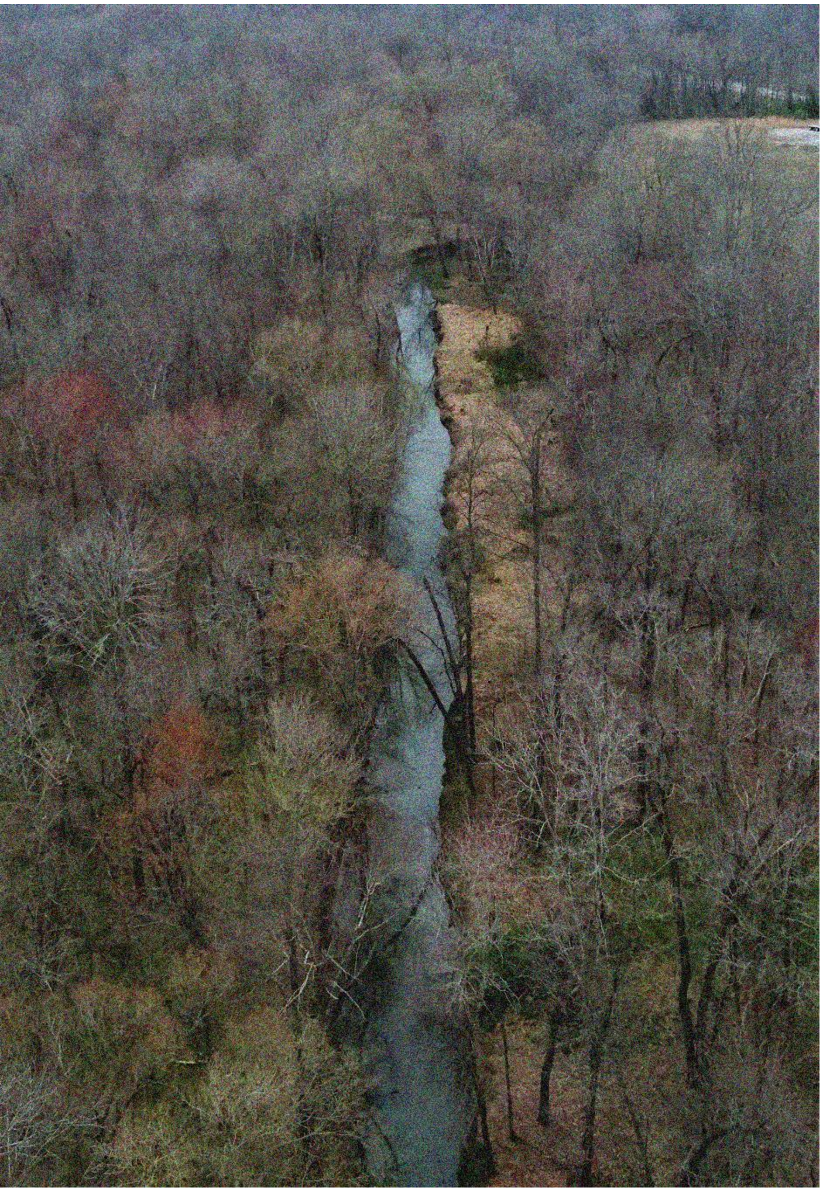
Lake Creek

Watershed-based Plan



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Illinois Environmental Protection Agency

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Pictured on cover: Lake Creek (streamside and aerial), Arrowhead Lake, Railroad Crossing at Confluence of Whiteash Branch and Lake Creek. (Photos by Greater Egypt)

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Acronyms and Abbreviations

ACS	American Community Survey
AISWCD	Association of Illinois Soil and Water Conservation Districts
ALMP	Ambient Lake Monitoring Program
AMA	Agricultural Management Assistance Program
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
CSP	Conservation Stewardship Program
CTA	Conservation Technical Assistance Program
CWA	Clean Water Act
DOI	Department of the Interior
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives program
HUC	Hydrologic Unit Code
ICN	Illinois Climate Network
IDNR	Illinois Division of Natural Resources
IEPA	Illinois Environmental Protection Agency
ISGS	Illinois State Geological Survey
LAUS	Local Area Unemployment Statistics
LRR	Lateral Recession Rate
MCL	Maximum Contaminant Level
MLCG	Maximum Contaminant Level Goal
MRLC	Multi-Resolution Land Characteristics Consortium
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NOAA	National Oceanic and Atmospheric Agency
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWI	National Wetland Inventory
PCB	Polychlorinated Biphenyl
RMMS	Resource Management Mapping Service
SMU	Subwatershed Management Unit
STEPL	Spreadsheet Tool for Estimating Pollutant Loads
SWCD	Soil and Water Conservation Districts
TSS	Total Suspended Solids
USACE	Unites State Army Corps of Engineers
USDA	Unites State Department of Agriculture
USFWS	Unites State Fish and Wildlife Service
USGS	Unites States Geological Survey
VLMP	Volunteer Lake Monitoring Program

Executive Summary

Beginning in early 2017, the Greater Egypt Regional Planning and Development Commission (Greater Egypt) was contracted by the Illinois Environmental Protection Agency (IEPA) to develop a watershed-based plan for the Lake Creek Watershed (071401060502) under Clean Water Act Section 604(b) funding.

The Lake Creek watershed encompasses 21,785 acres, or roughly 34 square miles and is located entirely in Williamson County, Illinois. It is part of the larger Big Muddy River watershed. One city and a single village make up the relatively small population of the watershed. Johnston City constitutes the largest urban environment in the watershed (Figure 1).

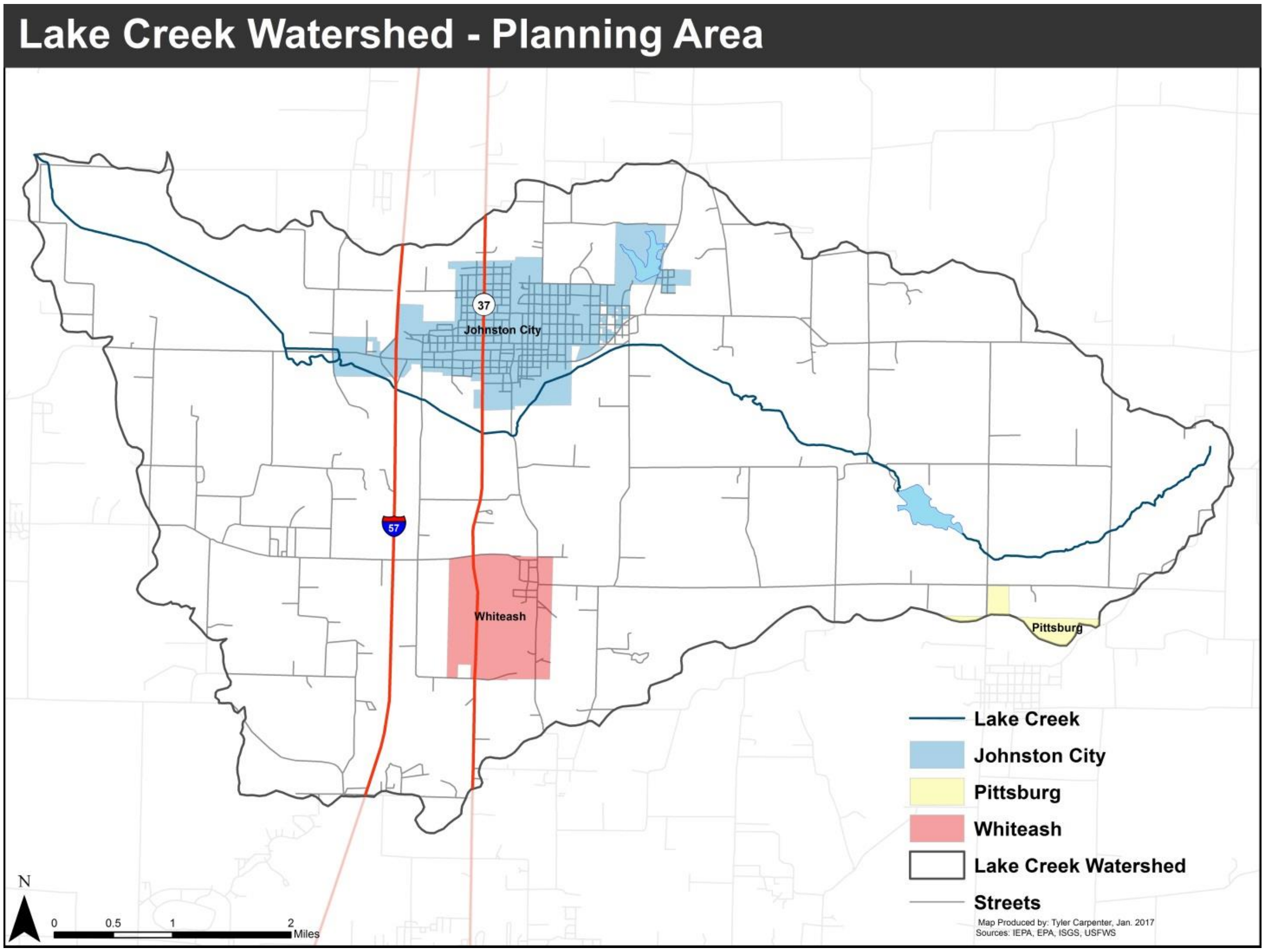
Four waterbodies in the watershed have been placed on the Illinois Environmental Protection Agency's 303(d) List of Impaired Waters. This list is comprised of waterbodies that do not meet water quality standards. In particular, Lake Creek (IL_NGA-02) has been placed on the list for impairments of dissolved oxygen and phosphorus. Beaver Creek (IL_NGAZ-JC-D1) is impaired by manganese and loss of instream cover. Both streams also exhibit impairments of changes in stream depth and velocity patterns.

Two lakes in the watershed are also represented on the list; Arrowhead Lake (IL_RNZX) and Johnston City Lake (IL_RNZE). While both lakes are impaired by phosphorus, Johnston City Lake is also challenged by increased volumes of aquatic algae and total suspended solids.

An initial stakeholder meeting was held in 2017 to gain awareness of planning efforts, and to garner membership for the Lake Creek Watershed Council. The council convened on a quarterly basis and provided guidance throughout the plan. This included discussing existing knowledge of the watershed, and suggesting best management practices (BMP) for the plan. The success of the plan relies heavily on the continuation of council activities. This includes overseeing implementation of the plan and monitoring progress.

Land use in the watershed is represented by large areas of agriculture and forest. Agriculture in the watershed is composed of 31.4 percent of pasture and hay and 8.6 percent of cultivated crops. Various degrees of development constitute 14 percent of the watershed. The remaining land uses in the watershed are open water (3.9 percent) and woody wetlands (2.5 percent). With 40 percent of the watershed being classified as agriculture, there is a high potential for nutrient runoff. This is exemplified by areas of cropland that run along Lake Creek.

Figure 1



While impervious surfaces in the watershed are low, the Johnston City constitutes the largest portion of the watershed's impervious network. The watershed exhibits around 14 percent of imperviousness features (10 percent or more impervious surface).

The Spreadsheet Tool for Estimating Pollutant Loads (STEPL) and the Region 5 Model were utilized to generate existing pollutant loads for the Lake Creek watershed and its subwatersheds. While the program produces general estimates, the baseline data was generated from multiple factors including: land use, climatic indicators, agriculture, septic rates, urban runoff, and streambank/shoreline impairments. Estimated pollutant loads are influenced heavily by urban areas and agriculture (see Table 1).

Table 1- Existing Pollutant Loads

Source	N Load (lb/yr)	Percent of Total Load	P Load (lb/yr)	Percent of Total Load	Sediment Load (tons/yr)	Percent of Total Load
Urban	27505.85	16.70%	4251.89	15.25%	631.37	4.01%
Cropland	25810.14	15.67%	7430.95	26.65%	4617.44	29.36%
Pastureland & Grassland	75732.41	45.99%	9077.97	32.55%	3425.45	21.78%
Forest	4323.70	2.63%	2039.25	7.31%	333.14	2.12%
Groundwater	20554.50	12.48%	945.82	3.39%	0.00	0.00%
Streambank/Shoreline	10751.08	6.53%	4139.16	14.84%	6719.42	42.73%
Totals	**164677.68**		**27885.06**		**15726.82**	

Pollutant load reduction targets were also generated for major pollutants. A reduction of nitrogen at 15 percent, phosphorus at 25 percent, and sediment reduction of 30 percent were calculated for the plan. Target goals are consistent with the Illinois Nutrient Loss Reduction Strategy (ILNLRS).

To achieve the target goals, BMP were suggested in regards to two major nutrient contributors in the watershed: urban runoff and agricultural practices. While the plan addresses watershed-wide practices, site-specific BMP have also been established to manage agricultural pollutants and urban runoff on a localized level.

These management efforts confront the impairments of the various waterbodies in the Lake Creek watershed. Some of the measures include: streambank and shoreline stabilization, agricultural and vegetated filter strips, and grassed waterways. They have also been categorized by priority based on feasibility, cost, and pollutant load reductions.

The plan incorporates the nine minimum elements required of a watershed-based plan. These elements include: a characterization of the watershed through a resource inventory and assessment to identify nonpoint source pollution, identification of BMP to address those pollutants, identifying funding and technical assistance, an educational component, and a monitoring and evaluation component to track progress and monitor accomplishments.

Funding will mainly come through EPA Clean Water Act 319 grants. Most of the BMP in the plan are eligible to receive funding through these grants since their focus is reducing nonpoint source pollution.

Outreach and education of watershed-related activities are important in promoting awareness of the plan and progression of plan implementation. Some of the outreach components include: holding public meetings, distributing flyers on the plan and agricultural activities, and locating volunteers for litter and debris cleanups.

Implementation of the plan is divided into three phases. Phase I represents the first two years of the plan where most educational and outreach component are implemented; along with selecting site-specific BMP for grant funding. Phase II will require the watershed action committee to continue submitting grants and starting implementation of BMP. Phase III represents the last four years of the planning period in which BMP implementation will continue and evaluating the plan will begin.

Interim measurable milestones, water quality benchmarks, and a monitoring component have also been established to track progress and evaluate the success of the plan. Table 2 represents the water quality benchmarks in the plan which focuses on nitrogen, phosphorus, and sediment.

Table 2- Water Quality Benchmarks

	Benchmark Reduction Target					
Benchmark Period	Nitrogen (percent)	Nitrogen (lbs/ yr)	Phosphorus (percent)	Phosphorus (lbs/yr)	Sediment (percent)	Sediment (tons/yr)
2 Year (Phase I)	-	-	-	-	-	-
6 Year (Phase II)	6	11527	10	2789	15	2359
10 Year (Phase III)	15	24701	25	6971	30	4718

The monitoring component of the plan features programs offered by IEPA and the Illinois Division of Natural Resources (IDNR). The Volunteer Lake Monitoring Program (VLMP) and the Ambient Lake Monitoring Program (ALMP) are both ways in which water quality can be tested. Results will be analyzed by the watershed action committee to determine success of BMP implementation and the plan itself.

1. Introduction

A watershed is a drainage basin where all water flows into from surrounding elevated lands. Precipitation and runoff drain to a waterbody, usually a lake or stream, which centralizes all flow of the watershed. Watersheds can range from regional land areas that span states to smaller basins that are encompassed within counties. Watershed size is classified by Hydrologic Unit Codes (HUC) which range from 2 (regional) to 12 (sub-watershed).

Watershed-based plans provide a framework for improving water quality in a specific watershed. They are often designed to reduce pollutants from nonpoint sources and identify other components that impair water quality. These plans include a characterization of the watershed through a resource inventory and assessment to identify nonpoint source pollution, identification of best management practices (BMP) to address those sources, and a monitoring and evaluation component to track progress and monitor accomplishments.

Four waterbodies in the watershed have been placed on IEPA's 303(d) List of Impaired Waters. This list is comprised of waterbodies that do not meet water quality standards. In particular, Lake Creek (IL_NGA-02) has been placed on the list because of impairments from changes in stream depth and velocity patterns, dissolved oxygen, and phosphorus. Beaver Creek (IL_NGAZ-JC-D1) exhibits other impairments including loss of instream cover and manganese.

The list also includes two lakes in the planning area: Arrowhead Lake (IL_RNZX) and Johnston City Lake (IL_RNZE). While Arrowhead is impaired solely by phosphorus, Johnston City Lake impairments also include aquatic algae and total suspended solids (TSS).

Watershed-based planning focuses on collaboration among stakeholders and local decision makers. Early in the planning process, an initial stakeholders meeting took place to explain the process of watershed-based planning and gather members for the Lake Creek Watershed Council. This planning committee met on a quarterly basis to oversee the planning process.

Watershed-based plans must follow guidelines set forth by the Environmental Protection Agency (EPA). To be successful, watershed-based plans need to include the Nine Minimum Elements of a Watershed-based Plan. [1] The components, information and location within this plan are as follows:

1. **Element A-** ***Identify causes and sources of pollution.***

   This was completed through an inventory and assessment of the Lake Creek Watershed. The inventory includes a characterization of the watershed including details on: boundaries, geology and climate, soils, jurisdictions, demographics, and land use. It also includes an assessment of waterbodies and water quality which identifies sources of pollution in the watershed. (Chapter 2)

2. **Element B-** ***Estimate load reductions expected from best management practices.***

   Pollutant load reduction targets were created to meet water quality goals. The load reduction goals for the Lake Creek Watershed-based Plan follow the statewide goals established in the Illinois Nutrient Loss Reduction Strategy. (Chapter 2.8.9)

3. **Element C-** ***Describe the nonpoint source best management practices that meet pollutant load reductions.***

   To achieve the load reduction targets, best management practices (BMP) have to be implemented. A description of each BMP type has been provided in the plan. Information for watershed-wide and site-specific BMP has also been provided. This includes: location, load reductions, amount, unit, and priority. (Chapter 3)

4. **Element D-** ***Identify the technical and financial assistance needed to implement the plan.***

   Costs and work associated with the technical and financial assistance have been calculated for each management measure in the plan. Grant

[1] Environmental Protection Agency, "Appendix C- Minimum Elements of a Watershed-based Plan," in *Nonpoint Source Program and Grants Guidelines for States and Territories* (Washington D.C., 2013.), 63-68.

funding opportunities and cost match notes for each BMP have also been identified. (Chapter 4)

5. **Element E-** ***Develop an information and education component.***

   An outreach and educational component was created to gain public involvement which can promote the strategies and implementation measures in the plan. Various activities have been included to inform the public on: watershed planning, BMP, and nonpoint source pollution. (Chapter 5)

6. **Element F-** ***Develop a schedule for implementing the nonpoint source best management practices in the plan.***

   A schedule was developed that outlines the best management practices, educational components, and other strategies in the plan. (Chapter 6.1)

7. **Element G-** ***Describe interim measurable milestones to monitor management measures in the plan.***

   Milestones are to be addressed for each BMP in the plan. These milestones are also developed for the outreach components and other strategies. Milestones were separated by phases throughout the planning period. (Chapter 6.2)

8. **Element H-** ***Develop criteria to measure progress of loading reductions through management measures.***

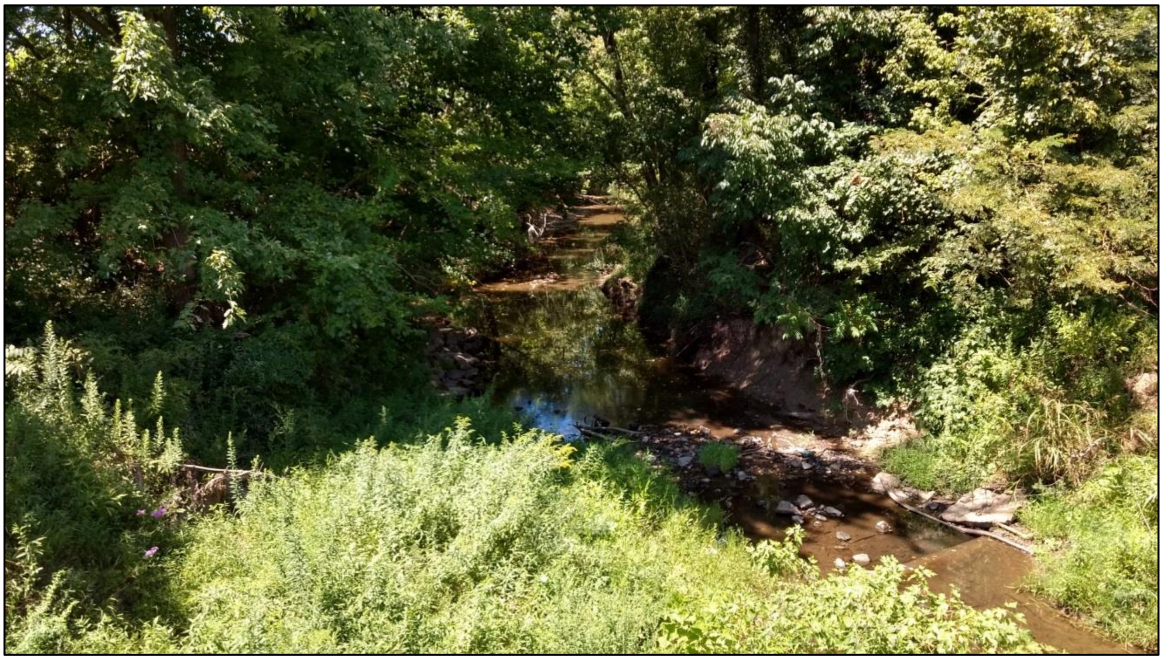
   These benchmarks signify whether BMP and other management measures are successful in reducing pollutant loads and are leading to water quality standards. (Chapter 7.1)

9. **Element I-** ***Develop a monitoring component that evaluates the efficacy of management measures.***

   Elements in the monitoring component determine whether loading reductions are being met and water quality standards are being achieved. (Chapter 7.2)

The Lake Creek Watershed-based Plan incorporates all of these elements in an effort to reduce pollutant loads and improve water quality within the watershed. The success of the plan largely depends on the collaboration of stakeholders and local officials to implement and oversee the plan's development.

Figure 2- Lake Creek, East Facing at Prosperity Road

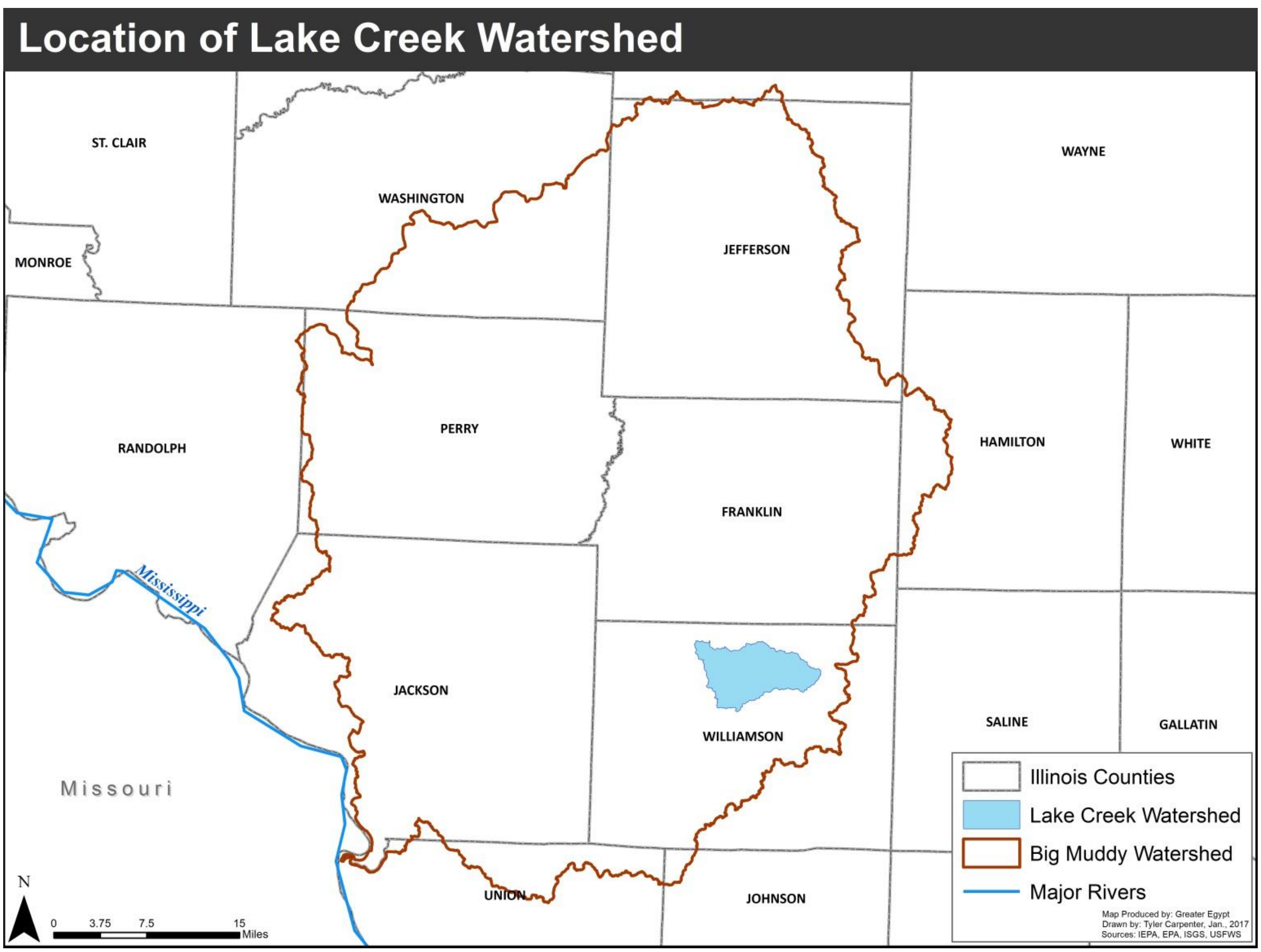


2. Lake Creek Watershed Inventory and Assessment

2.1 Geography and Climate

The Lake Creek watershed encompasses 21,785 acres, or 34 square miles, and has been assigned Hydrologic Unit Code (HUC) 071401060502. It is located in Williamson County, Illinois, and is a sub-basin of the larger Big Muddy River Watershed (Figure 3). The headwaters of Lake Creek originate west of Dwina Road, in Williamson County, Illinois. Municipalities in the subject area are Johnston City and Pittsburg; all of which lie entirely in Williamson County. The Lake Creek Watershed is bound to the north by German Church Road, to the east by Dwina Road, to the west by the City of Herrin, and to the south by the City of Marion (Figure 4).

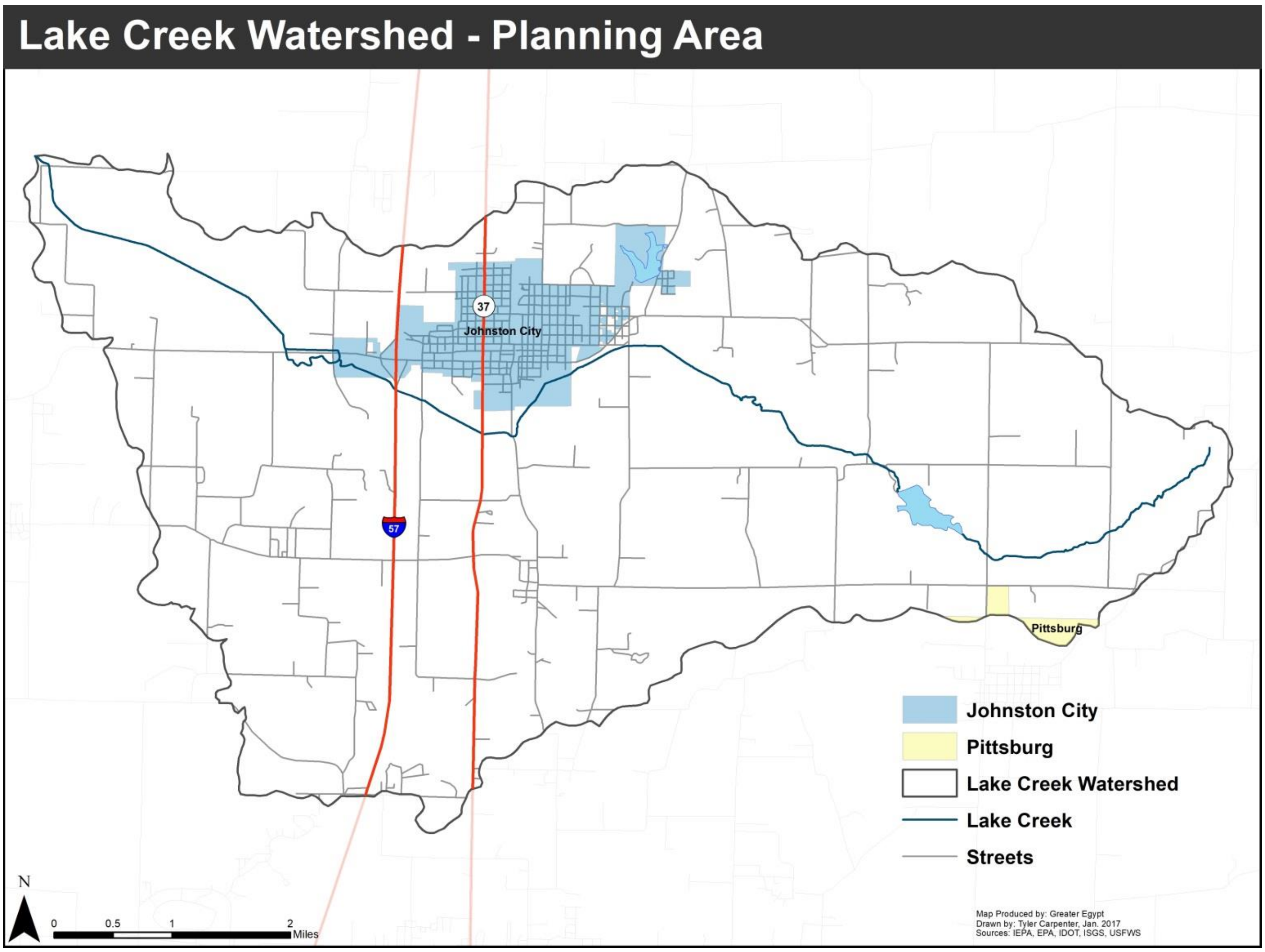
Figure 3



There are only two communities partially or entirely within the Lake Creek Watershed. With a population of 3,543, according to the 2010 Census, the largest municipality in the watershed is Johnston City, Illinois. Other communities in the watershed, such as the northern portion of the Village of Pittsburg and the former Village of Whiteash, sustain a much smaller population.

Few major roadways lie within the watershed. The most significant roadways divide the subject area east and west. Interstate 57 and Illinois Route 37 are traveled in a north-south direction.

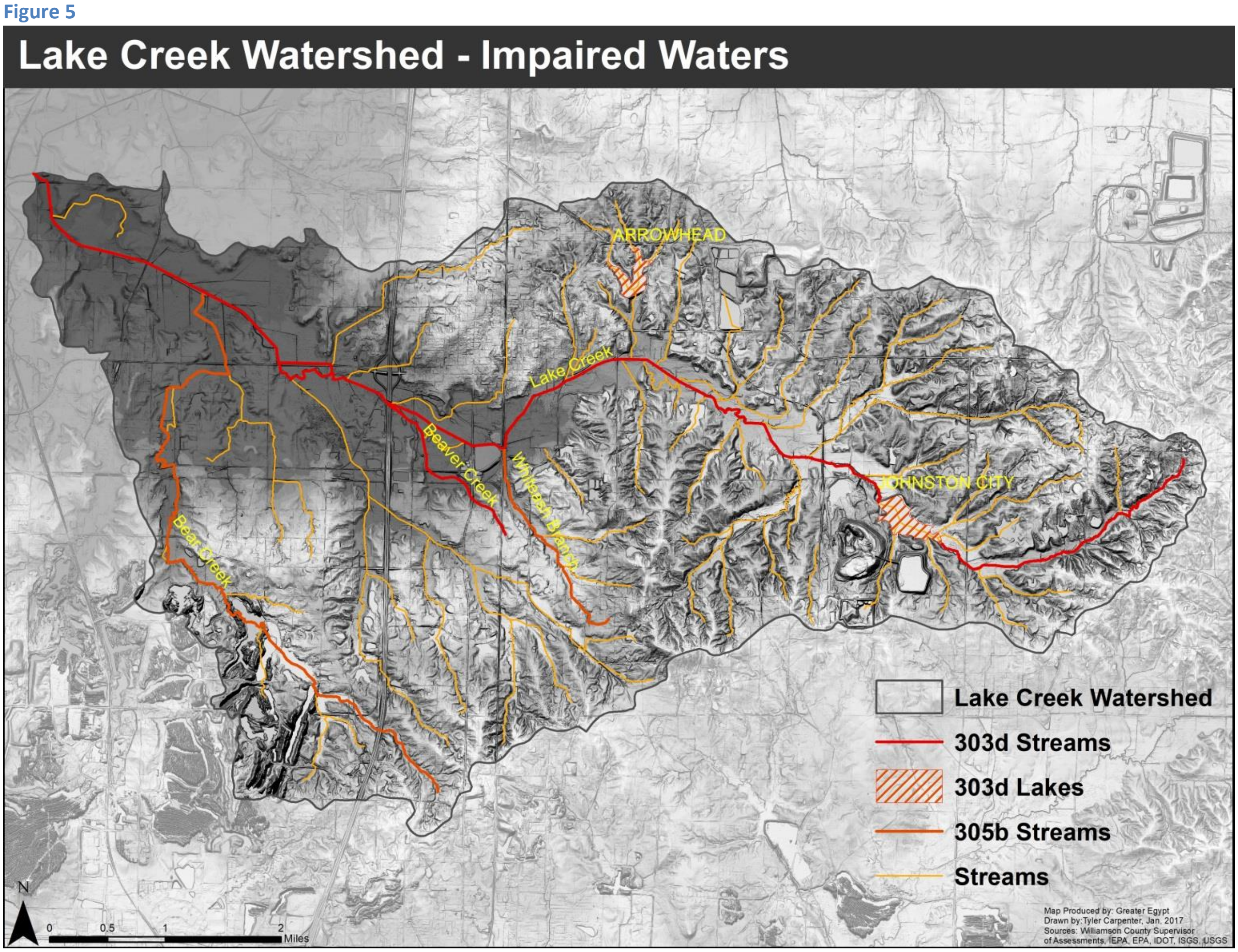
Figure 4



2.1.1 Location of Water Bodies

The Lake Creek watershed lies on the divide between the Ohio and Mississippi River basins. There are 92.8 miles of streams in the Lake Creek watershed as identified in the National Hydrography Dataset (NHD). Four main creeks represent the Lake Creek watershed's main hydrography (Figure 5); two of which are on the Illinois Environmental Protection Agency's (IEPA) 303(d) List of Impaired Waters and the other two being listed in the IEPA's 305(b) Inventory. Lake Creek (IL_NGA-02) runs 12.85 miles in a westerly/northwesterly direction through the center of the watershed before releasing into Pond Creek in the northwestern portion of the watershed.

Figure 5



Beaver Creek (IL_NGAZ-JC-D1) runs 1.7 miles in a northwesterly direction before discharging into Lake Creek south of Johnston City. Bear Creek (IL_NGAA) runs seven miles in a northerly direction ultimately releasing into Lake Creek. Whiteash Branch (IL_NGAB) flows two miles in a northerly direction, also releasing into Lake Creek near the mid-watershed. Other smaller, unnamed streams flow throughout the watershed in various directions.

Small ponds and lakes constitute a rather small area of the watershed; approximately 713 acres, according to the United States Fish and Wildlife's National Wetland Inventory (NWI). Two lakes stand out as being the larger bodies of water. Arrowhead Lake (IL_RNZX) is approximately 30 acres in area and rests in the central portion of the watershed. At 64 acres, Johnston City Lake (IL_RNZE) redirects the flow of Lake Creek in the eastern part of the watershed. Both waterbodies are on the IEPA's 303(d) list of impaired waters.

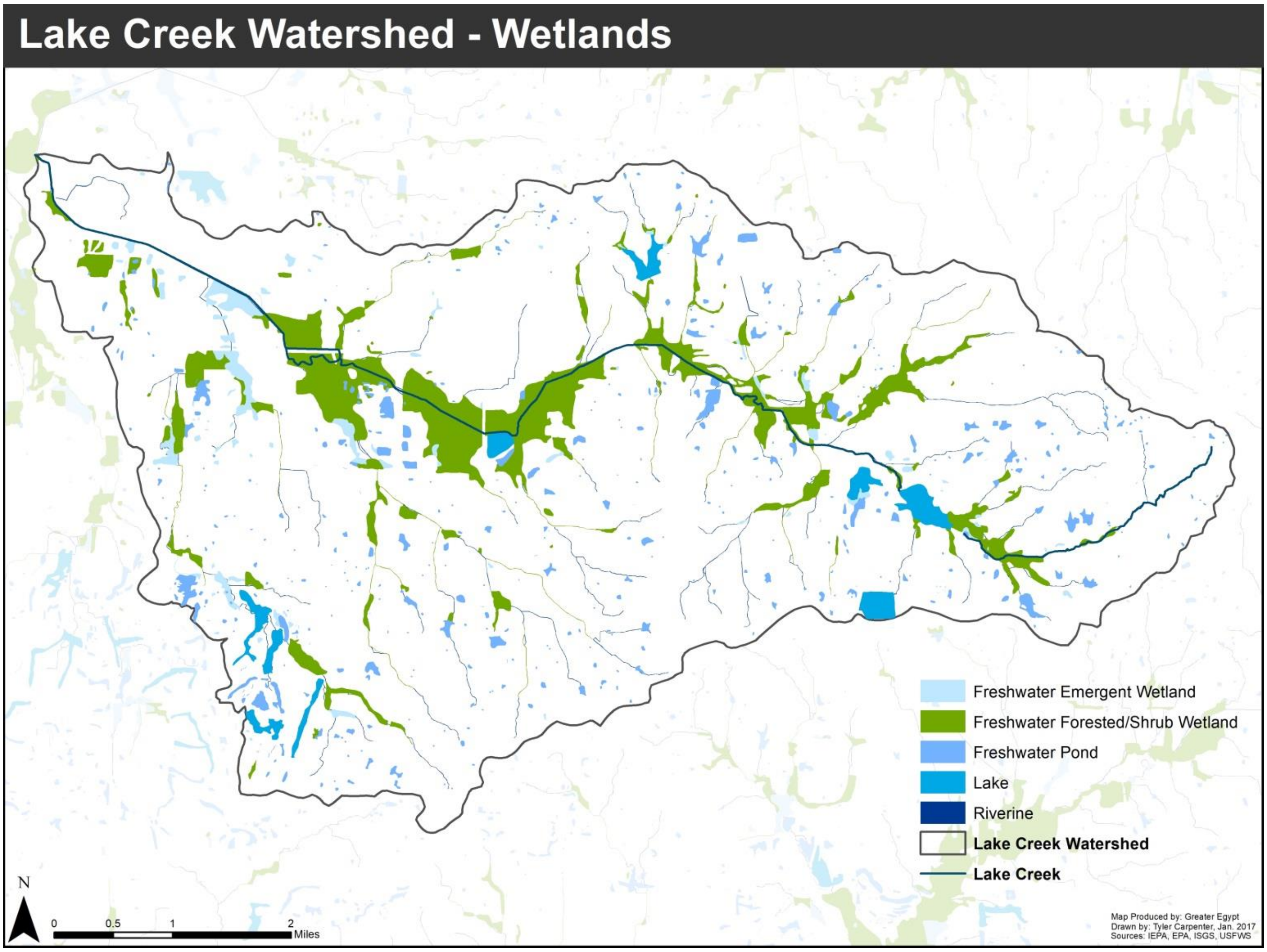
Wetlands are also a prominent feature throughout the target area. According to the NWI, there are five classifications of wetlands identified in the Lake Creek watershed: freshwater emergent, freshwater forested/ shrub, freshwater ponds, lakes, and riverine. Table 3 contains information on the distribution of wetlands. Freshwater forested and shrub wetland is the most apparent wetland classification in the watershed consisting of 1605 acres, or accounting for nearly 7.5 percent of the watershed. Wetlands have also been spatially displayed in Figure 6.

Table 3- Distribution of Wetlands

Wetland Type	Acres	Percent of Wetland Total	Percent of Watershed
Freshwater Emergent	252	9.39%	1.16%
Freshwater Forested/ Shrub	1605	59.80%	7.37%
Freshwater Pond	447	16.65%	2.05%
Lake	266	9.91%	1.22%
Riverine	114	4.25%	0.52%

Source: U.S. Fish and Wildlife Service National Wetlands Inventory

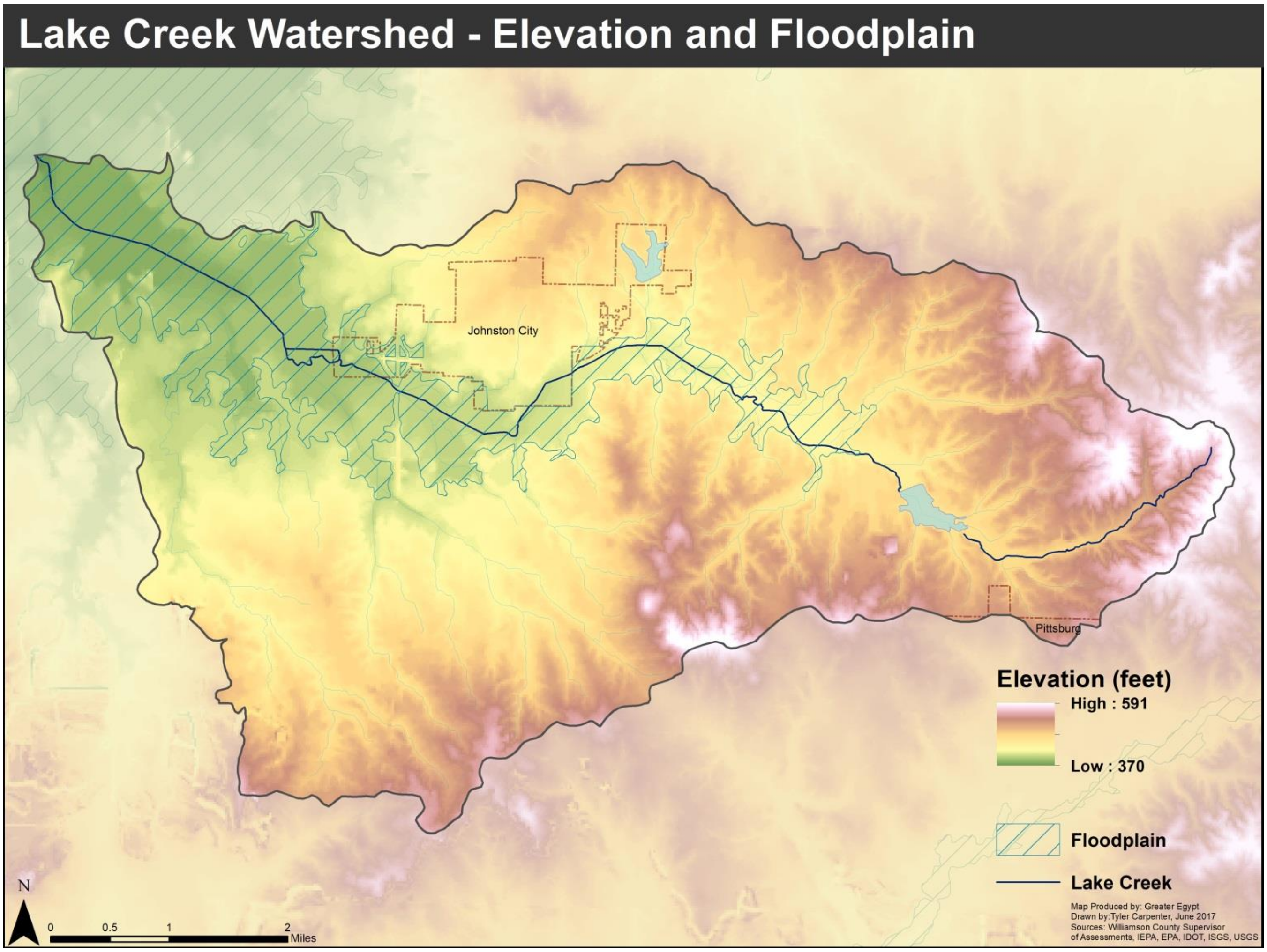
Figure 6



2.1.2 Topography

The Lake Creek watershed is located roughly nine miles north of the southern limit of the glacial till from the Illinoisan age. The watershed is generally flat, with gentle slopes near the headwaters and the south-central border. The topography is consistent with the surrounding watersheds of Southern Illinois. Figure 7 displays the elevation and floodplain of the watershed. The lowest elevations in the watershed are found in the northwest section at the confluence of Lake Creek and Pond Creek. This elevation is about 370 feet. The highest elevation in the watershed, around 600 feet, occurs at the southern border near the central part of the watershed. The watershed features an elongated shape with a mainly dendritic drainage pattern. Other areas in the watershed consist of a parallel drainage pattern.

Figure 7

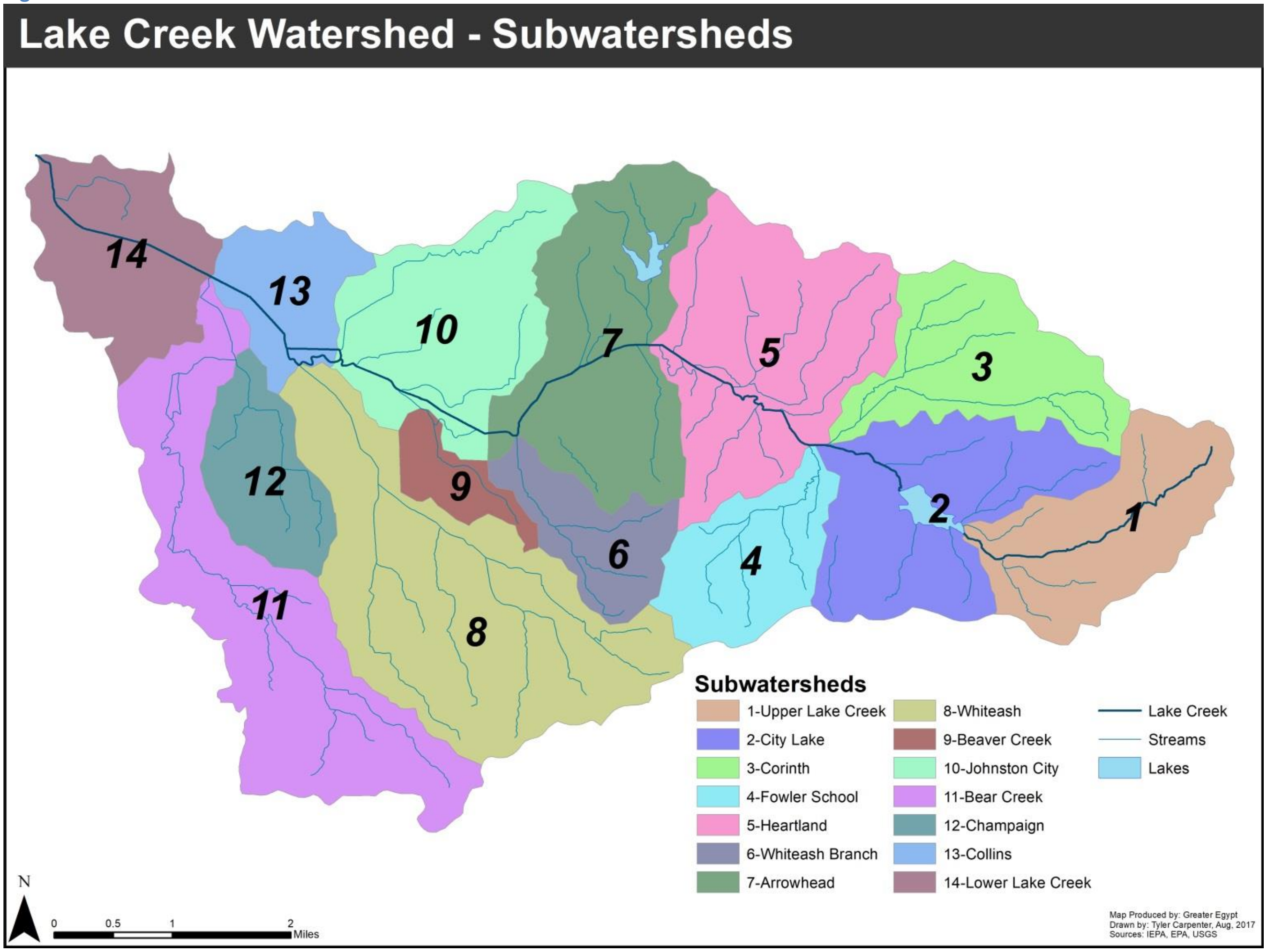


Around 17.25 percent (3,757 acres) of the watershed is in the floodplain. This area is mainly along Lake Creek and pools near the northeast portion of the watershed near the confluence of Pond Creek. While most of this area is agricultural, there are small areas in Johnston City within the floodplain. Flooding in these areas tends to be localized.

2.1.3 Subwatershed Management

The Lake Creek watershed has been delineated further into 14 smaller subwatershed management units (SMU). Along with the Lake Creek, each SMU will be examined individually in this inventory. Each SMU was delineated based on the drainage patterns, direction of flow of Lake Creek, and other hydrologic features in the watershed. The subwatersheds are illustrated in Figure 8.

Figure 8



2.1.4 Characteristics of the SMU

A unique identifier (HUC 14 code) was assigned to each subwatershed management unit for classification. Each SMU was also given a name. This information can be found in Table 4. This table also provides acreage and major waterbodies found within each SMU. Detailed information for the SMUs can be found in later chapters.

The Upper Lake Creek subwatershed (SMU 1) represents the eastern-most portion of the Lake Creek watershed. Within its borders also originates the headwaters of Lake Creek. The creek in this section has a low-flow, and in some parts, is generally a dry bed. With a total acreage of 1,459, this SMU features a low impervious network and land use is mainly comprised of forest and pasture/hay. The small portion of the Village of Pittsburg is also found in the Upper Lake Creek subwatershed.

The City Lake subwatershed (SMU 2) features a more diverse composition than the Upper Lake Creek. Lake Creek runs through the center of this watershed. The Johnston City Lake (IL_RNZE) is located near the middle of the watershed. Because the lake is on the IEPA 303(d) list, and the proximity of the Orient 4 Mine, this watershed could be a priority for best management practices.

