

# Charles City Watershed Management Plan

A roadmap for sustained agricultural production and improved water quality, flood resilience and urban-rural partnerships

**FEBRUARY 2018**

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Environmental Programs & Services**



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# WALTON FAMILY FOUNDATION



## **Watershed planning partners:**

Watershed residents, farmers and landowners

Charles City

Floyd Soil and Water Conservation District

Floyd County

Natural Resources Conservation Service

Iowa Department of Agriculture and Land Stewardship

Iowa Department of Natural Resources

Iowa State University Extension and Outreach

## **A roadmap for sustained agricultural production and improved water quality, flood resilience and urban-rural partnerships**

### **Why was the Charles City Watershed Management Plan developed?**

This watershed plan is intended to provide a roadmap for land and water improvements in the Charles City Watershed while simultaneously maintaining and improving agricultural performance, quality of life and collaboration. Environmental improvements are a big task, and trying to tackle everything at once can be daunting. This plan lays out a phased approach to implementation to ensure continuous improvements are made towards achieving long-term goals for the watershed.

### **Who owns this watershed plan?**

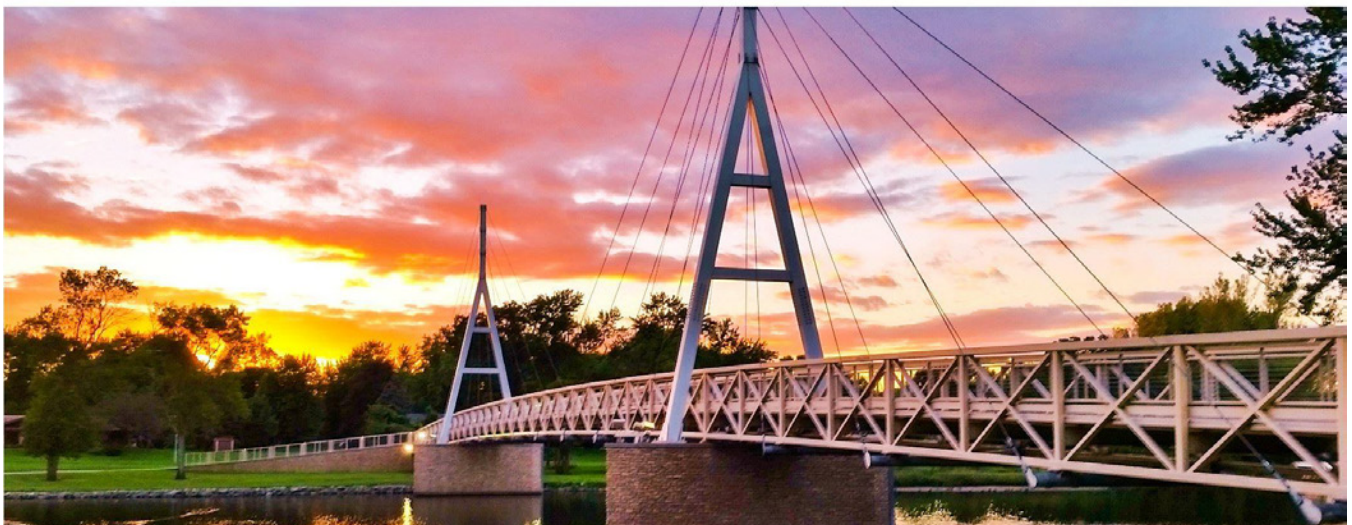
This plan is for all stakeholders interested in the Charles City Watershed, including landowners, farmers, residents, nongovernmental organizations and local, state and federal units of government. Ultimately, successful implementation of this plan will rest with these stakeholders.

### **Who developed this watershed plan?**

This plan was developed by the Iowa Soybean Association. Guidance and input was provided by representatives of landowners, farmers, residents and city, county, state and federal governments. The watershed planning process was led by the Iowa Soybean Association with assistance from the Floyd Soil and Water Conservation District, the Natural Resources Conservation Service, the City of Charles City, Floyd County, the Iowa Department of Agriculture and Land Stewardship, the Iowa Department of Natural Resources and Iowa State University.

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# 1. Executive Summary

A watershed is an area of land that drains to a single point such as a lake or larger stream. The watershed immediately upstream of Charles City is comprised of 35,489 acres. The watershed is located in Floyd County, Iowa, and includes the Cedar River along with three primary tributary streams: Stewart Creek, Wildwood Creek (officially Drainage Ditch 3) and Hyers Creek (officially an unnamed tributary). Figure 1.1 shows the location of the Charles City Watershed and these streams and Figure 1.2 illustrates how watersheds function.

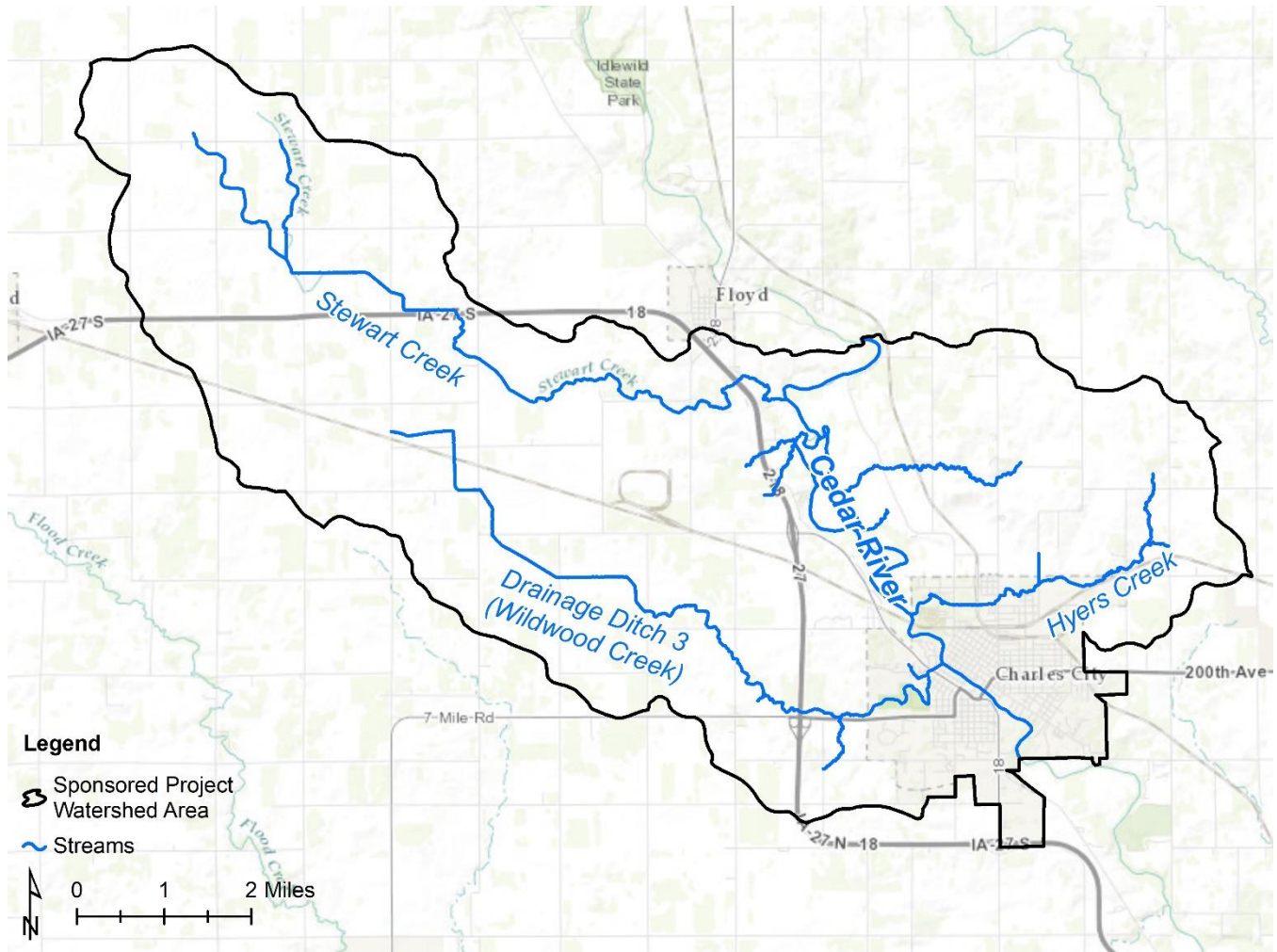


Figure 1.1. Location of the Charles City Watershed. The watershed extends from Floyd to Charles City.

This watershed plan defines and addresses existing land and water quality conditions, identifies challenges and opportunities and provides a path for improvement. The plan was developed according to the watershed planning process recommended by the Iowa Department of Natural Resources (IDNR; Figure 1.3) and incorporated input from a variety of public and private stakeholders. The Iowa Soybean Association led development of this watershed plan with funding provided by the Walton Family Foundation. Stakeholders including watershed farmers, landowners, conservation professionals and others contributed knowledge and insights throughout the watershed planning process. The Charles City Watershed Plan integrates existing data, citizen and stakeholder input and conservation practice recommendations to meet the goals established through the watershed planning process.



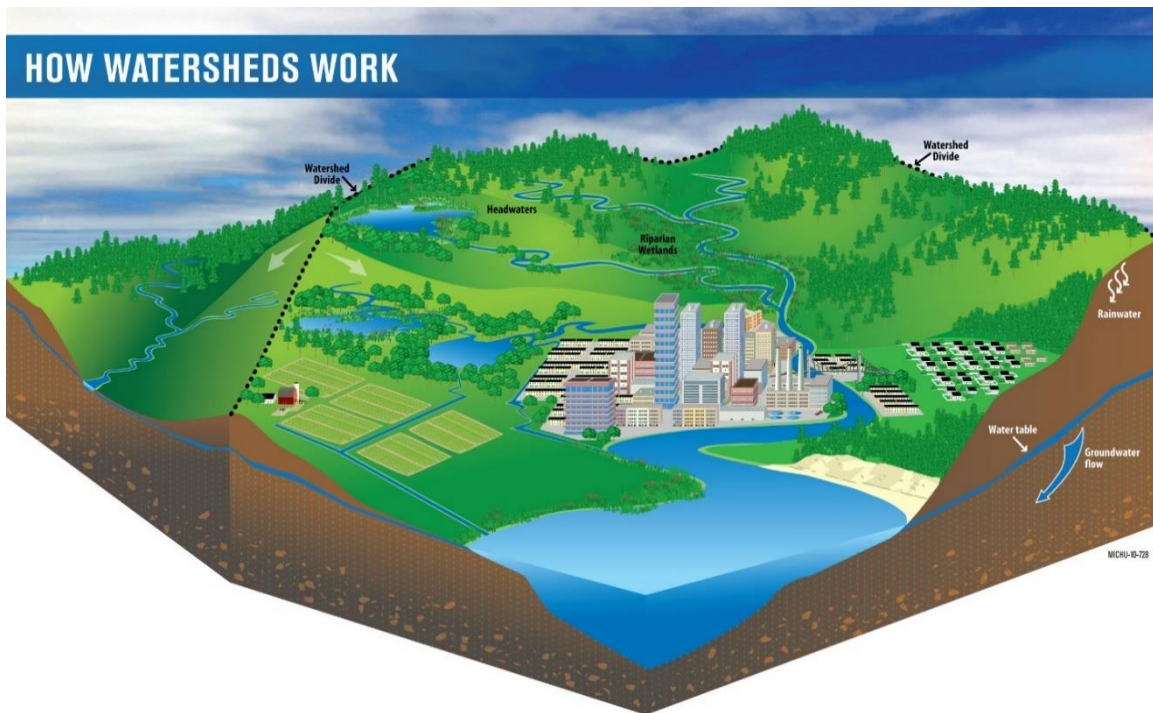


Figure 1.2. A watershed contains the land and water that flow to a common point ([Michigan Sea Grant](#)).



Figure 1.3. The watershed planning process.

The watershed area was identified for watershed planning initially due to interest from the City of Charles City to invest in water quality and flood reduction practices within its upstream watershed, which is the Upper Cedar Watershed. This watershed plan builds upon the Upper Cedar Watershed Management Improvement Authority Watershed Management Plan, which was developed in 2015. Relationships have been built and strengthened between the City of Charles City, watershed farmers and landowners, the Natural Resources Conservation

Service, the Floyd County Soil and Water Conservation District, the Iowa Soybean Association, Floyd County, the Iowa Department of Agriculture and Land Stewardship and the Iowa Department of Natural Resources. Community participation provided important insights throughout the watershed planning process. Local engagement and leadership has been and will continue to be essential as the plan is implemented.

The watershed project area is a subwatershed of the Upper Cedar River Watershed. Recent watershed programming and activities within the Upper Cedar Watershed have been in support of flood reduction and the [Iowa Nutrient Reduction Strategy](#) (INRS). The INRS identifies a broad strategy to reduce nutrient loads in Iowa water bodies and downstream waters that incorporates regulatory guidelines for point sources of nutrients and a non-regulatory approach for nonpoint nutrient sources. This watershed plan was developed within the flexible nonpoint source framework to identify a locally appropriate strategy to address INRS water quality improvement goals. This plan focuses on nonpoint source approaches to improve water quality within the watershed and downstream, which will complement ongoing and future point source improvements such as the City of Charles City's wastewater facility upgrade.

Goals for the Charles City Watershed have been identified to achieve the vision of all stakeholders. This document guides stakeholders according to a continuous improvement approach to watershed management. It is important both to adopt a long-term perspective and to realize that many small improvements must be made to cause large, lasting changes for the entire watershed. The long-term goals of the Charles City Watershed Plan are to:

1. Reduce soil erosion.
2. Increase local water quality data through stream and tile monitoring.
3. Increase agricultural returns on investment.
4. Increase public education.
5. Achieve Iowa Nutrient Reduction Strategy goals for nitrogen and phosphorus reduction.
6. Increase soil organic matter by one percent.
7. Increase resilience to extreme weather by reducing impacts of drought, flooding and flash flooding.
8. Increase participation in a water quality practice to 90 percent of farm operations.
9. Improve urban-rural partnerships.
10. Maintain and increase upland and aquatic habitat and recreation opportunities.

Public involvement was a key component of the watershed planning process. Watershed planners encouraged participation throughout the planning process and sought to incorporate diverse stakeholder input from farmers, landowners, residents, conservation and agricultural professionals and other local stakeholders to guide the development of this watershed plan.

Improving land and water resources in the Charles City Watershed is a complex challenge and will require substantial, long-term collaboration and partnerships. The implementation schedule in this watershed plan was developed to balance currently available resources and awareness with the need and desire to improve land and water quality. A 13-year phased implementation schedule has been designed to allow for continuous improvements that can be periodically evaluated to determine if progress is being made toward achieving the stated goals by the year 2030. The total investment necessary to accomplish the watershed plan goals is estimated to be approximately \$3,600,000 for initial infrastructure costs associated with structural practices, up to \$365,000 per year for annual costs associated with management practices and an additional \$80,000 to \$120,000 per year to fund technical assistance, outreach, monitoring and equipment necessary to promote and implement conservation in the watershed.

Expenditures for watershed improvement should be viewed as long-term investments in agricultural vitality and water quality. With this perspective in mind, the cost efficiency of any purchased investments (i.e., conservation

practices) can be considered along with their potential internal (local) and external (downstream) benefits and risks. This approach allows for water quality investors (i.e., public or private funding sources) to select conservation practices that align with investment preferences and goals. Table 1.1 contains estimates of annualized nitrate and phosphorus load reduction cost efficiency for practices that are included in the Charles City Watershed Plan. Many of these practices have additional on-farm and off-farm economic and ecosystem benefits that also could be considered as specific conservation practices are funded.

*Table 1.1. Estimated annual nutrient load reductions and cost efficiency of conservation practices included in the Charles City Watershed conceptual plan. Negative costs for no-till/strip-till and nutrient management reflect long-term cost savings. Nitrogen and phosphorus reduction costs were annualized to reflect the typical lifespan of each practice.*

	Practice	Unit	Needed	Cost per Unit	Cost	Watershed Load Reduction		Reduction Cost	
						Nitrogen (lb N/yr)	Phosphorus (lb P/yr)	Nitrogen (\$/lb N/yr)	Phosphorus (\$/ton P/yr)
Annual Costs	No-till/Strip-till	acres/yr	10,000	-\$10	-	0	1,706	-	-
	Cover crops	acres/yr	10,000	\$50	\$500,000/yr	80,600	550	\$6.20	\$0.45
	Nutrient management	acres/yr	12,000	-\$5	-	23,400	0	-	-
	Prairie strips	acres/yr	100	\$250	\$25,000/yr	22,100	142	\$1.13	\$0.09
Initial Costs	Saturated buffers	sites	30	\$3,000	\$300,000	19,500	0	\$0.21	-
	Bioreactors	sites	30	\$10,000	\$90,000	16,770	0	\$0.36	-
	Wetlands	sites	6	\$535,000	\$3,210,000	83,790	706	\$0.38	\$0.02

Ultimately any land and water quality improvements made in the watershed will be driven by local desire, education and participation. The implementation, monitoring, outreach and evaluation components of this watershed plan should provide a framework to guide efforts and focus resources in order to achieve the community vision of the Charles City Watershed.



## 2. Watershed Characteristics

### 2.1. General Information

The Charles City Watershed encompasses 35,489 acres (55 square miles) used primarily for agricultural production. Row crop agriculture occupies 68 percent of the watershed. Terrain in the watershed ranges from flat in the western portion of the watershed to rolling and substantially sloped, particularly near and east of the Cedar River. The Cedar River is the major surface water body within the watershed. Primary tributary streams in the watershed include Stewart Creek, Drainage Ditch 3 and an unnamed tributary. Locally, Drainage Ditch 3 is known as Wildwood Creek and the unnamed tributary that flows from the northeast and along the north side of Charles City is known as Hyers Creek. Charles City and Floyd are the only incorporated communities within the watershed. The majority of the watershed is privately owned. Rural public land in the watershed includes the Rotary, Trowbridge, River Bend and Mink Creek wildlife areas managed by the Floyd County Conservation Board. Table 2.1.1 lists general information for the watershed and Figure 2.1.1 displays the Hydrologic Unit Code (HUC)-12 subwatersheds.

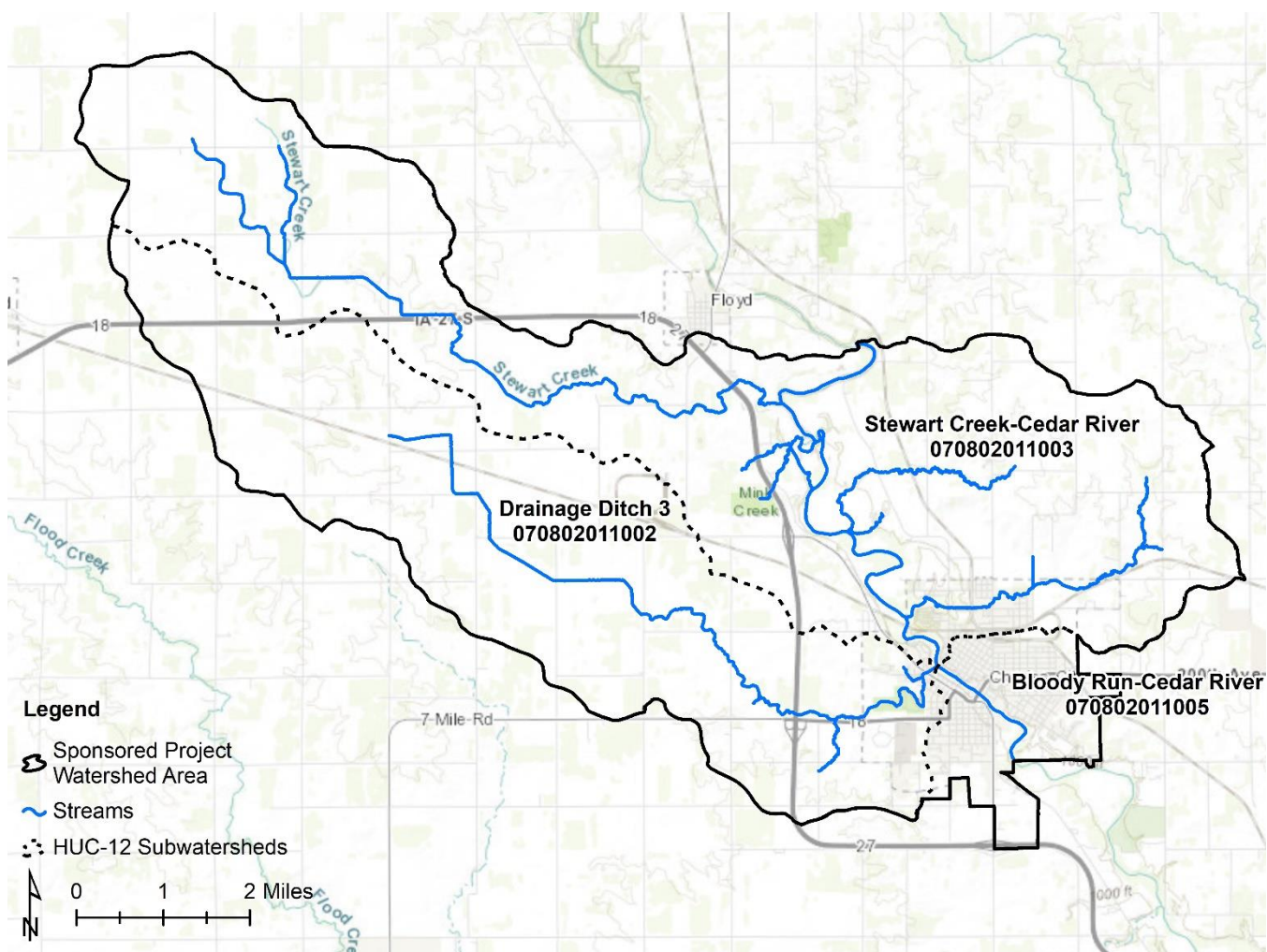


Figure 2.1.1. Charles City Watershed and HUC-12 subwatersheds.

