS

Land Cover: Kickapoo Creek (KC) Subwatersheds								
Land Cover Type	1 KC		2 KC		3 KC		4 KC	
	Acres	%	Acres	%	Acres	%	Acres	%
Water	61.8	1.35%	27.3	0.79%	21.0	0.82%	37.5	1.33%
Roads	20.1	0.44%	0.8	0.02%	1.0	0.04%	1.0	0.04%
Low Density Urban	111.0	2.43%	23.7	0.69%	14.0	0.55%	40.3	1.43%
Medium Density Urban	1.4	0.03%	1.1	0.03%	0.0	0.00%	0.0	0.00%
High Density Urban	0.6	0.01%	5.0	0.15%	0.0	0.00%	0.0	0.00%
Forest	119.1	2.60%	0.0	0.00%	43.4	1.70%	12.7	0.45%
Grassland	240.0	5.25%	37.7	1.09%	90.6	3.54%	130.6	4.63%
Wetland	1.4	0.03%	7.8	0.23%	0.0	0.00%	0.0	0.00%
Forested Wetland	8.1	0.18%	0.0	0.00%	17.7	0.69%	6.2	0.22%
Cropland	4,009.0	87.68%	3,343.7	97.00%	2,369.8	92.66%	2,590.4	91.90%
Total:	**4,572.5**	**100%**	**3,447.1**	**100%**	**2,557.5**	**100%**	**2,818.7**	**100%**

Land Cover: Kickapoo Creek (KC) Subwatersheds (Con't)								
Land Cover Type	5 KC		6 KC		7 KC		8 KC	
	Acres	%	Acres	%	Acres	%	Acres	%
Water	0.2	0.01%	25.5	1.26%	3.2	0.08%	3.8	0.12%
Roads	1.0	0.03%	2.0	0.10%	1.0	0.02%	18.7	0.57%
Low Density Urban	35.0	1.00%	13.4	0.66%	64.3	1.55%	46.2	1.41%
Medium Density Urban	0.0	0.00%	0.0	0.00%	0.0	0.00%	18.1	0.55%
High Density Urban	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Forest	1.8	0.05%	0.0	0.00%	0.3	0.01%	1.2	0.04%
Grassland	17.8	0.51%	17.1	0.85%	33.2	0.80%	59.0	1.81%
Wetland	77.2	2.20%	0.0	0.00%	6.4	0.15%	0.0	0.00%
Forested Wetland	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Cropland	3,371.4	96.20%	1,964.8	97.13%	4,046.0	97.39%	3,120.5	95.50%
Total:	**3,504.4**	**100%**	**2,022.8**	**100%**	**4,154.4**	**100%**	**3,267.5**	**100%**

TABLE 13: DEMOGRAPHICS

Demographics											
Census Tract Data					Block Group Data						
Tract	Current Population (2018)	Estimated Population (2023)	Growth Rate	Median Household Income	Block Group	Village/Township	Total Housing Units	Total Population	Male	Female	Median age
17115002200	5,412	5,257	-0.60%	$49,156.00	2	Whitmore	104	252	134	118	46
					5	Oakley	267	598	319	279	48.6
17115003000	3,435	3,300	-0.80%	$59,798.00	3	Maroa	46	105	52	53	50.5
					4	Friends Creek	183	441	232	209	48.4
					5	Argenta Village	272	667	335	332	39.7
17147954500	4,748	4,885	0.60%	$70,529.00	3	Goose Creek	148	344	185	159	45.8
17147954800	3,059	3,182	0.80%	$63,983.00	1	Willow Branch	190	485	245	240	38.3
17039971400	2,724	2,701	-0.20%	$51,038.00	1	De Witt	64	148	71	77	48.2
17039971500	2,869	2,843	-0.20%	$60,456.00	2	DeWitt	65	147	72	75	45.7
					3	Nixon	49	110	59	51	43
					3	Texas	60	141	72	69	41.5
					3	Creek	185	427	213	214	41.7
Totals	**22,247**	**22,168**	**-0.07%**	**$60,127.00**			**1,633**	**3,865**	**1,989**	**1,876**	**45.75**

FIGURE 15: 1800'S LAND COVER

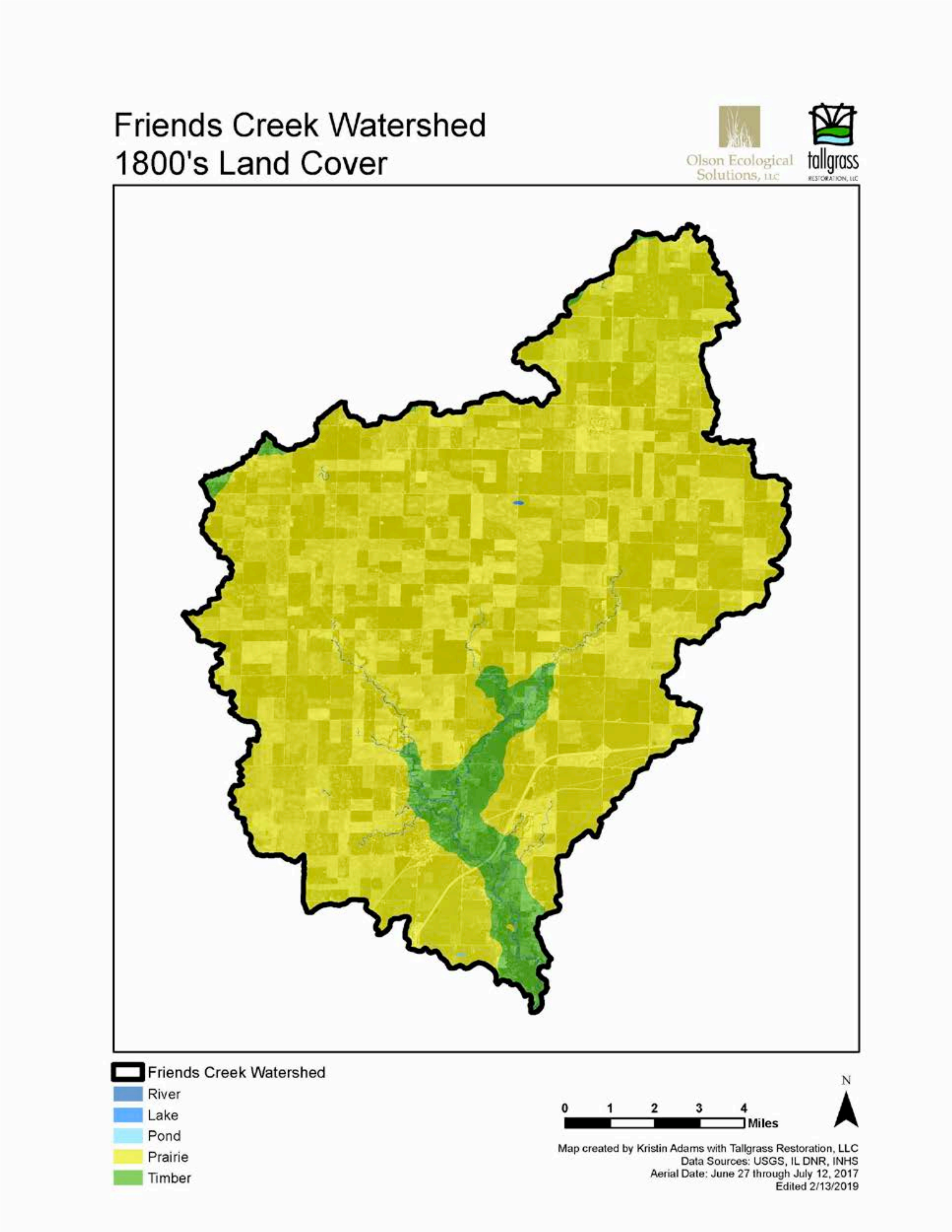
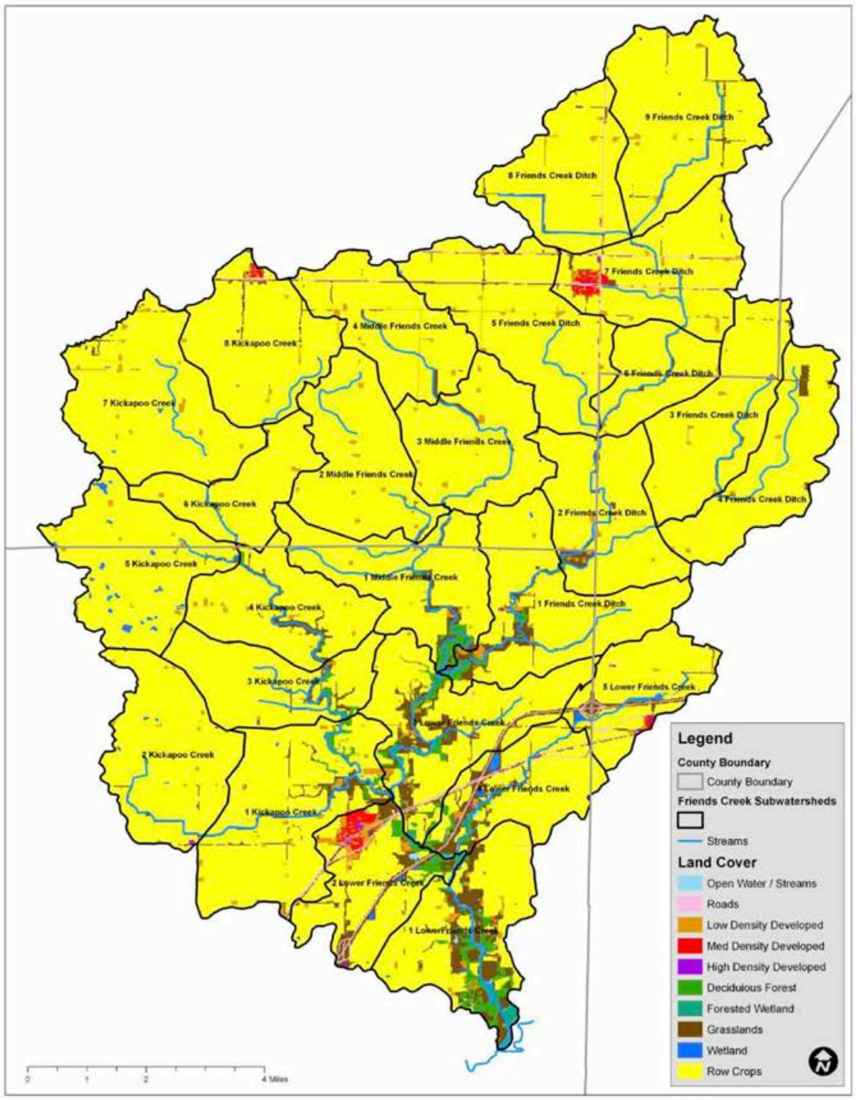
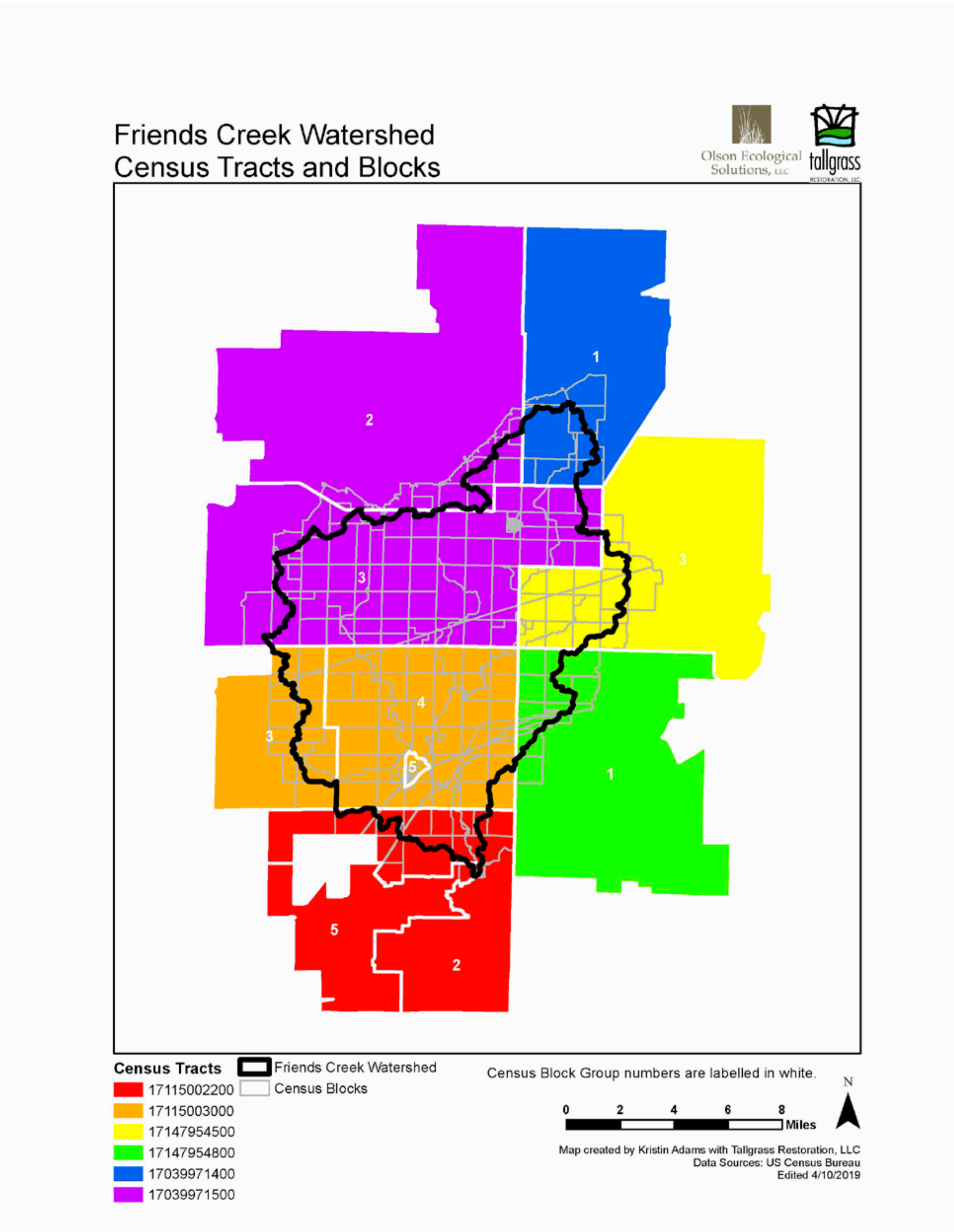


FIGURE 16: LAND COVER



Land cover of the 26 sub-watersheds within the Friends Creek Watershed located in Dewitt, Macon and Piatt counties of Central Illinois. Map created by Nathan Hill.

FIGURE 17: CENSUS TRACTS AND BLOCKS



SECTION1, CHAPTER 4: GEOLOGY AND CLIMATE

GEOLOGY

The geology of the Friends Creek Watershed was based on patterns of glaciation and bedrock formations. The Illinois landscape present today was formed by several glaciation events that covered about 90% of the state during the Quaternary Period which took place almost 2.6 million years ago. The glacier formations deposited sediment and created stream channels, smoothing most of the landscape presently seen as plains land formations in central Illinois.

The Quaternary deposits for the area can be reviewed in Figure 18 Page 42 and Table 14 Page 40. Friends Creek Watershed was located within the Bloomington Ridged Plain, part of a till plain of the Wisconsin Episode glacial boundary. The Wedron group, formed during the Wisconsin Episode, covered most of the Friends Creek Watershed. It smoothed the landscape as the sediment gathered on the edges of the glaciers and then receded. A small section along Friends Creek at the southern end of the watershed was part of the Cahokia and Henry Formations and characterized by sediment brought in through rivers and sand blown in by wind.

Bedrock formations, the underlying topography upon which the landscape was formed, were named for the period in which they were formed. The bedrock present in Friends Creek Watershed was part of the Pennsylvanian System (see Figure 19 Page 43 and Table 15 Page 40). The Bond Formation and Shelbourn-Patoka Formations accounted for most of the area, while the southern tip was part of the Mattoon Formation (see Table 15 Page 40). All of these were part of the McLeansboro Group. (D. Kolata, 2010).

TOPOGRAPHY

As in most portions of central Illinois, the landscape only had slight differences in elevation. The topography followed along the Friends Creek stream and its tributaries. There were three stretches along the width of the watershed where the topography was slightly more undulating, as seen in Figure 20 Page 44. Consequently, the erosion hazard was slight throughout the watershed, except along the Friends Creek stream corridor in the southern portion of the watershed. Any erosion occurring could be found most readily in the Lower Friends Creek Subwatershed.

CLIMATE

Climate played an important role in the formation of soils, due to the influence it had on plant and animal life in the region. The amount of rainfall received annually affected weathering of minerals and transportation of sediments in this watershed. The climate of this region had four distinct seasons and was an especially important factor to the crop producers in the area.

Climate in the Friends Creek Watershed was temperate and humid, with temperature extremes reached in both the summer and winter months and an annual precipitation of 38.45 inches. Data collected from Decatur Airport weather station, collected and accessed through the National Oceanic and Atmospheric Administration (NOAA), for the years 1981 through 2010 was averaged together to determine a normal climate pattern (see Table 16 Page 41). This time frame indicated a normal temperature range of 63.1°F to 84.5°F in the summer (June through August) and 21.7°F to 37.7°F during winter (December through

February). Spring (March through May) and fall (September through October) were temperate, with a combined average range of 41.7°F to 65.4°F. As examples of extreme temperatures in 2018, January 1st exhibited 13°F below zero while May 28th reached 97°F. In addition to being the hottest time of year, summer was usually the wettest time of the year (average 11.86 inches), followed closely by spring (average 10.73 inches) and fall (average 9.6 inches). Winter was normally the driest part of the year (average 6.26 inches) As an example of extreme storms experienced recently, September 7, 2018 received 3.06 inches of rain, and June and July of 2018 each reached slightly over 5.5 inches of rainfall (NCEI, 2018).

Over the course of the entire year in 2018, there were 5,783 heating degrees and 1,435 cooling degrees, which in both instances were above average. This indicated the sum number of degrees from the temperature average, either above or below 65 degrees. The significance of this number being higher than average was reflected in the amount of energy consumption required to heat or cool buildings or structures. It could be indicative of a greater trend towards climate change in a particular region which could lead to negative impacts on the quality of a watershed (NCEI, 2018).

TABLE 14: QUATERNARY DEPOSITS

Quaternary Deposits				
Event	**Stratigraphic Class**	**Material of geologic deposits**	**% Watershed**	**Acreage**
Wisconsin glaciation (100)	Wedron Group (40)	GM1: diamicton deposited as till and ice-marginal sediment (Wisconsin Episode)	98.51%	81,602
Wisconsin glaciation (100)	Cahokia and/or Henry Formation (10)	C1: waterlain river sediment and wind-blown beach sand	1.49%	1,231
		Total:	**100%**	**82,833**

TABLE 15: BEDROCK GEOLOGY

Bedrock Geology			
Abbreviation	**Lithological Name**	**% Watershed**	**Acres**
Psp	Shelburn-Patoka undivided	45.21%	37,449
Pb	Bond Formation	51.38%	42,556
Pm	Mattoon Formation	3.41%	2,828
	Total:	**100%**	**82,833**

TABLE 16: PRECIPITATION AND TEMPERATURE MONTHLY AVERAGES FOR 2018

Precipitation & Temperature Monthly Averages for 2018						
Month/Season	Total Precipitation (inches)	Temperature (F)			Degree Days	
		Mean	Max Avg.	Min Avg.	Heating	Cooling
January	1.03	24.9	33.9	15.9	1,242	0
February	4.10	32.9	42.8	23.1	898	0
Winter 2017-18:	**5.25**	**29.3**	**38.4**	**20.2**	**3,226**	**0**
March	3.37	38.7	48.4	29.0	816	0
April	1.87	45.5	57.2	33.8	587	2
May	1.97	71.8	83.9	59.6	7	217
Spring 2018:	**7.21**	**52.0**	**63.2**	**40.8**	**1,410**	**219**
June	5.53	75.7	86.0	65.3	0	321
July	5.61	74.3	84.4	64.2	3	290
August	2.84	75.2	84.7	65.8	2	320
Summer 2018:	**13.98**	**75.1**	**85.0**	**65.1**	**5**	**931**
September	4.54	71.1	82.7	59.5	33	216
October	2.59	55.2	66.3	44.0	373	69
November	2.50	35.5	42.5	28.6	884	0
Fall 2018:	**9.63**	**53.9**	**63.8**	**44.0**	**1,290**	**285**
December	4.40	34.7	42.6	26.9	938	0
Annual (2018):	**40.35**	**53.0**	**63.0**	**43.0**	**5,783**	**1,435**
Normal Weather Patterns (1981-2010) - **Higher** or **Lower** than Normal						
Winter (Dec-Feb)	6.26	29.7	37.7	21.7	3,176	0
Spring (Mar-May)	10.73	52.4	63.1	41.7	1,247	87
Summer (Jun-Aug)	11.86	73.8	84.5	63.1	22	832
Fall (Aug-Nov)	9.60	54.6	65.4	43.8	1,076	130
Annual	38.45	52.7	62.8	42.7	5,522	1,049
Station: Decatur Airport, IL. NOAA - www.ncdc.noaa.gov. Accessed 3/25/2019.						

FIGURE 18: QUATERNARY DEPOSITS

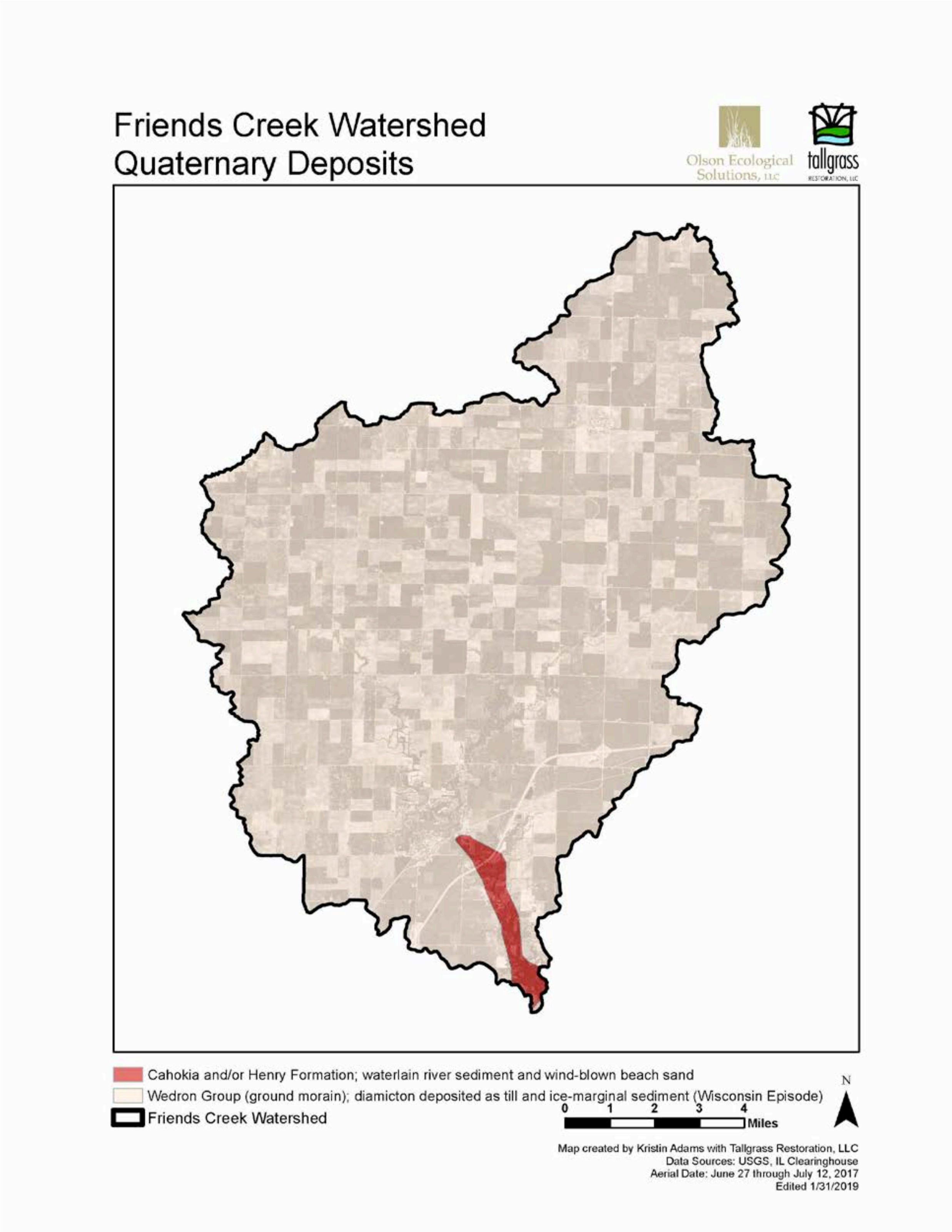


FIGURE 19: BEDROCK GEOLOGY

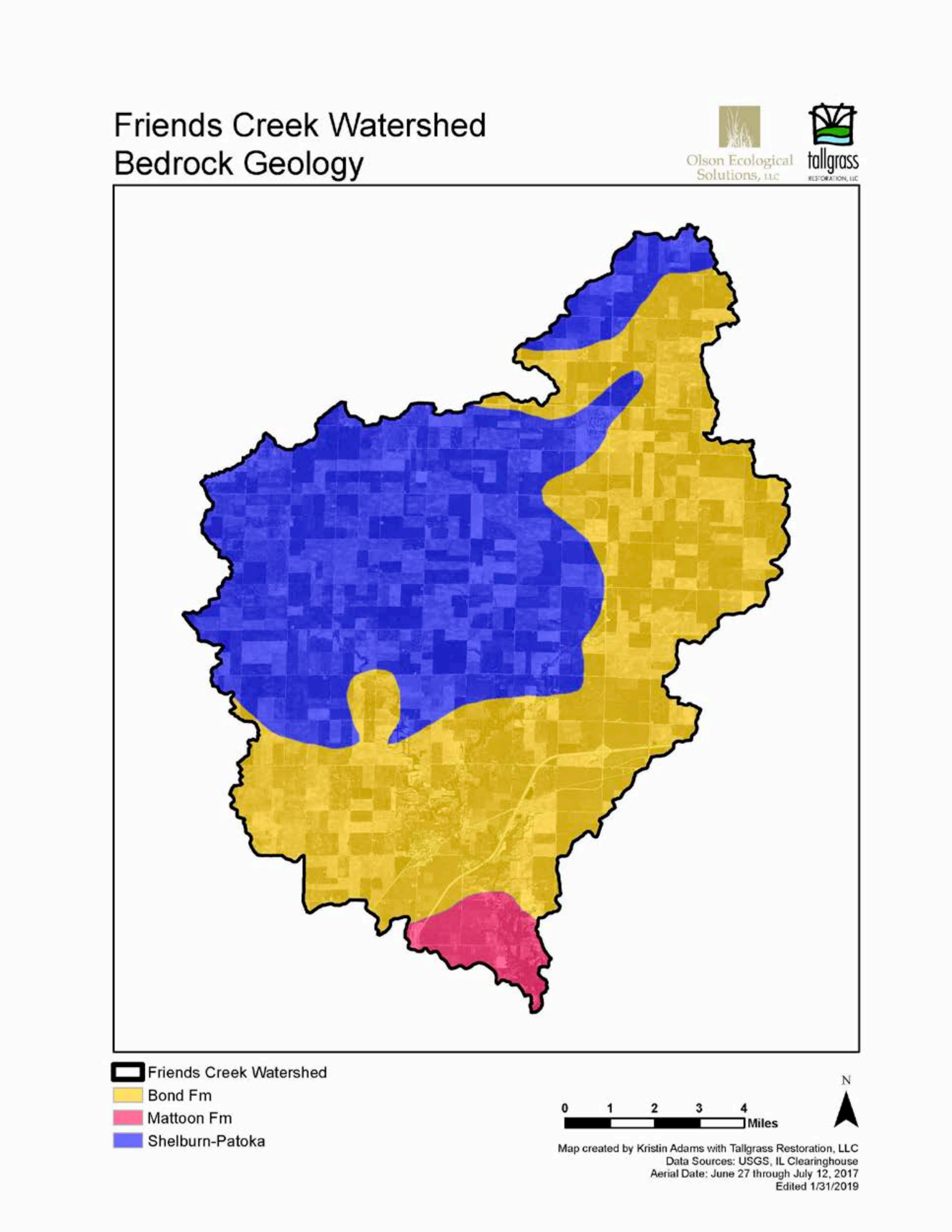
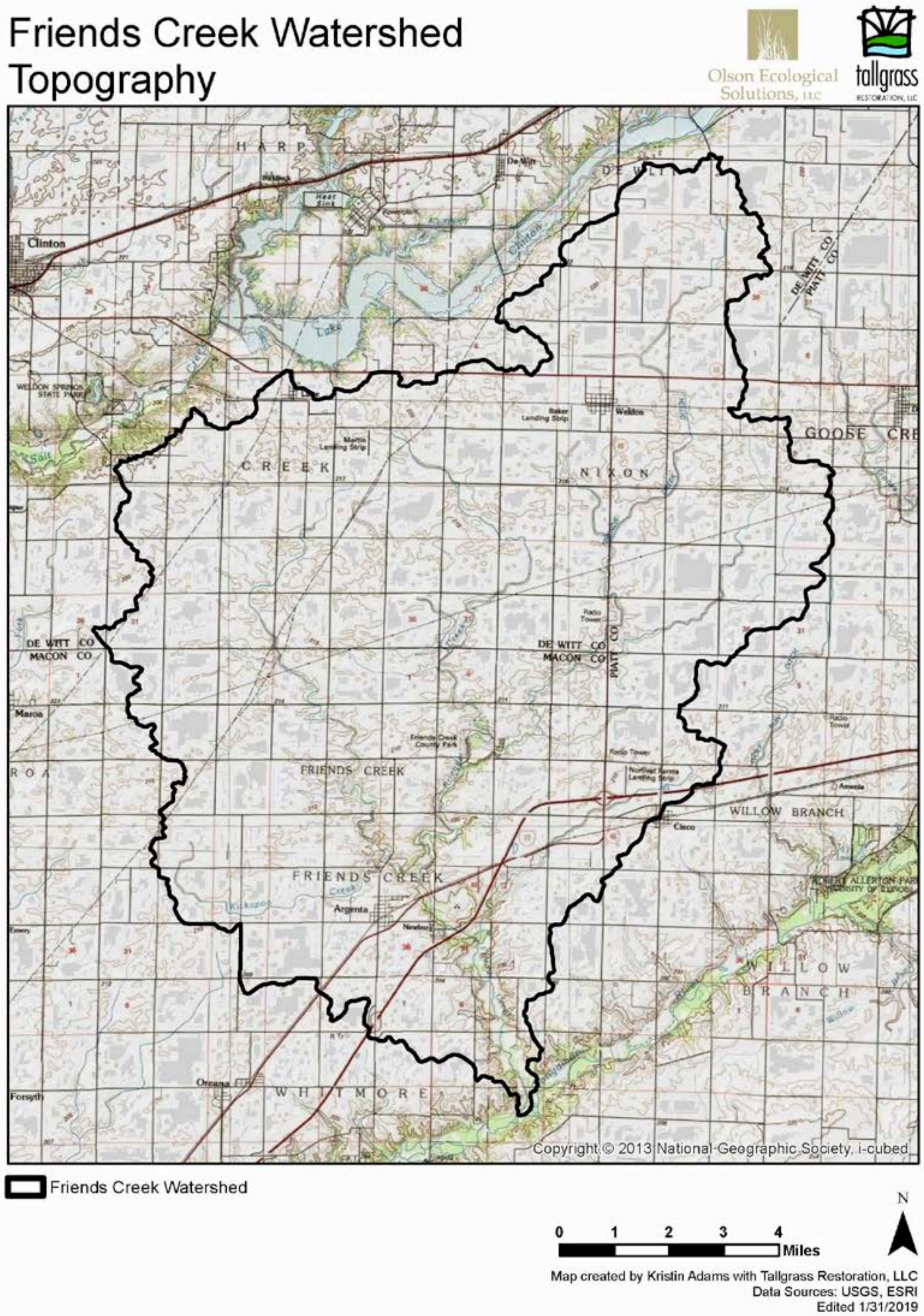


FIGURE 20: TOPOGRAPHY



SECTION1, CHAPTER 5: SOILS

To understand soils in the Friends Creek Watershed and their role in water quality, we looked at soil texture, types, farmland quality, hydric developments, hydrological groups and water transmission, drainage class, and erodibility.

SOIL TEXTURE

The soils of the Friends Creek Watershed developed both a silty and in some cases clay-like texture over time, qualifying as either a silty clay loam representing 51.88% of the watershed, or as a silt loam consisting of 47.24% of the watershed (see Table 17 Page 48 and Figure 21 Page 53). Clay textures developed as a clay loam and were found scattered along the stream corridor, accounting for less than 1% of the watershed. Silty clay texture was only represented in one soil type consisting of a mere seven acres in the entire watershed and found near the southern tip. The small, remaining area was classified as water (see Figure 21 Page 53 and Table 17 Page 48).

MAJOR SOIL TYPES

There were 52 different soil types present in the Friends Creek Watershed. Three of these soil types made up most of the watershed. The most prevalent soil type was Sable silty clay loam, which surfaced 38.42% of the watershed and was found away from the stream corridors. The next prevalent soil, Ipava silt loam, covered 18.48% of the watershed. Catlin silt loam accounted for 14.47% of the soils in the entire watershed. The remaining 42 soil types each had a presence of less than 10% of the watershed (see Figure 22 Page 54 and Table 18 Page 49).

FARMLAND QUALITY

Soils are typically evaluated for their ability to produce food, feed, forage, fiber, and oilseed crops. Illinois soils fall into categories of Prime farmland, Farmland of statewide importance, or not Prime farmland. Prime farmland produces the highest yields with the lowest expenditure of energy and economic resources and is the least damaging to the environment. Farmland of statewide importance is generally less productive than Prime farmland and possesses greater restrictions that negatively affect its use for agricultural purposes. Not prime farmland may have the potential for use as farmland, but some restriction(s) prevent its use for agriculture (Illinois Dept. of Agriculture, 2001).

Nearly all (96.62%) of the Friends Creek Watershed was considered Prime farmland, of which 43.34% needed no alteration to reach this standard while 50.08% needed to be properly drained, 1.69% needed to be protected from flooding, and 1.51% needed both draining and protection from flooding. Along the Friends Creek stream and its tributaries, 2.05% of the watershed exhibited Farmland of statewide importance. Only 1.33% of the watershed was not considered to be Prime farmland, contained within Lower Friends Creek Subwatershed and correlated with a few roads and along parts of the stream corridor (see Table 19 and Figure 23, Page 49 and Page 55).

HYDRIC SOILS

Hydric soils are defined as poorly drained soils, prone to flooding or wet conditions if not drained, which are sufficiently wet enough to develop low oxygen, anaerobic conditions in the upper part of the soil. They are naturally associated with wet prairies, forest floodplains, and wetlands, as they have been either saturated or inundated long enough to support the growth of hydrophytic vegetation (Soil Survey Staff, 2019). Even if these soils are drained, their hydric characteristics can still be seen, and they are often used to indicate areas of wetland restoration potential. There are four established ranges of hydric soils: low (1 to 32%), moderate (33 to 65%), high (66 to 99%), and entirely hydric (100%).

Within the Friends Creek Watershed, highly hydric soils were the most frequent soils found, covering 47.71% of the watershed. They could be found away from streams or tributaries. This suggested that most of the watershed formed under wetland conditions at one time. Combined with the status of Prime farmland if drained properly and local knowledge, most of the watershed likely had historic wetland loss due to instillation of agriculture drain tile for agricultural production purposes. Low hydric soils accounted for another 33.43% of the watershed and could be found in every subwatershed, more clustered near Friends Creek stream. Non-hydric soils were found interspersed throughout only 15.04% of the entire Friends Creek Watershed, with a larger presence in DeWitt County and infrequently along the Friends Creek stream corridor. Soils that were considered entirely hydric covered only 3.82% and were most abundant in Lowers Friends Creek and Kickapoo Subwatersheds near the streams and tributaries. None of the soils were considered moderately hydric (see Figure 24 Page 58 and Table 20 Page 1550).

HYDROLOGICAL SOIL GROUPS AND WATER TRANSMISSION

Hydrological Soil Groups (HSG) explain the runoff response potential of soils based on transmission rate of water; depth to water table or restrictive layer; and soil texture, structure, and degree of swelling when saturated. Soils are assigned into four groups: A, B, C, or D. HSG A include soils with low runoff potential when thoroughly wet, so that water transfers freely through the soil. HSG B includes soils with moderately low runoff potential. HSG C includes soils with moderately high runoff potential, and HSG D includes soils with high runoff potential. Furthermore, if a soil in HSG D is drained, it is assigned a dual class of either A/D, B/D, or C/D, with the first letter indicating the characteristic of the drained soil (Soil Survey Staff, 2019).

Over half of the soils in the Friends Creek Watershed were part of the B/D dual class Hydrological Soil Group. These B/D soils were found intermingled with soils in the C/D dual class which spanned 26.05% of the watershed. Concentrated along the stream corridor, Group C accounted for 19.83% with a few pockets of Group B clustered in the Lower Friends Creek Subwatershed. Only one map unit had Group D soils consisting of seven acres located at the southmost tip of the watershed (see Figure 25 Page 59 and Page 51).

SOIL DRAINAGE CLASS

Soil drainage class refers to the frequency and duration of wet periods for soils in their natural condition, without artificial drainage and under conditions similar to those under which the soil formed (Soil Survey Staff, 2019). Nearly 80% of the Friends Creek Watershed was considered to be poorly drained to varying degrees. Soils that were either well drained or moderately so were located nearest to the stream banks with occasional pockets found in upland cropfields (see Figure 26 Page 60 and Table 22 Page 51).

SOIL ERODIBILITY

Soil erosion, defined as the breakdown, detachment, transport, and redistribution of soil particles caused by water and wind combined with gravity, is of particular interest for the watershed due to its off-site impacts to water quality. In order to understand the characteristics of the soil, soil erodibility is based on the slope and soil erosion factor (K). Soil loss in the form of either rill or sheet erosion is predicted in areas where 50 to 75% of the soil surface is exposed (Soil Survey Staff, 2019).

Throughout the nation, soil erosion on cropland has been on a downward trend, decreasing by 43% between 1982 and 2007. Geographically, 54% of soil erosion from water has occurred in two of ten farm production regions in the United States, including Illinois, which emphasizes the national importance of reducing erosion in Northwest Illinois and this watershed. Expected erosion rates of soil are a factor of long-term climate data, inherent soil and site characteristics, and cropping and management practices (Soil Survey Staff, 2019).

Most of the Friends Creek Watershed only held a slight erosion hazard. Areas along the stream as well as a few roadsides had a moderate to severe risk for erosion, but it accounted for less than 1% of the entire watershed (see Figure 27 Page 61 and Page 52).

HIGHLY ERODIBLE LAND (HEL)

Highly erodible soils (HEL) are characterized by soil map units that have an erodibility index (EI) of eight or greater, as determined by the Revised Universal Soil Loss Equation (RUSLE). HEL status has been recorded by Farm Service Agency in 1990 in their Common Land Unit database (CLU). The 1985 Food Security Act Farm Bill has dictated compliance requirements related to HEL for agricultural producers who utilize programs offered by US Department of Agriculture with a purpose to minimize soil erosion, preserve land fertility of farmland, and protect water quality along with the nation's wetlands (Soil Survey Staff, "Background on Highly Erodible Land Compliance," N.D.). This database used by the Natural Resources Conservation Service (NRCS) and Farm Services Agency (FSA) for HEL status determination has not been updated since 1990 to include the current erodibility indexes.

According to the 1990 database, Figure 28 Page 62 and Table 24 Page 52 showed the soil locations classified as either HEL or Potentially HEL (PHEL) based on the frozen soil lists from 1990. Less than 1% of the soil map units in the Friends Creek Watershed were classified as HEL, with the highest concentration found in the Lower Friends Creek Subwatershed. PHEL soils were slightly more abundant at 6.58% and located mainly along the Friends Creek stream and its tributaries.