Table 4- SMU Information

Map ID	Name	Acres	HUC 14 Code	Major Waterbody
1	Upper Lake Creek	1459.32	07140106050201	Lake Creek
2	City Lake	1817.87	07140106050202	Lake Creek, Johnston City Lake
3	Corinth	1404.85	07140106050203	-
4	Fowler School	992.40	07140106050204	-
5	Heartland	2297.85	07140106050205	Lake Creek
6	Whiteash Branch	743.14	07140106050206	Whiteash Branch
7	Arrowhead	2109.54	07140106050207	Lake Creek, Arrowhead Lake
8	Whiteash	3211.59	07140106050208	-
9	Beaver Creek	366.26	07140106050209	Beaver Creek
10	Johnston City	1732.20	07140106050210	Lake Creek
11	Bear Creek	2760.84	07140106050211	Bear Creek
12	Champaign	833.81	07140106050212	-
13	Collins	755.07	07140106050213	Lake Creek
14	Lower Lake Creek	1298.19	07140106050214	Lake Creek

The Corinth and Fowler School SMUs (SMU 3, and 4) share similar characteristics. Both feature low levels of imperviousness, and have around the same acreage of deciduous forest. While both have a clear stream network, none of them were named prior to this report.

The Heartland subwatershed (SMU 5) is one of the larger SMU at 2,298 acres. Like most SMU in the eastern portion of the Lake Creek watershed, it is mainly comprised of deciduous forest and pasture/hay. It also features a low level of imperviousness. Lake Creek runs through the SMU in a northwesterly direction.

The Whiteash Branch SMU is named for the creek that runs through it for two miles in a northerly direction (IL_NGAB-JC-D2) eventually flowing into Lake Creek. This creek is on the IEPA's 305(b) Report. At only 743 acres, it is the second smallest subwatershed in the planning area.

Containing two impaired waterbodies, the Arrowhead subwatershed is roughly 2,110 acres with various land uses. Lake Creek splits the subwatershed north and south. Also present is the Arrowhead Lake (IL_RNZX). Development takes up nearly 500 acres with a mixture of low, medium, and high intensity. This developed area makes up the eastern portion of Johnston City, IL.

The Whiteash SMU is the largest subwatershed at 3,212 acres. It contains the former Village of Whiteash. Interstate 57 and Illinois Route 37 run in a northerly-southerly direction thought the SMU. Being the smallest subwatershed at 366 acres, the Beaver Creek SMU features the creek it is named after. Beaver Creek (IL_NGAZ-JC-D1) runs 1.7 miles in a northwesterly direction and has been placed on the IEPA's 303(d) List of Impaired Waters.

Constituting the majority of the city it's named after, the Johnston City subwatershed (SMU 10) is heavily developed. Nearly half of its land use is characterized by open space, and low, medium, and high intensity development. Lake Creek runs in a westerly direction in its southern border. There is also a presence of wetlands in the southern portion of the SMU along Lake Creek.

The Bear Creek SMU represents the southern-most portion of the Lake Creek watershed. Bear Creek (IL_NGAA) runs through the center of the subwatershed nearly seven miles in a northerly direction. This waterbody is on the IEPA's 305(b) Report. The third smallest subwatershed is the Champaign SMU. It constitutes 833 acres of deciduous forest (23 percent), pasture/hay (27 percent), cultivated crops (31 percent), and other smaller percentages of open space and other developed space.

The Collins (SMU 13) and Lower Lake Creek subwatershed (SMU 14) represent the final length of Lake Creek at the confluence of Pond Creek in the northwestern portion of the watershed. Both subwatersheds account for nearly 1,452 acres of agricultural land which makes up around 17 percent of the entire Lake Creek watershed's land use of pasture and crops.

2.1.5 Climate

The climate in the Lake Creek watershed borders the humid subtropical and humid continental climates. In the Upper Crab Orchard Creek: A Watershed Inventory, David Muir goes explains the climate in the area by stating, "The incursion of air masses from different directions results in quite variable weather patterns. Warm moist air from the gulf, cold dry air from Canada, and dry continental air from the southwest are the major influences on weather. Landform and topography have a negligible impact on climate in this area."[2]

Temperatures in the region can vary significantly due to the effects of warm gulf air from the south and cold Canadian air. Local climate data was taken from the Carbondale Sewage Treatment Plant located roughly ten miles southwest of the watershed in Carbondale, Illinois. Maximum and minimum temperatures recorded were 97 degrees Fahrenheit and 6 degrees Fahrenheit in 2016.[3] The average temperature for 2016 was 57.5 degrees Fahrenheit. Table 5 summarizes average monthly temperatures for the area during 2016.

Table 5- 2016 Monthly Average Temperatures

2016 MONTHLY AVERAGE TEMPERATURES (degrees farenheit)													
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Average High	40.5	46.7	60.3	69.6	73	87.3	87	85.7	82.5	73.5	61.9	44.1	67.68
Average	31.6	37.5	49.8	56.7	63	77	78.6	77.5	71.9	62	49.5	34.3	57.45
Average Low	22.8	28.3	39.2	43.8	53	66.6	70.2	69.4	61.3	50.5	37.2	24.5	47.23

Source: NOAA, National Climatic Data Center

The Lake Creek watershed is subject to considerable rainfall throughout the year. The average annual precipitation in the Lake Creek watershed is 54.7 inches. The wettest months are typically from April to June. Average snowfall amounts in the region are around 14 inches. Table 6 displays the monthly precipitation distribution of 2016.

[2] David Muir, et al., "Upper Crab Orchard Creek: A Watershed Inventory," Greater Egypt Regional Planning and Development Commission, 1988, 6.
[3] NOAA/National Climatic Data Search, "Climate Data Online Search," https://www.ncdc.noaa.gov/cdo-web/search. Accessed 19 July 2017.

Table 6- 2016 Monthly Average Precipitation

2016 MONTHLY AVERAGE PRECIPITATION (in inches)													
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Average	1.35	3.21	4.21	4.61	6.93	2.26	13.34	7.98	5.52	1.03	2.89	1.37	54.7
Daily Max	0.94	2.15	1.21	1.5	1.47	0.54	5.29	3.63	2.01	0.36	1.33	0.41	20.8

Source: NOAA, National Climatic Data Center

During the spring and summer months, damaging storms and heavy rainfall can be expected. This precipitation can lead to regional and localized flooding. More severe occurrences of flooding take place along the Big Muddy River and larger tributaries that flow into the Mississippi River. Like most areas in the Midwest, the watershed is susceptible to tornadoes. Winters can occasionally bring accumulations of snow and ice.

Wind data was obtained from the Illinois Climate Network (ICN) Carbondale Station, located on the SIU farm.[4] Wind speed generally ranges from 3 to 8 miles per hour throughout the year with an average of 5.6 miles per hour. However, gusts can average 25 to 47 miles per hour in any certain month. The data suggests a prevalent pattern of wind SSW (south/ southwest). Considering the region is fairly flat, wind direction is caused by incoming weather patterns.

Table 7- 2016 Wind Data

Month	Average Wind Speed (mph)	Max Speed (mph)	Average Direction
Jan	7.8	40.6	222.2
Feb	7.7	47.1	210.9
Mar	8.0	42.1	210.9
Apr	6.8	40.8	197.7
May	5.2	36.7	214.6
Jun	4.0	31.1	217.9
Jul	3.8	48.7	212.4
Aug	3.3	24.8	206.5
Sep	3.7	32.8	210.9
Oct	4.9	32.6	210.8
Nov	5.2	30.7	215.2
Dec	6.2	33.8	222.9
AVG	5.6	36.8	212.7

Source: Illinois Climate Network

[4] ICN, "Water and Atmospheric Resources Monitoring Program," http://www.isws.illinois.edu/warm/datatype.asp. Accessed 19 July 2017.

2.2 Geology

The Lake Creek watershed is located in the Central Lowland Province, Tills Plains Section. It is also in close proximity to the Interior Low Plateau to the south, and the Ozark Plateaus to the southwest. The physiographic provinces are further partitioned into divisions. The watershed rests just above the southern border of the Mt. Vernon Hill Country Division.[5]

Figure 10 shows the geologic units of the Lake Creek watershed and the surrounding area. The Pennsylvania System includes the uppermost bedrock in the Lake Creek watershed. It is overlain by relatively thin layers of glacial drift, loess, and alluvial deposits in river valleys. The Pennsylvanian surface is eroded by action of pre-glacial streams. System series, group, and underlying geologic formations can be seen in Figure 9.

Sometimes paired as a single formation, the Shelburn-Patoka Formation primarily consists of shale and sandstone. Other deposits include coal and limestone. General thickness of the Shelburn Formation is 100 to 275 feet. While it is mainly comprised of sandstone, the Shelburn Formation also exhibits deposits of black shale, coal and limestone.[6]

The Patoka Formation reaches a thickness of around 300 feet. Shale and sandstone comprise around 85 percent of the Patoka Formation. The Shelburn-Patoka Formation constitutes almost the entire geologic structure of the Lake Creek watershed. Only 38 acres of the formation underlying the watershed is classified as Carbondale.

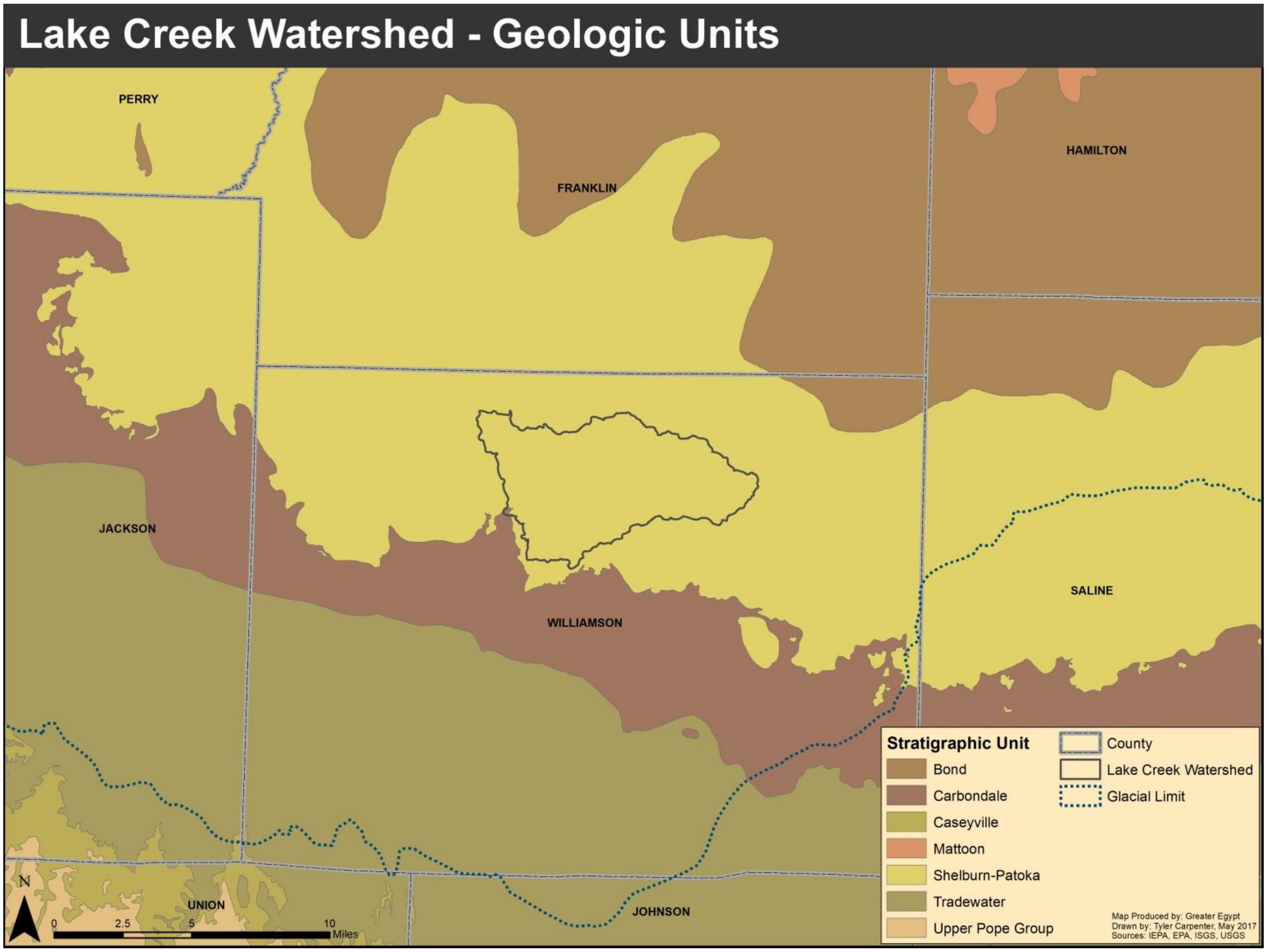
Figure 9- Generalized Stratigraphic Column of the Pennsylvanian in Illinois

PENNSYLVANIAN							SYSTEM
MORROWAN	ATOKAN	DESMOINESIAN		MISSOURIAN		VIRGILIAN	SERIES
Racoon Creek Group			McLeansboro				Group
Caseyville	Tradewater	Carbondale	Shelburn	Patoka	Bond	Mattoon	Formation

Source: ISGS (modified)

[5] M.M. Leighton, George E. Elkblaw, Leland Horberg, "Physiographic Divisions of Illinois," *The Journal of Geology*: ISGS, 1948, 16-33.
[6] Tri-State Committee on Correlation of the Pennsylvanian System in the Illinois Basin, *Toward a More Uniform Stratigraphic Nomenclature for Rock Units of the Pennsylvanian System in the Illinois Basin.* (Bloomington: Illinois Basin Consortium, 2001), 16.

Figure 10

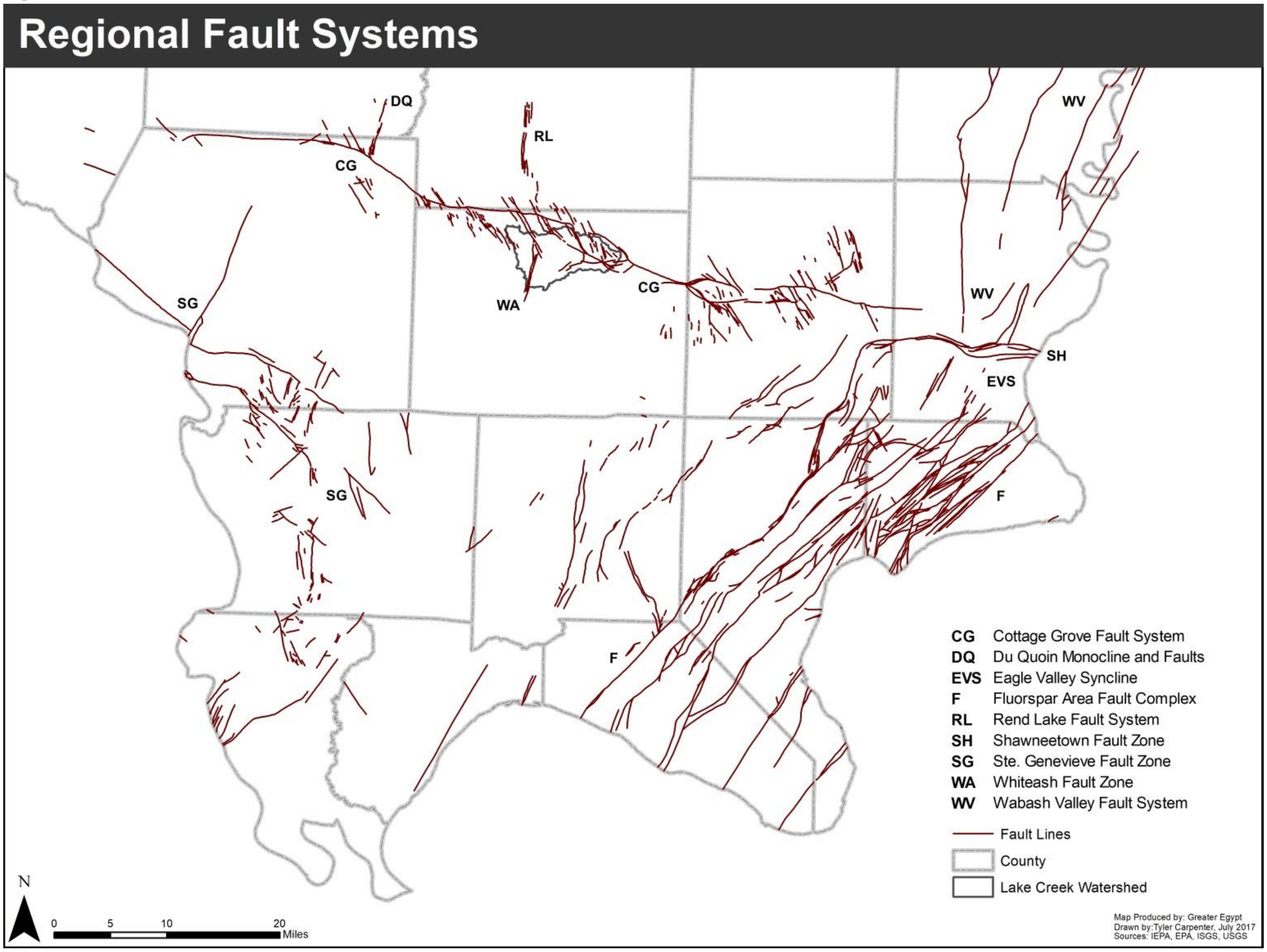


2.2.1 Geologic Faults

Regionally, the area exhibits a complex network of fault systems uncommon to most of the Midwestern United States. These zones are displayed in Figure 11. Southern Illinois lies just north of the most seismically active area of the Midwest, the New Madrid Seismic Zone. It also encompasses much of the Wabash Valley Fault Zone.

The Lake Creek Watershed lies above the convergence of three separate faults (Figure 12). The Cottage Grove Fault System runs in an easterly-westerly direction extending from Gallatin to Randolph County.

Figure 11

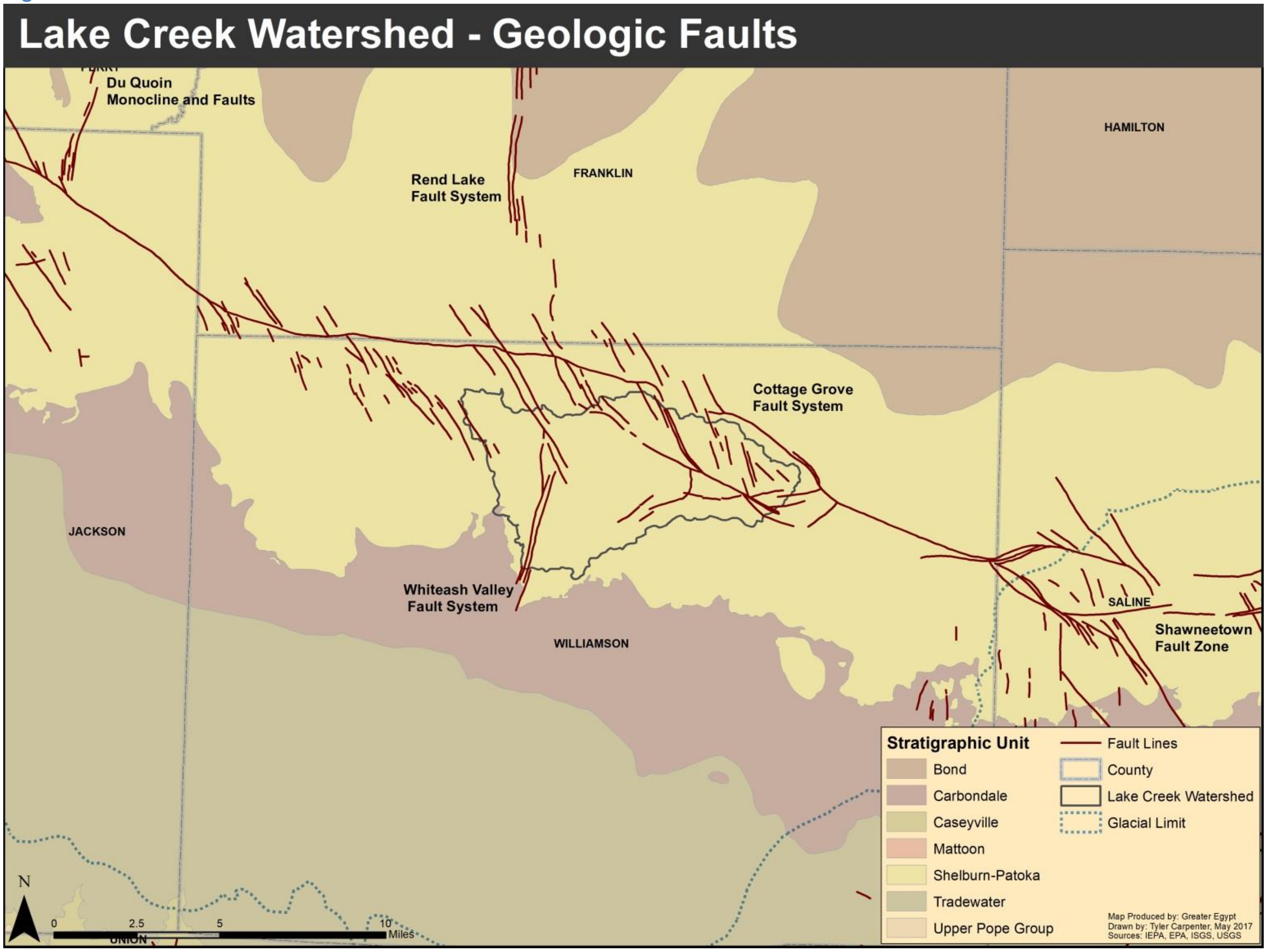


The Lake Creek Watershed marks the mid-section of this system. This system is intersected by the Whiteash Fault Zone to the south, and the Rend Lake Fault System to the north.

Other than possessing strictly geologic impacts, the fault zone (specifically Cottage Grove) has other significance. According to the ISGS, "Several discoveries have been made in structural traps along the system. The zone of faults generally marks the southern limit of petroleum production in Illinois. The fault also crosses on of the main coal-producing areas in Illinois and adds considerably to the danger and expense of mining there."[7]

[7] Nelson, John W., H.F. Krausse, *The Cottage Grove Fault System in Southern Illinois.* (Champaign, IL: Illinois State Geological Society, 1981, 1.)

Figure 12

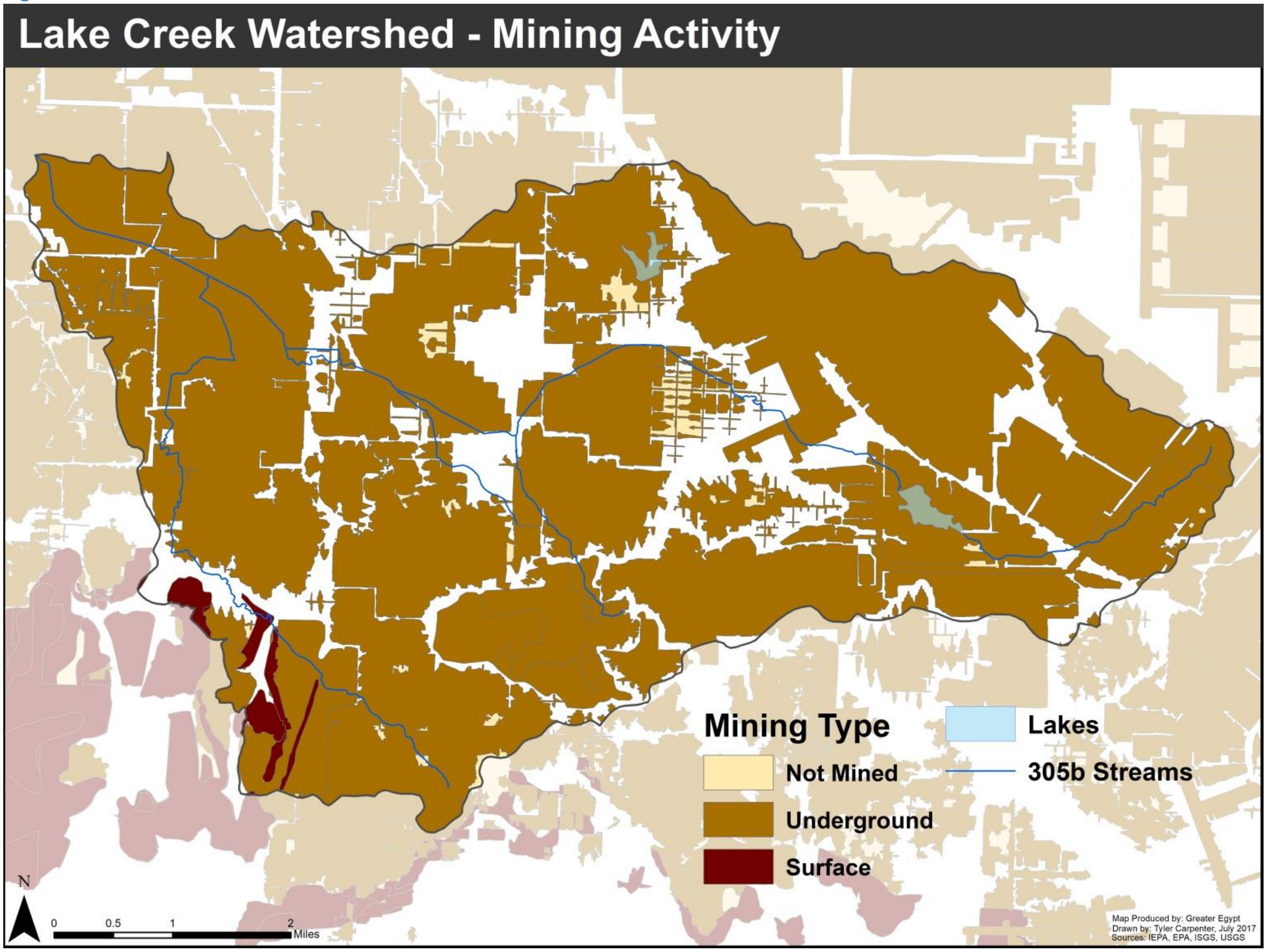


2.2.2 Mining

Although mining companies have ceased operations since 1987, the impact on the watershed is apparent. Mining in the watershed accounted for nearly 17,900 acres; of which 17,300 acres (97 percent) included underground mining. Figure 13 displays the location of former mining activity in the watershed by type.

Orient Mine No. 4 rests southwest of the Johnston City Lake. The mine was operational until the mid-1980s. An examination of the mine and impact on the Johnston City Lake can be found in the water quality section of this report.

Figure 13



Lake Creek Watershed - Mining Activity
Mining Type
Not Mined
Underground
Surface
Lakes
305b Streams
N
0
0.5
1
2
Miles
Map Produced by: Greater Egypt
Drawn by: Tyler Carpenter, July 2017
Sources: IEPA, EPA, ISGS, USGS

2.3 Soil Conditions

The United States Department of Agriculture Natural Resource Conservation Service (USDA-NRCS) soils mapping data (Web Soil Survey) and the Soil Survey of Williamson County was utilized for the examination of soils within the Lake Creek watershed. This data was utilized to summarize the soil types, soil erodibility, hydric status, soil drainage, and hydrologic soil groups.

2.3.1. Hydrologic Soil Groups

There are twenty-seven dominant soil types within the Lake Creek watershed. Figure 15 displays the names and locations of all dominant soil types. Each soil is placed in a certain hydrologic group depending on the rate of water infiltration. These factors include whether the soil is protected by vegetation, consistently wet, or receives precipitation from storms.[8] The USDA defines the hydrologic soil groups by the following:

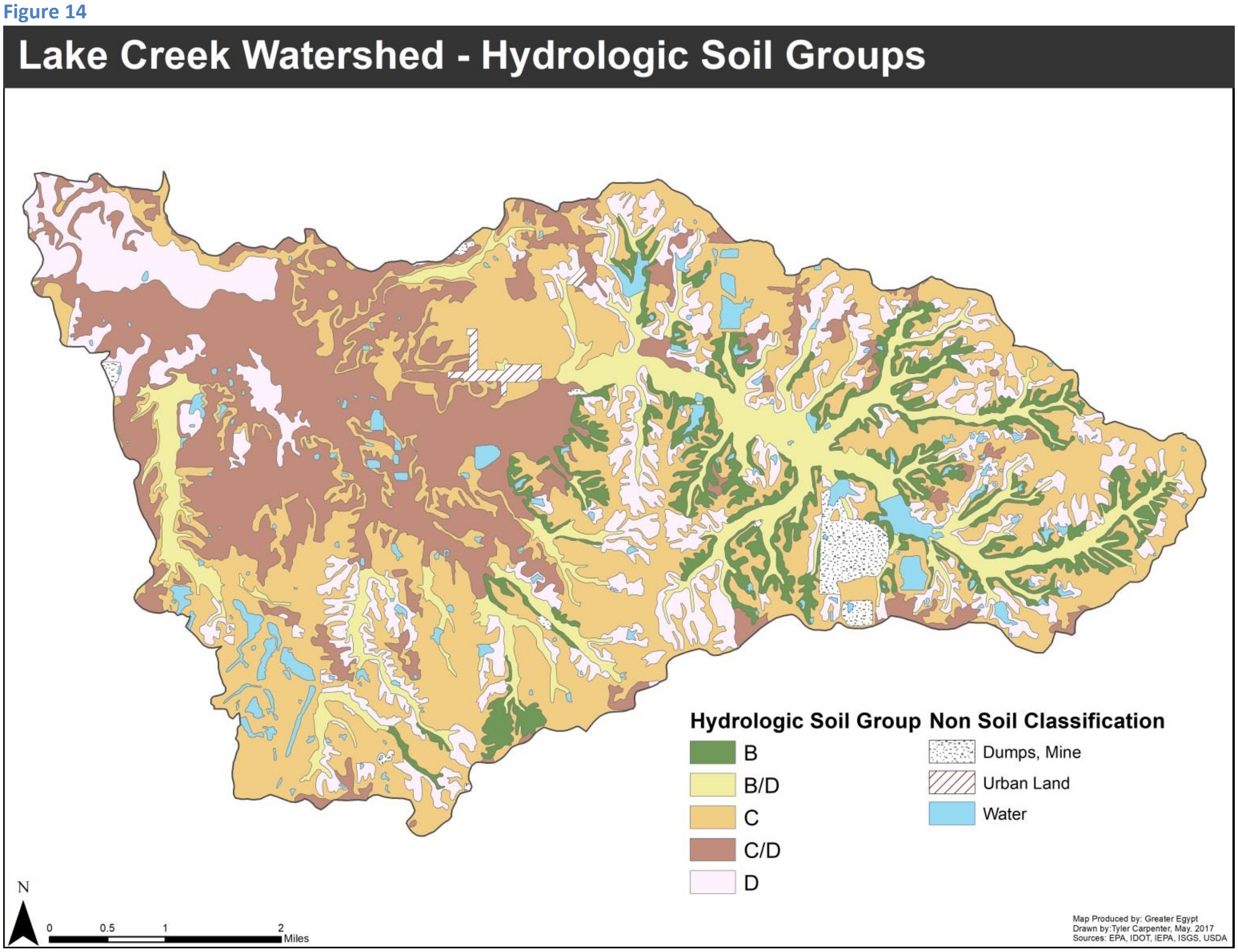
> **Group A**: Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
>
> **Group B**: Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
>
> **Group C:** Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
>
> **Group D:** Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a

[8] USDA, NRCS. "Web Soil Survey." http://websoilsurvey.sc.egov.usda.gov/. Accessed: March-May 2017.

claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.[9]

Soils can also be assigned to a dual hydrologic group (A/D, B/D, or C/D). The first letter represents drained areas while the latter represents undrained areas. Information on the hydrologic soil groups and relative information can be seen in Table 8. These groupings are also spatially depicted in the figure below.

Figure 14



[9] Ibid.

Table 8- Hydrologic Soil Groups

Hydrologic Group	Soil Texture	Drainage	Infiltration	Transmission Rate
A	Sand or Gravel	Deep, Well Drained to Excessivley Drained	High	High
B	Moderately Fine to Moderatley Coarse	Moderately Deep or Deep, Moderately Well Drained or Well Drained	Moderate	Moderate
C	Moderatley Fine to Fine	Layer that Impedes the Downward Movement of Water	Slow	Slow
D	Clays	High Shrink-Swell Potential, High Water Table, Claypan Layer Near Surface, Shallow Over Nearly Impervious Surfaces	Very Slow (High Runoff)	Very Slow

Source: USDA NRCS

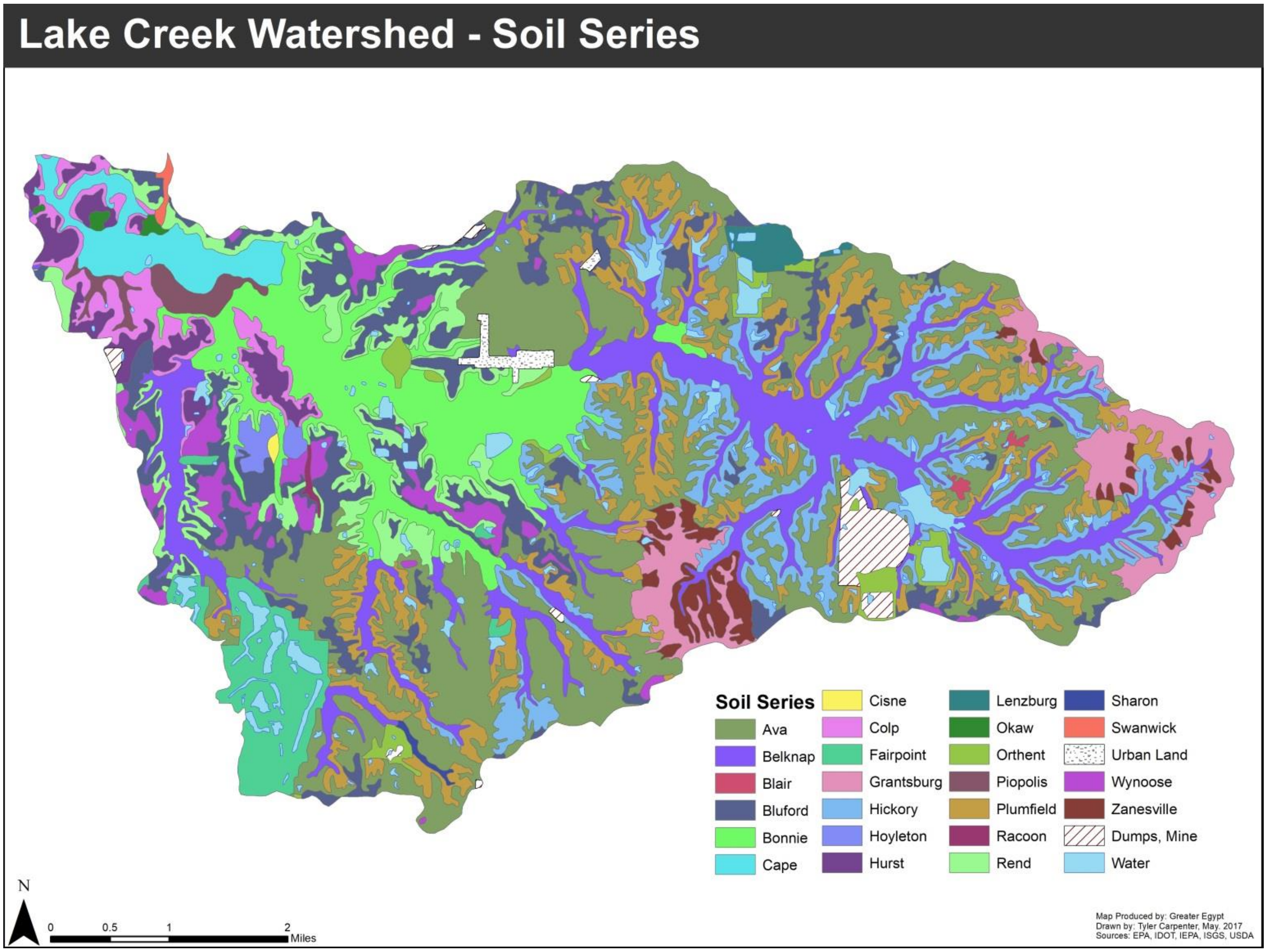
Covering approximately 5,236 acres in the Lake Creek watershed, Ava is the predominant soil series among the 27 soil types. This also accounts for twenty-four percent of the watershed. The Belknap soil type is the second most dominant soil type encompassing around 2,450 acres, or around eleven percent of the watershed. Information regarding the Lake Creek watershed general soil series can be found in Table 9.

Soils in the watershed vary within the hydrologic group classification. Only two soils fall under group B. These are the Hickory and Sharon soils. They account for eight percent of the watershed. Group C contains seven soils: Ava, Fairpoint, Grantsburg, Lenzburg, Orthents, Rend, and Swanwick. These soils make up nearly thirty-eight percent of the Lake Creek watershed. The Cape, Hoyleton, Hurst, Okaw, Plumfield, and Zanesville soils are categorized as group D and account for nearly sixteen percent of the watershed.

Dual hydrologic soil groups account for a third of the watershed. The Belknap soil type is the only soil representing group B/D. The remaining nine soils are associated with soil group C/D. These include: Blair, Bluford, Bonnie, Cisne, Colp, one subset of Hoyleton, Piopolis, Racoon, and Wynoose. Hydrologic groupings are also presented in Table 9.

Together, these soils account for approximately ninety-five percent of the Lake Creek watershed. The remaining five percent belongs to dumps and mines (1.35 percent), water (3.12 percent), and urban development (0.41 percent).

Figure 15



2.3.2 Hydric Soils

The NRCS defines hydric soils as "a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part".[10] Of the twenty-seven soils that comprise the Lake Creek watershed, only six are defined as hydric soils. Table 10 contains the hydric soils with acreage and percent of watershed. These soils account for 3001 acres, or eighteen percent of the watershed.

[10] Ibid.

Table 9- Soils and Classifications

Soil Series	Hydric Y/N	Erodibility K-Factor	Hydrologic Soil Group	Drainage	Acres	Percent of Watershed
Ava	N	.37- .43	C	MWD	5235.7	24.04%
Belknap	N	.43	B/D	SPD	2450.2	11.25%
Blair	N	.43	C/D	SPD	23.5	0.11%
Bluford	N	.49	C/D	SPD	1876.0	8.61%
Bonnie	Y	.43	C/D	PD	1766.6	8.11%
Cape	Y	.37	D	PD	498.0	2.29%
Cisne	Y	.49	C/D	PD	11.2	0.05%
Colp	N	.43-.49	C/D	MWD	437.5	2.01%
Dumps, Mine	-	-	-	-	293.8	1.35%
Fairpoint	N	.20-.32	C	WD	664.5	3.05%
Grantsburg	N	.43	C	MWD	810.4	3.72%
Hickory	N	.32-.43	B	WD	1728.0	7.93%
Hoyleton	N	.37-.49	C/D,D	SPD	101.7	0.47%
Hurst	N	.43	D	SPD	385.5	1.77%
Lenzburg	N	.20	C	WD	123.7	0.57%
Okaw	Y	.49	D	PD	32.7	0.15%
Orthents	N	.43	C	WD	265.4	1.22%
Piopolis	Y	.37	C/D	PD	174.7	0.80%
Plumfield	N	.49	D	MWD	2154.2	9.89%
Racoon	Y	.43	C/D	PD	18.0	0.08%
Rend	N	.43	C	MWD	1032.8	4.74%
Sharon	N	.43	B	MWD	22.2	0.10%
Swanwick	N	.43	C	MWD	23.1	0.11%
Urban	-	-	-	-	89.3	0.41%
Water	-	-	-	-	680.2	3.12%
Wynoose	Y	.49	C/D	PD	518.1	2.38%
Zanesville	N	.43	D	MWD	365.9	1.68%

Source: USDA NRCS

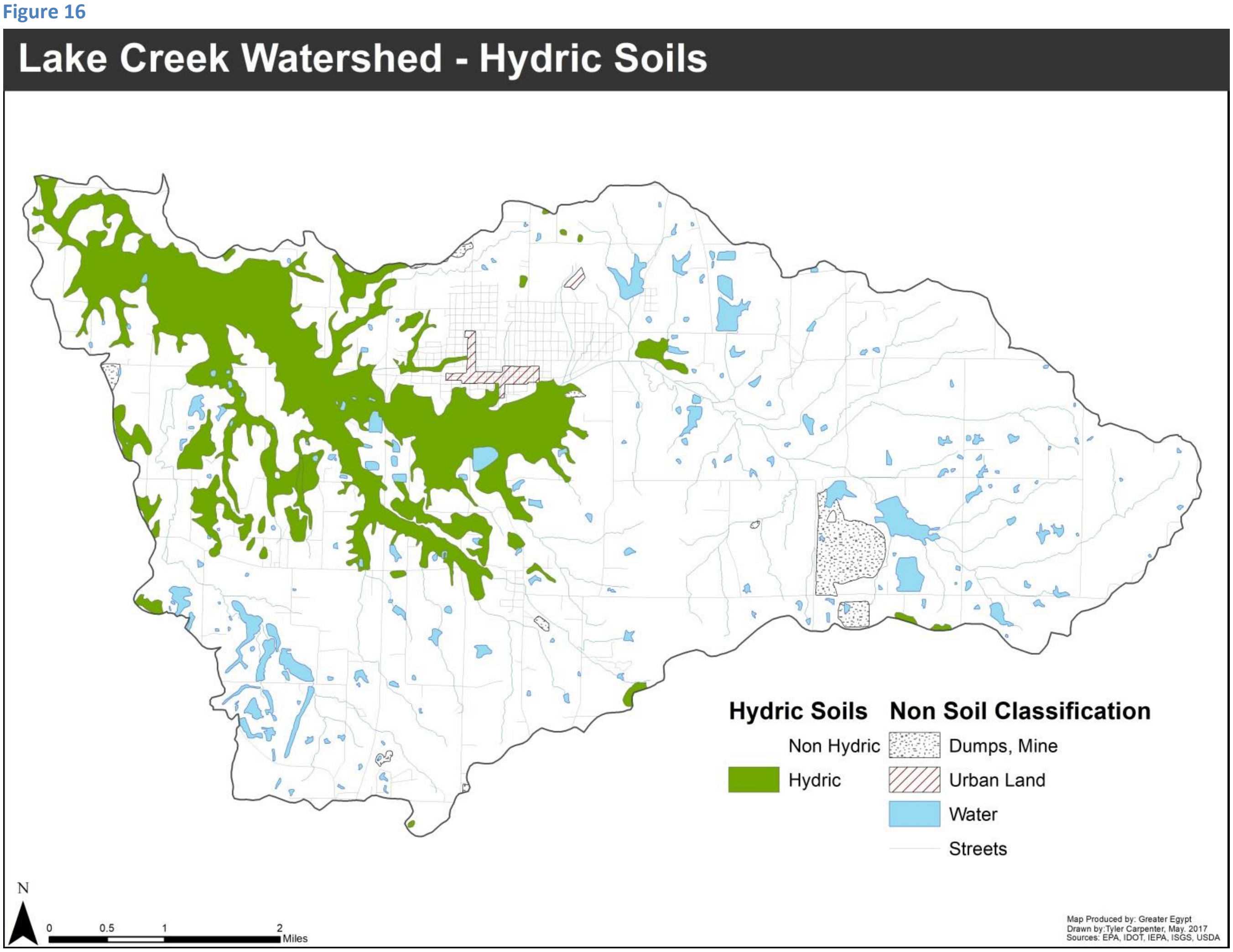
At 1766.6 acres, the Bonnie soil series is the largest hydric soil in the watershed. This also covers just over eight percent of the entire watershed. The Cape and Wynoose soils cover 4.67 percent at 1016 acres. The Cisne, Okaw and Piopolis soils make up one percent. Hydric soils in the watershed are depicted in Figure 16.

Table 10- Hydric Soils

Hydric Soils	Acres	Percent of Watershed
Bonnie	1766.6	8.11%
Cape	498	2.29%
Cisne	11.2	0.05%
Okaw	32.7	0.15%
Piopolis	174.7	0.80%
Wynoose	518.1	2.38%
Totals	**3001.3**	**18.09%**

Source: USDA NRCS

Figure 16



2.3.3 Soil Erodibility

Soil erodibility in the Lake Creek varies by location. The soil erodibility factor (K-factor) was utilized to delineate erodibility. The NRCS defines K-factor as the following:

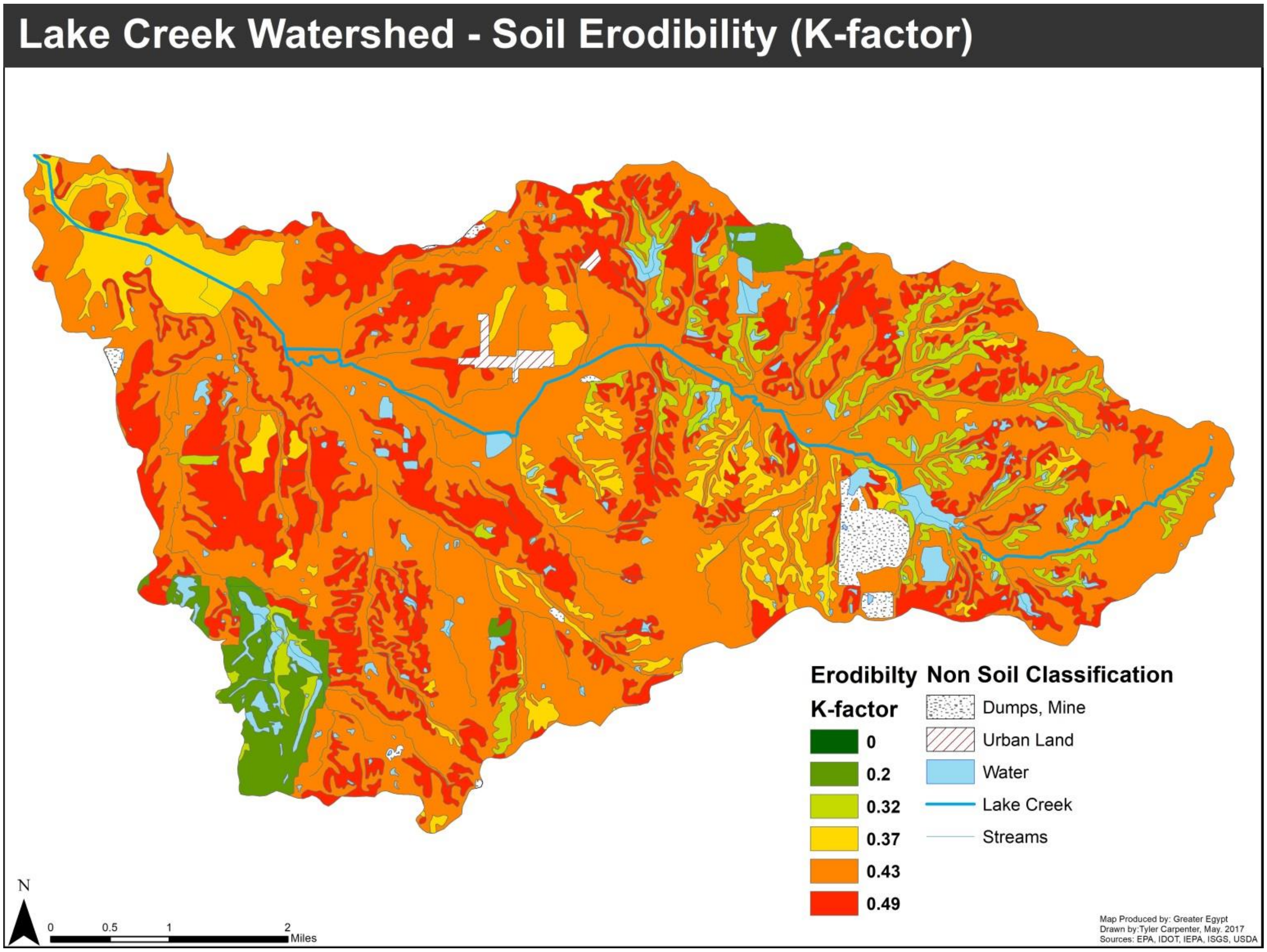
> Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.[11]

Erodibility correlates with the gradual increase in the K-factor value. The K-factor for soils in the Lake Creek watershed ranges from .20 to .49. These values are usually consistent with other features of the soils including hydric status and drainage classification.

K-factor values can be viewed in Table 9. Soils with the lowest K-factor value are the Lenzburg and Fairpoint series at .20. While the majority of soils have a K-factor value of .43, seven soils consist of a K-factor value of .49: Bluford, Cisne, Okaw, Plumfield, Wynoose and subsets of the Colp and Hoyleton soil series. These represent the highest erodible soils in the Lake Creek watershed. Soils and their K-factor values are depicted in Figure 17.

[11] Ibid.

Figure 17



2.3.4 Soil Drainage

The USDA also provides information regarding the drainage classifications of each soil type. In this case, these classes are meant to describe the natural drainage characteristics. There are seven classifications ranging from "Excessively drained," to "Very poorly drained." Of the seven, four classes represent the soil drainage classes located in the Lake Creek watershed. The USDA defines the classes by the following:

> **Well drained:** Water is removed from the soil readily but not rapidly. Internal free water occurrence commonly is deep or very deep; annual duration is not specified. Water is available to plants throughout most of the growing season in humid regions. Wetness does not inhibit growth of

roots for significant periods during most growing seasons. The soils are mainly free of the deep to redoximorphic features that are related to wetness.

Moderately well drained: Water is removed from the soil somewhat slowly during some periods of the year. Internal free water occurrence commonly is moderately deep and transitory through permanent. The soils are wet for only a short time within the rooting depth during the growing season, but long enough that most mesophytic crops are affected. They commonly have a moderately low or lower saturated hydraulic conductivity in a layer within the upper 1 m, periodically receive high rainfall, or both.

Somewhat poorly drained: Water is removed slowly so that the soil is wet at a shallow depth for significant periods during the growing season. The occurrence of internal free water commonly is shallow to moderately deep and transitory to permanent. Wetness markedly restricts the growth of mesophytic crops, unless artificial drainage is provided. The soils commonly have one or more of the following characteristics: low or very low saturated hydraulic conductivity, a high water table, additional water from seepage, or nearly continuous rainfall.