Table 2.1.1. Watershed and stream information for the Charles City Watershed.

<b>Location</b>	Floyd County	
<b>Waterbody</b>	Cedar River	Drainage Ditch 3
<b>Waterbody IDs (WBID)</b>	IA 02-CED-478	IA 02-CED-583, IA 02-CED-584
<b>Segment classes</b>	A1, B(WW-1), HH	A1, B(WW-1)
<b>Designated uses</b>	Primary contact recreation, Aquatic life, Fish consumption	
<b>WBID segment length</b>	19 miles	13.6 miles
<b>Total length of all streams</b>	44.8 miles	
<b>Watershed area</b>	35,489 acres	
<b>Dominant land use</b>	Row crop agriculture	
<b>Incorporated communities</b>	Charles City, Floyd	
<b>HUC-8 watershed</b>	Upper Cedar	
<b>HUC-8 ID</b>	07080201	
<b>HUC-10 watershed</b>	Gizzard Creek-Cedar River	
<b>HUC-10 ID</b>	0708020110	
<b>HUC-12 watersheds</b>	Drainage Ditch 3, Stewart Creek-Cedar River, Bloody Run-Cedar River	
<b>HUC-12 IDs</b>	070802011002, 070802011003, 070802011005	

## 2.2. Water and Wetlands

Surface water in the Charles City watershed includes the Cedar River, Stewart Creek, Drainage Ditch 3, Hyers Creek and additional unnamed tributary streams (Figures 1.1 and 2.1.1). Figure 2.2.1 displays the wetlands in the watershed as identified by the National Wetlands Inventory (NWI), which are also summarized in Table 2.2.1. The NWI dataset was developed beginning in the 1970s by the U.S. Fish and Wildlife Service via aerial photo interpretation.

Table 2.2.1. Classification of wetlands in the Charles City Watershed according to the National Wetlands Inventory.

<b>Type</b>	<b>Acres</b>
Artificially Flooded	< 1
Intermittently Exposed	67
Intermittently Flooded	21
Other	31
Permanently Flooded	233
Seasonally Flooded	179
Semipermanently Flooded	75
Temporarily Flooded	123
<b>Total</b>	<b>729</b>

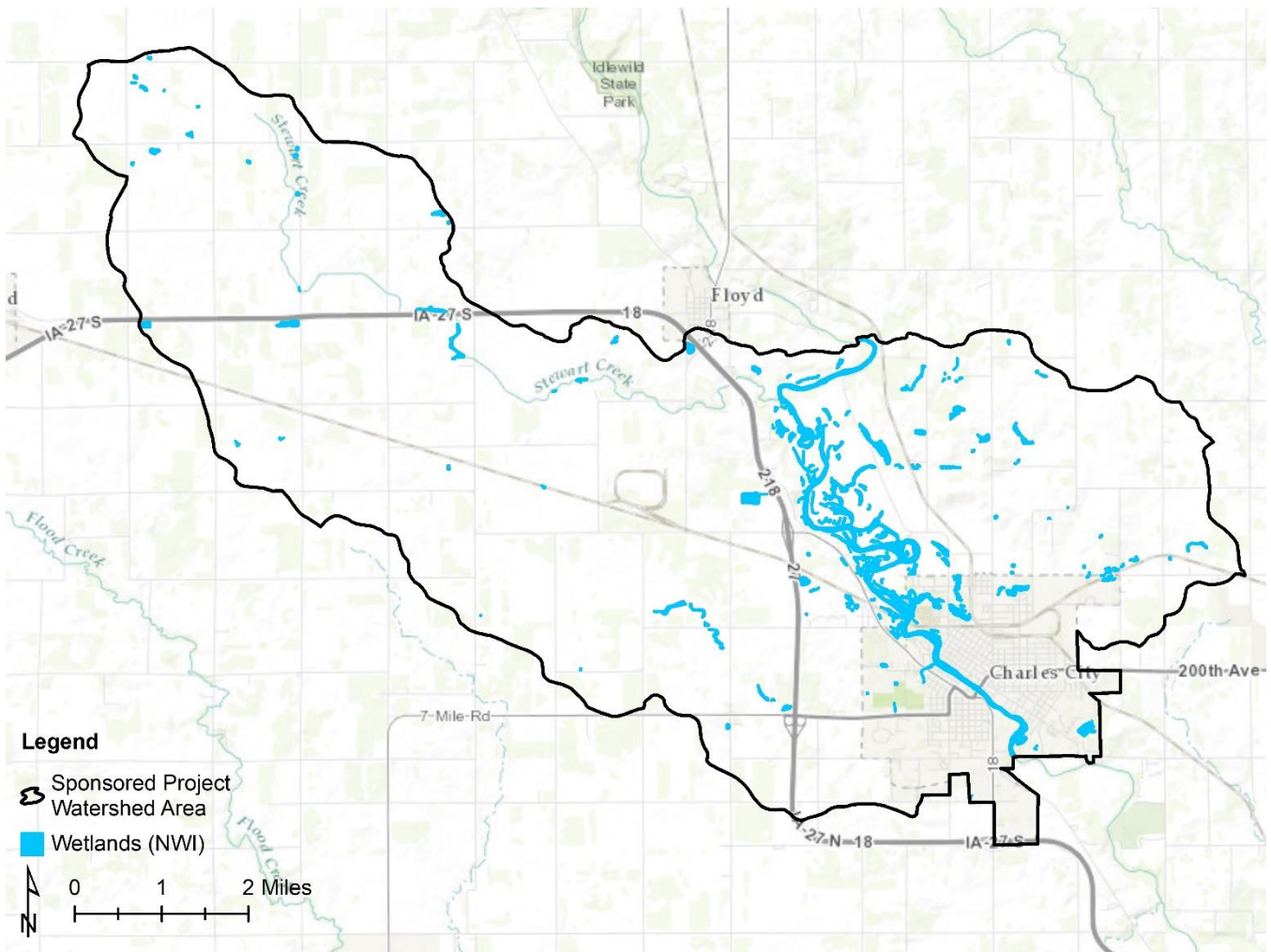


Figure 2.2.1. Wetlands in the Charles City Watershed mapped in the National Wetlands Inventory.

### 2.3. Climate

Precipitation data obtained from the [Iowa Environmental Mesonet](#) show annual total precipitation at Charles City averaged 37.2 inches per year from 2000 through 2017, with a range of 25.0 to 58.6 inches per year for the 18-year period, which shows large variability. Annual precipitation trends are shown in Figure 2.3.1. Precipitation is seasonal in the watershed, with May through August having the highest average monthly rainfall during the most recent 18 years. Monthly precipitation averages are displayed in Figure 2.3.2.



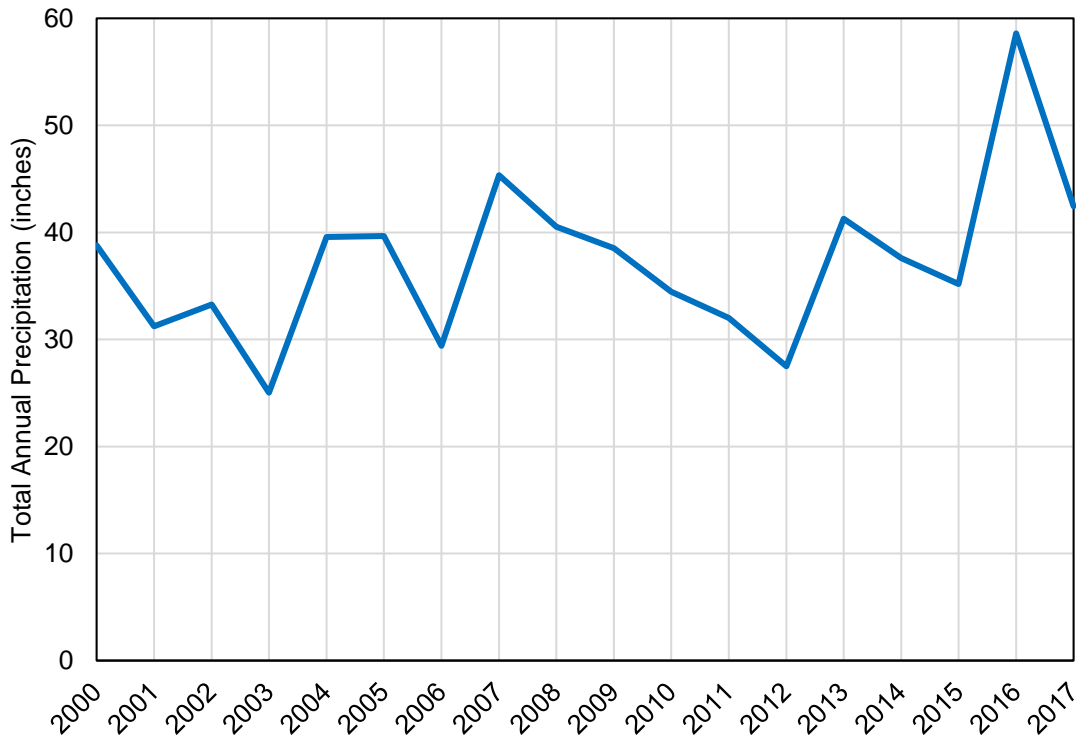


Figure 2.3.1. Total annual precipitation at Charles City from 2000 through 2017 (Iowa Environmental Mesonet).

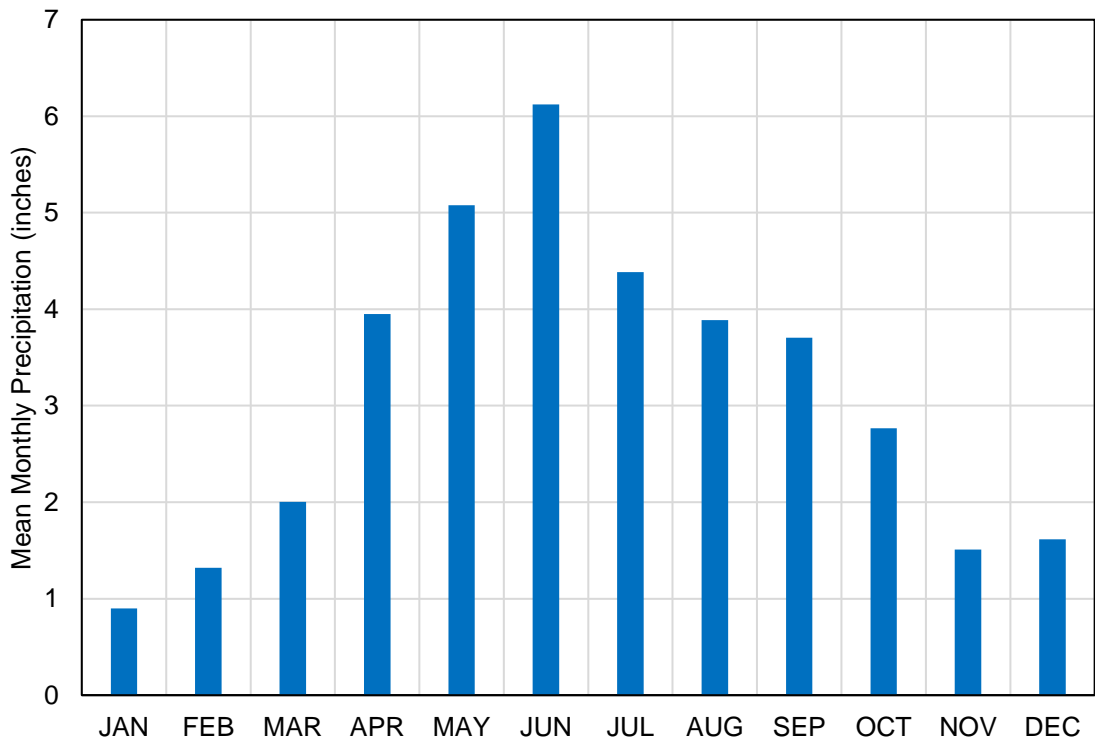


Figure 2.3.2. 2000 to 2017 average precipitation by month at Charles City (Iowa Environmental Mesonet).

## 2.4. Geology and Terrain

The Charles City Watershed is located within the lowland Surface landform region. The lowland Surface was last glaciated approximately 300,000 years ago. The present-day landscape is dominated by gently rolling terrain created by glacial processes and ensuing episodes of intense erosion, which most recently occurred between 21,000 and 16,000 years ago. This region contains many rocks and boulders deposited by glaciers and subsequently exposed due to erosion. Approximately 17 percent of the watershed contains alluvial deposits, the majority of which are located along the Cedar River. The watershed also is located within the Eastern Iowa and Minnesota Till Prairies Major Land Resource Area (MLRA 104).

Bedrock geology within the watershed is characterized by karst, which develops when subsurface bedrock, typically limestone, is dissolved. In addition to producing surface topographic features, this process also contributes to the formation of sinkholes, springs and losing streams. Groundwater and surface water in these areas are vulnerable to contamination because pollutants can bypass soil filtration and travel through fractures directly to aquifers, springs and streams. Areas underlain by shallow soluble carbonate bedrock along with historic and present sinkholes are mapped in Figure 2.4.1.

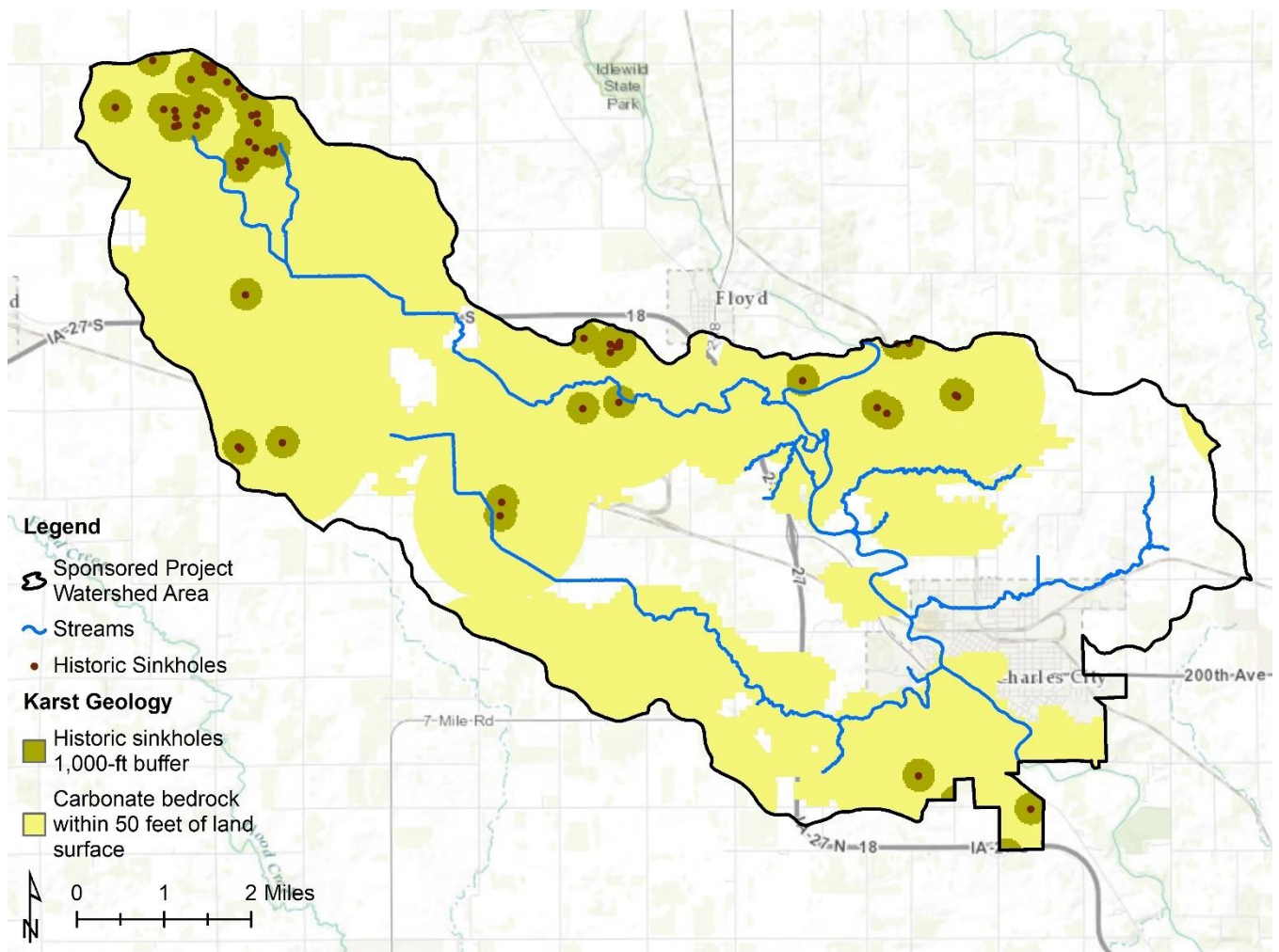


Figure 2.4.1. Shallow carbonate bedrock (limestone) is prevalent throughout the watershed, leading to formation of many sinkholes.

Land surface elevation in the watershed ranges from 972 to 1,170 feet above sea level. Figure 2.4.2 shows elevations derived from Light Detection and Ranging (LiDAR) data. Figure 2.4.3 displays the spatial distribution of

slope classes within the watershed, which are also listed in Table 2.4.1. Eighty-eight percent of the watershed has slopes of five percent or less.

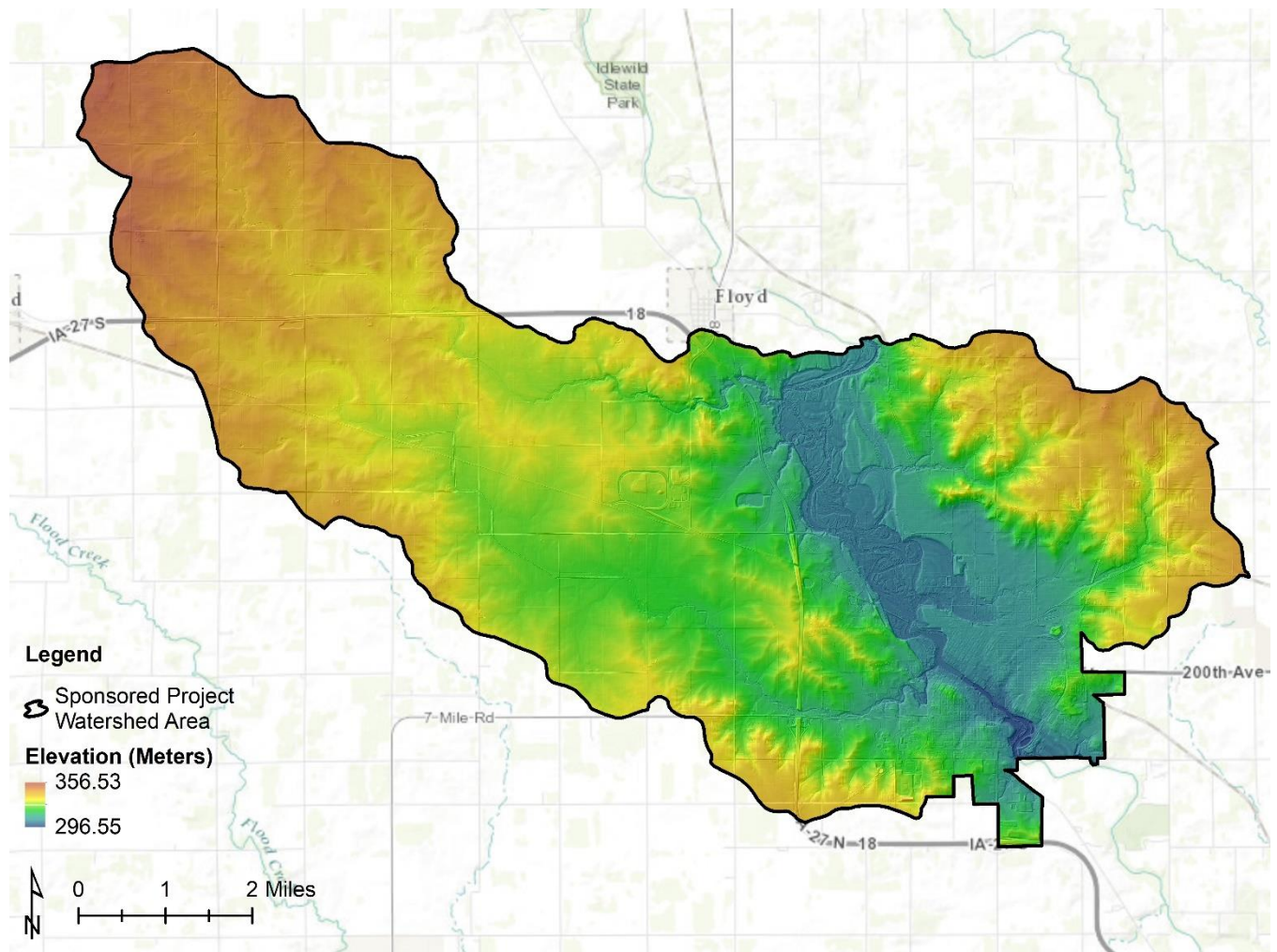


Figure 2.4.2. LiDAR-derived elevations within the Charles City Watershed.