TABLE 17: SOIL SURFACE TEXTURE

Soil Surface Texture		
Rating	**% Watershed**	**Acres**
Not Specified - water	0.13%	112
Silt loam	47.24%	39,131
Silty clay	0.008%	7
Silty clay loam	51.88%	42,977
Clay loam	0.73%	608
Total:	**100%**	**82,833**

TABLE 18: SOIL MAP UNITS

Soil Map Units (listed from most frequent to least)			
Symbol	Name and description	% Watershed	Acreage
68A	Sable silty clay loam, 0 to 2 percent slopes	38.42%	31,822
43A	Ipava silt loam, 0 to 2 percent slopes	18.48%	15,306
171B2	Catlin silt loam, 2 to 5 percent slopes, eroded	10.61%	8,789
154A	Flanagan silt loam, 0 to 2 percent slopes	6.35%	5,257
244A	Hartsburg silty clay loam, 0 to 2 percent slopes	5.07%	4,201
171B	Catlin silt loam, 2 to 5 percent slopes	3.84%	3,184
152A	Drummer silty clay loam, 0 to 2 percent slopes	3.62%	3,001
67A	Harpster silty clay loam, 0 to 2 percent slopes	2.69%	2,226
3451A	Lawson silt loam, cool mesic, 0 to 2 percent slopes, frequently flooded	1.55%	1,285
3107A	Sawmill silty clay loam, 0 to 2 percent slopes, frequently flooded	1.49%	1,230
233B	Birkbeck silt loam, 2 to 5 percent slopes	1.12%	931
56B	Dana silt loam, 2 to 5 percent slopes	0.62%	513
618C2	Senachwine silt loam, 5 to 10 percent slopes, eroded	0.60%	493
622C2	Wyanet silt loam, 5 to 10 percent slopes, eroded	0.50%	416
234A	Sunbury silt loam, 0 to 2 percent slopes	0.50%	414
236A	Sabina silt loam, 0 to 2 percent slopes	0.44%	365
322C2	Russell silt loam, Bloomington Ridged Plain, 5 to 10 percent slopes, eroded	0.41%	343
618F	Senachwine silt loam, 18 to 35 percent slopes	0.40%	328
618D3	Senachwine clay loam, 10 to 18 percent slopes, severely eroded	0.35%	286
56C2	Dana silty clay loam, 5 to 10 percent slopes, eroded	0.34%	286
198A	Elburn silt loam, 0 to 2 percent slopes	0.32%	268
291B	Xenia silt loam, Bloomington Ridged Plain, 2 to 5 percent slopes	0.29%	244
56B2	Dana silt loam, 2 to 5 percent slopes, eroded	0.23%	194
802B	Orthents, loamy, undulating	0.22%	181
330A	Peotone silty clay loam, 0 to 2 percent slopes	0.20%	163
618D2	Senachwine silt loam, 10 to 18 percent slopes, eroded	0.18%	146
348B	Wingate silt loam, 2 to 5 percent slopes	0.16%	136
7134B	Camden silt loam, 2 to 5 percent slopes, rarely flooded	0.13%	110
802D	Orthents, loamy, rolling	0.11%	94
3077A	Huntsville silt loam, 0 to 2 percent slopes, frequently flooded	0.09%	77
W	Water	0.09%	73
134B	Camden silt loam, 2 to 5 percent slopes	0.07%	54
17A	Keomah silt loam, 0 to 2 percent slopes	0.06%	52
705B	Buckhart silt loam, 2 to 5 percent slopes	0.05%	45
679B	Blackberry silt loam, 2 to 5 percent slopes	0.04%	37
618G	Senachwine silt loam, 35 to 60 percent slopes	0.04%	33
622C3	Wyanet clay loam, 5 to 10 percent slopes, severely eroded	0.04%	32
865	Pits, gravel	0.04%	30
3284A	Tice silty clay loam, 0 to 2 percent slopes, frequently flooded	0.03%	25
622B2	Wyanet silt loam, 2 to 5 percent slopes, eroded	0.03%	22
1107A	Sawmill silty clay loam, undrained, 0 to 2 percent slopes, frequently flooded	0.02%	20
3333A	Wakeland silt loam, 0 to 2 percent slopes, frequently flooded	0.02%	18
7802B	Orthents, loamy, undulating, rarely flooded	0.02%	15
136A	Brooklyn silt loam, 0 to 2 percent slopes	0.02%	15
171C2	Catlin silt loam, 5 to 10 percent slopes, eroded	0.02%	14
148B	Proctor silt loam, 2 to 5 percent slopes	0.02%	13
3074A	Radford silt loam, 0 to 2 percent slopes, frequently flooded	0.014%	12
7198A	Elburn silt loam, 0 to 2 percent slopes, rarely flooded	0.012%	10
7865	Pits, gravel, rarely flooded	0.011%	10
3083A	Wabash silty clay, 0 to 2 percent slopes, frequently flooded	0.008%	7
132A	Starks silt loam, 0 to 2 percent slopes	0.006%	5
749B	Buckhart silt loam, till substratum, 2 to 5 percent slopes	0.003%	3
138A	Shiloh silty clay loam, 0 to 2 percent slopes	0.002%	1
	Total:	**100%**	**82,833**

TABLE 19: FARMLAND CLASSIFICATION

Farmland Classification		
Description	**% Watershed**	**Acres**
All areas are prime farmland	43.34%	35,901
Farmland of statewide importance	2.05%	1,698
Not prime farmland	1.33%	1,100
Prime farmland if drained	50.08%	41,482
Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season	1.51%	1,254
Prime farmland if protected from flooding or not frequently flooded during the growing season	1.69%	1,398
Total:	**100%**	**82,833**

TABLE 20: HYDRIC RATING

Hydric Rating			
Rating	**Range**	**% Watershed**	**Acres**
Not Hydric	0%	15.04%	12,455
Hydric	1 to 32%	33.43%	27,692
	33 to 65%	0.00%	0
	66 to 99%	47.71%	39,522
	100%	3.82%	3,165
	Total:	**100%**	**82,833**

TABLE 21: HYDROLOGIC SOIL GROUP

Hydrologic Soil Group			
Group	Description	% Watershed	Acreage
N/A	Not applicable, pits or water.	0.13%	112
A	High infiltration rate when thoroughly wet, low runoff potential.	0.00%	0
A/D	Dual Class: drained areas show characteristics of Group A, undrained areas show characteristics of Group D.	0.00%	0
B	Moderate infiltration rate when thoroughly wet.	0.72%	596
B/D	Dual Class: drained areas show characteristics of Group B, undrained areas show characteristics of Group D.	53.26%	44,117
C	Slow infiltration rate when thoroughly wet.	19.83%	16,422
C/D	Dual Class: drained areas show characteristics of Group C, Undrained areas show characteristics of Group D.	26.05%	21,579
D	Very slow infiltration rate when thoroughly wet, high runoff potential.	0.008%	7
	Total:	**100%**	**82,833**

TABLE 22: SOIL DRAINAGE CLASS

Soil Drainage Class		
Rating	% Watershed	Acres
Not rated or not available	0.13%	112
Subaqueous	0.00%	0
Very poorly drained	0.23%	191
Poorly drained	51.30%	42,495
Somewhat poorly drained	27.79%	23,016
Moderately well drained	17.71%	14,666
Well drained	2.84%	2,352
Somewhat excessively drained	0.00%	0
Excessively drained	0.00%	0
Total:	**100%**	**82,833**

Table 23: Erosion Hazard

Erosion Hazard		
Rating	**% Watershed**	**Acres**
Not rated	0.13%	112
Slight	99.14%	82,119
Moderate	0.29%	240
Severe	0.44%	361
Very Severe	0.00%	0
Total:	**100%**	**82,833**

Table 24: Erodibility Classes

Erodibility Classes								
Highly Erodible Lands (HEL)					**RUSLE Components***			
Map Unit	**Soil name**	**Slope (%)**	**Characteristic**	**Acres**	**R-value***	**K-Factor***	**T-Factor***	**Length/Slope***
171C2	Catlin Silty Clay Loam	5-10	Eroded	14	180	0.32	5	0.694
322C2	Russell Silt Loam	4-10	Eroded	343		0.37	5	0.601
56C2	Dana Silt Loam	4-6	Eroded	286		0.32	5	0.694
802D	Ortents, Loamy, Rolling	N/A		94		-	-	-
			Total:	**737**	**% Watershed:**	**0.89%**		
Potentially Highly Erodible Lands (PHEL)					**RUSLE Components***			
Map Unit	**Soil name**	**Slope (%)**	**Characteristic**	**Acres**	**R-value***	**K-Factor***	**T-Factor***	**Length/Slope***
134B	Camden Silt Loam	1-5		54	180	0.37	5	0.601
148B	Proctor Silt Loam	1-5		13		0.32	5	0.694
171B	Catlin Silt Loam	1-5		3,184		0.32	5	0.694
233B	Birbeck Silt Loam	1-5		931		0.37	5	0.601
291B	Xenia Silt Loam	1-5		244		0.37	5	0.601
348B	Wingate Silt Loam	1-5		136		0.32	5	0.694
802B	Orthents, Loam, Undulating	N/A		181		-	-	-
56B	Dana Silt Loam	2-5		513		0.32	5	0.694
56B2	Dana Silt Loam	2-6	Eroded	194		0.32	5	0.694
			Total:	**5,449**	**% Watershed:**	**6.58%**		

FIGURE 21: SURFACE TEXTURE

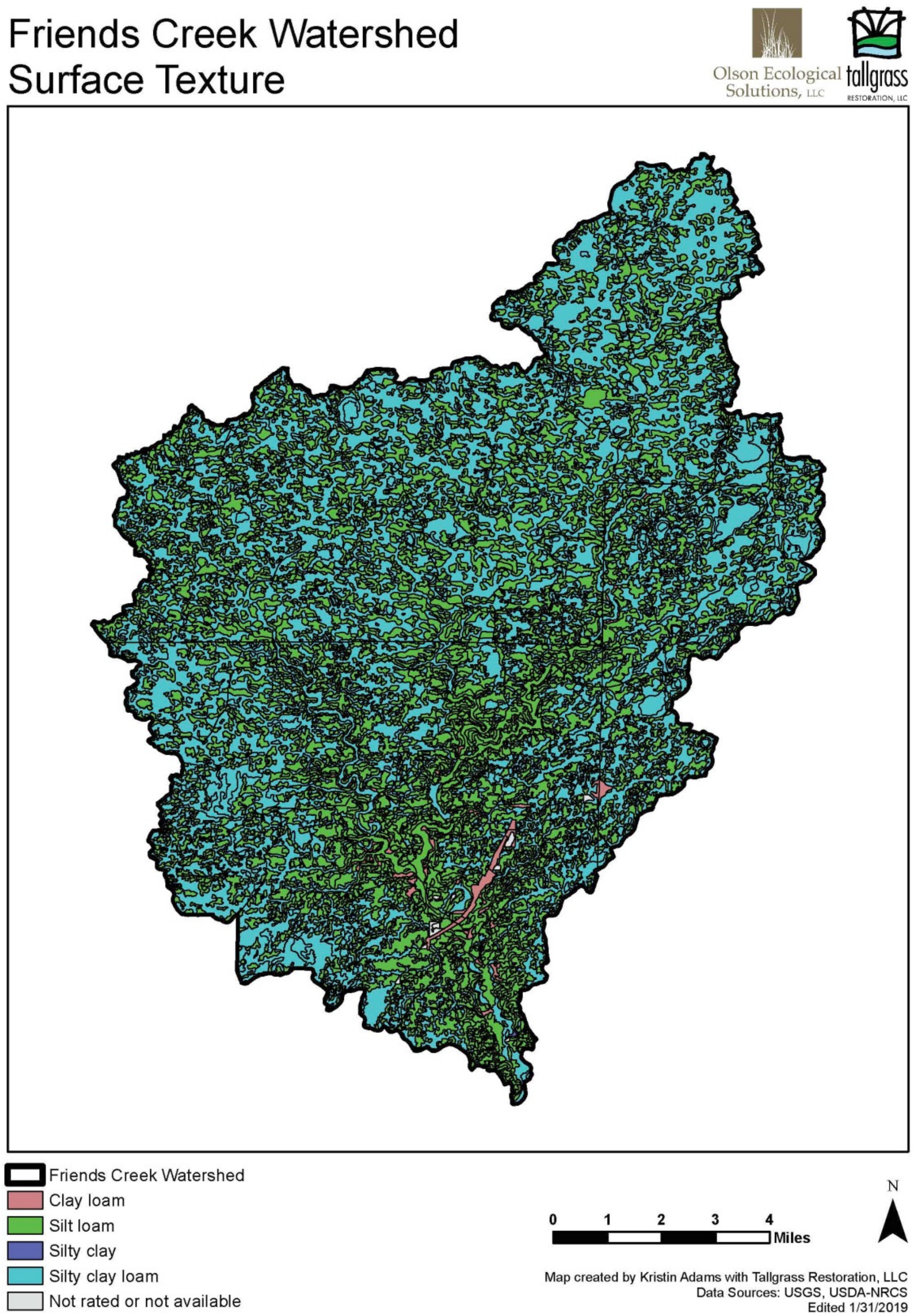
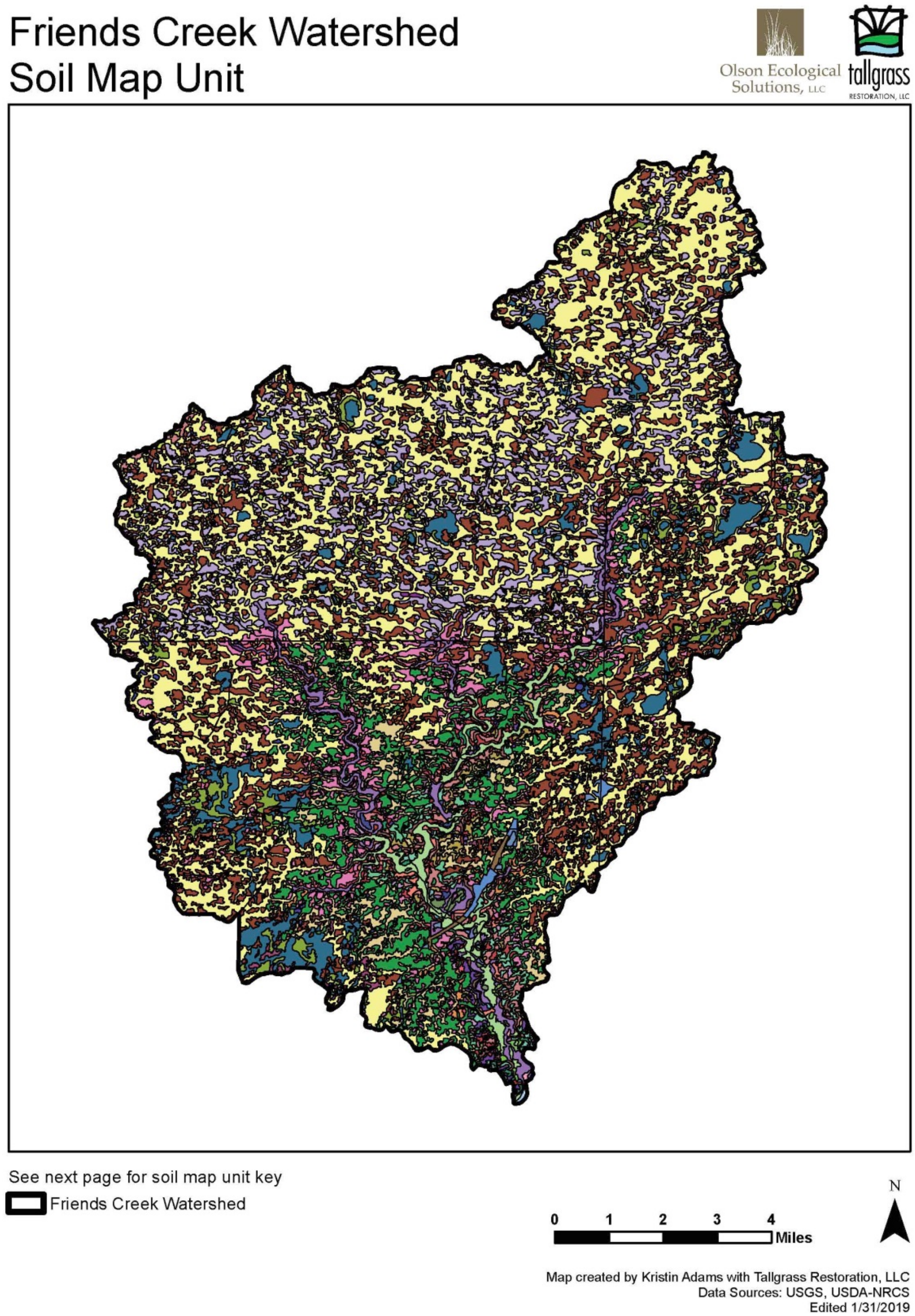


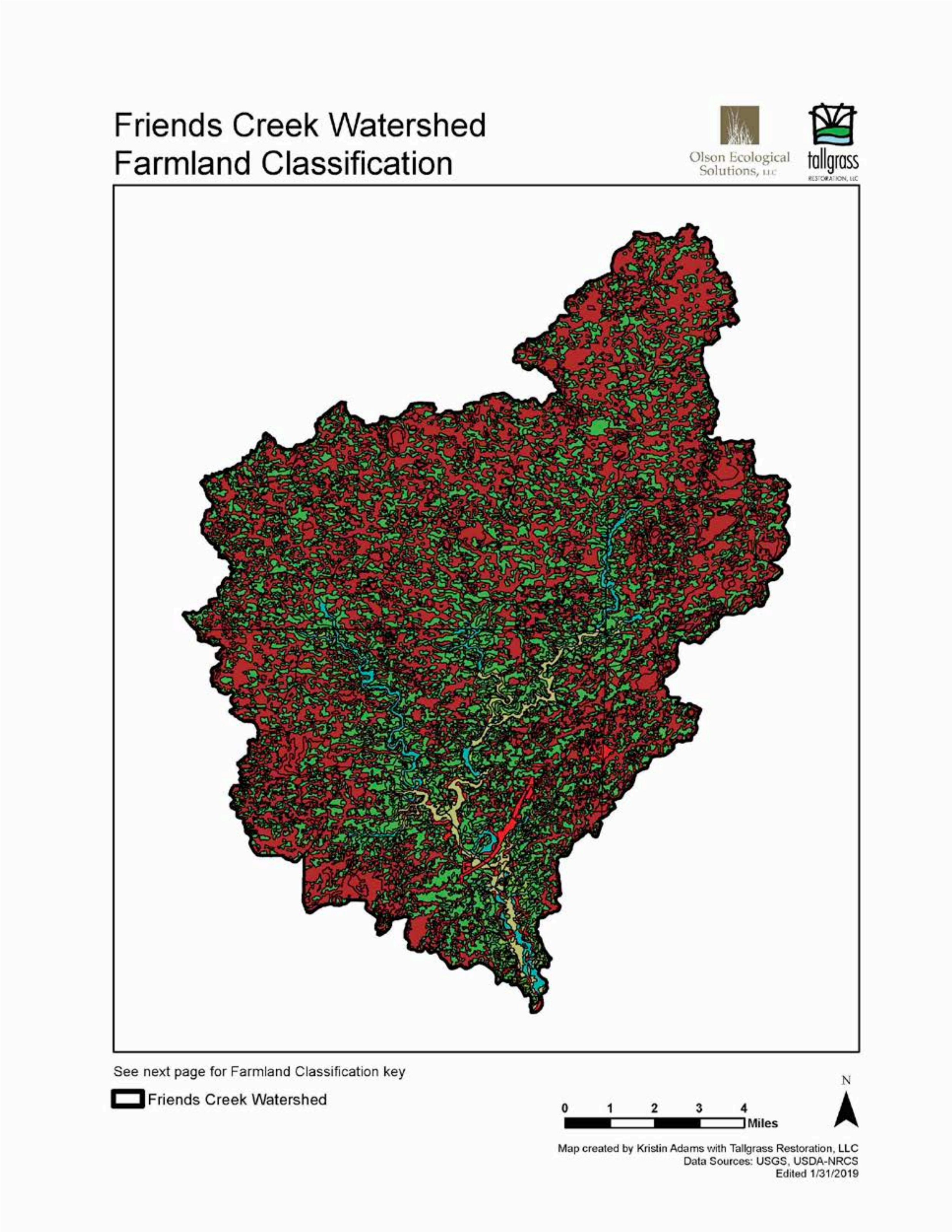
FIGURE 22: SOIL MAP UNIT



Map Units Name

- Birkbeck silt loam, 2 to 5 percent slopes
- Blackberry silt loam, 2 to 5 percent slopes
- Brooklyn silt loam, 0 to 2 percent slopes
- Buckhart silt loam, 2 to 5 percent slopes
- Buckhart silt loam, till substratum, 2 to 5 percent slopes
- Camden silt loam, 2 to 5 percent slopes
- Camden silt loam, 2 to 5 percent slopes, rarely flooded
- Catlin silt loam, 2 to 5 percent slopes
- Catlin silt loam, 2 to 5 percent slopes, eroded
- Catlin silt loam, 5 to 10 percent slopes, eroded
- Dana silt loam, 2 to 5 percent slopes
- Dana silt loam, 2 to 5 percent slopes, eroded
- Dana silty clay loam, 5 to 10 percent slopes, eroded
- Drummer silty clay loam, 0 to 2 percent slopes
- Elburn silt loam, 0 to 2 percent slopes
- Elburn silt loam, 0 to 2 percent slopes, rarely flooded
- Flanagan silt loam, 0 to 2 percent slopes
- Harpster silty clay loam, 0 to 2 percent slopes
- Hartsburg silty clay loam, 0 to 2 percent slopes
- Huntsville silt loam, 0 to 2 percent slopes, frequently flooded
- Ipava silt loam, 0 to 2 percent slopes
- Keomah silt loam, 0 to 2 percent slopes
- Lawson silt loam, cool mesic, 0 to 2 percent slopes, frequently flooded
- Orthents, loamy, rolling
- Orthents, loamy, undulating
- Orthents, loamy, undulating, rarely flooded
- Peotone silty clay loam, 0 to 2 percent slopes
- Pits, gravel
- Pits, gravel, rarely flooded
- Proctor silt loam, 2 to 5 percent slopes
- Radford silt loam, 0 to 2 percent slopes, frequently flooded
- Russell silt loam, Bloomington Ridged Plain, 5 to 10 percent slopes, eroded
- Sabina silt loam, 0 to 2 percent slopes
- Sable silty clay loam, 0 to 2 percent slopes
- Sawmill silty clay loam, 0 to 2 percent slopes, frequently flooded
- Sawmill silty clay loam, undrained, 0 to 2 percent slopes, frequently flooded
- Senachwine clay loam, 10 to 18 percent slopes, severely eroded
- Senachwine silt loam, 10 to 18 percent slopes, eroded
- Senachwine silt loam, 18 to 35 percent slopes
- Senachwine silt loam, 35 to 60 percent slopes
- Senachwine silt loam, 5 to 10 percent slopes, eroded
- Shiloh silty clay loam, 0 to 2 percent slopes
- Starks silt loam, 0 to 2 percent slopes
- Sunbury silt loam, 0 to 2 percent slopes
- Tice silty clay loam, 0 to 2 percent slopes, frequently flooded
- Wabash silty clay, 0 to 2 percent slopes, frequently flooded
- Wakeland silt loam, 0 to 2 percent slopes, frequently flooded
- Water
- Wingate silt loam, 2 to 5 percent slopes
- Wyanet clay loam, 5 to 10 percent slopes, severely eroded
- Wyanet silt loam, 2 to 5 percent slopes, eroded
- Wyanet silt loam, 5 to 10 percent slopes, eroded
- Xenia silt loam, Bloomington Ridged Plain, 2 to 5 percent slopes
- Not rated or not available

FIGURE 23: FARMLAND CLASSIFICATION



Farmland Classification Key

- Friends Creek Watershed
- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

FIGURE 24: HYDRIC RATING

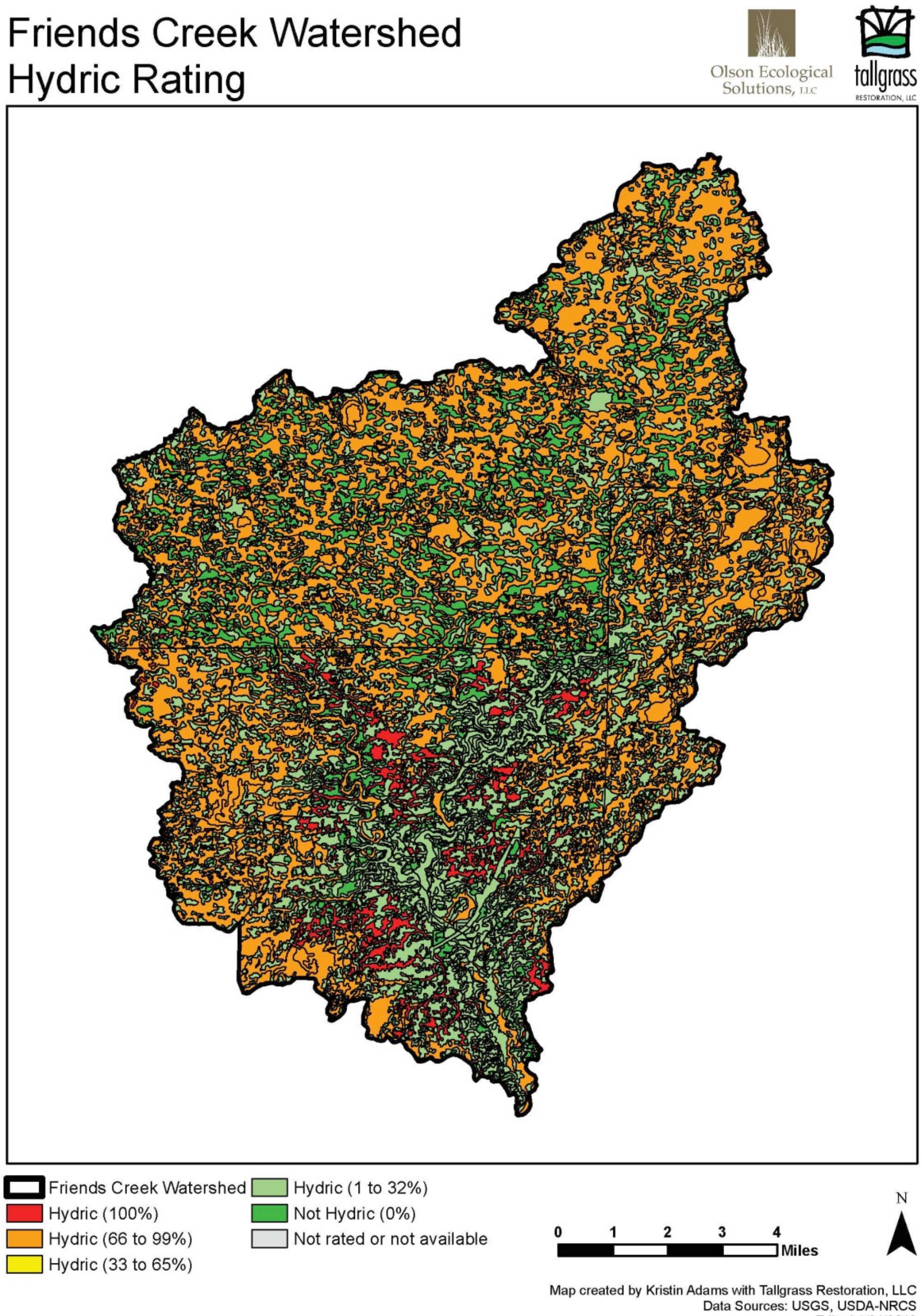


FIGURE 25: HYDROLOGIC SOIL GROUP

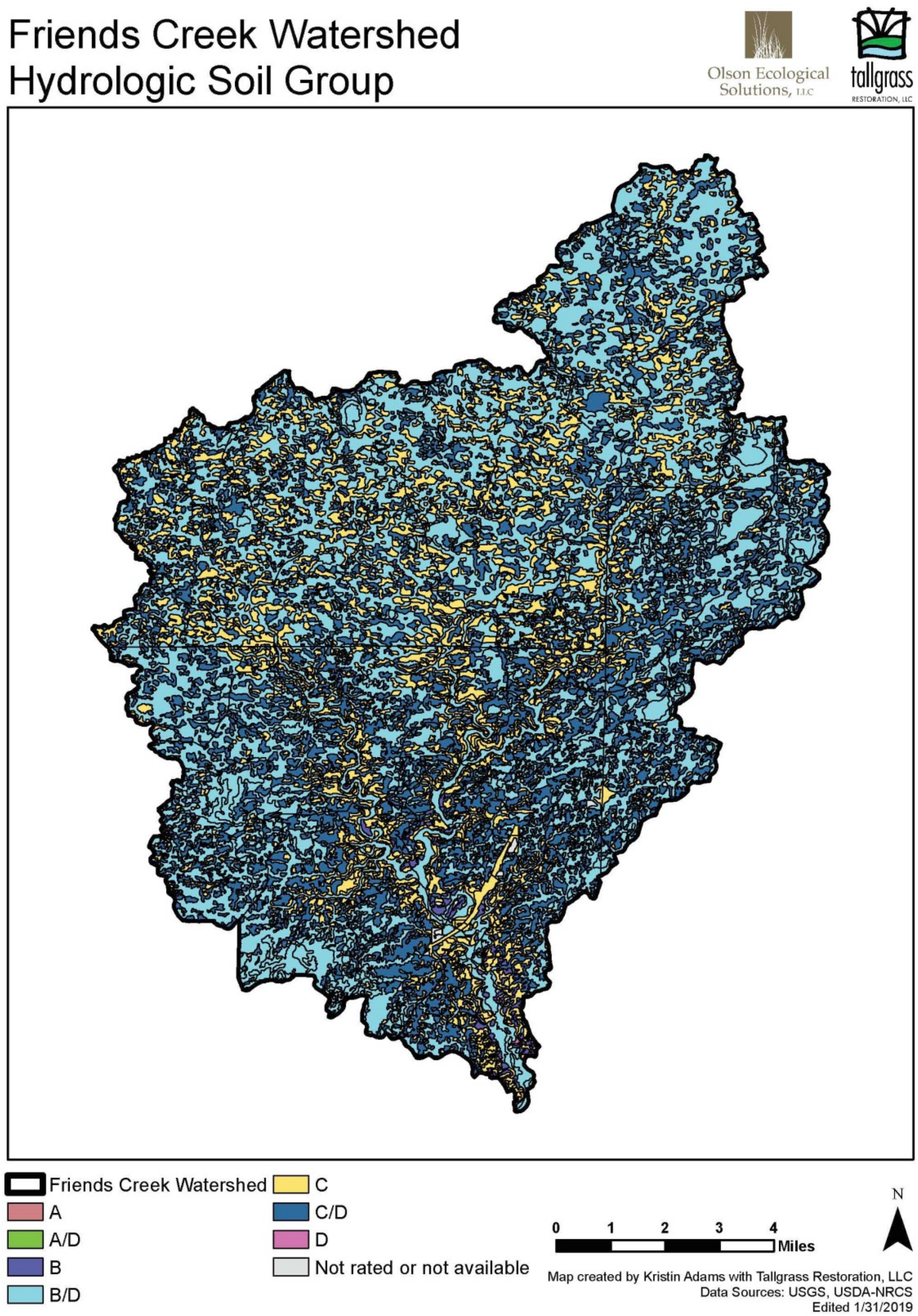


FIGURE 26: SOIL DRAINAGE CLASS

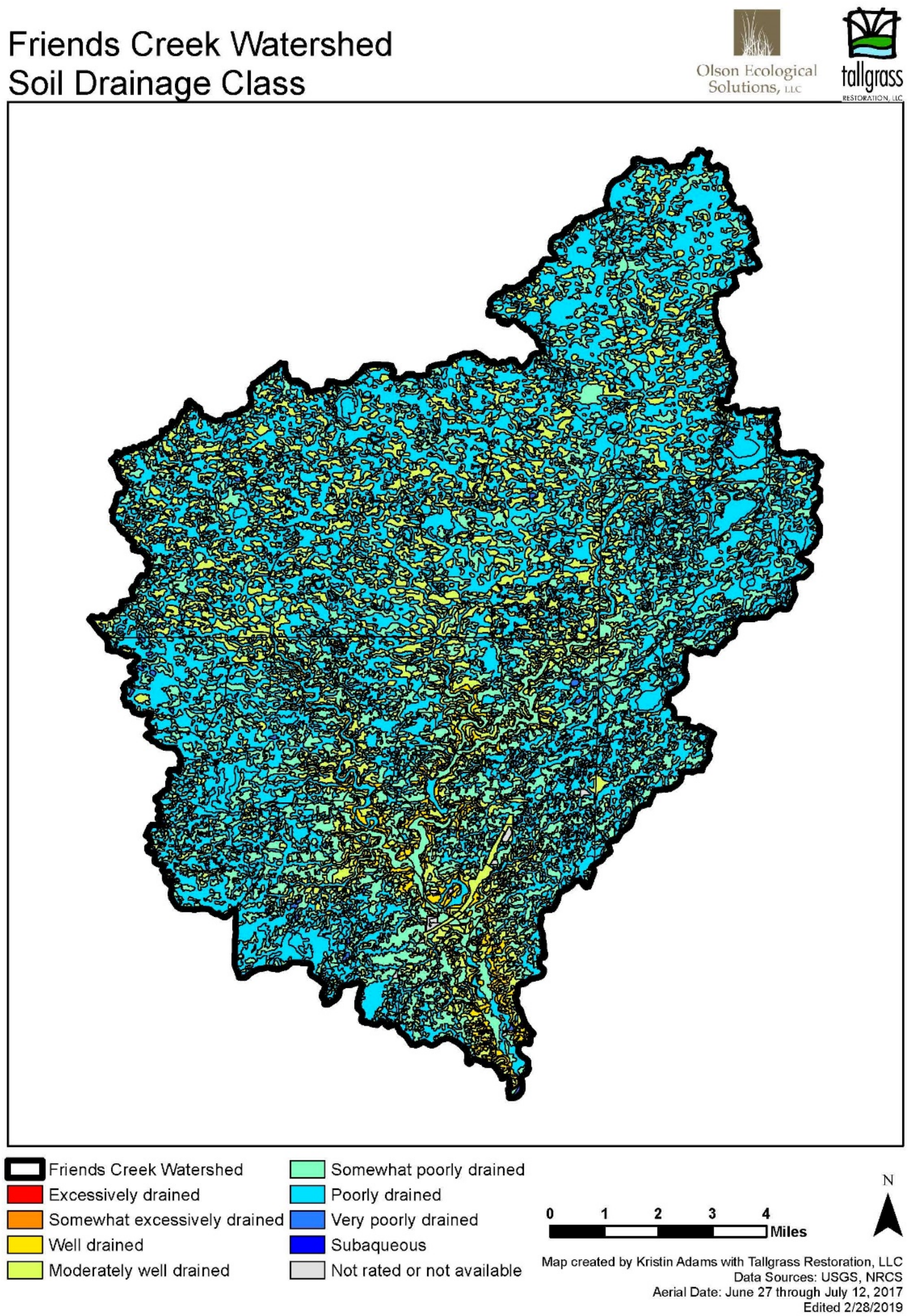


FIGURE 27: EROSION HAZARD

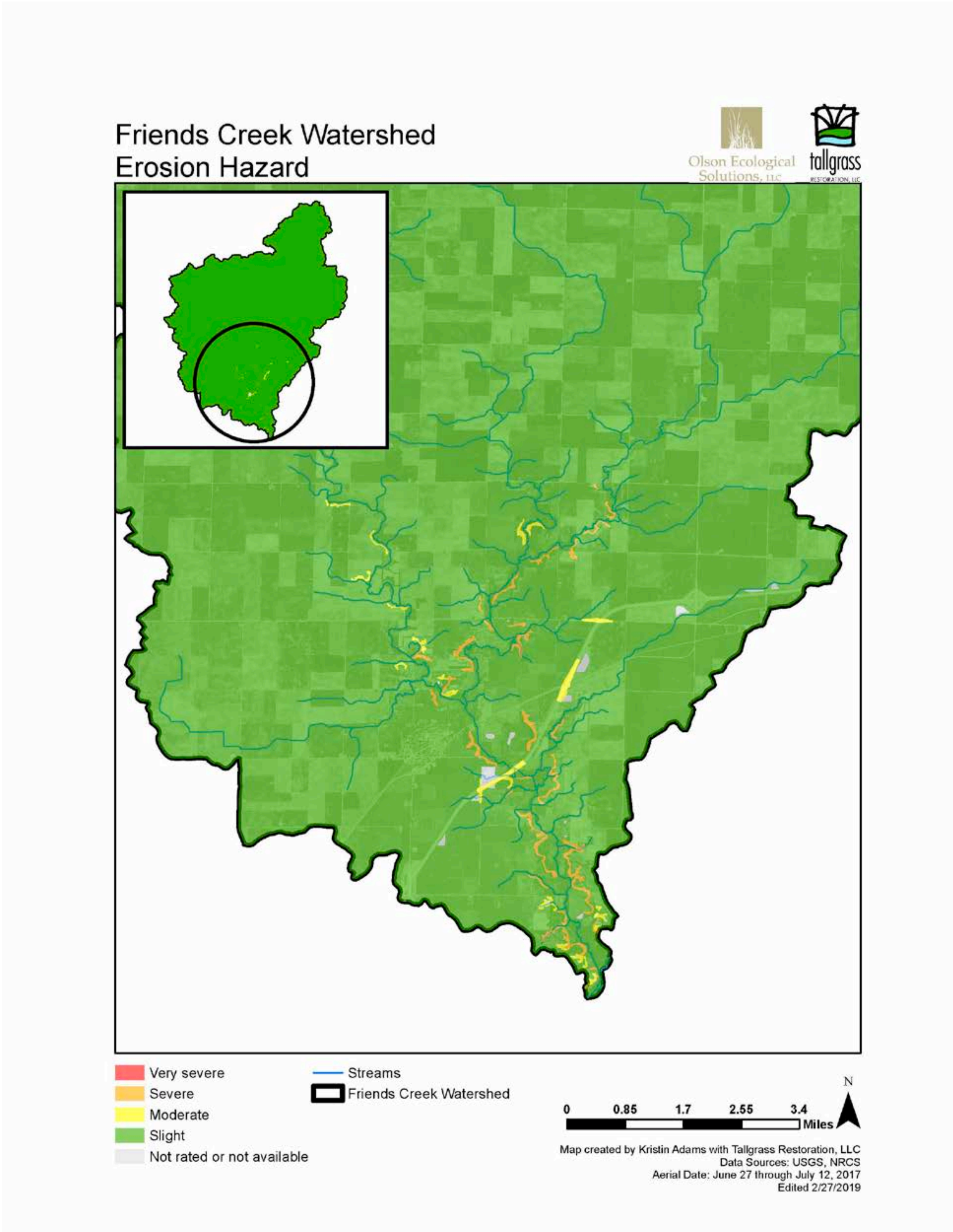
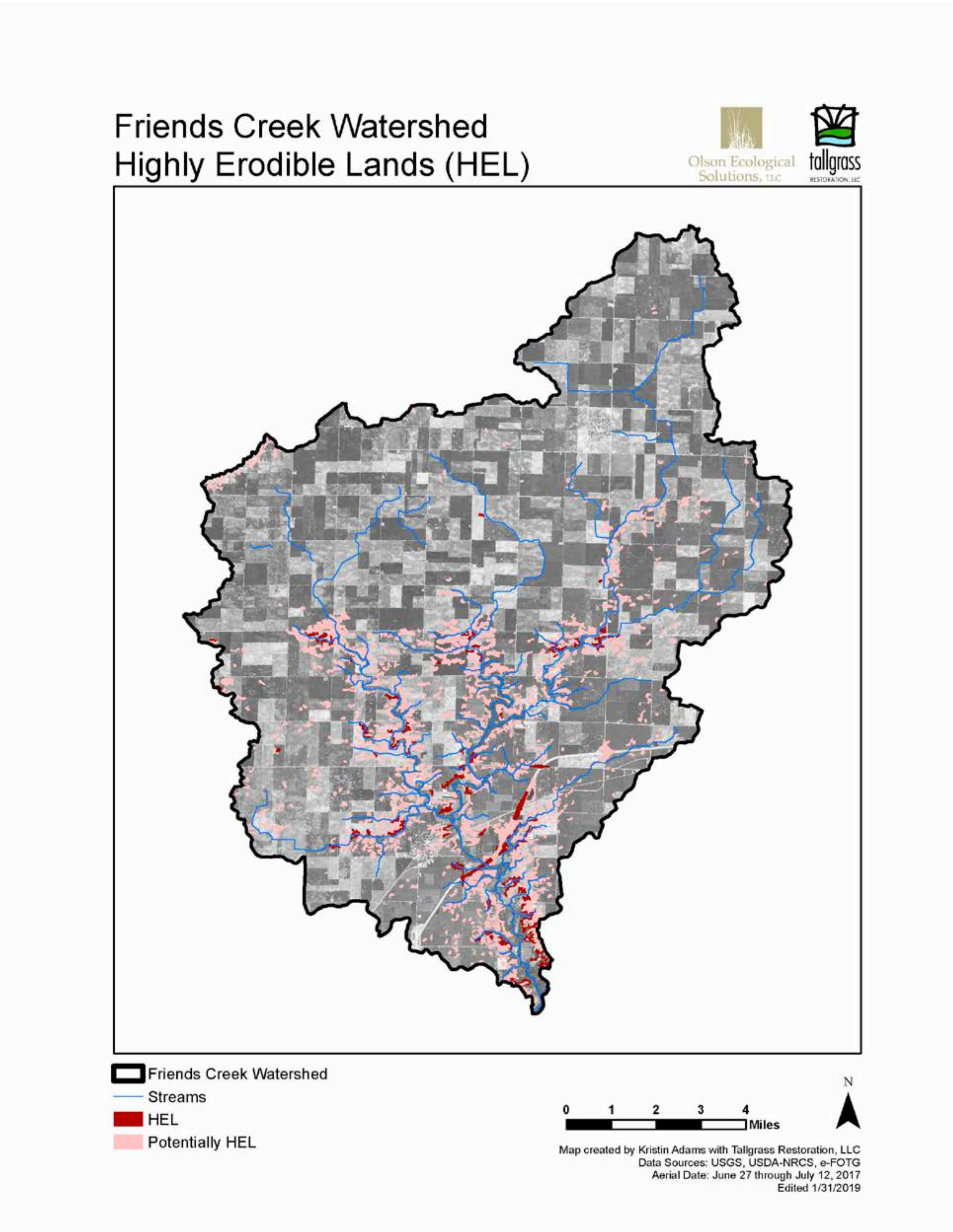


FIGURE 28: HIGHLY ERODIBLE LANDS (HEL)



SECTION1, CHAPTER 6:
WATER QUALITY ASSESSMENT

ILLINOIS INTEGRATED WATER QUALITY AND SECTION 303(D) LIST

There was little known about the water quality of the Friends Creek Watershed. We gleaned some limited information from the *Illinois Integrated Water Quality Report and Section 303(d) List – Volume 1: Surface Water* (ILEPA, 2018a and 2018b).

The *Illinois Integrated Water Quality and Section 303(d) List, 2018 - Clean Water Act Section 303(d), 305(b) and 314 - Water Resource Assessment Information and List of Impaired Waters - Draft (11/14/2018) (Illinois EPA, 2018) list* identified surface waters that had uses such as aquatic life, fish consumption, primary and secondary contact recreation, and aesthetic quality that were impaired by various causes like sedimentation and fecal coliform from various sources. There were no streams or waterbodies within the Friends Creek Watershed that were impaired according to EPA's 303(d) list. Two streams within the Friends Creek Watershed were assessed: Kickapoo Creek (IL_EVA) which flowed into Friends Creek (IL_EV-02). Friends Creek fully supported aquatic life and aesthetic quality while these aspects were not assessed for its main tributary, Kickapoo Creek. Neither of the streams assessed fish consumption nor primary and secondary contact recreation, along with any causes and sources. However, Friends Creek drained into a 13.7-mile stretch of the Upper Sangamon basin documented as impaired by sedimentation/siltation and alteration in stream-side or littoral vegetation (ILEPA, 2018b). The Illinois Environmental Protection Agency provided information about the Kickapoo Creek and Friends Creek in Table 25 Page 69(ILEPA, 2018a and 2018b).

A segment of the Sangamon River downstream from Friends Creek Watershed connected to Lake Decatur. Both water features were listed as impaired and can be reviewed in Table 26 Page 70 (ILEPA, 2018c). It can be assumed that the impairment was affected by pollutants that entered from the Friends Creek Watershed. A TMDL report for Lake Decatur was produced in 2007. The pollutants addressed in the report were phosphorous and nitrate, although also listed as causes were nitrogen, sedimentation, total suspended solids, excess algal growth, chlordane, and PCBs. The potential sources of pollutants were from industrial point sources, agriculture, crop-related sources, non-irrigated crop production, hydromodification and other habitat modification, flow regulation and modification, bank or shoreline modification and destabilization, marinas, forest, grassland, and parkland runoff, and other unknown sources. The direct contributing factors to the quality of this waterbody were listed as agricultural runoff and permitted sewage treatment plans. In 2006, Lake Decatur was listed as a high priority lake (IEPA, 2007). In the most recent 303(d) list of impaired waterways from 2018, it was considered to be medium priority. The loading capacity for total phosphorous was determined to be 954 kg/month for July and August, which exceeded the allocation to comply with the EPA standards of 858.6 kg/month. Waste load allocations for seven sewage treatment plants were not determined for phosphorous, however; nitrate was determined to be at least 105 kg/day and could experience up to an additional 312 kg/day depending on the discharge flow (IEPA, 2007). The stream segment from the Sangamon River (IL_E-95) did not have an existing approved TMDL report.

STREAM SURVEY

Midwest “Stream Technical Resource Evaluation and Management Services” (STREAMS) was commissioned to perform a thorough evaluation of stream conditions and sediment delivery through Friends Creek Watershed. Wayne Kinney performed the site evaluation in July 2017 by creating an inventory of over 36 miles of the predominant stream reaches, concentrated mostly in the Lower Friends Creek region. Stream divisions and names were created based on their location in the watershed to facilitate field research and to aid in descriptions. The streams inventoried included Friends Creek, Friends Creek Ditch, North Branch of Friends Creek, Kickapoo Creek, and three unnamed tributaries shown in Table 27 Page 71. The processes used to evaluate stream conditions were detailed in the full report, found in Attachment A. The riparian condition was quantified along with the lateral recession rate by using the standards listed Table 28 Page 71 and Table 29 Page 72. The reaches located in the northmost portion of the watershed were ditches and waterways that appeared to be in good condition with low sediment loads affecting the downstream water conditions. The findings suggested that Friends Creek was responsible for more than 55% of the sediment that was deposited into the Sangamon River. The range of sediment delivered from the inventoried stream channels fell anywhere between 26 and 195 tons per mile (Kinney, 2018). According to the streambank erosion survey 15% of inventoried streams were highly eroded, 14 % were moderately eroded and 71% had little to no erosion. We extrapolated these findings to also represent the entire watershed. (see Attachment A)

Both Friends Creek and Friends Creek Ditch had deposits of sand and gravel banks which in turn affected the capacity of the channel which further eroded the banks. The presence of sand and gravel in the channels were responsible for the lateral erosion that produced fine sediment and caused trees to fall into the stream creating damming issues. Fine sediment was not found throughout the stream inventory, except for near the confluence of Friends Creek and the Sangamon, which suggested that it continued downstream and ultimately into Lake Decatur. The most sediment-contributing reach was along Friends Creek (Code 003), which demonstrated incision and downcutting due to the way it was constructed to cut out a portion of the meandering channel (Kinney, 2018). A summary of the stream data can be observed in the full report found in Attachment A.

STREAM CHANNELIZATION AND RIPARIAN CONDITION WERE ANALYZED BY STEVE YOST OF OLSON ECOLOGICAL SOLUTIONS IN FEBRUARY OF 2018, SHOWN IN TABLE 30 **PAGE 72**. THE METHODS, CRITERIA, AND DETAILED ANALYSIS USED TO CLASSIFY THESE STREAMS CAN BE FOUND IN TABLE 28 **PAGE 71** AND TABLE 31 **PAGE 72**. OF THE 34,892 FEET OF STREAM ASSESSED, OVER HALF OF THE CORRIDORS INVENTORIED WERE FOUND TO BE IN GOOD CONDITION (62%), 21% WERE IN POOR CONDITION, AND 17% WERE CONSIDERED FAIR (MODERATE) BASED ON THE VEGETATION OBSERVATIONS. CHANNELIZATION WAS NOT PRESENT IN 43% OF THE INVENTORIED STREAMS WHILE 41% WERE CONSIDERED HIGHLY CHANNELIZED AND THE REMAINING 16% WERE MODERATELY CHANNELIZED (YOST, S., 2018). SEE

Figure 29 Page 75 for stream survey assessment locations.

WATERBODY SURVEY

The waterbodies located in the Friends Creek Watershed were found mostly in Lower Friends Creek Subwatershed, although a few were also located in the Kickapoo Creek Subwatershed. There were 49 ponds recorded in the watershed and 29 were inventoried for the rate of lateral recession and the condition of the riparian buffers, which used the same quantifying system used in the stream survey. A large portion of the waterbodies evaluated (73%) were considered to have slight to no lateral recession observed while a quarter (25%) were considered moderate. The remaining 2% were considered to be severe, accounting for half of the shoreline in Pond J (see Table 32 Page 73). The riparian condition for slightly over half (53%) of the waterbodies inventoried were considered to be in good condition. All of the pond edges that were considered to be in poor condition (41%) were mowed turf grass. The final 7% was considered to be in fair condition (see Figure 30 Page 76 and Table 33 Page 74).

HIGH QUALITY NATURAL AREAS AND WILDLIFE IN NEED OF PROTECTION

There is one high quality natural area in need of protection within the Watershed, the Friends Creek Conservation Area a 526 acre conservation area within the Friends Creek Watershed.

Wildlife living within the Friends Creek Watershed and more specifically the Friends Creek Conservation District were directly affected by water quality. In previous years the following surveys had been completed in the Friends Creek Watershed:

2001 Fish Survey: Millikin University students under the direction of their professors (Dr. Conrad Toepfer), conducted a fish survey for association of land use effect on fish assemblage and habitat in Friends Creek and Friends Creek Ditch. A total of 30 species were collected over three sampling periods. See Attachment B for more detail.

2005 Mussel Survey: Illinois Department of Natural Resources Restoration Ecologist Bob Szafoni conducted a mussel survey for species presence in both Friends Creek and Friends Creek Ditch. The purpose was to start an inventory for possible use as an indicator of creek and fish population health. See Attachment C for more detail.

2007-2008 Bat Survey: A bat survey was conducted at Friends Creek Conservation Area along both Friends Creek and Friends Creek Ditch as part of a county wide bat survey. The objective of the bat survey in Macon County was to conduct a multi-year study of bat diversity and richness on property owned by the Macon County Conservation District (MCCD), located in Friends Creek Watershed and for the presence (if any) of federally endangered Indiana bat (Myotis sodalist). The underlying purpose of the study was to get a better understanding of bats using the grounds for foraging and maternity roosting colonies and to allow MCCD to better manage forested bat habitat for long term sustainability. Captured bats were documented for species, weight, height, wingspan sex and age (juvenile or adult). All records of species documented for this study were kept by the Illinois Department of Natural Resources (IDNR).

2011-2012 Bird Banding Surveys: Millikin University Professor Dr. Travis Wilcoxen conducted song bird banding surveys at Friends Creek Conservation Area (as well as other sites owned by the MCCD) to inventory species and gather blood samples. See Attachment D for more detail (Friends Creek Conservation Area findings will appear in highlighted yellow). The following were birds banded at Friends Creek Conservation Area and were less common breeding birds or species of concern:

- Blue Grosbeak (not banded): An adult male, adult female, and two juveniles were seen. This species was not included as a Central Illinois breeding bird on range maps.
- Orchard Orioles (breeding): A male and female were captured at Friends Creek Conservation Area. Both were in reproductive condition well after migration time, suggesting they were nesting at the survey location.
- Yellow-breasted Chat: This species was not uncommon but rarely seen. Three were banded suggesting habitat quality was great.
- American Redstart (warbler): This species required high quality habitat. They were captured during Spring Migration.
- Olive-sided Flycatcher: This species was listed as threatened due to major habitat loss in its winter range. The capture specimen was migrating through in the Fall.

These results were less common breeding birds or species of concern sited within Friends Creek Conservation District. See Attachment E for more detail (Friends Creek Conservation Area findings will appear in highlighted yellow):

- Swainson's Thrushes: This species was migrating through in Spring and Fall, although currently species of less concern, their populations were thought to be declining across their range.
- Wilson's Warbler: The species was migrating through Spring and Fall and have a declining population across their range due to loss of habitat.
- Wood Thrushes: This species was somewhat common and were on the Audubon watch list for population declines across their range.
- Olive-sided Flycatcher: The species migrate though in the Spring and was listed as near threatened due to major loss in winter range.

Estimated Annual Pollutant Load

Considering the land cover of the Friends Creek Watershed and in consultation with the Macon County Soil and Water Conservation District, we estimated the amount of nonpoint source pollutants entering Friends Creek and its tributaries. Excess nutrients (phosphorous and nitrogen), sediment (total suspended solids), and pathogens that commonly result from agricultural and residential lands like those found in the Friends Creek Watershed were analyzed. Each pollutant within each of the 26 subwatersheds to determine a baseline pollutant load rate for each and see if there were specific areas of concern or opportunity within the Friends Creek Watershed was assessed. This was useful in determining the baseline pollutant loads within the watershed to analyze the future effects of implementing Best Management Practices (BMPs) within the watershed proposed by the Friends Creek Watershed Plan.