Poorly drained: Water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. The occurrence of internal free water is shallow or very shallow and common or persistent. Free water is commonly at or near the surface long enough during the growing season so that most mesophytic crops cannot be grown, unless the soil is artificially drained. The soil, however, is not continuously wet directly below plow-depth. Free water at shallow depth is usually present. This water table is commonly the result of low or very low saturated hydraulic conductivity of nearly continuous rainfall, or of a combination of these.[12]

These four classifications constitute 95 percent of the watershed total acreage, not including the non-soil classes (water, dumps, and urban land). Table 11 displays

[12] USDA. "Soil Survey Manual." (USDA 2017)

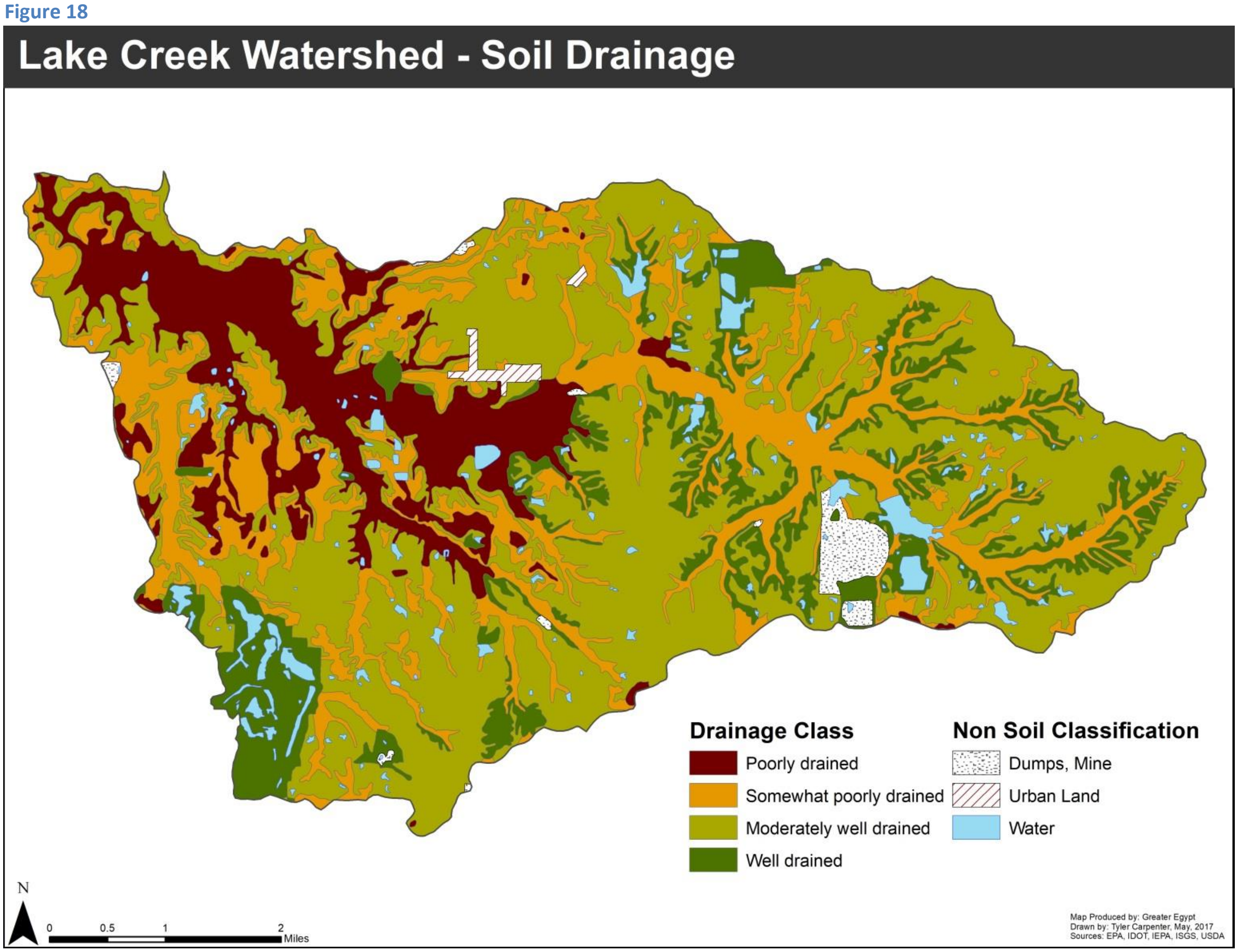
Table 11- Drainage Classifications

Drainage Class	Acres	Percent of Watershed
Poorly Drained	3019.3	13.86%
Somewhat Poorly Drained	4836.9	22.21%
Moderately Well Drained	10081.8	46.28%
Well Drained	2781.6	12.77%
Non-Soil Class	1063.3	4.88%

Source: USDA NRCS

these values. Most of the soils in the watershed are classified as moderately well drained at 10,081.8 acres, or 46.28 percent of the watershed. The group with the least representation is well drained; being 2,781.6 acres, or 12.77 percent of the watershed. These results are spatially displayed in the figure below.

Figure 18



2.4 Watershed Jurisdictions

While the Lake Creek watershed rests entirely within Williamson County, there are only two municipalities within its border. The City of Johnston City represents the largest municipality in the watershed. At approximately 1,287 acres, it is situated entirely within the borders of the Lake Creek watershed. The Village of Pittsburg represents the other municipality in the watershed. While it constitutes 1,352 acres, only 94 acres are within the borders of the Lake Creek watershed.

Although civil townships are absent in Williamson County, there is a presence of survey townships, or Congressional townships. Table 12 displays these townships and their size relative to the watershed. Municipalities are also depicted.

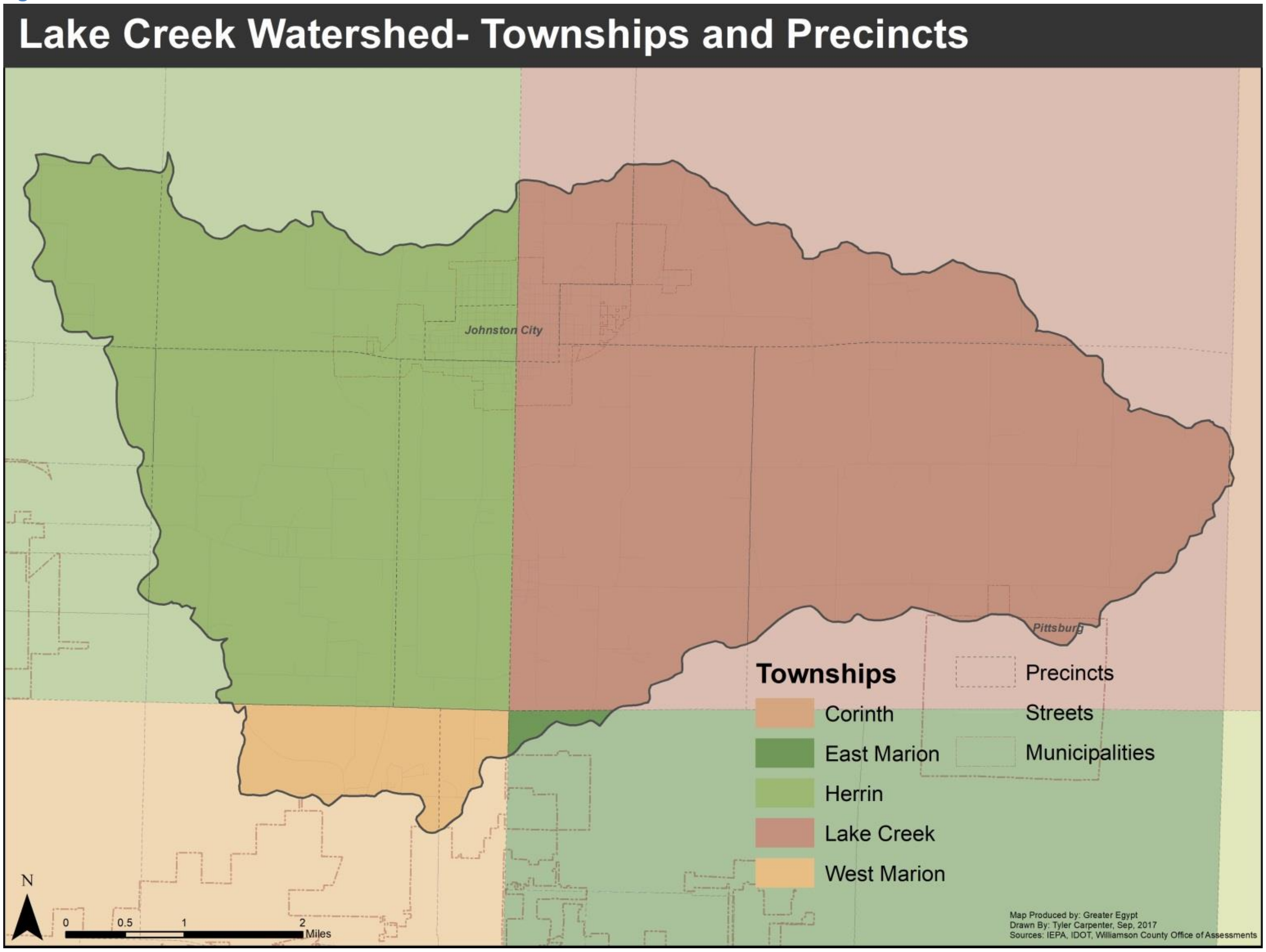
In Williamson County, municipalities generally operate wastewater treatment plants. The City of Johnston City operates their wastewater treatment plant within the Lake Creek watershed. The Village of Pittsburg operates a treatment plant, but the discharge is outside of the watershed boundary. Currently, there are no existing watershed planning initiatives in the Lake Creek watershed, but a few institutions conduct programs related to water quality.

Table 12 - Jurisdictional Areas

Jurisdiction	Total Acres	Acres in Watershed	Percent of Watershed
County	**284,213**	**21,783**	**100%**
Williamson	284,213	21,783	100%
Municipality	**2,639**	**1,381**	**6.34%**
Johnston City	1,287	1,287	5.91%
Pittsburg	1,352	94	0.43%
Townships	**118,385**	**21,783**	**18.40%**
Corinth	23,313	4	0.02%
East Marion	23,769	92	0.42%
Herrin	23,873	8,718	40.02%
Lake Creek	23,448	11,880	54.54%
West Marion	23,982	1,091	5.01%

Sources: US Census Bureau

Figure 19



2.4.1. Municipal Ordinances

Municipalities in the Lake Creek watershed have adopted ordinances in regards to flooding which includes elements of stormwater and erosion control. The communities have adopted the Williamson County Flood Damage Prevention Ordinance as a model for their specific codes. Information on these ordinances has been retrieved through the 2009 Williamson County Multi-Hazard Mitigation Plan.[13] The information has been verified by contacting each municipal department. This insures that information has not been edited since

[13] Greater Egypt Regional Planning and Development Commission, et al. "Williamson County Multi-Hazard Mitigation Plan," Greater Egypt, 2009, 102-104.

the adoption of the 2009 Williamson County Multi-Hazard Mitigation Plan and the 2015 update.

Ordinance No. 08-70-31-05 is the Flood Damage Prevention Ordinance for Williamson County. In addition to many other purposes, it serves to preserve the natural characteristics and functions of watercourses and floodplains in order to moderate flood and stormwater impacts, improve water quality, reduce soil erosion, protect aquatic and riparian habitat, provide recreational opportunities, provide aesthetic benefits and enhance community and economic development.[14]

Municipalities have also implemented programs and policies that target erosion. There are erosion and sediment controls under Subdivision Ordinance, Section 7 for Williamson County. To prevent or reduce erosion, subdividers are required to sod or reseed turf of exposed areas.[15]

2.4.2 Local, State and Federal Responsibilities

In the Lake Creek watershed, there are a few government agencies that implement programs related to watershed planning, water quality, and controlling nonpoint source pollution. While some of these agencies have applied programs that target water related resources specifically for the Lake Creek watershed, other agencies have programs designated for these purposes, but have not been established for the watershed.

The following agencies have been described by their roles related to watershed planning, water quality, and nonpoint source pollution within and outside of the Lake Creek watershed.

Franklin-Williamson Bi-County Health Department

Since Williamson County has a considerable municipal water program, the aim of the Franklin-Williamson Bi-County Health Department is to protect the water sources from private sources. According to their online information, the Health

[14] Williamson County, IL. "Flood Damage Prevention Ordinance," Williamson County, 2008, 2.
[15] Greater Egypt, 104.

Department conducts inspections that follow the guidelines set by the Illinois Water Well Construction Code and the Illinois Water Well Pump Installation Code (Environmental Health).[16]

Greater Egypt Regional Planning and Development Commission

Since the 1960s, the Greater Egypt Regional Planning and Development Commission (Greater Egypt) has played an important role in regional water-related issues such as: watershed planning, water quality, and monitoring nonpoint source pollution. Greater Egypt has produced watershed inventories and plans for: Rend Lake, Cedar Lake, Atchison Creek, Pinckneyville Reservoir, Upper Crab Orchard, and the Upper Big Muddy watershed. These reports involved describing watershed characteristics and water quality in the particular watershed.

More recently, Greater Egypt has produced watershed-based plans for HUC 12 watersheds in the larger Big Muddy watershed. These plans consist of an inventory and assessment, and identify best management practices to mitigate nonpoint source pollution in the watersheds. These plans follow the *Nine Minimum Elements of a Watershed Plan* outlined by the EPA.

In 1981, the Illinois Environmental Protection Agency established the Volunteer Lake Monitoring Program. This program was established to gather fundamental information on Illinois inland lakes. Greater Egypt coordinates the program for Southern Illinois for the ten-county region. Volunteers gather the data on water transparency and water quality. Johnston City Lake, located within the Lake Creek watershed, has been monitored in the past.

Greater Egypt coordinated the Regional Water Quality Coordinating Council (RWQCC) which served as a public forum that reviewed facility plans and domestic wastewater National Pollutant Discharge Elimination System (NPDES) permits. The council covered the ten-county region until January of 2015.

[16] Franklin-Williamson Bi-County Health Department. "Private Water Supply Program," http://www.bicountyhealth.org/index.php/potable-water-program.html. Accessed: Various Dates 2017.

Illinois Department of Natural Resources (IDNR)

The Illinois Department of Natural Resources is responsible for many programs related to water related activities. The IDNR Division of Resource Management is responsible for various activities such as: regulating public waters, regulating construction and maintenance of dams, National Flood Insurance Program coordination, and Flood Mitigation Program (nonstructural) administration. [17]

The Division also has an extensive permitting program in which they are responsible for permits for work along Illinois waterbodies. The four main components of the permitting program are: Floodway/Floodplain Management, Public Water Management, Dam Safety, and Lake Michigan Management. [18]

Illinois Environmental Protection Agency (IEPA)

The IEPA oversees and implements many programs that target watershed planning, water quality, and nonpoint source pollution. Through the National Pollutant Discharge Elimination System (NPDES), the IEPA handles stormwater and wastewater discharges to waterbodies. NPDES permits are required for discharges of: treated municipal effluents, treated industrial effluents, and stormwater discharged through municipal separate storm sewer systems (MS4s) and construction sites. The IEPA Bureau of Water characterizes NPDES and other stormwater regulations by the following:

> Under Phase I of the NPDES Storm Water program, operators were required to obtain permit coverage for construction activity that resulted in a total land disturbance of 5 acres or more or less than 5 acres if they were part of a "larger common plan of development or sale" with a planned land disturbance of 5 acres or greater. Phase II reduced that project size to 1 acre or more.
>
> Phase I of the NPDES Storm Water program began in 1990 and required medium and large municipal separate storm sewer systems (MS4s) to obtain NPDES coverage. The expanded Phase II program began in March 2003 and required small MS4s in urbanized areas to obtain NPDES

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[17] IDNR. "Division of Resource Management," https://www.dnr.illinois.gov/WaterResources/Pages/ResMan.aspx. Accessed: July 2017.
[18] Ibid.

permits and implement six (6) minimum control measures. An urbanized area as delineated by the Bureau of Census is defined as a central place or places and the adjacent densely settled surrounding area that together have a residential population of at least 50,000 people and an overall population density of at least 500 people per square miles.[19]

Two permitted dischargers of wastewater exist in the Lake Creek watershed. These are displayed in Table 13. The NPDES Facility locations are also depicted in Figure 20. More information on existing and discontinued NPDES facilities can be found in the Water Quality section of this report (Section 2.8.6).

Table 13 – NPDES Facilities

Facility	NPDES Permit ID
Freeman United Coal- Orient 4	IL0004685
Johnston City STP	IL0029301

Sources: US EPA

United States Fish and Wildlife Service (USFWS)

The USFWS works with many facets of government to oversee projects in water resource development, conservation planning, and natural resource damage assessment. In coordination with the United States Army Corps of Engineers (USACE) and other state agencies, the USFWS assists in developing resource projects for federal waters. These projects consist of dams, harbor development, flood control, and water storage. Under a collection of policies, the USFWS and the USACE collaborate to conserve the habitats of fish and wildlife during resource development. [20]

Along with water resource development, the agency also collaborates with multiple agencies by providing conservation planning assistance. USFWS staff assists organizations with developing plans of conservation and restoration that accompany their specific objectives of development. [21]

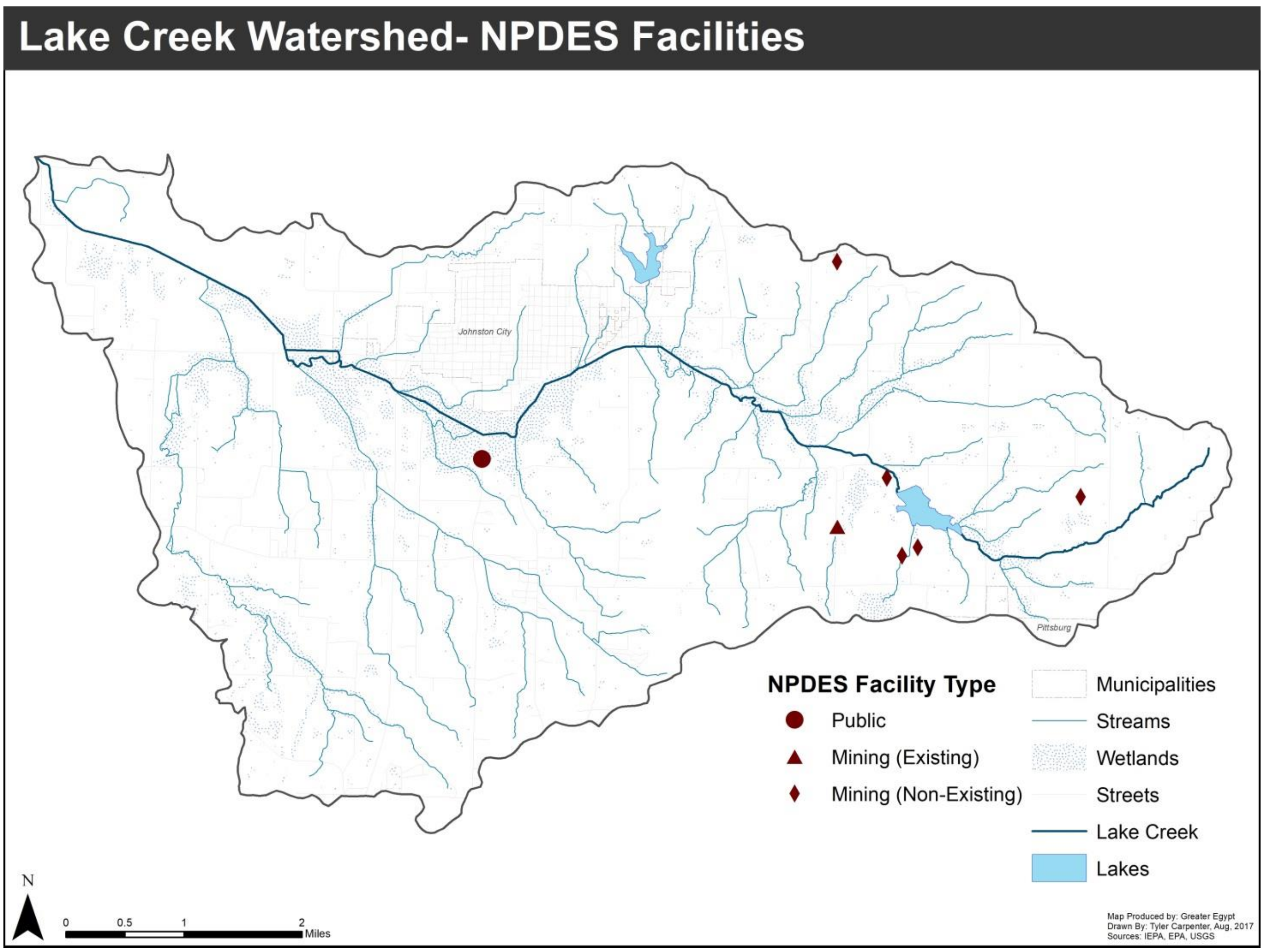
[19] Scott Ristau, e-mail message to author, September 9, 2015.
[20] USFWS. "Overview- Ecological Services," https://www.fws.gov/ecological-services/. Accessed: August 2017.
[21] Ibid.

United States Army Corps of Engineers (USACE)

The United States Army Corps of Engineers St. Louis District is responsible for the preservation and maintenance of waterways within its jurisdiction. Their jurisdiction covers an area which covers eastern Missouri and southwestern Illinois. The Corps is responsible for maintaining the data associated with the waterbodies within its district. Stations in closest proximity to the Lake Creek watershed include Murphysboro and Plumfield which are located along the Big Muddy River.[22]

The Corps is also responsible for water control operations which consist of four Mississippi River navigation structures and five multi-purpose reservoirs within the district which include Rend Lake located north of the Lake Creek watershed.[23]

Figure 20



[22] USACE. "St. Louis District- Water Management USACE," http://mvs-wc.mvs.usace.army.mil/. Accessed: August 2017.
[23] Ibid.

United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS)

The NRCS is a branch of the USDA that provides assistance to landowners by financial and technical means. Financial assistance programs provided by the agency include: Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP) and Agricultural Management Assistance Program (AMA). These programs assist landowners with agricultural and environmental improvements on their land.[24]

Technical assistance through the department is provided through the Conservation Technical Assistance Program (CTA). The CTA covers a variety of components and includes utilizing land management technology and improving and protecting water quality and fish habitat.[25]

Williamson County Soil & Water Conservation District (Williamson County (SWCD)

The Williamson County Soil and Water Conservation District implements several programs in relation to conserving natural resources. Some of their programs include implementing conservation practices for farming that reduce soil loss, and environmental sustainability.[26] Duties related to water resources include the conservation and restoration of wetlands, the protection of groundwater resources, and the prevention of soil erosion.

[24] USDA Natural Resources Conservation Service. "2014 Farm Bill- Financial Assistance Programs-NRCS," https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/farmbill/?cid=stelprdb1237774. Accessed 20 September 2017.
[25] USDA Natural Resources Conservation Service. "Technical Assistance," https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/. Accessed 20 September 2017.
[26] AISWCD. "Association of Illinois Soil and Water Conservation Districts AISWCD," http://www.aiswcd.org/. Accessed 14 July 2015.

2.5 Watershed Demographics

To assess the demographics of the Lake Creek watershed, each village and city was individually examined. Because there are only two municipalities in the entire watershed, an evaluation of Williamson County is also included. Municipalities in the watershed tend to have smaller populations, but are consistent with other smaller towns and villages in Southern Illinois.

The Village of Pittsburg, which is the only village in the watershed, has a population of only 572. By contrast, Johnston City has 3,543, according to the 2010 Census. Johnston City is also the only municipality located entirely within the watershed's borders. The population amounts from the 2000 and 2010 Census are depicted in Table 14.

Table 14- Population Change (2000 and 2010)

Municipality/County	Population 2000	Population 2010	Population Change	Population Change as %
Johnston City	3,557	3,543	-14	-0.4%
Pittsburg	575	572	-3	-0.5%
Williamson County	61,296	66,357	5,061	8.3%

Source: US Census Bureau

Growth forecasts as total and percentage are displayed in Table 15. According to the forecast, both of the municipalities will see a small decline in population. The data used in these tables reflect the municipalities as a whole and may not represent the sections represented only in the Lake Creek watershed. This is particularly evident with the Village of Pittsburg where only seven percent of the municipality is located within the watershed.

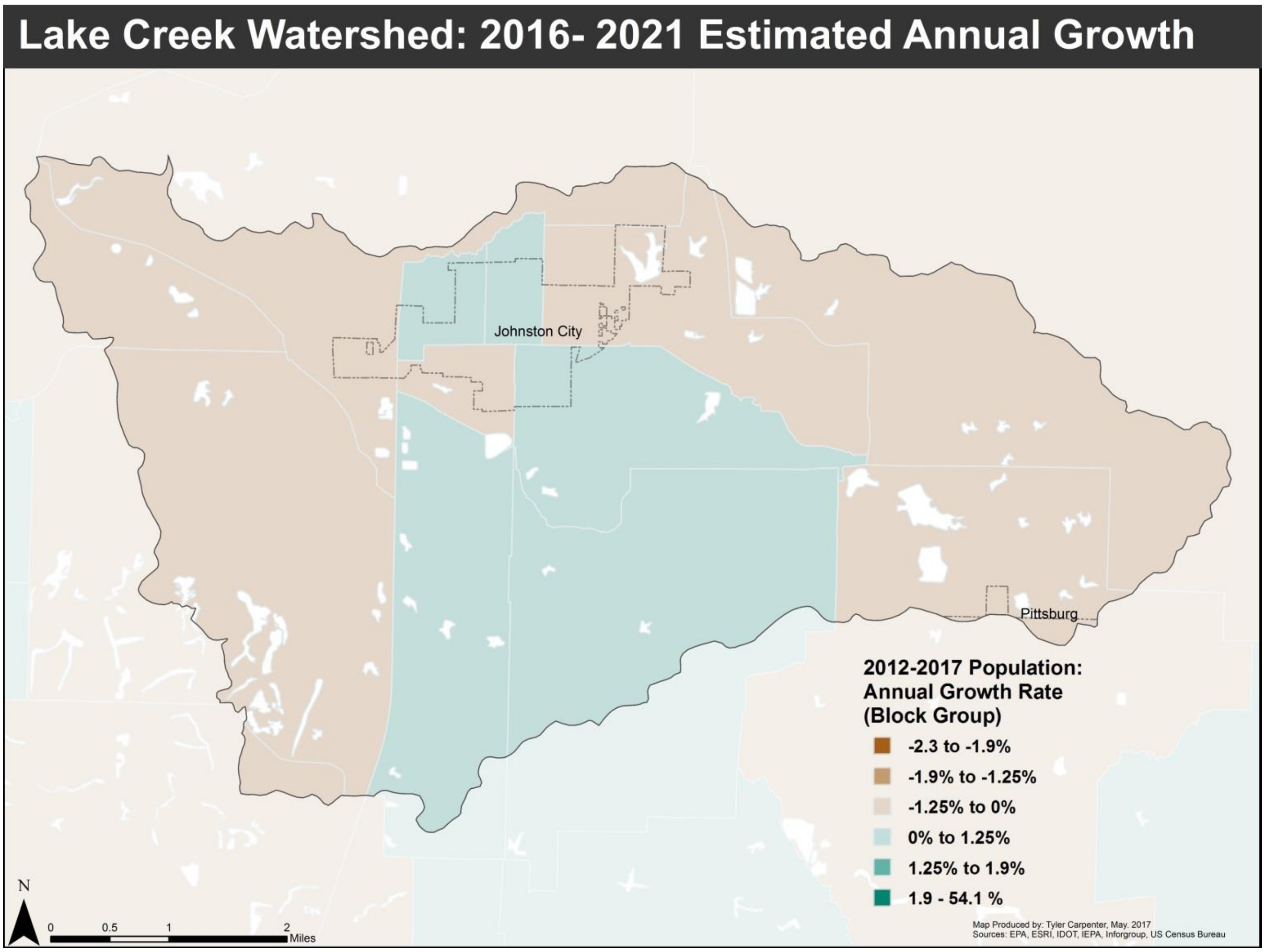
Table 15- Population Growth Forecast

Municipality/County	Growth Forecasts (Total Pop)	Population Growth Forecast as %
Johnston City	3,500	-1.2%
Pittsburg	559	-2.3%
Williamson County	67,466	1.7%

Source: US Census Bureau

Along with these estimates, individual Census Block Groups have been analyzed to display the estimated population growth from the period of 2016 to 2021. This data was derived from the Environmental Systems Research Institute's (ESRI) online map database which utilizes Census data and information obtained from Infogroup. Figure 21 displays the projected 2021 growth by Census Block Groups. This data shares similarities with the previous growth forecast.

Figure 21



The 2015 Illinois Department of Employment Security's Local Area Unemployment Statistics for Williamson County was at 5.9 percent. In 2016, this percentage rose slightly to 6.2 percent.

According to the 2010 Census, the median age for the municipalities within the Lake Creek watershed differs slightly from around 39 to 41 years of age. These numbers are consistent with the median age of Williamson County which is around 39 years of age. The median age and median income are displayed in Table 16.

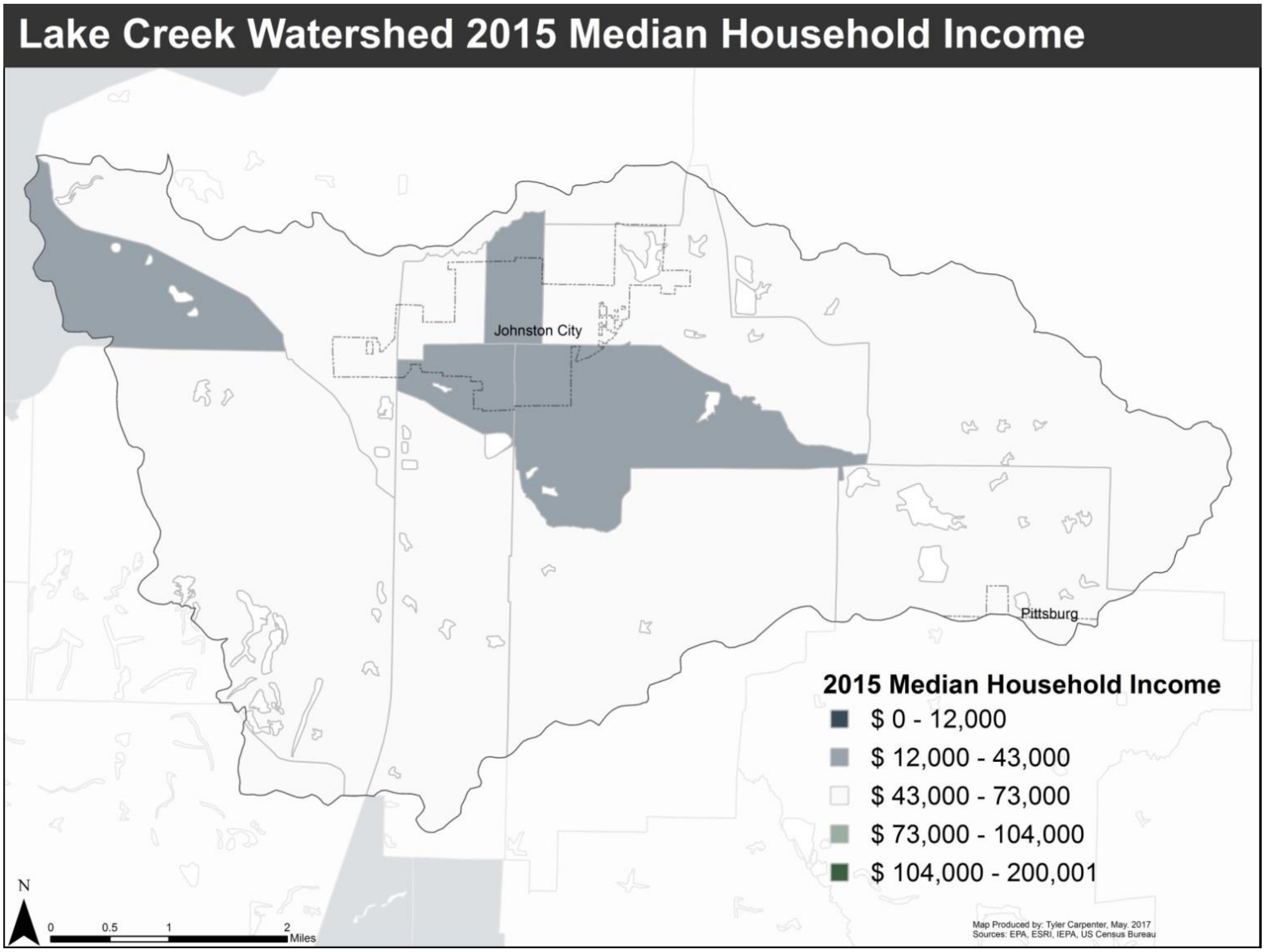
Table 16- Median Age and Income

Municipality/ County	Median Age	Median Income
Johnston City	39.3	$31,149
Pittsburg	41.3	$35,625
Williamson County	38.8	$44,453

Source: US Census Bureau, American Community Survey

Median income in the Lake Creek watershed varies slightly. Corresponding to the information from the 2015 American Community Survey, the Village of Pittsburg and Johnston City share similar income levels. These are well under the median income levels for Williamson County as a whole. Block group data has also been depicted in Figure 22 using information obtained from ESRI.

Figure 22



With the Lake Creek Watershed possessing a limited urban landscape and population, employment opportunities are often found outside of the watershed. Data was retrieved through the JobsEQ software developed by Chmura Economics and Analytics. Table 17 displays the current employment breakdown of occupations for Johnston City, IL. The top three job classifications by employment for Johnston City are: Food Preparation and Serving Related Occupations (129); Education, Training, and Library Occupations (104); and Office and Administrative Support Occupations (75). Employment information for Williamson County, IL has also been provided in Table 18.

Table 17- Johnston City Employment Information

Title	Number of Employees	Average Annual Salary	Location Quotient	Unemployment Numbers	Unemployment Rate
Management Occupations	35	$64,300	0.89	3	2.5%
Business and Financial Operations Occupations	21	$62,000	0.64	3	4.7%
Computer and Mathematical Occupations	6	$59,600	0.33	1	4.3%
Architecture and Engineering Occupations	5	$69,700	0.46	1	3.5%
Life, Physical, and Social Science Occupations	2	$39,300	0.44	0	n/a
Community and Social Service Occupations	13	$33,600	1.27	1	1.7%
Legal Occupations	2	$62,500	0.39	0	n/a
Education, Training, and Library Occupations	104	$43,900	2.86	3	2.5%
Arts, Design, Entertainment, Sports, and Media Occupations	7	$28,200	0.62	1	4.3%
Healthcare Practitioners and Technical Occupations	22	$55,700	0.60	2	1.5%
Healthcare Support Occupations	8	$26,900	0.42	4	6.7%
Protective Service Occupations	18	$41,600	1.32	2	5.2%
Food Preparation and Serving Related Occupations	129	$21,600	2.36	19	10.3%
Building and Grounds Cleaning and Maintenance Occupations	17	$26,400	0.76	6	11.1%
Personal Care and Service Occupations	20	$24,300	0.81	3	5.9%
Sales and Related Occupations	69	$27,800	1.06	11	6.6%
Office and Administrative Support Occupations	75	$29,200	0.79	18	7.1%
Construction and Extraction Occupations	29	$47,800	1.04	12	12.3%
Installation, Maintenance, and Repair Occupations	15	$36,600	0.61	4	5.4%
Production Occupations	26	$31,000	0.67	13	8.8%
Transportation and Material Moving Occupations	14	$31,400	0.34	11	9.5%
Total - All Occupations	638	$35,900	1.00	n/a	n/a

Source: JobsEQ

Table 18- Williamson County Employment Information

Title	Number of Employees	Average Annual Salary	Location Quotient	Unemployment Numbers	Unemployment Rate
Management Occupations	1,672	$75,300	0.91	43	2.5%
Business and Financial Operations Occupations	1,062	$60,800	0.68	51	4.6%
Computer and Mathematical Occupations	482	$62,200	0.55	22	4.4%
Architecture and Engineering Occupations	444	$69,500	0.86	15	3.5%
Life, Physical, and Social Science Occupations	138	$38,100	0.54	5	3.1%
Community and Social Service Occupations	490	$35,200	1.02	9	1.7%
Legal Occupations	164	$59,400	0.65	4	2.2%
Education, Training, and Library Occupations	1,761	$43,800	1.02	50	2.5%
Arts, Design, Entertainment, Sports, and Media Occupations	473	$28,700	0.87	20	4.3%
Healthcare Practitioners and Technical Occupations	2,765	$74,600	1.61	39	1.5%
Healthcare Support Occupations	1,164	$27,800	1.36	76	6.8%
Protective Service Occupations	723	$36,800	1.11	38	5.0%
Food Preparation and Serving Related Occupations	2,862	$22,100	1.10	306	10.3%
Building and Grounds Cleaning and Maintenance Occupations	954	$25,900	0.89	113	11.1%
Personal Care and Service Occupations	970	$23,100	0.83	56	5.8%
Sales and Related Occupations	2,936	$31,300	0.94	199	6.6%
Office and Administrative Support Occupations	4,555	$30,300	1.01	325	7.1%
Farming, Fishing, and Forestry Occupations	83	$23,300	0.41	13	11.1%
Construction and Extraction Occupations	1,413	$48,900	1.05	183	12.4%
Installation, Maintenance, and Repair Occupations	1,163	$38,600	1.01	63	5.4%
Production Occupations	2,261	$32,500	1.23	187	8.8%
Transportation and Material Moving Occupations	1,777	$31,900	0.88	178	9.5%
Total - All Occupations	30,312	$40,100	1.00	n/a	n/a

Source: JobsEQ

2.6 Watershed Land Use

For the land use portion of this inventory, the USGS Multi-Resolution Land Characteristics Consortium (MRLC) land cover and impervious datasets were used to complete the analyses.

2.6.1 Existing Land Use

The largest land use category in the Lake Creek watershed is agriculture. This is comprised of 31.4 percent of pasture and hay and 8.6 percent of cultivated crops. The breakdown of classifications is available in Table 19.

Forests and developed areas comprise 38.7 and 14 percent of the watershed, respectively. The remaining land uses in the watershed are barren land (0.02 percent), grassland/herbaceous (0.56 percent), open water (3.9 percent), and wetlands (2.8 percent). Figure 23 displays the land use map of the watershed, based on 2011 data.

With 40 percent of the watershed being agricultural, there is a high potential for erosion. This is especially true for the areas of cropland that run along Lake Creek, and other larger tributaries in the watershed.

Table 19- Land Use Classification

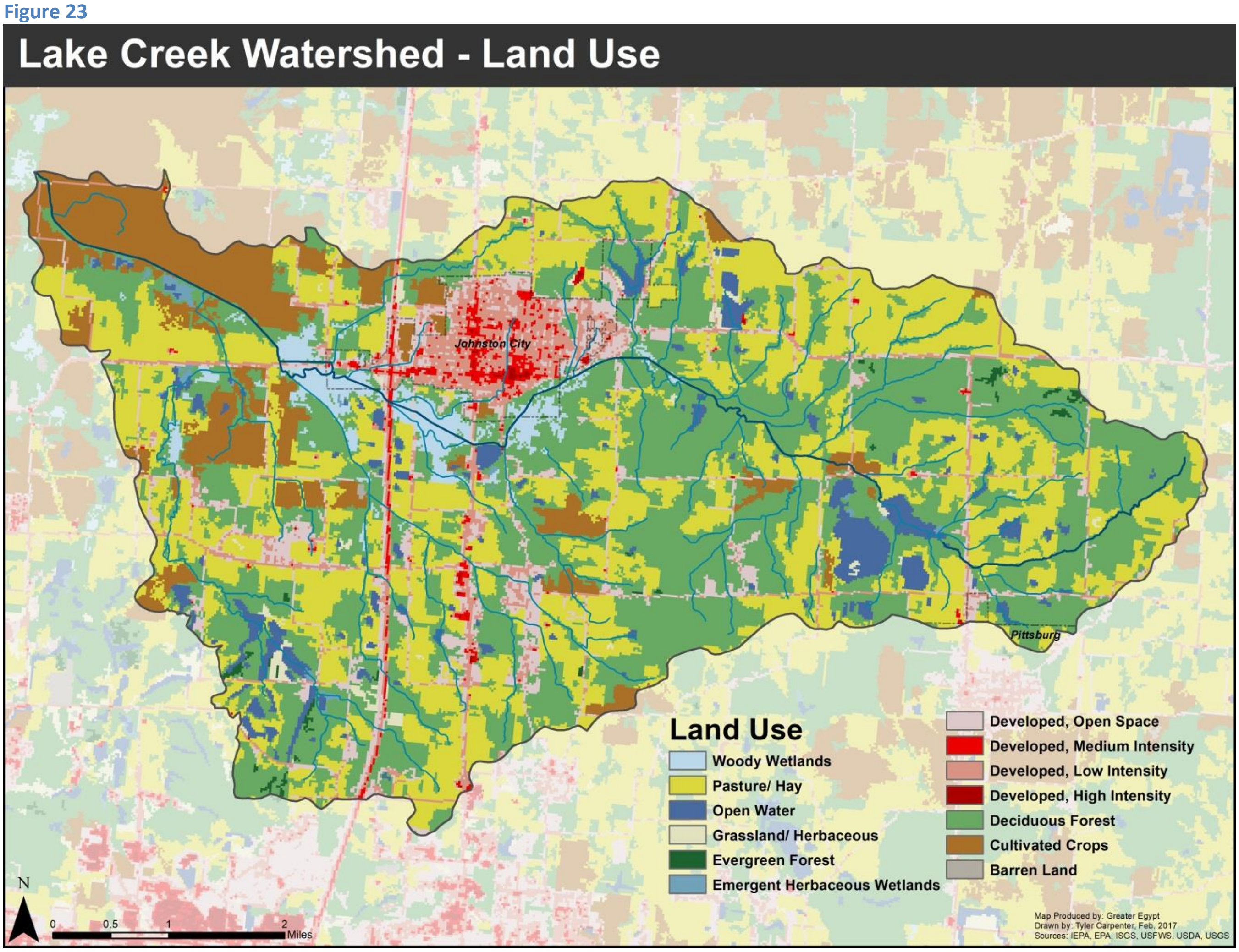
Classification	Acreage	Percent of Watershed
Open Water	843.86	3.87%
Developed, Open Space	1530.96	7.03%
Developed, Low Intensity	1249.01	5.73%
Developed, Medium Intensity	253.94	1.17%
Developed, High Intensity	22.90	0.11%
Barren Land	4.67	0.02%
Deciduous Forest	8355.46	38.35%
Evergreen Forest	68.49	0.31%
Grassland/ Herbaceous	121.63	0.56%
Pasture/ Hay	6845.41	31.42%
Cultivated Crops	1878.29	8.62%
Woody Wetlands	546.57	2.51%
Emergent Herbaceous Wetlands	63.82	0.29%

Source: USGS Multi-Resolution Land Characteristics Consortium (MRLC)

According to the NRCS Soil Survey of Williamson County, "the main concerns affecting the management of cropland in Williamson County include crusting, flooding, ponding, poor tilth, water erosion, and wetness. Equipment limitations, high pH, limited available water capacity, limited rooting depth, low pH, and restricted permeability are additional concerns."[27]

Along with problems affecting cropland, there are also concerns regarding pastureland. These concerns are, "…low pH, water erosion, and wetness. Additional management concerns include equipment limitations, flooding, high pH, limited available water capacity, ponding, and restricted trafficability."[28]

Figure 23



[27] USDA NRCS. "Soil Survey of Williamson County, Illinois," Published Soil Surveys for Illinois, 2006, 120.
[28] Ibid., 123.

According to the 2012 Census of Agriculture (USDA), farming in Williamson County consists mainly of soybeans, corn, and hay. Farmers in the county are predominantly white males, and are an average age of 59 years of age.[29] Cultivation within the Lake Creek watershed follows the same pattern.

Based on the USDA's National Agriculture Statistics Service CropScape[30], the watershed contains approximately 8,662 acres of agricultural land. This includes the 5,660 acres of grass and pasture land classifications. Table 20 displays the types of cultivation found within the watershed. Figure 24 shows the location of the various crops. Accounting for nearly 2,000 acres, soybeans are the largest form of cultivation in the Lake Creek watershed. Corn is also heavily cultivated at 880 acres. Fallow/idle cropland constitutes the next highest form of cultivation at 61 acres.

Table 20 - Agricultural Diversity

Agricultural Classification	Acreage	Percentage of Agriculture	Percentage of Watershed
Corn	880.11	10.16%	4.04%
Sorghum	0.22	>.01%	>.01%
Soybeans	1993.03	23.01%	9.15%
Winter Wheat	4.22	0.05%	0.02%
Winter Wheat/ Soybeans	10.01	0.12%	0.05%
Alfalfa	1.56	0.02%	0.01%
Other Hay/Non Alfalfa	51.14	0.59%	0.23%
Clover/Wildflowers	0.89	0.01%	0.00%
Fallow/Idle Cropland	60.93	0.70%	0.28%
Grass/Pasture	5660.00	65.34%	25.98%
Pumpkins	0.22	>.01%	>.01%

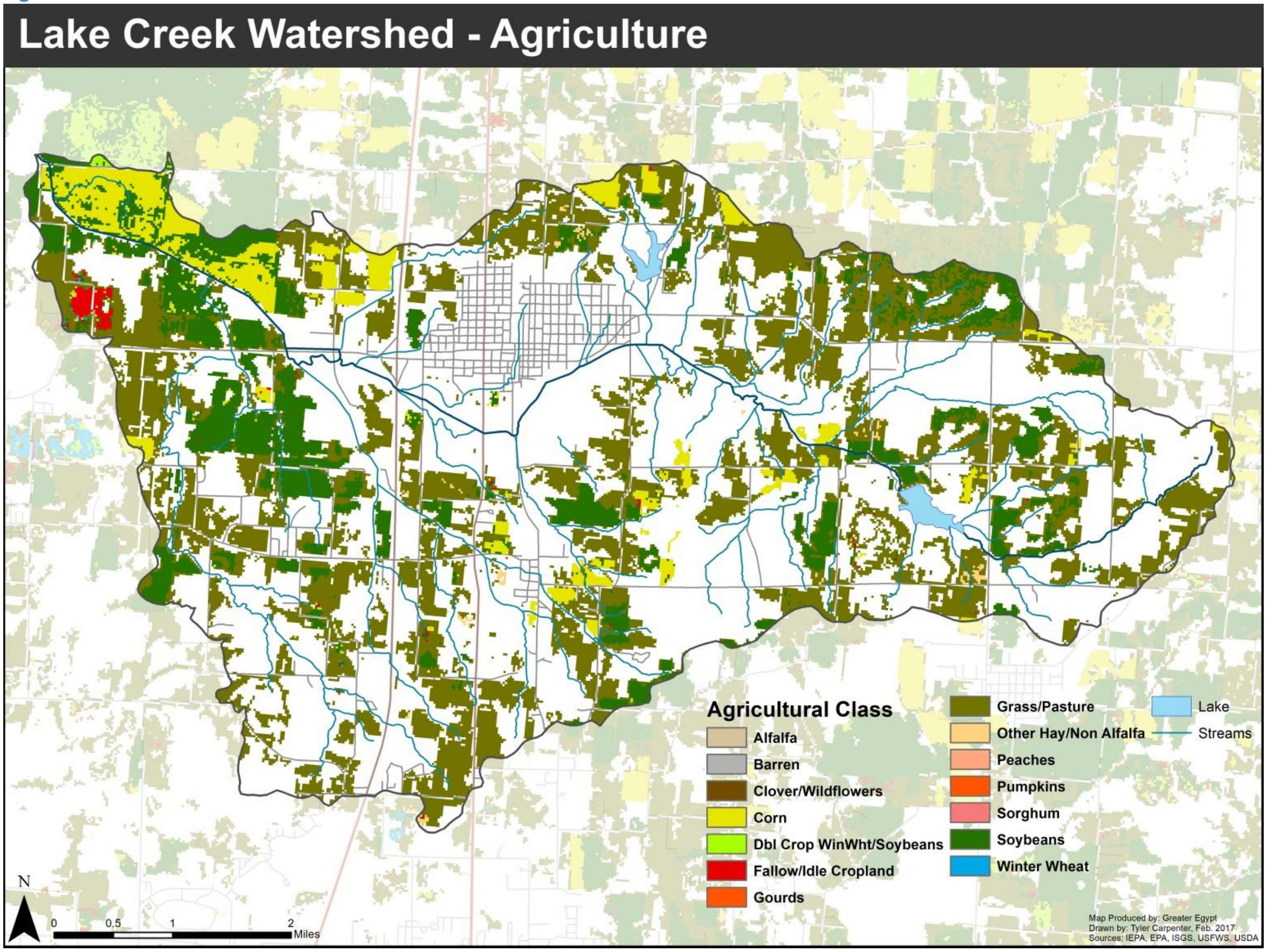
Source: USDA National Agricultural Statistics Service Cropland Data Layer

2.6.2 Predicted Future Land Use

To estimate the future land cover for the Lake Creek watershed, land cover from past and existing datasets has been analyzed. Land cover from 2001, 2006, and the existing 2011 dataset were used to compare past and present changes in land use. Because the classifications were not labeled consistently with the other

[29] Census of Agriculture. "2012 Census Publications," USDA, 2012, 1-2.
[30] *CropScape* (2017). USDA. National Agricultural Statistics Service, 2017.

Figure 24



years, and to prevent skewing of the data, the 1992 land cover dataset could not be utilized during this analysis.

The period from 2001 to 2011 is also a better representation of current land use change within the Lake Creek watershed. This is due to consistent farming practices and development within the target area. Table 21 displays the acreage and percent of watershed of each land use classification for 2001 and 2011.The percent of change from those years, predicted acreage, and percent change of each classification are also displayed.

Assuming development in the area will remain constant, the percent of change from 2001 to 2011 was used to calculate the predicted acreage and predicted percent change of each classification. Although little change occurs in the watershed, three notable contrasts in the predicted land use change occur within the deciduous forest, grassland/herbaceous and open water classifications.

The two increases from the study period are the grassland/ herbaceous and open water land cover. The MRLC defines the grassland/ herbaceous land cover dataset as, “areas dominated by gramanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.”[31] The predicted increase is 31.15 percent. This may seem like a large increase, but the land use only constitutes around 122 acres of the watershed. Open Water will see an increase of 1.69 percent. This accounts for an increase of about 14 acres. The land use with the highest decrease in percentage is the deciduous forest classification. The MRLC defines this classification as “areas dominated by trees generally than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.”[32] The predicted change of this land cover designation is only a decrease of 0.98 percent, but accounts for nearly 83 acres lost.

[31] Department of Interior (DOI) and USGS. “National Land Cover Database 2011 Product Legend,” http://www.mrlc.gov/nlcd11_leg.php. Accessed: June 19, 2017.
[32] Ibid.