Table 2.4.1. Extent of each slope class within the Charles City Watershed.

Slope Class	Range	Acres	Percent of Watershed
A	0-2%	19,995	60%
B	2-5%	9,217	28%
C	5-9%	2,380	7%
D	9-14%	806	2%
E	14-18%	324	1%
F	18-25%	333	1%
G	> 25%	268	1%



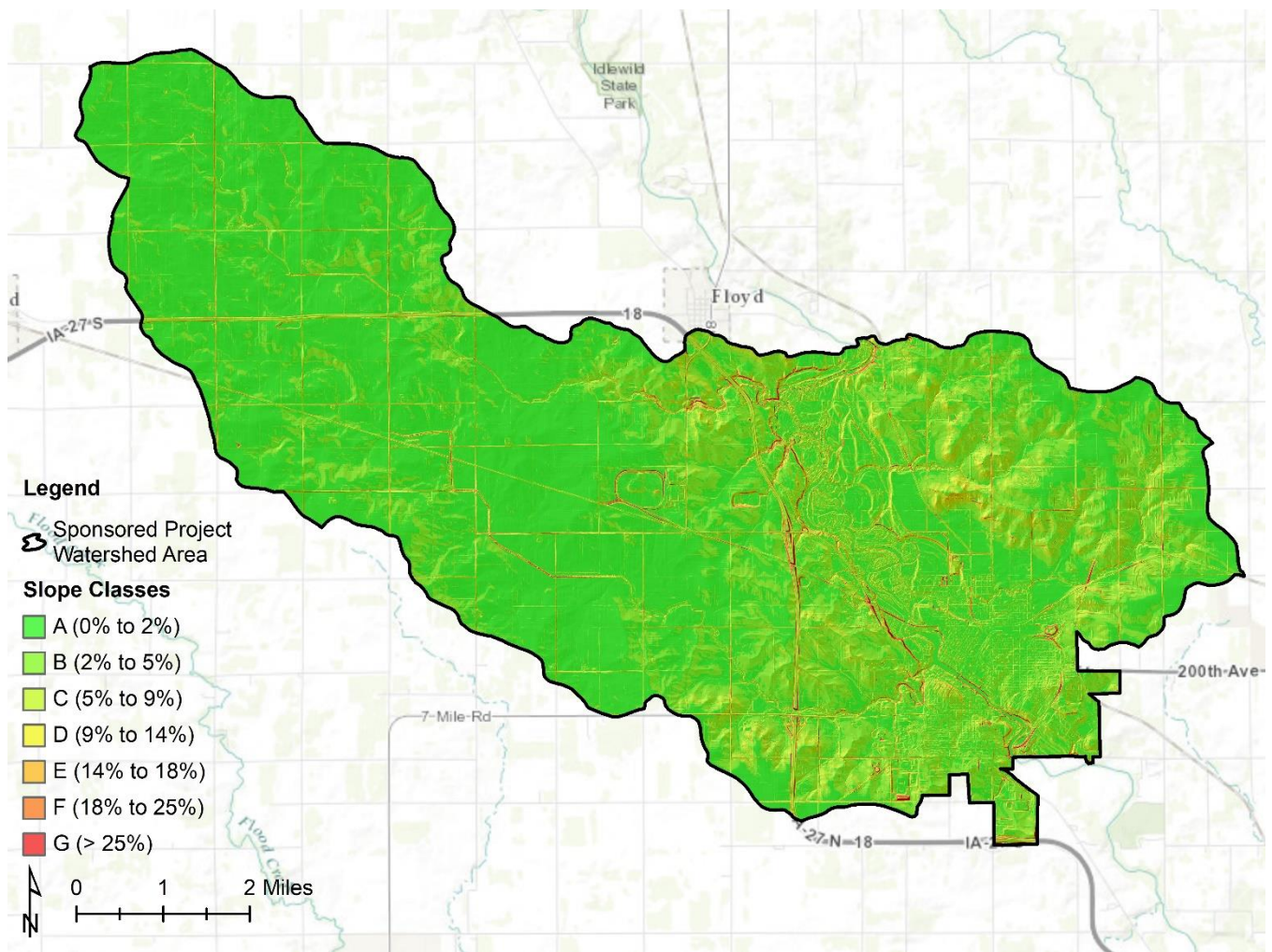


Figure 2.4.3. Charles City Watershed slope classifications derived from elevation data.

## 2.5. Soils

The most common soil association in the watershed is the Kenyon-Floyd-Clyde soil association. Parent materials include loess-mantled glacial till and mixed alluvium in river valleys. Native vegetation for these soils was tall and short grass prairie. These soils range from well drained to poorly drained, and tile drainage is common for many soils in this association. The six most prevalent soil series in the watershed are Clyde, Maxfield, Readlyn, Floyd, Ostrander and Kenyon. Descriptions of these series are given Table 2.5.1. Figure 2.5.1 is a map of the major soils within the watershed according to the Soil Survey Geographic Database (SSURGO) coverage developed by the National Cooperative Soil Survey and the USDA-Natural Resources Conservation Service (NRCS).

Table 2.5.1. Official NRCS soil series descriptions ([NRCS Official Soil Series Descriptions](#)).

Soil Series	Description
Clyde	Very deep, poorly and very poorly drained soils formed in 75 to 150 centimeters of loamy glacial outwash or erosional sediments and the underlying loamy till. These soils are on nearly level positions, swales and concave drainageways on interfluvial dissection on dissected till plains. Slope ranges from 0 to 4 percent.
Maxfield	Very deep, poorly drained soils formed in 60 to 102 centimeters of loess and underlying glacial till. Maxfield soils are on interfluvial dissection and on head slopes of broad, shallow drainageways on dissected till plains. Slope ranges from 0 to 2 percent.
Readlyn	Very deep, somewhat poorly drained soils that formed in 30 to 75 centimeters of loamy sediments and the underlying till. Readlyn soils are on slightly convex side slopes on dissected till plains of low relief on the lowan Erosion Surface. Slope ranges from 0 to 5 percent.
Floyd	Very deep, somewhat poorly drained soils formed in 75 to 150 centimeters of loamy sediments and in the underlying till. These soils are on concave foot slopes adjacent to upland drainageways on dissected till plains. Slope ranges from 0 to 5 percent.
Ostrander	Very deep, well drained soils that formed in 75 to 150 centimeters of silty or loamy sediments and in the underlying till. These soils are on summits, side slopes, or shoulder slopes on dissected till plains. Slope ranges from 0 to 18 percent.
Kenyon	Very deep, moderately well drained soils formed in 30 to 75 centimeters of silty or loamy sediments and the underlying till. These soils are on interfluvial dissection and side slopes on dissected till plains on the lowan Erosion Surface. Slope ranges from 2 to 35 percent.

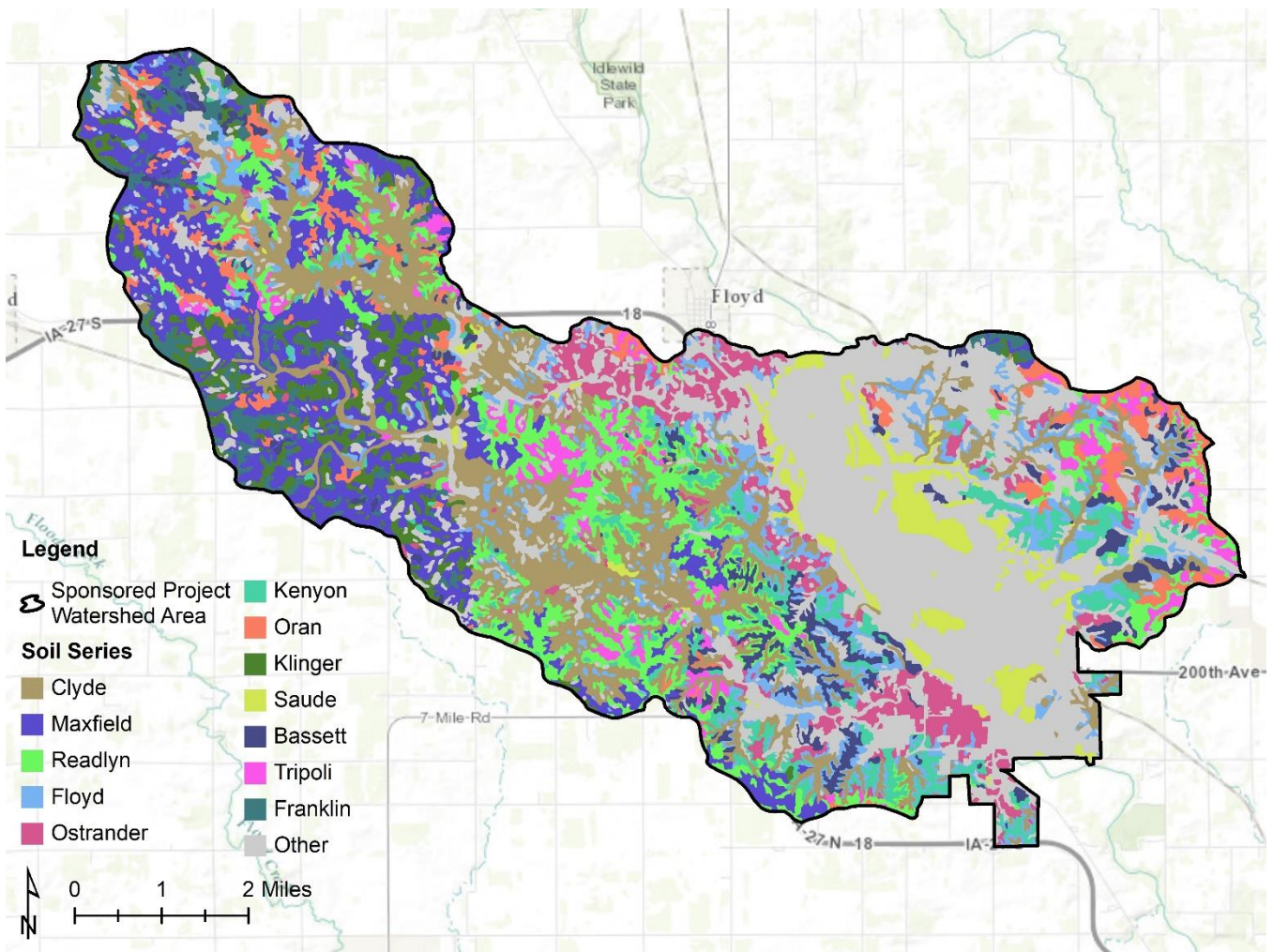


Figure 2.5.1. Charles City Watershed soil map derived from SSURGO data.



Soil drainage properties affect surface and subsurface water movement within the watershed. These characteristics are summarized in Table 2.5.2. Approximately 34 percent of the soils in the watershed are classified as hydric, which means they are saturated, flooded or ponded during the growing season for sufficient duration to develop anaerobic conditions in the upper portion of the soil profile. Hydric classification is independent of soil drainage status, so tilled soils may be hydric. Hydric soils within the watershed are mapped in Figure 2.5.2.

Table 2.5.2. Drainage properties and productivity (Corn Suitability Rating 2) of common soils in the watershed.

Soil Series	Acres	CSR2	Drainage Class	Hydrologic Group	Hydric Class	Percent of Watershed
Clyde	5,626	87	Poorly drained	B/D	All hydric	16%
Maxfield	4,433	93	Poorly drained	B/D	All hydric	12%
Readlyn	3,057	94	Somewhat poorly drained	B	Partially hydric	9%
Floyd	2,386	89	Somewhat poorly drained	B	Partially hydric	7%
Ostrander	1,710	88	Well drained	B	Not hydric	5%
Kenyon	1,554	83	Moderately well drained	B	Not hydric	4%

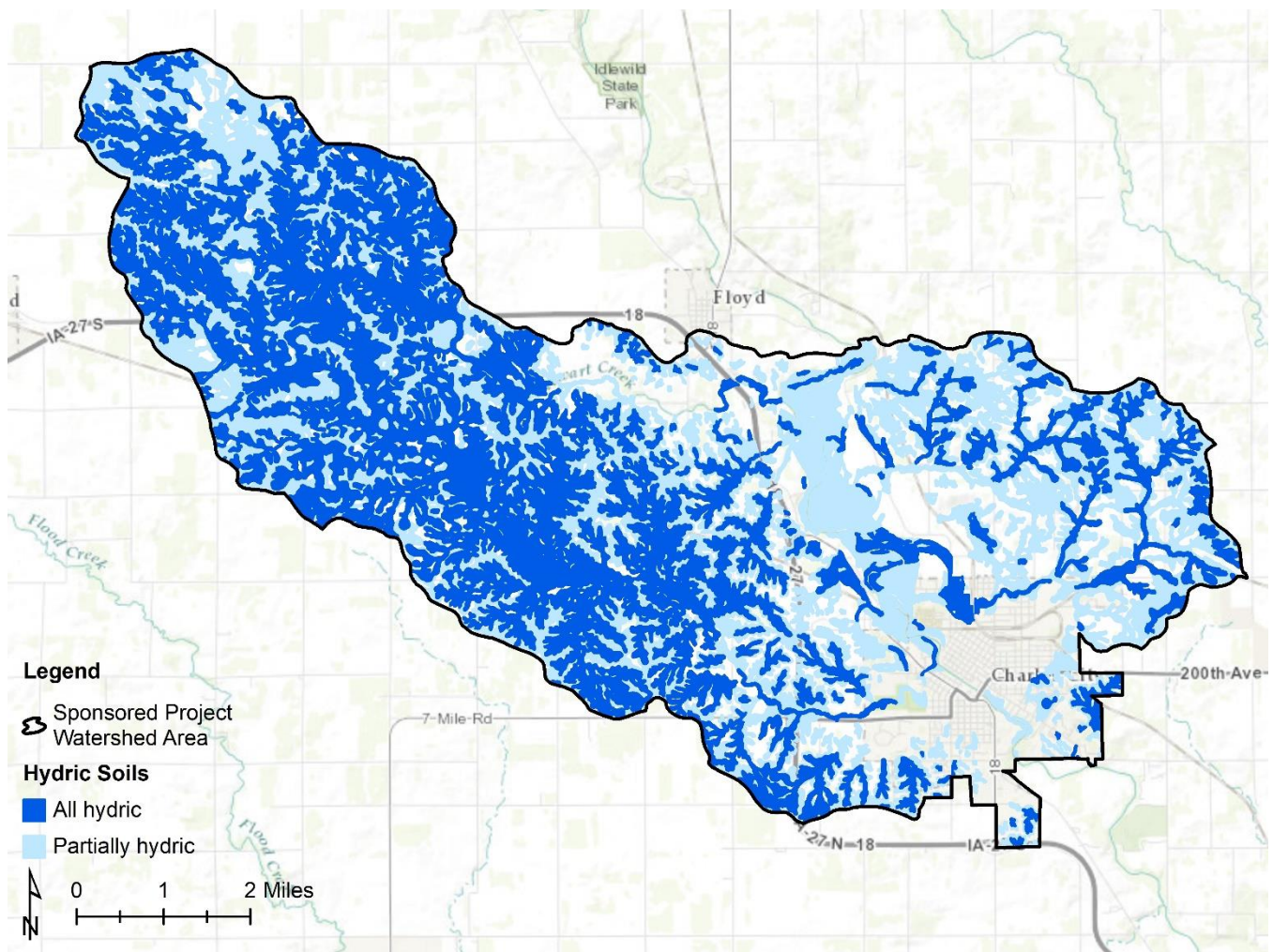


Figure 2.5.2. Soil map units in the Charles City Watershed that are classified as hydric.

Agricultural land within the watershed is likely to be tile drained in order to increase agricultural productivity. Public records of subsurface drainage infrastructure are sparse, but the USDA-Agricultural Research Service

(ARS) has developed a geographic coverage of soils in Iowa that are likely to be tile drained. Figure 2.5.3 uses this coverage to show where tile drainage may be necessary to maximize agricultural productivity but may not reflect all areas that currently have drainage tile.

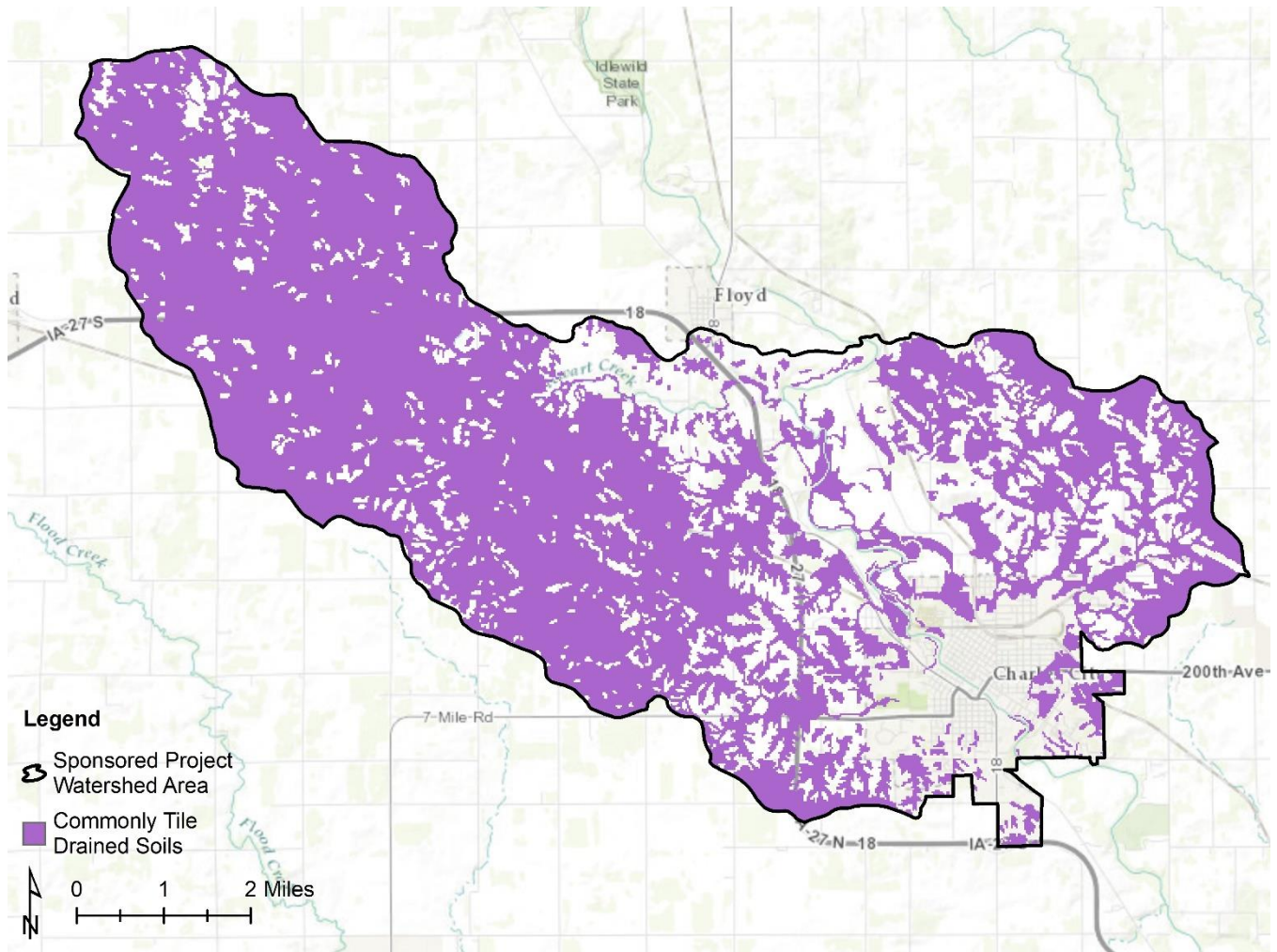


Figure 2.5.3. Areas in the Charles City Watershed requiring tile drainage to optimize agricultural production.