Pollutant Modelling Methods

The 26 subwatersheds were analyzed for pollutant loading into their respective tributaries and sections of Friends Creek using the Better Assessment Science Integrating Point and Non-Point Sources version 4.1 (BASINS) Pollutant Loading Estimator (PLOAD) software package (USEPA, 2001). BASINS is a multi-purpose environmental analysis system that integrates GIS, watershed data, and modeling tools supported by the U.S. Environmental Protection Agencies (USEPA, 2017). This software analyzed watershed and water quality using both user input data and data downloaded from the internet. Within this software was a model called PLOAD, a simplified, GIS-based model which calculated the pollutant load amounts within a watershed. Pollution loads were calculated within PLOAD using EPA's Simple Method, which used the area, amount of impervious surface, and event mean concentration (EMC) of pollutant loading during storms associated with each land cover type to estimate the annual pollutant loading in pounds per subwatershed. To make sure that PLOAD accurately reflected the Friends Creek Watershed, published research was referenced to determine comparable pollutant loading rates during storms measured as event mean concentrations (EMC) in Minnesota (Brezonik et al, 2002), Michigan (Lin, 2004), and Illinois (Terrio, 2006 and EPA, 1993), since local water quality sampling during storm events was not available. The EMCs per land use used for the pollutant modelling is shown in Table 34 and was determined by using the USEPA's Simple Method.

To summarize estimated existing annual pollutant loading by land cover type at the watershed scale, as seen in Table 35, the Export Coefficient Formula below was used:

Export Coefficient (lb/ac/yr) = ((P x CF x Rv) / 12) x C x 2.72,
Where P = Annual Precipitation (in/yr), 39.69 inches (assumed)
CF = Correction factor for storms with no runoff, 0.90
Rv = Runoff Coefficient = 0.05 + (0.09 x I)
I = Percent Impervious
C = Event Mean Concentration (mg/l)

The modeling exercise identified where various concentrations of the four target nonpoint source pollutants were originating throughout the watershed based on land cover. Total annual pollutant loading within the entire Friends Creek Watershed was observed. Also analyzed was pollutant loading from the 26 subwatersheds on a pound per acre per year basis. Total annual pollutant loading for each subwatershed (pounds per year) was reorted, but since the subwatersheds varied in size, the results were considered to be secondary to the per-acre approach.

Pollutant Loading Results

The mapping and modeling exercise resulted in a screening of land cover and estimated pollutant loading into Friends Creek and its tributaries. Land cover data, presented below, gave an overarching look at the Friends Creek Watershed. A land cover breakdown amongst 26 subwatersheds further assisted data analysis. Pollution loading was estimated for each of the 26 subwatersheds and a range was reported. These results were explored in greater depth below.

From the mapping and modeling exercise, land cover was identified and each of the 26 subwatersheds were highlighted for its contributing amounts of the four target pollutants to the stream. Watershed acreage by land cover illustrated land cover within subwatersheds, and colored subwatersheds in different hues to represent the pollutant loading range in which they fell for each of the four target pollutants. Variations in color allowed a quick reference the subwatersheds with the largest pollutant loads to the stream and therefore the greatest opportunity for change.

Pollutant Loading by Land Cover

Pollutant loading by land cover throughout Friends Creek Watershed gave an interesting comparison which can be observed in Table 35. For instance, the majority of the landscape, 74,604 acres of cropland, contributed about 53% (5,400 lb/yr) of the total phosphorous loading into Friends Creek and its tributaries. However, the much smaller 2,237 acres of developed lands accounted for about 45%

(4,500 lb/yr) of the total phosphorous loading, which was a much more intense concentration. In contrast, the 5,992 acres of open space, which was more than 2.5 times the size of the developed area, contributed less than 3% (270 lb/yr) of the total phosphorous loading. A similar comparison for total nitrogen resulted in about 66% (71,400 lb/yr) loading from cropland, 33% (35,900 lb/yr) from developed lands, and only 0.5% (540 lb/yr) from open space. For total suspended solids loading, there was not a great difference in contribution between the many acres of cropland (52% or 4,541,100 lb/yr) and the small amounts of development (48% or 4,186,400 lb/yr), while open space added a trace amount (0.5% or 40,000 lb/yr). Cropland contributed about 84% (83,333,000 counts/yr) of all pathogens, while developed lands added about 15% (14,746,000 counts/yr) and open space added another 1% (1,051,000 counts/yr).

When the pollutant loading analysis was applied to subwatersheds to identify certain areas that were contributing more than the others, trends tended to follow what was true for the entire Friends Creek Watershed (see Table 36 through Table 39 and Figure 31 through Figure 38). Overwhelmingly, Subwatershed 2 Lower Friends Creek contributed more phosphorous, nitrogen, suspended solids, and pathogens than all of the others. It was closely trailed by three subwatersheds: 4 Lower Friends Creek, 5 Lower Friends Creek, and 7 Friends Creek Ditch. Total phosphorous contributions were highest in all four subwatersheds when analyzed by pounds per acre per year. These subwatersheds each contributed between 0.17 and 0.39 pounds per acre of total phosphorous annually. Total nitrogen, total suspended solids, and pathogen loading into Friends Creek was also highest in Subwatershed 2 Lower Friends Creek, with nitrogen between 2.7 and 3.5 pounds per acre, suspended solids between 282.2 and 333.9 pounds per acre, and pathogens counts of 2,038 to 3,047 per acre each year. The three other subwatersheds mentioned above also had high annual contributions of 1.7 to 2.6 pounds per acre of nitrogen, 161.3 to 282.1 pounds per acre of suspended solids, and 1,651 to 2,038 counts per acre of pathogens.

The high pollutant loading of the four most contributing subwatersheds seemed to be related to land cover. These four subwatersheds individually had the highest amounts of roads and high-density development of any of the subwatersheds. Subwatershed 2 Lower Friends Creek had the most, with 105.2 acres of roads and 18.6 acres of high-density development. Collectively, the four subwatersheds housed 57% of the roads (367.5 of 640.32 acres) in the Friends Creek Watershed and 79% of the high-density development (38.4 of 48.9 acres). Subwatershed 2 Lower Friends Creek also housed the most medium density (119 acres), and low density (187.3 acres) development of any of the other subwatersheds. Some of this, along with high density development, was within the Village of Argenta. Interestingly, it had the second lowest acreage of crop ground (1766.5 acres) and the third highest amount of open space (520.6 acres). Most likely, the roads and development were responsible for the higher pollutant loading. Notably, Subwatershed 5 Friends Creek Ditch contributed a comparable amount of nutrients as the previously mentioned subwatersheds and had a higher than average percentage of agricultural and developed areas and a lower percentage of natural lands compared to the entire watershed. Subwatersheds with the highest amount of total pollutant loading detected were shaded darker on maps for comparison.

TABLE 25: ILLINOIS EPA WATER QUALITY DATA WITHIN FRIENDS CREEK WATERSHED

EPA Water Quality Data Within Friends Creek Watershed		
Friends Creek	**AUID:**	IL_EV-02
	Basin:	21, Upper Sangamon
	Category:	2, some uses supported but not all
	Stream Length:	21.85 miles
	TMDL:	None
	Status of Use Attainments:	Fully Supporting Aquatic Life (F582) Fish Consumption Not Assessed (X583) Primary Contact Not Assessed (X585) Secondary Contact Not Assessed (X586) Fully Supporting Aesthetic Quality (F590)
	Causes of Impairment:	N/A
	Sources of Impairment:	N/A
	Priority:	N/A
Kickapoo Creek	**AUID:**	IL_EVA
	Basin:	21, Upper Sangamon
	Category:	3, insufficient data
	Stream Length:	1.65 miles
	TMDL:	None
	Status of Use Attainments:	Fully Supporting Aquatic Life (X582) Fish Consumption Not Assessed (X583) Primary Contact Not Assessed (X585) Secondary Contact Not Assessed (X586) Fully Supporting Aesthetic Quality (X590)
	Causes of Impairment:	N/A
	Sources of Impairment:	N/A
	Priority:	N/A

TABLE 26: ILLINOIS EPA WATER QUALITY DATA FOR DOWNSTREAM AFFECTED WATERS

EPA Water Quality Data for Downstream Affected Waters		
Sangamon River	AUID:	IL_E-95
	Basin:	21, Upper Sangamon
	Category:	5, needs TMDL
	Stream Length:	5.9 miles
	TMDL:	None
	Status of Use Attainments:	Not Supporting Aquatic Life (N582) Not Supporting Fish Consumption (N583) Primary Contact Not Assessed (X585) Secondary Contact Not Assessed (X586) Fully Supporting Aesthetic Quality (F590)
	Causes of Impairment:	Loss of Instream Cover (501) Mercury (274)
	Sources of Impairment:	Dam or Impoundment (142) Atmospheric Deposition (10) Source Unknown (140)
	Priority:	Medium
Lake Decatur	AUID:	IL_REA
	Basin:	21, Upper Sangamon
	Category:	5, needs TMDL
	Stream Length:	1531.7 acres
	TMDL:	Approved
	Status of Use Attainments:	Fully Supporting Aquatic Life (F582) Not Supporting Fish Consumption (N583) Not Supporting Public and Food Processing Water Supplies (N584) Primary Contact Not Assessed (X585) Not Supporting Aesthetic Quality (N590)
	Causes of Impairment:	Chlordane (137) Mercury (274) Polychlorinated biphenyls (348) Nitrogen/Nitrate (452) Total Phosphorous (462)
	Sources of Impairment:	Golf Courses (45) Internal Cycling (65) Agriculture (156) Runoff from Forest/Grassland/Parkland (181) Atmospheric Deposition (10) Source Unknown (140)
	Priority:	Medium

TABLE 27: STREAM SUMMARY TABLE BY REACH CODE

Stream Summary Table By Reach Code										
Stream Name	Reach Code	Stream Length Assessed	Total Bank Length Assessed	*None or Low Erosion (Ft)	*Moderate Erosion (Ft)	*High Erosion (Ft)	*None or Low Erosion (%)	*Moderate Erosion (%)	*High Erosion (%)	Total %
Friends Creek	1	1.83 mi.	3.66 mi.	11,401ft.	3,837 ft.	4,086 ft.	59	19.86	21.14	100
	2	2.43 mi.	4.86 mi.	15,280 ft	5160 ft	5,220 ft.	59.55	20.11	20.34	100
	3	.20 mi.	0.40 mi.	912 ft.	0 ft.	1,200 ft.	43.18	0	56.82	100
	4	0.83 mi.	1.66 mi.	8,756 ft.	0 ft.	0 ft.	100	0	0	100
	5	1.68 mi	3.36 mi.	6,889 ft.	7,386 ft.	3,465 ft.	38.83	41.63	19.53	99.99
	6	2.42 mi.	4.84 mi.	15,020 ft.	3,951 ft.	6,585 ft.	58.77	15.46	25.77	100
	7	1.85 mi.	3.70 mi.	10,131 ft.	4,680 ft.	4,725 ft.	51.86	24	24.19	100.05
	8	3.0 mi.	6.0 mi.	21,930 ft.	7,020 ft.	2,730 ft.	69.22	22.16	8.62	100
Friend's Ck. Ditch	1	1.29 mi.	2.58 mi.	7,128 ft.	2,100 ft.	4,434 ft.	52.17	15.37	32.45	99.99
	2	1.10 mi.	2.20 mi.	8,436 ft.	503 ft.	1,671 ft.	72.62	12.9	14.38	99.9
	3	2.45 mi.	4.90 mi.	19,947 ft.	4,368 ft.	1,557 ft.	77.1	16.88	6.02	100
	4	0.70 mi.	1.40 mi.	5,481 ft.	651 ft.	1,260 ft.	74.15	8.81	17.05	100.01
North Branch	1	0.97 mi.	1.94 mi.	5,951 ft.	1,848 ft.	2,445 ft.	58.09	18.08	23.87	100.04
	2	0.61 mi.	1.22 mi.	5,398 ft.	555 ft.	489 ft.	83.79	8.62	7.59	100
	3	0.19 mi.	0.38 mi	1595 ft.	279 ft.	132 ft.	79.51	13.9	6.58	99.99
	4	2.69 mi.	5.38 mi.	23,747 ft.	3,156 ft.	1,503 ft.	83.6	11.11	5.29	100
	5	3.11 mi.	6.22 mi.	26,326 ft.	4,203 ft.	2,313 ft.	80.16	12.8	7.04	100
	6	1.70 mi.	3.40 mi.	17,064 ft.	339 ft.	549 ft.	95.05	1.89	3.06	100
Kickapoo Creek	1	1.37 mi.	2.74 mi.	11,528 ft.	495 ft.	2,445 ft.	79.68	3.42	16.9	100
	2	0.94 mi.	1.88 mi.	9,698 ft.	174 ft.	54 ft.	97.7	1.75	0.54	99.99
Tributary 1	1	2.49 mi.	4.98 mi.	18,704 ft.	2,925 ft.2	4,665 ft.	71.13	11.12	17.74	99.99
Tributary 2	1	1.14 mi.	2.28 mi.	5591 ft.	120 ft.	6327 ft.	46.44	1	52.56	100
Tributary 3	1	1.49 mi.	2.98 mi.	14,144 ft.	384 ft.	1206 ft.	89.9	2.44	7.66	100
	Total	36.49 mi.								

TABLE 28: BASIN RIPARIAN CONDITION CRITERIA

Basin Riparian Condition Criteria			
Category	Width	% Area Vegetated	Vegetation Height
Good	≥ 50 feet	≥ 55%	≥ 12 inches
	≥ 25 feet	≥ 70%	≥ 12 inches
	≥ 25 feet	≥ 55% and sandy/sandy loam	≥ 12 inches
Fair	≥ 15 feet but ≤ 25 feet	≥ 55%	≥ 12 inches
Poor	< 15 feet	-	-
	Or doesn't meet qualifications listed above		

TABLE 29: LATERAL RECESSION RATE CRITERIA

Lateral Recession Rate (LRR) Criteria		
LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or and culverts eroding out and changes in cultural features as above. Massive slips or eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-shaped and streamcourse or gully may be meandering.
If you have multiple LRR's on one pond, you will need to record a separate bank erosion length (ft) for each LRR observed.		

TABLE 30: SUMMARY OF CHANNELIZATION AND STREAM RIPARIAN CONDITIONS

Friends Creek Riparian Conditions

Data Summary of Channelization and Riparian Condition

Note. Channelization is based on linear distance of stream measured in Google Earth Pro.

Total Length and Riparian Condition are expressed in "buffer feet" (length of both sides of stream). 1 foot of stream: 2 buffer feet.

Stream Reach	Total Length	Total Length	Channelization (stream feet)			Buffer Condition (buffer feet)		
	stream feet	buffer feet	None/Low	Moderate	High	Good	Fair	Poor
Kickapoo-Macon Duroc to Connors	4442	8884	2775	1208	459	4019	2501	2364
Argenta-Friends Parr to Jordan	7364	14728	4425	1975	844	12325	718	1685
Shiloh-Friends: Conservation Area	2554	5108	1674	298	582	4524	163	421
Argenta-Friends Creek School to Cemetery	4065	8130	1547	246	2271	4480	1846	1804
Friends Creek- Macon County 000N to Briggs	7184	14368	4492	1600	854	9990	2705	1243
Kickapoo- DeWitt	5096	10192	0	179	4917	8086	2106	0
Shiloh Chapel Friends Creek: 1800E partway to White Pidgeon	2360	4720	0	87	2273	0	1703	3017
Shiloh Chapel: 1800E to Ospur	2185	4370	0	0	2185	0	0	4370
Combined	**34892**	**70071**	**14913**	**5593**	**14386**	**43424**	**11743**	**14904**
By Percent	**100%**	**100%**	**43%**	**16%**	**41%**	**62%**	**17%**	**21%**

TABLE 31: CHANNELIZATION CRITERIA

Low channelization - Areas with evidence of sinuosity and a clearly lacking any historical straightening.
Medium channelization – Areas of either primarily straight paths with much less sinuosity than low channelization or paths with straight channels, no sinuosity, and evidence of natural correction developing meandering in the channel.
High channelization – Areas with straight line channels, evidence of historical or recent dredging, and no sinuosity.

TABLE 32: SUMMARY OF POND AND BASIN EROSION

Summary of Pond and Basin Erosion								
Pond Name	Subwatershed	Total Shoreline (ft)	Lateral Recession Rate (LRR)	Bank Height (ft)	Bank Erosion Length (ft or %)			
					Slight (0.01 - 0.05)	Moderate (0.06 - 0.2)	Severe (0.3 - 0.5)	Very Severe (0.5+)
3	Lower Friends Creek	793.0	0.05	1-2'	793.0			
4	Lower Friends Creek	6939.2	0.05	2'	6939.2			
5	Lower Friends Creek	1099.0	.04/.06	2'/4'	879.2	219.8		
13	Lower Friends Creek	343.9	0.5	3-4'	343.9			
14	Lower Friends Creek	1691.1	.04/.06	3-4'	1268.3	422.8		
15	Lower Friends Creek	775.8	.04/.06	3-4'	581.8	193.9		
16	Lower Friends Creek	1011.5	.06/.04		202.3	809.2		
20	Lower Friends Creek	601.0	.06/.04		480.8	120.2		
21	Lower Friends Creek	2346.1	0.05	3'	2346.1			
22	Lower Friends Creek	1865.2	0.03	2-3'	1865.2			
23	Lower Friends Creek	1333.2	0.04	3-4'/1-2'	999.9	333.3		
24	Lower Friends Creek	962.0	0.3	1-2'	962.0			
25	Lower Friends Creek	506.4	.1/.04		253.2	253.2		
28	Lower Friends Creek	2151.5	0.07	2-3'	2151.5			
29	Lower Friends Creek	2181.6	0.04	1-2'	2181.6			
30	Lower Friends Creek	3250.8	0.04	2-3'	3250.8			
31	Lower Friends Creek	615.2	0.02	3'	615.2			
32	Lower Friends Creek	550.1	0.06	3-4'/1-2'		550.1		
33	Lower Friends Creek	691.1	0.06	2'		691.1		
34	Lower Friends Creek	2218.3	0.04	1-2'	2218.3			
C	Lower Friends Creek	232.2	.04/.06	3-4'	116.1	116.1		
D	Lower Friends Creek	726.0	0.03	1-2'/5'	726.0			
F	Lower Friends Creek	2665.8	0.8	4-8'		2665.8		
G	Lower Friends Creek	1056.8	0.06	2-4'		1056.8		
H	Lower Friends Creek	916.2	0.03	2'	916.2			
I	Lower Friends Creek	943.5	0.07	1-2'		943.5		
J	Lower Friends Creek	1485.9	0.2/.3	1-3'		742.9	742.9	
K	Kickapoo Creek	2230.9	0.03	2-4'	2230.9			
	Totals	**39952.3**			**30090.6**	**9118.7**	**742.9**	**0**
	Percentages	**100%**			**75%**	**23%**	**2%**	**0%**

TABLE 33: SUMMARY OF POND AND BASIN RIPARIAN AREA CONDITION

Summary of Pond and Basin Riparian Area Condition					
Pond Name	Subwatershed	Total Shoreline (ft)	Riparian Condition (ft or %)		
			Good	Fair	Poor
3	Lower Friends Creek	793.0			793.0
4	Lower Friends Creek	6939.2			6939.2
5	Lower Friends Creek	1099.0			1099.0
13	Lower Friends Creek	343.9	343.9		
14	Lower Friends Creek	1691.1	1691.1		
15	Lower Friends Creek	775.8	775.8		
16	Lower Friends Creek	1011.5			1011.5
20	Lower Friends Creek	601.0			601.0
21	Lower Friends Creek	2346.1	2346.1		
22	Lower Friends Creek	1865.2	1865.2		
23	Lower Friends Creek	1333.2	1333.2		
24	Lower Friends Creek	962.0	962.0		
25	Lower Friends Creek	506.4			506.4
28	Lower Friends Creek	2151.5			2151.5
29	Lower Friends Creek	2181.6	2181.6		
30	Lower Friends Creek	3250.8	3250.8		
31	Lower Friends Creek	615.2	615.2		
32	Lower Friends Creek	550.1		550.1	
33	Lower Friends Creek	691.1			691.1
34	Lower Friends Creek	2218.3	2218.3		
C	Lower Friends Creek	232.2	232.2		
D	Lower Friends Creek	726.0	726.0		
E	Lower Friends Creek	348.6			348.6
F	Lower Friends Creek	2665.8	2132.6	533.2	
G	Lower Friends Creek	1056.8	845.4	211.4	
H	Lower Friends Creek	916.2	916.2		
I	Lower Friends Creek	943.5		471.8	471.8
J	Lower Friends Creek	1485.9		742.9	742.9
K	Kickapoo Creek	2230.9	2230.9		
	Totals	**42531.8**	**24666.5**	**2509.3**	**15355.9**
	Percentages	**100%**	**58%**	**6%**	**36%**

FIGURE 29: STREAM SURVEYS

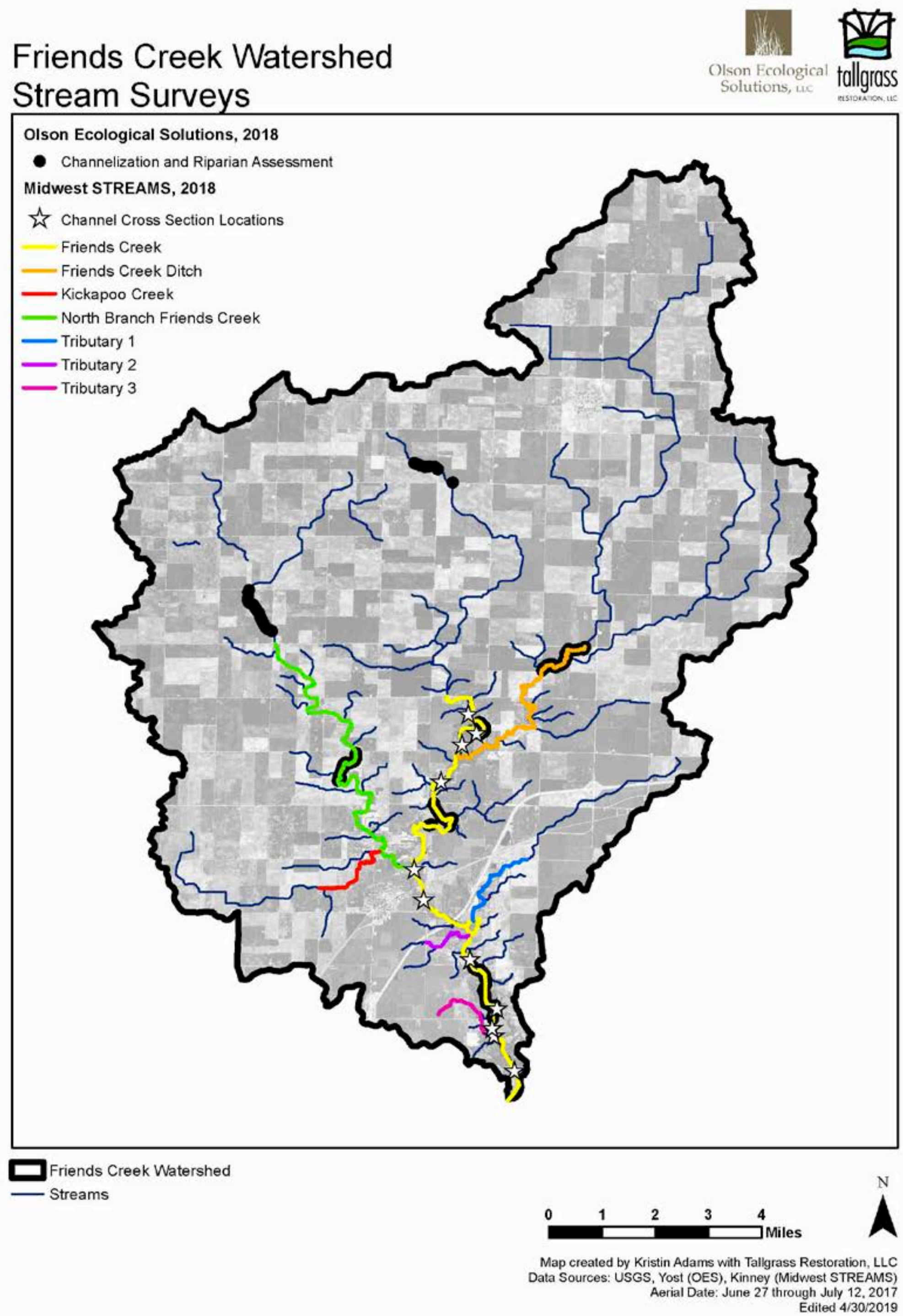


FIGURE 30: SURVEYED WATERBODY LOCATIONS

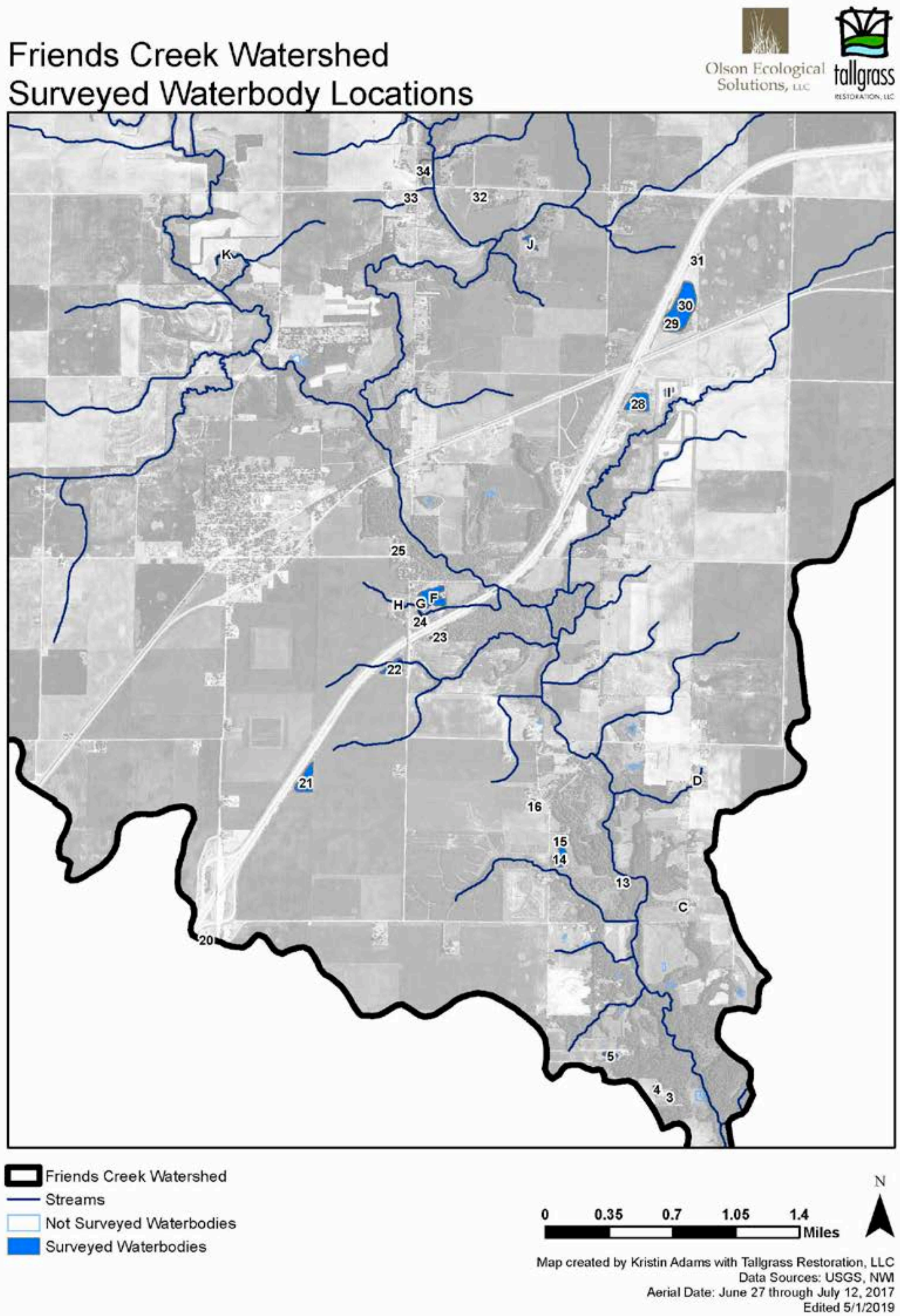


TABLE 34: ESTIMATED MEAN CONCENTRATIONS (EMCS)

Estimated Mean Concentrations (EMCs)					
Land Cover Type	Impervious % Cover	Pathogens (Counts/100ml)	TSS (mg/L)	TN (mg/L)	TP (mg/L)
Open Water/ Streams	0	500	70	1	0.2
Roads/Railroads	50	2000	25	2.3	0.5
Low Intensity Developed	25	2700	25	2.3	0.5
Med. Intensity Developed	33	2000	35	2	0.3
High Intensity Developed	85	2000	35	2	0.3
Deciduous Forest	0	500	16	1	0.2
Grassland	0	500	20	1	0.2
Row Crops	0	4000	30	2.5	0.4
Wetlands	0	500	10	0.9	0.1
Woody Wetlands	0	500	8	0.8	0.1

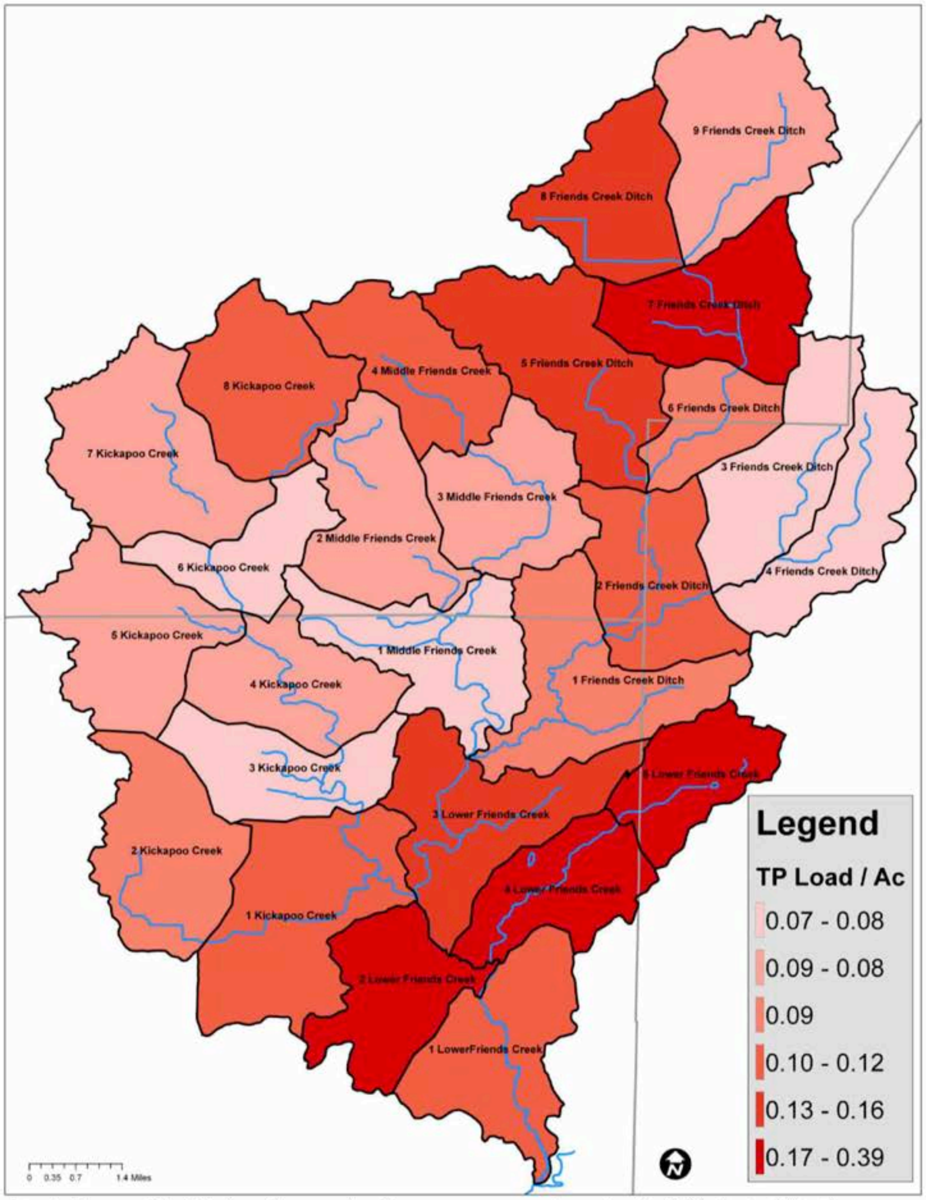
TABLE 35: POLLUTANT LOADING BY LAND COVER TYPE

Pollutant Loading by Land Cover Type - Friends Creek Watershed										
Land Cover Type	Land Cover (Acres, %)		Pollutant Load (Acres, %)							
			TP (lb/yr)		TN (lb/yr)		TSS (lb/yr)		Pathogens (counts/yr)	
Roads	640	0.77%	4,540	44.61%	35,898	33.28%	4,186,380	47.75%	14,745,540	14.88%
Low Density Urban	1,306	1.58%								
Medium Density Urban	242	0.29%								
High Density Urban	49	0.06%								
Water*	707	0.85%	268	2.63%	542	0.50%	39,897	0.46%	1,051,014	1.06%
Forest*	1,222	1.48%								
Forested Wetland*	304	0.37%								
Grassland*	3,584	4.33%								
Wetland*	176	0.21%								
Cropland	74,604	90.07%	5,370	52.76%	71,416	66.21%	4,541,088	51.80%	83,332,930	84.06%
Total:	**82,833**	**100%**	**10,178**	**100%**	**107,856**	**100%**	**8,767,365**	**100%**	**99,129,484**	**100%**

TABLE 36: ESTIMATED ANNUAL TOTAL PHOSPHOROUS LOADS

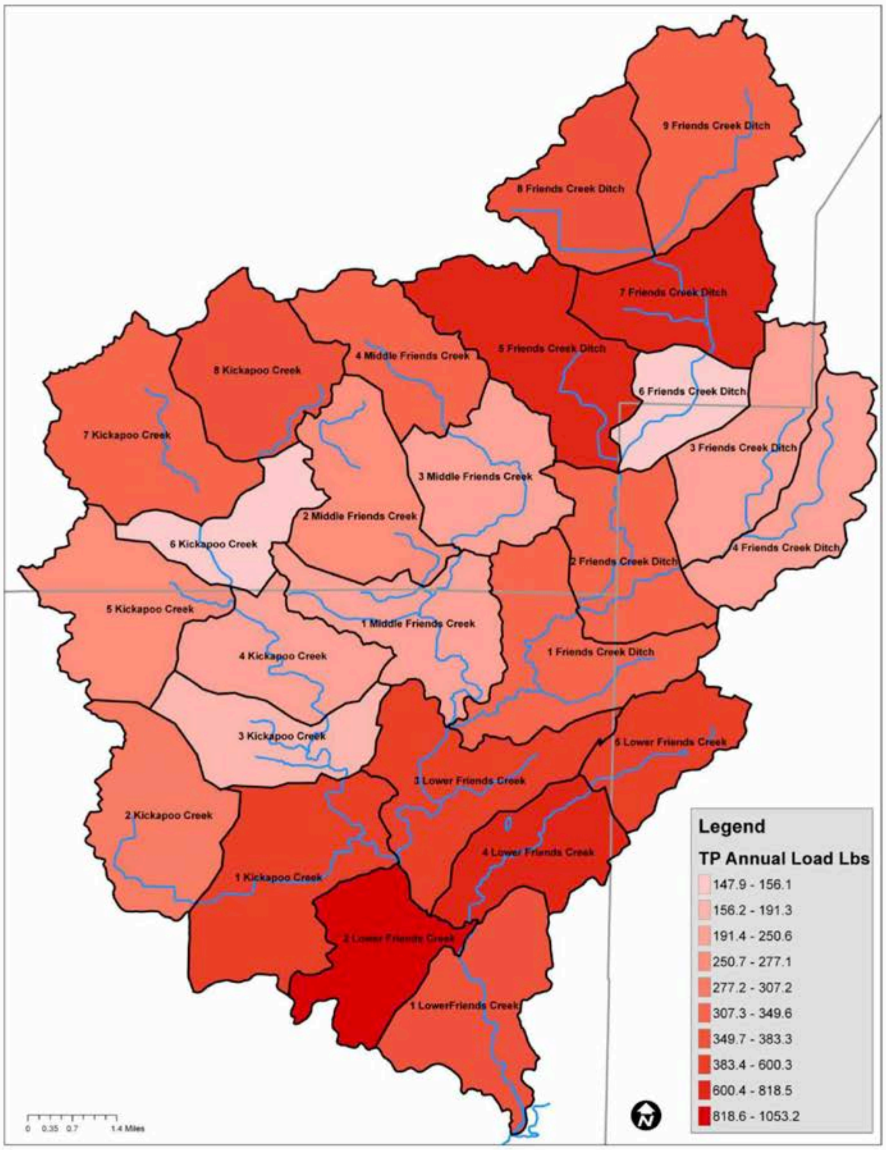
Estimated Annual Total Phosphorous Loads			
Subwatershed		(lbs/ac/yr)	(total lbs/yr)
Friends Creek Ditch	1	0.089	347
	2	0.111	350
	3	0.078	248
	4	0.076	223
	5	0.163	667
	6	0.086	148
	7	0.252	818
	8	0.133	383
	9	0.080	339
Kickapoo Creek	1	0.109	500
	2	0.089	307
	3	0.075	191
	4	0.082	231
	5	0.079	277
	6	0.077	156
	7	0.084	348
	8	0.113	369
Middle Friends Creek	1	0.076	251
	2	0.079	257
	3	0.081	245
	4	0.120	334
Lower Friends Creek	1	0.107	372
	2	0.388	1,053
	3	0.136	519
	4	0.252	642
	5	0.275	600
Total (Entire Watershed):			**10,175**

FIGURE 31: ESTIMATED ANNUAL TOTAL PHOSPHOROUS LOADS IN POUNDS PER ACRE PER YEAR



Estimated annual total phosphorous loads per acre per sub-watershed (lbs/ac/yr) for the Friends Creek Watershed located in Dewitt, Macon, and Piatt counties in Central Illinois. Map created by Nathan Hill.

FIGURE 32: ESTIMATED ANNUAL TOTAL PHOSPHOROUS IN POUNDS PER YEAR

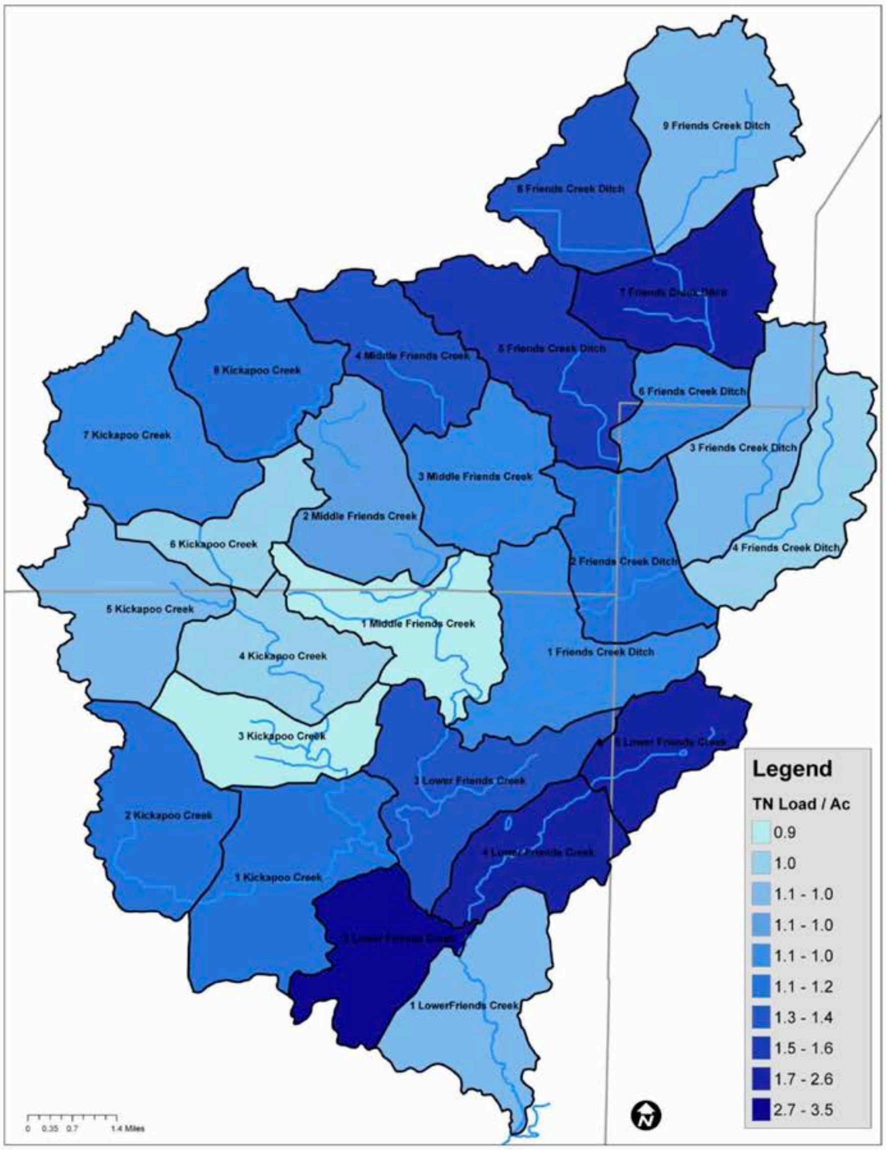


Estimated annual total phosphorous loads per sub-watershed (lbs/yr) for the Friends Creek Watershed located in Dewitt, Macon, and Piatt counties in Central Illinois. Map created by Nathan Hill.

TABLE 37: ESTIMATED ANNUAL TOTAL NITROGEN LOADS

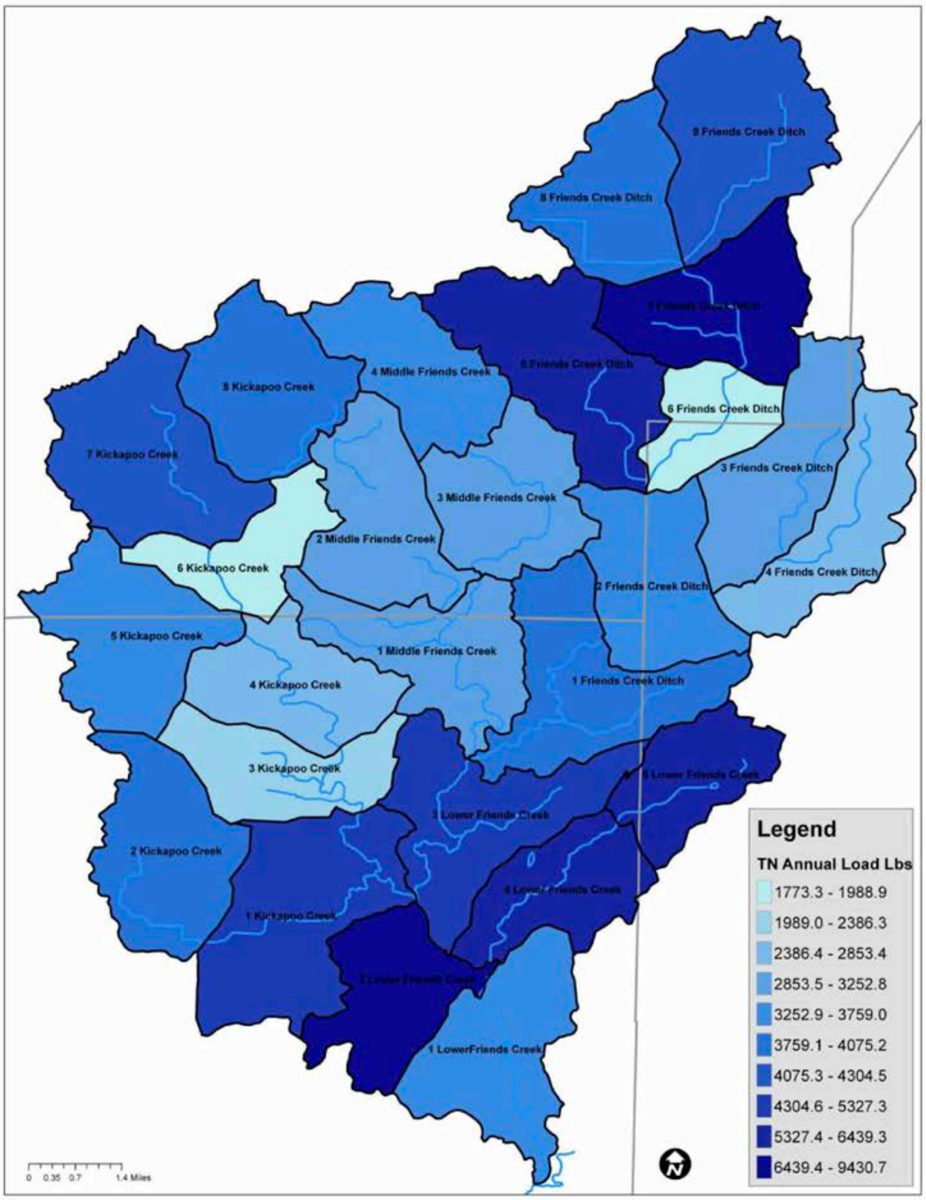
Estimated Annual Total Nitrogen Loads			
Subwatershed		(lbs/ac/yr)	(total lbs/yr)
Friends Creek Ditch	1	1.040	4,075
	2	1.195	3,759
	3	0.996	3,189
	4	0.973	2,853
	5	1.575	6,439
	6	1.029	1,773
	7	2.300	7,477
	8	1.374	3,975
	9	0.991	4,212
Kickapoo Creek	1	1.165	5,327
	2	1.156	3,985
	3	0.933	2,386
	4	0.985	2,777
	5	0.997	3,493
	6	0.983	1,989
	7	1.036	4,304
	8	1.232	4,026
Middle Friends Creek	1	0.919	3,016
	2	1.003	3,253
	3	1.026	3,090
	4	1.276	3,546
Lower Friends Creek	1	0.994	3,470
	2	3.471	9,431
	3	1.259	4,821
	4	2.196	5,587
	5	2.569	5,600
Total (Entire Watershed):			**107,853**

FIGURE 33: ESTIMATED ANNUAL TOTAL NITROGEN LOADS IN POUNDS PER ACRE PER YEAR



Estimated annual total nitrogen loads per acre per sub-watershed (lb/ac/yr) for the Friends Creek Watershed located in Dewitt, Macon, and Piatt counties in Central Illinois. Map created by Nathan Hill.