Table 21 – Existing and Projected Land Use

Land Use Classification	2001		2011		2001-2006	2006-2011	2001-2011	2011-2021	
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Percent Change	Percent Change	Percent Change	Projected Acreage (2021)*	Projected Percent Change
Open Water	829.81	3.81	843.86	3.87	1.45	0.24	1.69	858.15	1.69
Developed, Open Space	1531.73	7.03	1530.96	7.03	-0.20	0.15	-0.05	1530.19	-0.05
Developed, Low Intensity	1240.38	5.69	1249.01	5.73	-0.05	0.75	0.70	1257.69	0.70
Developed, Medium Intensity	247.10	1.13	253.94	1.17	0.99	1.76	2.77	260.97	2.77
Developed, High Intensity	20.24	0.09	22.90	0.11	6.59	6.16	13.16	25.92	13.16
Barren Land	0.00	0.00	4.67	0.02	0.00	100.00	100.00	9.34	100.00
Deciduous Forest	8438.21	38.73	8355.46	38.35	-0.51	-0.47	-0.98	8273.53	-0.98
Evergreen Forest	71.84	0.33	68.49	0.31	-5.26	0.63	-4.66	65.29	-4.66
Grassland/Herbaceous	92.74	0.43	121.63	0.56	40.77	-6.83	31.15	159.52	31.15
Hay/Pasture	6843.54	31.41	6845.41	31.42	-0.05	0.07	0.03	6847.27	0.03
Cultivated Crops	1867.13	8.57	1878.29	8.62	0.00	0.60	0.60	1889.52	0.60
Woody Wetlands	540.45	2.48	546.57	2.51	0.00	1.13	1.13	552.74	1.13
Emergent Herbaceous Wetlands	61.83	0.28	63.82	0.29	0.00	3.22	3.22	65.87	3.22

Source: USGS MRLC

2.6.3 Existing and Predicted Imperviousness

As a whole, the Lake Creek watershed has a rather low level of imperviousness with 86 percent of the watershed being categorized as zero percent impervious. This is mainly due to low levels of development with Johnston City being the only urbanized area in the watershed. Imperviousness in the watershed has been characterized by acreage and percent of the watershed by intervals of ten percent (See Table 22). These intervals have also been depicted spatially in Figure 25. As stated previously, 18,728 acres, or 86 percent, of the watershed consist of non-existing impervious cover. This is a major contrast to the 90-100 percent impervious cover, which constitutes less than one tenth of a percent (0.01 percent), or about two acres. The more impervious locations in the Lake Creek watershed occur in the central portions of the watershed in the Arrowhead and Johnston City subwatersheds (SMU 7& 10).

Other areas that exhibit imperviousness are the road networks throughout the watershed. This is particularly evident near the I-57 and IL-37 routes that run in a north-south direction near the western portion of the watershed.

Following the same method to predict future land use, impervious land cover from past and existing datasets has been analyzed. Impervious land cover from the 2001 and 2011 datasets were utilized to compare past and present variations in imperviousness. Table 22 also displays the predicted percent of change and acreage to the year 2021.

According to the analysis, levels of imperviousness will continue to rise. However, these levels are hardly noticeable. The only impervious levels set to decline is at the zero and 0-10 percent levels. They are both set to decline less than one tenth of a percent over the ten year period (16 and 0.73 acres). The largest increase in impervious cover in regards to acreage is the 40-50 percent cover at 3.76 acres. The largest increase by percentage is the 90-100 level at 25 percent. Since this level only accounted for a miniscule portion of the watershed, it will only see a rise of about 0.44 acres.

Figure 25

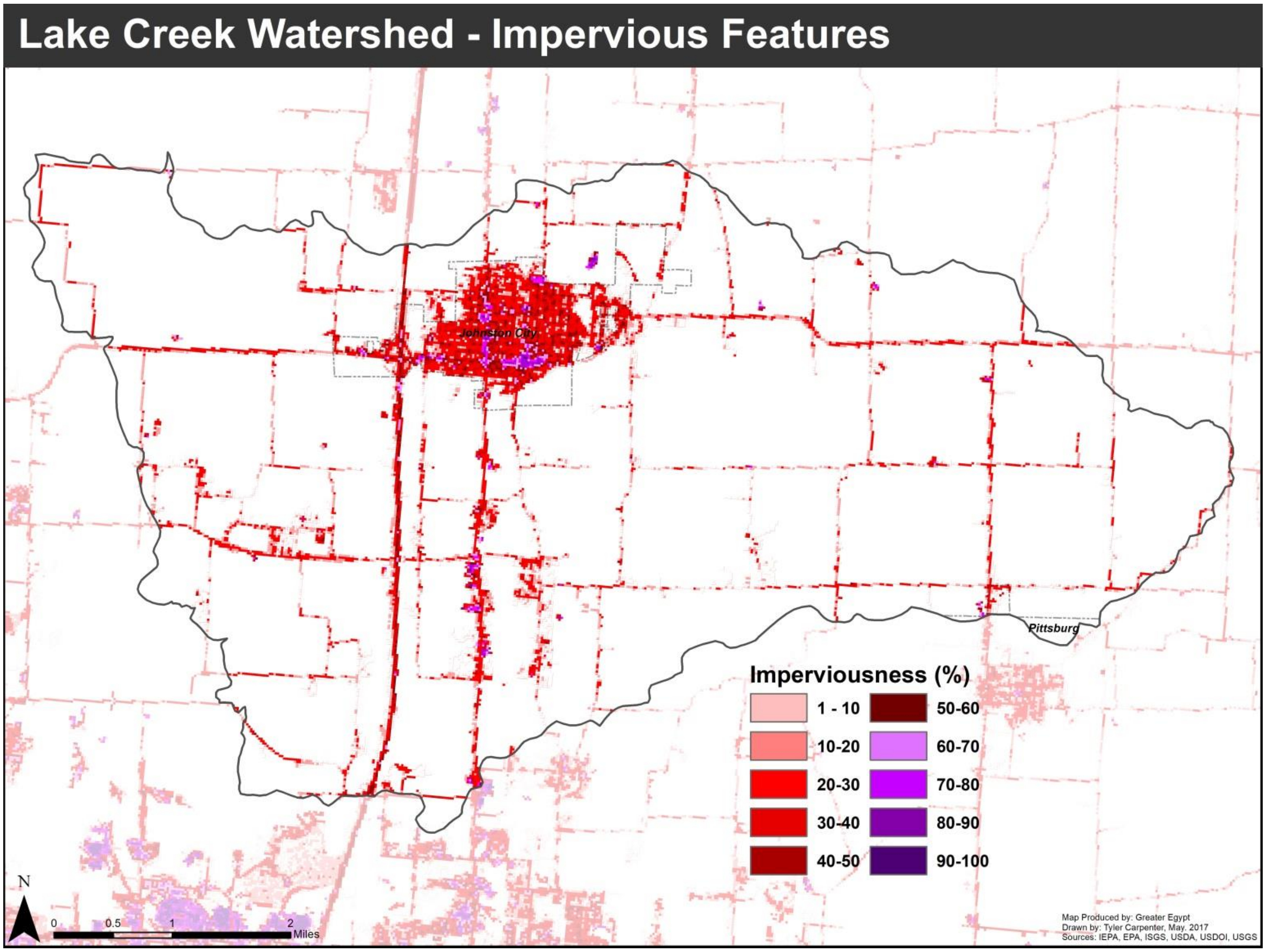

Lake Creek Watershed - Impervious Features
Johnston City
Pittsburg
Imperviousness (%)
1 - 10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-100
N
0
0.5
1
2
Miles
Map Produced by: Greater Egypt
Drawn by: Tyler Carpenter, May. 2017
Sources: IEPA, EPA, ISGS, USDA, USDOI, USGS

Table 22 – Existing and Projected Imperviousness

Percent Imperviousness	2001		2011		2001-2011	2011-2021	
	Acreage	Percent of Watershed	Acreage	Percent of Watershed	Percent Change	Projected Acreage (2021)	Projected Percent Change
0%	18744.00	86.04	18727.73	85.97	-0.08	18712.61	-0.08
0-10%	958.36	4.40	957.64	4.40	-0.07	956.97	-0.07
10-20%	640.98	2.94	641.61	2.95	0.10	642.28	0.10
20-30%	508.43	2.33	508.84	2.34	0.09	509.29	0.09
30-40%	380.76	1.75	383.86	1.76	0.82	386.99	0.82
40-50%	311.82	1.43	315.58	1.45	1.21	319.41	1.21
50-60%	139.90	0.64	140.78	0.65	0.64	141.67	0.64
60-70%	53.82	0.25	57.38	0.26	6.61	61.17	6.61
70-80%	29.58	0.14	32.25	0.15	9.02	35.16	9.02
80-90%	15.57	0.07	17.12	0.08	10.00	18.84	10.00
90-100%	1.78	0.01	2.22	0.01	25.00	2.78	25.00

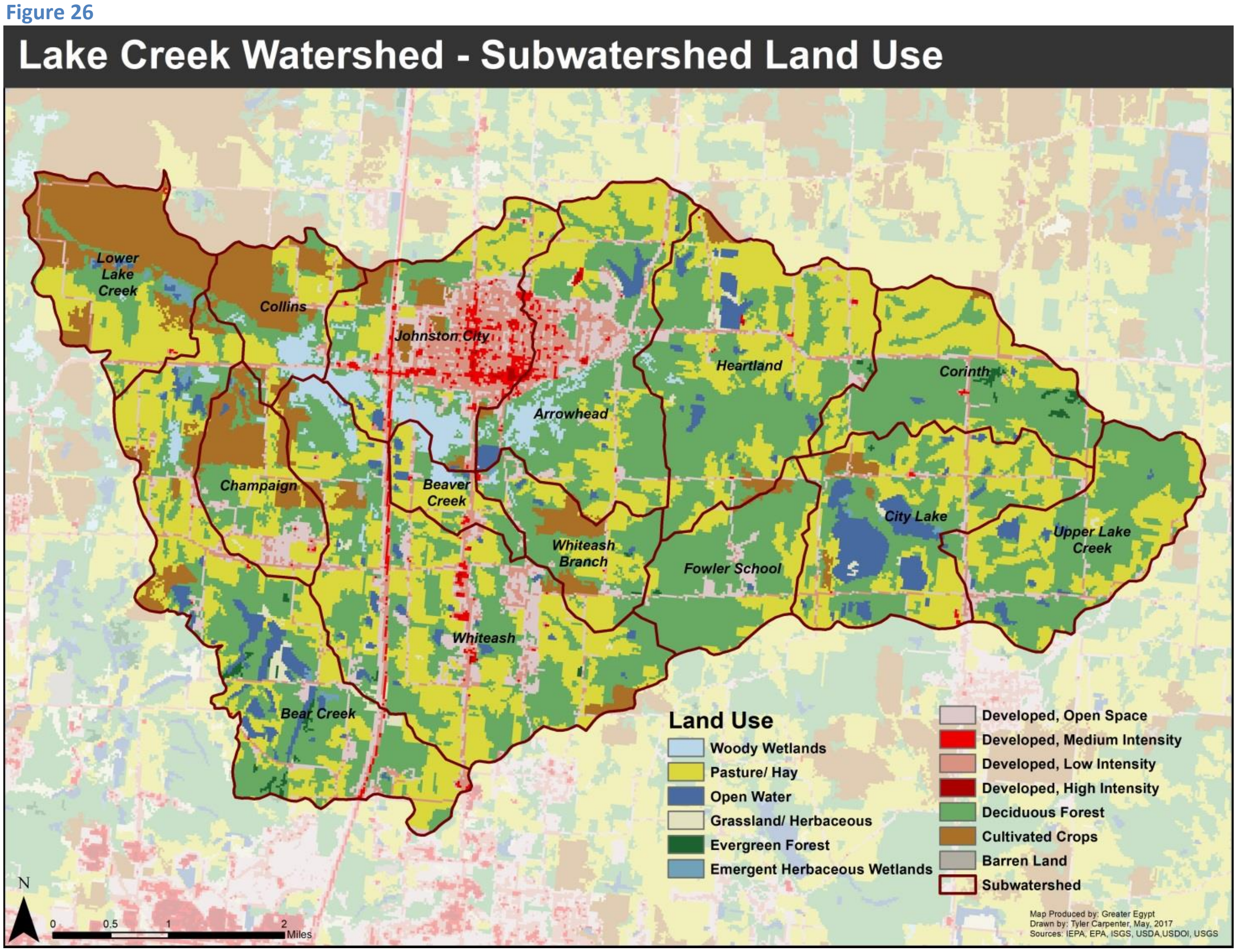
Source: USGS MRLC

2.6.4 Land Cover and Imperviousness of the Subwatersheds

Each subwatershed management unit has been delineated by land cover and imperviousness. Table 23 displays both the acreage and percentage of each SMU by the land use classification. Tables 24 and 25 present the impervious cover and predicted impervious cover of each subwatershed

The City Lake subwatershed (SMU 2) has the highest percentage of open water at 296 acres. This is due to the presence of Johnston City Lake for which it is named, and the lakes surrounding Orient Mine No.4. It should be noted that these estimations are based off of the MRLC 2011 data and include most of the Orient Mine No. 4 as open water. This accounts for roughly 125 acres being wrongly assigned open water. Disregarding this data, the Bear Creek subwatershed (SMU 11) would have the most acreage of open water at 201 acres. This includes many natural lakes near the southwestern portion of the watershed.

Figure 26



Because of the location of Johnston City, the Whiteash and Johnston City subwatersheds (SMU 8 & 10) exhibit the highest percentage of all developed land classifications. The Whiteash SMU encloses 351 acres of open space. The Johnston City SMU exhibits the highest concentrations of all other developed land use including low, medium, and high intensity. Together, this makes up around 578 acres, or nearly a third of the subwatershed. The Johnston City SMU also exhibits the most acreage of woody wetlands at 183 acres.

With more than a third of its total land use being classified as deciduous forest, the Whiteash subwatershed (SMU 8) is made up of nearly 1167 acres of the land use. This also accounts for five percent of the entire Lake Creek watershed. This SMU also has the highest concentration of pasture/hay with 1157 acres.

Because of its size, the Bear Creek subwatershed has the highest percentage of evergreen forest and grassland/herbaceous land classifications at 31 and 48 acres, respectively.

At 674 acres, the Lower Lake Creek subwatershed (SMU 14) has the highest concentration of cultivated crops. This accounts for over half of the subwatershed's total acreage. Lower Lake Creek also has the most emergent herbaceous wetland features at 29 acres featured along the Lake Creek in the northwest portion of the watershed.

Table 23 – Existing Subwatershed Land Use

Subwatershed Land Use Classification	Upper Lake Creek		City Lake		Corinth		Fowler School		Heartland	
	Acreage	% of SMU 1	Acreage	% of SMU 2	Acreage	% of SMU 3	Acreage	% of SMU 4	Acreage	% of SMU 5
Open Water	49.98	3.43%	295.90	16.28%	6.91	0.49%	1.79	0.18%	102.69	4.47%
Developed, Open Space	54.89	3.76%	68.01	3.74%	38.80	2.76%	67.95	6.85%	91.13	3.97%
Developed, Low Intensity	28.56	1.96%	56.86	3.13%	35.68	2.54%	8.72	0.88%	45.12	1.96%
Developed, Medium Intensity	0.00	0.00%	3.57	0.20%	1.34	0.10%	0.00	0.00%	4.00	0.17%
Developed, High Intensity	0.00	0.00%	0.22	0.01%	0.22	0.02%	0.00	0.00%	0.89	0.04%
Barren Land	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Deciduous Forest	865.27	59.31%	605.85	33.33%	742.20	52.83%	720.42	72.62%	1090.43	47.45%
Evergreen Forest	0.00	0.00%	1.11	0.06%	26.09	1.86%	1.34	0.14%	2.89	0.13%
Grassland/ Herbaceous	2.90	0.20%	11.60	0.64%	0.00	0.00%	0.00	0.00%	20.89	0.91%
Pasture/ Hay	456.06	31.26%	709.32	39.02%	546.83	38.92%	178.15	17.96%	879.50	38.27%
Cultivated Crops	1.34	0.09%	58.65	3.23%	6.91	0.49%	13.63	1.37%	49.57	2.16%
Woody Wetlands	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	10.89	0.47%
Emergent Herbaceous Wetlands	0.00	0.00%	6.91	0.38%	0.00	0.00%	0.00	0.00%	0.00	0.00%

Subwatershed Land Use Classification	Whiteash Branch		Arrowhead		Whiteash		Beaver Creek		Johnston City	
	Acreage	% of SMU 6	Acreage	% of SMU 7	Acreage	% of SMU 8	Acreage	% of SMU 9	Acreage	% of SMU 10
Open Water	7.78	1.05%	66.36	3.15%	66.08	2.06%	15.75	4.30%	14.69	0.85%
Developed, Open Space	47.33	6.37%	236.72	11.22%	351.16	10.93%	24.40	6.67%	231.75	13.38%
Developed, Low Intensity	15.78	2.12%	215.57	10.22%	185.74	5.78%	30.83	8.42%	418.53	24.16%
Developed, Medium Intensity	2.22	0.30%	38.97	1.85%	42.19	1.31%	5.32	1.45%	147.15	8.50%
Developed, High Intensity	0.00	0.00%	5.12	0.24%	4.02	0.13%	0.00	0.00%	12.69	0.73%
Barren Land	0.00	0.00%	0.00	0.00%	4.69	0.15%	0.00	0.00%	0.00	0.00%
Deciduous Forest	320.40	43.12%	886.76	42.03%	1166.67	36.33%	92.05	25.15%	278.95	16.11%
Evergreen Forest	2.22	0.30%	0.00	0.00%	3.57	0.11%	0.00	0.00%	0.00	0.00%
Grassland/ Herbaceous	0.00	0.00%	5.34	0.25%	16.74	0.52%	0.00	0.00%	13.13	0.76%
Pasture/ Hay	232.41	31.28%	527.78	25.01%	1157.30	36.04%	160.15	43.76%	310.34	17.92%
Cultivated Crops	103.98	14.00%	14.03	0.66%	129.70	4.04%	0.00	0.00%	122.00	7.04%
Woody Wetlands	7.33	0.99%	113.35	5.37%	81.93	2.55%	36.38	9.94%	182.77	10.55%
Emergent Herbaceous Wetlands	3.56	0.48%	0.00	0.00%	0.41	0.06%	1.11	0.30%	0.00	0.00%

Source: USGS MRLC

Table 23 cont'd – Existing Subwatershed Land Use

Subwatershed Land Use Classification	Bear Creek		Champaign		Collins		Lower Lake Creek	
	Acreage	% of SMU 11	Acreage	% of SMU 12	Acreage	% of SMU 13	Acreage	% of SMU 14
Open Water	200.50	7.26%	5.57	0.67%	0.00	0.00%	12.09	0.93%
Developed, Open Space	175.55	6.36%	96.04	11.52%	35.39	4.69%	16.34	1.26%
Developed, Low Intensity	114.73	4.16%	41.22	4.94%	26.93	3.57%	32.23	2.48%
Developed, Medium Intensity	10.25	0.37%	1.34	0.16%	0.45	0.06%	2.01	0.16%
Developed, High Intensity	0.45	0.02%	0.22	0.03%	0.00	0.00%	0.00	0.00%
Barren Land	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Deciduous Forest	1023.65	37.08%	193.41	23.20%	167.17	22.14%	202.56	15.60%
Evergreen Forest	31.41	1.14%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Grassland/ Herbaceous	48.12	1.74%	1.78	0.21%	1.11	0.15%	1.57	0.12%
Pasture/ Hay	968.84	35.09%	228.40	27.39%	149.14	19.75%	327.46	25.22%
Cultivated Crops	130.99	4.74%	261.60	31.37%	301.40	39.92%	673.72	51.90%
Woody Wetlands	36.09	1.31%	3.12	0.37%	73.01	9.67%	1.57	0.12%
Emergent Herbaceous Wetlands	20.27	0.73%	1.11	0.13%	0.45	0.06%	28.65	2.21%

Source: USGS MRLC

Imperviousness in the subwatersheds follows the same characteristics as the Lake Creek watershed as a whole. Table 23 displays the 2011 values of imperviousness in the subwatersheds. The majority of the subwatersheds are non-impervious. Only six of the thirteen subwatersheds exhibit under 90 percent of areas with zero percent imperviousness. Because of the proximity of Johnston City, I-57 and IL-13, and the former Village of Whiteash, SMUs 7, 8, and 10 are the only subwatersheds that have values for all levels of imperviousness. The existing impervious features can be seen in Figure 27.

The Johnston City subwatershed can be classified as being the most impervious subwatershed in the Lake Creek watershed while the Lower Lake Creek SMU is the least impervious.

According to the estimations (see Table 24), the predicted changes to impervious features in the subwatersheds are extremely low. Five of the fourteen subwatersheds will see no change. The Collins, Corinth, Lower Lake Creek, and Upper Lake Creek subwatersheds will actually see a decrease in impervious features. The remaining SMUs will see a slight rise in impervious features. This includes Johnston City and Whiteash where urban areas are more prevalent.

Figure 27

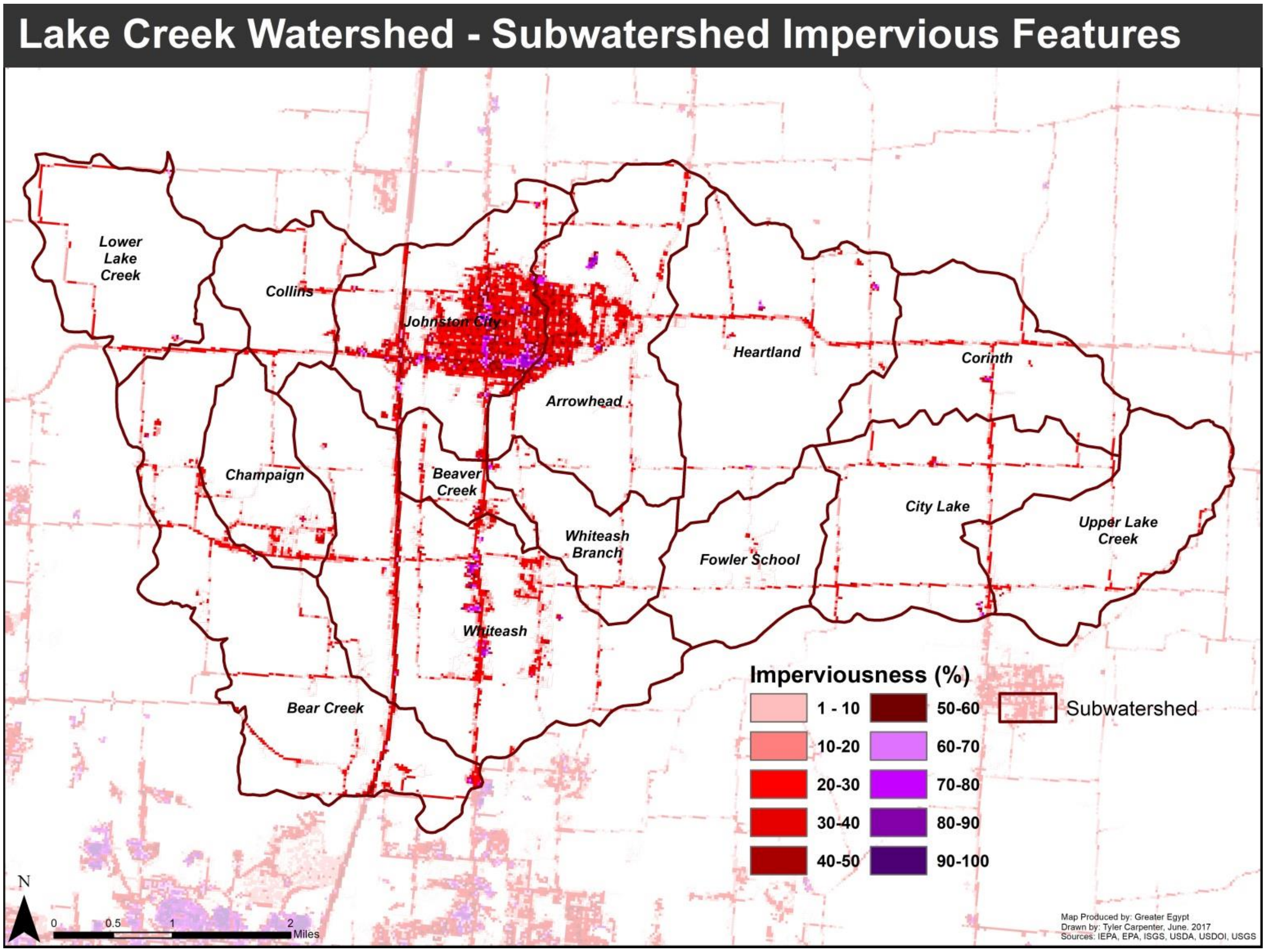

Lake Creek Watershed - Subwatershed Impervious Features
Lower Lake Creek
Collins
Johnston City
Heartland
Corinth
Arrowhead
Champaign
Beaver Creek
Whiteash Branch
Fowler School
City Lake
Upper Lake Creek
Whiteash
Bear Creek
Imperviousness (%)
1 - 10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-100
Subwatershed
N
0
0.5
1
2
Miles
Map Produced by: Greater Egypt
Drawn by: Tyler Carpenter, June, 2017
Sources: IEPA, EPA, ISGS, USDA, USDOI, USGS

Table 24 – Existing Subwatershed Imperviousness

2011 Percent Imperviousness	Upper Lake Creek		City Lake		Corinth		Fowler		Heartland	
	Acreage	% of SMU 1	Acreage	% of SMU 2	Acreage	% of SMU 3	Acreage	% of SMU 4	Acreage	% of SMU 5
0%	1376.16	94.30%	1691.66	93.06%	1329.16	94.61%	917.67	92.47%	2156.03	93.83%
0-10%	41.13	2.82%	33.39	1.84%	20.44	1.45%	56.94	5.74%	48.39	2.11%
10-20%	16.32	1.12%	36.95	2.03%	21.34	1.52%	10.68	1.08%	48.61	2.12%
20-30%	17.88	1.23%	35.39	1.95%	25.15	1.79%	5.78	0.58%	26.98	1.17%
30-40%	7.38	0.51%	13.58	0.75%	5.39	0.38%	0.89	0.09%	9.37	0.41%
40-50%	0.45	0.00	3.34	0.18%	2.02	0.14%	0.44	0.04%	4.24	0.18%
50-60%	-	-	1.34	0.07%	0.45	0.03%	-	-	1.11	0.05%
60-70%	-	-	1.34	0.07%	0.22	0.02%	-	-	1.11	0.05%
70-80%	-	-	0.67	0.04%	0.45	0.03%	-	-	1.34	0.06%
80-90%	-	-	0.22	0.01%	0.22	0.02%	-	-	0.67	0.03%
90-100%	-	-	-	-	-	-	-	-	-	-

2011 Percent Imperviousness	Whiteash Branch		Arrowhead		Whiteash		Beaver Creek		Johnston City	
	Acreage	% of SMU 6	Acreage	% of SMU 7	Acreage	% of SMU 8	Acreage	% of SMU 9	Acreage	% of SMU 10
0%	677.80	91.21%	1613.49	76.49%	2633.71	82.01%	305.66	83.45%	933.39	53.88%
0-10%	30.00	4.04%	153.85	7.29%	235.65	7.34%	13.98	3.82%	129.24	7.46%
10-20%	18.89	2.54%	90.17	4.27%	128.17	3.99%	12.43	3.39%	116.76	6.74%
20-30%	10.44	1.41%	76.81	3.64%	67.87	2.11%	13.76	3.76%	115.87	6.69%
30-40%	3.11	0.42%	75.92	3.60%	56.52	1.76%	7.77	2.12%	137.26	7.92%
40-50%	0.89	0.12%	59.22	2.81%	52.29	1.63%	7.55	2.06%	158.65	9.16%
50-60%	0.89	0.12%	24.05	1.14%	19.58	0.61%	4.00	1.09%	78.88	4.55%
60-70%	0.67	0.09%	6.46	0.31%	8.01	0.25%	1.11	0.30%	35.65	2.06%
70-80%	0.44	0.06%	5.34	0.25%	6.45	0.20%	-	-	16.27	0.94%
80-90%	-	-	3.78	0.18%	2.67	0.08%	-	-	9.14	0.53%
90-100%	-	-	0.45	0.02%	0.67	0.02%	-	-	1.11	0.06%

Source: USGS MRLC

Table 24 cont'd – Existing Subwatershed Imperviousness

2011 Percent Imperviousness	Bear Creek		Champaign		Collins		Lower Lake Creek	
	Acreage	% of SMU 11	Acreage	% of SMU 12	Acreage	% of SMU 13	Acreage	% of SMU 14
0%	2460.74	89.13%	691.40	82.92%	698.06	92.45%	1247.95	96.13%
0-10%	115.40	4.18%	61.45	7.37%	13.52	1.79%	3.51	0.27%
10-20%	65.43	2.37%	39.19	4.70%	20.69	2.74%	14.93	1.15%
20-30%	56.05	2.03%	24.93	2.99%	15.78	2.09%	15.58	1.20%
30-40%	37.27	1.35%	12.17	1.46%	5.74	0.76%	9.61	0.74%
40-50%	16.29	0.59%	3.09	0.37%	1.06	0.14%	4.15	0.32%
50-60%	6.35	0.23%	1.08	0.13%	-	-	0.67	0.05%
60-70%	1.10	0.04%	0.17	0.02%	-	-	0.13	0.01%
70-80%	1.10	0.04%	-	-	-	-		-
80-90%	0.00	0.00%	0.02	0.00	0.01	0.00		-
90-100%	-	-	-	-	-	-		-

Source: USGS MRLC

Table 25 – Subwatershed Projected Imperviousness

2011-2021 Percent Imperviousness	Upper Lake Creek SMU 1		City Lake SMU 2		Corinth SMU 3		Fowler SMU 4		Heartland SMU 5	
	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change
0%	1376.2	0.00	1691.7	0.00	1329.2	0.00	917.7	0.00	2156.0	0.00
0-10%	40.7	-1.09	33.4	0.00	20.4	-0.03	56.9	0.00	48.4	0.00
10-20%	16.3	-0.02	36.9	0.00	21.3	-0.03	10.7	0.00	48.6	0.00
20-30%	17.9	-0.02	35.4	0.00	25.1	-0.03	5.8	0.00	27.0	0.00
30-40%	7.4	-0.02	13.6	0.00	5.4	-0.03	0.9	0.00	9.4	0.00
40-50%	-	-	3.3	0.00	2.0	-0.03	0.4	0.00	4.2	0.00
50-60%	-	-	1.3	0.00	0.4	-0.03	-	-	1.1	0.00
60-70%	-	-	1.3	0.00	0.2	-0.03	-	-	1.1	0.00
70-80%	-	-	0.7	0.00	0.4	-0.03	-	-	1.3	0.00
80-90%	-	-	0.2	0.00	0.4	100.00	-	-	0.7	0.00
90-100%	-	-	-	-	-	-	-	-	-	-

2011-2021 Percent Imperviousness	Whiteash Branch SMU 6		Arrowhead SMU 7		Whiteash SMU 8		Beaver Creek SMU 9		Johnston City SMU 10	
	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change
0%	672.5	-0.78	1612.4	-0.07	2633.7	0.00	305.7	0.00	924.6	-0.95
0-10%	31.2	3.85	154.1	0.14	232.4	-1.40	14.0	0.00	131.0	1.40
10-20%	19.8	4.94	90.2	0.00	127.5	-0.52	12.4	0.00	117.2	0.38
20-30%	10.7	2.17	76.8	0.00	67.0	-1.29	13.8	0.00	117.0	0.97
30-40%	4.8	55.56	76.1	0.29	56.3	-0.39	7.8	0.00	139.8	1.82
40-50%	1.8	100.00	59.7	0.76	53.2	1.73	7.5	0.00	159.3	0.42
50-60%	1.8	100.00	24.0	0.00	19.6	0.0	4.0	0.00	79.3	0.57
60-70%	-	-	6.7	3.57	9.6	20.0	1.1	0.00	37.0	3.90
70-80%	-	-	5.3	0.00	8.5	31.8	-	-	16.5	1.39
80-90%	-	-	3.8	0.00	4.6	71.4	-	-	9.4	2.50
90-100%	-	-	0.4	0.00	1.0	50.0	-	-	1.4	25.0

Source: USGS MRLC

Table 25 cont'd– Subwatershed Projected Imperviousness

2011-2021 Percent Imperviousness	Bear Creek SMU 11		Champaign SMU 12		Collins SMU 13		Lower Lake Creek SMU 14	
	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change	Predicted Acreage (2021)	Predicted Percent Change
0%	2460.7	-0.02	691.8	0.39	698.1	0.00	1247.9	-0.10
0-10%	115.2	-0.22	61.4	-0.01	13.5	-0.06	3.4	-0.07
10-20%	65.4	-0.07	39.2	0.06	20.7	-0.01	14.9	-0.06
20-30%	56.0	-0.09	24.9	-0.01	15.8	-0.02	15.5	-0.08
30-40%	36.5	-0.82	12.1	-0.07	5.7	-0.04	9.6	-0.01
40-50%	16.1	-0.20	3.1	-0.02	1.0	-0.05	4.1	-0.10
50-60%	6.2	-0.11	1.1	-0.03	0.7	-0.01	0.7	0.00
60-70%	1.1	-0.01	0.3	0.17	1.3	-0.01	0.0	-1.21
70-80%	1.8	0.44	-	-	-	-	-	-
80-90%	-	-	0.4	0.22	-	-	-	-
90-100%	-	-	-	-	-	-	-	-

Source: USGS MRLC

2.7 Watershed Drainage and Assessment

To further characterize the waterbodies in the Lake Creek watershed, an assessment has been included to identify certain impairments of streams and lakes. Components assessed are channelization, condition of riparian area, and degree of bank erosion for streams. For the lake assessment, a summary of the riparian buffer zones and degree of shoreline erosion were assessed.

Assessment methods include field evaluations, analyses of aerial photography from 1938 to 2017, and remote analysis utilizing an unmanned aircraft system (UAS).

For each component, the assessed streams were delineated by their individual reach code. These reach codes identify certain portions of the stream, and represent varying degrees of stream length. Appendix A contains the stream name with its corresponding reach code and length. Appendix B spatially displays these reaches.

Streams that have an existing reach code, but have an unknown label, have been assigned a name. These include: Arrowhead Creek, Champaign Creek, Corinth Creek, Fowler Creek, Johnston City Tributary, and Whiteash Creek. The labels generally correspond with their subwatershed.

2.7.1 Streambank Erosion

Erosion is the degradation of a bank or shoreline by natural and non-natural processes. While natural activity can erode a streambank over time, changes to hydrology and land use can escalate this process. Factors such as channelization and loss of riparian habitat can also lead to eroded banks.

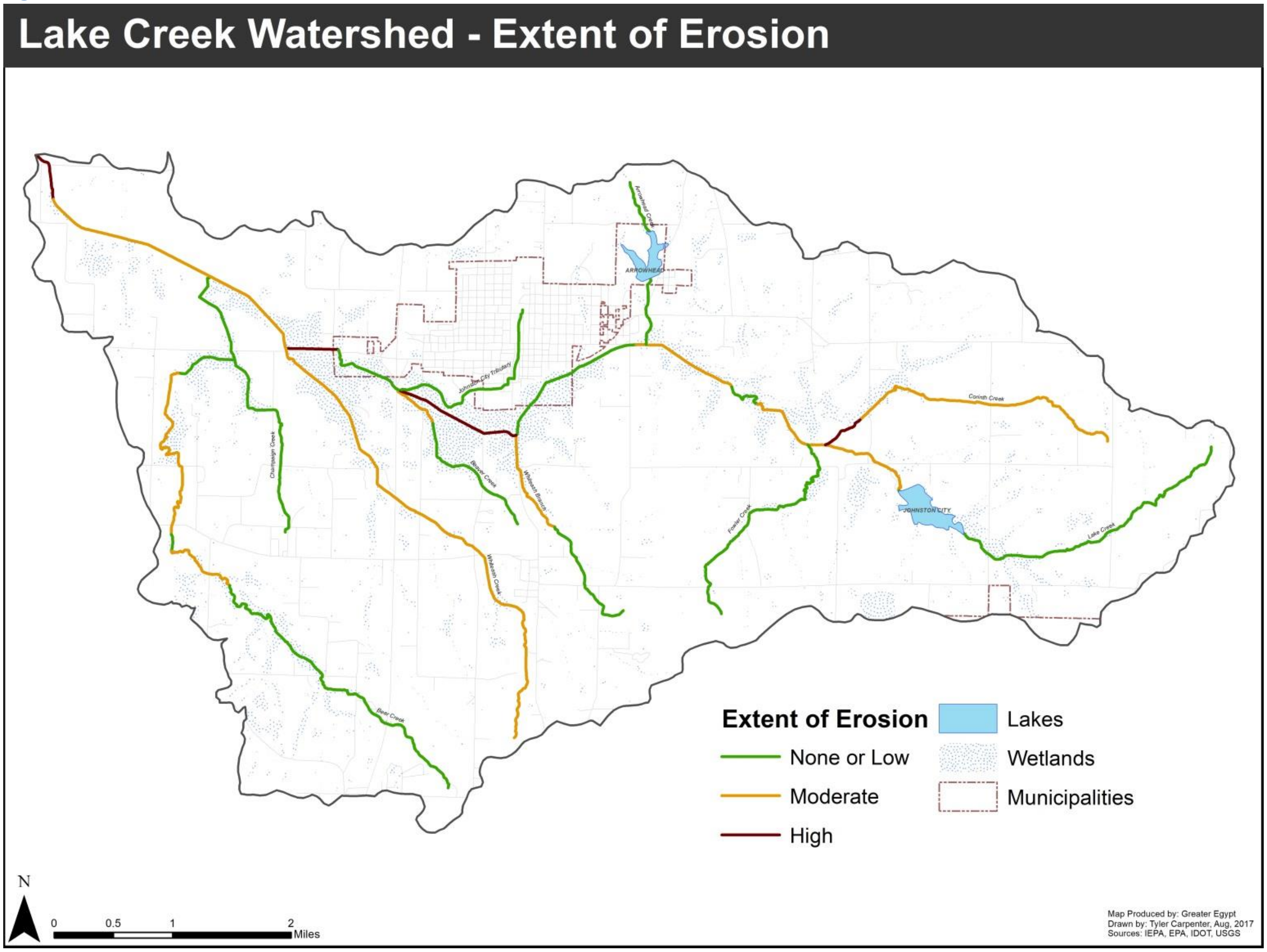
Erosion was assessed as none, or low (0-33 percent of banks displaying erosion), moderate (33-66 percent), and high (66-100 percent). Results for streambank erosion by reaches are summarized in Table 26.

Table 26- Streambank Erosion by Reach

Extent of Erosion	None or Low		Moderate		High	
	Reaches	%	Reaches	%	Reaches	%
Arrowhead Lake	6	100.0%	0	0.0%	0	0.0%
Bear Creek	10	66.7%	5	33.3%	0	0.0%
Beaver Creek	1	50.0%	1	50.0%	0	0.0%
Champaign Creek	2	100.0%	0	0.0%	0	0.0%
Corinth Creek	0	0.0%	1	50.0%	1	50.0%
Fowler Creek	1	100.0%	0	0.0%	0	0.0%
Johnston City Tributary	1	100.0%	0	0.0%	0	0.0%
Lake Creek	10	47.6%	7	33.3%	4	19.0%
Whiteash Branch	2	66.7%	1	33.3%	0	0.0%
Whiteash Creek	0	0.0%	3	100.0%	0	0.0%

The majority of streams and tributaries in the Lake Creek watershed exhibit some degree of streambank erosion. While there are areas of high erosion, they may be classified as moderate because of other parts of that particular reach exhibiting less erosion. Areas of increased erosion occur near the tributary confluences of Lake Creek, or highly channelized reaches. This is evident at the Lake Creek reach west of Johnston City (07140106006977). Other areas that experience high rates of erosion are streambanks around culverts. These results are also presented in Figure 28.

Figure 28



2.7.2 Stream Channelization

Channelization refers to reducing the natural meandering shape of a stream channel. While this straightening can sometimes limit the impact of flooding, it can have impacts on erosion and loss of habitat.

Since channelization encourages a non-sinuous course, water flows much faster resulting in an increase of sediment transport and decrease of riffles and pools that can delay heavy flow. The degree of channelization by stream reach is summarized in Table 27.

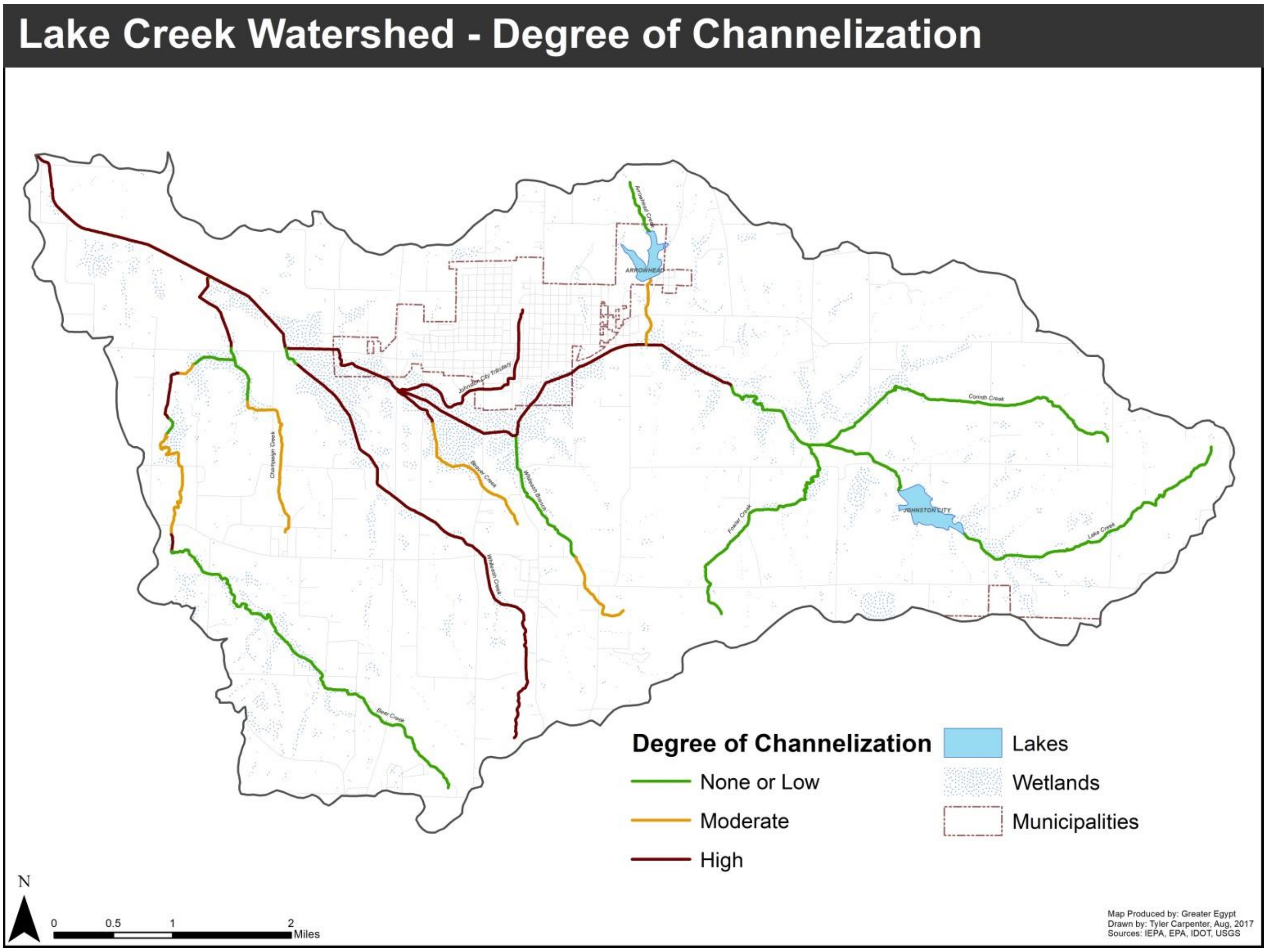
The method of assessing erosion is also applied to the degree of channelization where less than 33 percent of the particular reach is characterized as having none, or low channelization, 33 to 66 percent of reach channelized is moderate, and a high degree of channelization is expressed as exhibiting 66 percent or more channelized features.

Table 27- Degree of Channelization

Degree of Channelization	None or Low		Moderate		High	
	Reaches	%	Reaches	%	Reaches	%
Arrowhead Lake	4	66.7%	2	33.3%	0	0.0%
Bear Creek	10	66.7%	2	13.3%	3	20.0%
Beaver Creek	0	0.0%	1	50.0%	1	50.0%
Champaign Creek	1	50.0%	1	50.0%	0	0.0%
Corinth Creek	2	100.0%	0	0.0%	0	0.0%
Fowler Creek	1	100.0%	0	0.0%	0	0.0%
Johnston City Tributary	0	0.0%	0	0.0%	1	100.0%
Lake Creek	11	52.4%	0	0.0%	10	47.6%
Whiteash Branch	2	66.7%	1	33.3%	0	0.0%
Whiteash Creek	1	33.3%	0	0.0%	2	66.7%

The Lake Creek watershed is prone to all degrees of channelization. With the exception of reaches at the headwaters of streams, waterbodies in the watershed have been channelized at various locations. This is evident along the large expanses near pastures, farm land, and areas of urbanization. Figure 29 displays the degree of channelization for the assessed streams and tributaries.

Figure 29



2.7.3 Condition of Riparian Areas

Riparian corridors provide a buffer for streams and tributaries by filtering pollutants from runoff. Buffers also provide beneficial wildlife habitat. This assessment classifies riparian zones, or buffers, as the area up to 150 feet from the stream on either bank. The one-third method from the previous components has also been utilized for riparian buffers. Stream reaches that have 33 percent, or fewer areas with degraded riparian areas have been classified as good, 33-66 percent as fair, and 66 percent or more as poor. Table 28 displays the condition of riparian areas.

Table 28- Condition of Riparian Area

Condition of Riparian Area	Good		Fair		Poor	
	Reaches	%	Reaches	%	Reaches	%
Arrowhead Lake	6	100.0%	0	0.0%	0	0.0%
Bear Creek	10	66.7%	2	13.3%	3	20.0%
Beaver Creek	2	100.0%	0	0.0%	0	0.0%
Champaign Creek	2	100.0%	0	0.0%	0	0.0%
Corinth Creek	1	50.0%	1	50.0%	0	0.0%
Fowler Creek	1	100.0%	0	0.0%	0	0.0%
Johnston City Tributary	0	0.0%	0	0.0%	1	100.0%
Lake Creek	12	57.1%	8	38.1%	1	4.8%
Whiteash Branch	1	33.3%	0	0.0%	2	66.7%
Whiteash Creek	2	66.7%	1	33.3%	0	0.0%

In general, development in riparian zones is minimal in the Lake Creek watershed. While much of the Lake Creek riparian area is forested, many portions of the creek exhibit erosion, debris blockages, and areas of limited biodiversity.

Figure 30- Natural Debris Blockage (Whiteash Branch)

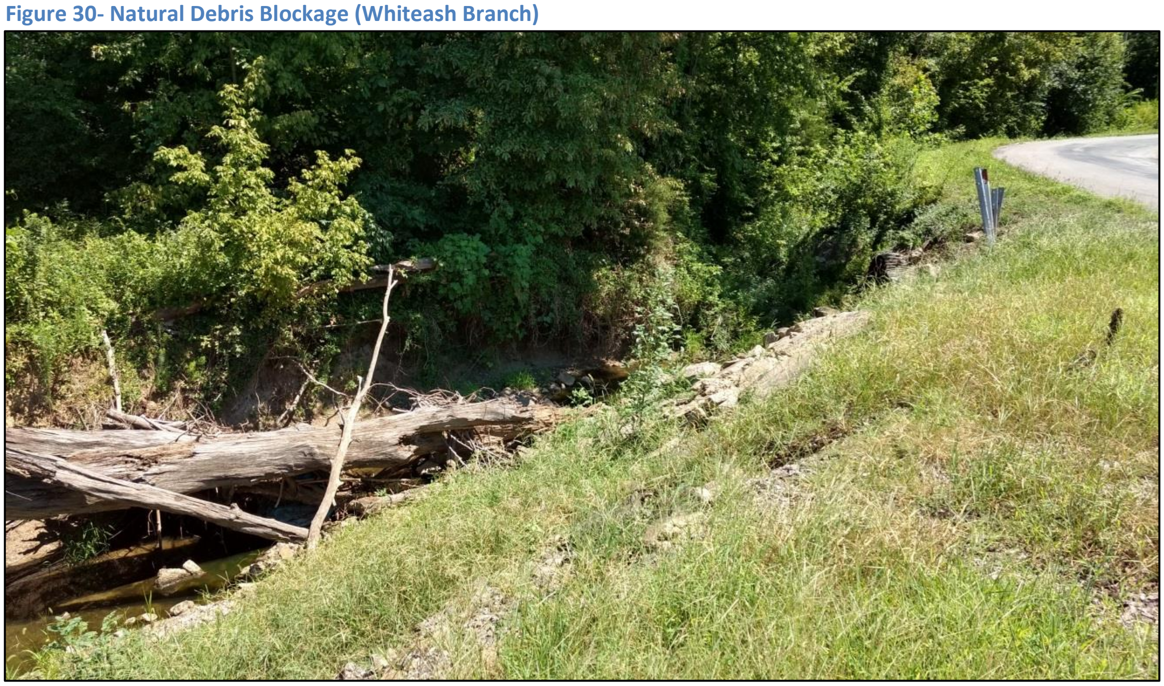
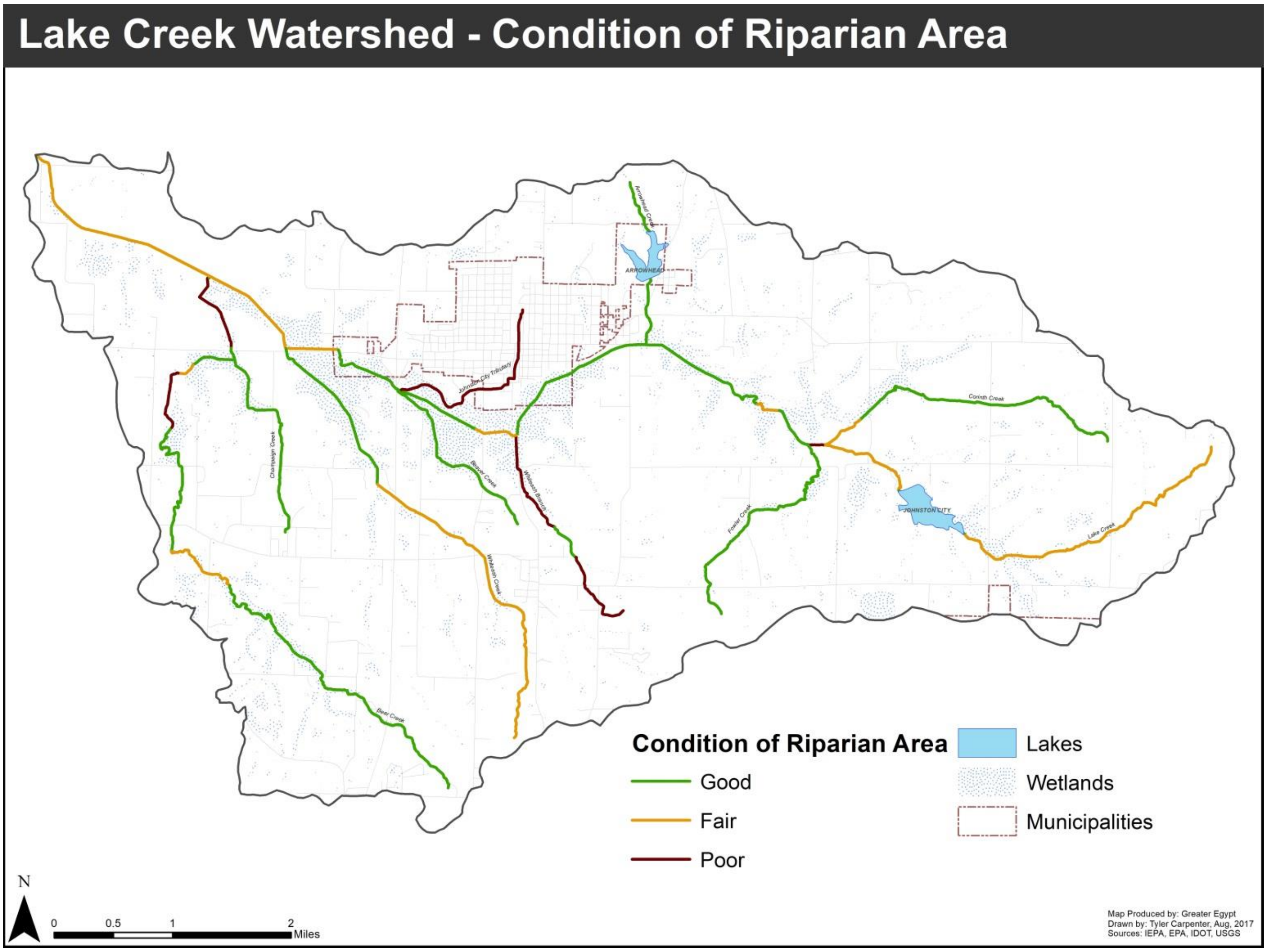


Figure 31



2.7.4 Lake Assessment

Two lakes were assessed for this report. Johnston City Lake (IL_RNZE) is the largest lake in the Lake Creek watershed. It is owned by the City of Johnston City, IL, and is leased by the Mach Mining Company. At approximately 64 acres, the Johnston City Lake lies in the easterly portion of the Lake Creek watershed and begins at the City Lake subwatershed.