Soil map units in Iowa are assigned [Corn Suitability Rating 2](#) (CSR2) values, which are listed for the major soil series within the watershed in Table 2.5.2. Figure 2.5.4 displays the CSR2 values for land within the watershed. This map was generated by matching spatial SSURGO data to the Iowa Soil Properties and Interpretations Database (ISPAID) version 8.1. The Iowa CSR2 is an index that provides a relative ranking of soils mapped in Iowa based on their potential to be utilized for row crop production and thus are sometimes used to compare yield potential. CSR2 scores range from 5 (severely limited soils) to 100 (soils with no physical limitations, no or low slope and can be continuously farmed). The rating system assumes adequate management, natural precipitation, artificial drainage where necessary, no negative effects from flooding and no land leveling or terracing.



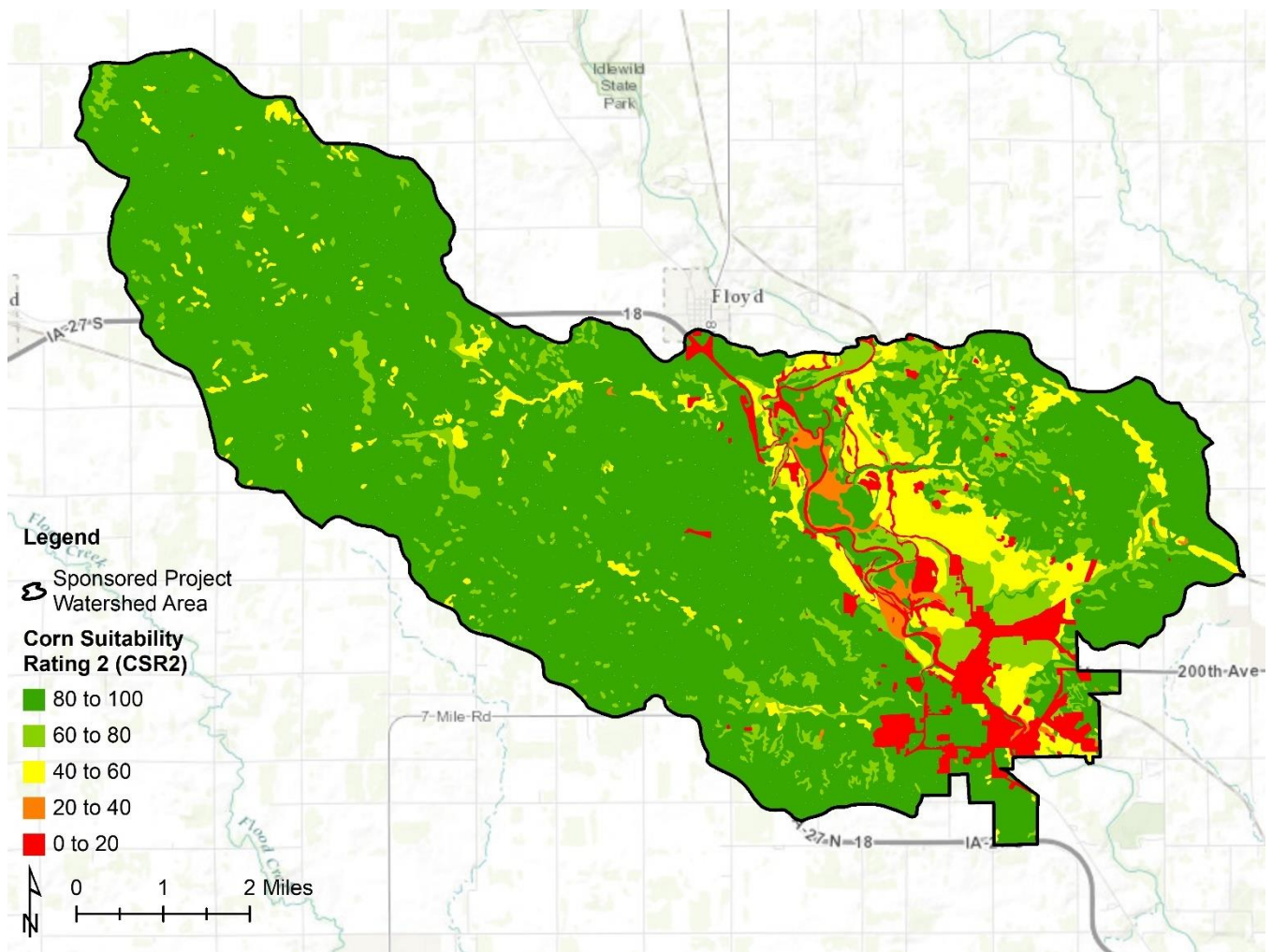


Figure 2.5.4. Corn Suitability Rating 2 (CSR2) values for land in the Charles City Watershed.

## 2.6. Land Use and Management

Land in the Charles City watershed is used primarily for row crop agriculture, along with perennial cover and developed land. The General Land Office (GLO) first surveyed the land in Iowa between 1832 and 1859. Surveyors recorded descriptive notes and maps of the landscape and natural resources such as vegetation, water, soil and landform. The collection of historic GLO maps and survey notes is one of few sources of information about native vegetation before much of Iowa's landscape was converted to agricultural land uses. The GLO surveyors classified land within the watershed as 80 percent prairie, 11 percent forested, 7 percent savanna and 2 percent water or wetlands. Figure 2.6.1 shows the distribution of these areas throughout the watershed. The current surface stream network connects and drains many of the naturally wet portions of the watershed.

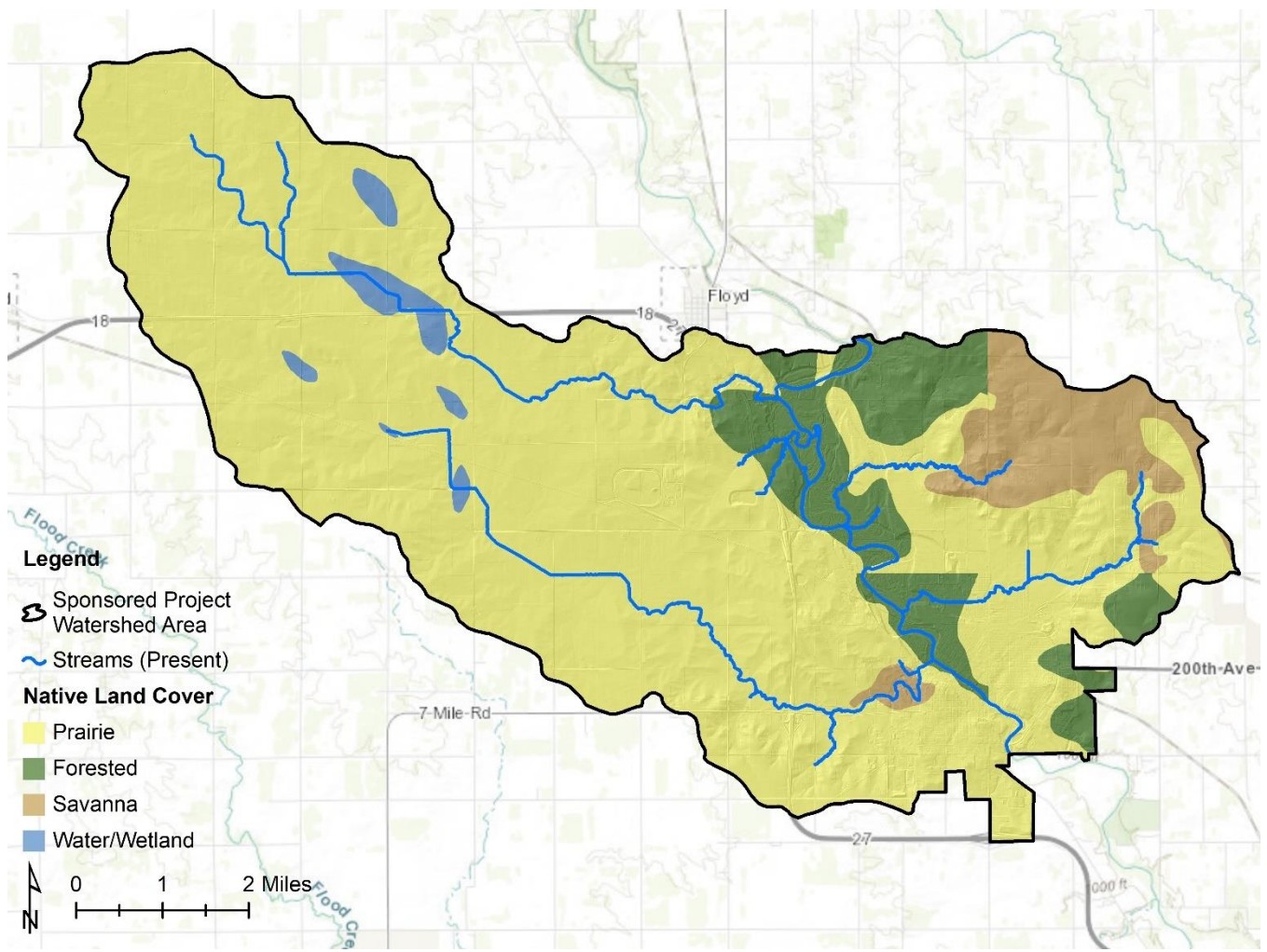


Figure 2.6.1. Native vegetation in the Charles City Watershed according to the GLO survey in the mid-nineteenth century. Present-day streams are shown.

Recent and current land use practices were assessed using the USDA-National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) 2003 through 2016 information and high-resolution IDNR data from 2009. Land use trends based on CDL data are shown in Figure 2.6.2. The IDNR land use information was developed from aerial imagery and LiDAR elevation data. A summary of the high-resolution IDNR land use data is presented in Table 2.6.1 and Figure 2.6.3. On average since 2003, approximately two-thirds of the watershed have been used for corn and soybean production.

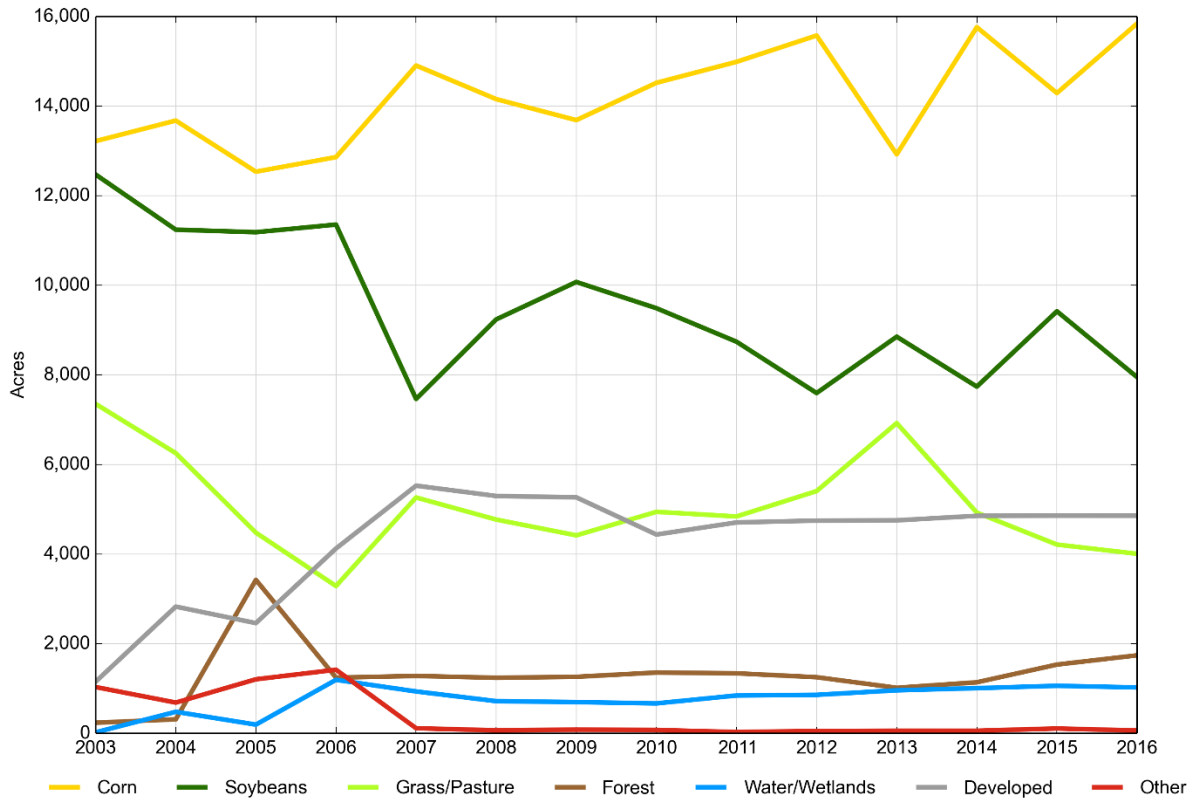


Figure 2.6.2. Charles City Watershed 2003 through 2016 land use according to CDL data.

Table 2.6.1. Charles City Watershed 2009 high-resolution land use according to IDNR data.

Land Use	Acres	Percent of Watershed
Water	344	1.0
Wetland	163	0.5
Coniferous Forest	181	0.5
Deciduous Short	604	1.7
Deciduous Medium	1,216	3.4
Deciduous Tall	1,036	2.9
Grass 1	3,415	9.6
Grass 2	1,886	5.3
Corn	13,917	39.2
Soybeans	10,397	29.3
Barren / Fallow	210	0.6
Structures	301	0.8
Roads / Impervious	1,706	4.8
Shadow / No Data	113	0.3
<b>Total</b>	<b>35,489</b>	<b>100</b>



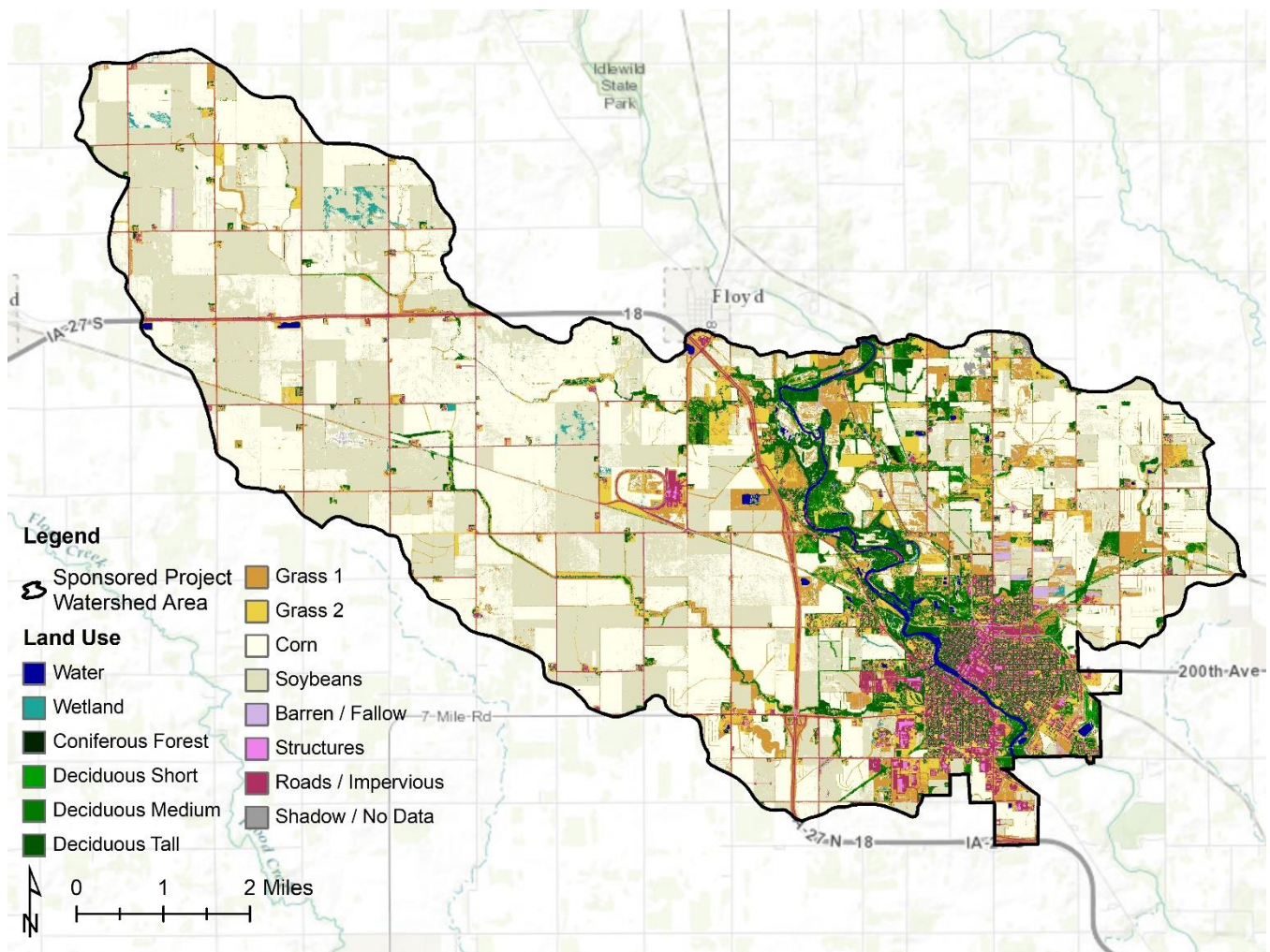


Figure 2.6.3. High-resolution 2009 land use map of the Charles City Watershed derived from IDNR data.

## 2.7. Population and Demographics

Charles City is the major incorporated community within the watershed. The southeast corner of Floyd also falls inside the watershed boundary. According to U.S. Census Bureau data, in 2010 Charles City had a population of 7,652 and Floyd had a population of 335. The estimated 2010 population in the watershed was 8,594 people. An analysis of publicly available land ownership data showed that approximately 8 percent of land in the watershed is owned by landowners outside of Iowa.

## 2.8. Existing Conservation Practices

Inventorying existing conservation infrastructure provides an important assessment of current conditions and is a useful exercise for determining the need for future conservation practice quantity and placement. Current conservation practices were assessed and catalogued using aerial photography, watershed surveys, stakeholder knowledge and structural practice location data provided by IDNR and Iowa State University (ISU). Many conservation practices were identified within the watershed, but determining levels of in-field management practices (e.g., nutrient management, no-till/strip-till, cover crops) can be difficult, so it is possible that this inventory does not capture all conservation within the watershed. Table 2.8.1 lists all practices and known existing implementation levels within the watershed. Figure 2.8.1 provides a map of existing conservation practices as of 2017.



Table 2.8.1 Inventory of Charles City Watershed existing conservation practices as of 2017.