FIGURE 34: ESTIMATE ANNUAL TOTAL NITROGEN LOADS IN POUNDS PER YEAR

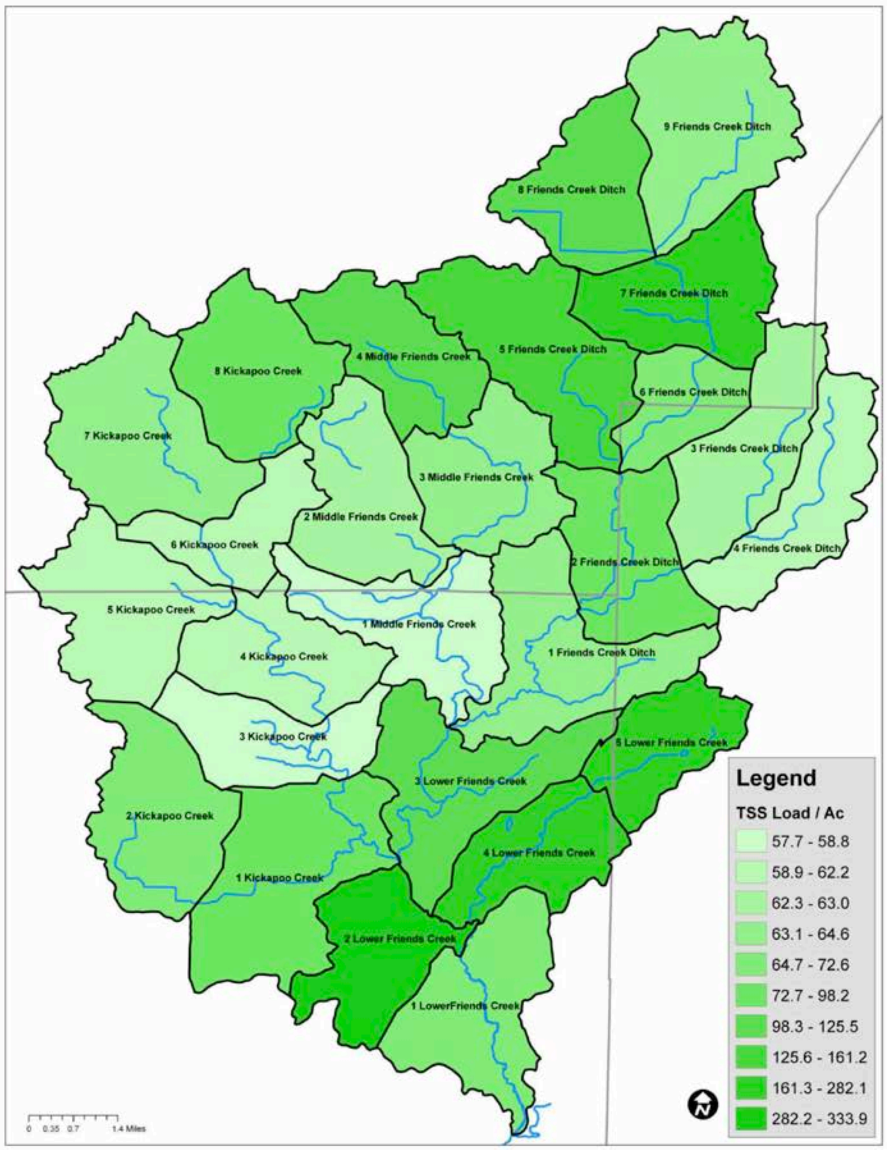


Estimated annual total nitrogen loads per sub-watershed (lb/yr) for the Friends Creek Watershed located in Dewitt, Macon, and Piatt counties in Central Illinois. Map created by Nathan Hill.

TABLE 38: ESTIMATED ANNUAL SUSPENDED SOLID LOADS

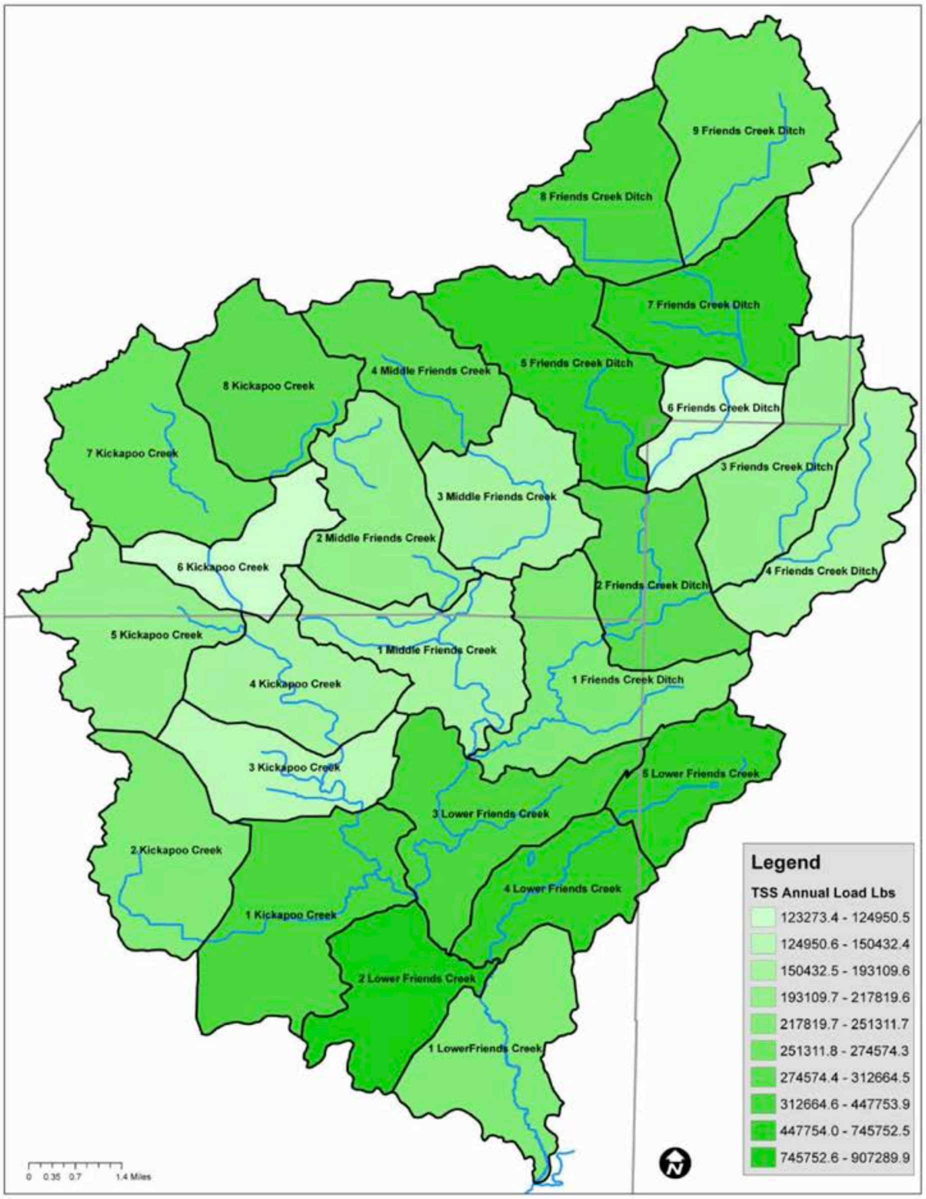
Estimated Annual Total Suspended Solid Loads			
Subwatershed		(lbs/ac/yr)	(total lbs/yr)
Friends Creek Ditch	1	64.151	251,312
	2	98.169	308,746
	3	62.717	200,802
	4	61.443	180,254
	5	161.231	659,020
	6	71.503	123,273
	7	229.441	745,752
	8	125.515	363,100
	9	64.602	274,574
Kickapoo Creek	1	86.435	395,235
	2	72.610	250,301
	3	58.818	150,432
	4	61.302	172,790
	5	62.154	217,820
	6	61.769	124,951
	7	64.574	268,200
	8	95.688	312,665
Middle Friends Creek	1	57.673	189,274
	2	62.970	204,195
	3	64.142	193,110
	4	108.644	301,837
Lower Friends Creek	1	70.593	246,486
	2	333.900	907,290
	3	116.895	447,754
	4	260.679	663,212
	5	282.090	614,982
Total (Entire Watershed):			**8,767,367**

FIGURE 35: ESTIMATED ANNUAL TOTAL SUSPENDED SOLID LOADS IN POUNDS PER ACRE PER YEAR



Estimated annual total suspended solid loads per acre per sub-watershed (lb/ac/yr) for the Friends Creek Watershed located in Dewitt, Macon, and Piatt counties in Central Illinois. Map created by Nathan Hill.

FIGURE 36: ESTIMATED ANNUAL TOTAL SUSPENDED SOLID LOADS IN POUNDS PER YEAR

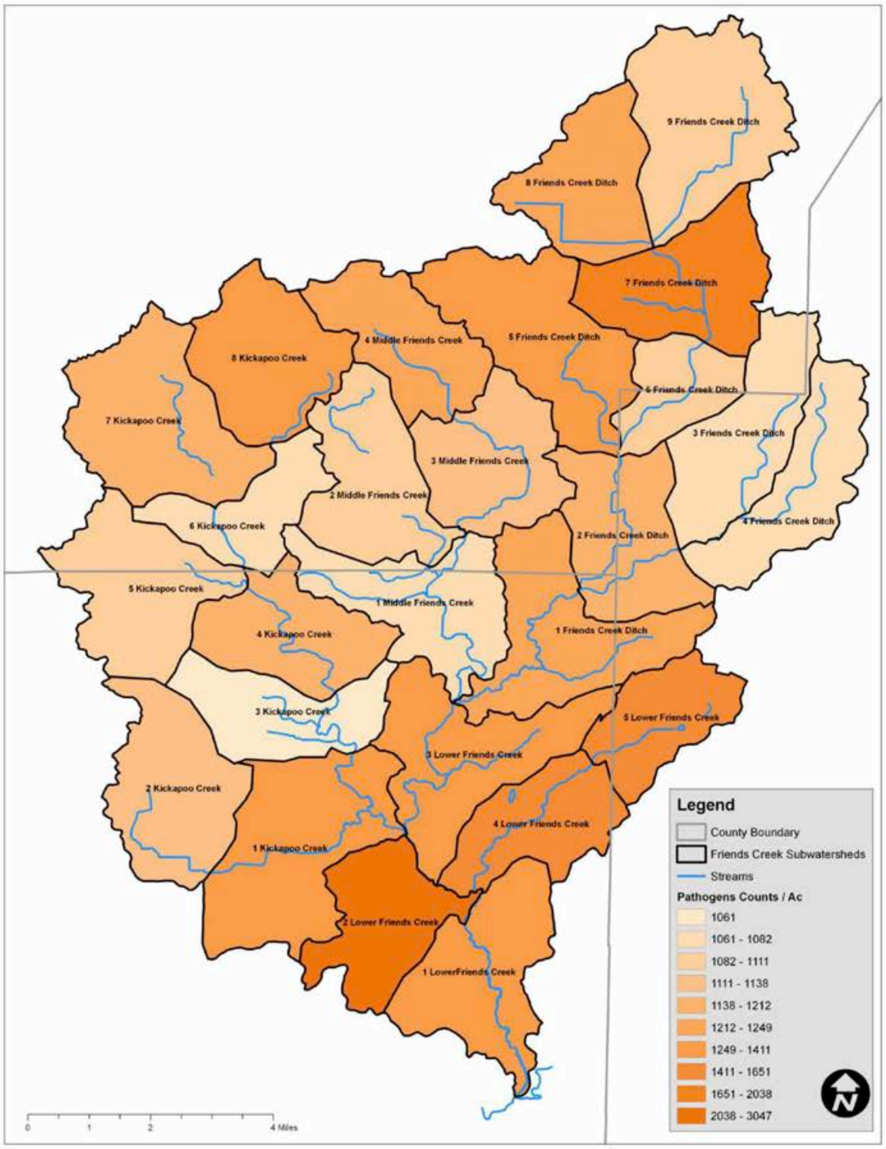


Estimated annual total suspended solid loads per sub-watershed (lb/yr) for the Friends Creek Watershed located in Dewitt, Macon, and Piatt counties in Central Illinois. Map created by Nathan Hill.

TABLE 39: ESTIMATED ANNUAL TOTAL PATHOGENS LOADS

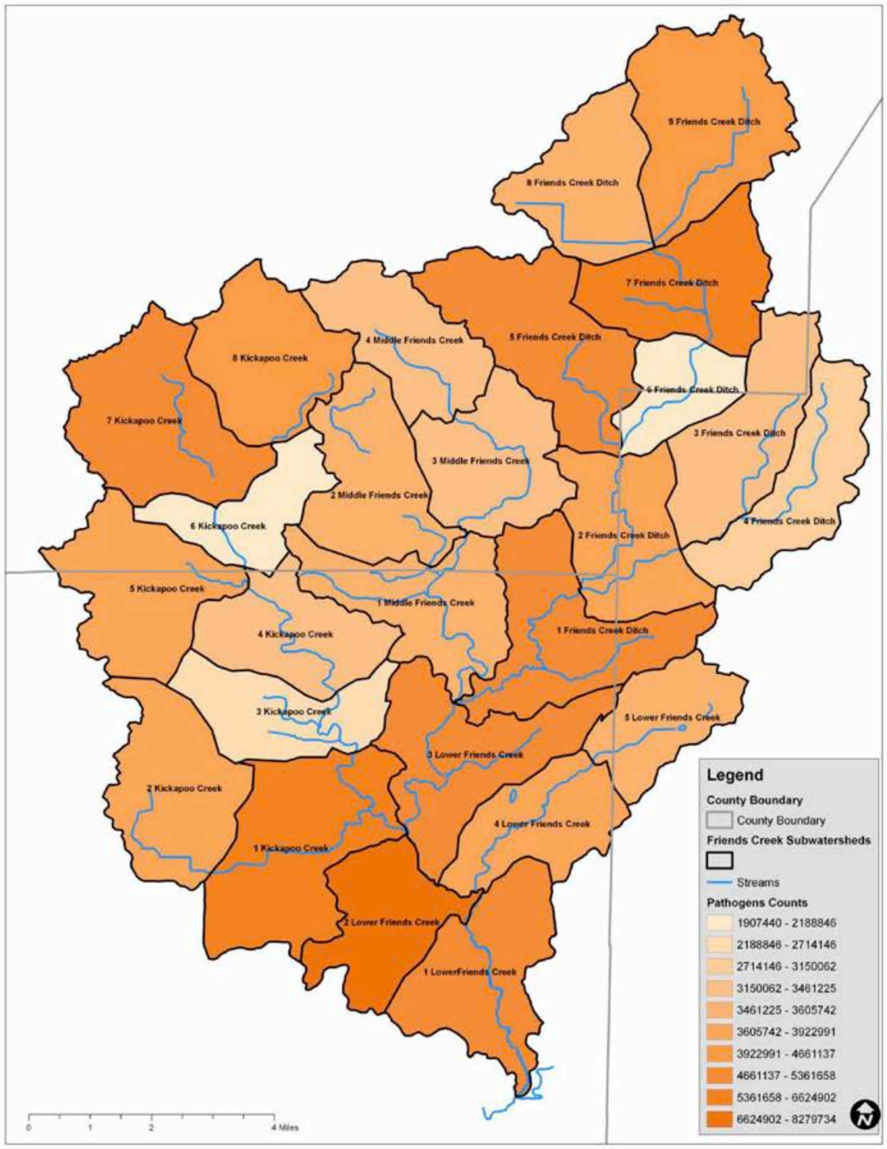
Estimated Annual Total Pathogen Loads			
Subwatershed		**(lbs/ac/yr)**	**(total lbs/yr)**
Friends Creek Ditch	1	1,249	4,893,164
	2	1,212	3,813,099
	3	1,081	3,461,225
	4	1,074	3,150,062
	5	1,312	5,361,658
	6	1,106	1,907,440
	7	2,038	6,624,902
	8	1,239	3,583,058
	9	1,097	4,661,137
Kickapoo Creek	1	1,328	6,071,352
	2	1,138	3,922,991
	3	1,061	2,714,146
	4	1,184	3,337,716
	5	1,104	3,870,690
	6	1,082	2,188,846
	7	1,185	4,922,121
	8	1,302	4,252,853
Middle Friends Creek	1	1,080	3,545,468
	2	1,112	3,605,742
	3	1,131	3,404,842
	4	1,246	3,460,381
Lower Friends Creek	1	1,411	4,928,058
	2	3,047	8,279,734
	3	1,366	5,231,531
	4	1,492	3,795,686
	5	1,652	3,600,678
Total (Entire Watershed):			**108,588,580**

Figure 37: Estimated Annual Pathogen Loads in Pounds per Acre per Year



Estimated annual pathogen loads per acre per sub-watershed (lb/ac/yr) for the Friends Creek Watershed located in Dewitt, Macon, and Piatt counties in Central Illinois. Map created by Nathan Hill.

FIGURE 38: ESTIMATED ANNUAL PATHOGEN LOADS IN POUNDS PER ACRE



Estimated annual pathogen loads per sub-watershed (lb/yr) for the Friends Creek Watershed located in Dewitt, Macon, and Piatt counties in Central Illinois. Map created by Nathan Hill.

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Section 2:

Friends Creek Watershed Plan

2019

MACON COUNTY SOIL
AND WATER
CONSERVATION DISTRICT

Olson Ecological Solutions, LLC

tallgrass RESTORATION, LLC

Funding for this project provided, in part, by the
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INTRODUCTION

Written by Alyssa Robinson and Angela Daily

Friends Creek Watershed is located at the intersection of 3 counties in central Illinois: Macon County, Dewitt County, and Piatt County. The Villages of Cisco, Weldon and Argenta reside within the watershed. The 83,000-acre Friends Creek Watershed is in the lower part of the Upper Sangamon River Watershed and headwaters into the Sangamon River and Lake Decatur.

Many stakeholders and landowners within Friends Creek Watershed are agricultural producers, mostly corn and bean production, with a small amount of wheat production. There are also a few small livestock operations and a small amount of grasslands for hay crop production.

Friends Creek Watershed houses various conservation best management practices, including pollinator areas, Conservation Reserve Program (CRP) acres, hardwood tree planting, drainage water management, and quail buffers.

Macon County Conservation District provides 526 acres of conservation areas within Friends Creek Watershed. Friends Creek Conservation Area offers:

- Three nature trails
- Two pavilions
- Creek fishing
- Playground
- Public Programs offered by naturalists
- Hiking
- Cross country skiing
- Picnic areas
- Playground

This document delivers a written plan for stakeholders to use for improving water quality within the watershed in correspondence to Illinois Environmental Protection Agency's watershed-based plan program. This plan intends to address water-quality issues and recommend corresponding conservation solutions. It invites local stakeholder collaboration in the creation of the plan in order to ensure the plan addresses stakeholder and other local concerns. Participation and contribution of stakeholders in watershed planning and the consequential implementation of the plan are both voluntary.

This introduction provides information on the planning efforts involved in creating the plan. The planning process details planning guidance, funding sources, purpose, scope and limitations, planning process overview and timeline, and a list of planning contributors. The following chapters further detail plan specifics, including concerns, goals, and objectives; education and outreach; recommended practices, financial and technical resources; and criteria for evaluating plan success.

Conservation Planning Guidance

The Friends Creek Watershed plan takes input from the "Friends Creek Watershed Resource Inventory" (see Section 1) along with local stakeholder input during the planning process. This plan complies with the Handbook for Developing Watershed Plans to Restore and Protect Our Waters (USEPA, 2008) as well as current watershed conservation planning standards. The creation of the Friends Creek watershed-based plan contains the nine minimum elements that will be consistent with the USEPA watershed-based plan guidance for future implementation of the watershed-based plan recommendations and is required for USEPA Clean Water Act Grants future funding considerations.

Funding and Contributions

Through Section 319 of the Clean Water Act, the Illinois Environmental Protection Agency (IEPA) provided funding for the creation of this watershed-based plan. Other organizations donated their time and expertise, including Macon County Soil and Water Conservation District, Dewitt County Soil and Water Conservation District, Piatt County Soil and Water Conservation District, Olson Ecological Solutions, LLC, Midwest Streams Inc., Natural Resource Conservation Service, Farm Service Agency, City of Decatur, Villages of Argenta and Weldon, Precision Conservation Management, University of Illinois Extension, Agricultural Watershed Institute, and Friends Creek Conservation District. Residents of Friends Creek Watershed also donated their effort and time to share input about the area and help plan for applicable solutions.

Purpose

In 2017 the Macon County Soil and Water Conservation District (SWCD) initiated the efforts for the creation of this plan. The purpose of this document is to create a plan that identifies and recommends solutions for water quality issues within Friends Creek Watershed. Friends Creek is a headwater tributary to Sangamon River and Lake Decatur, both of which IEPA has identified as impaired waterways on the 303(d) Streams and 303(d) Lakes list, respectively. Primary beneficiaries of this plan are stakeholders of Friends Creek Watershed and village residents of Argenta, Cisco, and Weldon.

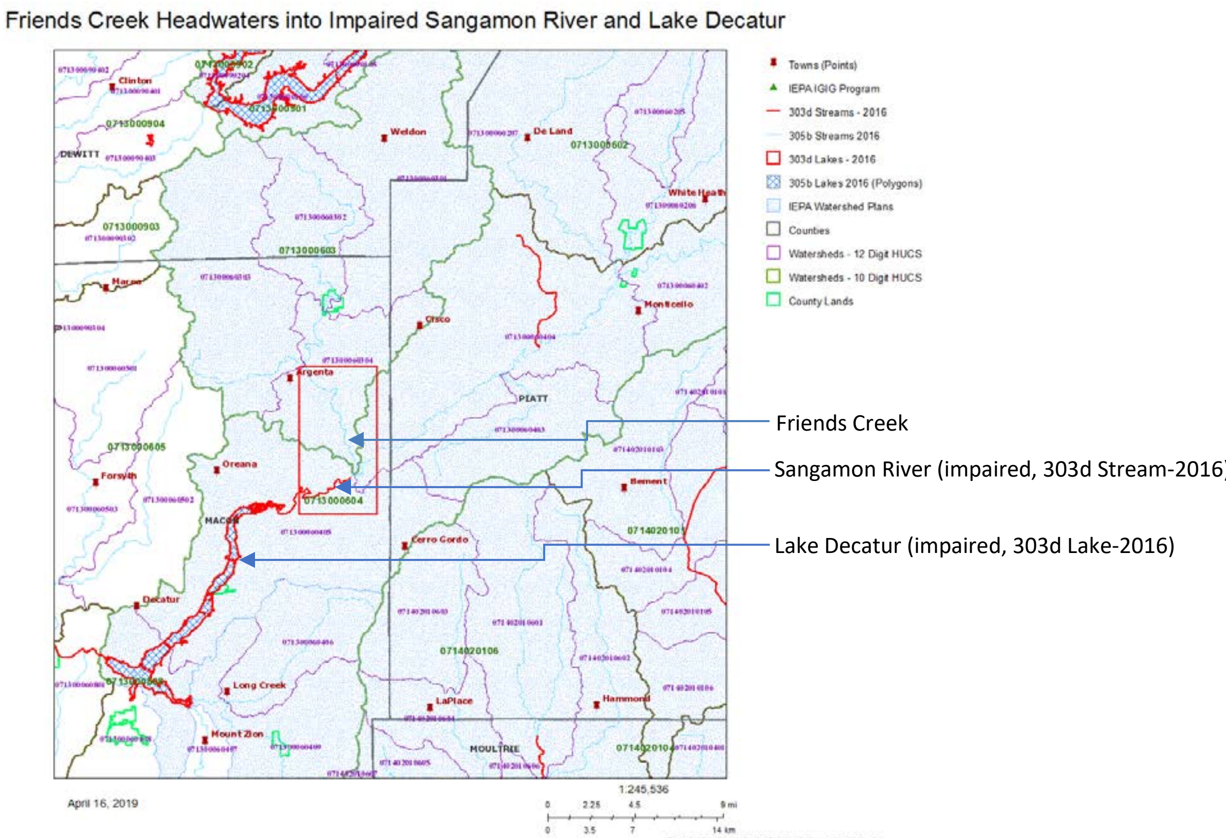
The plan outlines goals and recommended projects/best management practices (BMPs) that will aid landowners and stakeholders in voluntary implementation of said recommended BMPs. The contents of this plan aim to raise awareness of water impairment issues and subsequently to engage stakeholders to take actions that restore the impaired watershed. This plan should be updated annually.

Scope and Limitations

The scope of this plan is to confront the causes of non-point source pollution that are impairing the Friends Creek Watershed. This plan compiles current natural resource information, analyzes water quality data and possible sources of excess nutrients/pollution, collects input from residents and stakeholders who are willing to participate in planning and implementing solutions, and recommends conservation best management practices. Friends Creek headwaters directly into Sangamon River. Sangamon River has 303 (d) stream impairments of Nitrogen/Nitrate, Dissolved Oxygen, Total Phosphorous, Sedimentation/Siltation, and Total Suspended Solids (TSS). Sangamon River then enters into Lake Decatur, which has 303 (d) lake impairments of Chlordane, Mercury, and Polychlorinated biphenyls.

Figure I.1 below displays Friends Creek's spatial relation to Sangamon River and Lake Decatur. Figure I.1 was created through *Resource Management Mapping Service.*

Figure I.1



This plan focuses on a proactive approach which aims to prevent pollution from reaching waterways in the first place and balances stakeholder needs with the needs of the land and its resources. To ensure this balance, recommended BMPs offer smarter and more environmentally conscious practices that can operate within the current and planned confines of economically viable land uses.

Planning Process Overview and Timeline

The creation of the watershed plan began in June of 2017 when IEPA awarded Macon County SWCD a Section 319 grant, a two-year grant agreement, to expire on July 31, 2019. Two committees, the planning committee and the technical advisory committee, aided in carrying out the planning process for this document. On August 19, 2017, a Kick-Off Meeting formally invited people who reside and work within Friends Creek Watershed to come together and participate in the planning process. The planning committee discussed and decided on various water quality project ideas to be included in the plan. The second committee, the technical advisory committee, comprised of professionals within fields of agriculture, natural resource conservation, planning and zoning, and education and outreach. The technical advisory committee evaluated the inventory and planning process to provide technical feedback and expertise.

Local Involvement

Meetings for the technical advisor and planning committees, as well as, individual meetings and phone calls with landowners aimed to invite local participation in the creation of the watershed-based plan. Friends Creek Watershed residents, Macon County SWCD representatives, city/village governmental employees, and various consultants participated in these planning meetings.

Stakeholders involved in watershed planning met 7 times. Macon County SWCD initiated and facilitated all meetings and provided technical assistance along with the Piatt County SWCD, DeWitt County SWCD, and other local professionals. *Figure I.2* below lists the schedule of meetings that took place throughout the planning process.

Figure I.2 Schedule of Planning Meetings

DATE	AGENDA
June 22, 2017	Partners Meeting: Discussion of how the Friends Creek Watershed Action Plan will progress
August 17, 2017	Kick-off Meeting: Creating a Watershed-Based Plan presentation and brainstorming session
November 16, 2017	Overview of Friends Creek Project
February 28, 2018	Streambank Inventory by Wayne Kinney
June 13, 2018	Transect results, nutrient modeling results, riparian survey results, streambank results
September 19, 2018	BMPs (agriculture& urban): What will work in Friends Creek?
November 8, 2018	BMP Modeling Results, Best Case Scenario
February 21, 2019	BMP Survey and Modeling results
May 23, 2019	Present draft plan for review.
TBD	Present plan

Watershed Inventory

While locals, stakeholders, and advisors met and discussed watershed issues and potential solutions, Olson Ecological Solutions prepared an inventory of the watershed, which is a compilation of all available resources and information on the natural resources of the area. The inventory is comprised of pertinent information about the watershed including physical features, people, and water quality of the Friends Creek Watershed. Section 1 further details the contents of the Watershed Inventory.

Watershed Plan

Through the planning committee meetings, participants discussed their concerns and experiences with any water quality issues within Friends Creek Watershed. Planning participants also decided and ranked by priority which conservation practices and programs they would like to implement. Macon County SWCD staff, consultants, and technical advisors compiled and further developed these conservation practice ideas. Section 2 further details the contents of the Watershed Plan.

Watershed Planning Participants

Various organizations, public and private groups, and individuals contributed to the watershed planning effort. Below are the people who are recognized for their time and dedication to the successful planning effort.

Macon County Soil and Water Conservation District Board and Staff:
David Carr, Chairman
Eric Veech, Vice Chairman
Katie Sellmeyer, Secretary/Treasurer
Chase Brown, Director
Ross Ferrill, Director
Natalie Misner, Watershed Specialist
Manny Wei, Watershed Engineer
Angela Daily, Administrative Coordinator

Piatt County Soil and Water Conservation District Partner: Jonah Cooley
Dewitt County Soil and Water Conservation District Partner: Shelley Finfrock

Technical Advisors, Stakeholders, and Other Partners:
Keith Alexander, Water Productions Manager, City of Decatur
Doug Peters, District Conservationist, Natural Resources Conservation Service (NRCS)
Olson Ecological Solutions, LLC
Wayne Kinney, Consultant- Midwest Streams, Inc.
David Fulton, Conservation Specialist, PCM
Tim McMahon, AWI, Technical Advisor
Steve John, AWI, Technical Advisor
Doug Gucker, University of Illinois Extension
Paul Marien, Macon County Conservation District
Shane Ravellette, Macon County Conservation District
Julie Brock, Village of Weldon
Cindy Luedke, Mayor Village of Argenta

Kate Scott
Janet Frye
John Remmers
Mike Tumbleson
Gary Becker
Greg Shoop
Kim Williams
Lynn Atteberry
Sheri Debose
Charlie Debose
David Lehman
Gregg Ross
Jeff Olson
Karen Kaufman

Don Heldt
Craig Goeppinger
Jackie Goeppinger
Mark Smith
Gary Cox
Gary Cox II
Richard Cox
Robert Nixon
Terry Heinz
Connie Heinz
Shawn Reeves
Mitch Myers
Kyle Johnson

Alvin Boyd
Jon Seevers
Parker Zimmerman
Betty Jordan
Evelyn Kaufman
Roy Groves
Bob Ferrill
Roger Briggs
Cody Sheets
Laurie Sheets
Genevieve Williams
Bob Meschnark
Pat Meschnark

Doug Johnson Robert Anderson Lynn Clarkson

Local Resources for Agricultural Producers in Friends Creek Watershed

A critical attribute of farmland within the Friends Creek Watershed is its proximity to key agricultural markets. Long ago, agricultural processing giants, including Archer Daniels Midland Company (ADM) and Tate & Lyle, purposely located facilities adjacent to this fertile ground. Doing so has created one of the highest paying markets in the world for corn and soybeans. Many producers in the Watershed can deliver their grain directly into ADM or Tate & Lyle's facilities, which enables them to have some of the most competitive prices paid for grain in the world. Between the two companies, more than 900,000 bushels of grain are processed per day.

For over a century, Archer Daniels Midland Company has transformed crops into products for food, animal feed, and industrial and energy uses. They are one of that world's largest agricultural processors and food ingredient providers. For more information, visit https://www.adm.com/.

Tate & Lyle is a "global provider of solutions and ingredients for food, beverage and industrial markets." Product categories include beverages, dairy, soups, sauces, dressings, sweeteners, industrial starches, and fermentation products. For more information, please visit https://www.tateandlyle.com/home.

SECTION 2, CHAPTER 1
Concerns, Goals, and Objectives

Written by Angela Daily, Rebecca Olson, & Alyssa Robinson

Introduction
This chapter focuses on concerns, goals, and objectives for the watershed and future chapters provide guidance to meeting them.

Concerns
Concerns for the watershed and water quality of Friends Creek were derived from stakeholder input and the Watershed Resource Inventory (see Section 1). The concerns listed below address rural and urban aspects. Additionally stream and streambank concerns were identified and are listed below.

Rural concerns:

- agricultural tile runoff
- soil and fertilizer runoff from fields
- animal waste runoff
- loss of filter strips around waterways

Urban concerns:

- soil and fertilizer runoff from lawns and construction sites
- animal waste from pets and small livestock
- petroleum product runoff from roadways
- seepage of septic systems into waterways
- general drainage of low lying areas

Stream and streambank concerns:

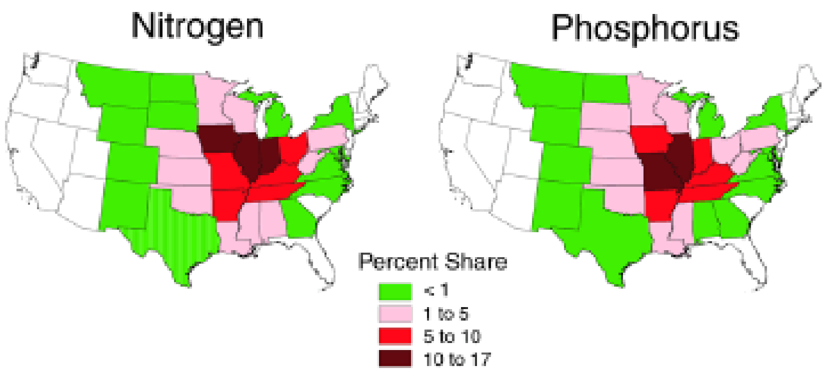
- streambank erosion
- water quality
- stream capacity
- sedimentation
- aquatic habitat
- stream channelization
- poor or fair quality riparian areas and buffer zones next to streams and ponds

Goals
Three goals resulted from considering concerns of the stakeholders and review of the Watershed Resource Inventory:

1. To reduce nutrient loading into streams
2. To reduce sediment loading into streams
3. To reduce pathogen loading into streams

These overarching goals encompass the concerns for the watershed, facilitate improvement of Friends Creek water quality, and compliment the goals of the Illinois Nutrient Loss Reduction Strategy, which calls on Illinois to reduce nitrogen and phosphorous within the Mississippi River Basin, of which Illinois is a part.

Illinois is one of 12 states in the Mississippi River Basin included in U.S. EPA's 2008 Gulf Hypoxia Action Plan. This plan calls on the 12 states to develop a strategy to reduce the amount of phosphorus and nitrogen carried to the Gulf of Mexico. Excess nutrients from these states have led to an aquatic life "dead zone" that stretches for thousands of miles. The goals of the Gulf Hypoxia Action Plan are to reduce the amount of total phosphorus and nitrogen by 45%, reduce nutrient loading to the Gulf of Mexico, and reduce the Gulf of Mexico hypoxic zone to 1,930 square miles. Illinois is one of the primary contributors of nitrogen and phosphorous to the Gulf of Mexico.



(USGS, https://water.usgs.gov/nawqa/sparrow/gulf_findings/faq.html)

As a response to the U.S EPA's Gulf Hypoxia Action Plan and an overall concern for Illinois' water quality, Illinois EPA developed the Nutrient Loss Reduction Strategy, or NLRS. The Nutrient Loss Reduction Strategy outlines best management practices to reduce nutrient losses from point sources, urban stormwater, and agricultural nonpoint sources. It uses scientific assessments to target the most critical watersheds and to build upon existing state and industry programs. The goal is to reduce the amount of total phosphorus and nitrate-nitrogen reaching Illinois waters by 45%. A NLRS Report was adopted and publicly released on July 21, 2015, and established 2025 interim milestone goals of reducing phosphorous loads by 25% and nitrogen loads by 15%. The 2015-2017 Biennial Report documents NLRS progress, including the tracking of staff and funding, outreach, land use changes and facility updates, and load reductions (*Nutrient Loss Reduction Strategy-NLRS: past, present, and future)*. In comparing numbers from eight major Illinois rivers from 1980-1996 to data from 2011-2015, Illinois has reduced nitrate-nitrogen by 10% and increased phosphorous by 17% (Drs. Mark David, Greg McIsaac, Corey Mitchell, University of Illinois at Urbana-Champaign in *Nutrient Loss Reduction Strategy-NLRS: past, present, and future*).

"The Illinois Farm Bureau supports the NLRS because it relies on education, outreach and voluntary incentive-based practices to fulfill agriculture's role in reducing nutrient losses."

~Lauren Lurkins, Director of Natural and Environmental Resources- Illinois Farm Bureau.

In order to reach these goals, stakeholders would need to meet the objectives outlined below.

Objectives

The objectives outlined below are measurable milestones designed to address the goals of this watershed plan. The objectives were deemed to be reasonable targets within the plan's timeline, given the known technical and financial resources available to the Friends Creek Watershed. Both the timeline and resources will be discussed in detail later in this plan.

1. To reduce **nitrogen** by 1000 lbs/yr.
    a. Reduction of 1% reflects estimated reduction to 106,856 lbs/yr from existing load of 107,856 lbs/yr.

    At a reduction of 1000 lbs./ year our goal for nitrogen reduction would be met in 14.5 years.

2. To reduce **phosphorous** by 500 lbs/yr.
    a. Reduction of 5% reflects estimated reduction to 9,677 lb/yr from existing load of 10,177 lbs/yr.

    At a reduction rate of 500 lbs/ year our goal for phosphorous reduction would be met in year 7.

3. To reduce **sediment** by 500 tons/yr.
    a. Reduction of 11% reflects estimated reduction to 3,884 tons/year from existing load of 4,384.

    At a reduction rate of 500 tons /year our goal for sediment reduction would be met in year 6.

Please note that there are no measurable objectives for pathogens in this report. The computer-aided models that we used to predict pollutant load reductions did not account for pathogen reductions. Each recommended project and practice addressing other pollutants are also effective in reducing pathogen loads. Therefore, as the measurable objectives become addressed, so will pathogens.

Figure 1.1 Estimated Total Load of Nitrogen, Phosphorous, and Sediment Entering Watershed Per Year

	Nitrogen	**Phosphorous**	**Sediment**
Current	107,856	10,177	4,384
Year 1	106,856	9,677	3,884
Year 2	105,856	9,177	3,384
Year 3	104,856	8,677	2,884
Year 4	103,856	8,177	2,384
Year 5	102,856	7,677	1,884
Year 6	101,856	7,177	1,384

In order to achieve these objectives, the stakeholders, Macon County SWCD staff, and consultants considered best management practices that were both effective and likely to be implemented by watershed residents and producers. These best management practices are discussed within the next chapters of this plan.

SECTION 2, CHAPTER 2
Recommended Projects and Practices

Written by Angela Daily, Alyssa Robinson, and Rebecca Olson

Introduction
Chapter 1 addressed concerns, goals, and objectives for the Friends Creek Watershed. This chapter provides a comparison of agricultural run-off and residential run-off, a list of already implemented projects and practices, and recommendations for new projects and practices for Friends Creek Watershed.

Agricultural Run-off vs. Residential Run-off
It is a common misconception that agricultural production is the main cause of water quality degradation. This is probably due to the visibility of both the vast expanses of agriculture in the Midwest and the significant degradation of streams and lakes. However, it is well documented that impervious cover like roads, rooftops, driveways, and sidewalks are the real culprit, all of which are found in much greater abundance within towns and cities. Even watersheds with as little as 6% of impervious cover can start to show measurable degradation of the biological, hydrologic, and geomorphic conditions of its streams, although various studies have found that this minimum can be as high as 20% based on site-specific variables (EPA, 2011).

It is also well known that acre for acre, residential and commercial development have the highest pollutant runoff, with agricultural production as a close second, as indicated by the Event Mean Coefficient (EMC) values documented by the EPA and other sources and used in our pollutant load reduction modeling estimates. The National Water Quality Inventory of 2003 found that urbanized area runoff is the principal cause of water quality impairments to surveyed estuaries and the third-largest cause of impairments to surveyed lakes (US EPA). As watersheds undergo urbanization, developers convert previously vegetated areas to impervious surfaces, i.e. driveways, roadways, parking lots, homes, corporate/industrial buildings. Impervious surfaces do not allow precipitation to infiltrate into the soil and therefore cause runoff accumulation and flooding. When water quickly runs off impervious surfaces into lower drainages areas or storm drains, it not only causes flooding but also does not allow slow infiltration through the soil. One of nature's ways of filtering out pollutants in precipitation is through soil infiltration. Humans are removing this natural step of filtration by increasingly utilizing impervious surfaces. Moreover, more development results in more pollutant accumulation onto these impervious surfaces. When stormwater flows over these surfaces, it collects pollutants like automobile petroleum by-products, deicing salts, fertilizers, pesticides, pet waste, metals, and sediment and then empties it into the nearest stream, lake, or other waterway. Even areas that are left undeveloped and vegetated may have compacted soils from surrounding development activities. Compacted soils make it difficult for precipitation to infiltrate soil.

Although agricultural areas can have runoff and erosion problems, generally the amount of runoff will be less on agricultural lands than on developed, residential lands. Although agricultural lands may have bare soil or compacted soil at times (especially if conventional till and no cover crop practices are used), they have much less impervious surfaces. Although there may be agricultural erosion and runoff concerns, there are more opportunities for precipitation to infiltrate into the soil.

The runoff coefficient, (C), is a value ranging from zero to one that considers the relation between the amount of precipitation and the amount of resulting runoff within a watershed (Water Boards, 2011). Other factors considered and displayed in *Figure 2.1* are soil type, slope, permeability, and land use. A high runoff coefficient means higher runoff and lower infiltration, potentially resulting in flash flooding during storms. Low runoff coefficients have lower runoff rates and higher infiltration. Larger, densely vegetated areas with flat slopes and permeable soil will have the lowest runoff coefficients because they have less impervious pavement. The runoff coefficient increases as impervious surfaces increase, clay content in soil increases, and slope steepens. The different soil groups (Group A, B, C, and D) in the charts below are categorized based on U.S. Soil Conservation Service (SCS) soil identifications and soil infiltration rates.

According to *Figure 2.1*, the runoff coefficient for farmland is always less than the runoff coefficient for residential areas, regardless of residential acreage, soil type, or slope.

Figure 2.1 Runoff Coefficient

	Runoff Coefficient, C					
	Soil Group A			Soil Group B		
Slope :	< 2%	2-6%	> 6%	< 2%	2-6%	> 6%
Forest	0.08	0.11	0.14	0.10	0.14	0.18
Meadow	0.14	0.22	0.30	0.20	0.28	0.37
Pasture	0.15	0.25	0.37	0.23	0.34	0.45
Farmland	0.14	0.18	0.22	0.16	0.21	0.28
Res. 1 acre	0.22	0.26	0.29	0.24	0.28	0.34
Res. 1/2 acre	0.25	0.29	0.32	0.28	0.32	0.36
Res. 1/3 acre	0.28	0.32	0.35	0.30	0.35	0.39
Res. 1/4 acre	0.30	0.34	0.37	0.33	0.37	0.42
Res. 1/8 acre	0.33	0.37	0.40	0.35	0.39	0.44
Industrial	0.85	0.85	0.86	0.85	0.86	0.86
Commercial	0.88	0.88	0.89	0.89	0.89	0.89
Streets: ROW	0.76	0.77	0.79	0.80	0.82	0.84
Parking	0.95	0.96	0.97	0.95	0.96	0.97
Disturbed Area	0.65	0.67	0.69	0.66	0.68	0.70

Rational Method Runoff Coefficients - Part I

	Runoff Coefficient, C					
	Soil Group C			Soil Group D		
Slope :	< 2%	2-6%	> 6%	< 2%	2-6%	> 6%
Forest	0.12	0.16	0.20	0.15	0.20	0.25
Meadow	0.26	0.35	0.44	0.30	0.40	0.50
Pasture	0.30	0.42	0.52	0.37	0.50	0.62
Farmland	0.20	0.25	0.34	0.24	0.29	0.41
Res. 1 acre	0.28	0.32	0.40	0.31	0.35	0.46
Res. 1/2 acre	0.31	0.35	0.42	0.34	0.38	0.46
Res. 1/3 acre	0.33	0.38	0.45	0.36	0.40	0.50
Res. 1/4 acre	0.36	0.40	0.47	0.38	0.42	0.52
Res. 1/8 acre	0.38	0.42	0.49	0.41	0.45	0.54
Industrial	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.89	0.89	0.90	0.89	0.89	0.90
Streets: ROW	0.84	0.85	0.89	0.89	0.91	0.95
Parking	0.95	0.96	0.97	0.95	0.96	0.97
Disturbed Area	0.68	0.70	0.72	0.69	0.72	0.75

Rational Method Runoff Coefficients - Part II

Source: Knox County Tennessee Stormwater Management Manual

The projects and practices already implemented in and recommended for the Friends Creek Watershed considered both rural and urban settings. Both contributed an almost equal amount of phosphorous and sediment loading to the streams, even though 90% of the watershed was agricultural and 3% was developed with low and medium density residential and commercial uses, as reported in Section 1. Agriculture contributed twice as much nitrogen as the developed areas of the watershed, probably due to the extensive tiling present, as nitrogen traveled with water through the tile while phosphorous bound to sediment.

Already Implemented Projects and Practices

Landowners within Friends Creek Watershed are proud of the conservation-minded practices already taking place within the watershed. A drive around the watershed will reveal conservation tillage, cover crops, and more.

The following projects have been implemented in the Friends Creek Watershed by the Macon County Soil and Water District using various financial resources:

- Grassed waterway with a rock check outlet

  The grassed waterway is 1000 feet long and drains 146 acres. The project is in section 13 of Friends Creek West Township.

  The waterway outlets approximately 1000 feet from Friends Creek.

- Grassed waterway and a concrete block chute grade stabilization structure

  The block chute is a 5 ft overfall structure and the grassed waterway is 600 feet long. The project is in section 4 Friends Creek East Township.

  The project drains 183 acres and outlets directly into Friends Creek.

- Concrete block chute grade stabilization structure.

  This structure stabilizes a 3 foot overfall and is located at 12288 Friends Creek Park Road.

  It drains approximately 552 acres and outlets approximately 4000 feet from Friends Creek.

- Streambank stabilization project approved for financial assistance and scheduled to be implemented in 2019.

  This project will protect a 170-foot length of Friends Creek streambank adjacent to the landowner's home.

Figure 2.2 Load Reduction Estimates for Already Implemented BMPs

	Reduction Estimates			
BMP Name	Sediment (tons/year)		Phosphorous (lbs/year)	Nitrogen (lbs/year)
Grassed waterway with rock check outlet	24.2		24.2	48.5
Grassed waterway with concrete block chute	14.5		14.5	29.1
Concrete block chute	1.2		1.2	2.4
Streambank stabilization	9.2		9.2	18.6
Total	**49.1**		**49.1**	**98.6**

Site Specific Recommendations
Referring to findings in Attachment A, the overall recommendation is to treat as many eroding streambanks as possible in the Friends Creek Watershed to reduce the total sediment loading of Lake Decatur. The following are site specific locations that should be of highest priority. Each of the projects described below vary in scope and are geographically located throughout the Friends Creek Watershed (Kinney, 2018).

- **Friends Creek Reach 003**
  This area is a 1,056-foot long channelized section that cuts off a large meander bend just below I-72 with nearly vertical, severely eroding banks. The bed is nearing stability after many years. Ideally, the channelized section would be eliminated and the water allowed to flow back through the original meander. Usually, such a scenario is unlikely to be implemented due to utilization of the land, in which case the recommendation is to construct a series of rock riffles within the channelized reach to stabilize the bed and create deeper pools to dissipate the energy in the stream segment (Kinney, 2018).

- **Friends Creek Ditch Reach 001**
  Friends Creek Ditch Reach 001 is an area 1.29 miles long (6,811 feet) that is developing a new channel at the confluence with Friends Creek. The existing channel has lost capacity due to excessive deposits of sand and gravel resulting in Friend Creek Ditch creating a "high flow" channel where larger flows are eroding a new channel that will enter Friends Creek approximately 800 feet downstream of the current confluence. The resulting "high flow" channel is very unstable with significant headcuts and is well undersized. As this high flow channel continues to develop into the "new" Friends Creek Ditch it will produce large amounts of sediment loading as it deepens and widens. The recommendation is to design a "new" channel in the approximate location of the developing channel and excavate a properly sized stable channel with the necessary grade control and Stone Toe Protection (Kinney, 2018).

- **Tributary 2 Reach 001**
  This 1.14-mile stretch (6,019 feet) is extremely incised and is very unstable with a rate of sediment per sq. mile of drainage area that is five times higher than any other stream segment. The recommendation is to install a series of grade control structures from Cemetery Road down to the confluence with Friends Creek (Kinney, 2018).