Arrowhead Lake (IL_RNZX), also referred to as Sweet Lake, is the second largest lake in the watershed at 36 acres. The City of Johnston City also owns and operates this lake. It is primarily used for recreation. Both lakes are on the Illinois

Environmental Protection Agency's 303(d) List of Impaired Waters. This will be covered further in the following chapter.

Each lake was given a shoreline code for documentation purposes. Parameters assessed were condition of shoreline buffer zones (riparian conditions) and degree of shoreline erosion. Observations from various assessment points were used to assess the parameters previously stated.

Johnston City Lake (IL_RNZE)

Table 29 contains information regarding the shoreline buffer zones. For this assessment, the buffer zone included the area approximately 150 feet from the shoreline. Johnston City Lake was assigned 12 shoreline codes for individual evaluation.

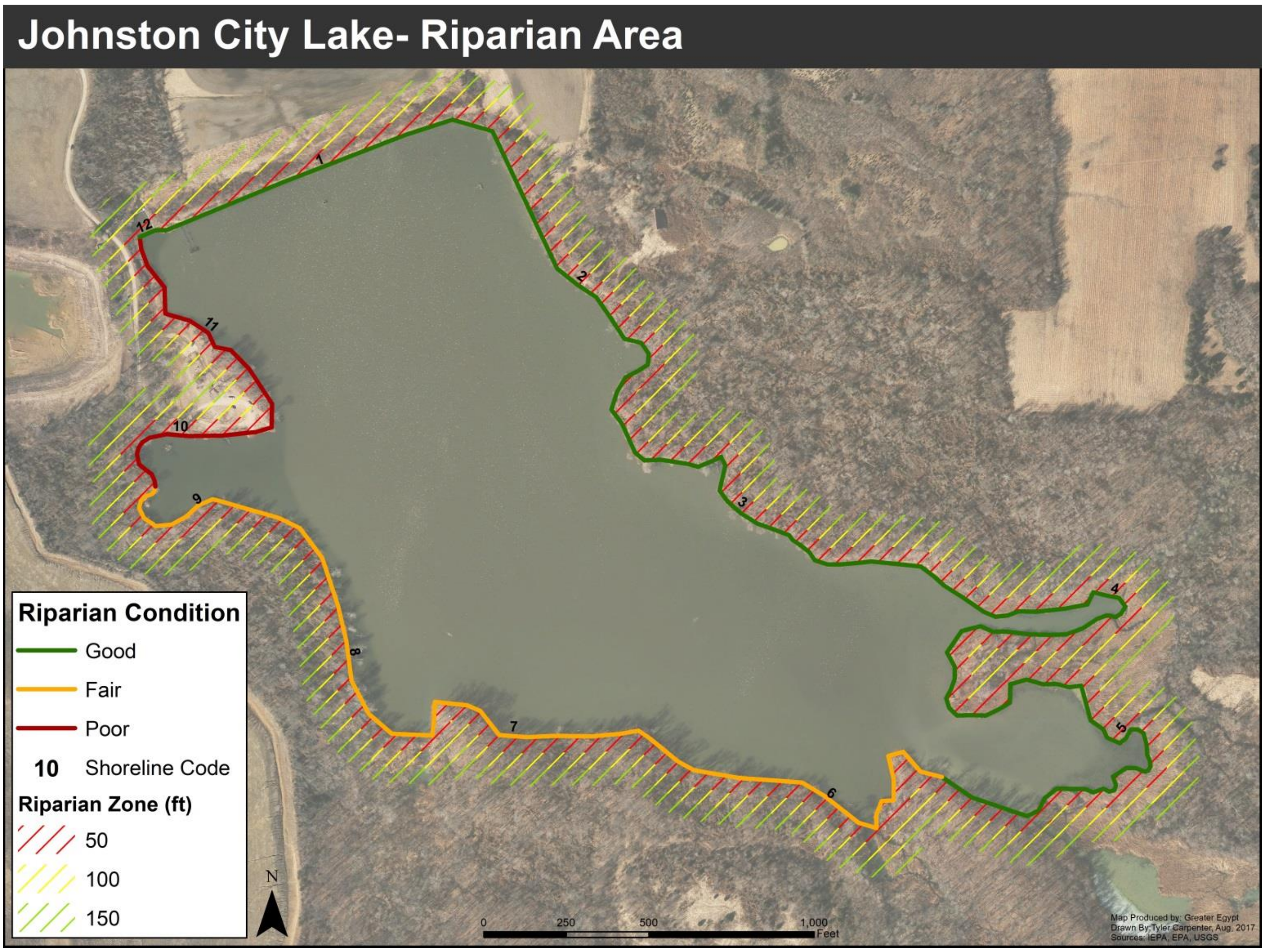
The riparian area around the Johnston City Lake is generally in good condition. However, there are a few things to consider.

Table 29- Johnston City Lake Condition of Riparian Area

Shore Code	Shoreline Length Assessed (ft)	Good Condition (ft/%)		Fair Condition (ft/%)		Poor Condition (ft/%)	
IL_RNZE-1	1089	1089	100%	0	0%	0	0%
IL_RNZE-2	1070	963	90%	107	10%	0	0%
IL_RNZE-3	1226	1165	95%	61	5%	0	0%
IL_RNZE-4	1320	1320	100%	0	0%	0	0%
IL_RNZE-5	1857	1764	100%	93	5%	0	0%
IL_RNZE-6	1256	1068	85%	188	15%	0	0%
IL_RNZE-7	760	646	85%	114	15%	0	0%
IL_RNZE-8	824	783	95%	41	5%	0	0%
IL_RNZE-9	641	609	80%	32	15%	0	5%
IL_RNZE-10	559	168	30%	224	40%	168	30%
IL_RNZE-11	772	39	5%	386	50%	347	45%
IL_RNZE-12	52	52	100%	0	0%	0	0%
TOTALS	**11427**	**9666**		**1246**		**515**	

While a majority of the riparian area is inhabited with forest and wetlands providing a buffer between outlying lands, the shoreline codes 6-11 experience some detrimental characteristics. Downed trees and debris cover some of the riparian area along the referenced shores. Beyond the riparian areas of these shores to the south and west rests the Orient Mine No.4. This is a reclaimed mine with an active slurry pond just south of shore code 6.

Figure 32



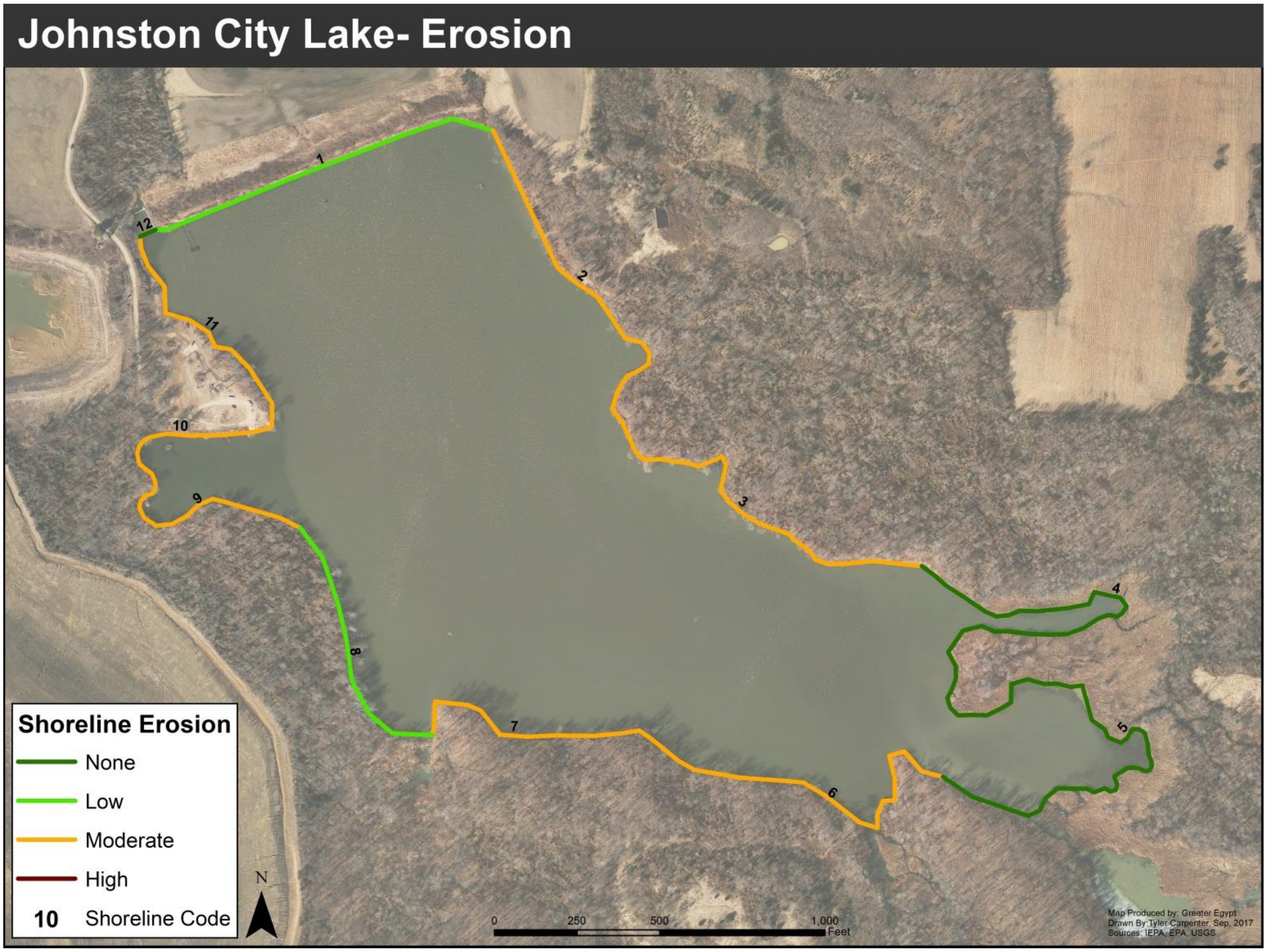
While the lake was once used publically as a water supply and for recreation, both uses are no longer an option. The northwestern portion of the lake (shore codes 10 and 11) experiences the most degradation to its riparian area. A picnic area and boat launch that was once used publically is now a non-access area with a gate. The area also exhibits illegal dumping of trash.

Erosion levels are fairly low around the Johnston City Lake shoreline. The highest part of the shoreline is at the eastern bank (shoreline code 2) at around 6 feet. This part of the lake experiences the greatest extent of erosion. Table 30 depicts the erosion conditions for the Johnston City Lake. Figure 33 spatially displays the conditions of the riparian area for the Johnston City Lake.

Table 30- Johnston City Lake Degree of Shoreline Erosion

Shore Code	Shoreline Length Assessed (ft)	None or Low Erosion (ft/%)		Moderate Erosion (ft/%)		High Erosion (ft/%)	
IL_RNZE-1	1089	1089	100%	0	0%	0	0%
IL_RNZE-2	1070	214	20%	749	70%	107	10%
IL_RNZE-3	1226	981	80%	245	20%	0	0%
IL_RNZE-4	1320	1320	100%	0	0%	0	0%
IL_RNZE-5	1857	1857	100%	0	0%	0	0%
IL_RNZE-6	1256	1005	80%	251	20%	0	0%
IL_RNZE-7	760	532	70%	228	30%	0	0%
IL_RNZE-8	824	742	90%	82	10%	0	0%
IL_RNZE-9	641	353	55%	288	45%	0	0%
IL_RNZE-10	559	447	80%	112	20%	0	0%
IL_RNZE-11	772	540	70%	232	30%	0	0%
IL_RNZE-12	52	52	100%	0	0%	0	0%
TOTALS	**11427**	**9132**		**2187**		**107**	

Figure 33



Arrowhead Lake (IL_RNZX)

Arrowhead Lake is also owned by the City of Johnston City, IL. However, unlike Johnston City Lake, it is still used publically as a recreational source. Table 31 contains information regarding the riparian area. Arrowhead Lake was assigned 15 shoreline codes for individual evaluation.

The riparian area around the Arrowhead Lake is generally in good condition. The forested area around the lake provides a buffer between other non-forested areas. These areas become less dense around the campground area to the west of the lake. A recreational vehicle area within a hundred feet of the shoreline represents one of the few impairments to the riparian habitat. Figure 34 displays the condition of the riparian area around Arrowhead Lake.

Table 31- Arrowhead Lake Condition of Riparian Area

Lake Name	Shore Code	Shoreline Length Assessed (ft)	Good Condition (ft/%)		Fair Condition (ft/%)		Poor Condition (ft/%)	
Arrowhead Lake	IL_RNZX-1	878	800	91%	78	9%	0	0%
Arrowhead Lake	IL_RNZX-2	310	180	58%	130	42%	0	0%
Arrowhead Lake	IL_RNZX-3	338	290	86%	48	14%	0	0%
Arrowhead Lake	IL_RNZX-4	419	400	95%	19	5%	0	0%
Arrowhead Lake	IL_RNZX-5	650	588	90%	62	10%	0	0%
Arrowhead Lake	IL_RNZX-6	599	550	92%	49	8%	0	0%
Arrowhead Lake	IL_RNZX-7	1341	1300	97%	41	3%	0	0%
Arrowhead Lake	IL_RNZX-8	1052	1000	95%	52	5%	0	0%
Arrowhead Lake	IL_RNZX-9	840	800	95%	40	5%	0	0%
Arrowhead Lake	IL_RNZX-10	999	960	96%	39	4%	0	0%
Arrowhead Lake	IL_RNZX-11	621	590	95%	31	5%	0	0%
Arrowhead Lake	IL_RNZX-12	732	545	75%	187	26%	0	0%
Arrowhead Lake	IL_RNZX-13	541	270	50%	271	50%	0	0%
Arrowhead Lake	IL_RNZX-14	360	90	25%	214	59%	56	16%
Arrowhead Lake	IL_RNZX-15	551	150	27%	341	62%	60	11%
Totals	**TOTALS**	**10231**	**8314**		**1801**		**116**	

Arrowhead Lake exhibits a fairly small amount of erosion along its shoreline. Table 32 contains information on the degree of shoreline erosion. The bank along the spillway to the south contains rip rap to control erosion. Most of the areas around the eastern and central portions of the lake (shore codes 2-11) have a gently sloping bank with a low degree of erosion.

This becomes less apparent near the western banks (shore codes 12-14) where the terrain becomes elevated and banks have less gentle slopes. This expanse is characterized by small lengths of overhang and exposed roots. The degree of shoreline erosion is also depicted in Figure 35.

Figure 34

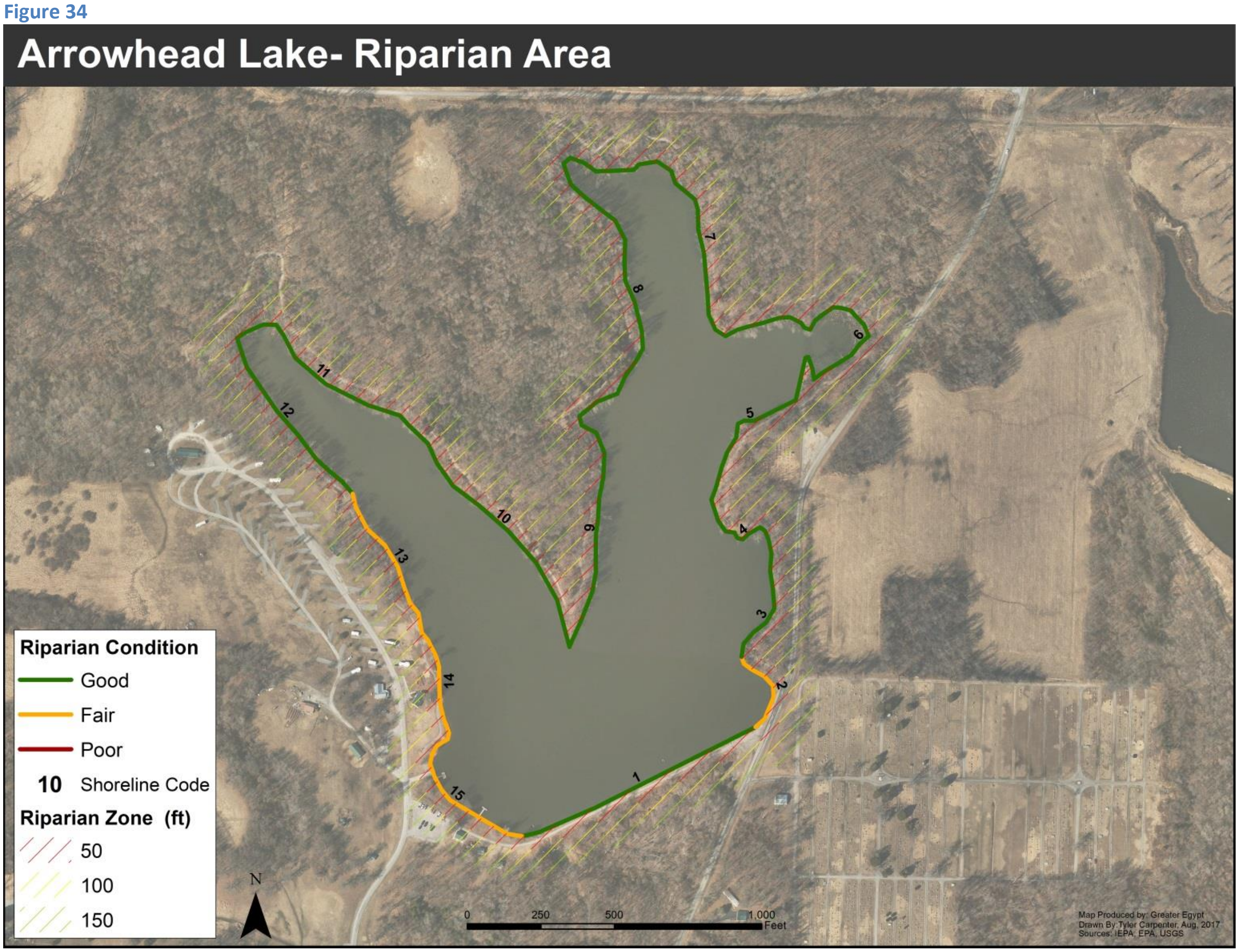
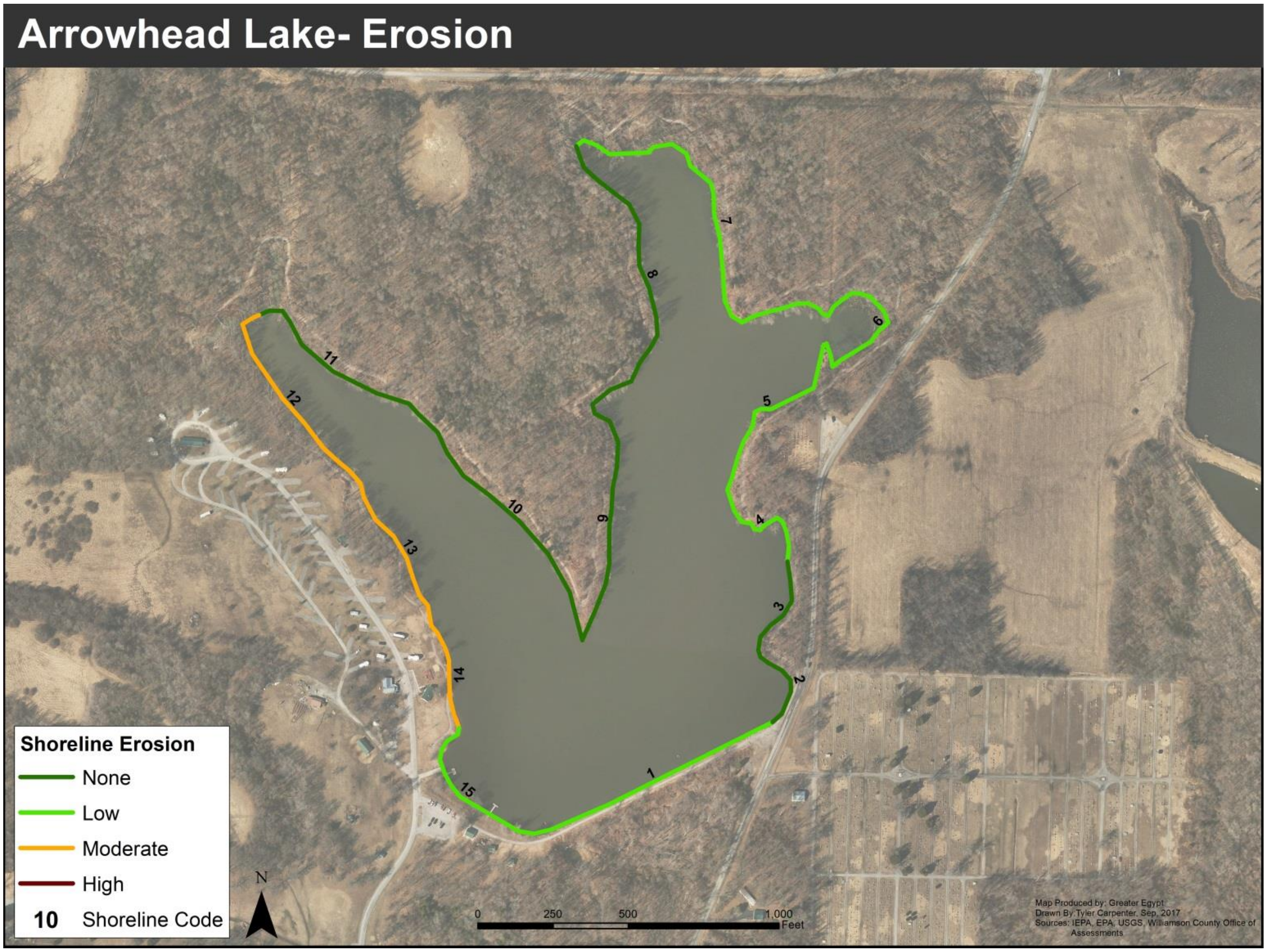

Arrowhead Lake- Riparian Area
Riparian Condition
Good
Fair
Poor
10 Shoreline Code
Riparian Zone (ft)
50
100
150
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
N
0
250
500
1,000
Feet
Map Produced by: Greater Egypt
Drawn By: Tyler Carpenter, Aug. 2017
Sources: IEPA, EPA, USGS

Table 32- Arrowhead Lake Degree of Shoreline Erosion

Lake Name	Shore Code	Shoreline Length Assessed (ft)	None or Low Erosion (ft/%)		Moderate Erosion (ft/%)		High Erosion (ft/%)	
Arrowhead Lake	IL_RNZX-1	878	788	90%	90	10%	0	0%
Arrowhead Lake	IL_RNZX-2	310	282	91%	28	9%	0	0%
Arrowhead Lake	IL_RNZX-3	338	320	95%	18	5%	0	0%
Arrowhead Lake	IL_RNZX-4	419	350	84%	69	16%	0	0%
Arrowhead Lake	IL_RNZX-5	650	540	83%	110	17%	0	0%
Arrowhead Lake	IL_RNZX-6	599	510	85%	89	15%	0	0%
Arrowhead Lake	IL_RNZX-7	1341	1180	88%	161	12%	0	0%
Arrowhead Lake	IL_RNZX-8	1052	980	93%	72	7%	0	0%
Arrowhead Lake	IL_RNZX-9	840	800	95%	40	5%	0	0%
Arrowhead Lake	IL_RNZX-10	999	950	95%	49	5%	0	0%
Arrowhead Lake	IL_RNZX-11	621	570	92%	51	8%	0	0%
Arrowhead Lake	IL_RNZX-12	732	442	60%	260	36%	30	4%
Arrowhead Lake	IL_RNZX-13	541	323	60%	180	33%	38	7%
Arrowhead Lake	IL_RNZX-14	360	172	48%	170	47%	18	5%
Arrowhead Lake	IL_RNZX-15	551	465	84%	70	13%	16	3%
Totals		**10231**	**8672**		**1457**		**102**	

Figure 35



2.7.5 Basins and Blockages

Detention and Retention Basins

Although the Lake Creek watershed is one of the larger HUC 12 watersheds in the greater Big Muddy, only 14 percent of the land use is characterized as developed with half of that number being represented by open space. With this limited amount of developed land, there are currently no detention or retention areas present. Since heavy rainfall can produce flooding in and around the Johnston City area, development of these basins could provide relief and mitigate the impact of these events.

Debris Blockages

Many areas in the Lake Creek watershed exhibit different types of debris blockages. These impediments are both natural and synthetic. Beaver dams and downed vegetation represent the majority of the blockages. This is most evident along the northwestern extent of Lake Creek. Figure 36 displays some of the obstructions in the northwestern portion of the watershed. Residents near the area have expressed concerns over flooding and other impairments related to the occurrences.

Figure 36- Lake Creek Obstructions

Litter is also prevalent in many portions of the watershed. This is typically evident around stream crossings and rural areas. The figure below reveals some areas where dumping has occurred at crossings of Lake Creek.

Figure 37- Lake Creek Dumping Sites

2.8 Water Quality Assessment

For this assessment, water quality of Lake Creek and those waterbodies with available data have been analyzed. A water quality assessment has also been completed for local municipalities within the Lake Creek watershed.

In conforming to the regulations of the Federal Clean Water Act (CWA) sections 303(d) and 305(b), the Illinois Environmental Protection Agency (IEPA) is required to inform the U.S. Environmental Protection Agency on water quality of Illinois waterbodies. While Section 303(d) requires the IEPA to provide a list of waterbodies whose designated uses are considered impaired, Section 305(b) entails an inventory of water quality of Illinois waterbodies and groundwater sources.

While there are seven designated uses in Illinois, only five apply within the Lake Creek planning area. These are Aquatic Life, Fish Consumption, Primary Contact, Secondary Contact, and Aesthetic Quality. Those not designated in the area are Public and Food Processing Water Supplies and Indigenous Aquatic Life.

2.8.1 Water Quality Impairments and Monitoring

303(d) and 305(b) Streams

Beaver Creek (IL_NGAZ-JC-D) and Lake Creek (IL_NGA-02) have been assessed for water quality impairments under Section 303(d). Arrowhead Lake (IL_RNZX) and Johnston City Lake (IL_RNZE) have also been placed on the list for assessment. A depiction of 303(d) and 305(b) waterbodies can be viewed in Figure 38.

While phosphorus remains a constant impairment amongst most of the waterbodies, water quality in the Lake Creek watershed differs for each body of water. Location, uses, and drainage are factors that influence the water quality of each particular lake or stream. Water quality assessments for these waterbodies have been detailed for this report. Data provided from the IEPA, municipalities, and other sources have been utilized for this assessment.

Tables 33 and 34 outline the designated uses and assessment status of Beaver Creek and Lake Creek as identified in the Illinois Integrated Water Quality Report and Section 303(d) List for 2016.[33] While Bear Creek and Whiteash Branch remain on the 305(b) Assessment list, neither was assessed for use attainment for the 2016 report.

The Illinois Integrated Water Quality Report categorizes Beaver Creek as only having one desginated use, aquatic life, which is not supported. All other categories were not assessed for the water quality report. The same pattern is followed by Lake Creek's assessment with only aquatic life being monitored, but not supported.

Table 33 – Assessment Status of Beaver Creek (IL_NGAZ-JC-D)

Designated Use	Use ID	Assessed in 2016 Integrated Report	Use Attainment
Aquatic Life	582	Yes	Not Supporting
Fish Consumption	583	No	N/A
Primary Contact	585	No	N/A
Secondary Contact	586	No	N/A
Aesthetic Quality	590	No	N/A

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

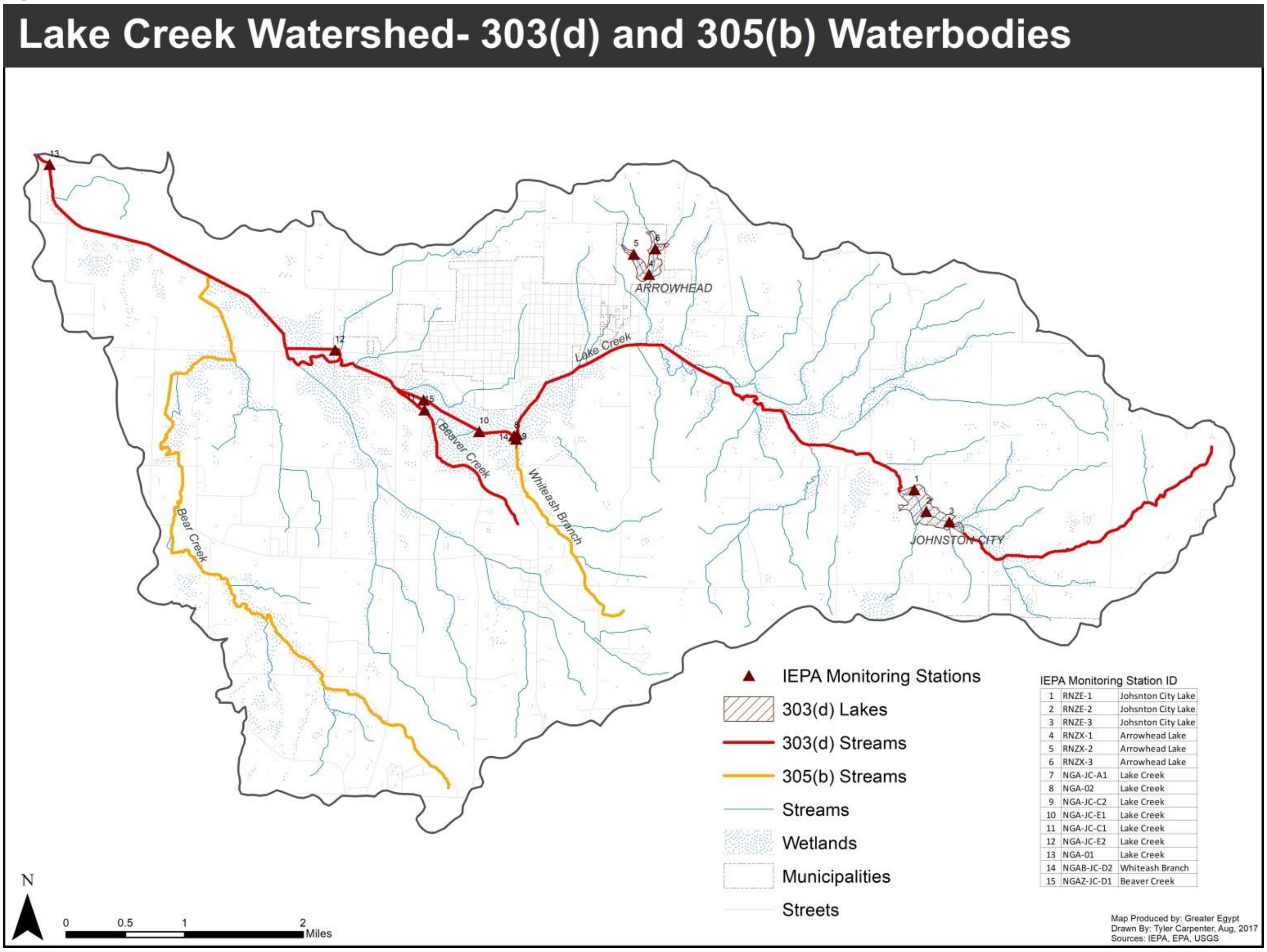
Table 34 – Assessment Status of Lake Creek (IL_NGA-02)

Designated Use	Use ID	Assessed in 2016 Integrated Report	Use Attainment
Aquatic Life	582	Yes	Not Supporting
Fish Consumption	583	No	N/A
Primary Contact	585	No	N/A
Secondary Contact	586	No	N/A
Aesthetic Quality	590	No	N/A

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

[33] IEPA. *2016 Integrated Water Quality Report and 303d Lists.* Springfield: IEPA, 2017.

Figure 38



Beaver Creek and Lake Creek have been placed on the IEPA's 303(d) list of impaired waters. This is due to several impairments to the waterbodies. Information from the 305(b) Assessment (Appendix B-3) can be found in Table 35.

While both streams share a similar impairment in changes in stream depth and velocity patterns, they differ in other ways. Beaver Creek also experiences impairments related to the presence of managanese and loss of instream cover. The assessment labels Lake Creek as being impaired by dissolved oxygen and phosphorus.

Table 35 – 305(b) Assessment Information for Streams

Waterbody	Assessment Unit ID	Size	Causes of Impairment(s)	Sources of Impairment(s)
Beaver Creek	IL_NGAZ-JC-D1	1.7 miles	Manganese, Changes in Stream Depth and Velocity Patterns, Loss of Instream Cover	Loss of Riparian Habitat, Municipal Point Source Discharges, Crop Production, Agriculture, Urban Runoff/ Storm Sewers, Runoff from Forest/Grassland/Parkland
Lake Creek	IL_NGA-02	12.85 miles	Dissolved Oxygen, Phosphorus, Changes in Stream Depth and Velocity Patterns	Municipal Point Source Discharges, Crop Production, Agriculture, Urban Runoff/ Storm Sewers, Unknown Sources

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

The information contained in the 303(d) section also lists the impaired designated use and cause of impairment. The following table summarizes the causes and sources of impairment for Beaver Creek and Lake Creek as identified in the 303(d) list (Appendix A-1) of the 2016 Integrated Report.

Table 36 – 303(d) Information for Streams

Waterbody	Assessment Unit ID	Size	Impaired Designated Use(s)	Causes of Impairment(s)
Beaver Creek	IL_NGAZ-JC-D1	1.7 miles	Aquatic Life	Manganese
Lake Creek	IL_NGA-02	12.8 miles	Aquatic Life	Dissolved Oxygen, Phosphorus

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

303(d) Lakes

The designated uses and attainment status for the two 303(d) lakes in the watershed are displayed in Tables 37 and 38. The Illinois Integrated Water Quality Report categorizes Arrowhead Lake and Johnston City Lake as having a single desginated use. While both lakes fully support aquatic life, neither support aesthetic quality. All other categories were not assessed for the water quality report.

Table 37 – Assessment Status for Arrowhead Lake (IL_RNZX)

Designated Use	Use ID	Assessed in 2016 Integrated Report	Use Attainment
Aquatic Life	582	Yes	Fully Supporting
Fish Consumption	583	No	N/A
Primary Contact	585	No	N/A
Secondary Contact	586	No	N/A
Aesthetic Quality	590	Yes	Not Supporting

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

Table 38 – Assessment Status for Johnston City Lake (IL_RNZE)

Designated Use	Use ID	Assessed in 2016 Integrated Report	Use Attainment
Aquatic Life	582	Yes	Fully Supporting
Fish Consumption	583	No	N/A
Primary Contact	585	No	N/A
Secondary Contact	586	No	N/A
Aesthetic Quality	590	Yes	Not Supporting

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

Both lakes have also have been placed on the IEPA's 303(d) list of impaired waters. This is due to several impairments to the waterbodies. Information from the 305(b) Assessment (Appendix B-3) can be found in Table 39.

Both lakes are impaired by phosphorus; a similarity shared by many watersheds within the larger Big Muddy watershed. While Arrowhead Lake has a single impairment, Johnston City Lake exhibits two others- total suspended solids (TSS) and aquatic algae.

Table 39 – 305(b) Assessments Information for Lakes

Waterbody	Assessment Unit ID	Size	Causes of Impairment(s)	Sources of Impairment(s)
Arrowhead Lake	IL_RNZX	36 acres	Phosphorus	Runoff from Forest/Grassland/Parkland
Johnston City Lake	IL_RNZE	64 acres	Total Suspended Solids, Phosphorus, Aquatic Algae	Littoral/ Shore Area Modifications, Runoff from Forest/Grassland/Parkland

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

The information contained in the 303(d) section also lists the impaired designated use and cause of impairment. Table 40 summarizes the causes and sources of impairment for Arrowhead Lake and Johnston City Lake as identified in the 303(d) list (Appendix A-1) of the 2016 Integrated Report. Both lakes share an impaired designated use of aesthetic quality being caused by phosphorus. However, Johnston City Lake is also impaired by TSS.

Table 40– 303(d) Information for Lakes

Waterbody	Assessment Unit ID	Size	Impaired Designated Use(s)	Causes of Impairment(s)
Arrowhead Lake	IL_RNZX	36 acres	Aesthetic Quality	Phosphorus
Johnston City Lake	IL_RNZE	64 acres	Aesthetic Quality	Phosphorus, Total Suspended Solids

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

Supplementary Monitoring and Strategies

In accordance with the CWA, impaired waterbodies are required to have a Total Maximum Daily Load (TMDL) be developed for each pollutant. Beginning in 2013, Limnotech, Inc began developing a TMDL for the Upper Big Muddy Watershed. This is a 313,435 acre watershed that encompasses the smaller Lake Creek watershed. The *Upper Big Muddy Watershed Total Maximum Daily Load Stage One & Stage Two Reports*[34] [35] were designed to provide detailed information for HUC 12 watershed withing the planning area. These reports include addressing

[34] Limnotech, Inc. *Upper Big Muddy River Watershed Total Maximum Daily Load Stage One Report.* Ann Arbor, MI, 2014. PDF File
[35] Limnotech, Inc. *Stage 2 Report for TMDL Sampling Activities in the Upper Big Muddy River Watershed, Illinois* . Ann Arbor, MI, 2016. PDF File

the impairments to specific waterbodies within the Lake Creek watershed such as: Lake Creek (IL_NGA-02), Beaver Creek (IL_NGAZ-JC-D1), Arrowhead Lake (IL_RNZX), and Johnston City Lake (IL_RNZE). Information from these reports will be utilized to develop TMDLs and Load Reduction Strategies (LRS).

Illinois Nutrient Loss Reduction Strategy (ILNLRS)

The Illinois Nutrient Loss Reduction Strategy is a colaborative effort between the Illinois Water Resources Center, the Illinois Department of Agriculture, and the IEPA to develop guidelines and promote best management practices to improve water quality by reducing nitrogen and phosphorus in Illinois waterbodies. [36]

While the strategy is designed to reduce these nutrients from runoff (agricultural and urban), it focuses on watersheds that are most impacted from nutirent loss. The Big Muddy watershed (07140106) is considered one of these priority watersheds for its nonpoint source load of phosphorus. While these nutrient loads can be attributed to other subwatersheds in the Big Muddy, phosphorus loads from the Lake Creek watershed can account for some of the overall nutrient load.

2.8.2 Water Quality of Impaired Streams

Lake Creek (IL_NGA-02)

The 2016 Illinois Integrated Water Quality Report states the designated use of Lake Creek as aquatic life, in which it does not support. Causes for impairments are dissolved oxygen, and phosphorus (total). Potential sources of these impairments include: agriculture, crop production (crop land and dry land), municipal point source discharges, unknown sources, and urban runoff/ storm sewers.

[36] IEPA. "Illinois Nutrient Loss Reduction Strategy Implementation." http://www.epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-loss-reduction-strategy/index. Accessed: September 6, 2017.

The IEPA has established seven monitoring stations along Lake Creek. IEPA designated monitoring sites for waterbodies in the Lake Creek watershed are displayed in Figure 38. Locations of these sites are detailed in the following table.

Table 41 - Lake Creek IEPA Monitoring Stations

Station Code	Station Location
NGA-01	3 MI NE HERRIN
NGA-02	CO RD 1200E 0.3 MI S JOHNSTON CITY
NGA-JC-A1	WATER ST (CR 14), 0.3 MI S OF JOHNSTON CITY AND 0.3 MI UPS JOHNSTON CITY WWTP
NGA-JC-C1	HERRIN AVE (CR 1), 0.5 MI SE OF JOHNSTON CITY AND 0.5 MI DNS JOHNSTON CITY WWTP
NGA-JC-C2	NEAR LAGOON OVERFLOW CO RD 1200 E (WATER ST) 0.3 MI S JOHNSTON CITY
NGA-JC-E1	JOHNSTON CITY WWTP, SR 37 SOUTH, 0.5 MI S OF JOHNSTON CITY
NGA-JC-E2	COLLINS RD 0.7 MI W OF JOHNSTON CITY

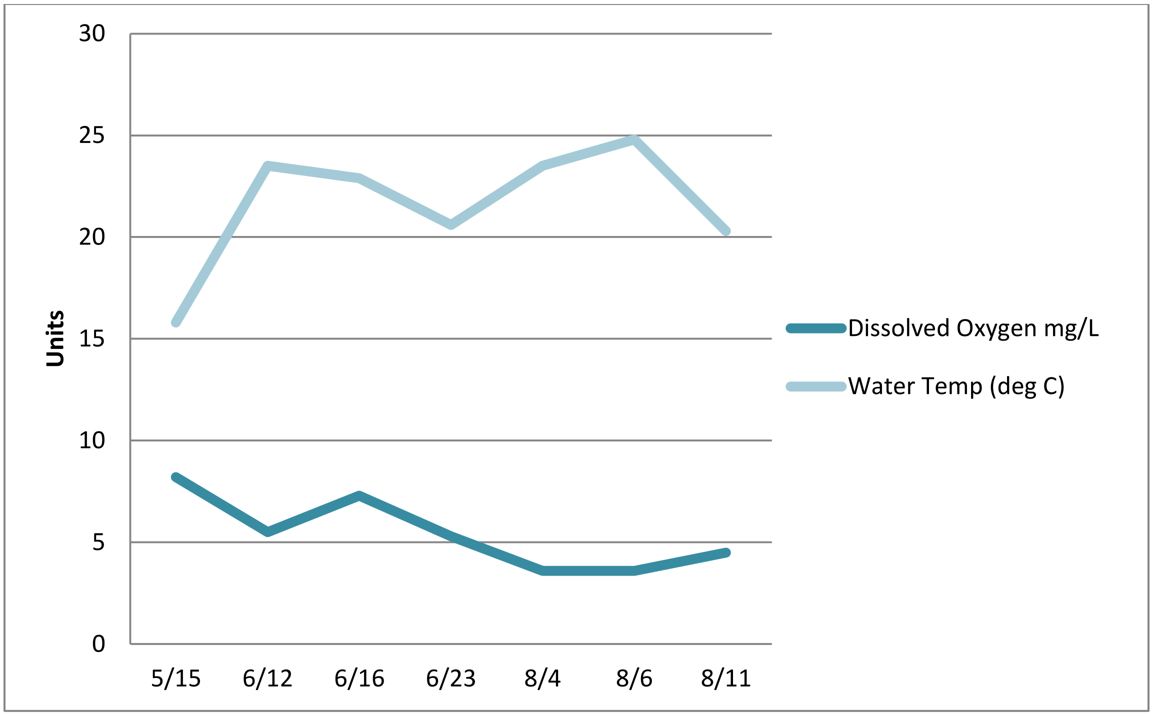
Source: RMMS (IEPA)

The most recent available data was taken from various sources including: Limnotech, Inc. (Stage 1 & 2 Reports- Upper Big Muddy River Watershed), Prairie Analytical, and available IEPA datasets. [37] The majority of the data was taken in 2008, while other smaller datasets were sampled in 2014 and 2015. While a variety of analytes were tested, focus will be directed towards nutrients causing the impairments in the waterbodies.

Samples were taken from all stations with the exception of NGA-JC-A1. Station NGA-02 was the most tested site. Figures 39 and 40 display the results of dissolved oxygen and phosphorus from the site in 2008. While the IEPA has no direct limitations on dissolved oxygen, the Illinois Water Quality Standard for phosphorus (total) is 0.05 mg/L. The range for the 2008 data is 0.021 mg/L to 0.093 mg/L with four of the samples being over the reporting limit.

[37] Norris, Tara. 'Lake Creek Watershed Water Quality Data'. Email. 2017.

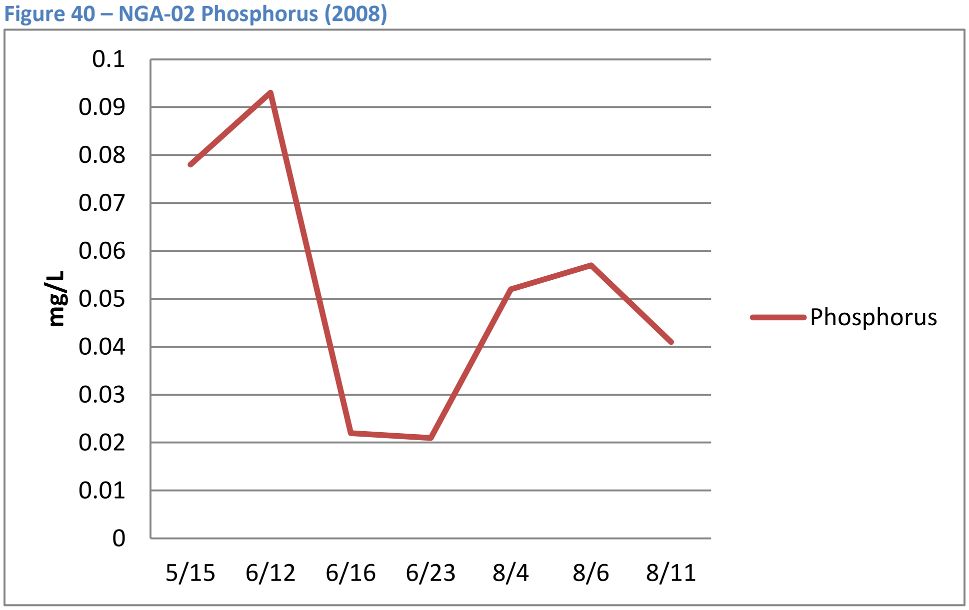
Figure 39 – NGA-02 Dissolved Oxygen (2008)



Source: IEPA, Surface Water Section

Samples were also taken in September of 2014 and 2015. Phosphorus was measured at 0.053 mg/L and .0218 mg/L on September 3, 2014 and September 24, 2015. Four dissolved oxygen measurements were also taken on September 25, 2015 and ranged from 6.75 mg/L to 8.83 mg/L.

Figure 40 – NGA-02 Phosphorus (2008)



Source: IEPA, Surface Water Section

Samples from the other monitoring sites were limited. In August of 2008, phosphorus readings from these stations ranged from 0.41 mg/L to 1.72 mg/L (NGA-JC-C1). Dissolved oxygen levels ranged from 2.2 mg/L to 8.7 mg/L.

Beaver Creek (IL_NGAZ-JC-D1)

Beaver Creek has been placed on the 303(d) List for impairments from manganese, changes in stream depth and velocity patterns, and loss of instream cover. Sources of these impairments include: loss of riparian habitat, municipal point source discharges, crop production, agriculture, urban runoff/ storm sewers, and runoff from various sources.

The IEPA has designated one monitoring station for the waterbody (NGAZ-JC-D1) whose location lies a quarter of a mile southeast of the confluence of Beaver Creek and Lake Creek.

Water quality data is limited for the station; being sampled once in August of 2008. Results can be viewed in Table 42.