Practice	Unit	Quantity
No-till/Strip-till	acres	1,710
Cover crops	acres	740
Nutrient management	acres	Unknown, est. 10%
Grassed waterways	feet	221,600
Terraces	feet	181,600
Buffers within 100' of streams	% perennial cover	83%
CRP perennial cover (as of 2008)	acres	up to 1,600
CREP wetland	sites	1
Floyd County Conservation Board land	acres	150

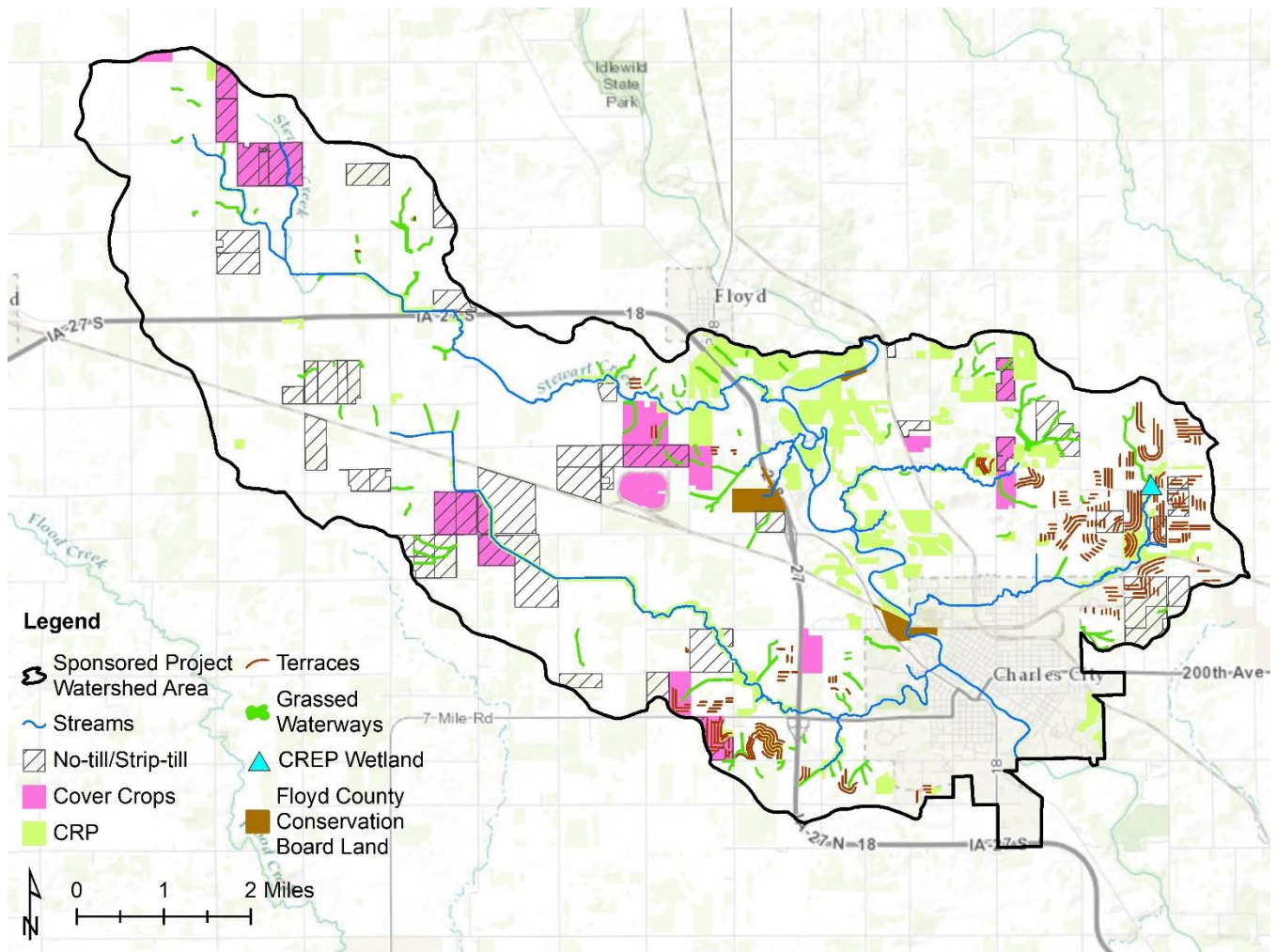


Figure 2.8.1. Conservation practices with known locations in the Charles City Watershed as of 2017.

## 2.9. Soil Erosion Assessment

Soil erosion for agricultural land in the watershed was estimated using factors from the Revised Universal Soil Loss Equation 2 (RUSLE2) for the various combinations of soils and land use within the watershed. RUSLE2 is a computer simulation model used to evaluate the impact of different tillage and cropping systems on soil sheet and rill erosion. The major RUSLE2 model factors incorporate climate, soils, topography and land management. The interactions between these factors drive the model results, but land use, crop rotation and tillage system

typically have the largest impacts on soil loss estimates within a watershed. Model inputs for land use were developed by integrating data from watershed surveys with crop rotation information available from the ARS. Based on the RUSLE2 analysis, sheet and rill erosion in the Charles City Watershed averages an estimated 1.03 tons per acre per year. The distribution of soil erosion rates across the watershed is shown in Figure 2.9.1. This estimated sheet and rill erosion rate aligns well with 1.10 tons per acre per year of simulated hillslope soil loss from 2007 through 2013 according to the [Daily Erosion Project](#) (DEP).

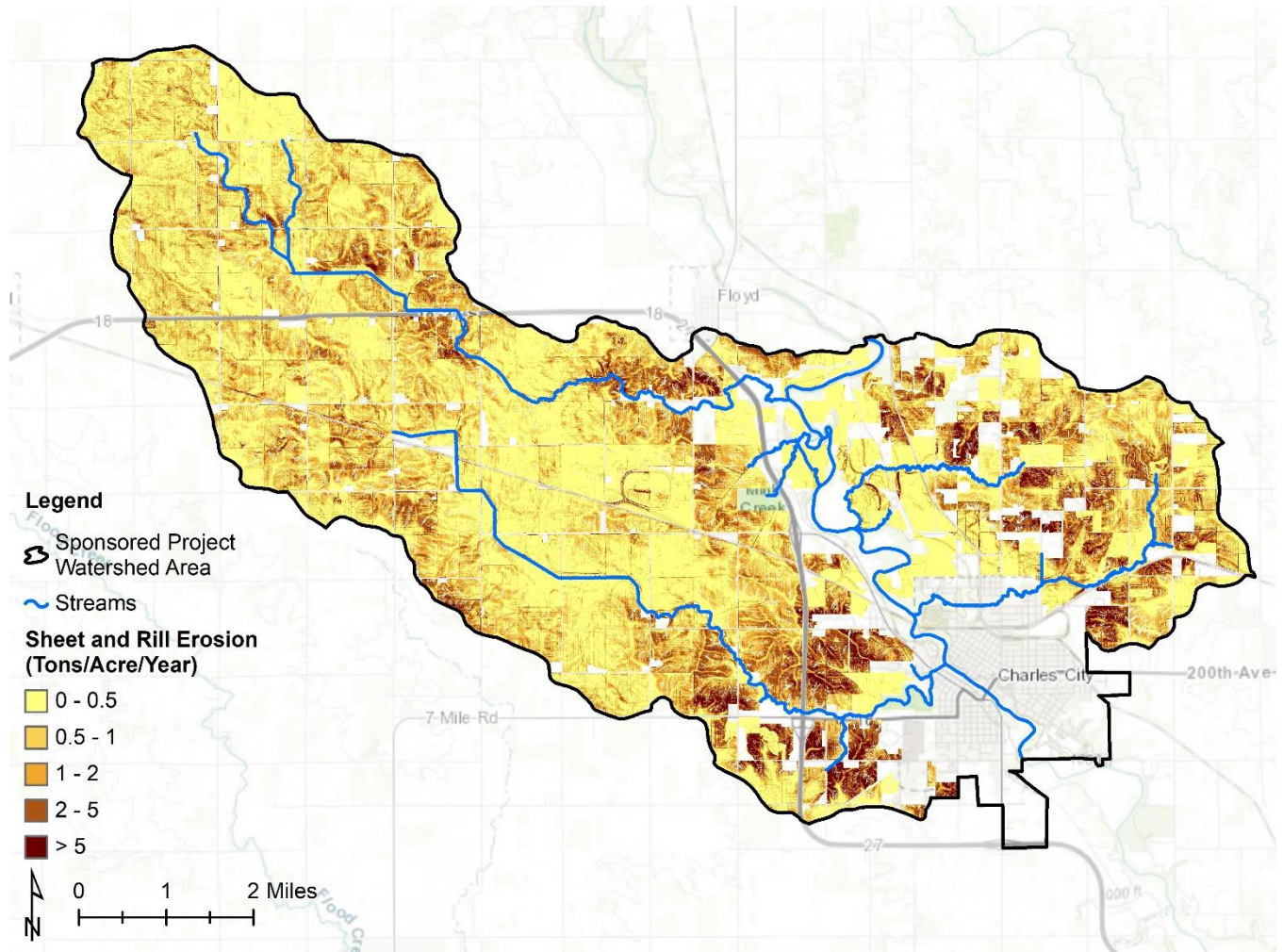


Figure 2.9.1. Estimated sheet and rill erosion rates based on soil types, topography and land use in the Charles City Watershed.

RUSLE2 and DEP estimates do not include any soil loss due to concentrated runoff such as ephemeral or classical gully erosion. Terrain analysis of the watershed was conducted to identify potential locations for gully initiation, which were then cross-referenced with land use data and existing conservation practice locations. The results of this analysis are displayed in Figure 2.9.2. This map shows potential for ephemeral gully erosion; actual locations of ephemeral gully erosion may vary.



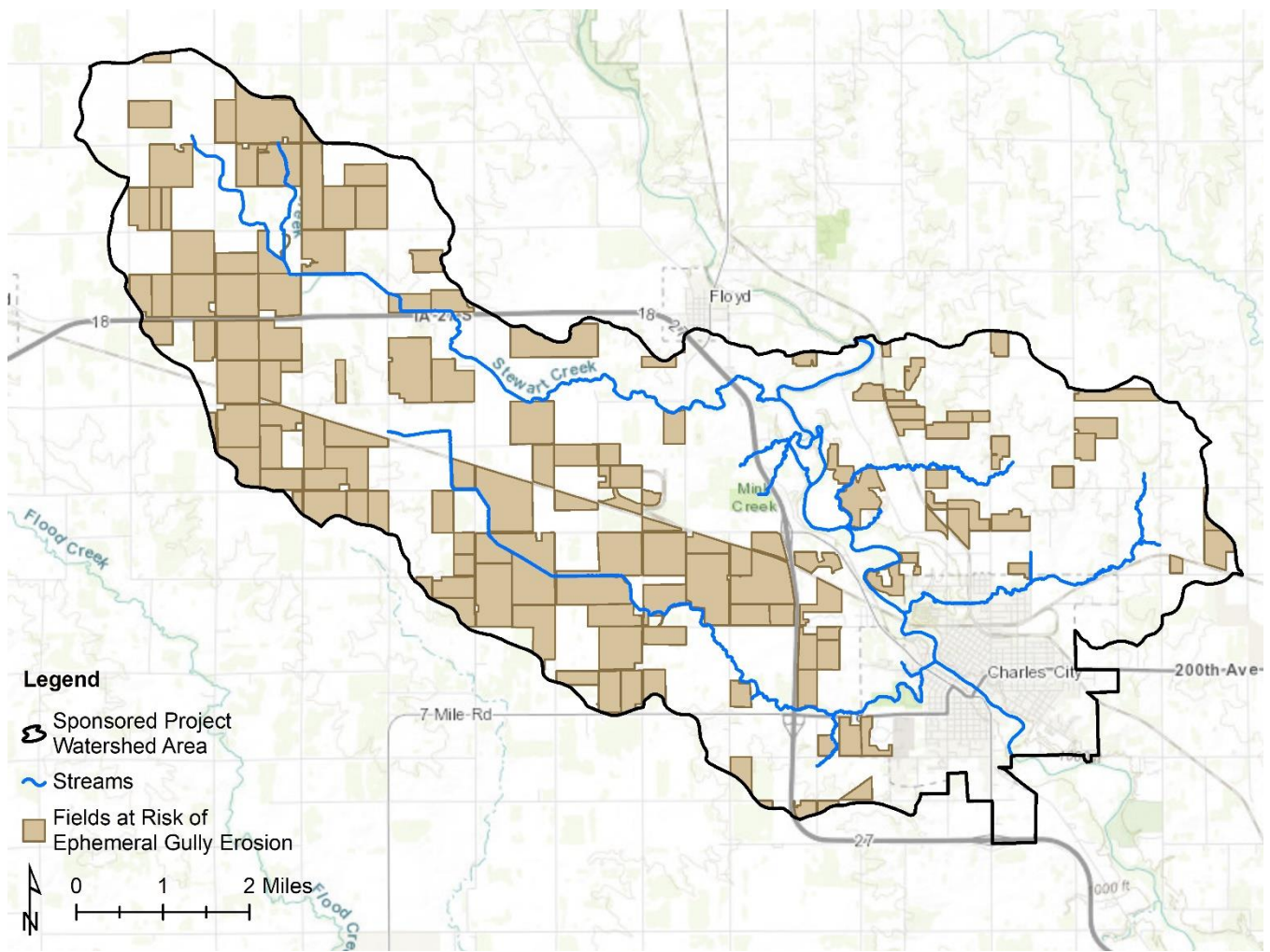


Figure 2.9.2. Locations of potential ephemeral gully erosion within the Charles City Watershed.

Sheet and rill erosion potential in the watershed is highest towards the south and east, which are also the portions of the watershed that have higher average slopes. These areas also align with soils that are classified as highly erodible, which are shown in Figure 2.9.3. Highly erodible land (HEL) in the watershed is primarily located east of U.S. Highway 18/Iowa State Highway 27, near the Cedar River and Charles City.

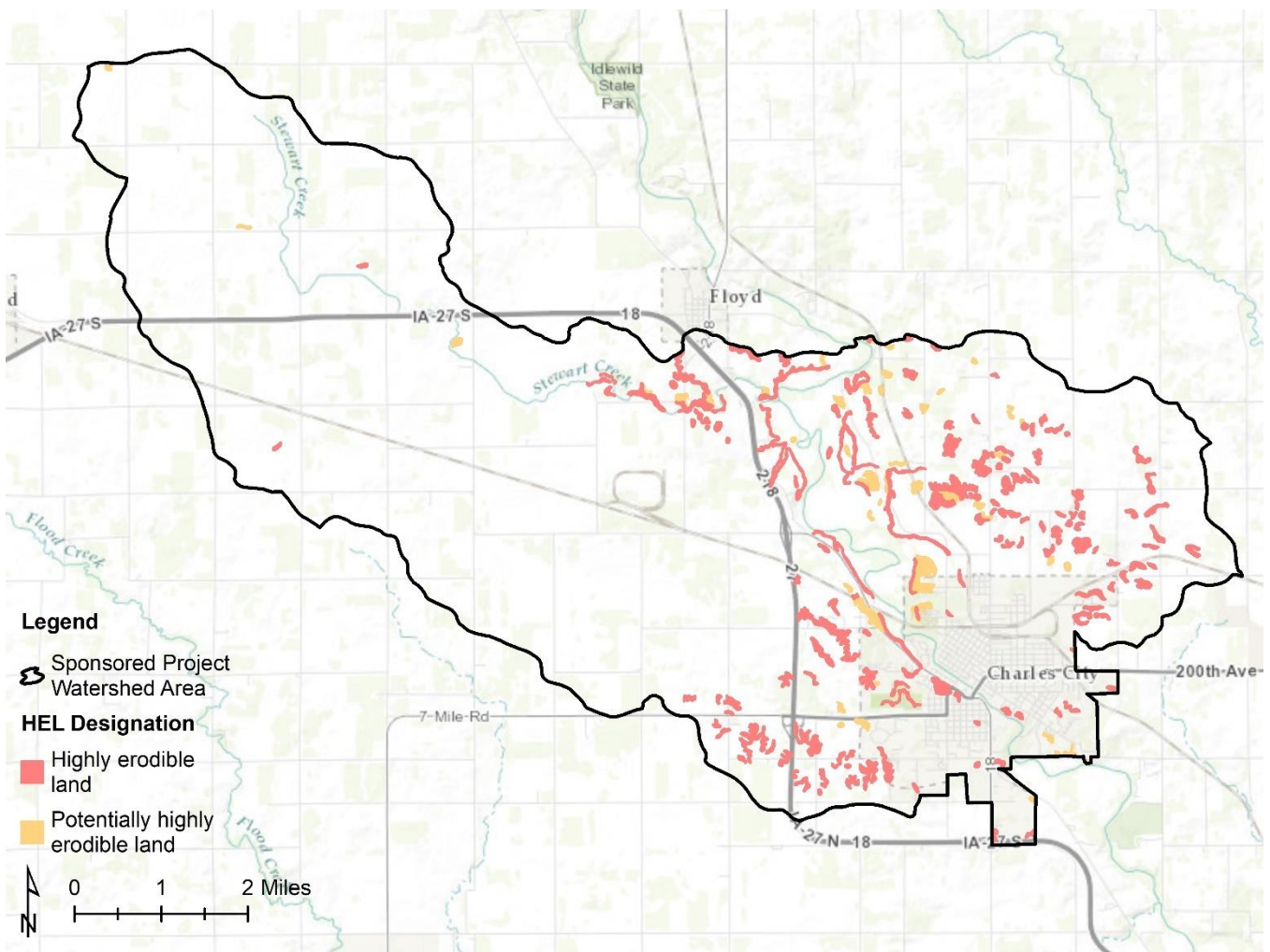


Figure 2.9.3. Highly erodible land (HEL) within the Charles City Watershed.

Not all sediment that moves small distances due to sheet and rill erosion ultimately leaves the watershed. Total sediment yield from the watershed is influenced by upland soil erosion rates, streambank erosion and the sediment delivery ratio (SDR), which reflects the proportion of sediment that is likely to be transported through and out of the watershed. The SDR depends on watershed size and shape, stream network density and conditions and topography. The SDR for the Charles City Watershed is estimated to be 10.8 percent. The total sediment load derived from sheet and rill erosion that is transported through the watershed is estimated to be 2,843 tons per year. Figure 2.9.4 shows areas of low and high sediment delivery to streams.



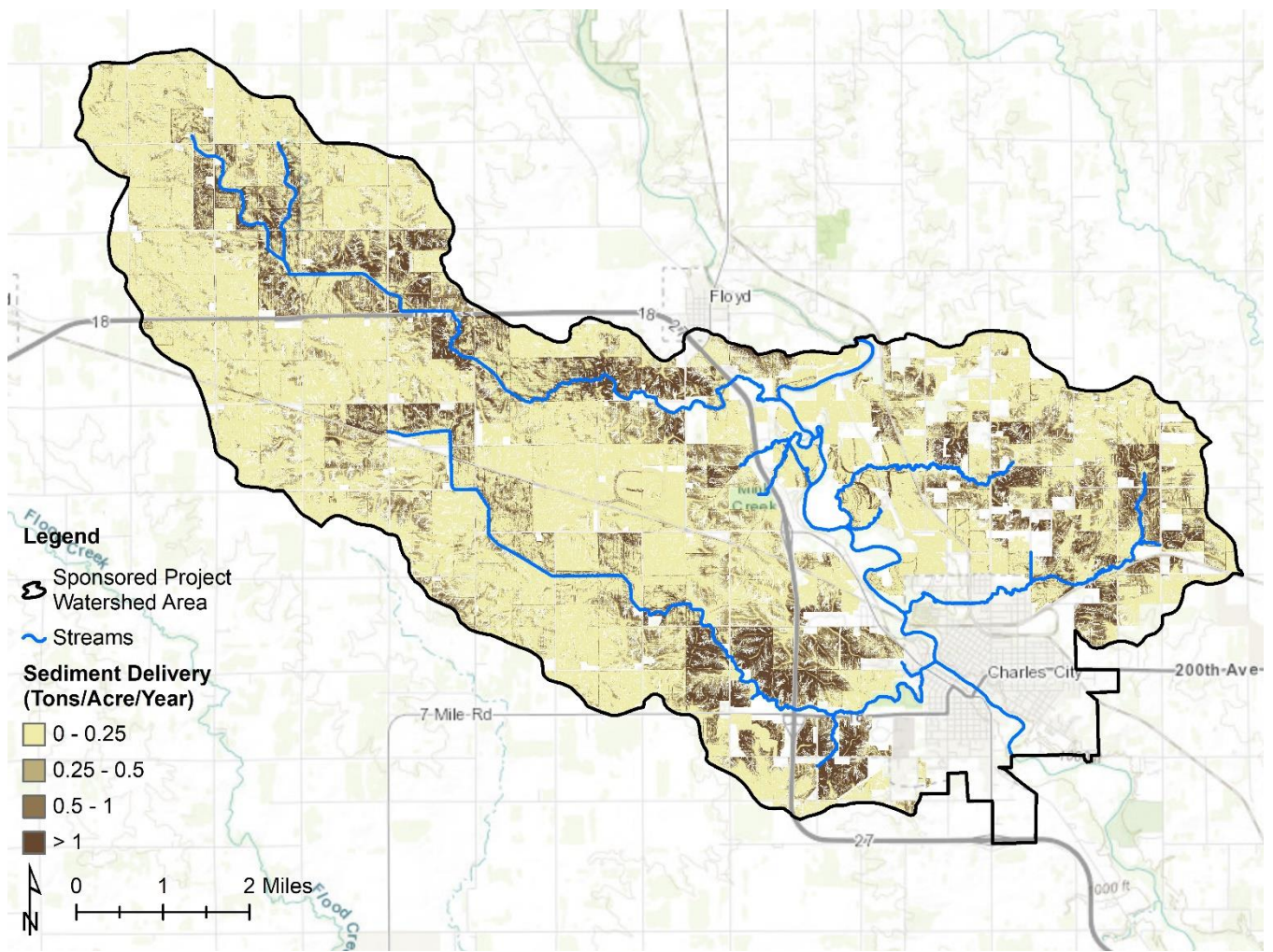


Figure 2.9.4. Estimated rates of sediment delivery to streams in the Charles City Watershed.