- **Tributary 3 Reach 001**
  This 1.49-mile stretch (7,867 feet) has a large degrading section with a very unstable bed 1,500 to 2,000 feet above Dunbar Road. A three to four-foot headcut exists at the upper end of this reach and will continue to migrate upstream generating large amounts of sediment if left unchecked. The recommendation is to install a series of Rock Riffle grade control structures in this reach (Kinney, 2018).

Figure 2.3 Load Reduction Estimates for Site Specific Recommendations

	Reduction Estimates			
BMP Name	Sediment (tons/year)		Phosphorous (lbs/year)	Nitrogen (lbs/year)
Friends Creek Reach 003	210		210	420
Friends Creek Ditch Reach 001	315		315	630
Tributary 2 Reach 001	215		215	430
Tributary 3 Reach 001	26		26	53
TOTAL	**766**		**766**	**1,533**

Watershed Wide Project/Practice Recommendations

Projects and practices that can be implemented throughout the watershed are described in the following pages. Each project or practice is correlated to the goals and objectives from Chapter 1 to which it addresses. There are three categories of recommendations: (A) Rural Recommendations, (B) Urban Recommendations, and (C) Stream Stabilization Recommendations. Projects and practices occurring within headwaters and as close to the source of pollution as possible should receive highest priority. This is especially true upstream of the Friends Creek Conservation Area, which is the only identified high quality natural resource needing protection in the watershed.

A. Rural Recommendations

*Refer to Attachment F taken from Illinois Nutrient Loss Reduction Strategy

Rural Recommendation 1: Conservation Tillage (No-Till/Strip Till)

Limiting soil disturbance to manage the amount, orientation, and distribution of crop and plant residue on the soil surface year-round is called conservation tillage. This term includes no-till and strip till as well as several other tillage methods.

Implementing conservation tillage serves multiple, beneficial purposes:

- Reduce sheet, rill and wind erosion as well as excessive sediment in surface water
- Reduce tillage induced particulate emissions
- Maintain or increase soil health or organic matter content
- Increase plant available moisture
- Reduce energy use
- Provide food and escape cove for animals

The recommended conservation tillage (≥60% Residue) limits soil disturbance by tilling fields prior to planting and keeping 60% or more of crop and other plant residue on the soil after planting. There are also conservation tillage systems (30-59% Residue) that till fields prior to planting and keep 30-59% of crop and other plant residue on the soil after planting helps to limit soil-disturbing activities. Both of these conservation tillage systems reduce sheet, rill, and wind erosion and excessive sediment in surface waters; reduce tillage-induced particulate emissions (air quality impact); maintain or increase soil health

and organic matter content; increase plant-available moisture; reduce energy use; and provide food and escape cover for wildlife (EPA, "BMP DESCRIPTIONS FOR STEPL AND REGION 5 MODEL").
https://efotg.sc.egov.usda.gov/references/public/IL/IL329FinalMarch2015.pdf

Rural Recommendation 2: Cover Crops

Conservation cover is the practice of establishing and maintaining perennial vegetative cover to protect soil and water resources on land that has been retired from agricultural production. It reduces soil erosion and sedimentation, improves water quality, and creates or enhances wildlife habitat.
Cover Crops are grasses, legumes, and forbs planted for seasonal vegetative cover with the purpose of the following:

- Prevent erosion from wind and water
- Provide ground cover, stabilize soil, and increase biodiversity
- Suppress weeds
- Reduce insect pests and diseases
- Absorb excess fertilizer and reduce nutrient leaching
- Minimize soil compaction
- Enrich soil with organic matter
- Promote nitrogen fixation and reduce energy use

Large quantities of nitrate can be lost from the soil left bare over winter. To combat this problem, cover crops primarily hold the soil and improve soil structure, blanketing entire fields rather than rows. Select species can root deeply and penetrate or prevent compacted layers.
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1046845.pdf

Rural Recommendation 3: Filter Strips

Filter Stirps by definition are strips or areas of vegetation for removing sediment, organic matter, and other pollutants from runoff and wastewater before they reach water bodies or water sources, including wells. Filter stirps are utilized where environmentally sensitive areas need to be protected from sediment, other suspended solids and contaminants in runoff. Filter Strips provide the following:

- Reduced suspended solids and associated contaminants in runoff and excessive sediment in surface waters
- Reduced dissolved contaminant loading in runoff
- Reduced suspended solids and associated contaminants in irrigation tailwater and excessive sediment in surface waters

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1241319.pdf
http://it.tetratech-ffx.com/steplweb/STEPLmain_files/BestManagementPracticesDefinitions.pdf

Rural Recommendation 4: Nutrient Management

Nutrient Management is best defined as managing the amount (rate), source, placement (method of application) and timing of plant nutrients and soil amendments to budget, supply, and conserve nutrients for plant production; to minimize agricultural nonpoint source pollution of surface and groundwater resources; to properly utilize manure or organic byproducts as a plant nutrient source; to protect air quality by reducing odors, nitrogen emissions (ammonia, oxides of nitrogen), and the formation of atmospheric particulates; and/or to maintain or improve the physical, chemical, and biological condition of soil.

In order to achieve success with nutrient management a Nutrient Management Plan for nitrogen, phosphorus and potassium must be created. A plan considers the crop requirements and all potential sources of nutrient including but not limited to commercial fertilizer, animal manure, legume credits and green manure as well as crop rotation.

The following are goals of a Nutrient Management Plan:

- Budget, supply and conserve nutrients
- Minimize nonpoint source pollution of surface and ground water
- Properly utilize manure, municipal and industrial biosolids, and other organic byproducts as plant nutrient sources
- Protect air quality by reducing nitrogen emissions
- Maintain or improve the physical, chemical and biological condition of the soil.

The use of soil sampling, testing and analysis are used to develop a Nutrient Management Plan.

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1192371.pdf
http://it.tetratech-ffx.com/steplweb/STEPLmain_files/BestManagementPracticesDefinitions.pdf

Rural Recommendation 5: Prescribed Grazing
Prescribed grazing is the management of vegetation harvesting through grazing or browsing animals. Any producer that manages grazing animals can implement prescribed grazing. There are a variety of purposes for prescribed grazing:

- Improve or preserve quantity and quality of forage for grazing/browsing animals
- Extend grazing season
- Enhance surface and/or subsurface water quality
- Improve and conserve riparian and watershed function
- Decrease soil erosion and improvement or maintenance of soil condition
- Improve or conserve quantity and quality of food for wildlife

When utilizing prescribed grazing methods, producers should consider the following to ensure water quality:

- Consider soil, water, air, plant and animal resources when deciding on livestock feeding and watering facility location.
- Place supplemental feeds (salt, mineral etc.) away form water shade sources to distribute livestock throughout the pasture and encourage uniform grazing.
- Preserve adequate vegetative cover on environmentally sensitive areas such as wetlands, riparian zones, etc.
- Have a contingency plan in the event of drought, flooding, or unexpected disturbance events.

Strive to create a prescribed grazing plan that:

- Minimizes animal waste input into waterbodies
    - Fencing off the animals from waterbodies
    - Providing alternative watering sources
- Lessens animal effects on streambank stability
    - Fencing off the animals from waterbodies
    - Providing alternative crossings for animals
- Allows for adequate plant density to lessen runoff

- Offers animal access points away from shade

https://efotg.sc.egov.usda.gov/references/public/IL/528il_7-30-2013.pdf
http://it.tetratech-ffx.com/steplweb/STEPLmain_files/BestManagementPracticesDefinitions.pdf

Rural Recommendation 6: Drainage Water Management (End Tile Treatment/Denitrifying Bioreactor)

The process of managing the drainage volume and water table elevation by regulating the flow from surface or subsurface agriculture drainage systems is Drainage Water Management (specifically end tile treatment known as Denitrifying Bioreactor).

The purposes of drainage water management include:
- Decrease the amount of pesticide, nutrient, and pathogen loading into downstream waters
- Enhance plant health and productivity
- Decrease oxidation of organic matter in soils

When implementing drainage water management practices the idea is to raise the water table as uniformly as possible over as much of the crop field as possible. Often times field tiles are utilized to achieve this. Field tile installation is one of the most beneficial capital improvements a landowner can make on their land, field tile removes excess water from the subsurface of the soil. Unfortunately, these field tiles can occasionally serve as conduits and speed up the movement of contaminants to surface water.   Implementation of end of tile treatment such as a denitrifying bioreactor or filter strips (as mentioned previously).

A denitrifying bioreactor; when implemented as end of tile treatment acts as an organic last line of defense against subsurface nitrates and provides the following:

- Improved water quality
- Reduction of nitrate nitrogen content
- Removal of 35-50% of nitrates from water flowing through it

https://www.nrcs.usda.gov/wps/portal/nrcs/il/water/resources/c4b37ee9-dcc5-4e82-a894-5f56ad0655ad/
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1027206.pdf
https://efotg.sc.egov.usda.gov/references/public/IL/IL554_5-31-17.pdf

B. Urban Recommendations
*For any of the following urban recommendations we recognize that some villages/cities may have ordinances referring to height restrictions of vegetation, i.e. taller vegetation is not encouraged or recommended. We do, however, recommend these ordinances be revised to encourage implementation of the recommended BMPs listed below. Per information provided by the Village of Argenta, Ordinance 92.16 restricts vegetation height in the Village of Argenta. We are utilizing their information to show an example of such ordinance.

§ 92.16 HEIGHT.

(A) "It shall be unlawful for anyone to permit any weeds, grass or plants, other than trees, bushes, flowers or other ornamental plants, to grow to a height exceeding ten inches anywhere in the village.

(B) Any plants, weeds or grass exceeding that height are hereby declared to be a nuisance."(2001 Code, § 25-2-2) Penalty, see § 10.99.

Urban Recommendation 1: Native Plantings
Plants native to the region provide benefits to water quality, streambank stabilization, erosion control, animal and insect habitat, and aesthetic appeal. Many native plants have much deeper roots that cultivated or invasive plants. Deep-rooted plants can trap suspended sediment and incorporate excessive nutrients into their biomass as polluted water flows through the vegetation. Deep roots also stabilize water shorelines, decrease erosion, and prevent sediment from entering water bodies. By increasing natural areas planted with natives habitat increases for birds, mammals, butterflies, and amphibians.

- More versatile for Illinois weather conditions - native plants are climate appropriate plants
- Much deeper root systems than typical lawn species thereby offering greater soil stability, higher evapotranspiration, and better infiltration of stormwater
- Attract several wildlife species (including pollinators)
- Less maintenance than large lawn areas - once established, native plants don't require fertilizer, pesticides, herbicides or watering.
- Diversity of species in your landscape reduces susceptibility to disease and pest outbreaks.
- Greater infiltration results in better pollutant filtering and more water replenishing the aquifer.

Urban Recommendation 2: Rain Gardens
A rain garden is a depressed, landscaped garden planted with native plants and is designed to retain and infiltrate stormwater runoff from individual residential sump pumps and roofs. Rain gardens can be installed in almost any unpaved space, are inexpensive, and easy to install. Rain gardens provide the following:

- Reduced runoff volumes and rates
- Recharged groundwater and stream baseflows
- Filtered runoff pollutants
- Increased aesthetic value for properties
- Wildlife habitat

(Lake County Stormwater Management Commission)

Urban Recommendation 3: Pet Waste Management
Pet waste is a major pollutant within the water supply. Proper clean up and disposal of pet waste limits the number of pathogens that can be washed into waterways and inevitably our water supply. Appropriate disposal includes bringing a bag, picking up the waste, and disposing of it in the trash.

Utilizing these recommendations provide the following:

- Less organic debris and bacteria in waterways
- Prevention of serious health concerns to humans or other animals
- Provide areas of taller vegetation/grass for animals to defecate as animals are draw to these areas and the areas are less often mowed

Passing village/city ordinances to regulate proper collection and disposal of pet waste is encouraged as well as pet waste collection bags being provided by municipalities for public use.

With information provided by the Village of Argenta, we have evidence that City Ordinance 90.03 has addressed the animal waste concern and is being used as an example below. Information was unable to be obtained from the other municipalities in Friends Creek Watershed at this time.

§ 90.03 INJURY TO PROPERTY.

(A) Unlawful. It shall be unlawful for any person to permit the dog or cat to go upon any sidewalk, parkway or private lands or premises without the permission of the owner of the premises and break, bruise, tear up, crush or injure any lawn, flower bed, plant, shrub, tree or garden in any manner whatsoever, or to defecate thereon, and the owner thereof shall be liable.

(B) Waste products; accumulations. It shall be unlawful for any person to cause or permit a dog or cat to be on property, public or private, not owned or possessed by that person unless the person has in his or her immediate possession an appropriate device for scooping excrement and an appropriate depository for the transmission of excrement to a receptacle located upon property owned or possessed by that person. This section shall not apply to a person who is visually or physically handicapped.

Urban Recommendation 4: Phosphorus-Free Fertilizer
Phosphorus is a common nutrient in lawn fertilizer; however, it is also one of the most prevelant pollutants in stormwater. High levels of phosphorus result in excess algae growth, which depletes oxygen in water, reduces water quality, and causes fish kills.

As a homeowner, following certain tips help to reduce the amount of phosphorous loading in the watershed from lawns:

- Choose a fertilizer that has ZERO Phosphorus
- Use the minimal amount of fertilizer necessary
- Apply fertilizer only one time per year, preferably in the fall
- Clean up leftover fertilizer from sidewalks and driveways

(Lake County Stormwater Management Commission)

In 2010, Illinois passed a law that prohibits any applicator-for-hire from applying phosphorus-containing fertilizers to a lawn unless a soil test recently indicated a phosphorus (P) deficiency. Homeowners are exempt from this law, but that does not mean that homeowners should not conduct a soil test. Deciphering what one's lawn is deficient in and how much of what nutrient it needs helps to ensure you are fertilizing the lawn with the right nutrient and the right amount. This more conscious effort reduces the amount of excess, unused fertilizer that runoffs in water bodies (University of Illinois Extension).

Most bagged lawn fertilizers contain phosphorus. Plants do need phosphorus for plant growth, but when applied in excess, runoff can occur. Lakes and streams containing high levels of phosphorous often have problems with excessive algae. When buying bagged fertilizer for established lawns, look for a N-P-K ratio with 0 as a value for P (phosphorous).

If a soil test does indicate phosphorous deficiency, commercial applicators may apply phosphorous-containing fertilizer. For more information on phosphorous lawn fertilization Illinois, consult this article by Dr. Bruce Branham: http://web.extension.illinois.edu/ipr/i7514_829.html#107588. In order to comply, one must conduct the required soil test within 36 months of application. The Lawn Care Products Application and Notice Act (commonly referred to as the Lawn Care Act) can be found here: http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1597&ChapterID=36

Urban Recommendation 5: Septic System Maintenance
In order to prevent leakage of pollutants from septic systems, it is important to properly use and maintain septic systems. Proactive approaches to proper septic maintenance is recommended and include:

- Pump or inspect the system at least once every three years
- Divert surface water away from drain field
- Avoid driving or parking on the drain field
- Keep roots away from drain field pipes

(Lake County Stormwater Management Commission)

Urban Recommendation 6: Vegetated Swales
Vegetated swales are shallow channels vegetated with deep rooted plants, which filter out pollutants and slow stormwater. These vegetated swales provide the following:

- Interception of stormwater runoff from impervious areas
- Filtration of pollutants and sediment form stormwater runoff
- Collection of stormwater sediment
- Slowing of stormwater runoff flow

Vegetated swales are well-suited to treat highway or residential road stormwater runoff and are applicable at the end of drains, building and are suitable for instillation adjacent to impervious surfaces such as parking lots and roadways.

(Lake County Stormwater Management Commission)

Streambank Stabilization Recommendation
Streambank Stabilization is the process of stabilizing and protecting natural or constructed channels and banks of lakes, estuaries, and reservoirs.

The intended purposes of streambank stabilization are to:

- Avoid loss of land or damage to land uses
- Maintain stream flow and capacity
- Reduce the offsite or downstream effects of sediment loading from bank erosion
- Enhance wildlife habitat, aesthetics, and recreation

Streambank protection may include:

- Vegetation/riparian
  - Vegetative solutions and planting of riparian areas are a consideration. In order to have sufficient function, it is recommended that vegetated filter strips be placed within 50 feet of streams and ponds. However, a large percentage of the riparian area is already

in woody vegetation with only a few instances of cropland directly bordering the stream channels. Preservation of the woody corridors should be a priority; in the few locations where there is not adequate grass or woody corridors, vegetative riparian area establishment should be a priority.

    - Vegetative solutions for the eroding streambanks are a consideration; however, to establish vegetation on the eroding banks would require shaping the banks to a stable slope and re-vegetating. There are two major issues to consider when contemplating this approach. First, to re-shape the banks would require removal of the existing vegetation, which in large part is well established woody vegetation that cannot be quickly replaced. Second, experience has proven that vegetation alone is usually not enough to stop erosion on the lower portion of eroding streambanks. The frequency and intensity of flow prevents establishment of most vegetation at or below the water surface. This steady flow results in the toe of the bank continuing to erode and then eventually causing the upper bank to fail as it is undercuts.

    - Biodegradable material, such as Coir Rolls and Turf Re-enforcement Mats, are effective at providing bank stabilization, but they have a relatively short life before they are compromised unless a hardened toe using stone or other inert material is included for long term stability. Additionally, experience has also taught that if the lower portion, the toe, of the eroding bank is stabilized with non-erodible material (i.e. stone) the upper bank will stabilize naturally.

- Construction materials
    - Stone Toe Protection (STP): Each eroding bank can be protected with non-erodible materials. Typically, meandering bends like those in the Friends Creek watershed can be stabilized by placing the hard armor only on the toe of the bank. The most common method is to use quarry stone, properly sized to resist movement, and place on the lower one-third of the bank in a windrow fashion. This technique is called Stone Toe Protection (STP) and is widely accepted and successful.

    - Rock Riffle Grade Control (RR): Use of loose rock grade control structures at the "natural" riffle locations in a stream will create or enhance the "riffle-pool" flow sequence found in natural channels. In stable systems this alternating "riffle-pool" sequence dissipates the energy in the stream and allows the streambanks to remain stable with little or no appreciable lateral movement. By installing Rock Riffles in an incised channel, the riffles will raise the water surface elevation resulting in lower effective bank heights, which increases the bank stability by reducing the tractive force on the banks. Research has found that stable streams have a riffle every 5 to 7 bank full widths and that at this natural spacing the stream is still able to transport the sediment generated in the watershed. This is crucial because failure to be able to transport sediment would result in the channel filling with sediment and losing its capacity. Such stable streams therefore have a well-developed floodplain at the one to two-year return interval discharge rate. Thus, the flows larger than this go "out-of-bank" and dissipate excess energy over a wide floodplain, allowing the banks to remain stable and intact.

*Refer to Attachment A for further details about Streambank Stabilization Recommendations.

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1046931.pdf

Figure 2.4 Load Reduction Estimates for Watershed Wide Project/Practice Recommendations

	Reduction Estimates			
BMP Name	Sediment (tons/year)		Phosphorous (lbs/year)	Nitrogen (lbs/year)
4 Agricultural Practices: Conservation Tillage (44,760 acres) Cover Crops (29,850 acres) Filter Strips (345 acres) Nutrient Management (29,850 acres)	389		956	7,085
Urban Practices: Vegetated Filter Strips (258 acres)	227		321	2,092
Urban Practices: Vegetated Swales (6.42 acres)	202		177	523
Urban Practices: Rain Gardens (6.42 acres)	33		79	695
Stream Practices: Stabilize Severely Eroded Streambanks (12,660 feet)	1,277		1,277	2,554
TOTAL	**2,128**		**2,810**	**12,949**

In order to estimate the efficacy of implementing the recommended BMPs, project planners determined from a stakeholder survey that 60% of agricultural producers were interested in practicing conservation tillage (leaving at least 60% crop residue) and installing filter strips, and 40% of producers would like to practice nutrient management and install cover crops. We used the STEPL BMP Calculator to calculate an overall cropland BMP efficiency. Implementing these practices would decrease sediment loading into the streams by 389 tons/yr, phosphorous by 956 pounds/yr, and nitrogen by 7,085 pounds/yr. The BMP Calculator did not estimate pathogen reduction.

Project planners did not receive responses from key stakeholders from the towns and villages; therefore, we decided to assess urban and stream BMP efficiencies by implementing each BMP on 40% of the developed area in order to be comparable to the agricultural practices. We used STEPL Region 5 Worksheets to estimate pollution load reductions for vegetated strips and swales implemented on 40% of residential areas and roads and added rain gardens to treat 40% of the residential area. The worksheets estimated these three BMPs to result in a total reduction of 1,157 tons of sediment, 1,442 pounds of phosphorous, and 8,274 pounds of nitrogen.

Streambank erosion causes pollutant loading in addition to land uses surrounding them. Implementing site specific and watershed wide recommended projects would significantly reduce pollutant loading into Friends Creek and its tributaries. Site specific recommendations address 21,753 feet of severely eroding streambank and would reduce sediment by 766 tons/yr, phosphorous by 766 pounds/yr, and nitrogen by 1,533 pounds/yr. Watershed wide recommendations on an estimated 12,650 feet, or 40% of the remaining severely eroded streambank in the remainder of the watershed (see Section 1), additional pollution reduction would be achieved in the amounts of 1,277 tons of sediment, 1,277 pounds of phosphorous, and 2,554 pounds of nitrogen.

Altogether, the site specific and watershed wide recommended BMPs would reduce 66% of the estimated sediment loading from the watershed along with 35% of the phosphorous and 13% of the nitrogen (see Figures 2.5 and 2.6).

Figure 2.5 Total Pollutant Load Reduction Estimates for the Watershed by Recommended BMPs

	Reduction Estimates			
BMP Name	Sediment (tons/year)		Phosphorous (lbs/year)	Nitrogen (lbs/year)
Site Specific Recommended Projects and Practices	766		766	1,533
Watershed Wide Recommended Projects and Practices	2,128		2,810	12,949
TOTAL	**2,894**		**3,576**	**14,482**

Objectives from the previous chapter would be accomplished for sediment reduction within the six years of this plan if our goals each year are met.

Figure 2.6 Percentage of Pollutant Load Reduction in the Watershed by Recommended BMPs

	Reduction Estimates			
BMP Name	Sediment (tons/year)		Phosphorous (lbs/year)	Nitrogen (lbs/year)
Current pollutant loading	4,384		10,177	107,856
Recommended BMPs (Watershed Wide and Site Specific)	2,894		3,576	14,482
Remaining pollutant loading	**1,490**		**6,602**	**93,374**
% REDUCTION	**66%**		**35%**	**13%**

Selected BMPs that Contribute to the Nutrient Loss Reduction Strategy (NLRS)
Nitrogen and phosphorous naturally occur as nutrients in aquatic systems; however, activities both rural and agricultural, have greatly increased the amounts that occur. Too much of these nutrients causes significant jumps in algae growth, which negatively impacts water quality, reduces or eliminates oxygen within the water, harms food resources, degrades aquatic habitats, and can eventually cause algal blooms. Some algal blooms produce toxins and promote bacteria growth, which can harm humans who come in contact with the water (EPA, "Nutrient Pollution: The Problem"). US EPA's Gulf Hypoxia Action Plan addresses the concerns associated with algal blooms and other negative water quality issues resulting from excess nutrients. Illinois' response to this call to action is the Nutrient Loss Reduction Strategy (NLRS), which is detailed in Chapter 1. The overall goal of this Strategy is to reduce the amount of nitrogen and phosphorous in waterways by 45% while also considering current land uses and cost-efficiency. The NLRS acknowledges that Illinois is a large contributor to this problem; therefore, NLRS call on Illinois residents and producers to demonstrate voluntary conservation. If Friends Creek stakeholders choose to implement the recommended BMPs that also correlate with the goals of the NLRS, then they will help reduce the amount of nutrients that Illinois contributes to waterways. Moreover, combing

multiple conservation practices together allows for additional compounding benefits. To achieve the NLRS goals, action will need to take place on every acre.

Most of the BMPs selected in this plan for implementation also contribute to the goals of the NLRS:

- Conservation Tillage: According to the NLRS Science Assessment, when 1.8 million acres of conventional tilled land eroding at greater than the soil T value is converted to conservation tillage or no-till, phosphorous is reduced by 50%. This massive phosphorous reduction also results in savings of $17 per acre.
- Cover Crops: The NLRS Science Assessment also found that utilizing cover crops on corn and soybean fields results in a 20.5% nitrogen loss reduction on tiled-drained acres and a 7.9% nitrogen loss reduction on non-tiled acres.
- Filter Strips: Filter strips may provide some reduction in stormwater runoff volume, but their primary function is to filter out contaminants in stormwater runoff. The EPA'S Region 5 STEPL Model estimated load reductions of 40% in nitrogen (N), 45% in phosphorous (P), 51% in biochemical oxygen demand (BOD), and 73% sediment in water sources when vegetated filter strips are in use.
- Nutrient Management: There are different ways to budget and conserve nutrients application that allow for reduction in the loss of nitrogen and phosphorous to runoff. For example, splitting nitrogen application to 40% in the fall, 10% pre-plant, and 50% as side dress results in a 15-20% reduction in nitrogen loss. Alternatively, nitrogen application only in the spring reduces nitrogen loss by 15-20% on tile-drained corn acres.
- Drainage Water Management: The NLRS Assessment found that the installation of bioreactors on 50% of tile-drained acres results in a nitrogen loss reduction of 25% (NLRS Science Assessment, 2016).
- Native Plantings, Rain Garden, and Vegetated Swales: Native plants, rain gardens, and vegetated swales can all aid in filtering excess nutrients out of runoff.
- Pet Waste Management and Septic System Maintenance: When pet owners properly pick up and dispose of their pet's waste and when homeowners maintain their septic systems properly, it ensures that less pathogens and organic waste loads into the watershed.
- Phosphorous-Free Fertilizer: Utilizing Phosphorous-free fertilizers or only applying the amount of phosphorus that the lawns needs reduces excess phosphorous run-off into the watershed.

SECTION 2, CHAPTER 3
Education and Outreach

Written by Angela Daily & Alyssa Robinson

Introduction

Various groups have already initiated education and outreach efforts to encourage local participation. Since the recommended projects and conservation practices within this plan are solely up to the stakeholders to implement, it is important to prioritize education and local engagement. The goal here is to educate local stakeholders of the value of addressing water quality concerns and empower them to implement and maintain the recommended conservation practices.

Education and outreach efforts focus on engaging landowners, producers, and the supporting community. Topics of education are the creation of this watershed plan and what it entails, existing concerns throughout the watershed, and the potential improvement that recommended projects could have if implemented on stakeholder property. Education and outreach efforts will continue throughout the duration of the plan. This plan requires education, outreach, planning, monitoring, meetings, investigations, and follow-up. The purpose of the plan is to address and improve water impairments, but more importantly the education, active participation, follow-through, and maintenance of these projects is vital to long-term success. The expected outcome and behavior change of this education and outreach strategy is a group of stakeholders who understand the value of this plan, take ownership of it and work to implement it.

Local Engagement and Involvement

Throughout the IEPA Section 319 grant period, Macon County SWCD sent out over 10,000 newsletters to Macon County landowners, (more specifically, landowners residing within the Friends Creek Watershed) operators, government officials/employees, farm managers, and so on. These newsletters promote the Friends Creek Watershed 319 Grant and all stakeholder meetings. In addition, the newsletters discuss an array of conservation-oriented topics and BMPs as well as technical and financial assistance information.

Detailed below are some of the conservation education and outreach events, groups, and programs that work to raise awareness of water quality concerns and increase local involvement in conservation efforts:

- Lady Landowners of Macon County is a group of women residing in Macon County that are interested in agriculture and conservation. The group meets every other month and hosts a variety of agriculture or conservation related speakers. The group reaches about 150 lady landowners each year.

- Macon County SWCD hosts a Strip Till field day every other year for interested participants from all over the United States. The field day covers conservation practices, particularly strip till and cover crops. The event also features demonstrations, lunch, and several keynote speakers. Over 100 people.

- In conjunction with their elections, the Macon County SWCD hosts an Annual Meeting featuring a keynote speaker. The event is open to everyone in Macon County. Friends Creek Watershed display was available and presented to everyone at the meeting.

- Macon County Farm Bureau sponsors Agucation, an agricultural education event at Richland Community College. Over the course of 3 days, the event reaches 600+ students from all areas of Macon County. Aspects of conservation from water quality to wildlife are considered.

- Habitat Conservation Connection makes connections between wildlife habitat and in field agriculture conservation. In 2018, thirty-two people participated.

- In 2018 and 2019, Macon County SWCD presented at Festival of Spring by utilizing the Enviroscape watershed demonstration as well as presenting rain garden information and backyard composting to over 600 attendees. The Sangamon Watershed Celebration was also attended and the Enviroscape watershed demonstration was presented to over 100 attendees.

Macon County NRCS, Dewitt County NRCS, and Piatt County NRCS are a grouping of NRCS Field Offices located in Central Illinois. The three offices work as a group to provide financial and technical assistance to producers within the three counties. The NRCS field offices offer Conservation Technical Assistance (CTA) in their jurisdiction. *Figure 3.1* below exhibits records of these NRCS projects according to the NRCS Performance Results System (PRS) report. The total acreage of CTA is general assistance they provide but may or may not lead to contracts. If CTA did lead to contracts, then they are included in the active/completed NRCS contracts column.

Figure 3.1 Natural Resources Conservation Service Involvement

	Active/Completed NRCS Contracts from 2017-2019	Total Acreage of Conservation Technical Assistance	Number of Projects/Practices Implemented
Macon County NRCS	15,492	16,491	220
Dewitt County NRCS	1,682	2,840	16
Piatt County NRCS	3,138	1,726	21
Total	**20,312**	**21,057**	**257**

- Precision Conservation Management (PCM) is a farmer-led effort developed to address natural resource concerns on a field-by-field basis with a primary focus on water quality. PCM identifies conservation practices that effectively address environmental concerns in a financially viable way. PCM specialists work with producers to identify conservation needs and use data from agronomic management practices, economic models, and sustainability metrics to develop customized solutions. PCM analyzes information provided by the producer and assesses BMP performance on crop productivity, soil health, and farm profitability. PCM also assists producers with enrollment into conservation programs such as those offered by NRCS and FSA as well as local SWCD offices. *Figure 3.2* reflects information provided by PCM Pivot Region Conservation Specialist, David Fulton.

Figure 3.2 Pivot Region* PCM Results for 2018 Enrollment Year

County	# of Producers Enrolled	# of Acres Enrolled	BMPs Being Utilized
Macon	6	2,964	Reduced Fertilizer amount, cover crops, and reduced tillage
Dewitt	6	1,423	Reduced Fertilizer amount, cover crops, and reduced tillage
Piatt	15	5,286	Reduced Fertilizer amount, cover crops, and reduced tillage
Total	**27**	**9,673**	

*Pivot Region includes Macon, DeWitt, and Piatt Counties and is the named assigned to the grouping by PCM

https://www.precisionconservation.org/

- Saving Tomorrow's Agriculture Resources (STAR) offers farm operators and landowners a simple, free, and confidential tool to evaluate their conservation land management practices. The goal of STAR is to encourage the continued adoption of conservation practices and recognize producers for their commitment to sustainability. Education efforts in the form of workshops and conservation days are underway to teach conservation land management practices recommended by STAR results for producers in the program. Currently in the State of Illinois 111 participants, 373 fields, and 23,267 acres are enrolled in the STAR program. (Bruce Henrickson, Champaign County SWCD)

  http://www.ccswcd.com/S.T.A.R./

The next Chapter will provide targets and measurable milestones being used to implement the recommended projects and practices, education and outreach and planning for the six-year period of the plan. The planning elements found in the next chapter portray schedules, budgets, and assistance available for the Friends Creek Watershed Alliance to utilize and we understand they may need to be adjusted.

SECTION 2, CHAPTER 4
Implementation

Written by Angela Daily & Rebecca Olson

Introduction

Section 2 Chapter 2 presents recommendations for implementation of projects and practices addressing rural, urban, and streambank concerns presented by stakeholders in the Friends Creek Watershed. This chapter utilizes information learned in previous chapters to provide targets and measurable milestones when implementing the recommended projects, practices, education and outreach, and planning.

Schedule for Implementation

It is intended for stakeholders within the Friends Creek Watershed to utilize this chapter as a working document in order to track progression of the plan.

These planning elements are summarized in a six-year implementation plan to the extent possible at the time this plan was written. Target reductions of 500 tons of sediment per year was the driving factor in selecting a six-year time frame. Using the total estimated pollutant loads from all site specific and watershed wide recommended projects and practices in Chapter 2, we determined that to reduce a total of 2,894 tons of sediment at 500 tons per year, the target would be reached in six years.

Changes to the milestones, schedules and budgets, as well as funding and technical assistance are likely and should be reviewed annually by the Friends Creek Watershed Alliance. Activities assumed to extend beyond six years were not addressed at this time. We recommend that this plan be updated in the fifth year to adjust for changes and project out for another five or six years.

In order to complete the recommended milestones within the six-year period, implementation will cost about $12.5 million which will be supported by planning and education in the amount of $2.2 million including start-up costs for the first year and other costs throughout the six years. *Figure 4.1* summarizes the cost for planning, implementing watershed-wide projects, implementing site-specific projects, and educating the stakeholders and public.

Figure 4.1 Cost Summary for Planning, Implementation, and Education & Outreach

Activity	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Total**
Planning	$ 85,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 285,000
Watershed-Wide Project Implementation	$1,875,000	$1,875,000	$1,875,000	$1,875,000	$1,875,000	$1,875,000	$11,250,000
Site-Specific Project Implementation	$ -	$ 64,000	$ 410,000	$ -	$ 362,000	$472,000	$ 1,308,000
Education	$ 320,000	$ 312,000	$ 312,000	$ 312,000	$ 312,000	$312,000	$ 1,880,000
Total	$2,280,000	$2,291,000	$2,637,000	$2,227,000	$2,589,000	$2,699,000	**$ 14,723,000**

To implement this plan, landowners would need to complete all the projects and practices recommended in Chapter 2 within a six-year time frame.

During the first year, landowners with site-specific projects will be contacted and recommendations will be presented. Funding and technical resources will be presented to the landowners and applications for funding will possibly be submitted (based on landowner interest). If applications for funding support are submitted and approved for projects and practices within Friends Creek Watershed, cost estimates will be assigned to each and a set of design plans will be provided for the project or practice. We recognize that some projects and practices recommended and initiated by this plan will need to be continued long term and that there may be opportunities for landowners to exceed goals set within this plan.

Figure 4.2 explains planning milestones and potential funding and/or technical support for said milestone. Some of the planning milestones are only for year 1, while others should be repeated annually.

Figure 4.2 Schedule for Planning

Year(s)	**Interim Benchmarks, Measurable Milestone**	**Potential Funding/ Tech. Support**	**Leading Organization**	**Value of Volunteer/Staff time**	
				Estimate ($)	**Actual ($)**
1	Set up Friends Creek Watershed Alliance.	IDNR, EPA, Farm Bureau, SWCD/NRCS, Friends Creek Township	Macon County SWCD	$1,750	
1	Designate a watershed coordinator to increase the implementation of the education and outreach program and ensure continuation and action by the alliance.	Macon County SWCD	Macon County SWCD	$33,600	
1	Submit a grant application for implementation projects.	Macon County SWCD, EPA	Individual Landowners	$10,000	
1-6	Work with a designated watershed coordinator to increase the implementation of the education and outreach program and ensure continuation and action by the alliance.	Macon County SWCD	Friends Creek Watershed Alliance	$204,000	
1-6	Conduct regular meetings of the alliance Revise this plan as needed.	Macon County SWCD	Friends Creek Watershed Alliance Macon County SWCD	$34,000	
1-6	Meet annually (at least) with the Friends Creek Watershed Alliance to collaborate efforts and financial and technical assistance.	Macon County SWCD	Friends Creek Watershed Alliance Macon County SWCD	$2,000	
Total Costs for Planning (for 6 Years)				**$ 285,000**	
Costs for Initiating Planning During First Year (for Year 1 Start-Up Costs)				**$ 45,000**	
Average Costs for Planning per Year (for Years 1-6)				**$ 40,000**	

Figure 4.3 details start-up education and outreach efforts for the first year only. These actions will help jump-start the plan and aid in raising awareness about the plan, BMP implementation, and funding. The estimated cost of the milestones considers the value of volunteer or staff time.

Figure 4.3 Schedule for Education and Outreach: Start-Up for Year 1

Year(s)	**Interim Benchmarks, Measurable Milestone**	**Potential Funding/Tech. Support**	**Leading Organization**	**Value of Volunteer or Staff Time***	
				Estimate ($)	**Actual ($)**
1	Distribute an executive summary and link to this plan via Conservation Connection newsletter.	Macon County SWCD	Macon County SWCD	$1,050	
1	Hold a public meeting to present the final plan.	Macon County SWCD	Macon County SWCD		
1	Create a page link on the maconcountyswcd.net website including the executive summary and link to this plan.	Macon County SWCD	Macon County SWCD	$175	
1	Provide educational materials to watershed landowners and farm managers regarding the Illinois Nutrient Loss Reduction Strategy.	Macon County SWCD, Dewitt County SWCD, Piatt County SWCD	Macon County SWCD, Dewitt County SWCD, Piatt County SWCD	$275	
1	Provide educational materials to watershed landowners and farm managers regarding opportunities for BMP implementation and funding.	Macon County SWCD, Dewitt County SWCD, Piatt County SWCD, NRCS, FSA, PCM, STAR	Macon County SWCD, Dewitt County SWCD, Piatt County SWCD, NRCS, FSA, PCM, STAR	$4,000	
Total Value for Education and Outreach Start-Up for Year 1				**$7,600**	

*Match reported for education costs represents the value of volunteer time, as no cash input is required. Value of volunteer time is based on $25.43 per hour as reported by the Independent Sector and includes everyone involved (hosts and audiences).

Figure 4.4 details a schedule of education and outreach milestones concerning the overall Friends Creek Watershed Plan. This schedule is for years 1-6 and each milestone should be completed annually. The estimated cost of the milestones considers the value of volunteer or staff time.

Figure 4.4 Schedule for Education and Outreach: Friends Creek Watershed Plan, Years 1-6

Year(s)	**Interim Benchmarks, Measurable Milestone**	**Potential Funding/Tech. Support**	**Leading Organization**	**Value of Volunteer or staff Time***	
				Estimate ($)	**Actual ($)**
1-6	Have a representative of the alliance individually contact the Macon, Piatt, & Dewitt County SWCD/NRCS to discuss the watershed plan.	SWCD/NRCS	Friends Creek Watershed Alliance	$510	
1-6	Have a representative of the alliance individually contact the Farm Bureau to discuss the watershed plan.	Farm Bureau	Friends Creek Watershed Alliance	$510	
1-6	Have a representative of the alliance individually contact Friends Township to discuss the watershed plan.	Friends Township	Friends Creek Watershed Alliance	$510	
1-6	Have a representative of the alliance individually contact Macon, Dewitt, & Piatt County Boards to discuss the watershed plan.	Macon, Dewitt, & Piatt County	Friends Creek Watershed Alliance	$510	
1-6	Have a representative of the alliance individually contact the Heart of the Sangamon River Ecosystem Alliance to discuss the watershed plan.	Heart of the Sangamon River Ecosystem Alliance	Friends Creek Watershed Alliance	$510	
1-6	SWCD offer a public event to demonstrate conservation practices every other year.	SWCD/NRCS	Macon County SWCD	$3,000	
Total Value for Education and Outreach (for 6 Years)				**$33,300**	
Average Value for Education and Outreach per Year (for Years 1-6)				**$5,550**	

*Match reported for education costs represents the value of volunteer time, as no cash input is required. Value of volunteer time is based on $25.43 per hour as reported by the Independent Sector and includes everyone involved (hosts and audiences).

Figure 4.5 details a schedule of education and outreach milestones regarding the recommended projects and practices given in Chapter 2. This schedule is for years 1-6 and each milestone should be completed annually or biannually. The estimated cost of the milestones considers the value of volunteer or staff time.

Figure 4.5 Schedule for Education and Outreach: Recommended Projects and Practices, Years 1-6

Year(s)	**Interim Benchmarks, Measurable Milestone**	**Potential Funding/Tech. Support**	**Lead Organization(s)**	**Value of Volunteer or Staff Time***	
				Estimate ($/year)	**Actual ($)**
1-6 (Annually)	Education for private landowners to install BMPs.	Macon County SWCD/NRCS	Macon County SWCD/NRCS	$102,970	
1-6 (Annually)	Engage the community in education events throughout the year that pertain to conservation (this should include at least one school).	Macon County SWCD	Macon County SWCD/NRCS	$12,040	
1-6 (Annually)	Provide technical assistance and training sessions for landowners with installed BMPs.	Macon County SWCD/NRCS	Macon County SWCD/NRCS	$178,970	
1-6 (Biannually)	Create displays (static or live) that can be set up at events and make appearances at events each year.	Macon County SWCD	Macon County SWCD Friends Creek Watershed Alliance	$2,100	
1-6 (Biannually)	Prepare and distribute newsletters to landowners twice a year with articles featuring BMPs, conservation, programs available etc.	Macon County SWCD	Macon County SWCD	$1,350	
1-6 (Annually)	Provide public educational workshops regarding land disturbance and urban stormwater current issues/ regulation and pipeline safety. Workshops target specific needs of contractors, engineers, and city officials.	Macon County SWCD	Macon County SWCD/NRCS	$7,000	
1-6 (Annually)	Provide technical assistance to urban contractors/municipalities/public for urban stormwater and land disturbance issues and questions.	Macon County SWCD	Macon County SWCD/NRCS	$3,000	
Total Value for Education and Outreach (for 6 years)				**$ 1,844,580**	
Average Value for Education and Outreach per Year (for Years 1-6)				**$ 307,430**	

*Match reported for education costs represents the value of volunteer time, as no cash input is required. Value of volunteer time is based on $25.43 per hour as reported by the Independent Sector and includes everyone involved (hosts and audiences).

Figure 4.6 displays a schedule of costs for implementing watershed wide project milestones retrieved from the recommended projects and practices in Chapter 2. * Interim, measurable benchmarks are used to meet water quality goals and load reduction targets.

Year(s)	Interim Benchmarks, Measurable Milestone	Potential Funding/Tech. Support	Lead Organization(s)	Value of Project or Practice*	Completion		
				Estimate ($/year)	Units	%	100% Complete (✓)
1-6	Implement conservation tillage on 7,460 ac/yr	Macon Co. SWCD/NRCS	Macon Co. SWCD/NRCS	$185,000			
1-6	Put into use cover crops on 4,975 ac/yr	Macon Co. SWCD/NRCS	Macon Co. SWCD/NRCS	$285,000			
1-6	Plant agricultural filter strips on 57.5 ac/yr	Macon Co. SWCD/NRCS	Macon Co. SWCD/NRCS	$12,500			
1-6	Practice nutrient management on 4,975 ac/yr	Macon Co. SWCD/NRCS	Macon Co. SWCD/NRCS	$95,000			
1-6	Practice prescribed grazing on 85 ac/yr	Macon Co. SWCD/NRCS	Macon Co. SWCD/NRCS	$30,000			
1-6	Install drainage water management on 57.5 ac/yr*	Macon Co. SWCD/NRCS	Macon Co. SWCD/NRCS	$12,500			
1-6	Install rain gardens on 1.07 ac/yr (1% of drainage area)	Macon Co. SWCD	Village	$550,000			
1-6	Instill pet waste management practices within 1 populated area/yr	Macon Co. SWCD	Village	$4,000			
1-6	Install vegetated swales along roadsides on 43 ac/yr	Macon Co. SWCD	Macon County SWCD	$25,000			
1-6	Install vegetated swales within residential areas on 1.07 ac/yr (1% of drainage area)	Macon Co. SWCD	Village	$550,000			
1-6	Stabilize streambank on 2,110 ft/yr	Macon Co. SWCD	Macon Co. SWCD	$126,000			
Total Value for Project and Practice Implementation (for 6 years)				**$ 11,250,000**			
Average Value for Project and Practice Implementation per Year (for Years 1-6)				**$ 1,875,000**			

Figure 4.7 portrays a schedule of costs for implementing site-specific project milestones retrieved from the recommended projects and practices in Chapter 2.

Year(s)	Interim Benchmarks, Measurable Milestone	Potential Funding/Tech. Support	Leading Organization(s)	Value of Project or Practice*		Completion		
				Estimate ($/year)	Actual ($)	Units	%	100% Complete (✓)
2	Friends Creek Reach 003 Stabilize 1,056 feet of severely eroded streambank	Macon Co SWCD/NRCS	Macon Co SWCD	$ 64,000				
3	Friends Creek Ditch Reach 001 Stabilize 6,811 feet of severely eroded streambank	Macon Co SWCD/NRCS	Macon Co SWCD	$ 410,000				
5	Tributary 2 Reach 001 Stabilize 6,019 feet of severely eroded streambank	Macon Co SWCD/NRCS	Macon Co SWCD	$ 362,000				
6	Tributary 3 Reach 001 Stabilize 7,867 feet of severely eroded streambank	Macon Co SWCD/NRCS	Macon Co SWCD	$ 472,000				
Total Value for Project and Practice Implementation (for 6 years)				**$ 1,308,000**				
Average Value for Project and Practice Implementation per Year (for Years 1-6)				**$ 218,000**				

From the education and outreach efforts of this plan, we expect stakeholders to exhibit greater awareness of watershed concerns and solutions and implement more best management practices on private and public lands for which they have decision making abilities. Indicators of success will include not only more best management practices implemented but also the number of participants and attendees at demonstration days, presentations, festivals and other events as well as the number of people enrolled in programs such as PCM and STAR.

As the recommended projects and practices are being implemented and education and outreach is happening, it will be important to monitor progress toward the goals and objectives stated in Chapter 1 and alter this plan accordingly. A monitoring and evaluation plan appear in the next chapters.

SECTION 2, CHAPTER 5
FINANCIAL AND TECHNICAL RESOURCES

Written by Alyssa Robinson, Angela Daily, Rebecca Olson, & Taylor McClerin

Introduction

Potential funding and technical assistance are available through various grant agencies and local environmental organizations suggested in this chapter. Costs can be deferred by organizing volunteer efforts, as grant agencies recognize the value of volunteer time and allow that value to provide matching funds for their grant dollars. For example, if a grant is secured to support 60% of the cost of implementing a $100,000 project, then the financial assistance could be up to $60,000 from the grant agency, the recipient would be responsible for budgeting $40,000 in cash or value of volunteer time to match the other 40%.

Local sources of matching funds are recommended and usually required to qualify for grant funding. Local match can come from several sources, including local environmental organizations, associations, businesses, developers, municipalities, and private citizens.

Funding and Technical Assistance Resources

The Macon County Soil and Water Conservation District is just one of many resources for financial and technical support. There are several cost incentive programs for residents of Macon County. Visit the Macon County SWCD Office at 3342 North President Howard Brown Blvd., Decatur IL 62521 or call 217-877-5670 x 3 for more information on programs available.

Figure 5.1 lists potential agencies that provide funding and/or technical support for implementing these types of conservation projects and practices. The pages that follow provide more detail into each organization.