Table 42 – NGAZ-JC-D1 2008 Sample Results

Analyte	Units	Result	Detection Limit	Reporting Limit
Aluminum	ug/l	133	2.78	60
Arsenic	ug/l		4.45	10
Barium	ug/l	53.4	0.13	5
Biochemical oxygen demand, standard conditions	mg/l	2.1		2
Boron	ug/l	150	2.73	10
Cadmium	ug/l	0.39	0.18	3
Calcium	ug/l	99900	4.76	300
Carbonaceous biochemical oxygen demand, standard conditions	mg/l	2.3		2
Chromium	ug/l		0.24	5
Cobalt	ug/l	6.22	0.22	10
Copper	ug/l	5.03	0.79	10
Dissolved oxygen (DO)	mg/l	4.7		
Hardness, Ca, Mg	ug/l	383000		
Iron	ug/l	623	3.06	50
Lead	ug/l	3.83	0.67	5
Magnesium	ug/l	32300	4.69	300
Manganese	ug/l	6410	0.05	15
Nickel	ug/l	15.1	0.41	5
pH	None	6.8		
Potassium	ug/l	4100	8.13	1400
Silver	ug/l		0.38	3
Sodium	ug/l	66500	231	300
Specific conductance	umho/cm	1026		
Strontium	ug/l	367	0.38	5
Temperature, air	deg C	27		
Temperature, sample	deg C	6		
Temperature, water	deg C	25.5		
Turbidity	NTU	11		
Zinc	ug/l	12.7	0.35	25

Source: IEPA, Surface Water Section

2.8.3 Water Quality of Impaired Lakes

Arrowhead Lake (IL_RNZX)

Arrowhead Lake has three designated monitoring locations assigned by IEPA. RNZX-1 rests on the southern portion of the lake near the spillway. The two extensions of the lake converge near the middle. RNZX-2 represents the western portion of the lake, while the northern extension constitutes the last site, RNZX-3.

Sampling was completed for all three locations in 2009 and 2013 under the IEPA Ambient Lakes Monitoring Program (ALMP). Testing in 2009 ranged from May to October, while 2013 samples were taken from April to October. While many nutrients were monitored, the pollutant of importance is phosphorus which causes Arrowhead Lake to remain on the IEPA's 303(d) List of Impaired Waters.

Results for phosphorus (dissolved and total) and nitrogen (as Kjeldahl) readings in 2009 are displayed in Table 43 and Figure 41. Sample depth is one foot. However, RNZX-1 had sampling completed at a 15 foot depth as well.

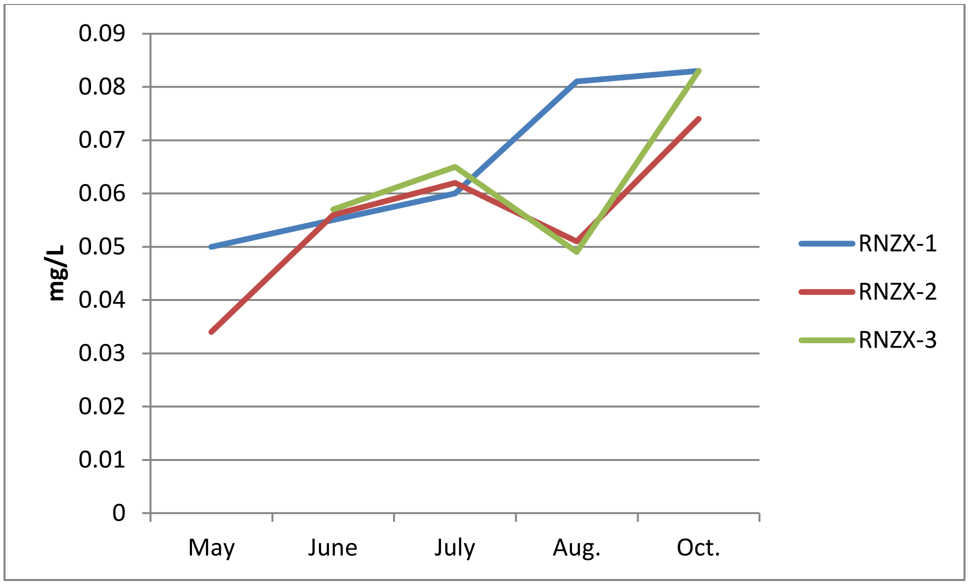
Table 43 – Arrowhead Lake Phosphorus and Nitrogen Results (2009)

Nutrient Measured		RNZX-1					RNZX-2					RNZX-3				
	Units	May	June	July	Aug.	Oct.	May	June	July	Aug.	Oct.	May	June	July	Aug.	Oct.
Nitrogen as Kjeldahl (1 ft. sample depth)	mg/L	0.608	0.916	0.908	1.8	1.21	0.527	0.992	0.914	1.16	4.92	-	0.959	1.13	1.41	1.21
Phosporus- Dissolved (1 ft. sample depth)	mg/L	0.014	0.009	0.008	0.029	0.019	0.013	0.007	0.009	-	0.013	0.012	0.007	0.007	0.029	0.013
Phosphorous- Total (1 ft. sample depth)	mg/L	0.05	0.055	0.06	0.081	0.083	0.034	0.056	0.062	0.051	0.074	-	0.057	0.065	0.049	0.083
Nitrogen as Kjeldahl (15 ft. sample depth)	mg/L	0.883	2.82	1.9	4.92	1.04	-	-	-	-	-	-	-	-	-	-
Phosporus- Dissolved (15 ft. sample depth)	mg/L	0.026	0.307	0.079	0.399	0.011	-	-	-	-	-	-	-	-	-	-
Phosphorous- Total (15 ft. sample depth)	mg/L	0.067	0.38	0.144	0.524	0.077	-	-	-	-	-	-	-	-	-	-

Source: IEPA, Surface Water Section

According to the 2016 IEPA Illinois Integrated Water Quality Report, potential sources of phosphorus for the lake include runoff from forest, grassland, and parkland.

Figure 41 – Arrowhead Lake Phosphorus Results: 1 ft. Sample (2009)



Source: IEPA, Surface Water Section

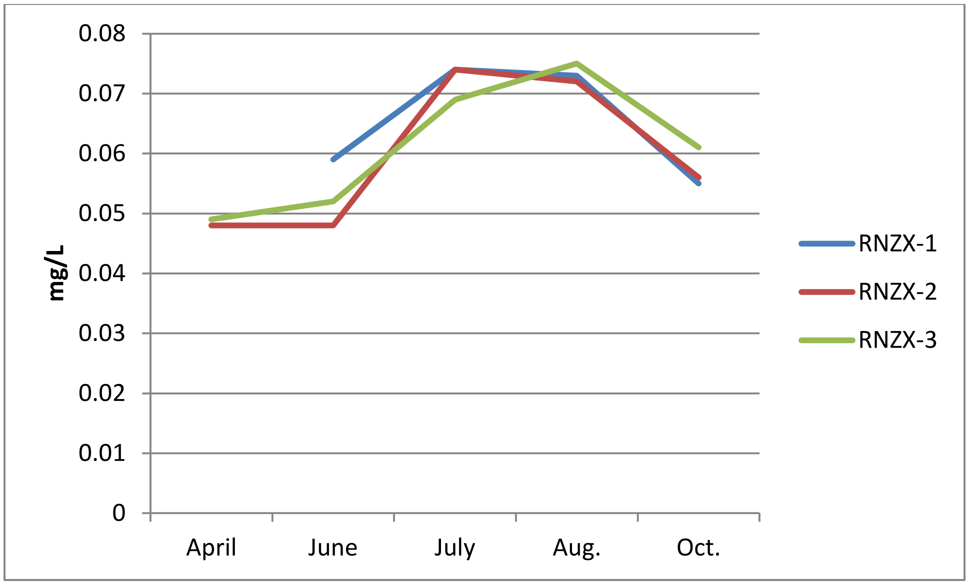
Results for phosphorus (dissolved and total) and nitrogen (as Kjeldahl) readings in 2013 are displayed in Table 44 and Figure 42. Sample depth is one foot. RNZX-1 also had sampling completed at a 15 foot depth. Potential sources of phosphorus remain as runoff from various origins.

Table 44 – Arrowhead Lake Phosphorus and Nitrogen Results (2013)

Nutrient Measured		RNZX-1					RNZX-2					RNZX-3				
	Units	April	June	July	Aug.	Oct.	April	June	July	Aug.	Oct.	April	June	July	Aug.	Oct.
Nitrogen as Kjeldahl (1 ft. sample depth)	mg/L	0.447	0.937	1.02	1.59	1.55	0.607	0.927	1.04	1.57	1.52	0.527	0.852	0.917	1.67	1.48
Phosporus- Dissolved (1 ft. sample depth)	mg/L	-	0.013	0.008	0.01	-	0.014	0.009	0.011	0.008	0.009	0.023	0.01	0.01	0.008	0.004
Phosphorous- Total (1 ft. sample depth)	mg/L	-	0.059	0.074	0.073	0.055	0.048	0.048	0.074	0.072	0.056	0.049	0.052	0.069	0.075	0.061
Nitrogen as Kjeldahl (15 ft. sample depth)	mg/L	0.696	2.52	4.24	3.21	7.12	-	-	-	-	-	-	-	-	-	-
Phosporus- Dissolved (15 ft. sample depth)	mg/L	0.012	0.1	0.447	0.17	0.61	-	-	-	-	-	-	-	-	-	-
Phosphorous- Total (15 ft. sample depth)	mg/L	0.069	0.179	0.54	0.275	0.212	-	-	-	-	-	-	-	-	-	-

Source: IEPA, Surface Water Section

Figure 42 – Arrowhead Lake Phosphorus Results: 1 ft. Sample (2013)



Source: IEPA, Surface Water Section

Johnston City Lake (IL_RNZE)

Johnston City Lake also has three designated monitoring locations assigned by IEPA. RNZE-1 is situated near the spillway to the northern portion of the lake. While RNZE-2 rests in the middle of the lake, RNZE-3 is located in the southeast where water flows into the lake from Lake Creek.

Sampling was completed for all three locations in 2002 under the IEPA Ambient Lakes Monitoring Program (ALMP). Testing in 2002 ranged from April to October, excluding September. Various nutrients were monitored, but phosphorus, and TSS will be given priority for this report. This is due to Johnston City Lake's status on the IEPA's 303(d) List of Impaired Waters for those nutrients.

Results for phosphorus (dissolved and total) and TSS readings in 2002 are displayed in Table 45. Sample depth is one foot. However, RNZE-1 also had sampling completed at a 10 foot depth.

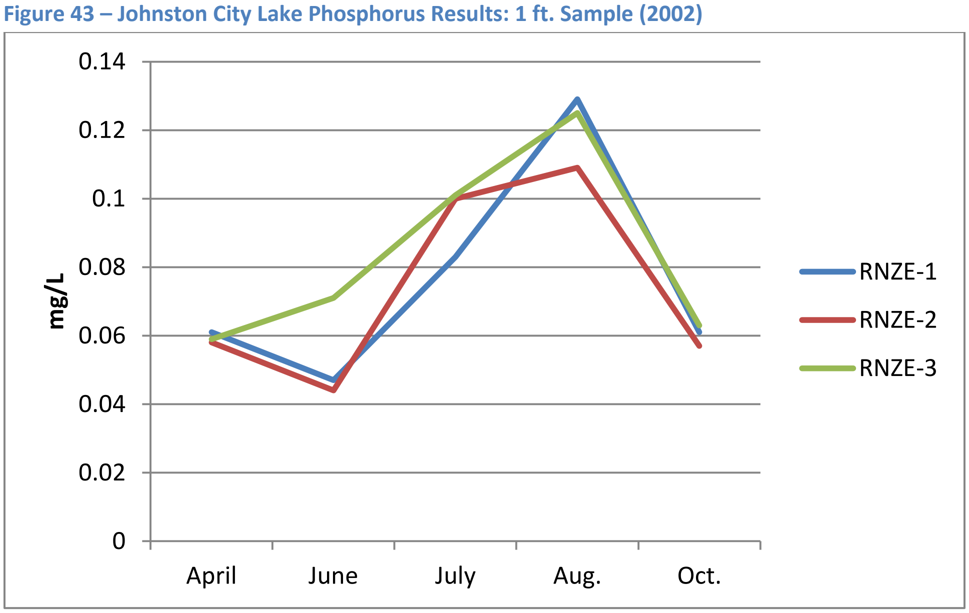
Table 45 –Johnston City Lake Phosphorus and Nitrogen Results (2002)

Nutrient Measured		RNZE-1					RNZE-2					RNZE-3				
	Units	April	June	July	Aug.	Oct.	April	June	July	Aug.	Oct.	April	June	July	Aug.	Oct.
Phosphorus - Dissolved (1 ft. sample depth)	mg/L	0.021	0.011	0.008	0.015	0.017	0.015	0.009	0.009	0.012	0.016	0.015	0.01	0.009	0.014	0.015
Phosphorus - Total (1 ft. sample depth)	mg/L	0.061	0.047	0.083	0.129	0.061	0.058	0.044	0.1	0.109	0.057	0.059	0.071	0.101	0.125	0.063
Total Suspended Solids (1 ft. sample depth)	mg/L	24	12	11	15	17	24	12	19	24	15	20	23	27	26	18
Phosphorus - Dissolved (10 ft. sample depth)	mg/L	0.005	0.008	0.009	0.011	0.013	-	-	-	-	-	-	-	-	-	-
Phosphorus - Total (10 ft. sample depth)	mg/L	0.035	0.046	0.084	0.09	0.06	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids (10 ft. sample depth)	mg/L	20	11	17	16	16	-	-	-	-	-	-	-	-	-	-

Source: IEPA, Surface Water Section

According to the 2016 IEPA Illinois Integrated Water Quality Report, potential sources of phosphorus and TSS for the Johnston City Lake include runoff from forest, grassland, parkland and littoral/ shore area modifications. Figures 43 and 44 display phosphorus and TSS results.

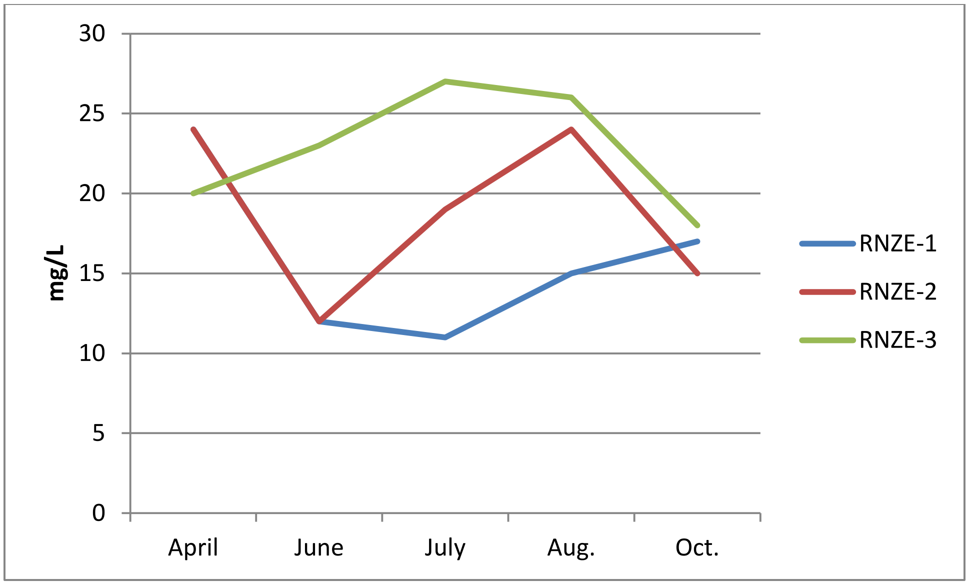
Figure 43 – Johnston City Lake Phosphorus Results: 1 ft. Sample (2002)



Source: IEPA, Surface Water Section

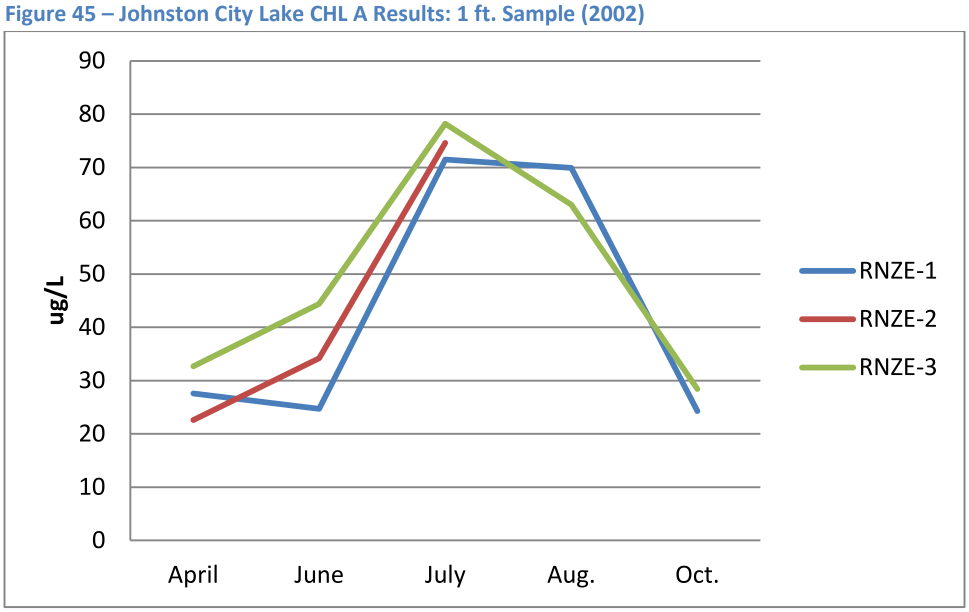
Chlorophyll results, as CHL A corrected for pheophytin, are also displayed in figure 45.

Figure 44 – Johnston City Lake TSS Results: 1 ft. Sample (2002)



Source: IEPA, Surface Water Section

Figure 45 – Johnston City Lake CHL A Results: 1 ft. Sample (2002)



Source: IEPA, Surface Water Section

2.8.4 Local Water Quality Assessment

To address water quality at the local level, an assessment has been completed for the municipalities within the Lake Creek watershed. This assessment was designed to review the latest annual water quality reports submitted by those municipalities. All districts in the watershed purchase treated water through the Rend Lake Inter-City Water System. The Rend Lake report has also been utilized for this assessment.

Each municipality is required to test certain organic and inorganic contaminants. Regulated contaminants consist of: Lead, Copper, Chloramines, Halocetic Acids, and Total Trihalomethanes. The following key represents the factors used in each water quality report:

> **Action Level (AL):** The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
>
> **Maximum Contaminant Level Goal (MLCG)**: The level of a contaminant in drinking water below which there is no known or expected risk to health. MLCCGs allow for a margin of safety.
>
> **Maximum Contaminant Level (MCL):** The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MLCGs as feasible using the best available treatment technology.
>
> **ppb:** Micrograms per liter or parts per billion- or one ounce in 7,350,000 gallons of water.
>
> **ppm:** Milligrams per liter or parts per million- or one ounce in 7,350 gallons of water[38]

[38] Leonard Killman. *Rend Lake Inner-City Water System.* Rend Lake Conservancy District, 2016. PDF File.

Table 46 displays the water quality reports for lead and copper. The Village of Pittsburg tests for lead and copper on a three-year cycle and is not available for this report. Entities have a MCLG of 1.3 ppm. Action Levels are also set at 1.3 ppm for each municipality and jurisdiction. The data for Johnston City was taken in 2014, whereas the data for Rend Lake was current for 2016. According to the water quality reports, no jurisdiction was in violation of lead or copper levels. Likely sources of lead consist of corrosion of household plumbing systems, and erosion of natural deposits. Sources of copper include erosion of natural deposits, leaching from wood preservatives, and corrosion of household plumbing materials.

Table 46 - Lead and Copper Information

Municipality	Contaminants	MCLG	Action Level (AL)	90th percentile	Sites Over Lead AL	Units	Violation	Likely Source of Contamination
Johnston City	Copper	1.3	1.3	0.04	0	ppm	N	Erosion of Natural Deposits, Leaching from wood preservatives, corrosion of household plumbing materials
	Lead	0	15	3.2	0	ppb	N	Corrosion of Household plumbing systems; erosion of natural deposits
Pittsburg	Copper	-	-	-	-	-	-	-
	Lead	-	-	-	-	-	-	-
Rend Lake ICWS	Copper	1.3	1.3	0	0	ppm	N	Erosion of Natural Deposits, Leaching from wood preservatives, corrosion of household plumbing materials
	Lead	0	15	9.3	0	ppb	N	Corrosion of Household plumbing systems; erosion of natural deposits

Source: City of Johnston City, Rend Lake Conservancy District

Along with lead and copper, other regulated contaminants that are reported are chloramines, halocetic acids and total trihalomethanes. The source of chloramines is likely a water additive used to control microbes. Halocetic acids and trihalomethanes seem to be by-products of drinking water disinfection. Information of these contaminants can be found in Table 47. All municipalities are within the limits for each contaminant, and no violations have occurred.

While each municipality tests for these certain contaminants individually, they also include a copy of the Rend Lake Inter-City Water System Water Quality Report with their annual review. This is detailed in the following section.

Table 47 - Municipal Water Quality: Regulated Contaminants

Municipality	Contaminants	Highest Level Detected	Range of Levels Detected	MCLG	MCL	Units	Violation	Likely Source of Contamination
Johnston City	Chloramines	2.3	2.3-2.4	MRDLG=4	MRDL=4	ppm	N	Water additive used to control microbes
	Halocetic Acids	29	12-37.5	N/A	60	ppb	N	By-product of drinking water chlorination
	Total Trihalomethanes	37	6.6-43.1	N/A	80	ppb	N	By-product of drinking water chlorination
Pittsburg	Chloramines	3.1	1.8-3.4	MRDLG=4	MRDL=4	ppm	N	Water additive used to control microbes
	Halocetic Acids	19	16.6-22.9	No goal	60	ppb	N	By-product of drinking water disinfection
	Total Trihalomethanes	38	30.3-46.7	No goal	80	ppb	N	By-product of drinking water disinfection

Source: City of Johnston City, Village of Pittsburg

2.8.5 Rend Lake Inter-City Water System

As stated previously, the two municipalities within the Lake Creek watershed purchase water through the Rend Lake Inter-City Water System. According to the Source Water Assessment of the Rend Lake Annual Drinking Water Quality Report, the system provides drinking water to approximately 173,000 persons. The area served includes 67 communities in an eight-county region.[39]

The water report includes the parameters from the previous municipal water quality reports identified as regulated contaminants. In addition, inorganic contaminants were also reported. This category includes substances such as: barium, arsenic, fluoride, nitrate (measured as nitrogen), and sodium. Radioactive contaminants and synthetic organic contaminants are also measured. Elements tested in these categories are radium and atrazine, respectively. Results are displayed in Table 48.

The contaminants in all categories are within the regulated range designated by the EPA. Therefore, no violations have occurred. Similar to the municipal sources of contamination, the regulated contaminants are likely caused by by-products of drinking water chlorination and water additives used to control microbes.

The sources of contamination of the inorganic contaminants differ somewhat. Possible causes of barium include: discharge of drilling waste, discharge from metal refineries, and erosion of natural deposits. While arsenic, fluoride and sodium are also characterized by erosion of natural deposits, there are a few differences. Likely sources of arsenic also include runoff from orchards and runoff from electronics production waste. Possible sources of fluoride include leaching from septic tanks and sewage.

The presence of the synthetic organic substance atrazine is possibly due to runoff from fertilizer used on row crops.

[39] Killman, *Rend Lake,* 2016.

Table 48- Rend Lake Inter-City Water System 2016 Water Quality Report

Contaminant		Highest Level Detected	Range of Levels Detected	MCLG	MCL	Units	Violation	Likely Source of Contamination
Regulated	Total Halocetic Acids	23	16.8-28.8	N/A	60	ppb	N	By-product of drinking water chlorination
	Total Trihalomethanes	45	3.1-47.6	N/A	80	ppb	N	By-product of drinking water chlorination
	Chlorite	0.42	.18-.42	0.8	1	ppm	N	By-product of drinking water chlorination
	Chloramines	3.5	2.6-3.5	MRDLG=4	MRDL=4	ppm	N	Water additive used to control microbes
Inorganic	Barium	0.0209	0.0209-0.0209	2	2	ppm	N	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
	Arsenic	1	.959-.959	0	10	ppb	N	Erosion of natural deposits; runoff from orchards; runoff from electronics production wastes
	Fluoride	0.6	.572-.572	4	4	ppm	N	Erosion of natural deposits; water additive which promotes strong teeth; fertilizer discharge
	Sodium	19	19.0-19.0	-	-	ppm	N	Erosion from naturally occurring deposits
Radioactive	Combined Radium 226/228	0.26	.26-.26	0	5	pCi/L	N	Erosion of naturally occurring deposits
Synthetic Organic	Atrazine	0.53	0-0.53	3	3	ppb	N	Runoff from fertilizer used on row crops
	Di (2-ethylhexyl) phthalate	2.5	0-2.5	0	6	ppb	N	Discharge from rubber and chemical factories

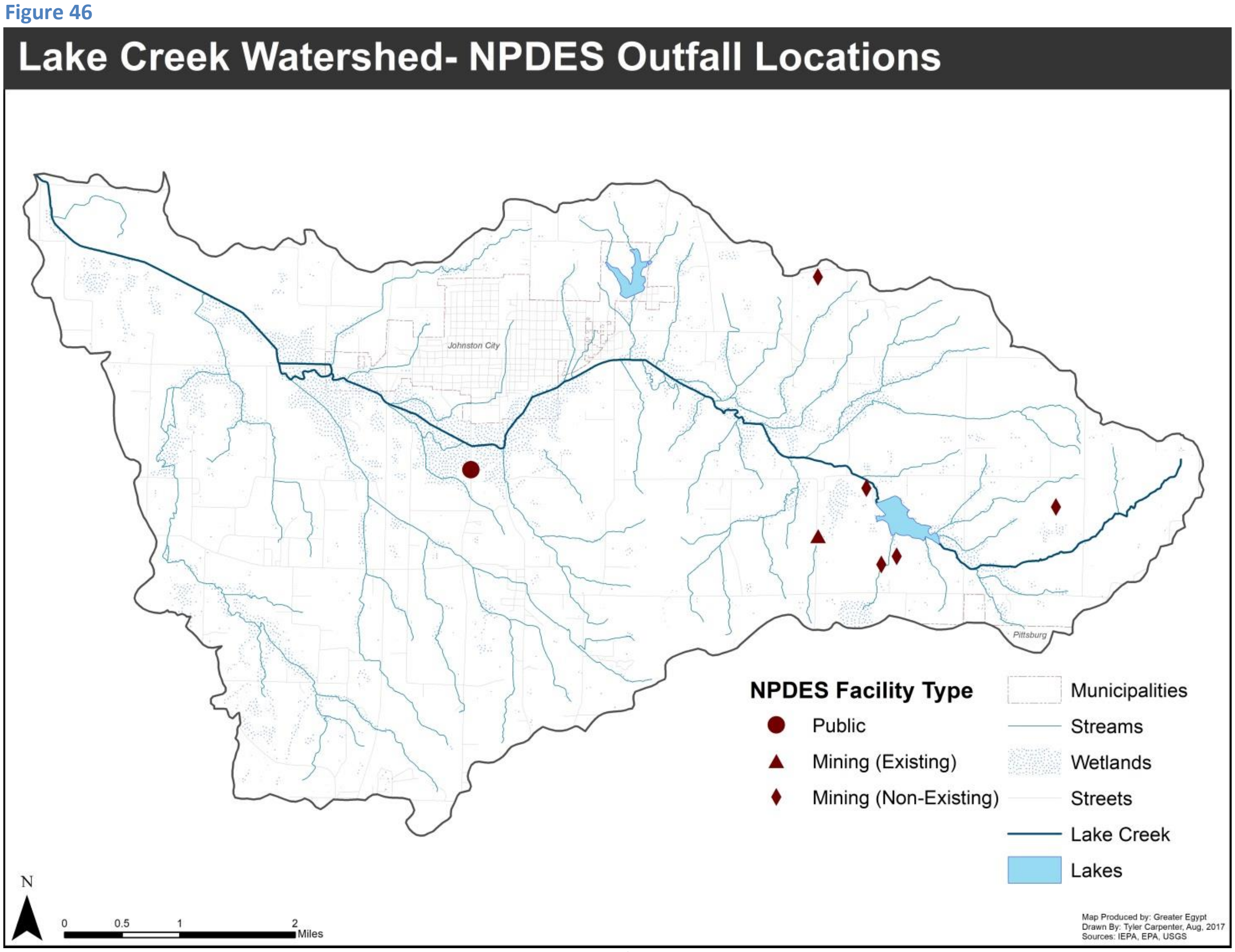
Source: Rend Lake Conservancy District

2.8.6 National Pollutant Discharge Elimination Systems (NPDES) Outfall Locations

There are two existing NPDES outfall locations within the Lake Creek watershed. These are outfalls from municipal sewage treatment plants and a mining operation that is in the reclamation process. Existing and non-existing NPDES outfalls are spatially displayed in Figure 46. The outfall for the City of Johnston City rests between the confluence of Lake Creek and Whiteash Branch and Beaver Creek about half of a mile south of the city. The receiving water for the discharge is Lake Creek.

Along with the Johnston City STP discharge, a single mining outfall is active in the Lake Creek watershed. The discharge takes place just west of the Freeman United Coal- Orient #4 mine. A slurry pond is currently being reclaimed at the site south of the Johnston City Lake which is the receiving water.

Figure 46



There are also five non-operational mining outfalls. The Springfield Coal Company had four outfalls at the previously mentioned Orient #4 Mine which were positioned around the Johnston City Lake area. Receiving waters included Johnston City Lake, Lake Creek, and an unnamed tributary to Johnston City Creek. The remaining retired outfall was permitted through Ziegler Coal Company in the northern part of the watershed east of Arrowhead Lake. The receiving water was an unnamed tributary to Lake Creek.

2.8.7 Pollutant Load Analysis

The Spreadsheet Tool for Estimating Pollutant Load (STEPL) modeling tool developed by Tetra Tech, Incorporated for the U.S. Environmental Protection Agency Office of Water was used to estimate the existing nonpoint source nutrient loads (nitrogen & phosphorus) and sediment loads. This was completed for the Lake Creek watershed at the HUC 12 level, and by individual subwatershed management units (SMU).

STEPL uses land cover category types, precipitation data, soils information, existing best management practices, stream and lake erosion, and other data input for calculating pollutant loads. The following table (49) identifies estimates of current pollutant loads by source and land use type for the Lake Creek watershed.

The STEPL model also utilizes other available data through the online STEPL preparation webpage. This generates numbers for agricultural animal counts, and data associated with septic systems. Since these numbers can only be generated at the HUC 12 watershed level, these were not utilized for the subwatershed analysis.

The model estimations suggest cropland and pastureland account for nearly 62 percent of the total nitrogen load, while pastureland individually constitutes the largest portion at approximately 46 percent. Urban land use accounts for 16.70 percent of the nitrogen load. Groundwater has been included in the model and calculates to be around 12 percent of the nitrogen load.

The majority of phosphorus loads stem from agriculture (cropland and pastureland/grassland), accounting for nearly 60 percent of the phosphorus load. Developed areas and streambank/shoreline both contribute a large amount of the nutrient load at 15 percent each.

The model suggests that streambank and shoreline erosion is responsible for the majority of the sediment load in the watershed. This accounts for approximately 43 percent of the entire load. Other major contributors include cropland (29.36 percent) and pastureland (21.78 percent).

Table 49 - Watershed-wide Existing Estimated Pollutant Loads

Source	N Load (lb/yr)	Percent of Total Load	P Load (lb/yr)	Percent of Total Load	Sediment Load (tons/yr)	Percent of Total Load
Urban	27505.85	16.70%	4251.89	15.25%	631.37	4.01%
Cropland	25810.14	15.67%	7430.95	26.65%	4617.44	29.36%
Pastureland & Grassland	75732.41	45.99%	9077.97	32.55%	3425.45	21.78%
Forest	4323.70	2.63%	2039.25	7.31%	333.14	2.12%
Groundwater	20554.50	12.48%	945.82	3.39%	0.00	0.00%
Streambank/Shoreline	10751.08	6.53%	4139.16	14.84%	6719.42	42.73%
TOTAL	**164677.68**		**27885.06**		**15726.82**	

Source: STEPL

2.8.8 Subwatershed Pollutant Loads

Subwatersheds were also individually modeled in STEPL. Pollutant loads reflect the dominant land use categories and size of each subwatershed. Results of the subwatershed STEPL model can be viewed in Table 50. Percentages of total pollutant loads by subwatershed are displayed in Table 51.

Because of its large size, the Whiteash subwatershed (SMU 8) exhibits the majority of the nutrient load. The nitrogen load for the subwatershed accounts for 15 percent of the overall watershed load. With 3,727 pounds of phosphorus per year, SMU 8 also makes up approximately 13 percent of the total watershed load for that nutrient. The subwatershed also contributes the second-most sediment load at 11.35 percent. These high rates of nutrients and sediment can be attributed to its size, concentrations of developments, pastureland, and amount of stream networks (69,356 feet).

Table 50- Subwatershed Estimated Existing Pollutant Loads

Subwatershed	SMU ID	Size (acres)	N Load (lb/yr)	N Load (lb/yr)/ Acre	P Load (lb/yr)	P Load (lb/yr)/ Acre	Sediment Load (t/yr)	Sediment Load (t/yr)/ Acre
Upper Lake Creek	**1**	1459.32	8123.14	5.57	1290.40	0.88	797.09	0.55
City Lake	**2**	1817.87	12680.14	6.98	1859.99	1.02	997.41	0.55
Corinth	**3**	1404.85	9868.06	7.02	1671.44	1.19	1295.27	0.92
Fowler School	**4**	992.40	4305.88	4.34	779.52	0.79	459.51	0.46
Heartland	**5**	2297.85	15730.49	6.85	2370.01	1.03	1342.57	0.58
Whiteash Branch	**6**	743.14	5916.24	7.96	1080.31	1.45	655.45	0.88
Arrowhead	**7**	2109.54	13170.73	6.24	2009.48	0.95	882.32	0.42
Whiteash	**8**	3211.59	24701.24	7.69	3726.56	1.16	1784.29	0.56
Beaver Creek	**9**	366.26	2977.79	8.13	414.00	1.13	205.41	0.56
Johnston City	**10**	1732.20	14055.09	8.11	2450.40	1.41	1197.70	0.69
Bear Creek	**11**	2760.84	20174.08	7.31	3164.98	1.15	1766.92	0.64
Champaign	**12**	833.81	8983.66	10.77	1780.17	2.13	1039.36	1.25
Collins	**13**	755.07	8028.14	10.63	1786.51	2.37	1165.87	1.54
Lower Lake Creek	**14**	1298.19	15962.98	12.30	3501.30	2.70	2137.64	1.65
TOTAL		**21782.93**	**164677.68**	**7.56**	**27885.06**	**1.28**	**15726.82**	**0.72**

Source: STEPL

The Lower Lake Creek subwatershed (SMU 14) constitutes the majority of the sediment load of the Lake Creek watershed. It also contributes the second highest rate of phosphorus loads. Since 77 percent of the subwatershed is classified as cultivated crops (52 percent) and pasture/hay (25 percent), 12.56 percent of the entire watershed phosphorus load is attributed to SMU 14.

Table 51- Percentage of Total Pollutant Load by Subwatershed

Subwatershed	SMU ID	Size (acres)	N Percent of Total Load	P Percent of Total Load	Sediment Percent of Total Load
Upper Lake Creek	**1**	1459.32	4.93%	4.63%	5.07%
City Lake	**2**	1817.87	7.70%	6.67%	6.34%
Corinth	**3**	1404.85	5.99%	5.99%	8.24%
Fowler School	**4**	992.40	2.61%	2.80%	2.92%
Heartland	**5**	2297.85	9.55%	8.50%	8.54%
Whiteash Branch	**6**	743.14	3.59%	3.87%	4.17%
Arrowhead	**7**	2109.54	8.00%	7.21%	5.61%
Whiteash Branch	**8**	3211.59	15.00%	13.36%	11.35%
Beaver Creek	**9**	366.26	1.81%	1.48%	1.31%
Johnston City	**10**	1732.20	8.53%	8.79%	7.62%
Bear Creek	**11**	2760.84	12.25%	11.35%	11.24%
Champaign	**12**	833.81	5.46%	6.38%	6.61%
Collins	**13**	755.07	4.88%	6.41%	7.41%
Lower Lake Creek	**14**	1298.19	9.69%	12.56%	13.59%

Source: STEPL

2.8.9 Pollutant Load Reduction Targets

The Lake Creek Watershed-based Plan will address the problematic areas in the watershed by proposing best management practices (BMP) to limit the nutrient runoff and other impairments. In order to better plan for these measures, pollutant load reduction targets are set to offer a benchmark for BMP effectiveness. While BMP can be site-specific and cover a wide range of techniques, they should target the major impairments in the watershed.

According to the Illinois Integrated Water Quality Report, there are several known and potential causes and sources of water pollution in the Lake Creek watershed. Table 52 summarizes the causes and sources based on the 2016 Illinois Integrated Water Quality Report and other factors identified in this inventory and assessment.

Table 52 – Causes and Sources of Watershed Impairments

Waterbody	Causes of Impairment	Possible Sources of Impairment
Beaver Creek	**Manganese, Changes in Stream Depth and Velocity Patterns, Loss of Instream Cover**	Agriculture
		Crop Production
		Loss of Riparian Habitat
		Municipal Point Source Discharges
		Runoff from Forest/Grassland/Parkland
		Urban Runoff/ Storm Sewers
Lake Creek	**Dissolved Oxygen, Phosphorus, Changes in Stream Depth and Velocity Patterns**	Agriculture
		Crop Production
		Municipal Point Source Discharges
		Unknown Sources
		Urban Runoff/ Storm Sewers
Arrowhead Lake	**Phosphorus**	Runoff from Forest/Grassland/Parkland
Johnston City Lake	**TSS, Phosphorus, Aquatic Algae**	Littoral/ Shore Area Modifications
		Runoff from Forest/Grassland/Parkland

Source: 2016 IEPA Illinois Integrated Water Quality Report and 303(d) Lists

As described in Section 2.8.1, the Illinois Nutrient Loss Reduction Strategy (ILNLRS) was designed to provide a framework for BMP implementation and reduction of nitrogen and phosphorus in Illinois waterbodies. The plan sets a Phase 1 milestone of state-wide nutrient reduction of nitrate-nitrogen at 15 percent. The target for phosphorus is 25 percent. These targets are to be met by 2025, with an overall target of 45 percent for both nutrients. [40]

Pollutant load reduction targets for Lake Creek watershed will conform to the targets presented in the ILNLRS. Table 53 provides a summary of the pollutant load reduction targets for the Lake Creek watershed and subwatersheds for a ten-year period. While the plan provides information on limiting sediment in waterbodies, it does not provide a target. However, a target of 30 percent has been assigned for the Lake Creek watershed. These targets are also presented in the following table.

[40] IEPA. "Illinois Nutrient Loss Reduction Strategy Implementation."

Table 53 – Summary of Pollutant Load Reduction Targets

Watershed	Nitrogen Load Reduction Target (lbs)	Nitrogen (Percent Reduction)	Phosphorus Load Reduction Target (lbs)	Phosphorus (Percent Reduction)	Sediment Load Reduction Target (tons)	Sediment (Percent Reduction)
Lake Creek	**24701.65**	**15.00%**	**6971.26**	**25.00%**	**4718.04**	**30.00%**
Subwatershed Load Reduction Targets						
SMU 1	1218.47	4.93%	322.60	4.63%	239.13	5.07%
SMU 2	1902.02	7.70%	465.00	6.67%	299.22	6.34%
SMU 3	1480.21	5.99%	417.86	5.99%	388.58	8.24%
SMU 4	645.88	2.61%	194.88	2.80%	137.85	2.92%
SMU 5	2359.57	9.55%	592.50	8.50%	402.77	8.54%
SMU 6	887.44	3.59%	270.08	3.87%	196.64	4.17%
SMU 7	1975.61	8.00%	502.37	7.21%	264.70	5.61%
SMU 8	3705.19	15.00%	931.64	13.36%	535.29	11.35%
SMU 9	446.67	1.81%	103.50	1.48%	61.62	1.31%
SMU 10	2108.26	8.53%	612.60	8.79%	359.31	7.62%
SMU 11	3026.11	12.25%	791.25	11.35%	530.08	11.24%
SMU 12	1347.55	5.46%	445.04	6.38%	311.81	6.61%
SMU 13	1204.22	4.88%	446.63	6.41%	349.76	7.41%
SMU 14	2394.45	9.69%	875.32	12.56%	641.29	13.59%
TOTAL	**24701.65**		**6971.26**		**4718.04**	

The summary suggests that with a 15 percent reduction target, watershed-wide nitrogen loading will be reduced by 24,701.65 pounds per a ten-year period. At a 25 percent reduction, phosporus loads will be reduced by 6,971.26 pounds. The summary also includes a reduction in sediment of 4,718.04 tons (30 percent). Results have also been categorized by annual pollutant load reductions. These are displayed in Table 54.

Table 54 – Annual Pollutant Load Reduction Targets

Watershed	Nitrogen Load Reduction Target (lbs/year)	Nitrogen (Percent Reduction)	Phosphorus Load Reduction Target (lbs/year)	Phosphorus (Percent Reduction)	Sediment Load Reduction Target (tons/year)	Sediment (Percent Reduction)
Lake Creek	**2470.17**	**15.00%**	**697.13**	**25.00%**	**471.80**	**30.00%**
Subwatershed Load Reduction Targets						
SMU 1	**121.85**	4.93%	32.26	4.63%	23.91	5.07%
SMU 2	**190.20**	7.70%	46.50	6.67%	29.92	6.34%
SMU 3	**148.02**	5.99%	41.79	5.99%	38.86	8.24%
SMU 4	**64.59**	2.61%	19.49	2.80%	13.79	2.92%
SMU 5	**235.96**	9.55%	59.25	8.50%	40.28	8.54%
SMU 6	**88.74**	3.59%	27.01	3.87%	19.66	4.17%
SMU 7	**197.56**	8.00%	50.24	7.21%	26.47	5.61%
SMU 8	**370.52**	15.00%	93.16	13.36%	53.53	11.35%
SMU 9	**44.67**	1.81%	10.35	1.48%	6.16	1.31%
SMU 10	**210.83**	8.53%	61.26	8.79%	35.93	7.62%
SMU 11	**302.61**	12.25%	79.12	11.35%	53.01	11.24%
SMU 12	**134.75**	5.46%	44.50	6.38%	31.18	6.61%
SMU 13	**120.42**	4.88%	44.66	6.41%	34.98	7.41%
SMU 14	**239.44**	9.69%	87.53	12.56%	64.13	13.59%
TOTAL	**2470.17**		**697.13**		**471.80**	

3. Best Management Practices and Pollutant Load Reductions

For the Lake Creek Watershed-based Plan, BMP have been separated into watershed-wide and site-specific classes. There are a variety of practices in the plan that address the issues of stormwater and agricultural practices in the watershed. BMP were suggested based on several factors including: reduction loads, need, feasibility, cost, and labor.

Pollutant load reductions have been calculated for each site-specific practice by implementing the STEPL Region 5 Model. Reductions were also estimated for watershed-wide BMP. However, estimations for site-specific BMP may be more accurate considering the variables used for those calculations pertain to a particular area.

BMP have been arranged by general area in the following section. Along with the general location, they have also been classified by: sub-watershed management unit, amount, unit, and priority ranking.

3.1 BMP Descriptions and Methodology

Each BMP type suggested in the plan has been characterized and described further by methodology. As previously stated, management measures address the major pollutants in the watershed derived from the original pollutant loads outlined in the watershed resource inventory. These are heavily geared towards pollutant load reductions in agriculture and urban stormwater runoff.

3.1.1 Agricultural BMP

According to the existing pollutant loads derived from the STEPL model, agricultural practices (cropland/pastureland) account for nearly 62 percent of the total nitrogen load, 59 percent of the total phosphorus load, and 51 percent of the total sediment load in the watershed. With the agricultural pollutant loading being so substantial, many of the BMP are focused on addressing load reductions from these land uses. Figure 47 displays various agricultural BMP presented in this plan.

Agricultural Filter Strips

Figure 47- Example of Agricultural BMP

Source: USDA NRCS, Ohio

Agricultural filter strips protect water quality by naturally filtering nutrients and sediment. Since Lake Creek is impaired by phosphorus, this BMP is effective in reducing these pollutant loads into the waterbody. Nearly 77 percent of Lake Creek is within 100 yards of agricultural land alone. With the amount of agricultural runoff taking place at these specific locations, agricultural filter strips are particularly effective in reducing pollutant loads. Pollutant load reductions were generated in STEPL assuming BMP efficiencies of: 65 percent sediment reduction; 75 percent phosphorus reduction; and 70 percent nitrogen reduction. The model also takes Universal Soil Loss Equation (USLE) or the Revised USLE (RUSLE) parameters into consideration. These are specific for the geographic area. Unless otherwise noted, all agricultural BMP follow the same efficiency percentages.

Conservation Tillage

Conversation tillage can include mulch-till, no-till, or strip-till practices. These forms of conservation tillage usually leave a residual of the previous layer of crops. Each method varies in practice, but the benefits are usually consistent with the others. Major benefits of implementing some form of conservation tillage include a reduction in soil erosion, and improved water quality.

Cover Crops

Cover crops provide benefits to agricultural land by improving water quality and reducing erosion. These are usually planted following seasonal harvests. Some landowners in the Lake Creek watershed already plant some form of cover crops, but this number is relatively small compared to the overall acreage of agricultural practices.

Grassed Waterways

Grassed waterways prevent erosion in areas prone to consistent water flow. They can also serve as a filtering mechanism for nutrients. Compared to surrounding areas, the Lake Creek Watershed has very few landowners that implement this practice. The parameters used in the STEPL model for grassed waterways include: soil type, top and bottom width of existing gully, depth, length, and number of years to form.

Figure 48- Grassed Waterways in Planning Area

Source: ISGS, NAIP 2015 Data Viewer

Since grassed waterways are very effective in addressing erosion and nutrients, the BMP efficiency used in the pollutant load reduction models was set at 1 (100 percent efficiency). Implementation of grassed waterways is assuming at least a 25 foot width per gully.

No Mow Pastures

Low mow, or no mow pastures, can provide some benefits to water quality and the environment in general. These can potentially act as a natural filtering system for water runoff from pastures. A larger swath could also act as a buffer and slow the flow of runoff. Since no mow pastures utilize the existing natural vegetation, costs are either low or non-existent.

Riparian Buffer

Riparian buffers are similar to filter strips, and have additional benefits. Like filter strips, buffers reduce sediment and nutrients by filtering the water that flows through it. Since buffers are generally larger than agricultural filters, they can reduce the flow of water at a higher pace. This is beneficial for the riparian buffers along Lake Creek. Since implementation of buffers can be more expensive than normal filter strips, they were suggested sparingly for the Lake Creek Watershed-based Plan.

3.2.2 Urban Stormwater BMP

Urban stormwater runoff contributes to the pollutant loading in the Lake Creek watershed. Nearly 17 percent of the nitrogen load in the watershed is attributed to urban runoff. It is also responsible for 15 percent of the phosphorus load, and only a small portion of the sediment load at around four percent. As previously stated, BMP were suggested based on: reduction loads, need, feasibility, cost, and labor. Since Johnston City represents the majority of the urban environment in the watershed, and has a smaller population, costs for these management practices had to be considered.

The STEPL Region 5 Model considers the type and acreage of the urban environment (commercial, transportation, residential, etc.). Considerations also include whether the area is sewered, or unsewered. Since Johnston City is considerably smaller than other cities in the region, the more nature-based solutions (swales, green roofs) are suggested sparingly. In most cases, these are considered pilot projects.

Swale

Swales act as a filter for stormwater nutrients. This type of BMP is effective in trapping sediment and other nutrients before releasing the water flow into other areas. Depending on the contributing area for the practice, swales are generally a suitable measure to reduce total suspended solids.

Infiltration/ Detention Basins

For the purpose of reducing flooding, manage stormwater and other water quality issues, infiltration basins have been proposed for the plan. Development of these basins will mitigate future flooding occurrences in areas prone to the back-up of water flow. They should also provide relief of stormwater runoff issues specifically in Johnston City.

Figure 50- Detention Area

Green Roof

Along with providing reduced energy costs, green roofs can also provide some environmental benefits including a reduction of stormwater runoff. While the construction of a green roof might immediately be costly, improved energy efficiency would negate the cost over a period of time. For the Lake Creek watershed, green roofs could also be used as an educational tool; providing a possible environment for sustainability and nature-based solutions to infrastructure.

Porous/ Permeable Pavement

Considering nearly 46 percent of the Johnston City subwatershed exhibits 10 percent or more impervious surfaces, porous and permeable pavement has been suggested as an option to reduce nutrient loads from stormwater runoff. Unlike normal pavement, permeable surfaces act to reduce larger volumes of stormwater across a specific site, and subsequently, limit the advancement of nutrients. This is also helpful in limiting other contaminants from vehicles.

Rain Barrels/ Rain Gardens

Rain gardens and barrels are cost effective measures in reducing stormwater runoff, notably at the residential level. Rain barrels capture stormwater runoff from a downspout, usually storing water for later use. Rain gardens have the potential to store excess runoff from urban environments. While they can provide environmental benefits, they can also have an aesthetic value.

Vegetated Filter Strip

Vegetated filter strips act much like an agricultural filter strip, but for more urban areas. As its name implies, these BMP filter nutrients and sediment in stormwater runoff. If using natural vegetation, filter strips can be a cost-effective strategy in reducing nutrient loads.

3.2.3 Waterbody BMP

While other BMP previously suggested have focused solely on agriculture and urban areas, it is important to recommend management measures that can immediately affect waterbodies. These management practices deal with both agriculture and urban environments.

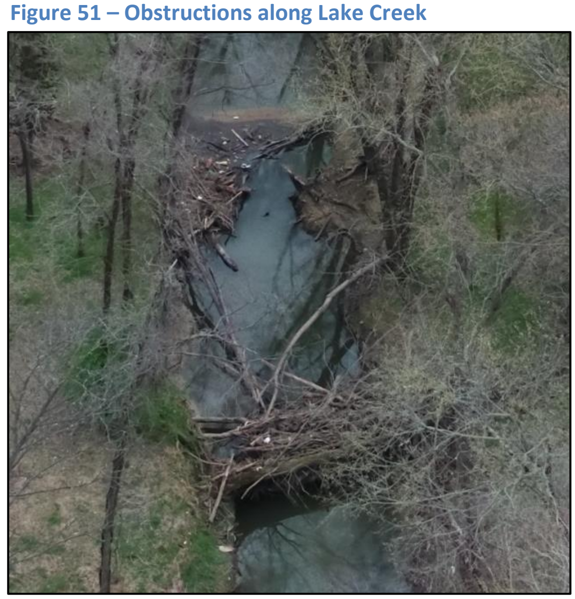
Culvert Inspections

Figure 50 – Deteriorating Culvert in Lake Creek Watershed

To function properly, culverts need to be free of any debris and be properly maintained. Some culverts in the Lake Creek watershed show signs of deterioration. While this can have environmental impacts, it could also be a potential health hazard. Figure 50 displays a culvert at the confluence of Whiteash Branch and Lake Creek.