### 3. Water Quality and Conditions

#### 3.1. Cedar River Water Quality

The Charles City Watershed is a subwatershed of the Upper Cedar Watershed, which is located within the larger Cedar River Watershed (Figure 3.1.1). The Cedar River, near Cedar Rapids, is impaired for elevated levels of nitrate that impact the drinking water source of the city of Cedar Rapids. Because of this impairment, a Water Quality Improvement Plan (or total maximum daily load, TMDL) for nitrate was developed by the Iowa DNR and approved by the Environmental Protection Agency (EPA) in 2006.

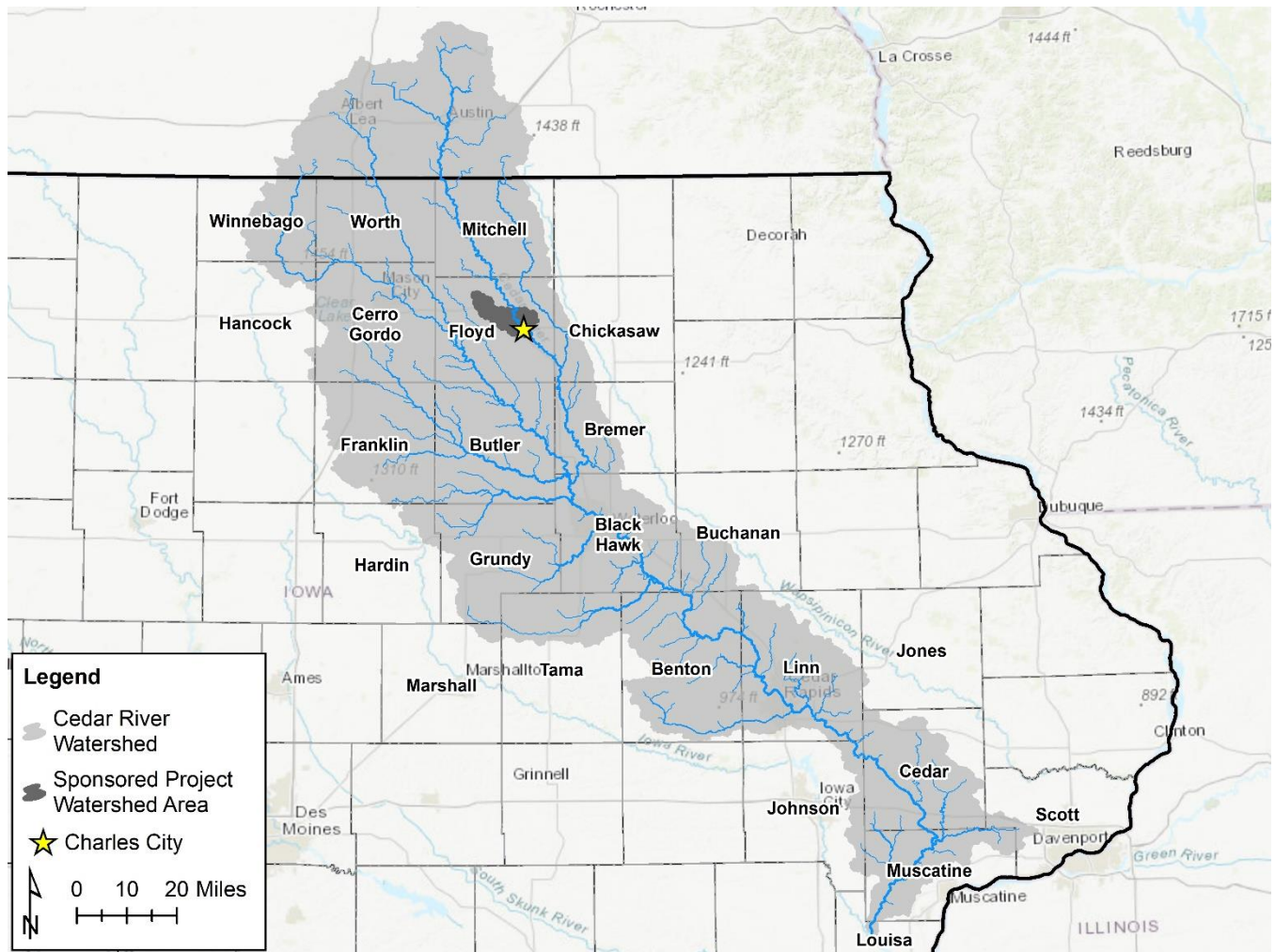


Figure 3.1.1. Location of the watershed and Charles City within the Cedar River Watershed.

The [Cedar River TMDL](#) was developed to address the nitrate impairment for an 11.6-mile segment of the Cedar River that flows adjacent to the city of Cedar Rapids' shallow alluvial wells, which was identified as impaired within the Iowa 2004 Integrated Report 305(b) assessment. The Class C designated use (drinking water) was determined to be impaired due to nitrate levels exceeding state water quality standards and the EPA maximum contaminant level (MCL). The applicable water quality standard for nitrate (nitrate as nitrogen, nitrate-N) is 10 milligrams per liter (mg/L). Accounting for a margin of safety (MOS) of 0.5 mg/L and the MCL, the target maximum daily nitrate-N concentration is 9.5 mg/L.

The TMDL identified nonpoint sources of nitrate as the primary cause of the Class C impairment. Water quality models used in the TMDL study determined that point sources and nonpoint sources contribute 8.8 and 91.2 percent, respectively, to the total nitrate load within the upstream watershed. The TMDL estimated that land in

the Upper Cedar Watershed contributes approximately 26 pounds of nitrate-N per acre per year. The TMDL reports a 35 percent reduction in the Cedar River nitrate concentration is necessary to attain a maximum daily nitrate-N concentration of 9.5 mg/L in order to meet water quality standards.

Within the Charles City Watershed, two segments of the Cedar River are listed as impaired. The river segment entering Charles City ([IA 02-CED-478](#)) was determined to have Class A1 (primary contact recreation) and Class HH (human health/fish consumption) impairments according to its [2016 assessment](#). The segment of the Cedar River flowing out of Charles City ([IA 02-CED-477](#)) was determined to have Class A1 and Class HH impairments and a potential Class B(WW-1) (warm water aquatic life) impairment according to its [2016 assessment](#). The Class A1 impairments have been attributed to indicator bacteria and elevated levels of mercury in fish are the cause of the Class HH impairments.

### **3.2. Tributary Water Quality**

There is little to no water quality information available for the tributary streams within the Charles City Watershed. Two segments of Drainage Ditch 3 ([IA 02-CED-584](#) and [IA 02-CED-583](#)) are listed in Iowa's water quality assessment database, but the designated uses were listed as Not Assessed in 2016 for both segments. Due to the lack of local water quality data, increased water quality monitoring is a formal goal of this watershed plan, and water quality monitoring recommendations are included in Section 7.

### **3.3. Point and Nonpoint Sources**

The INRS incorporates both point and nonpoint sources. Point sources with National Pollution Discharge Elimination System (NPDES) permits within the Charles City Watershed that have been identified as priorities for nutrient reduction within the INRS include [Cambrex Charles City, Inc.](#) and the [City of Charles City Water Pollution Control Plant](#), which has initiated the process of a facility upgrade to meet INRS standards. To achieve the watershed plan goal of meeting INRS nitrogen and phosphorus reduction goals for both point and nonpoint sources, it is expected that these facilities will adhere to technological and regulatory guidelines for nutrient reduction. Additional urban storm water management plans are detailed in Section 5.2. As this watershed plan focuses primarily on the upstream portion of the Charles City Watershed, the plan emphasizes nonpoint nutrient sources and prioritizes agricultural conservation practices to meet remaining nutrient reduction goals in order to improve water quality both within the Charles City Watershed and downstream.

### **3.4. Source Water Protection**

Protection of source water, or local drinking water resources, is important for human health within the Charles City Watershed. The IDNR Source Water Protection Program maintains an online database of source water protection plans, assessments and other information. Ground water capture zones for the [Floyd Municipal Water Supply](#), [Floyd Convenience Store](#), [Cedar River Harley Davidson](#) and [Charles City Water Supply](#) are tracked through this system, and the extents of these areas are shown in Figure 3.4.1.



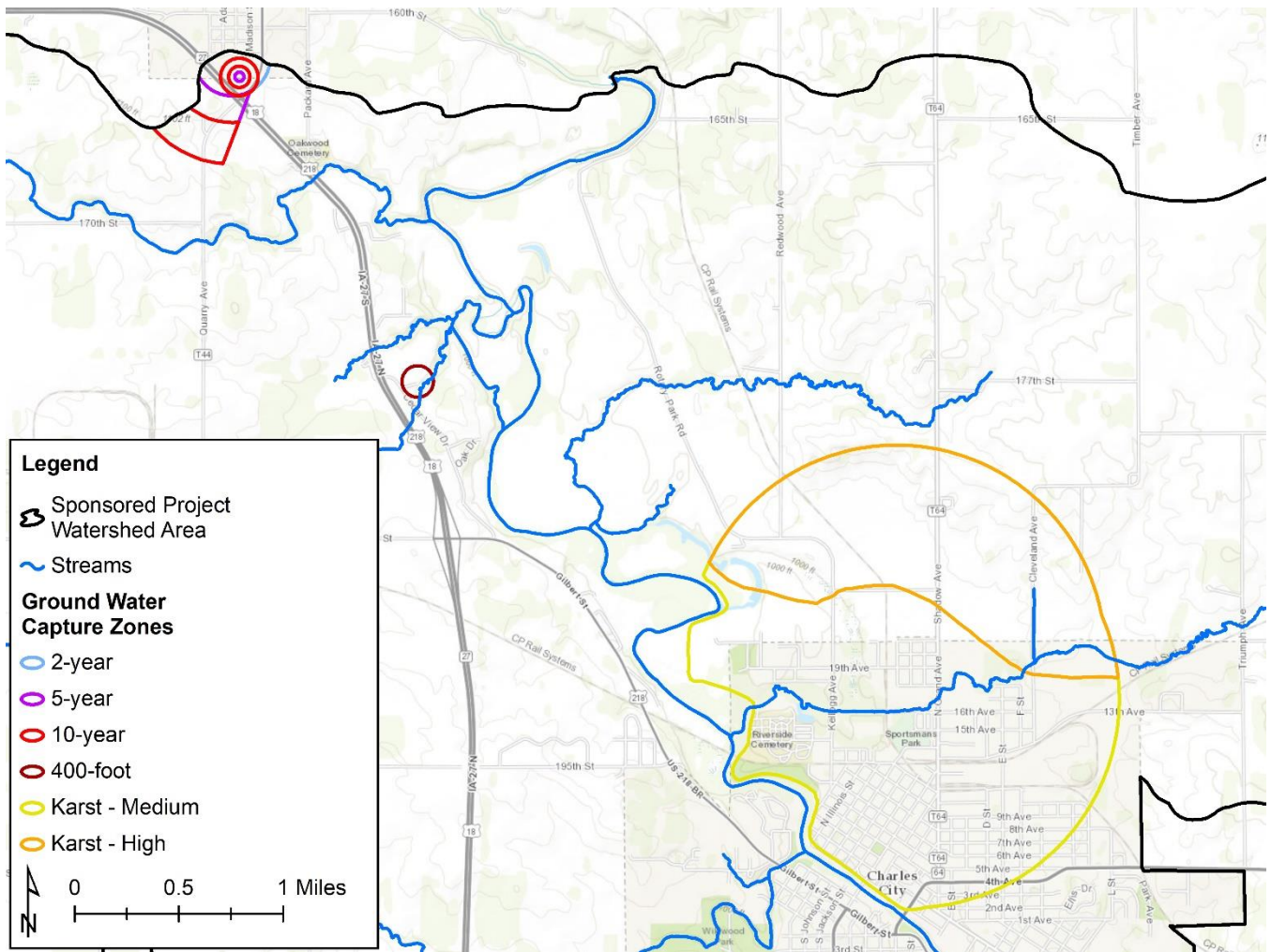


Figure 3.4.1. Priority areas for source water protection in the Charles City Watershed are located near Floyd and Charles City.



## 4. Goals and Objectives

This watershed management plan is a guiding document. Water and soil quality will only improve if conservation practices, or best management practices (BMPs), are implemented in the watershed. This will require active engagement of diverse local stakeholders and the continued collaboration of local, state and federal agricultural and conservation agencies, along with sustained funding. This plan is designed to be used by local agencies, watershed managers and citizens for decision support and planning purposes. The BMPs listed below represent a suite of tools that will help achieve soil, water, socioeconomic and ecosystem goals if appropriately utilized. It is up to all stakeholders to determine exactly how to best implement them. Locally driven efforts have proven to be the most successful in obtaining significant water quality improvements.

A key component of the watershed planning process is identification of the overall goals, as they will guide implementation approaches and activities. The goals listed in this plan were developed by watershed stakeholders to reflect current needs and opportunities, so this plan should be considered a living document. Changing social and economic conditions, Farm Bill revisions and new agricultural and conservation technologies may require that these needs, opportunities, goals and strategies be periodically reassessed. It is essential to allow for sufficient flexibility to respond to changing social, political and economic conditions while still providing guidance for future conservation efforts.

The statewide goals of the INRS provided an important starting point for goal development by stakeholders in the Charles City Watershed. The INRS is a scientific and technological framework for nutrient reduction in Iowa waters and the Gulf of Mexico from both nonpoint and point nutrient sources. The overall goals of the INRS are to reduce nitrogen and phosphorus loads by 45 percent. The INRS states that nonpoint sources need to reduce nitrate loading by 41 percent and phosphorus loading by 29 percent in order to achieve overall nutrient reduction goals.

The Nonpoint Source Nutrient Reduction Science Assessment portion of the INRS was initiated in 2010 to support development of the INRS approach for nonpoint sources by determining the nitrogen and phosphorus reduction effectiveness of specific practices. The agricultural conservation practices identified in the science assessment were broadly classified as nutrient management, land use change and edge-of-field practices. The science assessment illustrated that a combination of practices will be required to achieve nonpoint source nitrogen and phosphorus load reduction goals. The conceptual plan for the Charles City Watershed identified in Section 5.1 incorporates many of the nonpoint source practices assessed and included in the INRS.

Through the watershed planning process, the following goals were established for the Charles City Watershed and were prioritized by stakeholders:

- 1. Reduce soil erosion.**
- 2. Increase local water quality data through stream and tile monitoring.**
- 3. Increase agricultural returns on investment.**
- 4. Increase public education.**
- 5. Achieve Iowa Nutrient Reduction Strategy goals for nitrogen and phosphorus reduction.** (This includes both point and nonpoint sources. The nonpoint goal for nitrogen reduction of 41 percent will also meet the Cedar River nitrate TMDL target of 35 percent reduction.)
- 6. Increase soil organic matter by one percent.**
- 7. Increase resilience to extreme weather by reducing impacts of drought, flooding and flash flooding.**
- 8. Increase participation in a water quality practice to 90 percent of farm operations.**
- 9. Improve urban-rural partnerships.**
- 10. Maintain and increase upland and aquatic habitat and recreation opportunities.**

This watershed plan uses the year 2010 as the baseline for conservation practice implementation and determining progress towards reaching goals by 2030 because 2010 conditions reflect the pre-INRS status of the watershed. Watershed models were developed to determine the baseline, current and future nitrogen, phosphorus and sediment loads along with associated reductions in the Charles City Watershed. Table 4.1 provides estimates of watershed loading rates for the 2010 baseline and conditions during and after the implementation of practices identified in this watershed plan. Table 4.2 provides estimates of percent load reduction for each phase relative to the 2010 baseline.

*Table 4.1. Estimated baseline (2010), current (2017) and future rates of nitrate, phosphorus and sediment loading from cropland in the Charles City Watershed.*

	<b>Baseline</b>	<b>2017</b>	<b>2020</b>	<b>2024</b>	<b>2030</b>
<b>Nitrate-N (pounds/year)</b>	624,000	604,432	568,160	442,320	362,567
<b>Phosphorus (pounds/year)</b>	4,549	3,991	3,416	2,425	1,748
<b>Sheet and rill erosion (tons/year)</b>	26,299	24,588	22,067	18,656	16,107
<b>Sediment delivery (tons/year)</b>	2,843	2,505	2,175	1,662	1,344

*Table 4.2. Modeled nutrient and sediment load reductions from the baseline for each watershed plan phase.*

	<b>Baseline</b>	<b>2017</b>	<b>2020</b>	<b>2024</b>	<b>2030</b>
<b>Nitrate-N (percent reduction)</b>	-	3%	9%	29%	42%
<b>Phosphorus (percent reduction)</b>	-	12%	25%	47%	62%
<b>Sheet and rill erosion (percent reduction)</b>	-	7%	16%	29%	39%
<b>Sediment delivery (percent reduction)</b>	-	12%	23%	42%	53%

The phases and associated practices and implementation levels are detailed in Section 6. A practice-based model was used to determine the nitrogen load reductions based on practice nitrate reduction efficiencies from the Iowa Science Assessment of Nonpoint Source Practices to Reduce Nitrogen Transport in the Mississippi River Basin section of the INRS. Soil erosion projections were based on the watershed RUSLE2 model results and sediment delivery was calculated using a Sediment Delivery Model. For the purposes of this plan, only sediment derived from cropland sheet and rill erosion was used for calculations, so these estimates do not include streambank and gully erosion. Along with practice phosphorus reduction efficiencies from the Iowa Science Assessment of Nonpoint Source Practices to Reduce Phosphorus Transport in the Mississippi River Basin section of the INRS, a phosphorus enrichment ratio of 1.6 pounds of phosphorus per ton of upland sediment was used to estimate phosphorus loading.

In addition to the locally adopted 2030 target to achieve watershed goals, it is important to acknowledge that this timeline aligns with that of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force (or [Hypoxia Task Force](#), HTF). In a 2017 report, the HTF affirmed a deadline to achieve its Gulf of Mexico hypoxic zone goal of 45 percent reduction by 2035 and added an interim target of 20 percent nutrient load reduction by 2025. If the watershed conceptual plan (Section 5) and implementation schedule (Section 6) are implemented as planned, nitrate and phosphorus loads from the Charles City Watershed are expected to be reduced by 29 percent and 47 percent, respectively, by 2025, which would exceed the interim milestone recommended by the HTF.

## 5. Conceptual Plan

### 5.1. Agricultural Priorities

Best management practices (BMPs) are part of the foundation for achieving watershed goals. BMPs include practices and programs designed to improve water quality and other natural resource concerns such as changes in land use or management, structural pollutant control and changes in social norms and human behavior pertaining to watershed resources along with their perception and valuation. Efforts are made to encourage long-term BMPs, but this depends upon landscape characteristics, land tenure, commodity prices and other market trends that potentially compete with conservation efforts. With this in mind, it is important to identify all possible BMPs needed to achieve watershed goals. From an initial list of potential practices, priority practices were identified by narrowing the list to those practices most acceptable to watershed stakeholders. Watershed planning facilitators asked stakeholders to score BMPs based on likelihood of implementation or adoption. The results of this exercise are shown in Figure 5.1.1.

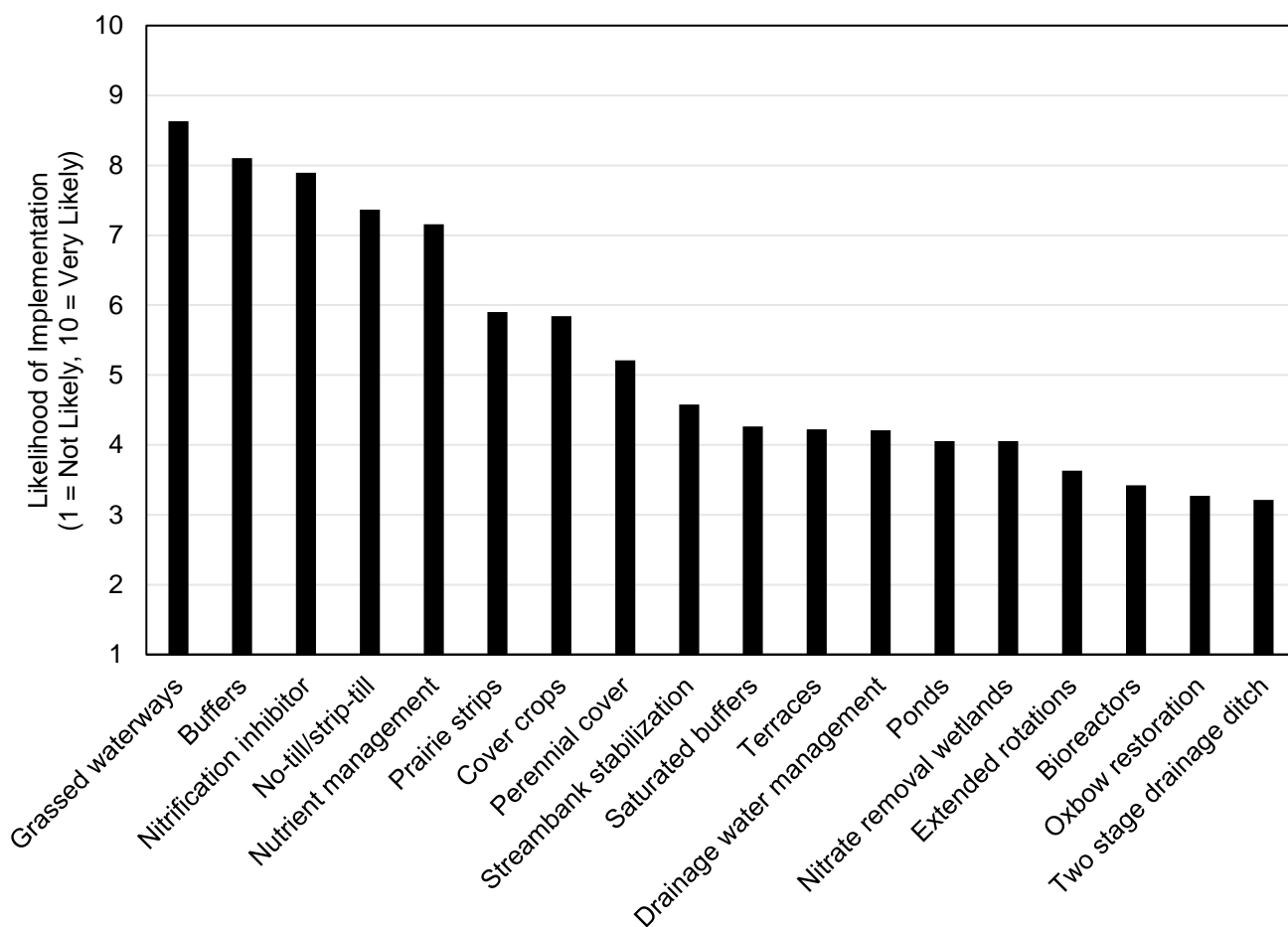


Figure 5.1.1. Results of the BMP adoption likelihood assessment.