Figure 5.1 Funding and technical support agencies

Abbr.	**Agency**	**Funding/ Technical Support**	**Mission or Program Goal**	**Website**
SWCD	Macon County Soil and Water Conservation District	Technical, Funding	Provides conservation technical assistance, funding, and education to address Macon County agricultural and natural resource issues.	http://www.maconcountyswcd.net/contact.html
NRCS	Macon County Natural Resources Conservation District	Technical, Funding	Reducing runoff of pollution from agricultural areas into streams and lakes.	No direct website. Go to: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/
USDA FSA	U.S. Department of Agriculture, Farm Service Agency	Funding	Provides yearly rental payment to farmers who convert environmentally sensitive land from agricultural production to native plantings.	https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/crp-continuous-enrollment/index

IDOA	Illinois Department of Agriculture, Partners for Conservation	Funding	Provides funding, cost-share assistance and technical assistance for natural resource management projects	https://www2.illinois.gov/sites/agr/Resources/Conservation/Pages/default.aspx http://www.iira.org/rdrg/partners-for-conservation-streambank-stabilization-and-restoration-program-ssrp/
McKnight	McKnight Foundation	Funding	"We use our resources to restore the water quality and resilience of the Mississippi River."	http://www.mcknight.org/
IDNR	Illinois Department of Natural Resources	Funding	Recreation facilities and trails, wildlife habitat, water quality, open space protection, etc.	http://www.dnr.illinois.gov/Pages/default.aspx
IEPA	Illinois Environmental Protection Agency, Bureau of Water	Funding	"Ensure that Illinois' rivers, streams, and lakes will support all uses for which they are designated including protection of aquatic life, recreation, and drinking water supplies."	https://www2.illinois.gov/epa/topics/water-quality/Pages/default.aspx
Sangamon	Sangamon River Alliance	Technical	promote watershed conservation, education, and recreation in the Sangamon River watershed	http://sangamonriveralliance.org/
Patagonia	Patagonia Corporate Grants Program	Funding	Donates funds to non-profit, community-based groups working towards a positive change for the planet.	https://www.patagonia.com/grant-guidelines.html
Grand Victoria	Grand Victoria Foundation, Vital Funds	Funding	Provides land acquisition funds to assist projects that pursue permanent protection and long-term stewardship of Illinois' vital lands.	https://grandvictoriafdn.org/what-we-fund/environment/
Wyss	The Wyss Foundation	Funding, invitation only	Supports long-term, creative solutions that foster livelihood, enhance communities, and encourage connections to the land.	https://www.wyssfoundation.org/
Trees Forever	Trees Forever: Illinois Buffer Partnership	Funding	Funds voluntary efforts of farmers and rural landowners in planting, maintaining, and enhancing conservation practices and buffers.	http://www.treesforever.org/Illinois_Buffer_Partnership
Illinois Clean Energy	Illinois Clean Energy Community Foundation, Natural Areas Program	Funding	Offers funding for conservation group organization capacity, community stewardship engagement, land acquisition, and planning for land acquisition	https://www.illinoiscleanenergy.org/natural-areas-program
USFWS	U.S. Fish and Wildlife Service	Funding	Protect waterfowl and migratory birds and their habitat.	http://www.fws.gov/grants/

Macon County Soil and Water Conservation District

Macon County Soil and Water Conservation District (MCSWCD) works with private landowners and other organizations to help prevent and control soil erosion, improve the water quality of local rivers, lakes and streams and to restore and enhance native wildlife habitat. They do so by offering FREE technical assistance to landowners. Macon County SWCD offer several cost share programs for landowners interested in implementing BMPs. Macon County SWCD also is a member of the MS4 group in Macon County and provides technical and professional assistance for stormwater management as well as educational events for the public on urban stormwater.

http://www.maconcountyswcd.net/
http://www.maconcleanwater.com/

United States Department of Agriculture Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) provides financial and technical assistance to assist agricultural producers and landowners who implement and maintain conservations practices that help protect agricultural land and natural resources. Applying for grant funding, organizing and planning for the workload, and implementing the specific conservation practices is completely left to the willingness of the producer.

https://www.usda.gov/sites/default/files/documents/2018-farm-bill-and-legislative-principles.pdf

NRCS provides financial assistance for these types of watershed projects and practices though two programs:

- *Environmental Quality Incentives Program (EQIP)*
- *Conservation Stewardship Program (CSP)*

Environmental Quality Incentives Program (EQIP)

Through EQIP, NRCS and grant recipients finance solutions that conserve natural resources while also improving agricultural operation. NRCS assists agricultural producers with financial resources, the development of a unique conservation plan, and implementation of conservation practices. With NRCS acting as a co-funder for conservation practice implementation, the participating agricultural producer voluntarily implements these practices. The best way to learn if EQIP is a good fit for you is by contacting your local NRCS office.

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/?cid=nrcseprd1328426

Conservation Stewardship Program (CSP)

The Conservation Stewardship Program partners qualifying farmers with NRCS to maintain and improve existing conservation plans and fund conservation practices, including brush management, residue and till management, conservation cover, cover crop, critical area planting, filter strip, grade stabilization structures, grassed waterways, streambank and shoreline protection, and more. This program helps to build on your existing conservation efforts while strengthening your operation. Funding is based off the conservation performance, i.e. the higher the conservation performance results in increased funding. Applications are accepted throughout the year. CSP contracts last 5 years, with the option to renew if participant has reached contract goals and agrees to implement additional conservation objectives. CSP contracts have a $1500 minimum annual payment. To be eligible, one must have current farm records with USDA Farm Service Agency and must be in compliance with highly erodible land and wetland conservation requirements.

https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/

Illinois Environmental Protection Agency (IEPA)

- *Section 319*
- *State Revolving Fund (SRF): Water Pollution Control Loan Program (WPCLP)*

Section 319 Program

The Clean Water Act requires EPA to give Section 319 grants to state nonpoint source agency in order to attain and preserve beneficial use of water. Section 319 provides watershed project funding for planning grants and implementation grants. States are required to use at least 50% of the annual appropriation of Section 319 funds to implement watershed projects that focus on restoring impaired waters and are guided by watershed-based plans. The federal contribution may not exceed 60% of the entire implementation cost. Administrative costs may not exceed 10% of the funding. Cost-sharing is available, but only for costs related to implementing demonstration projects. Demonstration projects are used to show the effectiveness of an approach as it applies to solving a water-quality issue in a specific area nd its unique hydrogeological and sociological features. States can make these granted funds available via subgrants to both public and private entities. Subgrants to individuals are limited to demonstration projects.

https://www.epa.gov/nps/319-grant-current-guidance
https://www.epa.gov/nps/funding-resources-watershed-protection-and-restoration

State Revolving Fund (SRF) Loan Programs: Water Pollution Control Loan Programs

Through the State Revolving Fund, a combination of federal and state funds provide loans to eligible recipients for wastewater, stormwater, and drinking water projects, including controlling nonpoint sources of pollution; implementing green infrastructure projects; developing and implementing watershed projects that are within the CWA section 122 criteria; and managing, treating, and recapturing stormwater or subsurface drainage water. In order to be considered for annual funding, applicants must submit a funding nomination form (FNF) on or before January 31st preceding the fiscal year in which the funding is requested and receive approval by January 31st. Once the FNF is in and the project is reviewed and qualifies, then projects with approved planning will be ranked and considered for placement on the Intended Funding List (IFL). This is a low interest loan program, not a grant funding program. To view some of the PDF links on the EPA website, it is recommended to use Internet Explorer as your browser. For Wastewater/Stormwater Loan Program Forms, please visit:

https://www2.illinois.gov/epa/topics/grants-loans/state-revolving-fund/Pages/state-revolving-fund-forms.aspx

Other useful EPA resources include:
https://www.epa.gov/cwsrf/learn-about-clean-water-state-revolving-fund-cwsrf
https://www2.illinois.gov/epa/topics/grants-loans/state-revolving-fund/Pages/default.aspx

United States Department of Agriculture (USDA) Farm Service Agency
Conservation Reserve Program (CRP)

USDA Farm Service Agency's (FSA) Conservation Reserve Program (CRP) is a voluntary program that helps agricultural producers use environmentally sensitive land for conservation benefits. CRP participants plant long-term, resource-conserving covers to improve the quality of water and air, control soil erosion and enhance wildlife habitat. In return, FSA provides participants with rental payments and cost-share assistance.

https://inside.fsa.usda.gov/Assets/USDA-FSA-Intranet/intranetfiles/state-offices/illinois/conservation/pdfs/Fact_Sheet_Continuous_CRP_Signup.pdf

Illinois Department of Agriculture (IDOA) Partners for Conservation Program

- *Sustainable Agriculture Grants Program*
- *Streambank Stabilization and Restoration Program* (SSRP)
- *Soil and Water Conservation District Grants Program*

Sustainable Agriculture Grants Program provides funding to organizations, educational institutions, nonprofits, governmental agencies, and individuals who demonstrate comprehension of sustainable agriculture systems and implement conservation practice projects. Illinois' soil and water conservation districts prioritize and select projects that will receive cost-share funding. To be eligible, the land for which the conservation practice is to be applied must have erosion rates greater than one and one-half times the tolerable soil loss level.

Streambank Stabilization and Restoration Program (SSRP) provides cost-share assistance or demonstration project funding to landowners who implement streambank stabilization projects that demonstrate effective and inexpensive solutions to soil and stream bank erosion. Funding partners for this program are the Illinois Department of Agriculture, Illinois' soil and water conservation districts (SWCSs), and Natural Resources Conservation Service (NRCS) of the USDA. Recipients must maintain the selected bank stabilization practices for at least 10 years.

Soil and Water Conservation District Grants Program, through the Illinois Agricultural Department, offers operating cost assistance and technical assistance to landowners in natural resource management. All Illinois districts are eligible and encouraged to contact the Illinois Department of Agriculture for information about receiving grants.

https://www2.illinois.gov/sites/agr/Resources/Conservation/Pages/default.aspx
http://www.iira.org/rdrg/partners-for-conservation-streambank-stabilization-and-restoration-program-ssrp/

Illinois Department of Natural Resources (IDNR)

- *Open Space Lands Acquisition & Development (OSLAD)*
- *Land & Water Conservation Programs (LWCF)*

Both of these programs allow local units of government to apply for funding when acquiring or developing land for open space or public parks. Applications must be submitted between May 1 and July 1. Types of projects funded through this program include the creation of water quality basins with native plantings and the preservation or improvement of permanent wetlands. This grant program awards up to $750,000 for acquisition projects or up to $400,000 for development/renovation projects (i.e. OSLAD program only). Under both OSLAD and LWCF, funding is available for up to 50% of total approved projects costs. See blank uniform application in appendix.

https://www.dnr.illinois.gov/AEG/Pages/OpenSpaceLandsAquisitionDevelopment-Grant.aspx

US Fish and Wildlife Service (FWS)

- *Partners for Fish and Wildlife*
- *Wildlife and Sport Fish Restoration Program (WSFR)*

https://www.fws.gov/grants/programs.html

Partners for Fish and Wildlife
Partners for Fish and Wildlife provides technical and financial assistance to private landowners who voluntarily implement habitat restoration and improvement programs. Typically, Partners will provide assistance for protects that conserve and restore native vegetation, hydrology, and soils.

https://www.fws.gov/partners/aboutus.html

Wildlife and Sport Fish Restoration Program (WSFR)
This program cooperates with states and other partnerships to conserve and manage fish and wildlife and their habitats. It funds activities that promote wildlife restoration and wildlife-based recreation.

https://wsfrprograms.fws.gov/home.html

Sangamon River Alliance
The Sangamon River Alliance draws on the mutual interests of Alliance members to promote watershed conservation, education, and recreation in the Sangamon River watershed. Restoration project workdays for volunteer support can be posted on their website by contacting info@sangamonriveralliance.org. Include date(s), time, name of event, location name, address or coordinates, organizer name and contact, and website and/or Facebook link.

http://sangamonriveralliance.org/

Patagonia
Patagonia Corporate Grants Program

Patagonia donates funds to non-profit, community-based groups working towards a positive change for the planet in their own backyards and have a demonstrated strong support base. Eligible community-based groups/projects must fit the following criteria: be a non-profit organization; focus on the root cause of the problem; have distinct action competent with measurable goals and objectives; and NOT be solely for environmental education, involve land acquisitions, land trusts, or conservation easements, be primarily research based, for an endowment fund, for a political candidate campaign, for a green building project, nor for a conference. If the project is not located near on of Patagonia's U.S. retail stores, then the proposal will be reviewed by an employee grants council at company headquarters. They provide grants ranging between $5000- $20,000 for projects like taking down dams, restoring forest and rivers, protecting critical land and marine habitat, and supporting local, organic, and sustainable agriculture. One proposal is accepted per group per fiscal year (May 1-April 30). There are two annual deadlines: April 30 (receive response by August 30) or August 31 (receive response by end of January). To find out if your group is eligible go to https://www.patagonia.com/corporate-funding-guidelines.html

https://www.patagonia.com/grant-guidelines.html

Grand Victoria Foundation
Vital Lands

Vital Lands land acquisition funds are intended to assist projects that pursue permanent protection and long-term stewardship of Illinois' vital lands. While criteria for proposed projects is flexible, the minimum standards are set high. Eligible applicants must be well-managed, fiscally healthy 501(c)(3) public charities or certified public institutions registered in Illinois and in good standing. 501(c)(3) organizations seeking land acquisition funding must have conservation programs in Illinois and have adopted the Land Trust Alliance's Standards and Practices. Grand Victoria Foundation will only provide up to 30% of total dedicated funds calculated for long-term stewardship. In the application process, organizations will be asked to describe and document how they responsibly invest, manage, and use financial assets and build and maintain dedicated funds for stewardship and defense. Applications may be submitted at any time, as grants are awarded on a rolling basis. Apply online by creating an account at https://www.grantrequest.com/SID_5410?SA=SNA&FID=35006

The McKnight Foundation

The McKnight Foundation uses their resources to "restore the water quality and resilience of the Mississippi River." It provides funding support for projects and management practices that restore and protect floodplains and wetlands and reduce agricultural pollution within the Mississippi River Basin including Illinois. They have four deadlines for initial inquiries throughout the year: February 1, May 1, August 1, and November 1.

https://www.mcknight.org/programs/mississippi-river/how-to-apply/

The Wyss Foundation

The Wyss Foundation is a private foundation that supports long-term, creative solutions that foster livelihood, enhance communities, and encourage connections to the land. The Wyss Foundation funds projects ranging from conservation, education and social justice. The grantmaking is invitation only. Past grant range from $15,000-$3,000,000.

https://www.wyssfoundation.org/

Trees Forever

Illinois Buffer Partnership

The Illinois Buffer Partnership is a water quality program funded by Trees Forever, Syngenta, Operation Pollinator, and Growmark. These funding partners desire to highlight the voluntary efforts of farmers and rural landowners in planting, maintaining, and enhancing conservation practices and buffers. The mission of this Partnership is to showcase the actions taking place to restore Illinois flood plains and to raise awareness of potential for streamside buffers to enhance water quality and pollinator habitat. Cost-share funding is available for various water quality projects including, but not limited to, streamside buffers, wildlife/pollinator habitat, wetland or pond project, rain garden/bioswale, field windbreak, livestock confinement buffer planting, organic crop buffer, nut or fruit production, and agroforestry projects. After all federal, state, and local funding has been applied, recipients will be reimbursed for 50% of their remaining expenses, up to $2,000. Applications are available in August and must be submitted by December 31st. Recipients agree to allow their projects to serve as demonstration sites for education. Projects are expected to be completed within the same year that the funding is awarded. If extensions are needed, then they must be requested in writing and will be approved on a case-by-case basis. Please see blank application attached.

http://www.treesforever.org/Illinois_Buffer_Partnership

Illinois Clean Energy Community Foundation: Natural Areas Program

The Illinois Clean Energy Community Foundation has six categories within their Natural Areas Program for funding. Categories that could potentially be applicable to watershed planning and the broader mission of conservation include Capacity Building, Community Stewardship Challenge Grant, Land Acquisition, and Planning for Land Acquisition.

Capacity Building

Funding for this category is for projects that focus on increasing the organizational capacity of conservation groups active in protecting natural areas and wildlife habitat. This program is primarily for 501(c)(3) nonprofit organizations. Funding rarely covers the entire costs of the project. Applicants may apply for up to $40,000 for a two-year grant project. Deadlines for application submissions are February 21, 2019 and August 27, 2019.

Community Stewardship Challenge Grant
This program is geared toward increasing community participation in the protection and care of natural areas that are managed by nonprofit organizations. This program can provide funding via 1) a cash donation match ($3 provided: $1 raised, not exceeding donation of $21,000), 2) volunteer labor ($4,000 awarded for stewardship activities upon verification of 400 stewardship volunteer hours logged), or 3) equipment purchase (reimburse up to 80% or $5,000 for capital cost of stewardship equipment). This program is for 501(c)(3) nonprofit organizations that have active volunteer participation in the stewardship of publicly-accessible natural areas that are owned by a non-profit, local government, or government agency. Grants awarded up to $32,000 for natural area sites owned by a nonprofit and $27,000 for sites owned by the government.

Land Acquisition
This program desires to aid non-profits that purchase land outright with the purpose of protecting and enhancing wildlife habitat. Eligible applicants include nonprofit organizations and local government agencies that serve Illinois residents. Priority is given to projects that purchase natural habitat, as opposed to open space or parks, utilize all the funds for the direct purchase of the natural habitat, and meet specified transactional requirements for payment. The program funds up to 80% of the direct cost in purchasing the land and up to $10,000 for restoration completed within the first year of purchase. Deadlines for application submissions are February 21, 2019 and August 27, 2019.

Planning for Land Acquisition
The Foundation provides some financial assistance to nonprofit conservation groups who are planning the management and protection of natural areas. Grants under this program are awarded to individual organizations, but project action can include the participation of multiple organizations, including public and private. Majority of applicants are nonprofit organizations; however, if a local government agency, college, or university desires to seek grant funding through this program, they may contact the Foundation before application submission. Deadlines for application submissions are February 21, 2019 and August 27, 2019.

https://www.illinoiscleanenergy.org/natural-areas-program

SECTION 2, CHAPTER 6
Monitoring and Evaluation

Written by Angela Daily

Introduction

After completion of the Friends Creek Watershed Plan a realistic system for monitoring and evaluation will be necessary to track improvements and effectiveness over a long span of time.

This Chapter presents how monitoring and evaluation of the Friends Creek Watershed Plan will unfold and reflect the positive results of the adoption and implementation of the plan as well as promotion of the overall goals of the watershed.

Members of the Friends Creek Watershed Alliance, which is made up of stakeholders of Friends Creek Watershed, will be responsible for monitoring and evaluation efforts.

Criteria to Measure Success

To ensure progress Friends Creek Watershed Alliance will meet annually to measure the following milestones:

- Communication
- Review of completed projects
- Presentation of information and evaluation of nutrients and sediment in Friends Creek
- Report of new funding sources available to Friends Creek Watershed Alliance
- Report of new programs available to Friends Creek Watershed Alliance
- Evaluation the Friends Creek Watershed Plan

Monitoring Worksheets

Friends Creek Watershed Alliance will utilize a monitoring worksheet to track BMPS within Friends Creek Watershed. The Friends Creek Watershed Alliance will be responsible for distribution, retrieval, and compilation of worksheet data. The Friends Creek Watershed Monitoring Worksheet can be found on pages 2-4 of this Chapter.

The worksheets will:

- Quantify BMPs over time
- Track maintenance
- Ensure follow-up
- Reiterate the goals of the Friends Creek Watershed through annual distribution

Utilization of data collected via the worksheets would enhance funding opportunities for BMPs and monitoring efforts in the watershed and eventually lead to nutrient and sediment reductions, which diminishes the need for additional regulatory mandates.

FRIENDS CREEK WATERSHED MONITORING WORKSHEET

* The Friends Creek Watershed Alliance has prepared this worksheet for use in recording, evaluating and tracking BMPs within the Friends Creek Watershed. This worksheet will be used by the alliance to gather information from landowners; which when compiled with others over a period of time will enhance funding opportunities for BMPs in the watershed, for monitoring efforts, and inevitably a reduction of nutrient and sediments resulting in no additional regulatory mandates.

1. Name of project or practice (example: grassed waterway, vegetated swale, cover crops, etc.) please include a detailed description of the project/practice including feet or acres affected and location etc. and lastly why you decided to implement:

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(Worksheet continued on next page)

2. Start or anticipated start date:

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3. Completion date:

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4. Approximate Cost of project/practice:

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Where any cost share programs utilized for implementation of project? Yes ____ No____

5. What benefits are you expecting to see or have already seen with this project/practice?

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6. Are there projects/practices you would like to implement in the future or that you would like more information about? (please list)

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(Worksheet continued on next page)

7. Would you be interested in information on financial or technical assistance for these projects/practices? (mark all that apply)   financial assistance ____

   technical assistance ____

8. Which Friends Creek Watershed Plan goals do you feel apply to your project?
   ____ To reduce nutrient loading into streams.
   ____ To reduce sediment loading into streams.

9. Are you interested in becoming more involved in the Friends Creek Watershed Alliance?
   Yes ____   No____

   If yes please provide your name, phone number, mailing address and email address.
   ____
   ____
   ____
   ____

Please provide a map of project location if available as well as any before and after photos. Thank you for your participation in our conservation efforts in Friends Creek Watershed.

Please return this worksheet to: Macon County SWCD

Attn: Friends Creek Watershed Alliance

3342 North President Howard Brown Blvd.

Decatur, IL 62521

Attachments:

Friends Creek Watershed

2019

Resource Inventory & Plan

MACON COUNTY SOIL AND WATER CONSERVATION DISTRICT

Olson Ecological Solutions, LLC

tallgrass RESTORATION, LLC

Funding for this project provided, in part, by the
Illinois Environmental Protection Agency through Section 319 of the Clean Water Act.

ATTACHMENT A

ASSESSMENT OF SEDIMENT DELIVERY AND STREAM CONDITIONS IN THE FRIENDS CREEK WATERSHED

WAYNE KINNEY, MIDWEST STREAMS, INC.

May 2018

Friends Creek is a tributary to the Sangamon River with the confluence being only 3.2 miles above Lake Decatur. Friends Creek drains 131.48 sq. miles of rural farmland with the small communities of Argenta and Weldon being the only towns within the watershed.

As a tributary to the Sangamon River, which is the primary stream supplying Lake Decatur, Friends Creek represents 14% of the 920 sq. mile watershed. Lake Decatur was constructed in 1922 and subsequent sediment surveys have determined a loss of over one-third of the storage capacity. Interestingly, an Illinois State Water Survey Report #107 completed in 1987 determined that "the 15% of the watershed area nearest the lake contributed approximately one-half of the sediment to the lake." (pg.1)

Friends Creek located very close to the lake therefore likely contributes a significant portion of the total sediment load. The purpose of this study is to develop an estimate of the annual sediment load from the Friends Creek Watershed.

Midwest "Stream Technical Resource Evaluation and Management Services" (STREAMS) was contracted in July 2017 to conduct an inventory and evaluation of the Friends Creek stream network. The study has been designed to:

1. Quantify the sediment contributions generated from within the stream system.
2. Evaluate the stability of identified stream segments.
3. Locate and prioritize critical areas of sediment generation.
4. Provide alternative solutions to reduce the sediment contributions.
5. Develop preliminary design and cost estimate data to support the recommendations.

Procedure for Assessment

In July, 2017 a reconnaissance survey determined that the upper reaches of the stream system appear to be maintained drainage ditches and waterways with very low sediment contributions. The lower portions of the stream system however begin as natural channels and progress through various levels of "improvements" at intermittent locations before reaching the more actively managed drainage ditches and waterways. The study has been designed to complete a 100% inventory on the lower portions of the major channels beginning at the confluence with the Sangamon River and extending upstream to the start of the "managed" drainage system in each channel. The length of channel inventoried totals over 36 miles with over 14 miles being the Friends Creek channel from the Sangamon River to East Washington Street. Other major channels inventoried were Friends Creek Ditch (5.5 miles), North Branch of Friends Creek (9+ miles) and Kickapoo Creek (2+ miles). The remainder of the inventoried streams consist of three smaller unnamed tributaries of 1 to 2.5 miles in length.

The method used to inventory the channels is an expanded adaptation of the Rapid Assessment, Point Method of Erosion and Sediment Inventory Procedures for Illinois (April 2001, Natural Resources Conservation Service). The NRCS procedure is intended to use 160-acre sample plots to estimate erosion from all sources and then expand the results to a larger watershed. In this study only the "streambank" erosion was estimated. However, rather than use a sample plot, a 100% inventory was completed on the major streams as identified earlier.

Erosion Calculations
A total of 36.49 miles of channel were physically walked and streambank erosion calculated by estimating the length, height and lateral recession rate of each eroding streambank that met or exceeded the "moderate" level. Areas determined to have only "slight" streambank erosion were not inventoried as they are assumed to contribute little to the overall sediment yield. Lateral recession rates were assigned based on field observations using the guidelines given in the NRCS procedure.

Ave. (ft/yr.)	**Category**	**Description**
0.03	Slight	Some bare banks but active erosion not readily apparent. No vegetative overhang. No exposed tree roots. Bank height minimal.
0.13	Moderate	Bank predominantly bare with some vegetative overhang. Some exposed tree roots. No slumping evident.
0.40	Severe	Bank is bare with very noticeable vegetative overhang. Many tree roots exposed and some fallen trees. Slumping or rotational slips present. Some changes in cultural features, such as missing fence posts and realignment of roads.
1.5	Very Severe	Bank is bare and vertical or nearly vertical. Soil material has accumulated at base of slope or in water. Many fallen trees and/or extensive vegetative overhang. Cultural features exposed or removed or extensively altered. Numerous slumps or rotational slips present. Generally silty or sandy bank material, NOT glacial till or exposed shale bedrock.

Pictures in Exhibits 1 thru 6 are examples of streams judged to be in each erosion category.

Exhibit 1----Slight Erosion:
Typical of drainage ditch with vegetated banks. Little erosion, but good sediment transport of silt entering from outside the channel

Exhibit 2---Slight Erosion: “Natural” stream segment with mature trees. Some roots exposed but very little bank recession

Exhibit 3----Moderate Erosion: Exposed tree roots, some bank overhang and trees leaning into channel

Exhibit 4---Severe Erosion: Tile outlet extending into channel, vertical bare banks and exposed tree roots.

Exhibit 5----Very Severe Erosion: In channel cutoff below I-72. Bank slumping with material at base of nearly vertical slope

Exhibit 6---Very Severe: Tile outlet exposed 10 ft. and trees falling into channel

Cross Sections

In addition to the erosion calculations, stream cross sections were taken at 31 locations to assess the current channel stability and Channel Evolution Model (CEM) stage. The Stream Stabilization Inventory and Evaluation Procedure developed by the NRCS in Illinois was used for this analysis. The cross-section data is summarized in Fig.5 (pg.13) and the detailed information for each cross section can be found under each “Tab” for the appropriate stream.

Flow Data

Since many incised streams do not have good “bankfull” indicators, the use of applicable USGS flow data from a comparable stream is used to help calibrate the field determined “bankfull discharges”. There is no current flow data available for Friends Creek, however there are flow records from 1967 thru 1982. While this data set is older and only for 17 years, an Annual Peakflow analysis was calculated as a flow baseline. From the Friends Creek gage a Flow Probability Curve was plotted to predict the 2-yr. peak discharge and the 1.5 yr. peak discharge. (Fig. 3)

Then the USGS Gage on the Sangamon River at Monticello was analyzed to determine a trend line for Annual Peakflow within the Sangamon River Watershed. This analysis from 1980 thru 2017 suggests that the Annual Peakflow trend is flat or slightly declining. (Fig. 2) Therefore the Friends Creek Gage information was determined to be worth considering as a predictor of current flow rates.

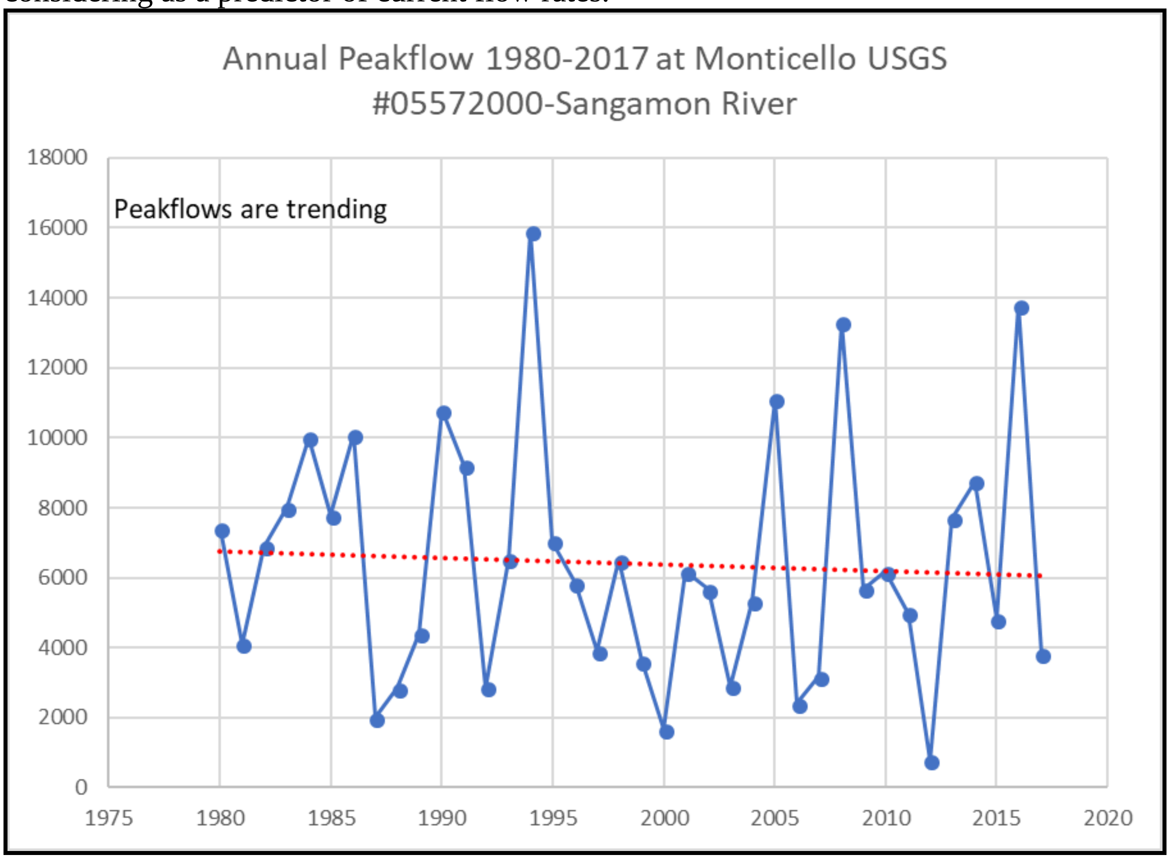

Fig. 2 Trendline for Annual Peak Discharge USGS Gage 05572000 @ Monticello

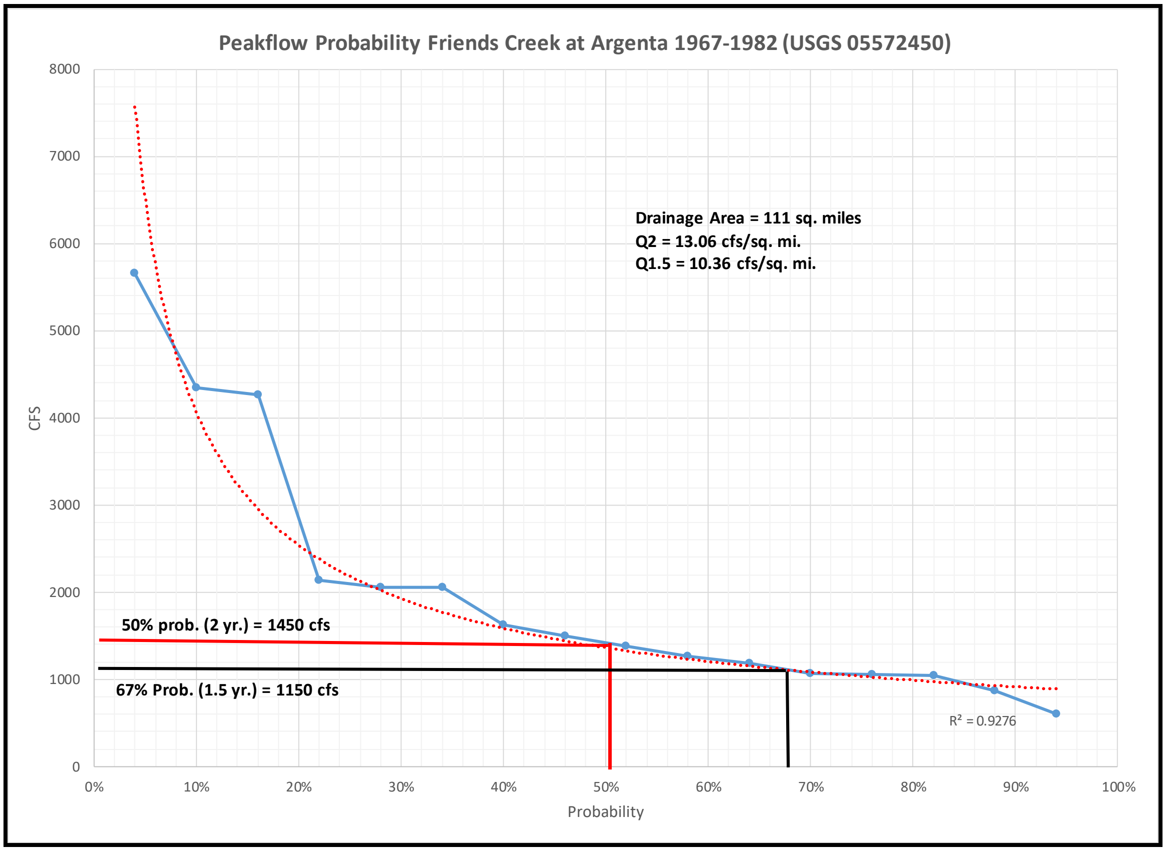

Fig. 3 Flow Probability Friends Creek USGS Gage 05572450

USGS gage data for other streams in the region is also available from the USGS "Streamstats" program to predict the 2 yr. discharge rates. However, by comparing these two predictions the "old" data from Friends Creek may be more applicable to the current flow rates than the predicted flows from "Streamstats" using other streams.

Therefore, the peak flow predictions from Friends Creek have been used for this study because when compared to the field estimated "geomorphic bankfull" flow data, collected from the 31 cross sections, the values fall much closer to the predicted channel capacity. From previous work and from the NRCS Streams program the predicted "geomorphic bankfull" flows are expected to fall somewhere in the range of 40 to 80% of the 2-yr. discharge prediction.

The peak flow predictions from the Friends Creek gage, even though over 30 years old, fit the field determined values found in Friends Creek much more closely. Therefore, in this study we will use the NRCS peak runoff projections based on the Friends Creek data found in the NRCS Stream Stabilization I&E Form.

Channel Evolution Model (CEM)

The Channel Evolution Model (Simon, 1990) is a useful tool to generalize current channel stability and trends, however it is somewhat subjective in that channel stability progresses on a continuum from Stage 3 thru Stage 6 and it requires some judgment by the observer to assign a CEM classification. When applied consistently the CEM model does provide a useful tool to discuss whether a channel is trending toward stability or toward instability. Recognizing the subjective nature of the CEM, each cross section has been assigned a CEM stage to allow stream segments to be categorized and compared. (Fig. 4) The CEM stage at each cross section is recorded in Fig.5.

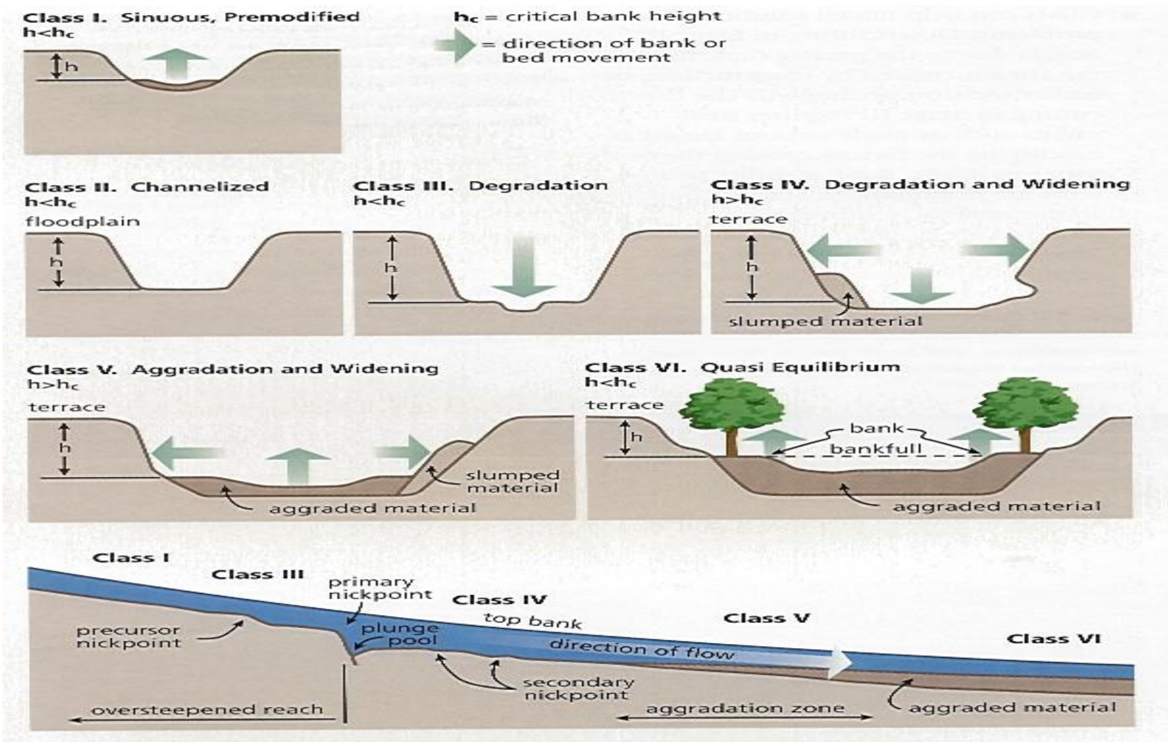

Figure 4. Channel Evolution Model (CEM)

Channel and Valley Slopes

The NRCS procedure requires a “valley slope” and a “channel slope” for each calculation. The valley slope for each cross section is calculated by the “Streamstats” program following the guidelines of U.S Geological Survey, Water Resources Investigations Report 87-4207.

The channel profiles developed for this determination are included under the separate tabs for each of the seven inventoried streams. Channel slope for this study has been calculated from the USGS topographic maps by carefully measuring the channel length between contour lines. While there will be short segments of channel where the channel slope may differ significantly, this procedure has been found to produce a very good approximation where there is no extensive stream profile survey available.

Specific Stream Detailed Data

Each of the seven (7) streams included in this inventory has under a separate tab the following information.

a) The GPS location of each eroding bank judged to be eroding either as Moderate, Severe or Very Severe
b) The rate of erosion, the length of the segment, the bank height and the tons of soil eroded annually.
c) The total sediment eroded annually and delivered to the Sangamon River from each segment
d) A table for each Stream Reach coded for erosion rate with a percentage of the total streambanks (left and right combined) in each erosion category.
e) The total tons of sediment delivered from each Stream Reach.
f) Summary of the Cross-Section data collected on the stream.
g) Profile of the stream from the USGS Topographic maps.
h) USGS Streamstats Report at each cross-section location.
i) NRCS Stream Stabilization I & E Form for each Cross Section.

Findings and Overall Conclusions from Data Collection:

All the streams physically walked and inventoried have been summarized below by Reach Code and broken down by the severity of the erosion and percent of erosion class in each Reach Code. This data along with cross section data and analysis have been evaluated to form the observations and conclusion that follow.

Stream Summary Table	By Reach Code									
		Stream Length	Total Bank	*None or Low	*Moderate	*High	*None or Low	*Moderate	*High	Total
Stream Name	Reach Code	Assessed	Length Assessed	Erosion (Ft)	Erosion (Ft)	Erosion (Ft)	Erosion (%)	Erosion (%)	Erosion (%)	%
Friends Creek	1	1.83 mi.	3.66 mi.	11,401ft.	3,837 ft.	4,086 ft.	59	19.86	21.14	100
	2	2.43 mi.	4.86 mi.	15,280 ft	5160 ft	5,220 ft.	59.55	20.11	20.34	100
	3	.20 mi.	0.40 mi.	912 ft.	0 ft.	1,200 ft.	43.18	0	56.82	100
	4	0.83 mi.	1.66 mi.	8,756 ft.	0 ft.	0 ft.	100	0	0	100
	5	1.68 mi	3.36 mi.	6,889 ft.	7,386 ft.	3,465 ft.	38.83	41.63	19.53	99.99
	6	2.42 mi.	4.84 mi.	15,020 ft.	3,951 ft.	6,585 ft.	58.77	15.46	25.77	100
	7	1.85 mi.	3.70 mi.	10,131 ft.	4,680 ft.	4,725 ft.	51.86	24	24.19	100.05
	8	3.0 mi.	6.0 mi.	21,930 ft.	7,020 ft.	2,730 ft.	69.22	22.16	8.62	100
Friend's Ck. Ditch	1	1.29 mi.	2.58 mi.	7,128 ft.	2,100 ft.	4,434 ft.	52.17	15.37	32.45	99.99
	2	1.10 mi.	2.20 mi.	8,436 ft.	503 ft.	1,671 ft.	72.62	12.9	14.38	99.9
	3	2.45 mi.	4.90 mi.	19,947 ft.	4,368 ft.	1,557 ft.	77.1	16.88	6.02	100
	4	0.70 mi.	1.40 mi.	5,481 ft.	651 ft.	1,260 ft.	74.15	8.81	17.05	100.01
North Branch	1	0.97 mi.	1.94 mi.	5,951 ft.	1,848 ft.	2,445 ft.	58.09	18.08	23.87	100.04
	2	0.61 mi.	1.22 mi.	5,398 ft.	555 ft.	489 ft.	83.79	8.62	7.59	100
	3	0.19 mi.	0.38 mi	1595 ft.	279 ft.	132 ft.	79.51	13.9	6.58	99.99
	4	2.69 mi.	5.38 mi.	23,747 ft.	3,156 ft.	1,503 ft.	83.6	11.11	5.29	100
	5	3.11 mi.	6.22 mi.	26,326 ft.	4,203 ft.	2,313 ft.	80.16	12.8	7.04	100
	6	1.70 mi.	3.40 mi.	17,064 ft.	339 ft.	549 ft.	95.05	1.89	3.06	100
Kickapoo Creek	1	1.37 mi.	2.74 mi.	11,528 ft.	495 ft.	2,445 ft.	79.68	3.42	16.9	100
	2	0.94 mi.	1.88 mi.	9,698 ft.	174 ft.	54 ft.	97.7	1.75	0.54	99.99
Tributary 1	1	2.49 mi.	4.98 mi.	18,704 ft.	2,925 ft.2	4,665 ft.	71.13	11.12	17.74	99.99
Tributary 2	1	1.14 mi.	2.28 mi.	5591 ft.	120 ft.	6327 ft.	46.44	1	52.56	100
Tributary 3	1	1.49 mi.	2.98 mi.	14,144 ft.	384 ft.	1206 ft.	89.9	2.44	7.66	100
	Total	36.49 mi.								

1. **Bankfull discharges in the Friends Creek watershed typically fall in the lower end or even below the expected 40 to 80% range of the 2-yr. rainfall event when compared to the NRCS generated peakflows. (Fig. 5)**

CROSS SECTION SUMMARY--FRIENDS CREEK AND TRIBUTARIES															
			ADA	Channel	Valley	Q2	BKF	Width	Depth	Ratio	BKF	Bedload			
X-Sec	Easting	Northing	Sq. Mi.	Slope ft/ft	Slope %	CFS	CFS	Ft.	Ft.	W/D	Vel. Fps	D90 in.	CEM	cfs/sq.mi.	BKF cfs/Q2
FC-1	39.93945	88.7715	130.3	0.00052	3.9	2350	704	42	6.36	6.60	2.6	1	6	5.40	30.0%
FC-2	39.94878	88.77896	129.5	0.00052	3.9	2360	782	58	5.42	10.70	2.5	1	1	6.04	33.1%
FC-3	39.9509	88.77959	129.4	0.00052	3.8	2320	689	49	5.8	8.45	2.4	1	1	5.32	29.7%
FC-4	39.95631	88.77816	127.4	0.00052	4	2310	737	54	5.48	9.85	2.5	1	1	5.78	31.9%
FC-5	39.9696	88.78786	125.7	0.00052	4	2320	887	60	5.7	10.53	2.6	1	1	7.06	38.2%
FC-6	39.9855	88.80466	114.1	0.00052	4.2	2190	783	60	5.4	11.11	2.4	1	1	6.86	35.8%
FC-7	39.99371	88.80798	69.1	0.00095	4.2	1510	604	43	4.96	8.67	2.8	1	1	8.74	40.0%
FC-8	40.01786	88.79929	64.6	0.00095	3.9	1390	559	44	4.39	10.02	2.9	1	2	8.65	40.2%
FC-9	40.028	88.79199	20.6	0.00095	5.2	665	137	28	2.47	11.34	2	1	1	6.65	20.6%
FC-10	40.03214	88.78803	20.3	0.00095	4.9	642	268	45	2.72	16.54	2.2	1	1	13.20	41.7%
FC-11	40.03636	88.79014	20	0.00095	5	638	218	25	3.85	6.49	2.3	1	1	10.90	34.2%
FCD-1	40.02418	88.79335	43.11	0.00074	4	1040	235	23	4.24	5.42	2.4	1	3	5.45	22.6%
FCD-2	40.02564	88.78867	42.99	0.00074	3.9	1020	575	39	5.08	7.68	2.9	3	5	13.38	56.4%
FCD-3	40.02909	88.77994	42.57	0.00074	3.8	1010	480	41	4.4	9.32	2.7	1	5	11.28	47.5%
FCD-4	40.03105	88.77509	42.27	0.00074	3.6	978	252	35	3.3	10.61	2.2	1	5	5.96	25.8%
FCD-5	40.03266	88.77103	42.13	0.00074	3.6	982	172	31	2.82	10.99	2	2	1	4.08	17.5%
FCD-6	40.03847	88.76945	39.53	0.00074	3.8	956	273	29	3.9	7.44	2.4	1	1	6.91	28.6%
NB-1	39.99433	88.81028	44.15	0.00210	5.3	1180	665	42	3.86	10.88	4.1	4	2	15.06	56.4%
NB-2	40.00892	88.82615	28.98	0.00120	5.1	855	400	36	3.74	9.63	3	2	1	13.80	46.8%
NB-3	40.0182	88.82952	27.62	0.00120	5	815	400	33	4	8.25	3	2	4	14.48	49.1%
NB-4	40.03202	88.83137	22.79	0.00079	4.8	699	305	28	4.2	6.67	2.6	1	1	13.38	43.6%
NB-5	40.03568	88.84563	22.36	0.00079	4.8	685	240	31	3.37	9.20	2.3	1	1	10.73	35.0%
KP-1	39.99843	88.82197	14.08	0.00220	4.9	488	225	20	3.16	6.33	3.6	2	4	15.98	46.1%
TRIB 1-1	39.99338	88.77846	4.8	0.00190	7.7	265	105	25	1.77	14.12	2.4	1	1	21.88	39.6%
TRIB 1-2	39.99279	88.7805	5.07	0.00190	7.6	273	82	18	1.86	9.68	2.4	1	1	16.17	30.0%
TRIB 1-3	39.99021	88.78275	5.1	0.00190	7.3	270	120	20	2.21	9.05	2.7	1	3	23.53	44.4%
TRIB-2-1	39.97266	88.79936	1.73	0.00640	10.3	136	110	15	1.78	8.43	4.1	2	3	63.58	80.9%
TRIB 3-1	39.95631	88.78632	1.78	0.00612	14	157	110	16	1.69	9.47	4.1	1	4	61.80	70.1%
TRIB 3-2	39.95778	88.78972	1.66	0.00612	11.8	132	105	12	2.03	5.91	4.3	1	1	63.25	79.5%
TRIB 3-3	39.95733	88.79441	0.73	0.00612	14.7	82	75	8	2.18	3.67	4.3	1	3	102.74	91.5%
TRIB 3-4	39.95649	88.79545	0.7	0.00612	15.3	80	75	12	1.65	7.27	3.8	1	1	107.14	93.8%

Fig. 5 Cross Section Summary---Yellow indicates "No Incision"

Estimates of "bankfull discharge" are based on bankfull indicators from field observations, cross section data, and the NRCS flow predictions for estimating annual peak discharge for rural streams. Utilizing all these criteria the estimated bankfull discharge for inventoried channels ranges from 5 to over 13 CFS per sq. mile for Friends Creek and Friends Creek Ditch. The North Tributary to Friends Creek has only slightly higher bankfull discharges ranging from 11 to 15 cfs per sq. mile. Tributary 1 has bankfull discharges of 16 to 24 cfs per sq. mile while the smaller Tributaries 2 and 3 have discharges around 60 cfs per sq. mi. The decrease in peak discharge expressed as cfs per sq. mile as the watershed size increases is quite normal due to changes in watershed characteristics. However only 10 of 17 cross sections in Friends Creek and Friends Creek Ditch have discharges above the expected level of 40% of the predicted 2 yr. discharge. Five (5) of the remaining seven falls in the 30 to 39% range and two cross sections have a maximum capacity of less than 30% of the 2-yr. discharge.