Debris Removal

Figure 51 – Obstructions along Lake Creek



Many areas in the Lake Creek Watershed exhibit some form of blockages. This is certainly evident in some segments of Lake Creek. While this is sometimes overlooked, it can be detrimental to the health of a stream or lake. Depending on the flow, a blockage can alter the stream channel and cause erosion on the streambank. Areas with major blockages can also exhibit flooding.

Shoreline and Streambank Stabilization

Varying degrees of erosion occur on all waterbodies. This is particularly evident in Lake Creek and the two lakes. Stabilization of shorelines and streambanks is important to reduce the progress of erosion and mitigate any future occurrences. Stabilization measures can also reduce nutrient loads from runoff.

The Region 5 Model uses various parameters to estimate load reductions for shoreline and streambank stabilization. Soil, length and height are components included in the model. Lateral recession rates (LRR) are also used in determining the effectiveness of stabilization. Table 55 displays the modified LRR characterization used in the STEPL Region 5 Model.

Table 55- Modified Lateral Recession Rate Diagram in STEPL Region 5 Model

LRR (ft/yr)	Category	Median Value	Description
0.01 - 0.05	Slight	0.03	Some bare bank but active erosion not readily apparent
0.06 - 0.2	Moderate	0.13	Bank is predominantly bare with some rills and vegetative overhang
0.3 - 0.5	Severe	0.4	Bank is bare with rills and severe vegetative overhang
0.5+	Very Severe	0.5	Bank is bare with gullies and severe vegetative overhang

Source: EPA, IEPA

For consistency, LRRs used for streambank and shoreline stabilization were set at median values: Slight (0.03), Moderate (0.13), Severe (0.4). Efficiency parameters were set at 1 (100 percent efficiency). In most cases, this strategy was used for both banks of a reach unless otherwise noted.

3.3 BMP Recommendations

Best management practices for the Lake Creek watershed have been proposed by agricultural, urban, and waterbody categories. BMP previously described are further subdivided by watershed-wide and site-specific areas.

3.3.1 Watershed-wide BMP

As previously stated, BMP suggested in the plan are separated into watershed-wide and site-specific categories. Table 56 displays the watershed-wide BMP, amount, and their estimated load reductions.

Watershed-wide BMP include: swales, conservation tillage, cover crops, green roofs, no mow pastures, porous pavement, rain barrels, rain gardens, and streambank stabilization. Load reductions are symbolized by N (Nitrogen), P (Phosphorus), TSS (Total Suspended Solids), BOD (Biological Oxygen Demand), and COD (Chemical Oxygen Demand).

For the agricultural watershed-wide BMP, a suggestion of a twenty percent of land to implement conservation tillage, cover crops, and no mow pastures has been suggested. The twenty percent constitutes nearly 400 acres of agricultural land. In regards to nutrient load reductions, these practices seem to provide the most benefits considering the small application size.

Watershed-wide streambank stabilization was based on the extent of erosion. Proposed total stabilized stream length by subwatershed is displayed in Table 57. In general, load reductions are based on one bank being stabilized for watershed-wide and site-specific categories. Low extent of erosion leads to 20 percent of the reach becoming eligible for stabilization, moderate at 30 percent, and high being 70 percent of the reach. The percent of streambank stabilization by individual reach can be found in Appendix A.

Porous and permeable pavement has also been suggested as a watershed-wide BMP. A suggestion of a five acre sample will be reduced or converted from impervious surfaces. This constitutes only a small portion of impervious surfaces in the watershed. These would likely consist of parking areas with poor runoff and sidewalks.

With these measures, estimations for nutrient load reductions account for: nitrogen (19,459 lbs/yr), phosphorus (9,672 lbs/yr), and sediment (12,002 tons/yr). Other load reductions have been calculated for TSS, BOD, and COD.

Table 56- Watershed-wide BMP and Load Reductions

BMP	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)					
			N	P	Sediment	TSS	BOD	COD
Conservation Tillage	400	acres	3514	1769	2626	-	-	-
Cover Crops	400	acres	3514	1769	2626	-	-	-
Green Roof	2	acres	22	15	-	2640	104	640
No Mow Pastures	400	acres	3514	1769	2626	-	-	-
Porous Pavement	5	acres	534	58	-	47791	-	14639
Rain Barrel	-							
Rain Garden	-							
Streambank Stabilization*	127,632	feet	8248	4124	4124	-	-	-
Swale	5	acres	113	168	-	148155	224	101690
		TOTALS:	**19459**	**9672**	**12002**	**198586**	**328**	**116969**
			N	P	Sediment	TSS	BOD	COD

BOD	**BIOCHEMICAL OXYGEN DEMAND**
COD	**CHEMICAL OXYGEN DEMAND**
TSS	**TOTAL SUSPENDED SOLIDS**
TN	**TOTAL NITROGEN**
TP	**TOTAL PHOSPHORUS**

* Streambank is listed under this table as a watershed-wide practice. Load reductions for Individual reaches have also been established as site-specific practices. These reductions are based on single streambanks, not both.

Table 57- Streambank Stabilization by Subwatershed

SMU ID	Subwatershed	Total Stream Length (ft.)	Total Proposed Streambank Stabilization
1	Upper Lake Creek	30951.25	11056.14
2	City Lake	32905.69	11990.76
3	Corinth	36217.64	12222.64
4	Fowler School	23912.78	5959.5
5	Heartland	59777.22	16650.37
6	Whiteash Branch	19621.21	5297.57
7	Arrowhead	43175.02	10858.9
8	Whiteash	69247.69	19094.17
9	Beaver Creek	8969.59	2023.63
10	Johnston City	36157.59	8805.73
11	Bear Creek	44641.47	10267.32
12	Champaign	17712.76	4044.73
13	Collins	10844.81	4196.01
14	Lower Lake Creek	16024.49	5164.81
	Total:	**450159.21**	**127632.28**

3.3.2 Site-specific BMP

Many of the watershed-wide BMP have also been suggested at site-specific areas. Other BMP such as shoreline stabilization, grassed waterways, and agricultural filter strips have been recommended. Figure 52 illustrates the locations of site-specific BMP for the Lake Creek Watershed by map code. Map codes are also available on the site-specific BMP load reductions in the following section. The subwatersheds that include Johnston City (SMU 7 and 10) have also been examined for critical flooding areas around the municipality. Figure 53 displays these areas with the corresponding subbasin.

Site-specific BMP and load reductions are displayed by SMU. Load reductions follow the same layout as the watershed-wide diagram. A priority ranking has also been established for each BMP. Rankings were based on various factors including elements that were previously used in establishing BMP: load reductions, need, feasibility, cost, labor, and other benefits from the BMP. Table 58 illustrates the priority ranking IDs. These are congruent with the phases outlined in Element F of the plan (schedule for implementing nonpoint source management measures).

Table 58- BMP Priority Index

Priority	Description
L	Low Priority
M	Medium Priority
H	High Priority

Figure 52

Lake Creek Watershed- Site-specific BMP Locations

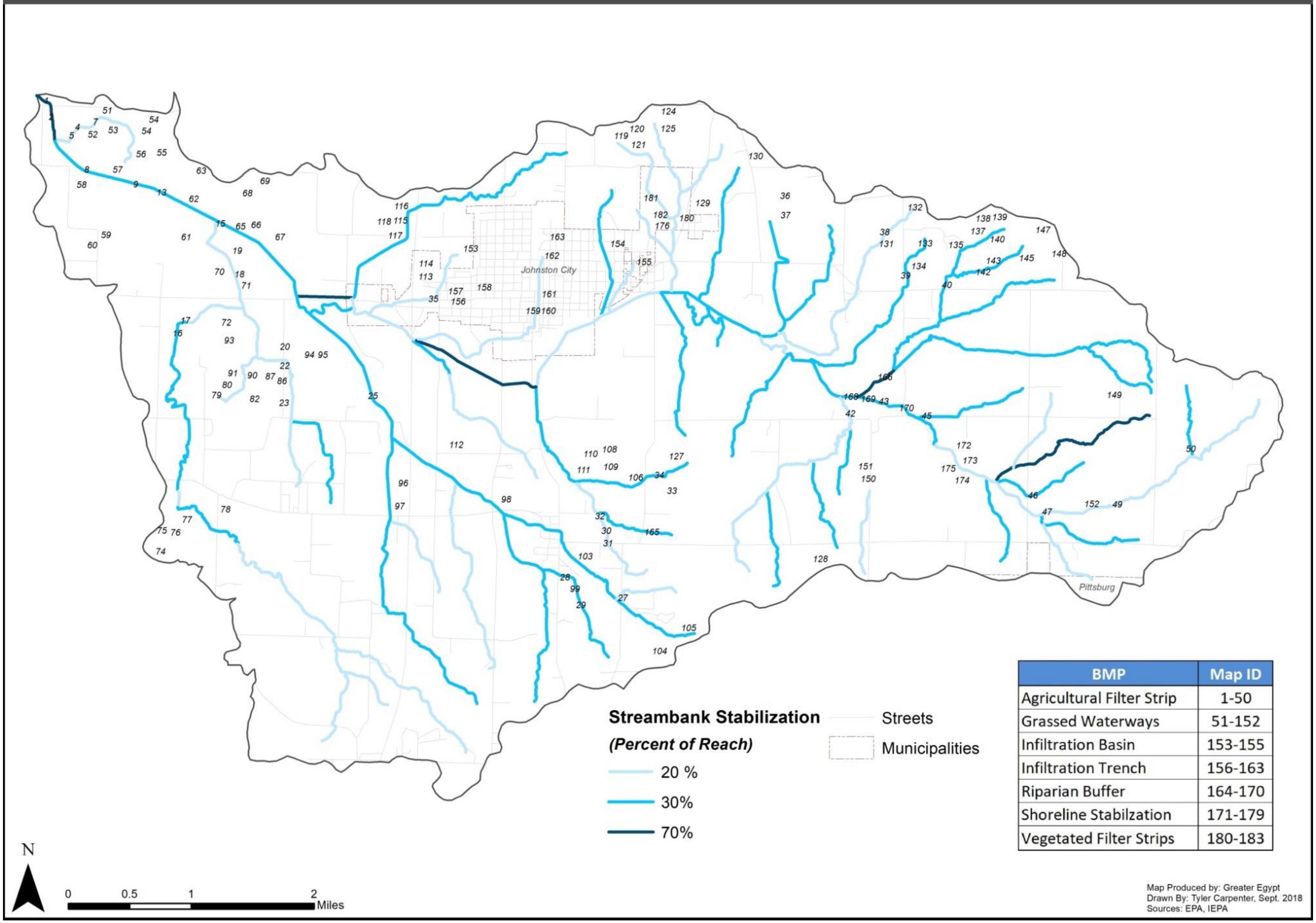
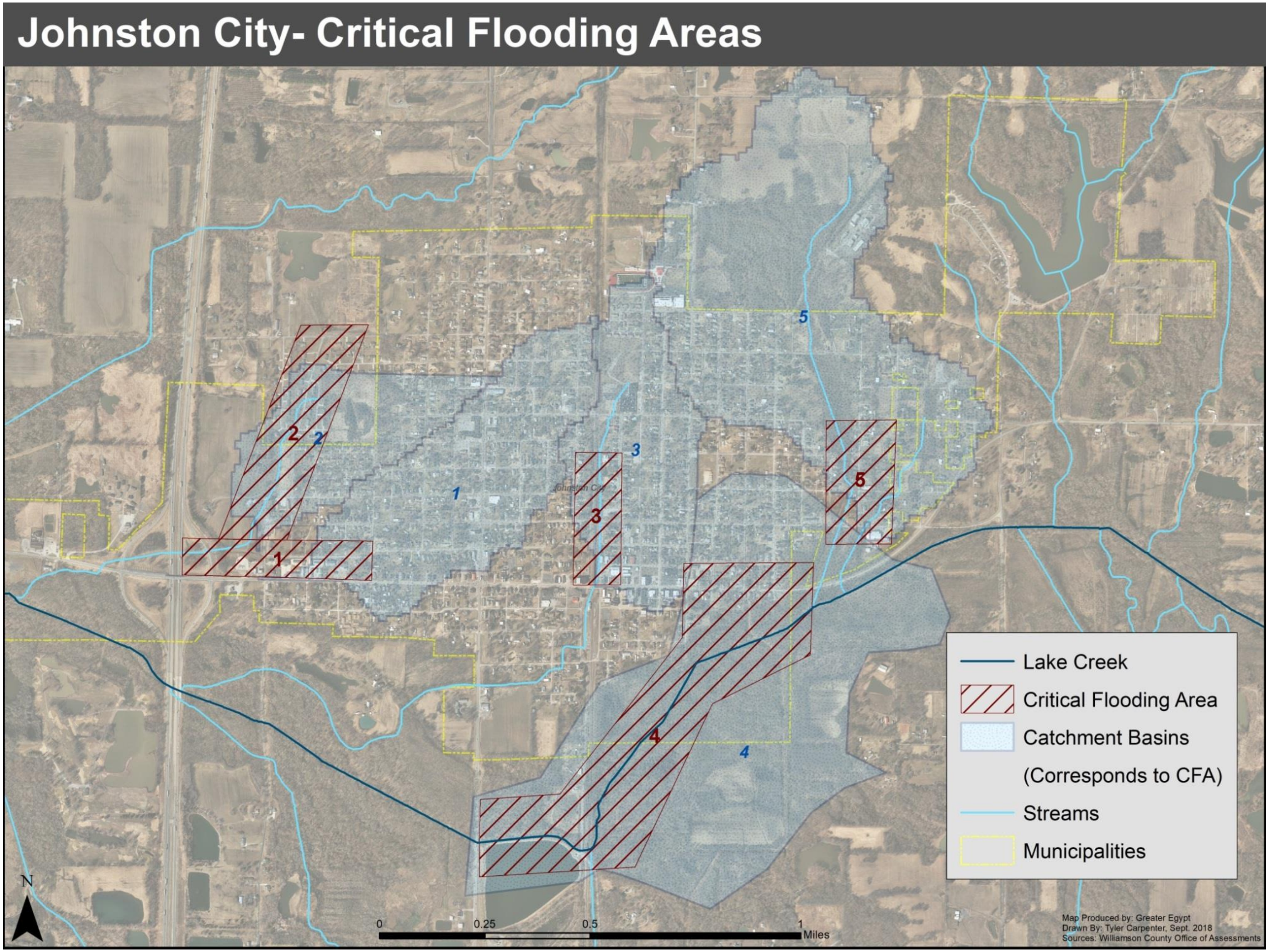


Figure 53



Johnston City- Critical Flooding Areas
1
2
3
4
5
Lake Creek
Critical Flooding Area
Catchment Basins
(Corresponds to CFA)
Streams
Municipalities
N
0
0.25
0.5
1
Miles
Map Produced by: Greater Egypt
Drawn By: Tyler Carpenter, Sept. 2018
Sources: Williamson County Office of Assessments

Table 59- Upper Lake Creek (SMU 1) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Upper Lake Creek	Agricultural Filter Strip	46	07140106007046	344	feet	22	12	11	-	-	-	L
		47	07140106000121	305	feet	22	12	11	-	-	-	L
		48	07140106000121	722	feet	142	76	69	-	-	-	H
		49	07140106000121	736	feet	59	32	29	-	-	-	M
		50	07140106007015	516	feet	142	76	69	-	-	-	H
	Grassed Waterways	152	07140106000121	616	feet	16	7.9	7.9	-	-	-	L
	Streambank Stabilization	-	07140106000121	2878.1	feet	36.7	18.3	18.3	-	-	-	L
		-	07140106007093	716.5	feet	1.8	0.9	0.9	-	-	-	L
		-	07140106007046	1370.4	feet	8.2	4.1	4.1	-	-	-	M
		-	07140106007015	993.8	feet	33.8	16.9	16.9	-	-	-	M
		-	07140106007064	5097.3	feet	26	13	13	-	-	-	M
					TOTALS:	**509.5**	**269.1**	**250.1**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 60- City Lake (SMU 2) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
City Lake	Agricultural Filter Strip	43	07140106000119	1057	feet	236	126	113	-	-	-	H
		44	07140106000119	999	feet	158	85	77	-	-	-	M
		45	07140106007010	733	feet	190	102	92	-	-	-	H
	Debris Removal	-	07140106000119	-	-	-	-	-	-	-	-	M
		-	07140106025661	-	-	-	-	-	-	-	-	M
	Grassed Waterways	149	07140106001228	479	feet	48	23.9	23.9	-	-	-	H
		150	07140106007105	175	feet	55	27.4	27.4	-	-	-	H
		151	07140106007105	327	feet	11	5.3	5.3	-	-	-	L
	Riparian Buffers	168	07140106000119	748	feet	134	72	77	-	-	-	H
		169	07140106000118	415	feet	78	42	39	-	-	-	M
		170	07140106000119	229	feet	78	42	39	-	-	-	M
	Shoreline Stabilization	171	07140106025661	190	feet	13	6	6	-	-	-	L
		172	07140106025661	386	feet	26	13	13	-	-	-	M
		173	07140106025665	186	feet	16	8	8	-	-	-	H
		174	07140106025661	554	feet	38	19	19	-	-	-	M
		175	07140106025665	396	feet	34	17	17	-	-	-	L
	Streambank Stabilization	x	07140106007010	1489.3	feet	63.3	31.6	31.6	-	-	-	M
		x	07140106001228	5686.1	feet	290	145	145	-	-	-	H
		x	07140106025661	313.2	feet	4	2	2	-	-	-	L
		x	07140106025665	274.6	feet	3.5	1.8	1.8	-	-	-	L
		x	07140106025667	85.1	feet	1.1	0.5	0.5	-	-	-	L
		x	07140106000119	1357.1	feet	75	37.5	37.5	-	-	-	M
		x	07140106025672	71.1	feet	0.9	0.5	0.5	-	-	-	L
		x	07140106007032	758.9	feet	1.9	1	1	-	-	-	L
		x	07140106007105	757.4	feet	4.8	2.4	2.4	-	-	-	L
		x	07140106025668	1197.8	feet	9.2	4.6	4.6	-	-	-	M
					TOTALS:	**1568.7**	**815.5**	**783.5**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 61- Corinth (SMU 3) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Corinth	Agricultural Filter Strip	40	07140106006921	522	feet	110	59	54	-	-	-	H
	Grassed Waterways	135	07140106006921	569	feet	75	37.4	37.4	-	-	-	M
		136	07140106006921	167	feet	41	20.5	20.5	-	-	-	M
		137	07140106006921	539	feet	82	41.1	41.1	-	-	-	M
		138	07140106006921	545	feet	190	95.2	95.2	-	-	-	H
		139	07140106006921	436	feet	34	16.8	16.8	-	-	-	L
		140	07140106006921	602	feet	65	32.4	32.4	-	-	-	M
		141	07140106006921	280	feet	43	21.6	21.6	-	-	-	M
		142	07140106006923	207	feet	23	11.3	11.3	-	-	-	L
		143	07140106006923	304	feet	12	5.8	5.8	-	-	-	L
		144	07140106006923	294	feet	34	17	17	-	-	-	L
		145	07140106006923	318	feet	96	47.8	47.8	-	-	-	H
		146	07140106006923	373	feet	55	27.4	27.4	-	-	-	M
		147	07140106006923	440	feet	169	84.6	84.6	-	-	-	H
		148	07140106001230	499	feet	49	24.4	24.4	-	-	-	M
	Riparian Buffer	166	07140106001229	447	feet	80	43	39	-	-	-	H
		167	07140106001229	400	feet	93	50	46	-	-	-	H
	Streambank Stabilization	x	07140106001231	3981.7	feet	132	66	66	-	-	-	M
		x	07140106001229	1402.9	feet	161	80.5	80.5	-	-	-	H
		x	07140106006979	1306	feet	10	5	5	-	-	-	L
		x	07140106006921	1658.4	feet	31.7	15.9	15.9	-	-	-	M
		x	07140106006923	1102.7	feet	37.5	18.7	18.7	-	-	-	L
		x	07140106001230	2771	feet	70.7	35.3	35.3	-	-	-	L
					TOTALS:	**1693.9**	**856.7**	**843.7**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 62- Fowler School (SMU 4) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Fowler School	Agricultural Filter Strip	42	07140106001227	568	feet	76	41	38	-	-	-	M
	Grassed Waterways	128	07140106007080	438	feet	62	31.1	31.1	-	-	-	M
	Streambank Stabilization	x	07140106001227	2428.7	feet	18.6	9.3	9.3	-	-	-	L
		x	07140106007116	1338.1	feet	45.5	22.7	22.7	-	-	-	M
		x	07140106007053	911.6	feet	23.2	11.6	11.6	-	-	-	M
		x	07140106007080	1281.1	feet	13.1	6.5	6.5	-	-	-	M
					TOTALS:	**238.4**	**122.2**	**119.2**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 63- Heartland (SMU 5) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Heartland	Agricultural Filter Strip	36	07140106001235	553	feet	110	59	54	-	-	-	H
		37	07140106001235	179	feet	22	12	11	-	-	-	L
		38	07140106001234	363	feet	126	68	62	-	-	-	H
		39	07140106001229	439	feet	59	32	29	-	-	-	M
		41	07140106001232	556	feet	126	68	62	-	-	-	H
	Grassed Waterways	129	07140106006951	220	feet	8	4	4	-	-	-	L
		130	07140106006951	475	feet	64	31.9	31.9	-	-	-	M
		131	07140106001234	509	feet	83	41.4	41.4	-	-	-	H
		132	07140106001234	323	feet	16	7.8	7.8	-	-	-	L
		133	07140106000094	379	feet	48	23.9	23.9	-	-	-	M
		134	07140106000094	677	feet	108	54.1	54.1	-	-	-	H
	Streambank Stabilization	x	07140106001235	1975.8	feet	23.5	11.8	11.8	-	-	-	M
		x	07140106001236	1621.2	feet	19.3	9.6	9.6	-	-	-	M
		x	07140106006951	1908.8	feet	22.7	11.4	11.4	-	-	-	M
		x	07140106006981	1506.9	feet	13.4	6.7	6.7	-	-	-	L
		x	07140106001226	1673.7	feet	19.9	10	10	-	-	-	M
		x	07140106000114	1457.4	feet	80.5	40.3	40.3	-	-	-	M
		x	07140106000115	403.6	feet	5.1	2.6	2.6	-	-	-	L
		x	07140106000116	369.8	feet	20.4	10.2	10.2	-	-	-	M
		x	07140106000117	632	feet	34.9	17.5	17.5	-	-	-	M
		x	07140106000118	231.4	feet	12.8	6.4	6.4	-	-	-	M
		x	07140106001234	2161.8	feet	13.8	6.9	6.9	-	-	-	L
		x	07140106001232	2708.1	feet	20.7	10.4	10.4	-	-	-	M
					TOTALS:	**1057**	**545.9**	**524.9**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 64- Whiteash Branch (SMU 6) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Whiteash Branch	Agricultural Filter Strip	30	07140106007117	933	feet	158	85	77	-	-	-	H
		31	07140106007117	368	feet	41	22	21	-	-	-	L
		32	07140106007117	540	feet	41	22	21	-	-	-	L
		33	07140106001240	161	feet	76	41	38	-	-	-	M
		34	07140106001240	415	feet	41	22	21	-	-	-	L
	Debris Removal	-	07140106001239	-	-	-	-	-	-	-	-	M
	Grassed Waterways	106	07140106001240	459	feet	26	13.1	13.1	-	-	-	L
		107	07140106001240	570	feet	61	30.5	30.5	-	-	-	M
		108	07140106001240	1267	feet	315	157.4	157.4	-	-	-	H
		109	07140106001240	703	feet	180	89.9	89.9	-	-	-	H
		110	07140106001240	519	feet	19	9.4	9.4	-	-	-	L
		111	07140106001240	502	feet	172	85.9	85.9	-	-	-	H
	Riparian Buffer	164	07140106007083	281	feet	37	20	19	-	-	-	M
		165	07140106007083	386	feet	35	19	18	-	-	-	M
	Streambank Stabilization	x	07140106007070	363.7	feet	2.8	1.4	1.4	-	-	-	L
		x	07140106007117	813.9	feet	6.2	3.1	3.1	-	-	-	L
		x	07140106001239	1457.5	feet	48.3	24.2	24.2	-	-	-	M
		x	07140106007083	1080.2	feet	45.9	23	23	-	-	-	M
		x	07140106001240	1582.3	feet	53.8	26.9	26.9	-	-	-	M
					TOTALS:	**1359**	**695.8**	**679.8**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 65- Arrowhead Lake (SMU 7) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Arrowhead	Grassed Waterways	119	07140106026269	561	feet	24	12.1	12.1	-	-	-	L
		120	07140106026269	414	feet	34	16.7	16.7	-	-	-	M
		121	07140106026269	405	feet	28	14.2	14.2	-	-	-	L
		122	07140106026269	149	feet	6	3.1	3.1	-	-	-	L
		123	07140106026267	411	feet	55	27.4	27.4	-	-	-	M
		124	07140106026267	195	feet	12	6.1	6.1	-	-	-	K
		125	07140106026267	277	feet	16	8.3	8.3	-	-	-	K
		126	07140106026267	246	feet	8	4.1	4.1	-	-	-	K
		127	07140106001225	562	feet	57	28.7	28.7	-	-	-	H
	Infiltration Basin	154	07140106006968	86436	cu. ft.	88	12	-	9401	-	3543	M
		155	07140106006962	37636	cu. ft.	335	42	-	32372	-	10010	H
	Shoreline Stabilization	176	07140106026269	310	feet	16	8	8	-	-	-	L
		177	07140106026269	372	feet	32	16	16	-	-	-	M
		178	07140106026269	458	feet	70	35	35	-	-	-	H
		179	07140106026269	299	feet	51	25	25	-	-	-	H
	Streambank Stabilization	x	07140106026267	173	feet	0.9	0.4	0.4	-	-	-	L
		x	07140106006946	338.4	feet	1.7	0.9	0.9	-	-	-	L
		x	07140106026268	249	feet	1.3	0.6	0.6	-	-	-	L
		x	07140106006878	514.9	feet	2.6	1.3	1.3	-	-	-	L
		x	07140106026270	52.3	feet	0.3	0.1	0.1	-	-	-	L
		x	07140106006927	297.5	feet	1.5	0.8	0.8	-	-	-	L
		x	07140106006968	1750.4	feet	23.8	11.9	11.9	-	-	-	M
		x	07140106001225	2075.8	feet	21.2	10.6	10.6	-	-	-	M
		x	07140106006962	531.6	feet	2	1	1	-	-	-	L
		x	07140106026266	601.6	feet	2.6	1.3	1.3	-	-	-	L
		x	07140106000113	1445.6	feet	18.4	9.2	9.2	-	-	-	L
		x	07140106007012	1327.9	feet	254	127	127	-	-	-	H
		x	07140106026269	984.2	feet	8.4	4.2	4.2	-	-	-	L
		x	07140106006928	516.7	feet	3.3	1.6	1.6	-	-	-	L
	Vegetated Filter Strip	180	07140106026267	172	feet	22	12	11	-	-	-	M
		181	07140106026269	157	feet	24	13	12	-	-	-	M
		182	07140106026269	608	feet	46	25	23	-	-	-	M
		183	07140106026269	283	feet	26	14	13	-	-	-	M
					TOTALS:	**1292**	**493.6**	**434.6**	**41773**	**0**	**13553**	
						N	P	Sediment	TSS	BOD	COD	

Table 66- Whiteash (SMU 8) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Whiteash	Agricultural Filter Strip	25	07140106001221	361	feet	41	22	21	-	-	-	M
		26	07140106001221	326	feet	41	22	21	-	-	-	M
		27	07140106007132	268	feet	22	12	11	-	-	-	L
		28	07140106007171	1626	feet	187	101	106	-	-	-	H
		29	07140106007171	1655	feet	161	86	92	-	-	-	H
	Grassed Waterways	94	07140106001221	382	feet	15	7.3	7.3	-	-	-	L
		95	07140106001221	369	feet	16	7.9	7.9	-	-	-	L
		96	07140106001222	292	feet	12	6.1	6.1	-	-	-	L
		97	07140106001222	320	feet	13	6.5	6.5	-	-	-	L
		98	07140106001223	435	feet	15	7.6	7.6	-	-	-	L
		99	07140106007171	1652.6	feet	67	33.4	33.4	-	-	-	H
		100	07140106007156	401	feet	23	11.4	11.4	-	-	-	M
		101	07140106007156	226	feet	13	6.4	6.4	-	-	-	L
		102	07140106007156	274	feet	31	15.5	15.5	-	-	-	M
		103	07140106007156	712	feet	93	46.6	46.6	-	-	-	H
		104	07140106007156	975	feet	29	14.6	14.6	-	-	-	L
		105	07140106007156	282	feet	12	6.1	6.1	-	-	-	L
	Streambank Stabilization	x	07140106007139	845.7	feet	3.1	1.5	1.5	-	-	-	L
		x	07140106007184	1865.3	feet	6.2	3.1	3.1	-	-	-	L
		x	07140106007132	649.3	feet	1.7	0.8	0.8	-	-	-	L
		x	07140106001222	4243.7	feet	50.5	25.2	25.2	-	-	-	M
		x	07140106007156	3225.4	feet	38.4	19.2	19.2	-	-	-	M
		x	07140106001221	2015.5	feet	66.8	33.4	33.4	-	-	-	M
		x	07140106001223	4614.7	feet	153	76.5	76.5	-	-	-	M
		x	07140106007171	1634.7	feet	14.6	7.3	7.3	-	-	-	M
					TOTALS:	**1125.3**	**579.4**	**587.4**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 67- Beaver Creek (SMU 9) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Beaver Creek	Grassed Waterways	112	07140106001224	670	feet	41	20.4	20.4	-	-	-	M
	Streambank Stabilization	x	07140106000109	689.2	feet	22.8	11.4	11.4	-	-	-	M
		x	07140106001224	1334.5	feet	10.2	5.1	5.1	-	-	-	L
					TOTALS:	**74**	**36.9**	**36.9**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 68- Johnston City (SMU 10) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Johnston City	Agricultural Filter Strip	35	07140106006983	251	feet	59	32	29	-	-	-	H
	Grassed Waterways	113	07140106006983	647	feet	103	51.7	51.7	-	-	-	H
		114	07140106006983	252	feet	34	17	17	-	-	-	L
		115	07140106008387	1292	feet	137	68.6	68.6	-	-	-	H
		116	07140106008387	329	feet	173	86.6	86.6	-	-	-	H
		117	07140106008387	1226	feet	142	71.1	71.1	-	-	-	H
		118	07140106008387	289	feet	44	22	22	-	-	-	L
	Infiltration Basin	153	07140106006983	169744	cu. ft.	99	15	-	10082	-	3752	H
	Infiltration Trench	156	07140106006983	15368	cu. ft.	369	46	-	41408	-	14840	H
		157	07140106006983	15296	cu. ft.	105	11	-	10133	-	3970	H
		158	07140106006983	7774	cu. ft.	163	25	-	17654	-	6588	H
		159	07140106006999	64876	cu. ft.	150	13	-	13676	-	5550	H
		160	07140106006999	25500	cu. ft.	147	17	-	13472	-	5108	H
		161	07140106006999	47956	cu. ft.	343	35	-	30942	-	10853	H
		162	07140106006999	65120	cu. ft.	97	16	-	13315	-	4398	M
		163	07140106006999	74480	cu. ft.	68	11	-	8906	-	2826	M
	Streambank Stabilization	x	07140106006999	188.6	feet	14.4	7.2	7.2	-	-	-	L
		x	07140106008387	4116.6	feet	175	87.5	87.5	-	-	-	M
		x	07140106000108	678.1	feet	8.6	4.3	4.3	-	-	-	L
		x	07140106008390	82.1	feet	1	0.5	0.5	-	-	-	L
		x	07140106001242	2662.8	feet	509.3	254.6	254.6	-	-	-	H
		x	07140106006983	1077.6	feet	4.6	2.3	2.3	-	-	-	L
					TOTALS:	**2945.9**	**894.4**	**702.4**	**159588**	**0**	**57885**	
						N	P	Sediment	TSS	BOD	COD	

Table 69- Bear Creek (SMU 11) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Bear Creek	Agricultural Filter Strip	16	07140106007020	689	feet	93	50	46	-	-	-	H
		17	07140106007020	1104	feet	142	76	69	-	-	-	H
		18	07140106002680	1302	feet	158	85	77	-	-	-	H
		19	07140106002680	966	feet	236	126	113	-	-	-	H
	Grassed Waterways	70	07140106002680	259	feet	57	28.4	28.4	-	-	-	M
		71	07140106002680	467	feet	323	161.5	161.5	-	-	-	H
		72	07140106004308	291	feet	138	68.7	68.7	-	-	-	H
		73	07140106007123	636	feet	32	15.9	15.9	-	-	-	L
		74	07140106007123	770	feet	39	19.4	19.4	-	-	-	L
		75	07140106007123	298	feet	15	7.5	7.5	-	-	-	L
		76	07140106007123	393	feet	19	9.3	9.3	-	-	-	L
		77	07140106007123	408	feet	29	14.7	14.7	-	-	-	L
		78	07140106007123	223	feet	54	26.9	26.9	-	-	-	M
	Streambank Stabilization	x	07140106000549	1603.2	feet	16.4	8.2	8.2	-	-	-	L
		x	07140106002680	779	feet	7.9	4	4	-	-	-	L
		x	07140106004308	344	feet	3.5	1.8	1.8	-	-	-	L
		x	07140106004311	125.7	feet	5.6	2.8	2.8	-	-	-	M
		x	07140106006997	173.8	feet	1.8	0.9	0.9	-	-	-	L
		x	07140106007020	728.5	feet	32.2	16.1	16.1	-	-	-	M
		x	07140106007025	130.2	feet	5.8	2.9	2.9	-	-	-	M
		x	07140106007088	1912.5	feet	84.5	42.3	42.3	-	-	-	M
		x	07140106007102	152.7	feet	1.6	0.8	0.8	-	-	-	L
		x	07140106007123	1120.6	feet	49.5	24.8	24.8	-	-	-	M
		x	07140106007140	578	feet	5.9	2.9	2.9	-	-	-	L
		x	07140106007181	956.0	feet	9.8	4.9	4.9	-	-	-	L
		x	07140106026228	56.1	feet	0.6	0.3	0.3	-	-	-	L
		x	07140106026224	116.8	feet	1.2	0.6	0.6	-	-	-	L
		x	07140106007239	720.6	feet	3.1	1.5	1.5	-	-	-	L
		x	07140106007195	769.4	feet	3.3	1.6	1.6	-	-	-	L
					TOTALS:	**1567.7**	**805.7**	**773.7**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 70- Champaign (SMU 12) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Champaign	Agricultural Filter Strip	20	07140106001220	545	acre	22	12	11	-	-	-	L
		21	07140106001220	191	acre	22	12	11	-	-	-	L
		22	07140106001220	1276	acre	295	158	141	-	-	-	H
		23	07140106001220	293	acre	158	85	77	-	-	-	M
		24	07140106001220	124	feet	22	12	11	-	-	-	L
	Grassed Waterways	79	07140106001220	789	acre	111	55.5	55.5	-	-	-	H
		80	07140106001220	383	feet	19	9.6	9.6	-	-	-	L
		81	07140106001220	313	feet	12	5.7	5.7	-	-	-	L
		82	07140106001220	1026	feet	162	81.2	81.2	-	-	-	H
		83	07140106001220	169	feet	8	4.1	4.1	-	-	-	L
		84	07140106001220	288	feet	18	8.8	8.8	-	-	-	L
		85	07140106001220	156	feet	67	33.7	33.7	-	-	-	M
		86	07140106001220	291	feet	14	6.9	6.9	-	-	-	L
		87	07140106001220	314	feet	1205	602.3	602.3	-	-	-	H
		88	07140106001220	236	feet	908	454.2	454.2	-	-	-	H
		89	07140106001220	345	feet	85	42.5	42.5	-	-	-	M
		90	07140106001220	512	feet	180	90.2	90.2	-	-	-	H
		91	07140106001220	763	feet	53	26.7	26.7	-	-	-	M
		92	07140106001220	345	feet	16	7.8	7.8	-	-	-	L
		93	07140106026229	220	feet	13	6.4	6.4	-	-	-	L
	Streambank Stabilization	x	07140106026229	428.7	feet	3.3	1.6	1.6	-	-	-	L
		x	07140106001220	1482.4	feet	11.3	5.7	5.7	-	-	-	L
		x	07140106007037	621.3	feet	4	2	2	-	-	-	L
		x	07140106007084	1512.3	feet	25.7	12.9	12.9	-	-	-	M
					TOTALS:	**3434.3**	**1736.8**	**1708.8**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 71-Collins (SMU 13) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Collins	Agricultural Filter Strip	15	07140106008388	136	feet	22	12	11	-	-	-	L
	Grassed Waterways	64	07140106008388	213	feet	47	23.4	23.4	-	-	-	M
		65	07140106008388	526	feet	47	23.4	23.4	-	-	-	M
		66	07140106008388	1459	feet	141	70.5	70.5	-	-	-	H
		67	07140106008388	602	feet	29	14.7	14.7	-	-	-	L
		68	07140106008388	409	feet	28	14.2	14.2	-	-	-	L
		69	07140106008388	754	feet	152	76.1	76.1	-	-	-	H
	Streambank Stabilization	x	07140106008388	1483.9	feet	82	41	41	-	-	-	M
		x	07140106006977	1649.5	feet	315.5	157.7	157.7	-	-	-	H
		x	07140106008391	308.5	feet	10.2	5.1	5.1	-	-	-	M
		x	07140106000107	754.1	feet	55.8	27.9	27.9	-	-	-	M
					TOTALS:	**929.5**	**466**	**465**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Table 72- Lower Lake Creek (SMU 14) BMP and Load Reductions

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Load Reductions- lbs/ yr (N,P, TSS, BOD, COD), ton/yr- (Sediment)						
						N	P	Sediment	TSS	BOD	COD	Priority
Lower Lake Creek	Agricultural Filter Strip	1	07140106008377	130	feet	41	22	21	-	-	-	M
		2	07140106008377	714	feet	205	110	99	-	-	-	H
		3	07140106008377	539	feet	266	145	127	-	-	-	H
		4	07140106008380	1633	feet	537	288	253	-	-	-	H
		5	07140106008380	1644	feet	524	280	246	-	-	-	H
		6	07140106008380	861	feet	190	102	92	-	-	-	H
		7	07140106008380	889	feet	496	266	233	-	-	-	H
		8	07140106008380	551	feet	1003	537	463	-	-	-	H
		9	07140106008380	1197	feet	425	228	201	-	-	-	H
		10	07140106008380	1115	feet	764	410	416	-	-	-	H
		11	07140106008380	217	feet	59	32	29	-	-	-	L
		12	07140106008380	272	feet	325	174	155	-	-	-	H
		13	07140106008380	453	feet	59	32	29	-	-	-	L
		14	07140106008380	202	feet	59	32	29	-	-	-	L
	Debris Removal	-	07140106008380	-	-	-	-	-	-	-	-	H
		-	07140106008377	-	-	-	-	-	-	-	-	H
	Grassed Waterways	51	07140106008380	530	feet	92	46	46	-	-	-	H
		52	07140106008380	678	feet	128	63.9	63.9	-	-	-	H
		53	07140106008380	1048	feet	67	33.5	33.5	-	-	-	M
		54	07140106008380	1995	feet	310	154.4	154.4	-	-	-	H
		55	07140106008380	1199	feet	107	53.3	53.3	-	-	-	H
		56	07140106008380	1057	feet	356	178	178	-	-	-	H
		57	07140106008380	532	feet	72	35.8	35.8	-	-	-	M
		58	07140106008380	343	feet	92	45.8	45.8	-	-	-	H
		59	07140106008380	320	feet	14	6.9	6.9	-	-	-	L
		60	07140106008380	1255	feet	279	139.4	139.4	-	-	-	H
		61	07140106008380	1438	feet	116	58.1	58.1	-	-	-	H
		62	07140106008380	602	feet	147	73.4	73.4	-	-	-	H
		63	07140106008380	650	feet	71	35.7	35.7	-	-	-	M
	Streambank Stabilization	-	07140106008377	1622.3	feet	310.3	155.1	155.1	-	-	-	H
		-	07140106008380	2403.5	feet	132.8	66.4	66.4	-	-	-	M
		-	07140106006901	1139	feet	4.8	2.4	2.4	-	-	-	L
					TOTALS:	**7251.9**	**3806.1**	**3541.1**	**0**	**0**	**0**	
						N	P	Sediment	TSS	BOD	COD	

Total load reductions are exceed the load reduction targets found in Section 2.8.9. Pollutant load reduction totals are displayed in the table below.

Table 73- Total BMP Load Reductions

	N	P	Sediment	TSS	BOD	COD
Total Load Reduction:	**44506**	**21796**	**23453.1**	**399947**	**328**	**188407**
Percent of Pollutant Load:	**27.03%**	**78.16%**	**149.13%**			
Load Reduction Target	**15%**	**15%**	**30%**	**-**	**-**	**-**

Implementation of every BMP in the plan would result in a nearly 27 percent reduction in nitrogen; 78 percent reduction in phosphorus; and a sediment total reduction that exceeds the target by more than five times.

Since total suspended solids (TSS), biological oxygen demand (BOD), and chemical oxygen demand (COD) were not calculated in the watershed pollutant loading, pollutant load percentages and load reduction targets were not generated.

4. Summary of Technical and Financial Assistance

Each BMP in the plan has also been described by the technical and financial assistance needed to implement each measure. While technical assistance comes from a few select groups, the financial assistance for management measures comes from a variety of different sources. Table 74 summarizes the cost, technical assistance, and possible funding source for each BMP. The diagram also characterizes the elements associated with the educational component that will be discussed in Chapter 5.

4.1 Technical Assistance

The labor to execute the BMP will largely come from local municipalities, public works, landowners, and the planning commission. State and federal agencies such as the USDA/NRCS and the Williamson County Soil and Water Conservation District will also be utilized.

The type of technical assistance largely depends on which type of BMP is being implemented. For agricultural BMP, the USDA and Soil and Conservation Districts will be able to provide their services. If the BMP is municipal, local public works can offer their support. However, for most management measures, drawings and surveys will likely be required by an engineer.

The Greater Egypt Regional Planning and Development Commission could also provide technical assistance for some of the BMP. This includes: GIS services, site plans and drawings, and grant writing and administration.

4.2 Funding Sources

A majority of the management measures described in Chapter 3 will require funding. The major source of funding will be through the Clean Water Act Section 319 Grant Program. This would be administered through the IEPA.

Section 319 grants can cover up to 60 percent of the costs. The other 40 percent would be met through a local match (municipal, landowner, etc.)

While 319 funding covers most BMP in the plan, other funding sources have to be considered for the remaining measures. The USDA offers many funding opportunities through programs such as: Environmental Quality Incentives Program (EQIP), Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), and the Wetland Reserve Program (WRP).

In most cases, these programs will not cover the entire cost of the selected BMP. The remaining costs would have to be funded by landowners, municipalities, businesses, and other entities.

Table 74- Technical and Financial Assistance for BMP

BMP	Cost	Unit	Technical Assistance	Funding Source(s)
Agricultural Filter Strip	$0.00-$300	acre	Landowner, public works, NRCS	IEPA 319 Grant, FSA CRP (No cost assumes using existing vegetation, if
Swale	$2-$41	square foot	IDOT, contractor, municipality, public works	IEPA 319 Grant
Conservation Tillage	$25.00	acre	Landowner, public works, NRCS	NRCS EQIP, FSA CRP
Cover Crops	$50.00	acre	Landowner, public works, NRCS	NRCS EQIP, FSA CRP
Debris Removal	$486.00	site	Volunteers, landowners, public works, contractor	Volunteers, landowners, public works, contractor
Grassed Waterways	$20.00	square feet	Landowner, public works, NRCS	IEPA 319 Grant, FSA CRP
Green Roof	$15.00	square feet	Landowner, public works, business	IEPA 319 Grant
Infiltration Basin	$6.00	cubic feet	Landowner, public works, business	IEPA 319 Grant
Infiltration Trench	$4-$13	cubic feet	Landowner, public works, business	IEPA 319 Grant
Litter Cleanup	$0.00	acre	Volunteers	-
No Mow Pasture	$0.00	acres	Landowner	Landowners, municipality
Porous/ Permeable Pavement	$3-$26	square feet	Contractor, volunteer	IEPA 319 Grant
Public Education on Fertilizer Use	$0.50 each / $150.00 per 300	flyer/brochure	Planning Commission	IEPA 319 Grant, Planning Commission
Public Education on Stormwater/Agricultural Management	$0.50 each / $150.00 per 300	flyer/brochure	Planning Commission	IEPA 319 Grant, Planning Commission
Rain Barrels	$60.00-$150.00	unit	Landowner, businesses, school district	IEPA 319 Grant
Rain Gardens	$4-$29	square feet	Landowner, public works, businesses, school district	IEPA 319 Grant
Riparian Buffer	$330.00	acre	Landowner, public works, NRCS	IEPA 319 Grant, FSA CRP
Shoreline Stabilization	$88.00	feet	Landowner, volunteer, contractor	IEPA 319 Grant
Streambank Stabilization	$88.00	feet	Landowner, volunteer, contractor	IEPA 319 Grant
Vegetated Filter Strip	$0.00-$300	acre	Landowner, volunteer, contractor	IEPA 319 Grant (No cost assumes using existing vegetation)

4.3 Implementation Costs

The associated cost of each BMP is displayed in Table 75. Costs largely depend on which BMP is being implemented. To implement all BMP suggested in the plan, the total would be $21,726,696.00. Costs generally take into account the technical and financial assistance needed along with the maintenance following implementation. The majority of the costs come from the implementation of: green roofs, infiltration devices, streambank stabilization, and swales.

The cost for filter strips (agricultural, urban vegetated) is dependent on whether the entity is using existing or natural vegetation compared to planting new vegetation.

Table 75- Implementation Costs

BMP	Cost	Unit	Total Units	Total Cost
Agricultural Filter Strip	$0.00-$300	acre	18.6	$5,580.00
Conservation Tillage	$25.00	acre	400	$10,000.00
Cover Crops	$50.00	acre	400	$20,000.00
Debris Removal	$486.00	site	5	$2,430.00
Grassed Waterways	$3,250.00	acre	31	$100,750.00
Green Roof	$15.00	square feet	87120	$1,306,800.00
Infiltration Basin	$6.00	cubic feet	293816	$1,762,896.00
Infiltration Trench	$4-$13	cubic feet	316370	$4,112,810.00
Litter Cleanup	$0.00	acre	-	-
No Mow Pasture	$0.00	acres	-	-
Porous/ Permeable Pavement	$3.00-$26.00	square feet	217800	$653,400.00
Public Education on Fertilizer Use	$0.50 each / $150.00 per 300	flyer/brochure	1500	$750.00
Public Education on Stormwater Management	$0.50 each / $150.00 per 300	flyer/brochure	1500	$750.00
Rain Barrels	$60.00-$150.00	unit	2	$300.00
Rain Gardens	$4-$29	square feet	400	$11,600.00
Riparian Buffer	$330.00	acre	10	$3,300.00
Shoreline Stabilization	$88.00	feet	3151	$277,288.00
Agricultural Management Workshop	$1,000.00	workshop	6	$6,000.00
Streambank Stabilization	$88.00	feet	125934	$11,082,192.00
Swale	$2-$41	square feet	59241	$2,369,640.00
Vegetated Filter Strip	$0.00-$300	acre	0.7	$210.00
			Total:	**$21,726,696.00**

5. Public Outreach and Education

The success of the Lake Creek Watershed-based Plan is largely dependent on public outreach and educational measures. During the planning phase, public meetings, Watershed Council meetings, and other events were held to provide guidance and raise awareness of the plan. These activities will continue after the plan is approved and will support the success of the plan.

Early in the planning phase, an initial stakeholders meeting was held to gather local knowledge of the watershed and define preliminary goals including identifying key areas of watershed impairments. Another goal of the initial meeting was to gather members for the Lake Creek Watershed Planning Council. Meetings were usually held quarterly, and were designed to provide guidance for the plan. Council members provided local knowledge of water-related activities and identified BMP that were suggested in the plan.

5.1 Outreach and Educational Components

The Lake Creek Watershed-based Plan has several public awareness and educational components. The recommendations are as follows:

1. **Establish a Lake Creek Watershed Action committee.** This assembly would serve much like the planning council during the development of the plan. The goal of a steering committee would be to promote awareness of the watershed and monitor and oversee the progress of plan implementation.

2. **Hold public meetings.** An initial public meeting would serve to inform the public on implementation of the plan and garner membership for the steering committee. Like the public meetings during the planning phase, flyers, newspaper ads, and PSAs could be used to inform the public of meeting dates.

3. **Create a website for watershed activities.** This would include posting key dates for meetings, events, and other watershed-related activities.

4. **Post Lake Creek watershed signs.** Signs will be posted informing the public about the watershed and activities. Placement of the signs would be in areas most visible to the public: parks, schools, libraries, and government buildings. Signs for best management practices will also be posted at implementation sites.
5. **Enlist volunteers for litter cleanup days.** Local volunteer groups were contacted throughout the planning phase to gain interest in these events. Groups such as 4H, Boy Scouts of America, Girl Scouts of USA, and other local volunteers groups would likely be implemented in these events.
6. **Create and distribute flyers and brochures for watershed management efforts.** These flyers would contain information about the watershed-based plan and management efforts. Along with the stormwater management and similar workshops, distributing flyers on the importance of agricultural and residential measures to limit nonpoint source pollution would be critical in lowering the nutrient loads.
7. **Hold an electronics recycling drive or similar drop off event.** During the watershed assessment of the planning phase, large amounts of litter and electronics were observed in the waterbodies; specifically various stream segments. An electronics drive directed towards rural areas would be beneficial by limiting the amount of large debris in the Lake Creek waterbodies.
8. **Hold public Agricultural Management Workshops and similar events to educate and promote the best management practices in the plan.** These workshops would raise awareness for agricultural BMP and stormwater runoff measures. Agricultural activities would likely be in cooperation with the local USDA-NRCS Office, or the Williamson County Farm Bureau.

The schedule for implementing the educational and informational components of the plan is further detailed in the following chapter.

6. Implementation Schedule and Interim Milestones

To be successful, watershed-based plans require designing a thorough monitoring and evaluation component. These elements include: an implementation schedule which identifies key intervals for management measures (Element F), a description of interim measurable milestones for nonpoint source management (Element G), benchmarks to monitor the effectiveness of BMP load reductions (Element H), and the overall monitoring component to evaluate the progress of implementation (Element I). Elements H and I will be discussed in Chapter 7 of this plan.

6.1 Implementation Schedule

The implementation schedule reflects the general goals in the Lake Creek Watershed-based plan. Components of the schedule have been classified into three separate phases as seen in Table 76.