When selecting and implementing BMPs, it is important to identify if a particular practice is feasible in a given location. Site feature suitability and practice alignment with stakeholder values should be considered. It also is important to determine how effective the practice will be at achieving goals, objectives and targets. Table 5.1.1 provides a list of BMPs identified by watershed stakeholders and a rating of each practice's efficacy to address identified water and soil goals. While only the practices italicized in Table 5.1.1 are included in the conceptual plan and nutrient reduction calculations, the other practices will be important to consider when making decisions about water and soil improvement.



Table 5.1.1. Best management practices and relative impact scores (3 = High impact, 2 = Moderate impact, 1 = Low impact, 0 = No impact). *Italicized BMPs are those included in the conceptual plan.*

	Practice	Soil Erosion	Nitrogen Reduction	Phosphorus Reduction
In-Field	<i>Nutrient Management</i>	0	1	1
	Nitrification Inhibitor	0	1	0
	<i>Cover Crops</i>	3	3	3
	Perennial Cover	3	3	3
	<i>Prairie Strips</i>	3	3	3
	Extended Rotations	3	2	2
	<i>No-Till/Strip-Till</i>	3	0	3
	<i>Grassed Waterways</i>	2	0	2
	Drainage Water Management	0	3	0
Edge-of-Field	<i>Terraces</i>	2	0	2
	<i>Bioreactors</i>	0	3	0
	<i>Saturated Buffers</i>	0	3	1
	Buffers	0	1	3
In/Near-Stream	Ponds	0	1	3
	<i>Nitrate Removal Wetlands</i>	0	3	1
	Streambank Stabilization	0	0	2
	Two-Stage Ditch	0	1	0
	Oxbow Restoration	1	3	2

Figure 5.1.2 (following page) provides a map of a conceptual BMP implementation scenario that sites BMPs in locations intended to achieve maximum benefit (e.g., nitrate removal wetlands placed at strategic locations or bioreactors placed at likely drainage tile outlets). See Appendix A for larger conceptual plan maps. The BMP conceptual plan is ambitious, but this level of implementation is needed to achieve the goals identified in this watershed management plan. This scenario is one of a variety of potential combinations of BMPs that would allow for this plan's goals to be reached. Deviations from the proposed implementation plan should be made with the knowledge that additional or alternative practices may then be needed in other locations within the watershed to ensure that goals are met. For example, cover crops grown within a wetland drainage area may not result in the same water quality benefit at the watershed outlet as cover crops grown downstream of a wetland.

A team of USDA-Agricultural Research Service (ARS) scientists have developed the [Agricultural Conservation Planning Framework](#) (ACPF) to facilitate the selection and implementation of conservation practices in watersheds with predominately agricultural land uses. The ACPF outlines an approach for watershed management and conservation. The framework is conceptually structured as a pyramid. This conservation pyramid is built on a foundation of soil health. Practices that build soil health will support watershed goals due to improved soil function and associated benefits of erosion control, water infiltration and retention, flood reduction, increased soil organic matter and improved nutrient cycling. Management practices that build soil health and improve agricultural profitability over the long-term, such as nutrient management, cover crops and no-till/strip-till, should be implemented on all cropland within the watershed. The priority cover crop zones delineated in Figure 5.1.2 have been identified for maximum water quality improvement potential at the watershed outlet. Following the conservation pyramid concept, structural practices to control and treat water should then be installed at specific in-field, edge-of-field and in-stream locations where maximum water quality benefits can be realized.

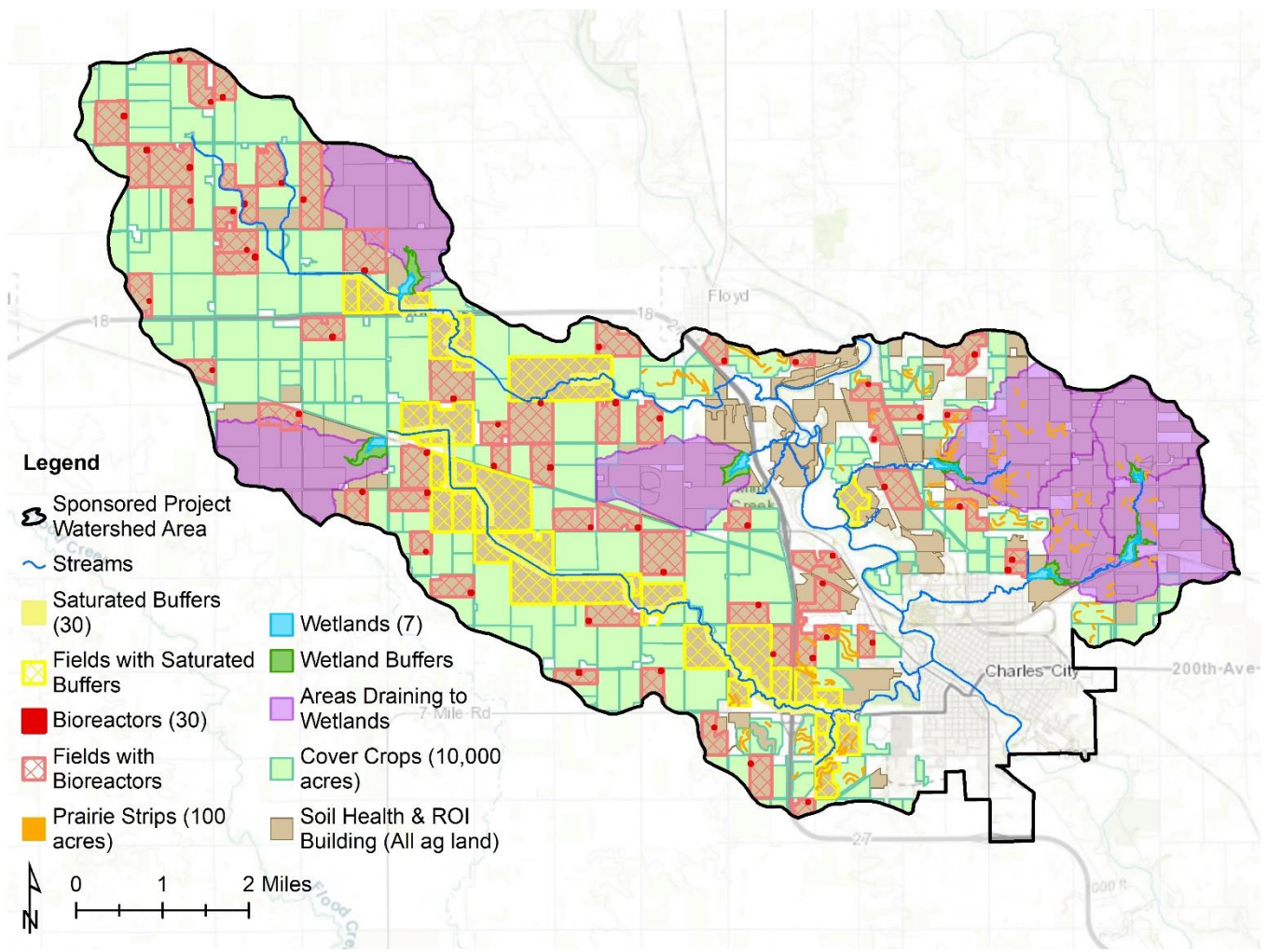


Figure 5.1.2. Conceptual plan for agricultural BMP implementation in the Charles City Watershed. Appendix A contains detailed maps.

The ACPF includes a software mapping toolbox to identify potential locations for conservation practice adoption. Selected results of applying these siting tools to the Charles City Watershed have been incorporated into this conceptual plan. Appendix B contains detailed ACPF maps for all potential BMPs within the watershed. The ACPF maps contain many practices in more locations than necessary to achieve water quality goals, so along with the conceptual plan displayed in Figure 5.2.1 serving as the overarching guide, the ACPF results can be used to adapt practice adoption as needed during the implementation phase of the watershed project.

The practices proposed in this conceptual plan were selected primarily for their soil health and water quality impacts to maintain focus on the goals of the Charles City Watershed. The recommended practices will mitigate some risk of bacteria transport to streams in Charles City Watershed and the Cedar River, but additional practices should be adopted where applicable in order to address the bacteria impairments in the Cedar River. Such practices include adhering to manure management plans, maintaining manure applicator certifications, using setback distances for manure application, updating septic systems, constructing monoslope buildings for livestock, maintaining or planting stream buffers, constructing stream crossings for cattle and taking precautions to avoid over-application of manure or equipment failure. Together with the practices identified in the conceptual plan and implementation schedule, these practices should contribute to reduced nutrient and bacteria transport to the Cedar River.

## 5.2. Urban Priorities

The City of Charles City has prioritized urban conservation practices by focusing on two priority watershed areas to implement Low Impact Development (LID) practices around the intersection of South Main Street and 9th Street along with an area just off Jackson Street near downtown. These two areas were determined by the city and its partners to be the best locations to accomplish the watershed goals and objectives. Practices selected will follow the design criteria within the [Iowa Storm Water Management Manual](#) and at a minimum treat the Water Quality Volume first 1.25 inches of rainfall within a 24-hour period. In locations where space allows the city will consider sizing the practices to treat the Channel Protection Storage Volume of 2.4 inches of rainfall to reduce peak flows in the Cedar River.

In 2014 Charles City received a grant from the Iowa Economic Development Authority to convert the blighted area at the intersection of South Main Street and 9th Street into a Net Zero Development, now called the Parkside Development Area. This method of construction would build homes that would require minimal use of natural resources and manage all storm water on site. Along with the construction of the homes, bioswales and a permeable paver street have been installed in the subdivision, which are treating the majority of the runoff from this area.

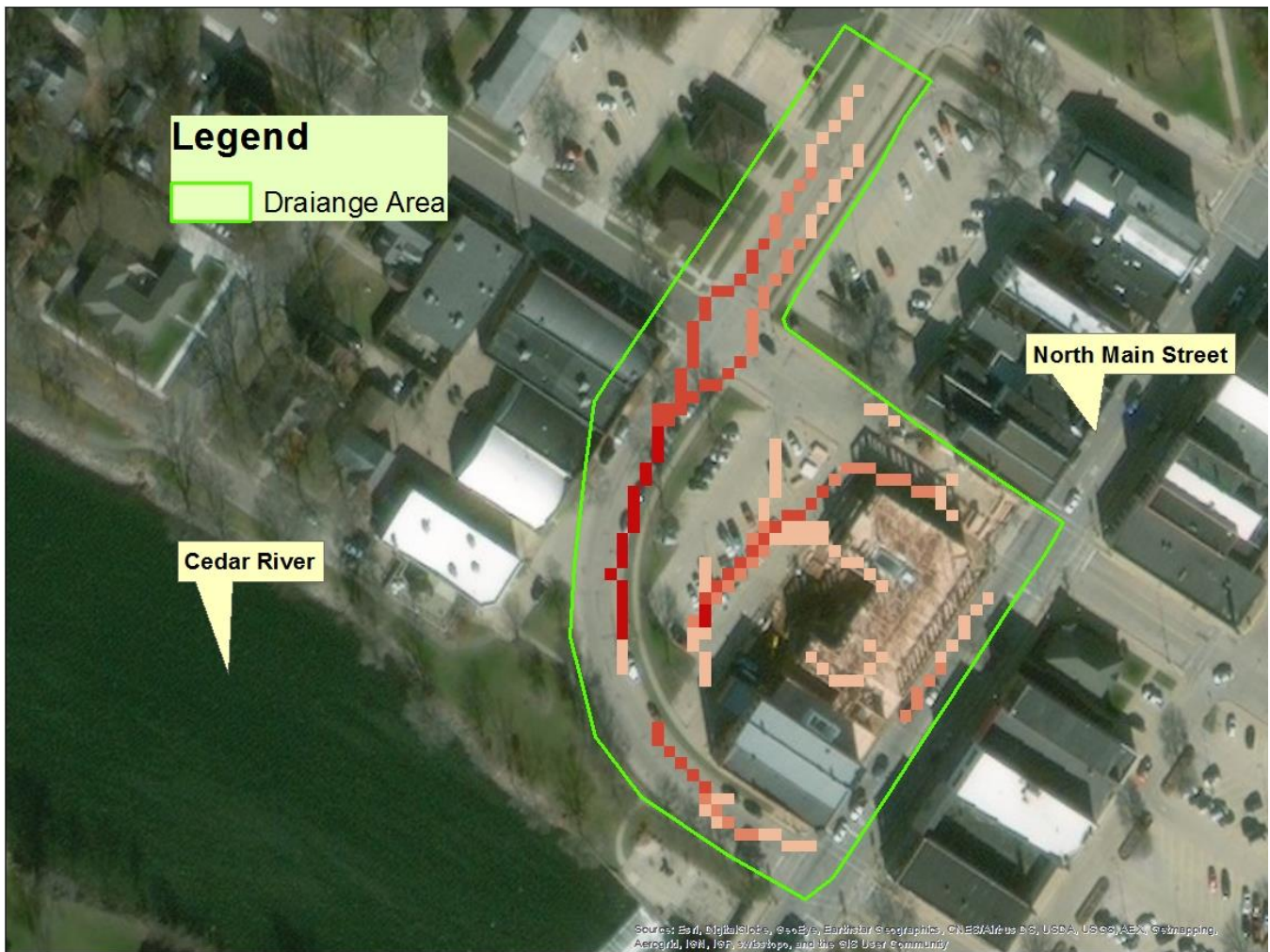
The city wants to expand upon previous successes and implement additional practices within this area of town. After working with Conservation Design Forum and partners it was determined the existing pavement along 9th Street could be converted to permeable pavers. Due to right-of-way constraints and accessible city owned property, permeable pavers are the only practice that could fit to adequately treat the storm water on site. The integration of the permeable pavers would dovetail into the existing LID practices to completely treat storm water runoff from this subwatershed in town. There are currently 6.1 acres of urban runoff that flows into the street before entering the storm sewer system and discharging into the Cedar River. These permeable pavers would capture and treat the runoff before it enters the storm sewer system. Figure 5.2.1 is a map showing the proposed project location along with the associated drainage area.





Figure 5.2.1. Proposed permeable paver installation location and contributing subwatershed in the Parkside Development Area in Charles City.

The downtown corridor of Charles City is the area of town with the highest impervious values the city. The high impervious values coupled with the proximity to the river result in the highest delivery rates of pollutants and volume of storm water in the city. These factors lead the city to focus on the downtown area for possible project locations. During its search, the city identified a future project along Jackson Street on the southwest corner of the downtown corridor adjacent to the Cedar River. Currently this 3.5-acre subwatershed is fully developed with a parking lot that sheds all its runoff directly into the river. Figure 5.2.2 is a map showing the area as it currently exists along with the watershed area and storm water flow lines.



*Figure 5.2.2. Storm water runoff flowpaths from the Jackson Street project area towards the Cedar River in Charles City.*

The city is looking to revamp this area and wants to integrate LID practices into the construction of the project versus trying to retrofit them into existing construction elsewhere downtown. Currently the city is planning to replace the existing parking lot and add LID practices within green spaces in lieu of additional impervious surfaces. Unlike the other targeted area there will be green space to integrate practices here, which gives the city additional options versus just permeable pavers. Depending on the final design of the parking lot, the city will explore using a combination of rain gardens, bioretention cells and bioswales to treat the runoff from this area. Figure 5.2.3 is a concept drawing of the parking lot design.





Figure 5.2.3. Potential layout of new parking lot at Jackson Street in Charles City with integrated LID practices.



## 6. Implementation Schedule

Implementation schedules are intended to serve as a reference tool to recognize tasks scheduled for the upcoming year and to identify and focus the necessary resources for the current phase of the project. The implementation schedule should be adaptable and updated on a regular basis due to shifting priorities, unexpected delays and new opportunities.

The 13-year phased implementation schedule in Table 6.1 was approved by watershed stakeholders and should be used to set yearly objectives and gauge progress. The goals listed for each phase are intended to build upon existing levels and previous phases, so practice retention is also important. Practices included in the implementation schedule only include those identified to reach the watershed plan goals. Practices that are not included in the implementation schedule such as drainage water management, extended rotations, stream buffers and streambank stabilization should be promoted and implemented wherever appropriate. In-field management practices such as no-till/strip-till, cover crops and nutrient management are applicable and recommended for all cropland, so the levels below should be considered minimum goals.

*Table 6.1. Watershed plan implementation schedule with three project phases for the Charles City Watershed.*

<b>Practice</b>	<b>Unit</b>	<b>Existing</b>	<b>2018-2020</b>	<b>2021-2024</b>	<b>2025-2030</b>	<b>Total</b>
No-till/Strip-till	acres	1,710	2,500	3,290	2,500	10,000
Cover crops	acres	740	1,760	5,000	2,500	10,000
Nutrient management	acres	Unknown	3,000	5,000	4,000	12,000
Prairie strips	acres	-	20	50	30	100
Grassed waterways	feet	221,600	<i>As needed for erosion control</i>			
Terraces	feet	181,600	<i>As needed for erosion control</i>			
Saturated buffers/Bioreactors	sites	-	5	40	15	60
Wetlands	sites	1	1	3	2	7

## 7. Monitoring Plan

Monitoring is an essential component of watershed plan implementation and provides an opportunity to assess progress. Monitoring can come in many different forms including water monitoring, biological surveys, soil and plant tissue sampling as well as social assessments. This section describes recommendations for future monitoring actions to document improvements resulting from watershed plan implementation.

### 7.1. Stream Monitoring

Perhaps the most important monitoring activity is stream monitoring. In addition to modeled nutrient reductions, water monitoring results will be key indicators of water quality improvement in the Charles City Watershed. Monitoring data within the watershed are sparse. A small network of stream sites could be established to build a baseline database and track water quality trends as the watershed plan is implemented. Figure 7.1.1 shows recommended locations to collect water samples from Stewart Creek, Drainage Ditch 3 and Hyers Creek. Location information for these sites is detailed in Table 7.1.1.