2. **Over 55 percent of the sediment contributed from streambank erosion is generated in Friends Creek. (Fig. 6)**

Summary of Erosion by Watershed							
		Length		Sed. Del. Est.*			
Stream Name	ADA (sq. mi.)	Assessed (mi.)	Tons Soil Del.	Non-Inventoried	% Total	Tons/sq.mi.	Tons/Mi.
Friends Creek	131.48	14.25	2780	262	57.57%	21.14	195.09
North Branch	44.16	9.27	618	103	13.64%	13.99	66.67
Friends Ck. Ditch	43.11	5.54	715	207	17,74%	16.59	129.06
Kickapoo Creek	14.09	2.31	153	57	3.97%	10.86	66.23
Trib. 1	6.83	2.49	94	11	1.99%	13.76	37.75
Trib.2	1.87	1.14	215	16	4.37%	114.97	188.60
Trib. 3	1.86	1.49	26	27	1.00%	13.98	26.17
	Total	36.49	4601	683			
	Grand Total All sediment			5284 Tons			
*Sediment estimated from streambanks with "slight" or "no erosion"							

Fig. 6 Summary of Total Erosion by Watershed

The streambank erosion inventory found that the total sediment yield to Lake Decatur from the inventoried erosion sites in Friends Creek total approx. 5284 tons of sediment delivered annually. An assumption has been made that approx. 50% of the streambanks not inventoried along the 36.49 miles of field investigation have “slight” or “no erosion” are eroding at the rate of “slight” (0.03 ft./yr.) with the other 50% having no erosion. The estimated sediment delivered from these sites is included as the “non-inventoried” Sediment Delivery Est.

3. Stream channels inventoried are delivering to Lake Decatur from 26 tons to 195 tons of sediment per mile of stream channel. (Fig. 6)

The sediment generated from streambank erosion varies widely from the lowest (Trib. 3) to the highest (Friends Creek). Friends Creek is producing the most overall sediment due to its length and high Sediment Transport Factor. Trib. 3 is the lowest overall sediment producer, however there is a short very erosive section midway along this tributary with severe downcutting. Stabilizing this short length of downcutting is one on the preliminary recommendations.

Trib. 1 on the other hand is the next lowest sediment producer but is one of the more unstable streams with severe downcutting. Since it is rather short and has a lower “sediment transport factor” (STF) due to the fact it empties into an abandoned oxbow and drops most of its sediment there before reaching the active channel of Friends Creek.

4. Channel incision is not a major factor in the streambank erosion of Friends Creek or the major tributaries.

Of the 31 cross sections taken 71% (22 of 31) were found to be in either CEM stage 1 or CEM stage 6 meaning they were either aggrading or had a stable bed. (Fig. 2 CEM stages). At these 22 representative cross sections the bankfull discharge was determined to be at the elevation of the top bank (floodplain) meaning that the major streams of

Friends Creek, Friends Creek Ditch and North Branch are well connected to their floodplains. Only the smaller unnamed tributaries show significant signs of incision. (Fig. 5)

5. The extent and the magnitude of the "bedload" in many stream segments do indicate a "system-wide" instability problem.

With 71% of the cross sections being classified as CEM 1 or CEM 6 the usual assessment would be that the stream system is near a stable condition. However, twelve of these 22 cross sections are on Friends Creek and Friends Creek Ditch with an average capacity of only 45% of the predicted 2 yr. discharge. This is very much in the lower end of the expected 40 to 80% range of capacity.

6. **Friends Creek and Friends Creek Ditch are heavily impacted by small gravel and sand deposits within the channel resulting in loss of channel capacity and eroding banks as the stream channel adjusts to reduced capacity.**

7. **Stream Reach Code 003 in Friends Creek is an exception as this segment has been constructed to eliminate a large meander bend. This reach is very incised and downcutting.**

8. **Almost no fine sediments are found within these aggrading sections except for the lower 3500 ft. of Friends Creek Reach 001 that is impacted by backwater from the Sangamon River. Therefore, the assumption is made that a high percentage of fine sediments are being transported downstream, at least to this point 0.66 mi. above the confluence with the Sangamon River. This lower reach of FC001 is within the Sangamon River floodplain and sediment delivered to this point is considered for this study to be delivered to the Sangamon. However, there will be a small undetermined volume of fine sediments deposited within the floodplain of Friends Creek.**

9. **Sediment Transport Factor (STF) is a major factor in determining the sediment generated from streambank erosion that reaches the Sangamon River and then presumably Lake Decatur. The following observations and conclusion have been used to determine the appropriate STF for the Friends Creek Watershed.**
   A) In Friends Creek very little silt or clay deposits have been identified above the backwater influence from the Sangamon River
   B) Therefore, it seems safe to assume that a large percentage of the silt and clay particles within the stream are transported at least as far as the Sangamon.
   C) This assumption seems especially applicable to the "natural" stream segments inventoried as these segments with natural meanders have significantly more sand and gravel than the channelized reaches. The conclusion drawn is that the channelized reaches are more capable of transporting the sand and gravel, which is then deposited in the "natural" reaches where the velocity is somewhat lower.

D) Therefore, the Sediment Transport Rate (for the eroding streambank portion of sediment) should be equal to percent of silt and clay in eroded streambanks plus a small amount of sand and minus a small amount of deposition outside the active channel during flood flows. (Sediments in Lake Decatur were found to be 57% clay, 36% silt and 7 % sand. {Illinois State Water Survey Report ISWS/RI-107/87}

E) Without any study to determine the sediment deposited in the floodplain, the assumption is made that floodplain deposition is equal to the sand portion that is delivered to Lake Decatur and thus they cancel each other out in our calculations. The STF then becomes equal to the percent Silt and Clay in eroded streambanks.

F) The percent silt and clay can be estimated from the analysis of soil types in the floodplain using the Soil Survey for Macon County.

G) The floodplains in Friends Creek Watershed are composed of primarily Lawson and Sawmill soil types. Lawson is listed as 83% Silt and Clay in upper 80 inches. Sawmill listed as 88% Silt and Clay in upper 60 inches.

H) A conservative estimate is then that at least 75% of the eroded material from the streambanks is Silt or Clay.

I) Therefore, a Sediment Transport Factor (STF) of 75% for eroded material from streambank erosion will be used to estimate sediment delivered to the Sangamon River. (Except for Trib. #1 which empties into Friends Creek reach code 004 which is an abandoned oxbow with ample opportunity for sediment deposition.)

10) Friends Creek and tributaries presents a dilemma in the sense that the presence of sand and gravel deposits in the channel are causing the channel to erode laterally, producing fine grained sediment that is easily transported downstream. In addition, as the stream erodes laterally more trees fall into the channel obstructing flow and creating logjams.

The problem of sand and gravel deposits is particularly a concern from a point midway between Parr Road and Jordan Road and continuing downstream. (Stream Reach FC001 and the lower half of FC002) The problem is also critical between Dantown Road and Cemetery Road. (The middle section of Stream Reach FC005) Both of these locations are in the lower gradient section of Friends Creek downstream of Rt. 48 East of Argenta and below areas where Friends appears to have had some channel modifications in the past. These areas have become the “deposition” zone for much of the heavier material that can no longer be transported by Friends Creek due to reduced stream gradients and slower velocities.

The predominant source of the sand and gravel is the eroding streambanks. Sediment entering the stream from overland sources is comprised almost totally of silts and clays with most heavier sand and gravel being filtered out of runoff before entering the stream. Streambanks, however contain sand and gravel in the lower part of the eroding banks with no opportunity for filtering, therefore 100% is delivered to the stream. This sand and gravel is being transported through parts of Friends Creek and tributaries. However, the sand and gravel will be the first to be deposited when the flow velocity slows down. The

segments that appear to be most affected by the deposition of sand and gravel are below channelized reaches (see 9C above) and just above the backwater effects of flow in the Sangamon River. (see 8 above)
It may seem logical to remove the sand, gravel and logjams from these sections of Friends Creek to open the channel and prevent the lateral bank erosion caused by these restrictions. However, to narrow the channel and harden the eroding banks in an attempt to flush the sand and gravel to restore the channel capacity (if that were possible) would result in more bed material moving downstream and potentially into Lake Decatur. The results would therefore be contrary to our goal of reducing the material being deposited in the lake.
The overall recommendation is therefore to stop as much streambank erosion as possible, especially since the source of the heavier sand and gravel is the eroding streambanks having 12% to 17% sand and gravel. An important consideration is that this effort should first be concentrated outside of FC001, the lower half of FC002 and middle section of FC005. Working in these areas before the bedload causing the problem is addressed would not result in long term benefits.
By concentrating on stabilizing the streambanks the recommendation will accomplish a two-fold purpose.
A) By reducing the amount of heavy bedload material entering the channel upstream the volume of sand and gravel being deposited in the lower reaches of Friends Creek can be reduced. As the volume of sand and gravel is reduced the lower end of Friends Creek and Friends Creek Ditch will not be driven to erode its banks by the gravel deposits.
B) By stabilizing the eroding banks, the fine sediment load being eroded and transported all the way to the Sangamon will also be greatly reduced.

Preliminary Recommendations:

While the overall recommendation is to treat as many eroding streambanks as possible to reduce the total sediment loading to Lake Decatur, there are some very specific locations that should be of highest priority.

1) **Friends Creek Reach 003** is a channelized section that cuts off a large meander bend just below I-72. This cutoff was completed some time ago, but the banks remain nearly vertical and severely eroding. The bed is nearing stability after many years.
   The recommendation is to construct a series of Rock Riffles in this reach to stabilize the bed and create deeper pools to dissipate the energy in the stream segment.
2) **Friends Creek Ditch Reach 001** is developing a new channel at the confluence with Friends Creek. The existing channel has lost capacity due to excessive deposits of sand and gravel resulting in Friend Creek Ditch creating a "high flow" channel where larger flows are eroding a new channel that will enter Friends Creek approx. 800 downstream of the current confluence. The resulting "high flow" channel is very unstable with significant headcuts and is well undersized.

As this high flow channel continues to develop into the "new" Friends Creek Ditch it will produce large amounts of sediment as it deepens and widens. **The recommendation is to design a "new" channel in the approximate location of the developing channel and excavate a properly sized stable channel with the necessary Grade Control and Stone Toe Protection.**

3) **Tributary 2 Reach 001** is extremely incised and is very unstable with a rate of sediment per sq. mile of drainage area that is 5 times as higher than any other stream segment.
   The recommendation is to install a series of grade control structures from Cemetery Road down to the confluence with Friends Creek.
4) **Tributary 3 Reach 001** has a large degrading section with a very unstable bed 1500 to 2000 ft. above Dunbar Road. A 3 to 4 ft. headcut exists at the upper end of this reach and will continue to migrate upstream generating large amounts of sediment if left unchecked.
   The recommendation is to install a series of Rock Riffle Grade Control structures in this reach.

Prioritizing Stream Reaches

After the four preliminary recommendations are addressed, the question becomes which Stream Reach Codes have the highest priority. There are several ways to consider where the most effort and resources should be applied. In order to do that four different methods of evaluation were considered.

1) Total Sediment delivered by Stream Reach Code. (Fig. 7)
2) Sediment delivered by Mile of Stream Reach Code (Fig. 8)
3) Sediment Delivered by Square Mile of Drainage for each Reach Code (Fig. 9)
4) Sediment delivered by Square Mile of Drainage divided by Stream Length (Fig. 10)
5) Finally, the sum of the Ranking for Each Category was used to create a Table of the highest priority Stream Reach Code using all the ranking factors. (Fig. 11)

Sediment Delivery by Stream Reach					Ranking by Total Sediment		
		Stream (mi.)	Area	Delivered	Mi. of Stream	Sq. mi. Drainage	Sq. mi/length
	Reach	Length	Drainage	Tot. Sed.	Sed. Del.	Sed. Del.	Sed. Del.
Stream Name	Code	Assessed	Sq. mi.	Tons	Tons	Tons	Tons
Friends Creek	006	2.42	69.15	577.7	238.7	8.4	3.45
Friends Creek	002	2.43	129.52	514.2	211.6	4.0	1.63
Friends Creek	005	1.68	115.42	492.4	293.1	4.3	2.54
Friends Creek	001	1.83	131.46	405.1	221.4	3.1	1.68
Friends Creek	007	1.85	65.6	368	198.9	5.6	3.03
Friend's Ck. Ditch	001	1.29	43.11	314.7	244.0	7.3	5.66
Friends Creek	008	3	20.67	228.5	76.2	11.1	3.68
Tributary 2	002	1.14	1.87	215.8	189.3	115.4	101.23
Friends Creek	003	0.2	123.25	210.2	1051.0	1.7	8.53
Friend's Ck. Ditch	003	2.45	40.33	198.8	81.1	4.9	2.01
North Branch	005	3.11	24.33	184.6	59.4	7.6	2.44
North Branch	001	0.97	44.16	175.7	181.1	4.0	4.10
North Branch	004	2.69	29.23	167.8	62.4	5.7	2.13
Kickapoo Creek	001	1.37	14.05	146.7	107.1	10.4	7.62
Friend's Ck. Ditch	002	1.1	42.36	121.9	110.8	2.9	2.62
Tributary 1	001	2.49	6.83	94.2	37.8	13.8	5.54
Friend's Ck. Ditch	004	0.7	26.66	83.5	119.3	3.1	4.47
North Branch	002	0.61	29.73	41.8	68.5	1.4	2.30
Tributary 3	003	1.49	1.86	26.4	17.7	14.2	9.52
North Branch	006	1.7	21.52	26.35	15.5	1.2	0.72
North Branch	003	0.19	29.61	15.9	83.7	0.5	2.83
Kickapoo Creek	002	0.94	11.18	6.2	6.6	0.6	0.59
Friends Creek	004	0.83	0	0	0.0	0.0	0.00

Fig. 7

Sediment Delivery by Stream Reach					Ranking by Mile of Stream		
		Stream (mi.)	Area	Delivered	Mi. Stream	Sq. mi. Drainage	sq. mi/length
Stream Name	Reach	Length	Drainage	Tot. Sed.	Sed. Del.	Sed. Del.	Sed. Del.
	Code	Assessed	Sq. mi.	Tons	Tons	Tons	Tons
Friends Creek	003	0.2	123.25	210.2	1051.0	1.7	8.53
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Friends Creek	002	2.43	129.52	514.2	211.6	4.0	1.63
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Tributary 2	002	1.14	1.87	215.8	189.3	115.4	101.23
North Branch	001	0.97	44.16	175.7	181.1	4.0	4.10
Friend's Ck. Ditch	004	0.7	26.66	83.5	119.3	3.1	4.47
Friend's Ck. Ditch	002	1.1	42.36	121.9	110.8	2.9	2.62
Kickapoo Creek	001	1.37	14.05	146.7	107.1	10.4	7.62
North Branch	003	0.19	29.61	15.9	83.7	0.5	2.83
Friend's Ck. Ditch	003	2.45	40.33	198.8	81.1	4.9	2.01
Friends Creek	008	3	20.67	228.5	76.2	11.1	3.68
North Branch	002	0.61	29.73	41.8	68.5	1.4	2.30
North Branch	004	2.69	29.23	167.8	62.4	5.7	2.13
North Branch	005	3.11	24.33	184.6	59.4	7.6	2.44
Tributary 1	001	2.49	6.83	94.2	37.8	13.8	5.54
Tributary 3	003	1.49	1.86	26.4	17.7	14.2	9.52
North Branch	006	1.7	21.52	26.35	15.5	1.2	0.72
Kickapoo Creek	002	0.94	11.18	6.2	6.6	0.6	0.59
Friends Creek	004	0.83	0	0	0.0	0.0	0.00

Fig. 8

Sediment Delivery by Stream Reach					Ranked by Sediment per square mile		
Stream Name		Stream (mi.)	Area	Delivered	Mi. of stream	sq. mi. Drainage	sq. mi/length
	Reach	Length	Drainage	Tot.Sed.	Sed. Del.	Sed. Del.	Sed. Del.
	Code	Assessed	Sq. mi.	Tons	Tons	Tons	Tons
Tributary 2	001	1.14	1.87	215.8	189.3	115.4	101.23
Tributary 3	001	1.49	1.86	26.4	17.7	14.2	9.53
Tributary 1	001	2.49	6.83	94.2	37.8	13.8	5.54
Friends Creek	008	3	20.67	228.5	76.2	11.1	3.68
Kickapoo Creek	001	1.37	14.05	146.7	107.1	10.4	7.62
Friends Creek	006	2.42	69.15	577.7	238.7	8.4	3.45
North Branch	005	3.11	24.33	184.6	59.4	7.6	2.44
Friend's Ck. Ditch	001	1.29	43.11	314.7	244.0	7.3	5.66
North Branch	004	2.69	29.23	167.8	62.4	5.7	2.13
Friends Creek	007	1.85	65.6	368	198.9	5.6	3.03
Friend's Ck. Ditch	003	2.45	40.33	198.8	81.1	4.9	2.01
Friends Creek	005	1.68	115.42	492.4	293.1	4.3	2.54
North Branch	001	0.97	44.16	175.7	181.1	4.0	4.10
Friends Creek	002	2.43	129.52	514.2	211.6	4.0	1.63
Friend's Ck. Ditch	004	0.7	26.66	83.5	119.3	3.1	4.47
Friends Creek	001	1.83	131.46	405.1	221.4	3.1	1.68
Friend's Ck. Ditch	002	1.1	42.36	121.9	110.8	2.9	2.62
Friends Creek	003	0.2	123.25	210.2	1051.0	1.7	8.53
North Branch	002	0.61	29.73	41.8	68.5	1.4	2.30
North Branch	006	1.7	21.52	26.35	15.5	1.2	0.72
Kickapoo Creek	002	0.94	11.18	6.2	6.6	0.6	0.59
North Branch	003	0.19	29.61	15.9	83.7	0.5	2.83
Friends Creek	004	0.83	0	0	0.0	0.0	0.00

Fig. 9

Sediment Delivery by Stream Reach					Ranking by Sq. Mile/Stream Length		
Stream Name	**Reach**	**Stream (mi.)**	**Area**	**Delivered**	**mi. of stream**	**sq. mi. Drainage**	**sq. mi/length**
	Code	**Length**	**Drainage**	**Tot. Sed.**	**Sed. Del.**	**Sed. Del.**	**Sed. Del.**
		Assessed	**Sq. mi.**	**Tons**	**Tons**	**Tons**	**Tons**
Tributary 2	001	1.14	1.87	215.8	189.3	115.4	101.23
Tributary 3	001	1.49	1.86	26.4	17.7	14.2	9.52
Friends Creek	003	0.2	123.25	210.2	1051.0	1.7	8.53
Kickapoo Creek	001	1.37	14.05	146.7	107.1	10.4	7.62
Friend's Ck. Ditch	001	1.29	43.11	314.7	244.0	7.3	5.66
Tributary 1	001	2.49	6.83	94.2	37.8	13.8	5.54
Friend's Ck. Ditch	004	0.7	26.66	83.5	119.3	3.1	4.47
North Branch	001	0.97	44.16	175.7	181.1	4.0	4.10
Friends Creek	008	3	20.67	228.5	76.2	11.1	3.68
Friends Creek	006	2.42	69.15	577.7	238.7	8.4	3.45
Friends Creek	007	1.85	65.6	368	198.9	5.6	3.03
North Branch	003	0.19	29.61	15.9	83.7	0.5	2.83
Friend's Ck. Ditch	002	1.1	42.36	121.9	110.8	2.9	2.62
Friends Creek	005	1.68	115.42	492.4	293.1	4.3	2.54
North Branch	005	3.11	24.33	184.6	59.4	7.6	2.44
North Branch	002	0.61	29.73	41.8	68.5	1.4	2.30
North Branch	004	2.69	29.23	167.8	62.4	5.7	2.13
Friend's Ck. Ditch	003	2.45	40.33	198.8	81.1	4.9	2.01
Friends Creek	001	1.83	131.46	405.1	221.4	3.1	1.68
Friends Creek	002	2.43	129.52	514.2	211.6	4.0	1.63
North Branch	006	1.7	21.52	26.35	15.5	1.2	0.72
Kickapoo Creek	002	0.94	11.18	6.2	6.6	0.6	0.59
Friends Creek	004	0.83	0	0	0.0	0.0	0.00

Fig. 10

Sediment Delivery by Stream Reach---Ranking						By Reach Code Order			
		Stream mi.	Area	Delivered	Sed. Del.	Sed. Del.	Sed. Del.		
	Code	Assessed	sq. mi.	Rank	Rank	Rank	Rank	Rankings	Overall
Stream Name	Reach	Length	Drainage	Tot. Sed.	mi.stream	sq. mi.(Tons)	sq. mi/length	Sum of	Ranking
Tributary 2	001	1.14	1.87	8	8	1	1	18	1
Friends Creek	006	2.42	69.15	1	4	6	10	21	**2**
Friend's Ck. Ditch	001	1.29	43.11	6	3	8	5	22	**3**
Friends Creek	003	0.2	123.25	9	1	18	3	31	4
Friends Creek	005	1.68	115.42	3	2	12	14	31	5
Friends Creek	007	1.85	65.6	5	7	10	11	33	6
Friends Creek	008	3	20.67	7	15	4	9	35	7
Kickapoo Creek	001	1.37	14.05	14	12	5	4	35	8
Friends Creek	002	2.43	129.52	2	6	13	20	41	9
North Branch	001	0.97	44.16	12	9	13	8	42	10
Tributary 3	001	1.49	1.86	19	20	2	2	43	11
Friends Creek	001	1.83	131.46	4	5	16	19	44	12
Tributary 1	001	2.49	6.83	16	19	3	6	44	13
Friend's Ck. Ditch	004	0.7	26.66	17	10	15	7	49	14
North Branch	005	3.11	24.33	11	18	7	15	51	15
Friend's Ck. Ditch	003	2.45	40.33	10	14	11	18	53	16
Friend's Ck. Ditch	002	1.1	42.36	15	11	17	13	56	17
North Branch	004	2.69	29.23	13	17	9	17	56	18
North Branch	003	0.19	29.61	21	13	22	12	68	19
North Branch	002	0.61	29.73	18	16	19	16	69	20
North Branch	006	1.7	21.52	20	21	20	21	82	21
Kickapoo Creek	002	0.94	11.18	22	22	21	22	87	22
Friends Creek	004	0.83	0	23	23	23	23	92	23

Fig. 11

Finally, another way to prioritize may be to simply consider the percentage of erosion class in each Reach Code. Fig. 12 is an attempt to prioritize the Reach Codes using this method.

		Erosion (%)	Erosion (%)	Erosion (%)	%	
Stream Name	Reach Code	*None or Low	*Moderate	*High	High + Mod	
Friends Creek	4	100	0	0	0	low
Kickapoo Creek	2	97.7	1.75	0.54	2.29	low
North Branch	6	95.05	1.89	3.06	4.95	low
Tributary 3	1	89.9	2.44	7.66	10.1	low
North Branch	2	83.79	8.62	7.59	16.21	moderate
North Branch	4	83.6	11.11	5.29	16.4	moderate
North Branch	5	80.16	12.8	7.04	19.84	moderate
Kickapoo Creek	1	79.68	3.42	16.9	20.32	moderate
North Branch	3	79.51	13.9	6.58	20.48	moderate
Friend's Ck. Ditch	3	77.1	16.88	6.02	22.9	moderate
Friend's Ck. Ditch	4	74.15	8.81	17.05	25.86	moderate
Friend's Ck. Ditch	2	72.62	12.9	14.38	27.28	moderate
Tributary 1	1	71.13	11.12	17.74	28.86	moderate
Friends Creek	8	69.22	22.16	8.62	30.78	moderate
Friends Creek	2	59.55	20.11	20.34	40.45	high
Friends Creek	1	59	19.86	21.14	41	high
Friends Creek	6	58.77	15.46	25.77	41.23	high
North Branch	1	58.09	18.08	23.87	41.95	high
Friend's Ck. Ditch	1	52.17	15.37	32.45	47.82	high
Friends Creek	7	51.86	24	24.19	48.19	high
Tributary 2	1	46.44	1	52.56	53.56	high
Friends Creek	3	43.18	0	56.82	56.82	high
Friends Creek	5	38.83	41.63	19.53	61.16	high
Possible Priority by reach code considering Percent of Erosion Class						

Fig. 11A

Comparing the methods of prioritizing Stream Reaches in the Friends Creek study the top 6 Stream Reaches in Fig. 11 also rank as <u>high</u> priority in Fig. 11A. Therefore these 6 Stream Reaches (shaded in yellow in Fig. 11 and Fig.11A) appear to be those which should receive the highest priority for treatment.

These reaches can be described as:

a. **Beginning at the end of the Friends Creek "cutoff" below I-72 and extending upstream to the confluence with Friends Creek Ditch. (except for area between Dantown Rd. and Cemetery Rd.)**
b. **Tributary 2 from confluence to Cemetery Rd.**
c. **Friends Creek Ditch from confluence through Friends Creek Campground.**

Recommended Treatment Alternatives

Re-Direction Techniques

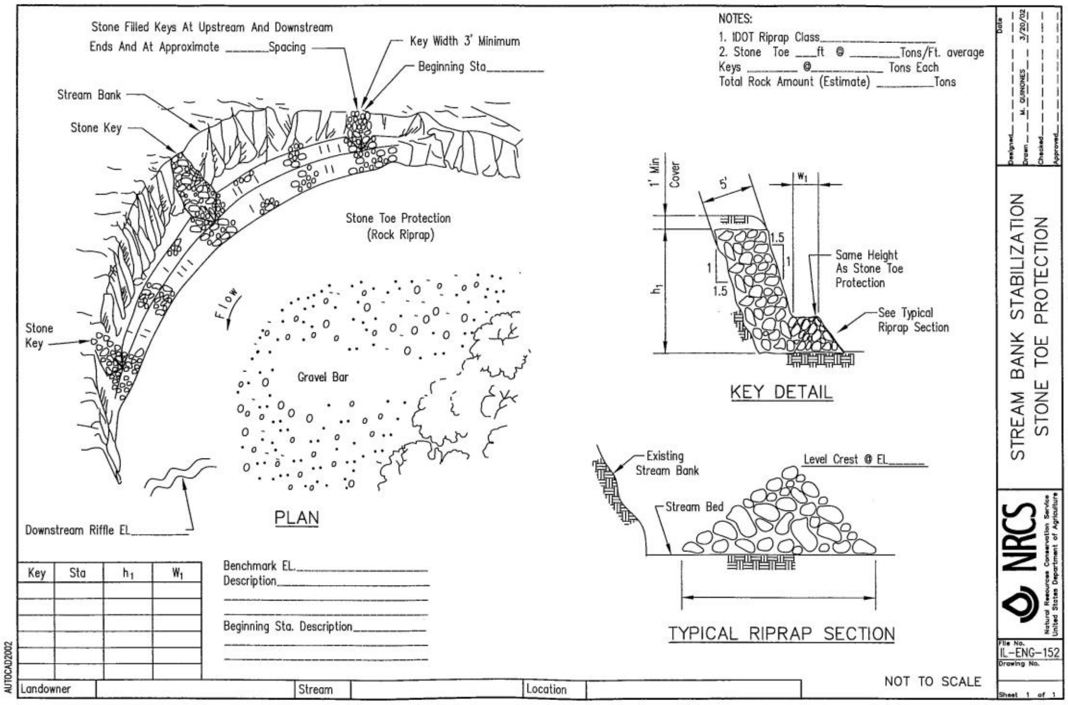
By re-directing the high velocity flows away from the eroding banks these techniques can induce deposition near the outer banks and in that manner stabilize eroding banks. These techniques are useful but are more applicable to streams with wide channel bottoms. The "bankfull" widths of the majority of inventoried stream segments is 60 feet or less. Use of Bendway Weirs are generally only applicable to wider channels with bar material that can be easily moved. Stream Barbs are best suited where the meander bend is very sharp and only re-direction of flow will be successful. Therefore, the use of in channel flow re-direction with Stream Barbs or Bendway Weirs will be limited to only a few areas. But should not be completely dismissed.

Vegetative Solutions
Vegetative solutions and planting of riparian areas are a consideration. However, a large percentage of the riparian area is already in woody vegetation with only a few instances of cropland directly bordering the stream channels. Preservation of the woody corridors should be a priority and in the few locations where there is not adequate grass or woody riparian areas establishment should be a priority.
Vegetative solutions for the eroding streambanks are also a consideration, however to establish vegetation on the eroding banks would require shaping the banks to a stable slope and re-vegetating. There are two major issues to consider when contemplating this approach. First, to re-shape the banks would require removal of the existing vegetation, which in large part is well established woody vegetation that cannot be quickly replaced. Second, experience has proven that vegetation alone is usually not sufficient to stop erosion on the lower portion of eroding streambanks. The frequency of flow prevents establishment of most vegetation at or below the water surface resulting in the toe of the bank continuing to erode and then eventually causing the upper bank to fail as it is undercut, and sloughing occurs.
Biodegradable material, such as Coir Rolls and Turf Re-enforcement Mats are effective but have a relatively short life before they are compromised unless a hardened toe using stone or other inert material is included for long term stability.
Additionally, experience has also taught that if the lower portion, the toe, of the eroding bank is stabilized with non-erodible material (i.e. stone) the upper bank will stabilize naturally.

Two major approaches are left for consideration to stabilize the eroding banks.

1. **Stone Toe Protection (STP):** Each eroding bank can be protected with non-erodible materials. Typically, meandering bends like those in the Friends Creek watershed can be stabilized by placing the hard armor only on the toe of the bank. The most common method is to use quarry stone properly sized to resist movement and placed on the lower one third of the bank in a windrow fashion. This technique is called Stone Toe Protection (STP) and is widely accepted and successful.
   There are three obstacles to overcome in this watershed to make use of STP successful. First, some of the bends in the channel are “unstable” having a radius of curvature less than 1.5 times the channel width. Research has shown that bends with a radius of less than about 1.8 times the bankfull width are unstable and tend to “cutoff”. To use STP successfully under these conditions the channel would need to be “realigned” in order to produce a radius of curvature that falls within the range of “stable” geometric planforms. Installing STP without making these channel adjustments would be to risk failure of the STP and encourage channel cutoffs leaving the STP application in an “abandoned” reach of channel.

Second, the total amount of eroding bank will require many sections of the stream to have STP on one side or the other, resulting in extensive use of STP and a very costly application.



NRCS Standard Drawing of Stone Toe Protection

2. **Rock Riffle Grade Control (RR):** Use of loose rock grade control structures at the "natural" riffle locations in a stream will create or enhance the "riffle-pool" flow sequence found in natural channels. In stable systems this alternating "riffle-pool" sequence dissipates the energy in the stream and allows the streambanks to remain stable with little or no appreciable lateral movement. By installing Rock Riffles in an incised channel, the riffles will raise the water surface elevation resulting in lower effective bank heights, which increases the bank stability by reducing the tractive force on the banks. **Research has found that stable streams have a riffle every 5 to 7 bankfull widths and that at this natural spacing the stream is still able to transport the sediment generated in the watershed. This is crucial because failure to be able to transport sediment would result in the channel filling with sediment and loosing its capacity.** Such stable streams therefore have a well-developed floodplain at the one to two-year return interval discharge rate. Thus, the flows larger than this go "out-of-bank" and dissipate excess energy over a wide floodplain, allowing the banks to remain stable and intact.

   In Friends Creek watershed 70% all the cross sections evaluated are now well connected to floodplain. Only Friends Creek Reach 003 and Tributaries 1, 2 and 3 are in need of Rock Riffle Grade Controls.

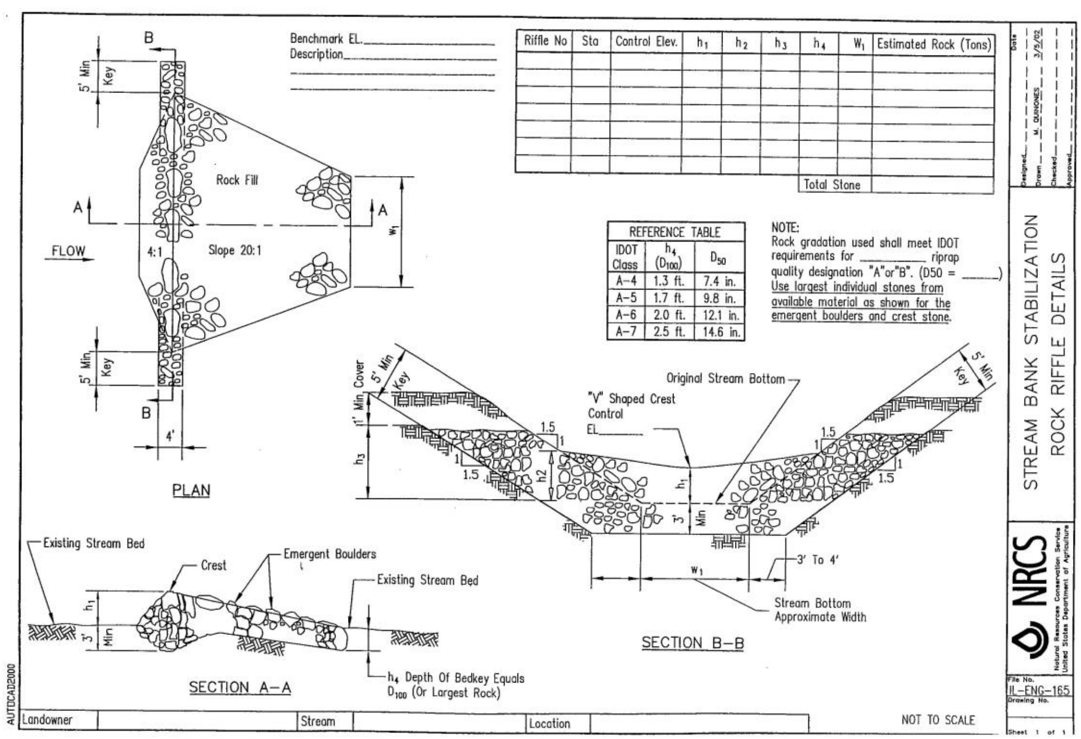
   However, Rock Riffles have other benefits as well as controlling channel incision. These benefits include creating "riffle-pool" sequences where pool depth is increased resulting in improved aquatic habitat. These deeper pools also serve as energy dissipaters and reduce the erosive forces on the banks resulting in more stable banks.

To most observers it would appear that adding a rock riffle to a stream that is already connected to its floodplain, would increase the flooding frequency. However, in low gradient streams, such as Friends Creek, Friends Creek Ditch and North Branch this is not necessarily the case as velocity is increased immediately downstream of each riffle crest. This increase in velocity therefore can compensate for the reduced velocity in the deepened pools resulting in NO INCREASED flood frequency.

That leaves us to consider the effect of Rock Riffles on sediment transport. Riffles at the 5 to 7 bankfull width spacing tend to pass most sediment through the system, however the heavier material, sand and gravel, are more difficult and may be deposited in the pool above the riffle. The silt and clay will almost certainly be transported and will not cause a problem with stream capacity. Even Riffles spaced much, much wider than the 5 to 7 bankfull widths have been proven to pass silt and clay. However, sand and or gravel depositing in the pool areas may require removal at some point to maintain the designed pool depth and channel capacity.

Therefore, Rock Riffles will be applicable in the Friends Creek Watershed under three conditions.

1) Each potential site would require careful design limits to ensure that the proposed riffle height would NOT increase flood frequencies. Preliminary hydraulic calculation indicate riffle heights of 1 to 3 ft. are possible.
2) Riffles would need to be located where there would be no backwater on existing tile outlets. In some reaches this limitation may preclude any riffle construction.
3) Riffles should be monitored to determine the material being deposited in the pools, a long-term maintenance expense of removing sand and gravel should be evaluated during the early stages of implementation.



NRCS Standard Drawing for Rock Riffle Grade Control

Comparison of Advantages and Disadvantages to Stone Toe Protection and Rock Riffles

Comparing these two alternative treatments to stabilizing streambanks there are pros and cons to each.

STP Pros:

a. STP provides continuous bank protection to an eroding bank.
b. STP requires minimal survey and design
c. STP is very effective and has a long life

STP Cons:

a. STP requires access along the entire eroding reach, which generally requires partial removal of the trees on the top bank for equipment access.
b. STP is usually more expensive when expressed as cost per foot of bank treated.

Rock Riffle Pros:

a. Riffles are usually less expensive when expressed as cost per foot of bank treated.
b. Riffles improve aquatic habitat
c. Riffles only require access to the stream at a single location per riffle, reducing the amount of tree removal needed for equipment access.

Rock Riffle Cons:

a. Riffles do not provide continuous bank protection; therefore, some bank erosion may continue between riffles.
b. Riffles require more extensive survey and design procedures.
c. Riffles may not be feasible in some locations due to tile outlets near the flow line.
d. Riffles may require periodic removal of bedload from the pool areas.
e. Construction requires more training of installation contractors to insure design standards are met.

Brief Narrative of Stream Segments and Treatment Recommendations

This section will further subdivide Friends Creek (FC), Friends Creek Ditch (FCD), North Tributary (NB), Kickapoo Creek (KP) and the Tributaries T1 thru T3 into stream reaches. Each reach on each stream will be labeled from downstream to upstream beginning with segment “001” progressing to segment “002” progressing to segment “003”, etc. until reaching the upstream end of the recommendations. As an example, Reach Code FC001 would be the most downstream segment of Friends Creek and Reach Code FC003 would be located two stream segments upstream.

To make the recommendations as clear as possible each stream is discussed in a separate section. Each stream section will have:

a) Table of each inventoried stream bank with location, length, erosion level, etc.
b) Table of each class of erosion within each Reach Code with a summary by reach code
c) Summary table of the cross sections foe each stream
d) Profile of the stream generated from USGS Topographic maps/
e) Printouts of “USGS Streamstats” for each cross section
f) Printouts of calculations from NRCS Stream Stabilization I&E Forms

Summary Table of Treatment Options for All Segments

Treatment options for streams in the Friends Creek inventory area have been prepared in Fig. 12-14 for three levels of treatment for comparison purposes. Since 100% treatment is unrealistic, even with ample funding when working on private property, a 75% participation rate is used as an optimistic participation level, but a good goal.
Next, each Stream Reach was assessed as to the most applicable treatment option. But several factors need to be emphasized to properly understand the estimated cost and benefits.
Fig. 12 shows that to treat 75% of the entire area judges to have Moderate Erosion would cost about $2.18 million to treat with Stone toe Protection and costs are broken down by Stream Reach.
Fig. 13 shows the treatment cost for 75% of the entire area judged to have Severe or Very Severe Erosion with Stone Toe Protection would cost about $2.28 million.
Fig. 13 also shows the cost of installing Rock Riffles in each Stream Reach Code, but these figures include 100% of the total study area as Rock Riffles create "pools" to dissipate energy and reduce erosion in the entire reach between each Riffle. Therefore 100% participation of landowners may not be required, although some agreement to allow the "pools" to cross property lines may be needed. The cost to install Rock Riffles on the entire study reach, where applicable, would cost an estimated $2.42 million. As discussed in the section of this report about the advantages and disadvantages of STP and Rock Riffles, the STP will be more effective in this watershed, first because downcutting and incision is limited to a few areas and secondly because STP provides continuous bank protection where installed, effectively stopping all erosion.
However, Riffles would potentially treat the entire study reach at about half the cost of STP on both Moderately and Severely eroding Stream Reaches. Some lateral erosion would likely still need to be treated with STP in addition to the Riffles to fully stabilize streambanks in some areas, but probably only in the more severe cases.
Fig. 14 shows in the last two columns the cost per ton of sediment reduced (once again assuming 100% control) and the cost per year with a 25-yr. life of the treatment assumed.
These figures assume the cost of doing both STP and Rock Riffles throughout the watershed, but if Rock Riffles are constructed the amount of STP could realistically be reduced by 50% which would reduce the cost per ton of sediment saved by about one third.

Finally, this inventory did not record every tile outlet elevation, nor did it calculate the "maximum permissible" riffle height at every location. There are locations where Riffles will not be feasible, and the height of the riffles will determine their effectiveness in each reach. The treatment options and cost provided in this section will in fact become a combination of both STP and Riffles that will be site specific and cannot be accurately expressed without detailed investigations at each proposed site. Fig. 12-14 should be viewed as the maximum treatment level with maximum cost associated and can best be used to show relative cost between Stream Reaches to help target resources.

Estimated Treatment Cost										
Stream Summary Table		By Reach Code						Feet	Tons	Mod. Erosion
Stone Cost $75 t		STP	Stone per	*None or Low	Treatment	*Moderate	Treatment	STP	Stone	STP Cost
Stream Name	Reach Code	Ton/Ft	Riffle	Erosion (Ft)	None	Erosion (Ft)				
Friends Creek	1	1	n/a	11,401ft.	None	3,837 ft.	STP	2877	2877	$215,775
	2	1	350	15,280 ft	None	5160 ft	STP	3870	3870	$290,250
	3	none	300	912 ft.	None	0 ft.	None	0	#VALUE!	$0
	4	n/a	n/a	8,756 ft.	None	0 ft.	None	0	#VALUE!	$0
	5	0.75	300	6,889 ft.	None	7,386 ft.	STP	5540	4155	$311,625
	6	0.75	200	15,020 ft.	None	3,951 ft.	Riffles	2950	2212.5	$165,938
	7	0.6	200	10,131 ft.	None	4,680 ft.	Riffles	3500	2100	$157,500
	8	0.6	100	21,930 ft.	None	7,020 ft.	Riffles	5250	3150	$236,250
Friend's Ck. Ditch	1	0.75	175	7,128 ft.	None	2,100 ft.	Riffles	1550	1162.5	$87,188
	2	0.75	175	8,436 ft.	None	503 ft.	Riffles	375	281.25	$21,094
	3	0.75	175	19,947 ft.	None	4,368 ft.	Riffles	3276	2457	$184,275
	4	0.75	150	5,481 ft.	None	651 ft.	Riffles	500	375	$28,125
North Branch	1	0.75	125	5,951 ft.	None	1,848 ft.	STP	1386	1039.5	$77,963
	2	0.75	150	5,398 ft.	None	555 ft.	STP	400	300	$22,500
	3	0.75	175	1595 ft.	None	279 ft.	Riffles	200	150	$11,250
	4	0.6	150	23,747 ft.	None	3,156 ft.	STP	2350	1410	$105,750
	5	0.6	125	26,326 ft.	None	4,203 ft.	STP	3150	1890	$141,750
	6	0.6	125	17,064 ft.	None	339 ft.	STP	250	150	$11,250
Kickapoo Creek	1	0.6	125	11,528 ft.	None	495 ft.	STP	350	210	$15,750
	2	0.5	n/a	9,698 ft.	None	174 ft.	STP	125	62.5	$4,688
Tributary 1	1	0.5	100	18,704 ft.	None	2,925 ft.	Riffles	2200	1100	$82,500
Tributary 2	1	0.5	200	5591 ft.	None	120 ft.	STP	90	45	$3,375
Tributary 3	1	0.5	175	14,144 ft.	None	384 ft.	STP	275	137.5	$10,313
	Total									$2,185,106

Fig. 12

Estimated Treatment Cost											
Stream Summary Table	By Reach Code					Feet	Tons	Hi Erosion		Tons	Riffle
		*High	Treatment	STP	Stone per	STP	Stone	STP Cost	No. Riffles	Stone	Cost*
Stream Name	Reach Code	Erosion (Ft)		Ton/Ft	Riffle						
Friends Creek	1	4,086	STP	1	n/a	3064.5	3065	$229,838	n/a		
	2	5,220	STP	1	350	3915	3915	$293,625	6	2100	$157,500
	3	1,200	Riffles&STP	none	300	900	0	o	2	600	$45,000
	4	0	None	n/a	n/a	0	0	$0	n/a	0	$0
	5	3,465	STP	0.75	300	2598.75	1949	$146,180	4	1200	$90,000
	6	6,585	Riffles	0.75	200	4938.75	3704	$277,805	6	1200	$90,000
	7	4,725	Riffles	0.6	200	3543.75	2126	$159,469	10	2000	$150,000
	8	2,730	Riffles	0.6	100	2047.5	1229	$92,138	15	1500	$112,500
Friend's Ck. Ditch	1	4,434	Riffles	0.75	175	3325.5	2494	$187,059	6	1050	$78,750
	2	1,671	Riffles	0.75	175	1253.25	940	$70,495	5	875	$65,625
	3	1,557	Riffles	0.75	175	1167.75	876	$65,686	11	1925	$144,375
	4	1,260	Riffles	0.75	150	945	709	$53,156	3	450	$33,750
North Branch	1	2,445	STP	0.75	125	1833.75	1375	$103,148	9	1125	$84,375
	2	489	STP	0.75	150	366.75	275	$20,630	6	900	$67,500
	3	132	Riffles	0.75	175	99	74	$5,569	1	175	$13,125
	4	1,503	STP	0.6	150	1127.25	676	$50,726	24	3600	$270,000
	5	2,313	STP	0.6	125	1734.75	1041	$78,064	27	3375	$253,125
	6	549	STP	0.6	125	411.75	247	$18,529	15	1875	$140,625
Kickapoo Creek	1	2,445	STP	0.6	125	1833.75	1100	$82,519	24	3000	$225,000
	2	54	STP	0.5	n/a	40.5	20	$1,519	0	0	$0
Tributary 1	1	4,665	Riffles&STP	0.5	100	3498.75	1749	$131,203	15	1500	$112,500
Tributary 2	1	6327	Riffles&STP	0.5	200	4745.25	2373	$177,947	15	3000	$225,000
Tributary 3	1	1206	Riffles&STP	0.5	175	904.5	452	$33,919	5	875	$65,625
Total								$2,279,222			$2,424,375
* Riffle Cost is for entire study reach (36+ miles)											

Fig. 13

Estimated Treatment Cost								
Stream Summary Table		By Reach Code						Cost
			Mod. Erosion	Hi Erosion	Riffle	Total	Cost per	Ton/Yr.
		Tons	STP Cost	STP Cost	Cost*	Cost	Ton	25 yr. life
Stream Name	Reach Code	Sediment					Sediment	
Friends Creek	1	405	$215,775	$229,838		$445,613	$1,100.28	$44.01
	2	514	$290,250	$293,625	$157,500	$741,375	$1,442.36	$57.69
	3	210	$0	$0	$45,000	$45,000	$214.29	$8.57
	4	0	$0	$0	$0	$0	$0.00	$0.00
	5	492	$311,625	$146,180	$90,000	$547,805	$1,113.42	$44.54
	6	578	$165,938	$277,805	$90,000	$533,742	$923.43	$36.94
	7	368	$157,500	$159,469	$150,000	$466,969	$1,268.94	$50.76
	8	228	$236,250	$92,138	$112,500	$440,888	$1,933.72	$77.35
Friend's Ck. Ditch	1	315	$87,188	$187,059	$78,750	$352,997	$1,120.63	$44.83
	2	122	$21,094	$70,495	$65,625	$157,214	$1,288.64	$51.55
	3	199	$184,275	$65,686	$144,375	$394,336	$1,981.59	$79.26
	4	84	$28,125	$53,156	$33,750	$115,031	$1,369.42	$54.78
North Branch	1	176	$77,963	$103,148	$84,375	$265,486	$1,508.44	$60.34
	2	42	$22,500	$20,630	$67,500	$110,630	$2,634.04	$105.36
	3	16	$11,250	$5,569	$13,125	$29,944	$1,871.48	$74.86
	4	168	$105,750	$50,726	$270,000	$426,476	$2,538.55	$101.54
	5	185	$141,750	$78,064	$253,125	$472,939	$2,556.43	$102.26
	6	26	$11,250	$18,529	$140,625	$170,404	$6,553.99	$262.16
Kickapoo Creek	1	147	$15,750	$82,519	$225,000	$323,269	$2,199.11	$87.96
	2	6	$4,688	$1,519	$0	$6,206	$1,034.38	$41.38
Tributary 1	1	94	$82,500	$131,203	$112,500	$326,203	$3,470.25	$138.81
Tributary 2	1	216	$3,375	$177,947	$225,000	$406,322	$1,881.12	$75.24
Tributary 3	1	26	$10,313	$33,919	$65,625	$109,856	$4,225.24	$169.01
			$2,185,106	$2,279,222	$2,424,375	$6,888,703		

Fig. 14

Of equal importance in selecting priorities will be the interest of the local landowners to participate in these treatment options. An effort to educate the landowners on the findings of this report and determine possible interest in treatment options would be in order.