Phase I signifies the short-term actions to be taken in the first two years of the plan. These goals include establishing a watershed action council which would serve to implement the plan and track progress. The other educational and informational components of the plan largely fall under this phase.

Phase II constitutes the mid-term implementation of the plan. Components in this phase should be completed within the sixth year of plan implementation. Key elements of this phase include the continuation of public involvement, and submitting grant applications for BMP suggested in the plan. The implementation and execution of BMP will also fall under this segment of the plan.

Phase III indicates the final stage of the plan. This is characterized by continuing efforts in BMP implementation and evaluating accomplishments throughout the plan.

Site-specific BMP have been characterized by a priority ranking in Chapter 3. These priority rankings follow the phases of the implementation schedule. Generally, BMP with a high priority ranking will be the first to have grant submissions written for them. Grant submissions, implementation, and execution of high priority BMP will be considered mainly Phase II components. Subsequently, medium and low priority BMP will be implemented in the latter part of Phase II and beginning of Phase III depending on available funding.

Table 76- Implementation Schedule

Target	Phase I		Phase II				Phase III			
	Short-term (2 yr)		Mid-term (3-6 yr)				Long-term (7-10 yr)			
	1	2	3	4	5	6	7	8	9	10
Establish watershed action committee	X									
Hold public meetings to gain input	X	X	X	X	X	X				
Post watersheds sign for public awareness and BMP implementation	X	X	X	X	X	X	X	X	X	X
Create a website for watershed activities and key dates		X								
Enlist volunteers for litter cleanup days		X	X	X	X	X	X	X	X	X
Enlist volunteers for VLMP		X								
Hold Electronic Recycling Drives			X			X			X	
Distribute flyers for stormwater and agricultural management	X		X		X		X		X	
Hold workshops to inform public on stormwater/ agricultural management		X		X		X		X		
Continue researching funding and technical assistance	X	X	X							
Select site-specific BMP for preliminary designs	X	X	X							
Submit grant applications based on BMP in plan		X	X	X	X	X	X	X		
Meet with landowners to review BMP in plan		X	X	X	X	X	X	X		
Implement and execute BMP			X	X	X	X	X	X	X	X
Monitor BMP implementation				X	X	X	X	X	X	X
Announce success of plan implementation					X	X	X	X	X	X

6.2 Interim Measurable Milestones

To determine whether nonpoint source best management practices are being implemented, interim measurable milestones have been designed to monitor success. The educational and outreach components have also utilized the milestone matrix. These milestones follow the same phases as the implementation schedule with three phases distinguishing varying degrees of BMP implementation. Interim measurable milestones are displayed in Table 77.

Table 77- Interim Measurable Milestones

Interim Measurable Milestones				
Goal	**Indicator**	**Short (2-year)**	**Mid (6-yr)**	**Long (10-yr)**
Address Impairments from Agricultural Practices/ Improve Water Quality	Linear Feet of Streambank Stabilized	-	7,500	15,000
	Agricultural Strips Created	-	12	24
	Acres Converting to Conservation Tillage	100	300	400
	Acres to Implement Cover Crops	100	300	400
	Grassed Waterways Created	-	20	45
	Acres of No Mow Pastures	100	300	400
	Riparian Buffers Created	-	2	4

Table 77- Interim Measurable Milestones (Cont'd)

Interim Measurable Milestones				
Goal	**Indicator**	**Short (2-year)**	**Mid (6-yr)**	**Long (10-yr)**
Outreach and Education	Educational Brochures for Fertilizer Use	500	1000	1500
	Educational Brochures for Stormwater Management	500	1000	1500
	Electronic Recycling Drives Held		1	3
	Lakes in Volunteer Lake Monitoring Program	1	2	-
	Number of Litter Cleanup Days	-	4	8
	Public Meetings Held	4	10	14
	Stormwater/ Agricultural Management Workshops Held	-	2	5
Reduce/Mitigate Flooding	Targeted Debris Removal Areas	-	3	5
	Infiltration Basins Installed	-	1	2
	Infiltraton Trenches Installed	-	2	4
Reduce Stormwater Runoff/ Mitigate Urban Impact/ Improve Water Quality	Swales Installed	-	1	2
	Green Roofs Installed	-	1	2
	Linear Feet of Shoreline Stabilized	-	400	750
	Porous/ Permeable Pavement Installed (sq. ft.)	-	10000	20000
	Rain Barrels Installed (units)	-	30	60
	Rain Gardens Created (sq. ft.)	-	700	1400
	Vegetated Filter Strips Installed	-	2	4

Understanding that every BMP in the plan may not be implemented is important in identifying the measurable milestones. Feasibility of each BMP has to be considered when distinguishing milestones. If BMP implementation is advanced throughout the plan, the interim measurable milestones in this plan are attainable over a ten-year implementation period.

Progress in achieving the milestone and goals will be evaluated periodically by the Lake Creek Watershed Action Committee. If milestones are not being met, there may be need for adjustments. Adjustments may come in the form of establishing new BMP, or adjusting the interim measurable milestones to adhere to current progress. Since these milestones are originally established to document progress, any changes should not be significant.

7. Evaluation Criteria and Monitoring Component

Along with the implementation schedule and interim measurable milestones, water quality benchmarks (Element H) and a monitoring component (Element I) are required to evaluate the implementation and the overall success of the plan.

7.1 Evaluation Criteria (Water Quality Benchmarks)

The benchmarks provided in Table 78 are based on the implementation of all BMP in the plan. Practices that were ranked as high priority, as seen in Chapter 3, will be completed by the sixth year; or Phase II of the planning period. Those with a medium or low priority ranking will be implemented by the tenth year. This characterizes Phase III. Determining success and achieving these benchmarks will be dependent on the number of BMP that are actually implemented in the planning period.

Benchmarks in this plan target nitrogen, phosphorus, and sediment. This is largely due to the availability of data from models and nutrient loading information, and the impairments from the 303(d) waters in the Lake Creek Watershed.

Since Phase I of the plan extends to the end of the second year, benchmarks have not been assigned. This is due partly to the activities in that phase not having an immediate impact on nutrient load reductions (workshops, flyers, etc.). Load reductions that do occur in this period will be minimal.

Table 78- Benchmarks for Determining Plan Progress

	Benchmark Reduction Target					
Benchmark Period	Nitrogen (percent)	Nitrogen (lbs/ yr)	Phosphorus (percent)	Phosphorus (lbs/yr)	Sediment (percent)	Sediment (tons/yr)
2 Year (Phase I)	-	-	-	-	-	-
6 Year (Phase II)	6	11527	10	2789	15	2359
10 Year (Phase III)	15	24701	25	6971	30	4718

While many of the high-priority BMP will be implemented in Phase II, benchmarks have been set to around half of the overall nutrient load reduction targets. Considering Phase II ends at the sixth year of the planning period, effects of some BMP implementation may not be apparent until Phase III of the plan.

Phase III benchmarks account for the total reductions of nutrients in the plan. Phase III BMP should be implemented by the tenth year of the plan. These include any remaining high-priority BMP and the medium and low BMP according to the priority index.

7.2 Monitoring Component

Because Lake Creek (IL_NGA-02), Beaver Creek (IL_NGAZ-JC-D1), Arrowhead Lake (IL_RNZX), and Johnston City Lake (IL_RNZE) were placed on the IEPA's 303(d) list of Impaired Waters, the focus of this plan will be to address the issues pertaining to those particular waterbodies. A monitoring component is essential to a watershed-based plan in order to determine progress in achieving water quality.

Several elements represent the monitoring component for the plan. These elements will provide water quality data that can be used to assess the efficacy of the Lake Creek Watershed-based Plan. The monitoring strategy components are as follows:

1. **Volunteer Lake Monitoring Program (VLMP) –** Volunteers are recruited and trained to monitor the health of their lakes by taking various measurements of water quality. The program is structured by a tiered approach. [41] Table 79 displays each tier and corresponding responsibilities. A brief history can be viewed in the Watershed Jurisdictions section of the Lake Creek Watershed Resource Inventory (Section 2.4.2)

[41] IEPA. *Tiered Approach.* Springfield, IL: IEPA. http://www.epa.illinois.gov/topics/water-quality/monitoring/vlmp/tiered-approach/index (accessed: July, 2016)

Since the VLMP uses a tiered approach, volunteers wishing to graduate to the next tier must first spend one year in each previous tier. While Arrowhead and Johnston City Lakes have been monitored in the past, new volunteers are needed for the program. Since these waterbodies have been placed on the 303(d) list, it is important to have the lakes in the program and be consistently monitored.

Because both lakes are impaired by phosphorus, it is especially important for them to have a Tier II volunteer who can take water samples. This nutrient data will be invaluable in determining the success of watershed plan implementation.

Table 79 - VLMP Duties

Tier	Volunteer Responsibilities	Testing Intervals
I	Secchi disk transparency monitoring and field observations.	Twice per month from May to October
II	Tier I duties and collection of water samples at Site one which test for nutrients, suspended solids, and chlorophyll	Once per month from May to August
III	Tier I & II duties (all sites). Volunteers may also choose to take dissolved oxygen/ temperature profiles	Once per month from May to August and October

2. **Ambient Lakes Monitoring Program (ALMP) –** 50 inland lakes are monitored on a routine basis through field agents of the IEPA.[42] Priority is given to public water sources. However, other lakes are monitored such as Arrowhead and Johnston City Lake. Since monitoring in this program is cyclical, having baseline data for these lakes would be a priority. This would begin at the start of the plan in 2019. Monitoring would also occur at five-year intervals.

[42] Norris, Tara. IEPA. Personal Correspondence to the Author (phone). August 9, 2016.

3. **Watershed Basin Surveys-** Every five years IEPA and IDNR conduct intensive basin surveys of various watersheds in Illinois. [43] IDNR completes testing of aquatic species while the IEPA monitors instream habitats and water quality. The last basin survey for the Big Muddy Watershed was in 2013. The current study is in development and will be completed in 2018.

4. **Independent D.O. Monitoring-** Because Lake Creek is impaired by dissolved oxygen, measuring and monitoring the level of this feature is crucial in evaluating the effectiveness of the plan. Dissolved oxygen measurements would likely come from IEPA, the planning commission, or a consultant.

These monitoring components will be utilized throughout the ten-year planning period. The schedule for monitoring is displayed in Table 80. The information from these components will have to be reviewed by the Lake Creek Watershed Action Committee to measure the effectiveness of plan implementation.

Table 80- Schedule for Monitoring Components

Monitoring Component	Phase I		Phase II				Phase III			
	1	2	3	4	5	6	7	8	9	10
Ambient Lakes Monitoring Program	X					X				
Independent D.O. Monitoring			X	X	X	X	X	X	X	X
Volunteer Lake Monitoring Program	X	X	X	X	X	X	X	X	X	X
Watershed Basin Surveys		X					X			

[43] Fertaly, Margaret. IEPA. Personal Correspondence to the Author (electronic mail). September, 2018.

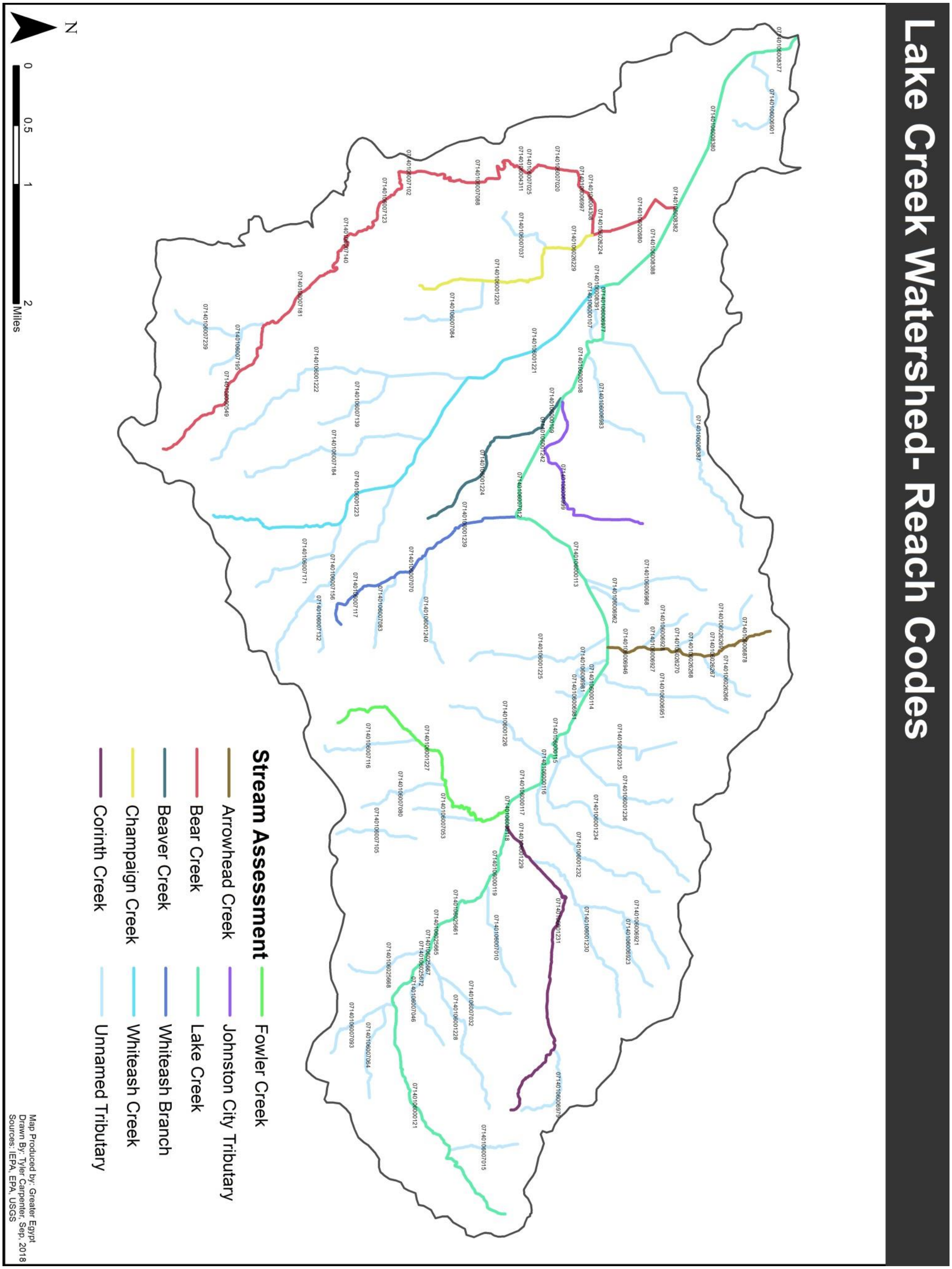
Appendix A – Streambank Stabilization by Reach

Stream or Tributary Name	Reach Code	Stream Length (ft.)	Proposed Streambank Stabilization	Percent of Reach
Arrowhead	07140106006968	5834.54	1750.36	30%
Arrowhead	07140106001225	6919.26	2075.78	30%
Arrowhead	07140106006962	2657.97	531.59	20%
Arrowhead	07140106026266	3007.82	601.56	20%
Arrowhead	07140106026267	8125.85	1625.17	20%
Arrowhead	07140106026269	4920.88	984.18	20%
Arrowhead	07140106006928	2583.69	516.74	20%
Arrowhead Creek	07140106026267	864.91	172.98	20%
Arrowhead Creek	07140106006946	1692.24	338.45	20%
Arrowhead Creek	07140106026268	1245.08	249.02	20%
Arrowhead Creek	07140106006878	2574.43	514.89	20%
Arrowhead Creek	07140106026270	261.59	52.32	20%
Arrowhead Creek	07140106006927	1487.61	297.52	20%
Bear Creek	07140106000549	8016.21	1603.24	20%
Bear Creek	07140106002680	3895.14	779.03	20%
Bear Creek	07140106004308	1720.11	344.02	20%
Bear Creek	07140106004311	418.88	125.66	30%
Bear Creek	07140106006997	869.16	173.83	20%
Bear Creek	07140106007020	2428.60	728.50	30%
Bear Creek	07140106007025	433.83	130.15	30%
Bear Creek	07140106007088	6374.82	1912.45	30%
Bear Creek	07140106007102	763.48	125.70	20%
Bear Creek	07140106007123	3735.23	1120.57	30%
Bear Creek	07140106007140	2891.80	578.36	20%
Bear Creek	07140106007181	4779.79	955.96	20%
Bear Creek	07140106008382	86.62	17.32	20%
Bear Creek	07140106026224	583.83	116.77	20%
Bear Creek	07140106026228	280.50	56.10	20%
Bear Creek	07140106007239	3603.13	720.63	20%
Bear Creek	07140106007195	3846.95	769.39	20%
Beaver Creek	07140106000109	2297.18	689.15	30%
Beaver Creek	07140106001224	6672.41	1334.48	20%
Champaign	07140106007037	3109.72	621.34	20%
Champaign	07140106007084	5047.73	1512.32	30%
	Totals:	**104031.00**	**24125.53**	

Stream or Tributary Name	Reach Code	Stream Length (ft.)	Proposed Streambank Stabilization	Percent of Reach
Champaign Creek	07140106026229	2143.27	428.65	20%
Champaign Creek	07140106001220	7412.04	1482.41	20%
City Lake	07140106007010	4964.47	1489.34	30%
City Lake	07140106001228	8123.05	5686.13	70%
City Lake	07140106007032	3794.53	758.91	20%
City Lake	07140106025668	3992.77	1197.83	20%
City Lake	07140106007105	3787.10	757.42	30%
Collins	07140106000107	2513.70	754.11	30%
Corinth Creek	07140106001231	13272.20	3981.66	30%
Corinth Creek	07140106001229	2004.14	1402.90	70%
Corinth	07140106006979	4353.16	1305.95	30%
Corinth	07140106006921	5528.01	1658.40	30%
Corinth	07140106006923	3675.68	1102.70	30%
Corinth	07140106001230	9236.78	2771.03	30%
Fowler Creek	07140106001227	12143.40	2428.68	20%
Fowler School	07140106007116	4460.42	1338.13	30%
Fowler School	07140106007053	3038.65	911.60	30%
Fowler School	07140106007080	4270.31	1281.09	30%
Heartland	07140106001235	6585.82	1975.75	30%
Heartland	07140106001236	5403.94	1621.18	30%
Heartland	07140106006951	6362.50	1908.75	30%
Heartland	07140106006981	5023.10	1506.93	30%
Heartland	07140106001226	5579.83	1673.65	30%
Heartland	07140106001234	10808.90	2161.78	20%
Heartland	07140106001232	9026.85	2708.05	30%
Johnston City	07140106008387	13722.00	4116.60	30%
Johnston City	07140106006983	5387.74	1077.55	20%
Johnston City Tributary	07140106006999	9442.95	1888.59	20%
Lake Creek	07140106000108	3390.28	678.06	20%
Lake Creek	07140106000113	7227.97	1445.59	20%
Lake Creek	07140106000114	4857.86	1457.36	30%
Lake Creek	07140106000115	2018.23	403.65	20%
Lake Creek	07140106000116	1232.78	369.83	30%
Lake Creek	07140106000117	2106.08	632.04	30%
	Totals:	**196890.51**	**56362.29**	

Stream or Tributary Name	Reach Code	Stream Length (ft.)	Proposed Streambank Stabilization	Percent of Reach
Lake Creek	07140106000118	771.33	231.40	30%
Lake Creek	07140106000119	4523.76	1357.13	30%
Lake Creek	07140106000121	14390.60	2878.12	20%
Lake Creek	07140106001242	3804.01	2662.81	70%
Lake Creek	07140106006977	2356.45	1649.50	70%
Lake Creek	07140106007012	1897.03	1327.92	70%
Lake Creek	07140106008377	2317.56	1622.29	70%
Lake Creek	07140106008380	8011.74	2403.52	30%
Lake Creek	07140106008388	4946.34	1483.90	30%
Lake Creek	07140106008390	410.61	82.12	20%
Lake Creek	07140106025661	1565.97	313.19	20%
Lake Creek	07140106025665	1373.03	274.61	20%
Lake Creek	07140106025667	425.32	85.06	20%
Lake Creek	07140106025670	61.24	12.25	20%
Lake Creek	07140106025672	355.69	71.14	20%
Lower Lake Creek	07140106006901	5695.19	1139.04	20%
Upper Lake Creek	07140106007093	3582.56	716.51	20%
Upper Lake Creek	07140106007046	4568.15	1370.44	30%
Upper Lake Creek	07140106007015	3312.68	993.80	30%
Upper Lake Creek	07140106007064	5097.26	1529.18	30%
Whiteash	07140106007139	4228.29	845.66	20%
Whiteash	07140106007184	9326.66	1865.33	20%
Whiteash	07140106007132	3246.47	649.29	20%
Whiteash	07140106001222	14145.50	4243.65	30%
Whiteash	07140106007156	10751.30	3225.39	30%
Whiteash	07140106007171	5448.92	1634.68	30%
Whiteash Branch	07140106007070	1818.25	363.65	20%
Whiteash Branch	07140106007117	4069.70	813.94	20%
Whiteash Branch	07140106007083	3600.63	1080.19	30%
Whiteash Branch	07140106001240	5274.42	1582.33	30%
Whiteash Creek	07140106008391	1028.32	308.50	30%
Whiteash Creek	07140106001221	6718.15	2015.45	30%
Whiteash Creek	07140106001223	15382.40	4614.72	30%
	Totals:	**154505.53**	**45446.72**	

Appendix B – Stream Reach Code Map



Appendix C – Site-specific BMP Costs

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Costs
Upper Lake Creek	Agricultural Filter Strip	46	07140106007046	344	feet	$236.91
		47	07140106000121	305	feet	$210.06
		48	07140106000121	722	feet	$497.25
		49	07140106000121	736	feet	$506.89
		50	07140106007015	516	feet	$355.37
	Grassed Waterways	152	07140106000121	616	feet	$1,148.99
	Streambank Stabilization	-	07140106000121	2878.1	feet	$253,274.56
		-	07140106007093	716.5	feet	$63,053.06
		-	07140106007046	1370.4	feet	$120,598.72
		-	07140106007015	993.8	feet	$87,454.75
		-	07140106007064	5097.3	feet	$448,558.88
					TOTALS:	$975,895.43

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
City Lake	Agricultural Filter Strip	43	07140106000119	1057	feet	$727.96
		44	07140106000119	999	feet	$688.02
		45	07140106007010	733	feet	$504.82
	Debris Removal	-	07140106000119	-	-	$486.00
		-	07140106025661	-	-	$486.00
	Grassed Waterways	149	07140106001228	479	feet	$893.45
		150	07140106007105	175	feet	$326.42
		151	07140106007105	327	feet	$609.93
	Riparian Buffers	168	07140106000119	748	feet	$850.00
		169	07140106000118	415	feet	$471.59
		170	07140106000119	229	feet	$260.23
	Shoreline Stabilization	171	07140106025661	190	feet	$16,720.00
		172	07140106025661	386	feet	$33,968.00
		173	07140106025665	186	feet	$16,368.00
		174	07140106025661	554	feet	$48,752.00
		175	07140106025665	396	feet	$34,848.00
	Streambank Stabilization	x	07140106007010	1489.3	feet	$131,061.92
		x	07140106001228	5686.1	feet	$500,379.44
		x	07140106025661	313.2	feet	$27,561.07
		x	07140106025665	274.6	feet	$24,165.33
		x	07140106025667	85.1	feet	$7,485.67
		x	07140106000119	1357.1	feet	$119,427.44
		x	07140106025672	71.1	feet	$6,260.13
		x	07140106007032	758.9	feet	$66,783.73
		x	07140106007105	757.4	feet	$66,652.96
		x	07140106025668	1197.8	feet	$105,409.04
					TOTALS:	$1,212,147.14

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Corinth	Agricultural Filter Strip	40	07140106006921	522	feet	$359.50
	Grassed Waterways	135	07140106006921	569	feet	$1,061.32
		136	07140106006921	167	feet	$311.50
		137	07140106006921	539	feet	$1,005.37
		138	07140106006921	545	feet	$1,016.56
		139	07140106006921	436	feet	$813.25
		140	07140106006921	602	feet	$1,122.88
		141	07140106006921	280	feet	$522.27
		142	07140106006923	207	feet	$386.11
		143	07140106006923	304	feet	$567.03
		144	07140106006923	294	feet	$548.38
		145	07140106006923	318	feet	$593.15
		146	07140106006923	373	feet	$695.74
		147	07140106006923	440	feet	$820.71
		148	07140106001230	499	feet	$930.76
	Riparian Buffer	166	07140106001229	447	feet	$507.95
		167	07140106001229	400	feet	$454.55
	Streambank Stabilization	x	07140106001231	3981.7	feet	$350,386.08
		x	07140106001229	1402.9	feet	$123,455.20
		x	07140106006979	1306	feet	$114,923.60
		x	07140106006921	1658.4	feet	$145,939.20
		x	07140106006923	1102.7	feet	$97,037.60
		x	07140106001230	2771	feet	$243,850.64
					TOTALS:	**$1,087,309.33**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Costs
Fowler School	Agricultural Filter Strip	42	07140106001227	568	feet	$391.18
	Grassed Waterways	128	07140106007080	438	feet	$816.98
	Streambank Stabilization	x	07140106001227	2428.7	feet	$213,723.84
		x	07140106007116	1338.1	feet	$117,755.44
		x	07140106007053	911.6	feet	$80,220.36
		x	07140106007080	1281.1	feet	$112,735.92
					TOTALS:	**$525,643.72**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Heartland	Agricultural Filter Strip	36	07140106001235	553	feet	$380.85
		37	07140106001235	179	feet	$123.28
		38	07140106001234	363	feet	$250.00
		39	07140106001229	439	feet	$302.34
		41	07140106001232	556	feet	$382.92
	Grassed Waterways	129	07140106006951	220	feet	$410.35
		130	07140106006951	475	feet	$885.99
		131	07140106001234	509	feet	$949.41
		132	07140106001234	323	feet	$602.47
		133	07140106000094	379	feet	$706.93
		134	07140106000094	677	feet	$1,262.77
	Streambank Stabilization	x	07140106001235	1975.8	feet	$173,866.00
		x	07140106001236	1621.2	feet	$142,663.84
		x	07140106006951	1908.8	feet	$167,970.00
		x	07140106006981	1506.9	feet	$132,609.84
		x	07140106001226	1673.7	feet	$147,281.20
		x	07140106000114	1457.4	feet	$128,247.68
		x	07140106000115	403.6	feet	$35,520.85
		x	07140106000116	369.8	feet	$32,545.04
		x	07140106000117	632	feet	$55,619.52
		x	07140106000118	231.4	feet	$20,363.20
		x	07140106001234	2161.8	feet	$190,236.64
		x	07140106001232	2708.1	feet	$238,308.40
					TOTALS:	$1,471,489.53

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Whiteash Branch	Agricultural Filter Strip	30	07140106007117	933	feet	$642.56
		31	07140106007117	368	feet	$253.44
		32	07140106007117	540	feet	$371.90
		33	07140106001240	161	feet	$110.88
		34	07140106001240	415	feet	$285.81
	Debris Removal	-	07140106001239	-	-	$486.00
	Grassed Waterways	106	07140106001240	459	feet	$856.15
		107	07140106001240	570	feet	$1,063.19
		108	07140106001240	1267	feet	$2,363.26
		109	07140106001240	703	feet	$1,311.27
		110	07140106001240	519	feet	$968.06
		111	07140106001240	502	feet	$936.35
	Riparian Buffer	164	07140106007083	281	feet	$319.32
		165	07140106007083	386	feet	$438.64
	Streambank Stabilization	x	07140106007070	363.7	feet	$32,001.20
		x	07140106007117	813.9	feet	$71,626.72
		x	07140106001239	1457.5	feet	$128,256.48
		x	07140106007083	1080.2	feet	$95,056.72
		x	07140106001240	1582.3	feet	$139,245.04
					TOTALS:	$476,592.99

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Arrowhead	Grassed Waterways	119	07140106026269	561	feet	$1,046.40
		120	07140106026269	414	feet	$772.21
		121	07140106026269	405	feet	$755.42
		122	07140106026269	149	feet	$277.92
		123	07140106026267	411	feet	$766.62
		124	07140106026267	195	feet	$363.72
		125	07140106026267	277	feet	$516.67
		126	07140106026267	246	feet	$458.85
		127	07140106001225	562	feet	$1,048.27
	Infiltration Basin	154	07140106006968	86436	cu. ft.	$518,616.00
		155	07140106006962	37636	cu. ft.	$225,816.00
	Shoreline Stabilization	176	07140106026269	310	feet	$27,280.00
		177	07140106026269	372	feet	$32,736.00
		178	07140106026269	458	feet	$40,304.00
		179	07140106026269	299	feet	$26,312.00
	Streambank Stabilization	x	07140106026267	173	feet	$15,222.38
		x	07140106006946	338.4	feet	$29,783.42
		x	07140106026268	249	feet	$21,913.41
		x	07140106006878	514.9	feet	$45,309.97
		x	07140106026270	52.3	feet	$4,603.95
		x	07140106006927	297.5	feet	$26,181.94
		x	07140106006968	1750.4	feet	$154,031.68
		x	07140106001225	2075.8	feet	$182,668.64
		x	07140106006962	531.6	feet	$46,780.27
		x	07140106026266	601.6	feet	$52,937.63
		x	07140106000113	1445.6	feet	$127,212.27
		x	07140106007012	1327.9	feet	$116,856.96
		x	07140106026269	984.2	feet	$86,607.49
		x	07140106006928	516.7	feet	$45,472.94
	Vegetated Filter Strip	180	07140106026267	172	feet	$29.61
		181	07140106026269	157	feet	$27.03
		182	07140106026269	608	feet	$104.68
		183	07140106026269	283	feet	$48.73
					TOTALS:	**$1,832,863.09**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Whiteash	Agricultural Filter Strip	25	07140106001221	361	feet	$248.62
		26	07140106001221	326	feet	$224.52
		27	07140106007132	268	feet	$184.57
		28	07140106007171	1626	feet	$1,119.83
		29	07140106007171	1655	feet	$1,139.81
	Grassed Waterways	94	07140106001221	382	feet	$712.52
		95	07140106001221	369	feet	$688.27
		96	07140106001222	292	feet	$544.65
		97	07140106001222	320	feet	$596.88
		98	07140106001223	435	feet	$811.38
		99	07140106007171	1652.6	feet	$3,082.50
		100	07140106007156	401	feet	$747.96
		101	07140106007156	226	feet	$421.54
		102	07140106007156	274	feet	$511.08
		103	07140106007156	712	feet	$1,328.05
		104	07140106007156	975	feet	$1,818.61
		105	07140106007156	282	feet	$526.00
	Streambank Stabilization	x	07140106007139	845.7	feet	$74,417.90
		x	07140106007184	1865.3	feet	$164,149.04
		x	07140106007132	649.3	feet	$57,137.87
		x	07140106001222	4243.7	feet	$373,441.20
		x	07140106007156	3225.4	feet	$283,834.32
		x	07140106001221	2015.5	feet	$177,359.60
		x	07140106001223	4614.7	feet	$406,095.36
		x	07140106007171	1634.7	feet	$143,851.84
					TOTALS:	**$1,694,993.95**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Beaver Creek	Grassed Waterways	112	07140106001224	670	feet	$1,249.71
	Streambank Stabilization	x	07140106000109	689.2	feet	$60,645.20
		x	07140106001224	1334.5	feet	$117,434.42
					TOTALS:	**$179,329.33**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Johnston City	Agricultural Filter Strip	35	07140106006983	251	feet	$172.87
	Grassed Waterways	113	07140106006983	647	feet	$1,872.70
		114	07140106006983	252	feet	$1,206.81
		115	07140106008387	1292	feet	$470.04
		116	07140106008387	329	feet	$2,409.89
		117	07140106008387	1226	feet	$613.67
		118	07140106008387	289	feet	$2,286.79
	Infiltration Basin	153	07140106006983	169744	cu. ft.	$1,018,464.00
	Infiltration Trench	156	07140106006983	15368	cu. ft.	$199,784.00
		157	07140106006983	15296	cu. ft.	$198,848.00
		158	07140106006983	7774	cu. ft.	$101,062.00
		159	07140106006999	64876	cu. ft.	$843,388.00
		160	07140106006999	25500	cu. ft.	$331,500.00
		161	07140106006999	47956	cu. ft.	$623,428.00
		162	07140106006999	65120	cu. ft.	$846,560.00
		163	07140106006999	74480	cu. ft.	$968,240.00
	Streambank Stabilization	x	07140106006999	188.6	feet	$16,595.92
		x	07140106008387	4116.6	feet	$362,260.80
		x	07140106000108	678.1	feet	$59,668.93
		x	07140106008390	82.1	feet	$7,226.74
		x	07140106001242	2662.8	feet	$234,327.28
		x	07140106006983	1077.6	feet	$94,824.40
					TOTALS:	**$5,915,210.83**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Bear Creek	Agricultural Filter Strip	16	07140106007020	689	feet	$474.52
		17	07140106007020	1104	feet	$760.33
		18	07140106002680	1302	feet	$896.69
		19	07140106002680	966	feet	$665.29
	Grassed Waterways	70	07140106002680	259	feet	$483.10
		71	07140106002680	467	feet	$871.07
		72	07140106004308	291	feet	$542.79
		73	07140106007123	636	feet	$1,186.29
		74	07140106007123	770	feet	$1,436.24
		75	07140106007123	298	feet	$555.84
		76	07140106007123	393	feet	$733.04
		77	07140106007123	408	feet	$761.02
		78	07140106007123	223	feet	$415.95
	Streambank Stabilization	x	07140106000549	1603.2	feet	$141,085.30
		x	07140106002680	779	feet	$68,554.46
		x	07140106004308	344	feet	$30,272.00
		x	07140106004311	125.7	feet	$11,058.43
		x	07140106006997	173.8	feet	$15,297.29
		x	07140106007020	728.5	feet	$64,108.00
		x	07140106007025	130.2	feet	$11,453.20
		x	07140106007088	1912.5	feet	$168,295.60
		x	07140106007102	152.7	feet	$13,434.43
		x	07140106007123	1120.6	feet	$98,610.16
		x	07140106007140	578	feet	$50,895.68
		x	07140106007181	956.0	feet	$84,124.30
		x	07140106026228	56.1	feet	$4,936.80
		x	07140106026224	116.8	feet	$10,275.48
		x	07140106007239	720.6	feet	$63,415.09
		x	07140106007195	769.4	feet	$67,706.32
					TOTALS:	**$913,304.71**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Champaign	Agricultural Filter Strip	20	07140106001220	545	acre	$375.34
		21	07140106001220	191	acre	$131.54
		22	07140106001220	1276	acre	$878.79
		23	07140106001220	293	acre	$201.79
		24	07140106001220	124	feet	$85.40
	Grassed Waterways	79	07140106001220	789	acre	$1,471.68
		80	07140106001220	383	feet	$714.39
		81	07140106001220	313	feet	$583.82
		82	07140106001220	1026	feet	$1,913.74
		83	07140106001220	169	feet	$315.23
		84	07140106001220	288	feet	$537.19
		85	07140106001220	156	feet	$290.98
		86	07140106001220	291	feet	$542.79
		87	07140106001220	314	feet	$585.69
		88	07140106001220	236	feet	$440.20
		89	07140106001220	345	feet	$643.51
		90	07140106001220	512	feet	$955.00
		91	07140106001220	763	feet	$1,423.18
		92	07140106001220	345	feet	$643.51
		93	07140106026229	220	feet	$410.35
	Streambank Stabilization	x	07140106026229	428.7	feet	$37,721.55
		x	07140106001220	1482.4	feet	$130,451.90
		x	07140106007037	621.3	feet	$54,678.27
		x	07140106007084	1512.3	feet	$133,084.16
					TOTALS:	**$369,080.00**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Collins	Agricultural Filter Strip	15	07140106008388	136	feet	$93.66
	Grassed Waterways	64	07140106008388	213	feet	$397.30
		65	07140106008388	526	feet	$981.12
		66	07140106008388	1459	feet	$2,721.39
		67	07140106008388	602	feet	$1,122.88
		68	07140106008388	409	feet	$762.88
		69	07140106008388	754	feet	$1,406.39
	Streambank Stabilization	x	07140106008388	1483.9	feet	$130,583.20
		x	07140106006977	1649.5	feet	$145,156.00
		x	07140106008391	308.5	feet	$27,148.00
		x	07140106000107	754.1	feet	$66,361.68
					TOTALS:	**$376,734.50**

Subwatershed Management Unit	BMP	Map ID	Target Area (Reach Code)	Amount	Unit	Cost
Lower Lake Creek	Agricultural Filter Strip	1	07140106008377	130	feet	$89.53
		2	07140106008377	714	feet	$491.74
		3	07140106008377	539	feet	$371.21
		4	07140106008380	1633	feet	$1,124.66
		5	07140106008380	1644	feet	$1,132.23
		6	07140106008380	861	feet	$592.98
		7	07140106008380	889	feet	$612.26
		8	07140106008380	551	feet	$379.48
		9	07140106008380	1197	feet	$824.38
		10	07140106008380	1115	feet	$767.91
		11	07140106008380	217	feet	$149.45
		12	07140106008380	272	feet	$187.33
		13	07140106008380	453	feet	$311.98
		14	07140106008380	202	feet	$139.12
	Debris Removal	-	07140106008380	-	-	$486.00
		-	07140106008377	-	-	$486.00
	Grassed Waterways	51	07140106008380	530	feet	$988.58
		52	07140106008380	678	feet	$1,264.63
		53	07140106008380	1048	feet	$1,954.78
		54	07140106008380	1995	feet	$3,721.16
		55	07140106008380	1199	feet	$2,236.43
		56	07140106008380	1057	feet	$1,971.56
		57	07140106008380	532	feet	$992.31
		58	07140106008380	343	feet	$639.78
		59	07140106008380	320	feet	$596.88
		60	07140106008380	1255	feet	$2,340.88
		61	07140106008380	1438	feet	$2,682.22
		62	07140106008380	602	feet	$1,122.88
		63	07140106008380	650	feet	$1,212.41
	Streambank Stabilization	-	07140106008377	1622.3	feet	$142,761.52
		-	07140106008380	2403.5	feet	$211,509.76
		-	07140106006901	1139	feet	$100,232.00
					TOTALS:	**$484,374.01**

Appendix D – Meeting and Planning Correspondence

WATERSHED PLANNING MEETING

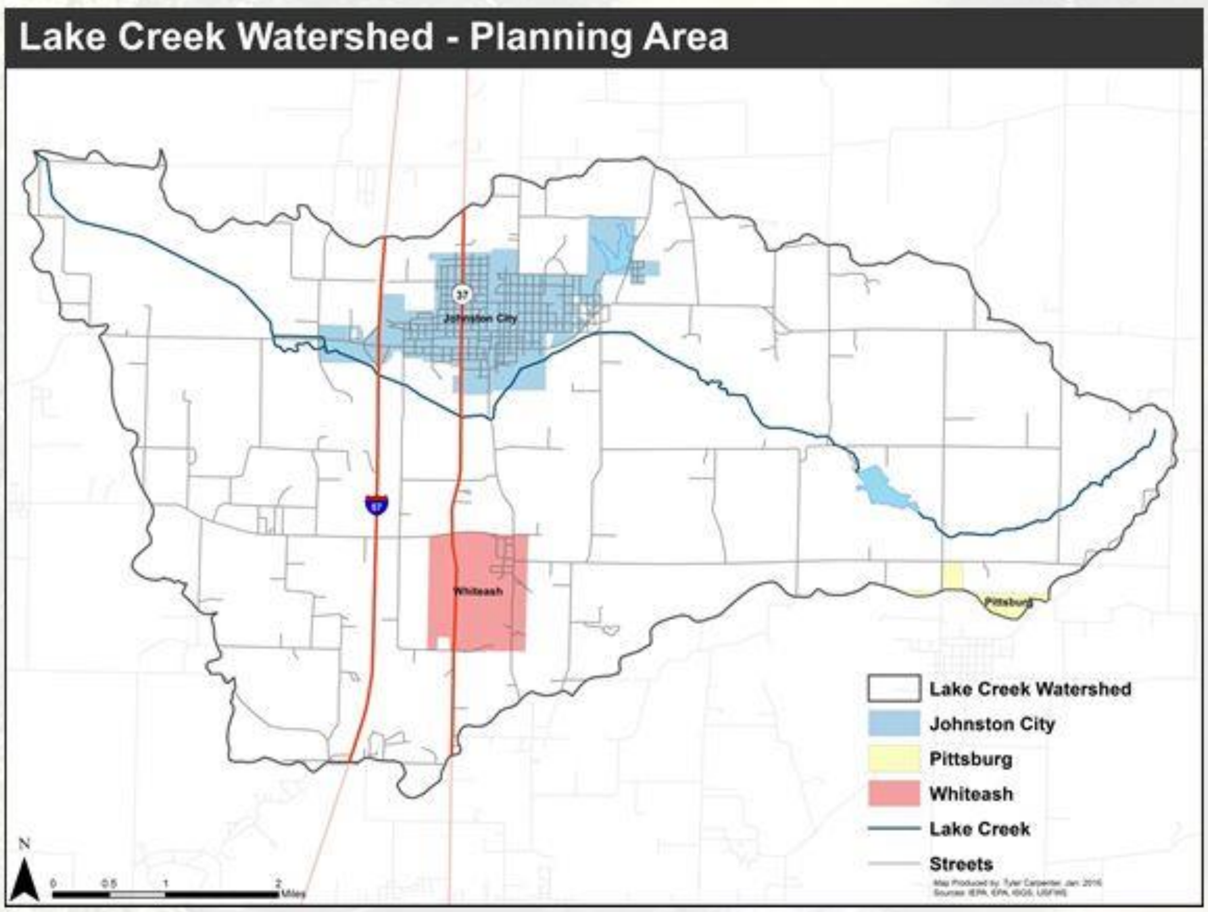
Johnston City High School
March 1, 2017 - 6:00PM
1500 Jefferson Avenue
Johnston City, IL 62951

The Greater Egypt Regional Planning and Development Commission will be holding an initial public information meeting for the Lake Creek Watershed-based Plan.

This meeting will help to address the community's concerns regarding water quality issues in the watershed. The purpose of the workshop is to determine approaches that encourage sustainability of water resources.

Citizens and businesses of Johnston City, Pittsburg, and Whiteash are encouraged to attend the meeting and provide comments about their experiences involving water quality and other issues regarding water resources.

The meeting will be held on **Wednesday, March 1, 2017 at 6:00 PM**. The location is the **Johnston City High School**. If you have questions or comments, please contact Tyler Carpenter at the Greater Egypt Office: **618-997-9351** or **tylercarpenter@greateregypt.org**.



Lake Creek Watershed Council

Greater Egypt Regional Planning and Development Commission
3000 West DeYoung Street, Suite 800B-3
Marion, IL 62959 (618) 997-9351

AGENDA

April 27, 2017

10:00 AM

Greater Egypt Office

(Refreshments to be served)

1.) Welcome and Introductions

2.) Introduction of the Watershed-based Plan
- a. Elements of a Watershed-based Plan
- b. Expectations from EPA

3.) Synopsis of the Lake Creek Watershed- Inventory
- a. Boundaries
- b. Soils
- c. Land Use
- d. Pollutant Loads/ Pollutant Loading
- e. Assessment

4.) Concerns within the Watershed
- a. EPA 303d List: Impairments
- b. EPA 305b List: Inventory Report to Congress

5.) Preliminary Goals

6.) Needs from the Council

7.) Meeting Schedule

8.) Adjourn

Lake Creek Watershed Council

Greater Egypt Regional Planning and Development Commission
3000 West DeYoung Street, Suite 800B-3
Marion, IL 62959 (618) 997-9351

AGENDA

August 1, 2017
10:00 AM
Greater Egypt Office
(Refreshments to be served)

1.) Welcome and Introductions

2.) Components of the Watershed-based Plan
- a. Elements of a Watershed-based Plan
- b. Expectations from EPA

3.) Concerns within the Watershed
- a. EPA 303d List: Impairments
- b. EPA 305b List: Inventory Report to Congress

4.) Update of the Lake Creek Watershed Inventory
- a. Jurisdictions
- b. Soils
- c. Land Use
- d. Pollutant Loads/ Pollutant Loading
- e. Assessment (Drainage)
- f. Water Quality Analysis & Pollutant Load Reduction Targets

5.) Outreach Measures/Public Involvement

6.) Preliminary Goals

7.) Future Involvement

8.) Adjourn

Lake Creek Watershed Council

Greater Egypt Regional Planning and Development Commission
3000 West DeYoung Street, Suite 800B-3
Marion, IL 62959 (618) 997-9351

AGENDA

November 15, 2017
10:00 AM
Greater Egypt Office
(Refreshments to be served)

1.) Welcome and Introductions

2.) Completed Components of the Watershed-based Plan
 a. Element A- Identification of Impairments (Inventory and Assessment)
 b. Element B- Pollutant Load Reduction Targets

3.) Lake Creek Watershed Inventory Review
 a. Assessment (Drainage)
 b. Pollutant Loads/ Pollutant Loading
 c. Water Quality Analysis & Pollutant Load Reduction Targets

4.) Element C- Nonpoint Source Management Measures to Achieve Load Reduction Targets

4.) Element E- Outreach Measures/Public Involvement

5.) Future Involvement

6.) Adjourn

Lake Creek Watershed Council

Greater Egypt Regional Planning and Development Commission
3000 West DeYoung Street, Suite 800B-3
Marion, IL 62959 (618) 997-9351

AGENDA

March 29, 2018
10:00 AM
Greater Egypt Office
(Refreshments to be served)

1.) Welcome and Introductions

2.) Review of Planning Meetings
  - a.) Farm Bureau: 2/7/2018
  - b.) Johnston City Officials: 2/27/2018

3.) Pollutant Load Reduction Targets

4.) Element C: Best Management Practices to Achieve Load Reduction Targets
  - a.) General BMP review
  - b.) Watershed-wide Practices
  - c.) Site-Specific Practices

5.) Element D: Technical and Financial Assistance

6.) Element E: Outreach Measures/Public Involvement

7.) Elements F-I: Implementation and Monitoring Strategy Components

8.) Projected Meeting Schedule

9.) Adjourn

WATERSHED PLANNING MEETING

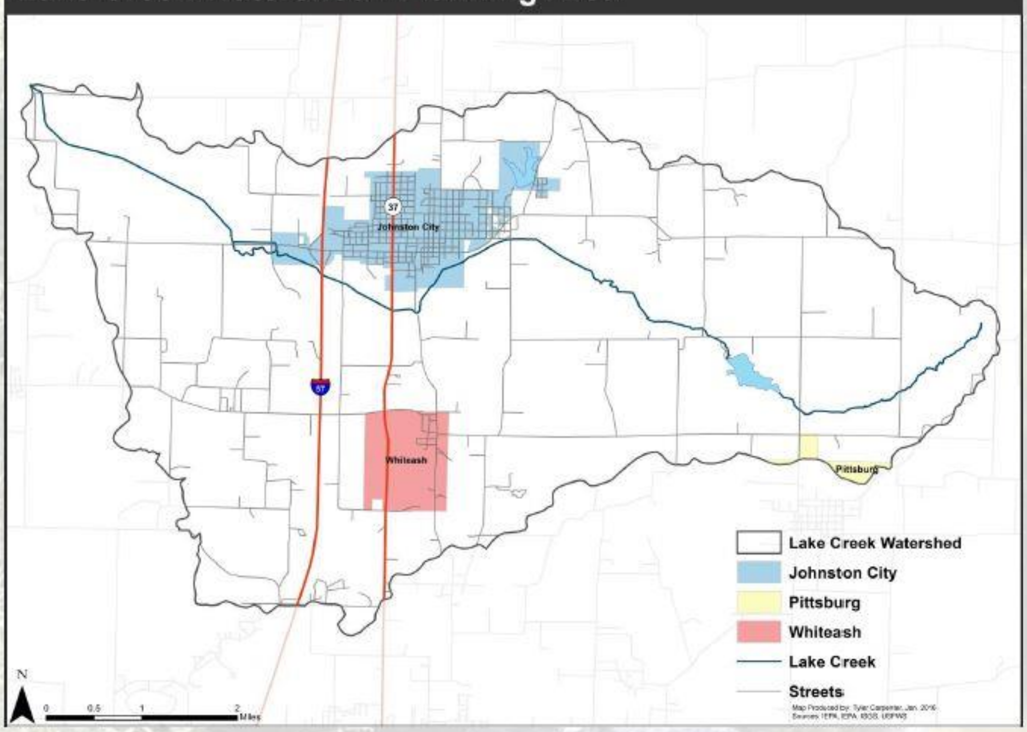
Arrowhead Campground
May 3, 2018- 6:00PM
1600 Peterson Avenue
Johnston City, IL 62951

The Greater Egypt Regional Planning and Development Commission will be holding a public information meeting for the Lake Creek Watershed-based Plan.

This meeting will help to address the community's concerns regarding water quality and drainage issues in the watershed. The purpose of the workshop is to determine approaches that encourage sustainability of water resources.

Citizens and businesses of Johnston City, Pittsburg, and Whiteash are encouraged to attend the meeting and provide comments about their experiences involving water quality and other issues regarding water resources.

The meeting will be held on **Thursday, May 3, 2018 at 6:00 PM**. The location is the **Arrowhead Lake Campground**. If you have questions or comments, please contact Tyler Carpenter at the Greater Egypt Office: **618-997-9351** or **tylercarpenter@greateregypt.org**.



Lake Creek Watershed - Planning Area

Lake Creek Watershed Council

Greater Egypt Regional Planning and Development Commission
3000 West DeYoung Street, Suite 800B-3
Marion, IL 62959 (618) 997-9351

AGENDA

August 9, 2018
10:00 AM
Greater Egypt Office
(Refreshments to be served)

1.) Welcome and Introductions

2.) Review of Planning Meetings
   a.) Public Meeting- Arrowhead Lake Campground: 5/3/2018

3.) Pollutant Load Reduction Target Summary

4.) Element C: Best Management Practices to Achieve Load Reduction Targets
   a.) Recap of current BMP in plan
   b.) Watershed-wide & Site-specific Practices
   c.) Pollutant Load Reductions
   d.) Other BMP

5.) Element D: Technical and Financial Assistance
   a.) Available Grants
   b.) Other Funding Sources

6.) Element E: Outreach & Education
   a.) Current Measures
   b.) Electronic Recycling Drive (or other) Discussion

7.) Elements F-I: Implementation and Monitoring Strategy Components
   a.) Schedule/ Milestones
   b.) Evaluation Criteria/ Monitoring Component

8.) Projected Meeting Schedule
   a.) Review Meeting in September
   b.) Other Planning Efforts

9.) Adjourn