Finally, these recommendations are preliminary and concern sediment delivery to Lake Decatur and stream conditions in the watershed. These recommendations are not intended to represent a construction plan or design on which to begin implementation. The recommended next step is to determine interest in pursuing treatment options and then proceeding into a design phase that can provide the detail required to develop engineering plans and designs.

Friends Creek Description

Streambank erosion on Friends Creek contributes over 50% of the total sediment load delivered from channel erosion in this watershed. The inventory stopped at East Washington St. where Friends Creek becomes a managed drainage ditch. Below Washington St. the channel has been modified at numerous places, however there is a riparian corridor along the entire inventoried portion of mostly woody vegetation.
The sections that have been modified are typically nearly straight and have fewer sand and gravel bars present. However, the segment immediately below these sections often are the segments with the most sand and gravel bars. This pattern is repeated going downstream until approximately 2000 ft. below Parr Road where the bedload of sand and gravel begins to dominate the stream. Photos 1 thru 4 depict the large bedload deposits beginning about 4000 ft. above the confluence of Friends Creek and the Sangamon River. Downstream of Photo 1 the heavy bedload is no longer present as the gradient and backwater effects from the Sangamon prevent the heavy bedload from being transported beyond this point.
There is one other section of extremely heavy bedload deposits just above Dantown Road (Photos 6 and 7).
The recommendation for these reaches is to delay any efforts to stabilize the streambank erosion until the bedload quantities are substantially reduced by stabilizing eroding streambanks on the remainder of Friends Creek and Tributaries.
All other reaches of Friends Creek can and should be stabilized using Stone Toe Protection or Rock Riffle Grade Controls to reduce both the silt and clay sediment that reaches Lake Decatur and the Sand and Gravel that is creating the lateral erosion around sand and gravel bars and fallen trees.
Friends Creek Reach Codes 003, 005, 006 and 007 are ranked as high priority reaches for bank stabilization. (See map)

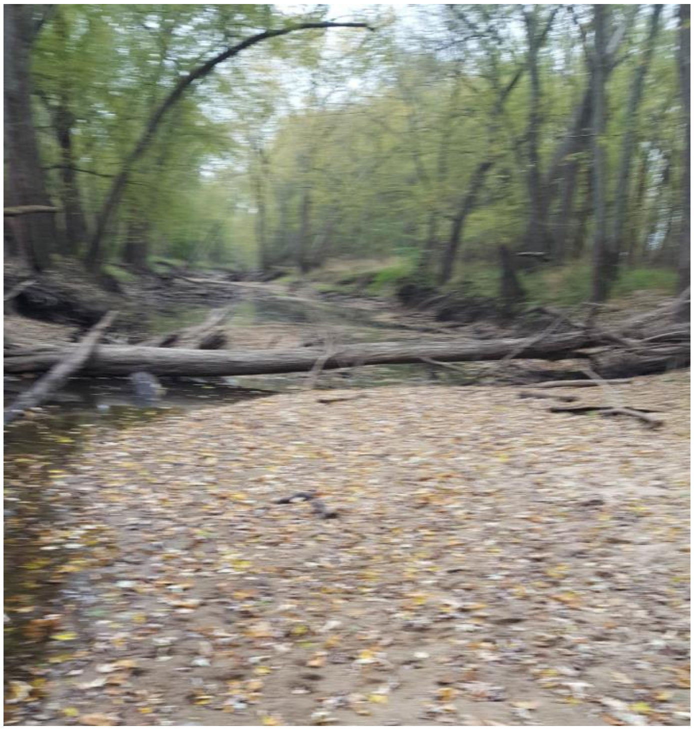


Photo 1: Large gravel deposit at lower end of Friends Creek (Reach 001)

Photo 2: Friends Creek large gravel deposits near lower end (Reach 001)


Photo 3: Wide bedload laden Friends Creek near lower end (Reach 001)


Photo 4: Heavy bedload above Jordon Road (Reach 002)


Photo 5: Constructed channel cutoff below I-72 with severe erosion (Reach 003)

Photo 6: Logjams in creek above Dantown Road (Reach 005)


Photo 7: Mid Channel gravel bars above Dantown Road (Reach 005)


Photo 8: Typical Friends Creek streambank above Parr Road. Lateral erosion undercutting mature trees, but significantly less bedload. (Photo taken below Rte. 48) (Reach 005)

Photo 9: Typical erosion in upper part of Friends Creek inventory. Woody debris is a problem throughout Friends Creek. (Reach 007)

Friends Creek Ditch Description

Friends Creek Ditch only shows excessive sand and gravel deposits as it joins Friends Creek on the Friends Creek Park property. At this point there is an active channel avulsion in progress. Friends Creek Ditch has large deposits of sand and gravel at the confluence causing flow to overtop the banks and begin to form a new channel that will enter Friends Creek about 800 ft. downstream of the current confluence. This new channel is actively downcutting and getting wider with each flow event.
The priority on Friends Creek Ditch is to stabilize this new channel by enlarging it to carry all the flow and stabilize the bed and banks with Rock Riffles and Stone Toe Protection.
Friends Creek Ditch contributes about 18% of the total sediment load from the watershed. Only Stream Reach Code 001 (See map) ranks as a high priority for streambank stabilization.
Stone Toe and/or Rock Riffles are the recommended treatment for all of Friends Creek Ditch.
The inventory was completed upstream to the Macon County line at Rd. 000E.

Phot 10: New channel forming at confluence Friends Creek ditch and Friends Creek (Reach 001)

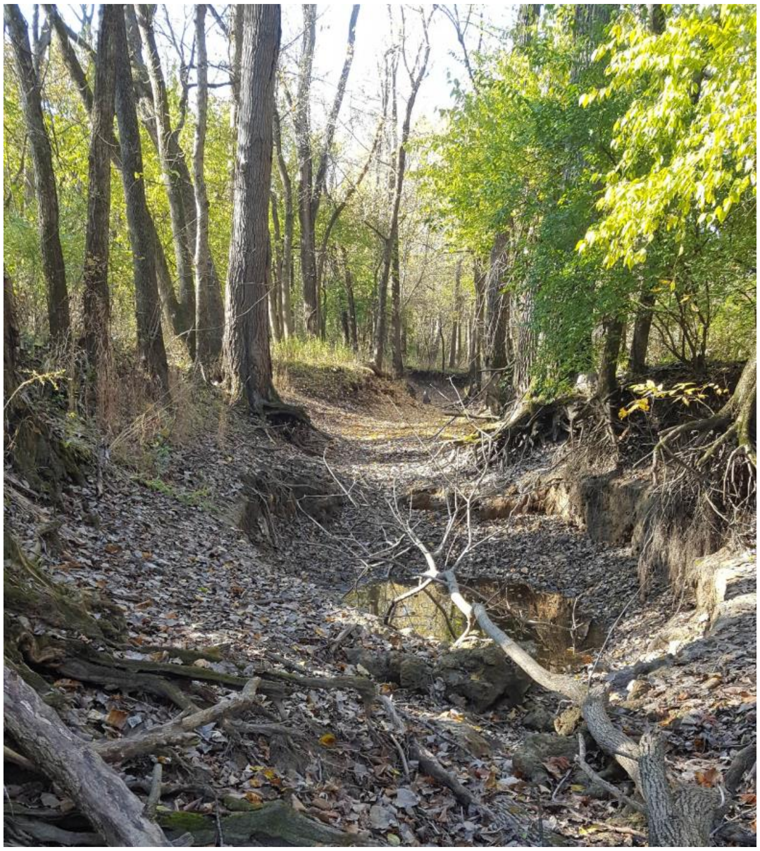


Photo:11 Upper end of new cutoff channel on Friends Creek Ditch (Reach 001)


Phot 12: Friends Creek Ditch above Friends Creek Park. Stable bed but eroding banks are common. (Reach 002)

Photo 13: Friends Creek Ditch with 1600 ft. of riprap on the bank. (Reach 003)

Photo 14: Upper end of Friends Creek Ditch near Rd. 000E
Note length of tile outlet protruding into stream. (Reach 004)

North Branch Description

North Branch differs from Friends Creek and Friends Creek Ditch in that there are no segments in the inventory that show excessive sand and gravel deposits.
North Branch does have a steeper gradient than Friends Creek or Friends Creek Ditch in the inventoried area. Since soils are like other areas of the watershed it is likely that North Branch lacks the large deposits of sand and gravel because it can carry them to Friends Creek. North Branch contributes about 14% of the total sediment from this watershed.
It is generally connected to its floodplain and only the lower Stream Reach 001 is ranked as a high priority for treatment.
Recommended treatment practices applicable to all North Branch are Stone Toe and Rock Riffles.

Photo 15: Lower end of North Branch in a channelized reach with eroding banks. No downcutting is evident. (Reach 001)

Photo 16: Beaver dam below Washington Street: Note stable banks upstream (Reach 005)

Photo 17: Tile outlet on eroding bank in a pasture on North Branch above Duroc Road. Note tile is near flowline of channel. (Reach 005)

Kickapoo Creek Description

Kickapoo Creek joins North Branch just above Argenta Road and contributes about 4% of the total sediment loading in the watershed. The lower Stream Reach 001 (See map) is ranked as a moderate priority for streambank stabilization while Stream Reach 002 is the lowest priority other than the abandoned oxbow in Friends Creek Stream Reach 004.

Kickapoo Creek is somewhat incised and very sinuous in Reach 001 and has a few very severely eroding bends, but it does not warrant any special consideration.

The recommended treatment for Kickapoos Creek where needed is Stone Toe and/or Rock Riffles.

Severely Eroding bend with exposed tile outlet and fallen trees. (Reach 001)

Trib. 1 Description

Tributary 1 is a very unstable stream with significant degradation occurring in the middle section near the I-72 Rest area. **However**, this tributary enters Friends Creek thru an old oxbow (Friends Creek Reach Code 004) abandoned when the channelization in Reach Code 003 located just downstream of I-72 was completed. Therefore, most of the sediment generated from Trib.1 is deposited in this old oxbow before reaching the active channel of Friends Creek.

While this channel is very unstable it is only ranked as a moderate priority for streambank stabilization due to its low "Sediment Transport Factor" because of the deposition occurring in the abandoned oxbow.

This feature of Trib. 1 makes it a low contributor to the sediment loading of Friends Creek and only contributes about 2% of the total sediment load.

Recommended treatment for Trib. 1 is Rock Riffle Grade Control and Stone Toe.

Photo 18: Beaver Dam on Trib. 1 near I-72 Rest Area

Photo 19: Headcut on Trib. 1 behind I-72 Rest Area


Photo 20: Severely eroding bank on Trib. 1 above Newburg Road

Trib. 2 Description

Tributary 2 enters Friends Creek just below the channelized reach in Reach Code 003 below I-72. This channel is experiencing severe downcutting and unstable banks and ranks as a high priority for streambank stabilization. The recommendation is to install a series of Rock Riffle Grade Control Structures to stabilize the bed and then add Stone Toe Protection as needed to stabilize the remaining banks that continue to erode.

Trib. 2 only contributes about 4.5% of the total sediment load, but it is second only to Friends Creek in sediment delivered per mile of stream at 188 tons/mile.

Photo 21: Deeply incised Tributary #2

Photo 22: Both banks eroding severely on Trib. 2


Photo 23: Headcut on Trib. 2 near the lower end

Trib. 3 Description

Trib. 3 ranks only as a low priority for streambank stabilization and contributes only 1% of the total sediment load. However, there is one segment of Trib. 3 that has a large headcut with some very unstable banks downstream. Even though Trib. 3 is a low priority the stabilization of this headcut is listed as a “preliminary recommendation” and should receive high priority for treatment. If left untreated this headcut will continue to migrate upstream inducing more bank instability.

Photo 24: Upper end of Trib. 3 approx. 150 ft. upstream of headcut.


Photo 25: 3 ft. (+ or -) headcut midway up Trib. 3. Channel is 10 ft. deep and severely eroding.


Photo 26: Trib. 3 downstream of headcut 500 ft. where channel has stabilized and built a new floodplain at a lower elevation.

Attachment B

Abstract

Two streams in Macon County, Illinois, Friends Creek and Friends Creek Ditch, flow through and combine in Friends Creek Conservation Area, continuing to a confluence with the Sangamon River. We surveyed fish assemblages and stream habitat in five sites above, on, and below the conservation area during the summer and fall of 2001. Species diversities, ranging from 0.787-0.951, were highest in an upstream site and a conservation area site. A Canonical Correspondence Analysis accounted for 47% of the fish-habitat variation indicating that the presence and abundance of some species were partially explained by habitat differences. The upstream site with the least similar fish assemblage was also most divergent in habitat structure with increased vegetation and riffle formation. Species such as *Etheostoma flabellare* and *E. spectabile* that are associated with riffles were most abundant at this site. Also, *Lepomis macrochirus*, which prefers deeper pools, was most abundant in the larger combined channel below the conservation area. Although the reduced silt and bank erosion in the conservation area indicated enhanced water and habitat quality, there were few clear associations between fish assemblages and land use effects.

Introduction

Friends Creek is a small stream located northeast of Decatur, Illinois. Approximately 2 km of each of the two approximately 21-km channels are located on Friends Creek Conservation Area, a 422-acre area owned by Macon County Conservation District. Portions of the drainage above and below the park are located on agricultural land. As an example of managed land, this area can be a major concern because the disruption of vegetation and streambanks could increase runoff and sedimentation (Richards et al. 1996).

Basic stream surveys provide information on the interactions of fish and habitat and the effect of these interactions on temporal and spatial fish community variation (Schlosser 1987). Presence/absence and abundance of individual species or groups of species can be strongly associated with specific habitat gradients such as channel morphology (Meffe and Sheldon 1988; Taylor et al. 1993). Instream conditions, however, are frequently influenced by land use in the surrounding watershed. Land-use activities such as agriculture or silviculture can result in changes in channel morphology, water and sediment transport, and energy sources (Schlosser 1991). Any of these factors could alter fish population dynamics and community structure.

The main vegetation types on the conservation area are restored tallgrass prairie and oak-hickory forest. Above and below the conservation area, the streams cross land that is predominately agricultural with few forested tracts. Since Friends Creek is exposed to both agricultural and conservation land use, it provided an opportunity to see if the land conservation influenced stream habitat quality and fish communities.

Materials and Methods

related to environmental features in a Canonical Correspondence Analysis (CCA; ter Braak and Verdonschot 1995) calculated with PC-ORD (McCune and Mefford 1999). CCA is a direct gradient analysis based on multiple regression that indicates the total amount of variation in species and sampling locations that can be explained by the environmental variables (ter Braak and Verdenschot 1995). To lessen the influence of the dominant species, fish abundances were square-root transformed before analysis. To improve normality continuous habitat variables (e.g., conductivity) were log transformed while percentage variable (e.g., large gravel) were arcsin transformed.

Results

A total of 30 species was collected from Friends Creek over the three sampling periods (Table 1). Some species such as *Lythrurus umbratilis* and *Nocomis biguttatus* were found in most sites during each sampling period. Other species, such as *Etheostoma spectabile*, were collected in all three months but were found in only a couple of the sites. The majority of species, however, were relatively uncommon.

Species diversity values in the one of the conservation area sites (H′ = 0.951) and the upstream Creek site (H′ = 0.941) were significantly higher than the other three sites (Table 2). The fish community in Site 3, Friends Creek in the conservation area, was most similar to the community in Site 5 in the combined channel downstream from the conservation area (Figure 2). Shiners such as *Cyprinella spiloptera* and *Hybognathus nuchalis* dominated both sites. Site 1, the upstream Ditch, was also similar to these two sites with comparable abundances of species such as *Luxilus chrysocephalus* and *Lythrurus umbratilus*. Sites 2 and 4, however, were less similar to the other three sites and were the source of nearly all individuals of the darters *Etheostoma flabellare*, *E. nigrum*, and *E. spectabile*.

most abundant in lower sites in June and July before the upper portion of the drainage dried into isolated pools. Finally, another species common only in one site (Site 5), *Lepomis macrochirus*, prefers larger pools that were characteristic of the combined downstream site (Pflieger 1997).

Human alterations of the physical, chemical, or biological properties of streams usually result in changes in the distribution and structure of fish communities (Maret et al. 1997). Both channels, Friends Creek and Friends Creek Ditch, flow across agricultural land, a prime region for surface erosion (Beschta and Platts 1986), before entering the park. In some areas, cropland extends all the way to the top edge of the stream bank so there is the potential for fine sediment to move into the stream by surface erosion or mass wasting. High fine sediment concentrations can negatively impact fish by clogging gills or trapping eggs under sediment deposits (Waters 1995). Site 2 in an agricultural area had the greatest amount of silt but also the second highest fish diversity. Cattle have had access to the channel, however, and may contribute to further degradation of the streambanks, as evidenced by higher bank angles at this site. Increased nutrients from the input of fecal material have led to an increase in algal growth. The algae may provide additional instream cover as well as trapping sediment. The sediment can lead to the creation of riffles, a habitat feature favored by some fish species, such as the darters.

There were no clear patterns suggesting that the conservation area had a positive effect on fish communities in the Friends Creek drainage. While the highest diversity value was in Site 4 in the conservation area, the second highest diversity was in Site 2, the site that was impacted the most by agriculture. Diversity declined in Friends Creek but increased in Friends Creek Ditch as each entered the conservation area. In addition, species richness (number of species) was lowest in the conservation area sites. Because the diversity increased within Friends Creek Ditch, the conservation area may have provided some enhancement. However, since the conservation area

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Table 2. Species richness and Shannon-Wiener diversity for sampling sites in Friends Creek and Friends Creek Ditch in Macon County, Illinois. Values represent all individuals collected from June-October 2001. Numbers in parentheses refer to the locations in Figure 1. In the species diversity column, sites with different letters are significantly different ($p < 0.025$).

Site	Richness	Species diversity
Friends Creek Ditch (1)	20	0.787[a]
Friends Creek (2)	19	0.941[b]
Friends Creek (3)	16	0.855[a]
Friends Creek Ditch (4)	19	0.951[b]
Friends Creek (5)	20	0.839[a]

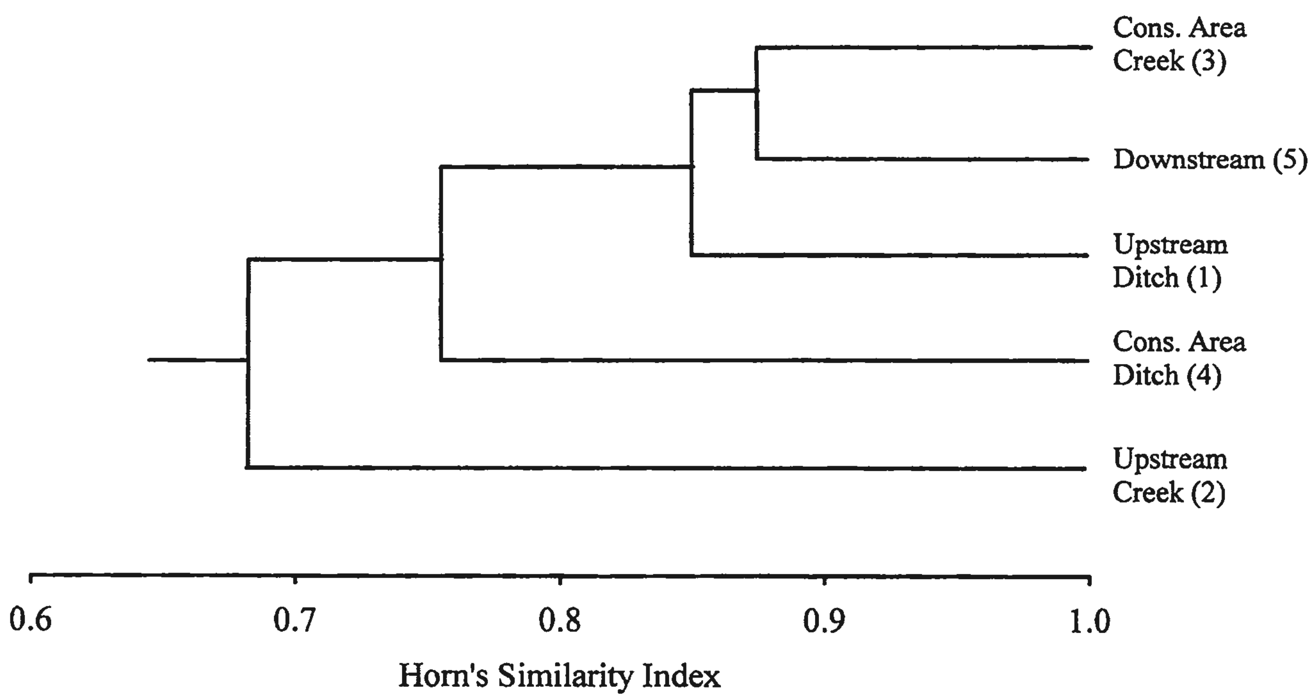
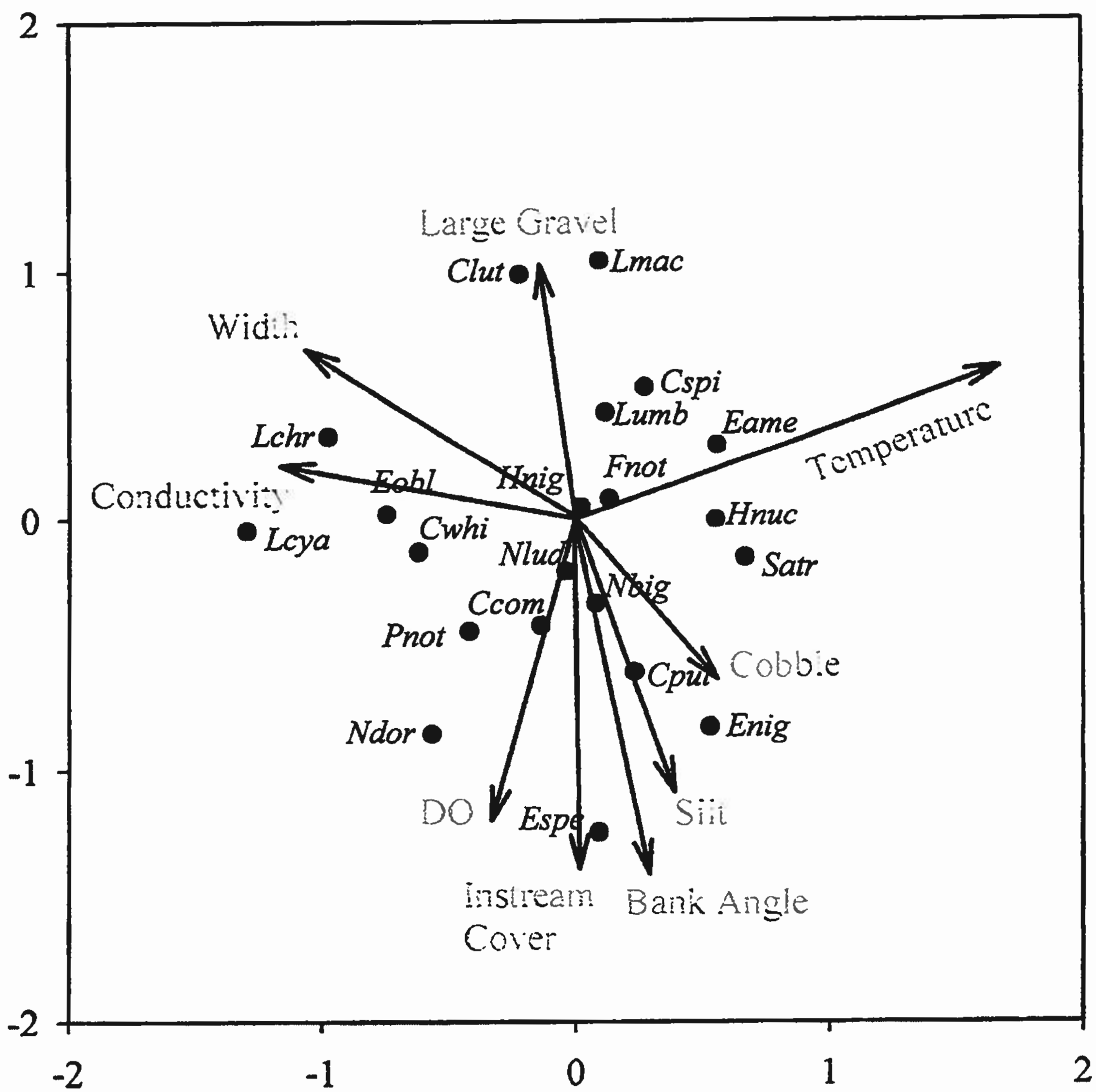


Figure 2. Cluster analysis of Horn's similarity indices for the five sites. Numbers in parentheses refer to locations in Figure 1.



Species List
Ameirus natalis
Aphredoderus sayanus
Campostoma pullum
Catostomus commersoni
Cyprinella lutrensis
Cyprinella spiloptera
Cyprinella whipplei
Erimyzon oblongus
Esox americanus
Etheostoma nigrum
Etheostoma spectabile
Fundulus notatus
Hybognathus nuchalis
Hypentelium nigricans
Lepomis cyanellus
Lepomis macrochirus
Lepomis megalotis
Luxilus chrysocephalus
Lythrurus umbratilis
Nocomis biguttatus
Notropis dorsalis
Notropis ludibundus
Phenacobius mirabilis
Pimephales notatus
Semotilus atromaculatus

Figure 4. Association of fish and environmental gradients in Friends Creek. Species names are abbreviated with the first letter of the genus and the first three letters of the species. Full names are listed to the right.

Attachment C

Freshwater Mussel Survey
Friends Creek and Friends Creek Ditch
Friends Creek County Park
Macon County Conservation District
13 July 2005

Freshwater mussels are important components of stream and river ecosystems. Due to their sensitivity to stream flow and bottom substrate, filter feeding habits, and relative inability to move far in response to environmental stresses, freshwater mussels act as biological indicators of stream condition and biological integrity. Larval mussels require fish hosts for completion of development to adulthood and for dispersal. Many mussels require specific fish host species. Therefore, mussel populations can be indicators of healthy fish populations.

On 8 July 2005, staff from IDNR, MCCD, and volunteers surveyed freshwater mussels at two locations in Friends Creek County Park.

Site #1 was located in Friends Creek up- and downstream of the hiking bridge located just off county road 1900E (T18N, R4E, S7SE). Staff spent 4.0 man-hours searching the stream bottoms for live mussels and dead shell. Visibility was poor but the shallow water and number of staff resulted in samples that likely accurately reflect the current status of mussels in this stream.

Site # 2 was located in Friends Creek Ditch just downstream from the emhoff plant (T18N, R4E, S8SW). Staff spent 4.0 man-hours searching the stream bottoms for live mussels and dead shell.
Visibility was poor but the shallow water and number of staff resulted in samples that likely accurately reflect the current status of mussels in this stream.

At both sites, mussels were identified to species and counted. Live individuals were returned to the stream of collection and dead shell was collected for voucher specimens. All vouchers will be deposited in the Illinois Natural History Survey Mollusk Collection.

Attachment D
banding data (Friends Creek information is highlighted in yellow)

Species Handled	Number	Origin of Specimen	Disposition (released, destroyed, donated to what institution)
American Goldfinch (Carduelis tristis)	12	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
American Goldfinch (Carduelis tristis)	9	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
American Goldfinch (Carduelis tristis)	11	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
American Goldfinch (Carduelis tristis)	7	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Black-capped Chickadee (Poecile atricapilus)	6	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Black-capped Chickadee (Poecile atricapilus)	40	Ft. Daniel Cons. Area., Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Black-capped Chickadee (Poecile atricapilus)	29	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Black-capped Chickadee (Poecile atricapilus)	27	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Brown-headed Cowbird (Molothrus ater)	6	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Brown-headed Cowbird (Molothrus ater)	12	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Brown-headed Cowbird (Molothrus ater)	5	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Brown-headed Cowbird (Molothrus ater)	35	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Chipping Sparrow (Spizella passerina)	5	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Chipping Sparrow (Spizella passerina)	2	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Downy Woodpecker (Picoides pubescens)	3	Friends Creek Cons. Area., Argenta	Given USGS aluminum band, small blood sample taken, released
Downy Woodpecker (Picoides pubescens)	38	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Downy Woodpecker (Picoides pubescens)	26	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Downy Woodpecker (Picoides pubescens)	16	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Gray Catbird	14	Friends Creek	Given USGS aluminum band, small blood sample taken

(Dumetella carolinensis)		Cons. Area, Argenta	released
Gray Catbird (Dumetella carolinensis)	7	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Dark-eyed Junco (Junco hyemalis)	2	Ft. Daniel, Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Dark-eyed Junco (Junco hyemalis)	8	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
House Finch (Carpodacus mexicanus)	22	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
House Finch (Carpodacus mexicanus)	19	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
House Sparrow (Passer domesticus)	6	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Indigo Bunting (Passerina cyanea)	11	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Indigo Bunting (Passerina cyanea)	5	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Indigo Bunting (Passerina cyanea)	10	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Indigo Bunting (Passerina cyanea)	3	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Northern Cardinal (Cardinalis cardinalis)	12	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Northern Cardinal (Cardinalis cardinalis)	15	Ft. Daniel Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Northern Cardinal (Cardinalis cardinalis)	11	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Northern Cardinal (Cardinalis cardinalis)	16	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Red-bellied Woodpecker (Melanerpes carolinus)	5	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Red-bellied Woodpecker (Melanerpes carolinus)	6	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Red-bellied Woodpecker (Melanerpes carolinus)	9	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Tufted Titmouse (Baeolophus bicolor)	3	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released

(Oporornis formosus)		Envir. Center, Decatur	
Magnolia Warbler (Dendroica magnolia)	1	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, released
Mourning Dove (Zenaida macroura)	3	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Mourning Dove (Zenaida macroura)	1	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Rose-breasted Grosbeak (Pheucticus ludovicianus)	4	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Red-eyed Vireo (Vireo olivaceus)	4	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, released
Olive-sided Flycatcher (Contopus cooperi)	1	Friends Creek Cons. Area, Argenta	Released without banding
White-throated Sparrow (Zonotrichia albicollis)	2	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
White-throated Sparrow (Zonotrichia albicollis)	4	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Brown Thrasher (Toxostoma rufum)	4	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Cedar Waxwing (Bombycilla cedrorum)	1	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, released
Eastern Bluebird (Sialia sialis)	1	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, released
Orchard Oriole (Icterus spurius)	2	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Red-breasted Nuthatch (Sitta canadensis)	2	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Fox Sparrow (Passerella iliaca)	3	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Yellow-breasted Chat (Icteria virens)	3	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, released

Attachment E
Sited (Friends Creek information is highlighted in yellow)

Species Handled	Number	Origin of Specimen	Disposition (released, destroyed, donated to what institution)
American Goldfinch (Carduelis tristis)	2	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
American Goldfinch (Carduelis tristis)	1	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
American Goldfinch (Carduelis tristis)	9	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
American Goldfinch (Carduelis tristis)	11	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Black-capped Chickadee (Poecile atricapilus)	3	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Black-capped Chickadee (Poecile atricapilus)	18	Ft. Daniel Cons. Area., Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Black-capped Chickadee (Poecile atricapilus)	8	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Black-capped Chickadee (Poecile atricapilus)	6	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Brown-headed Cowbird (Molothrus ater)	3	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Brown-headed Cowbird (Molothrus ater)	2	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Brown-headed Cowbird (Molothrus ater)	4	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Chipping Sparrow (Spizella passerina)	5	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Chipping Sparrow (Spizella passerina)	4	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Downy Woodpecker (Picoides pubescens)	1	Friends Creek Cons. Area., Argenta	Given USGS aluminum band, small blood sample taken, released
Downy Woodpecker (Picoides pubescens)	10	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Downy Woodpecker (Picoides pubescens)	8	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Downy Woodpecker (Picoides pubescens)	2	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Gray Catbird (Dumetella carolinensis)	8	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Gray Catbird	2	Rock Springs	Given USGS aluminum band, small blood sample taken, released

(Dumetella carolinensis)		Envir. Center, Decatur	
Dark-eyed Junco (Junco hyemalis)	1	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
House Finch (Carpodacus mexicanus)	27	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
House Sparrow (Passer domesticus)	4	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Indigo Bunting (Passerina cyanea)	14	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Indigo Bunting (Passerina cyanea)	9	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Indigo Bunting (Passerina cyanea)	1	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Indigo Bunting (Passerina cyanea)	4	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Northern Cardinal (Cardinalis cardinalis)	11	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Northern Cardinal (Cardinalis cardinalis)	6	Ft. Daniel Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Northern Cardinal (Cardinalis cardinalis)	6	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Northern Cardinal (Cardinalis cardinalis)	7	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Red-bellied Woodpecker (Melanerpes carolinus)	1	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Red-bellied Woodpecker (Melanerpes carolinus)	3	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Red-bellied Woodpecker (Melanerpes carolinus)	2	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Tufted Titmouse (Baeolophus bicolor)	1	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, small blood sample taken, released
Tufted Titmouse (Baeolophus bicolor)	18	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Tufted Titmouse (Baeolophus bicolor)	12	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Tufted Titmouse (Baeolophus bicolor)	4	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released

		Decatur	
Eastern Wood Pewee (Contopus virens)	1	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, released
European Starling (Steruns vulgaris)	1	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Field Sparrow (Spizella pusilla)	2	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Hermit Thrush (Catharus guttatus)	3	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, released
Hermit Thrush (Catharus guttatus)	1	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, released
Kentucky Warbler (Oporornis formosus)	3	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, released
Magnolia Warbler (Dendroica magnolia)	3	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, released
Mourning Dove (Zenaida macroura)	3	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Mourning Dove (Zenaida macroura)	5	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Nashville Warbler (Vermivora ruficapilla)	2	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, released
Rose-breasted Grosbeak (Pheucticus ludovicianus)	1	Rock Springs Envir. Center, Decatur	Given USGS aluminum band, small blood sample taken, released
Red-eyed Vireo (Vireo olivaceus)	1	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, released
Red-winged Blackbird (Agelaius phoeniceus)	10	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, small blood sample taken, released
Red-winged Blackbird (Agelaius phoeniceus)	5	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Summer Tanager (Piranga rubra)	1	Ft. Daniel Cons. Area, Mt. Zion	Given USGS aluminum band, small blood sample taken, released
Swainson's Thrush (Catharus ustulatus)	2	Friends Creek Cons. Area, Argenta	Given USGS aluminum band, released
Swainson's Thrush (Catharus ustulatus)	1	Sand Creek Cons. Area, Decatur	Given USGS aluminum band, released
White-crowned Sparrow (Zonotrichia leucophrys)	2	Sand Creek Cons. Area Decatur	Given USGS aluminum band, small blood sample taken, released

Attachment F

ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Nutrient loss reduction:

Using science to find the right practices for your field

IWRC ILLINOIS WATER RESOURCES CENTER

UNIVERSITY OF ILLINOIS EXTENSION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Illinois Department of Agriculture

While no single practice will be suitable for every acre in Illinois, every single acre needs at least one new practice.

Nutrient loss and water quality

Every year, more than 400 million pounds of nitrate-nitrogen and around 38 million pounds of total phosphorus from Illinois fields, city streets, factories, and wastewater treatment plants flow into the Mississippi River. When these nutrients reach the Gulf of Mexico, they jump-start algal growth, creating massive blooms that consume oxygen when they decompose each summer. The result is a hypoxic zone roughly the size of Connecticut that is all but devoid of aquatic life. Illinois is one of the largest contributors to this "dead zone."

Algal blooms and high nutrient concentrations here at home also lower property values, hinder recreation, threaten public health, and require utilities to install costly drinking water treatment technologies.

Illinois' strategy

The Illinois Nutrient Loss Reduction Strategy outlines a suite of required and recommended practices for sewage districts and municipalities and recommended practices for the agricultural industry. Finalized in 2015, the strategy builds on existing state and industry programs and aligns with the results of a comprehensive science assessment of current nutrient loads and cost-effective nutrient loss reduction options. Combined practices are expected to cut phosphorus and nitrogen loading to rivers by 45 percent. Illinois is one of 12 states in the Mississippi River Basin implementing nutrient loss reduction plans.

Agricultural practices

The challenge for those working in agriculture is to adopt the nutrient loss reduction practices appropriate to their operations and to demonstrate that strategy goals can be met with voluntary action without regulation. Fortunately, the science assessment at the heart of the Illinois Nutrient Loss Reduction Strategy provides guidance on where and when practices will yield the highest cost efficiencies.

Practice effectiveness and cost

In–field management practices **Edge–of–field structural practices** **Land use changes**

Nitrogen loss reduction practices	Reduction	Cost per acre	Cost efficiency in $ per lb N saved
Reducing N application rate from the background rate to the rate giving the Maximum Return to Nitrogen on 10% of acres	10%	–$8*	–$4.25
Nitrification inhibitor for all fall-applied fertilizer on tile-drained corn acres	10%	$7	$2.30
Split N application to 50% fall and 50% spring on tile-drained corn acres	7.5–10%	$17	$6.20
Split N application to 40% fall, 10% pre-plant, and 50% side dress	15–20%	$17	—
Spring only N application on tile-drained corn acres	15–20%	$18	$3.20
Cover crops on all corn/soybean tile-drained acres	30%	$29	$3.20
Cover crops on all corn/soybean non-tiled acres	30%	$29	$11.00
Bioreactors on 50% of tile-drained acres	25%	$17	$2.20
Wetlands on 35% of tile-drained acres	50%	$61	$4.00
Buffers on all applicable cropland	90%	$294	$1.60
Perennial/energy crops equal to pasture/hay acreage from 1987 (tiled and non-tiled acres)	90%	$86	$9.30
Perennial/energy crops on 10% of tile-drained acres	90%	$86	$3.20

**Cost savings*

Phosphorus loss reduction practices	Reduction	Cost per acre	Cost efficiency in $ per lb P saved
Change conventional tillage to conservation tillage or no-till on 1.8 million acres eroding at greater than the soil T value	50%	–$17*	–$16.60
P application rate reduction on fields with soil test P levels above the recommended maintenance level	7%	–$8*	–$48.80
Cover crops on all corn/soybean tile-drained acres	30%	$29	$130
Cover crops on 1.6 million acres eroding at greater than the soil T value and currently in conservation tillage or no-till	50%	$29	$24.50
Wetlands on 25% of tile-drained acres	0%	—	—
Buffers on all applicable cropland	25–50%	$294	$12.00
Perennial/energy crops equal to pasture/hay acreage from 1987 (tiled and non-tiled acres)	90%	$86	$102
Perennial/energy crops on 1.6 million acres eroding at greater than the soil T value and currently in conservation tillage or no-till	90%	$86	$40.40
Perennial/energy crops on 10% of tile-drained acres	50%	$86	$250

**Cost savings*

What may be right for your farm?

Combining multiple practices can provide extra benefit

Do you have tile-drained land?

Yes → **Nitrogen** loss in tile drainage water is likely the bigger priority.

Are you interested in changing how you do things in-field?

Yes →

TRY

- A **new nitrogen application strategy** like a nitrification inhibitor, moving fall applications to spring, or side-dressing nitrogen.
- Planting **cover crops** in the fall to retain nitrogen in your field over the winter.
- Growing a **perennial or energy crop** to take up nitrogen during times of the year when annuals cannot.

No →

TRY

- Installing a **woodchip bioreactor** at the edge of your field to convert nitrogen in tile water to benign nitrogen gas.
- Constructing a **wetland**, which not only removes nitrogen from drainage water but also provides flood retention and wildlife habitat.

No → **Phosphorus** loss from soil erosion is likely the bigger priority.

Are you interested in changing how you do things in-field?

Yes →

TRY

- **Conservation tillage or no-till**, which helps keep the soil protected so erosion, and thus phosphorus loss from your field, is reduced.
- Planting a **cover crop** in the fall to hold soil in place over the winter, thus reducing erosion and phosphorus loss.
- Reducing your **phosphorus application rate** when a soil test indicates you're above the recommended maintenance level.
- Growing a **perennial or energy crop** to protect the soil and reduce erosion and phosphorus losses during times of the year when annuals cannot.

No →

TRY

- Planting **buffers** to help catch sediment and sediment-bound nitrogen and phosphorus before water runoff reaches streams.

Developed by: Dr. Laura Christianson, Crop Sciences, University of Illinois
Illinois Water Resources Center

Attachment G **BMP Landowner Survey 2019**

Consider the following BMPs and then anser the questions below:

a. Cover Crops
b. Nutrient Management
c. Filter Strips
d. Grassed Waterways
e. No-Till / Strip Till
f. Drainage Water Management
g. Bioreactors
h. Sediment Basins
i. Streambank Stabilization

Question 1 **What BMPs have you already adopted? Please write the letter of each BMP that applies.**

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**
Response 1	X	X	X	X	X	X			
Response 2			X	X	X				
Response 3	X	X	X	X	X	X			
Response 4				X	X	X			
Response 5			X						
Response 6	X	X	X	X	X				
Response 7		X	X	X	X				X
Response 8						X		X	
Response 9					No response				
Response 10				X					
Response 11	X		X	X	X	X			
Response 12				X				X	
Response 13	X			X	X				
Response 14	X	X	X	X	X				
Response 15		X	X	X					
SUM	**6**	**6**	**9**	**12**	**9**	**5**	**0**	**2**	**1**

Question 2	What BMPs are you likely to adopt? Please write the letter of each BMP that applies.								
	a	b	c	d	e	f	g	h	i
Response 1									X
Response 2					No response				
Response 3					No response				
Response 4			X				X	X	
Response 5					No response				
Response 6					No response				
Response 7	X								
Response 8	X								
Response 9					No response				
Response 10					No response				
Response 11		X							
Response 12	X				X				X
Response 13	X				X				
Response 14	X	X	X	X	X	X		X	X
Response 15	X								
SUM	**6**	**2**	**2**	**1**	**3**	**1**	**1**	**2**	**3**

Question 3	Which BMPs are you NOT comfortable adopting? Please write the letter of each BMP that applies.								
	a	b	c	d	e	f	g	h	i
Response 1							X		
Response 2		X					X		
Response 3					No response				
Response 4			X				X	X	
Response 5					No response				
Response 6							X	X	
Response 7						X	X	X	
Response 8					No response				
Response 9					No response				
Response 10					No response				
Response 11							X		
Response 12					No response				

Response 13					Mostly all used as hunting ground.				
Response 14							X		
Response 15					No response				
SUM	**0**	**1**	**1**	**0**	**0**	**1**	**7**	**3**	**0**

Question 4 **Consider your answer(s) to Question 3. What factors have kept you from adopting these BMPs? Check all that apply.**

	Cost	**Time**	**Commidity**	**Risk**	**Need more**	**Tenant/Fa**	**Other**
Response 1	X		X		X		
Response 2					X		
Response 3					X		
Response 4	X				X		
Response 5				No response			
Response 6	X	X	X		X		
Response 7	X		X		X		
Response 8					X		
Response 9				No response			
Response 10				No response			
Response 11							Have other option.
Response 12	X				X		(i) Sangamon River too big.
Response 13	X	X			X		
Response 14	X				X		
Response 15	X						
SUM	**8**	**2**	**3**	**0**	**10**	**0**	**0**

SUMMARY

	TALLY			PERCENTAGE		
	YES	MAYBE	NO	YES	MAYBE	NO
Cover Crops	6	6	0	40%	40%	0%
Nutrient Management	6	2	1	40%	13%	7%
Filter Strips	9	2	1	60%	13%	7%
Grassed Waterway	12	1	0	80%	7%	0%
No-Till / Strip Till	9	3	0	60%	20%	0%
Drainage Water Management	5	1	1	33%	7%	7%
Bioreactors	0	1	7	0%	7%	47%
Sediment Basins	2	2	3	13%	13%	20%
Streambank Stabilization	1	3	0	7%	20%	0%

WHY NOT?	
Cost	8
Time Constraints	2
Low Commodity Prices	3
Too Risky	0
Need More Info	10
Landowner/Tenant Difference	0
Other	Other options / Not feasible