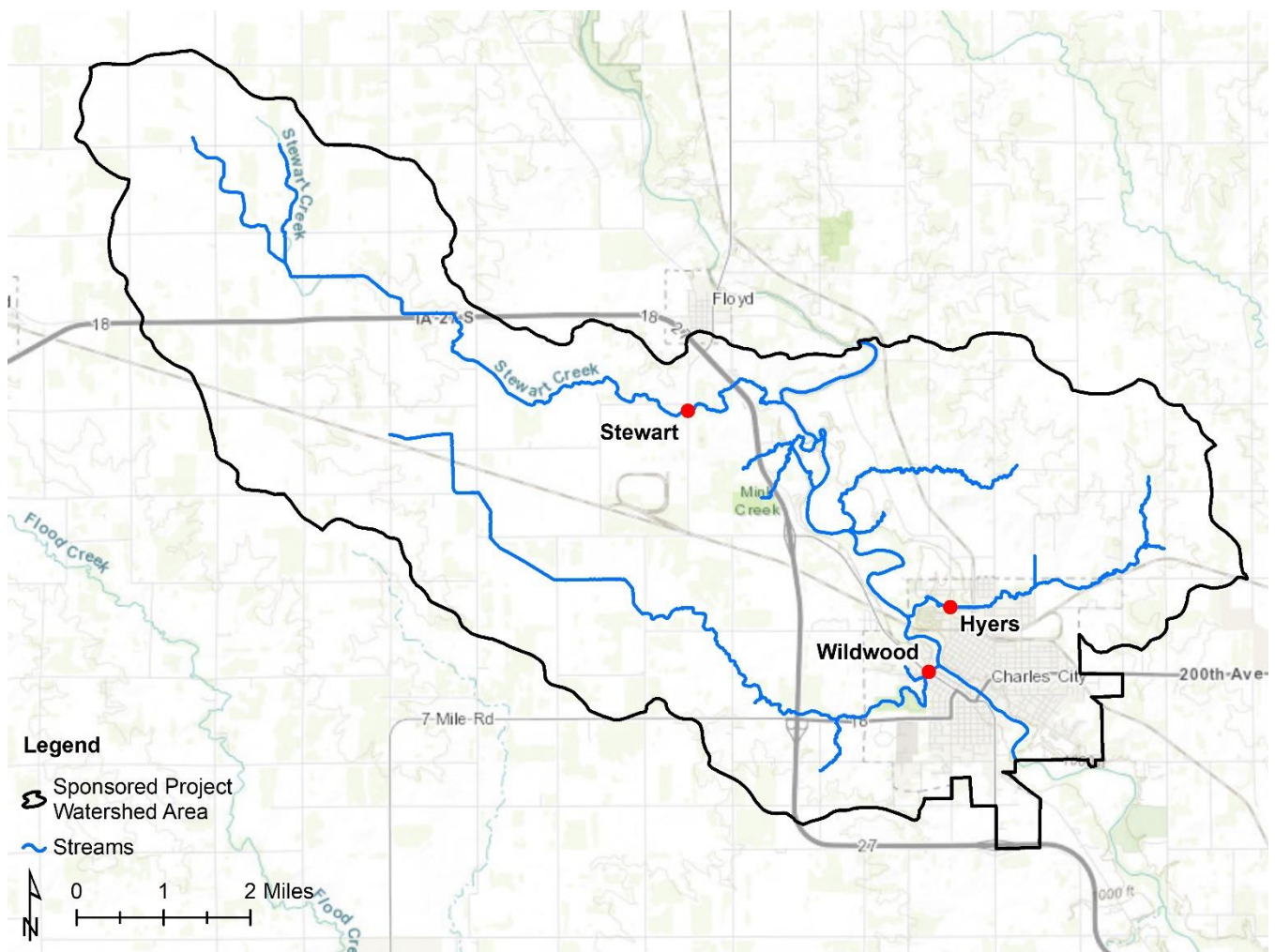


Figure 7.1.1. Recommended locations for collection of stream water samples in the Charles City Watershed.

Table 7.1.1. Location information for three potential stream monitoring sites.

Site	X	Y	Note
Stewart	-92.742166	43.111241	Stewart Creek at T44
Wildwood	-92.687517	43.067582	Wildwood Creek at Hwy 18/Gilbert St
Hyers	-92.682567	43.078352	Hyers Creek at Kellogg Ave

This monitoring site network would allow for consistent water quality information to be gathered throughout the entire watershed. Ideally, bi-weekly samples should be collected beginning in April and extending through October. At a minimum, the samples should be analyzed for nitrate, phosphorus, sediment and bacteria.

In addition to water grab sampling, stream discharge also could be recorded in order to determine nitrogen, phosphorus, sediment and bacteria loading. One method to capture stream discharge is to measure the stream stage and use a hydrograph to calculate discharge. The US Geological Survey (USGS) [Water Science School](#) provides an overview of this process. Alternatively, a calibrated watershed hydrologic model could be used to estimate stream discharge for loading calculations. The [Iowa Water Quality Information System](#) (IWQIS) provides real-time water quality and discharge data for many streams and rivers in Iowa. The downstream IWQIS sensor closest to the Charles City Watershed is a USGS gauge in the Cedar River at Waverly, Iowa, with station ID 05458300.

## 7.2. Biological Monitoring

In addition to chemical and physical indicators of water quality, the biological community of a stream reflects its overall health. Surveys of benthic macroinvertebrate species in streams are excellent biological indicators of water quality. More diverse communities and presence of sensitive species reflect good quality streams. The IOWATER program provides protocols and recommendations for assessing the stream biological community in its [Biological Monitoring Manual](#). Existing biological monitoring data are stored in the IDNR [BioNet](#) database.

## 7.3. Field Scale Water Monitoring

Water quality monitoring at finer scales should be conducted to assess the effectiveness of individual conservation practice installations. Field-scale water samples should be collected from either tile water exiting subsurface drainage systems or surface runoff from a targeted area. Monitoring surface runoff is difficult because runoff events are irregular and often missed by a regular monitoring program. Tile water monitoring is reliable due to more consistent flow. However, monitoring tile water may only provide data on nitrate loss because the majority of phosphorus and sediment loss occurs via surface runoff.

Tile monitoring should be targeted to drainage systems that drain a single field to allow for changes in management practices to be isolated and detectable. Tile outlets that are easily accessible and provide the opportunity to capture sufficient tile flow should be selected for monitoring. Flow volume from tiles can be calculated by measuring the time needed to fill a container of known volume or by using flow sensors such as pressure transducers. Tile flow, nutrient concentration and tile system drainage area can be used to calculate the nutrient loading rate (e.g., pounds of nitrate loss per acre per year) at a tile outlet.

## 7.4. Soil Sampling

Agricultural soils contain many nutrients, especially where fertilizer or manure have been applied. At a minimum, soil samples should be analyzed for phosphorus, potassium, nitrogen and organic matter. Improved soil fertility data will better inform nutrient management, which can result in increased profitability and decreased nutrient loss due to improved nutrient application. Additionally, collection of soil samples in coordination with field-scale water monitoring could improve understanding of the relationship between nutrient management practices, soil fertility, soil health and water quality. Soil samples should be collected for multiple years, particularly if agronomic management practices are altered or in-field conservation practices are



implemented. In-season soil nitrate testing can be used to inform adaptive nutrient management practices with the goals of improving agronomic production and reducing nutrient losses. Tests to measure soil health and biological activity also can be utilized to quantify the benefits of management practices that build soil health.

### **7.5. Plant Tissue Sampling**

The end-of-season [corn stalk nitrate test](#) is a tool used to evaluate the availability of nitrogen to the corn crop. Nitrate concentrations measured from stalk sections for the lower portion of a corn plant taken after the plant reaches maturity are indicative of nitrogen available to the plant. The corn plant will move available nitrogen to the grain first. By measuring the amount of nitrogen left after grain fill, a determination can be made as to how much nitrogen was left in the plant relative to what was needed for optimal grain yield. Producers should collect samples over multiple years to account for weather and seasonal variations before modifying operations.

### **7.6. Social Surveys**

Surveys are a tool that should periodically be used to assess awareness and attitudes regarding water quality in the Charles City Watershed and whether the watershed plan goals are on schedule. Detailed surveys could be conducted during or after each phase of the implementation schedule (Table 6.1). Results could be used to modify approaches as needed during the subsequent implementation phase. Surveys also could be paired with specific educational events like field days to assess the effectiveness of different outreach formats, which could improve information and education strategies as the project proceeds. Iowa Learning Farms has developed the [Watershed-Based Community Assessment Toolkit](#) to provide guidance for such surveys.

## 8. Information and Education Plan

Behavior patterns of all stakeholders, and especially producers and landowners, must be considered in implementation strategies for water quality projects. To cause changes in behavior, goal-based outreach that addresses the actual and defined needs of key stakeholders is critical. It is important to leverage preexisting relationships and successes to build a community of support and knowledge around producers and landowners who will be implementing conservation practices. Barriers to conservation implementation may be overcome by providing adequate education and outreach regarding how land management practices influence the local and downstream natural resources. Knowledge increases awareness, which may then motivate changes in behavior.

A goal-based outreach plan will need to be designed to facilitate the goals set by stakeholders and to support the timeline defined in this watershed plan. With a 13-year timeline, progress can be hindered if expectations are not managed both initially and throughout the project. First, awareness and participation should be raised among farmers, landowners and conservation experts to build community confidence that action is being taken. Next, the broader community should be invited to learn about and participate in the watershed project. Emphasis should be placed on engaging "middle adopters" of conservation, or farmers and landowners that may not typically attend traditional community outreach events such as meetings and field days.

The goal of the communication plan is to increase awareness, acceptance, and adoption of practices to achieve watershed goals. The primary audience for outreach will be property and landowners, farmers, and technical experts directly involved in BMP implementation. The secondary audience will be watershed residents, government officials, community members and additional partners. Project objectives and progress should be communicated to all stakeholders, but messaging also should be tailored for unique audiences. The following tables summarize outreach tools and potential partners. The project also should be promoted through local media including the Charles City Press and radio stations such as KCHA 1580 AM/95.9 FM along with regional news and farm publications such as the Waterloo-Cedar Falls Courier and Farm Bureau Spokesman.

*Table 8.1. Outreach strategies and tools.*

Logo and other branding	Stream signs	Coffee shop hours
Website and social media	Conservation practice signs	Conservation icons or graphics
Fact sheets	Volunteer workshops	Guest speakers at area events
Direct mailings	Youth outdoor learning	Individual on-farm visits
Demonstration field days	Urban/ag learning exchanges	Practice-specific outreach
Watershed boundary signs	Stream cleanup events	Farmer-led listening sessions

*Table 8.2. Current and potential project partners and contacts. This list is not exhaustive.*

Watershed farmers and landowners	Floyd Soil and Water Conservation District Commissioners
City of Charles City	City of Floyd
Floyd County Board of Supervisors	USDA-Natural Resources Conservation Service
Iowa Department of Natural Resources	Iowa Department of Agriculture and Land Stewardship
Iowa Soybean Association	Iowa Farm Bureau Federation
Iowa Corn	Iowa Pork Producers Association
Iowa Agriculture Water Alliance	Upper Cedar Watershed Management Improvement Authority
Iowa State University Extension and Outreach	University of Iowa-IIHR and Iowa Flood Center
The Nature Conservancy	Agricultural cooperatives and agribusinesses
Trees Forever	Iowa Natural Heritage Foundation
Pheasants Forever	Ducks Unlimited
Floyd County Conservation Board	Charles City Rotary

## 9. Evaluation Plan

Project evaluation and recognition of successes and challenges will be a critically important step in implementing this watershed plan. This section lays out a self-evaluation process for project partners to measure project progress in four categories: project administration, attitudes and awareness, performance and results. A project evaluation worksheet can be found in Appendix C.

### 9.1. Project Administration

- **Yearly partner review meeting.** Watershed project partners should host an annual review meeting. This will provide an opportunity to evaluate project progress using an evaluation worksheet.
- **Quarterly project partner update.** Each quarter, project leadership should ensure project goals and objectives are being accomplished, plan logistics and coordinate outreach, events and monitoring. Input from farmer leaders also can provide feedback and ideas for the project to adapt as needed.

### 9.2. Attitudes and Awareness

- **Farmer and landowner surveys.** Periodically a survey should be conducted with a statistically valid sample of farmers and landowners in the watershed. Results of the surveys should be used to determine changes in knowledge, attitudes and behaviors. Surveys should include questions to determine effectiveness of different outreach methods.
- **Field day attendance.** Field days are an important outreach component of watershed projects. To quantify the impact of the field days, a short survey should be administered at the conclusion of each field day. The goal of the surveys will be to determine if understanding or attitudes were changed or practices have been or will be adopted as a result of the field day events.
- **Regional and statewide media awareness.** Media awareness and promotion of the project should be tracked by collecting and cataloging all articles and stories related to the project.

### 9.3. Performance

- **Practice adoption.** Locations of implemented practices should be tracked over the life of the project. Practice adoption rates should be aggregated to the watershed scale and reported to partners annually.
- **Practice retention.** Retention of management practices, such as cover crops, should be emphasized. Yearly follow-up with farmers implementing practices will help gauge practice retention trends.

### 9.4. Results

- **Practice scale monitoring.** Tile water or edge-of-field monitoring results should be used to gauge water quality improvements at the field scale. Individual results should be provided to farmer participants. All monitoring data should be aggregated to the watershed scale and shared with other farmers, landowners and partners.
- **Stream scale monitoring.** Stream water monitoring data should be used to determine if long-term water quality improvements are being realized. Year-to-year improvements will likely be undetectable but long-term progress on the order of ten years or more may be measurable if significant practice implementation occurs in the watershed.
- **Soil and agronomic tests.** Scientifically valid methods should be used to determine soil and agronomic impacts of BMP adoption. These results will be shared with farmer participants. All soil and agronomic results should be aggregated to the watershed scale and shared with other farmers, landowners and partners.
- **Modeled improvements.** The project should work with appropriate groups or individuals to estimate soil and water improvements resulting from practice implementation. Appendix D can be used to estimate watershed nitrate load reduction based on practice implementation levels.



## 10. Estimated Resource Needs

An estimate of resource needs is crucial to maintain current financial support and to gain support from potential funding sources. Table 10.1 provides an estimate of the total cost to implement conservation practices identified in this plan. Annual BMP implementation costs are estimated at up to \$365,000 per year and initial structural costs are estimated to be \$3,600,000. A [National Association of Conservation Districts](#) report highlighted that practices such as nutrient management, no-till/strip-till and cover crops that build soil health may result in long-term cost savings to farmers and landowners. Therefore, cost-share or incentive payment rates may need to be evaluated during the implementation phase of this plan.

*Table 10.1. Estimated resource needs to meet the Charles City Watershed BMP implementation level goals.*

Practice	Unit	Needed	Cost per Unit	Total Cost
No-till/Strip-till	acres/year	10,000	-\$10	-\$100,000
Cover crops	acres/year	10,000	\$50	\$500,000
Nutrient management	acres/year	12,000	-\$5	-\$60,000
Prairie strips	acres/year	100	\$250	\$25,000
Saturated buffers	sites	30	\$3,000	\$90,000
Bioreactors	sites	30	\$10,000	\$300,000
Wetlands	sites	6	\$535,000	\$3,210,000

Nutrient management, which includes application of nitrogen at the maximum return to nitrogen (MRTN) rate and phosphorus and potassium application tailored to site specific soil fertility and crop nutrient uptake, can result in decreased nutrient application and/or improved crop utilization and therefore a net economic benefit (negative cost). Cost savings for no-till/strip-till are expected due to decreased fuel use. Cover crop costs include seed, labor and termination cost estimates from Iowa State University Extension and Outreach Ag Decision Maker and Iowa Learning Farms tools. The annual cost for prairie strips is the watershed weighted average Conservation Reserve Program (CRP) soil rental rate. Costs for saturated buffers and bioreactors are based on typical total installation costs but can vary depending on timing, material availability and contractor experience. Wetland costs were estimated from Iowa Conservation Reserve Enhancement Program (CREP) data and Agricultural Conservation Planning Framework (ACPF) model outputs.

The initial investment needed to construct all proposed edge-of-field structural practices (saturated buffers, bioreactors and wetlands) is estimated at \$3,600,000. Annual investments are necessary to increase and maintain adoption and implementation of in-field management practices (no-till/strip-till, cover crops, nutrient management and prairie strips). The estimated yearly total for these practices fully implemented is \$365,000 per year. Cost-share payments may not be permanently available, so alternative funding sources for management practices may need to be pursued. The dollars necessary to fund structural and management practices could fully or partially come from many different sources including farmers and landowners, downstream municipalities, other local or regional stakeholders and conservation organizations. Section 11 describes additional potential funding sources.

Additional costs associated with watershed improvement are estimated to be at approximately \$80,000 to \$120,000 per year to fund salary, benefits and training for a watershed coordinator; information and education supplies and events; monitoring activities; and office space, computer, phone and vehicle.

## 11. Funding Opportunities and Approaches

To achieve the goals of this watershed plan, significant resources will be needed. Current funding mechanisms provided by local, state and federal units of government may not be adequate to address all goals outlined in this plan, so creative approaches to secure sustainable funding may be needed. Appendix E provides a listing of current local, state and federal programs and grants that may be able to provide resources to support plan implementation. The following list provides ideas to leverage nontraditional funding resources. Further research may be needed to determine feasibility.

- **Locally organized cover crop seeding programs.** Farmers and landowners are often busy with harvest during the prime cover crop seeding time period. To simplify cover crop adoption, cover crop seeding programs could be developed at the Floyd Soil and Water Conservation District (SWCD), Floyd County Conservation Board or local farm cooperatives. For example, some SWCDs around Iowa have developed a "One Stop Cover Crop Shop" program to facilitate and expedite the cover crops cost-share application, planning and planting process for farmers.
- **Local cover crop seed production.** Access to and cost of cover crop seed may become problematic as adoption of cover crops increases in Iowa and the Upper Mississippi River Basin. A solution to this problem is to promote local production of cover crop seed, such as cereal rye. Typical yield of rye is 30 to 50 bushels per acre, so a seeding rate of 1.5 bushels per acre means that every acre of rye grown for seed would allow a rye cover crop to be planted on 20 to 33 acres of row crop land. To avoid taking productive land out of corn and soybean production, rye plantings could be targeted to marginal soils or lands.
- **Conservation addendums to agricultural leases.** More than half of Iowa's farmland is cash rented or crop shared, and an increase in this trend presents issues for ensuring proper conservation measures are in place on Iowa farms. Conservation addendums may be a way to ensure both the landowner and the tenant agree on conservation. Addendums could include any conservation measure, but the practices included in this plan would be of most benefit. A standard conservation addendum could be developed and shared with all absentee landowners in the Charles City Watershed.
- **Conservation easements.** Land easements have proven successful in preservation of conservation and recreation land in Iowa (e.g., Iowa Natural Heritage Foundation, Wetland Reserve Enhancement Program). Some landowners may be interested in protecting sensitive land for extended periods of time or in perpetuity. For these landowners, long-term conservation easements may be a good fit.
- **Nontraditional watershed partners.** Traditional watershed partners (e.g., IDALS, IDNR, SWCD, NRCS) likely will not have the financial resources to fully implement this plan, so local project partners should seek nontraditional partners to assist with project promotion and funding (see Table 8.2). Involvement could be in the form of cash or in-kind donations.
- **Nutrient trading.** Water quality trading programs are market-based programs involving the exchange of pollutant allocations between sources within a watershed. The most common form of trading occurs when trading nutrient credits between point and nonpoint sources. Trading programs could be established to trade nutrient credits. The [Iowa League of Cities](#) is leading a pilot program in Iowa that is testing this nutrient reduction exchange model. Trading within the larger Cedar River Watershed may be appropriate to increase potential nutrient trading partners.
- **Recreational leases.** Recreational leases, such as hunting leases, may be promoted as a tool to increase landowner revenue generated from conservation lands, particularly those in perennial cover such as wetlands or grasslands.
- **Equipment rental programs.** Farmers are often hesitant to invest in new conservation technologies that require new equipment or implements. Project partners could invest in conservation equipment, such as a strip-till bar or cover crop drill, and then rent the equipment to interested farmers. In addition to building community support for the watershed project, such cooperation can lower overall practice costs.

- **Reverse auctions.** Reverse auctions, or pay for performance programs, can be a cost-effective way to allocate conservation funding. In some watersheds where reverse auctions have been used, the environmental benefits per dollar spent have been significantly more efficient than traditional cost-share programs such as the USDA-NRCS Environmental Quality Incentives Program (EQIP). In a reverse auction, landowners or farmers compete to provide a service (or conservation practice) to a single buyer (e.g., SWCD). All bids are analyzed for their environmental benefits and the organizer (e.g., SWCD) begins providing funds to the most efficient bids (environmental benefit per dollar) until all available resources have been allocated.
- **Watershed organization.** Often the most successful watershed projects are led by formal watershed organizations. Groups can be formed via a nonprofit organization, 28E intergovernmental agreement, watershed management authority or other agreement or organization. Most watershed projects have significant partner involvement, each with an existing mission or goal. A watershed organization with a dedicated mission to improve land and water quality in the Charles City Watershed may prove to be more successful than existing groups working together without formal organization. The Upper Cedar Watershed Management Improvement Authority may be appropriate for this purpose. At a minimum, the farmers and landowners involved in the development of this watershed plan should convene regularly to discuss and evaluate project progress, continually develop innovative outreach and implementation strategies and set specific work plans to support steady progress towards the 2030 watershed plan goals.
- **Subfield profit analysis.** Farmers understand some locations within a field produce higher yields and profits, so analyzing the distribution of long-term profitability within fields may be an important selling point for conservation. Incorporating profitability analysis into conservation planning could result in higher profit margins and increased conservation opportunities on land that consistently yields no or negative return on investment.
- **Sponsored projects.** Iowa administrative code authorizes use of the Clean Water [State Revolving Fund](#) (CWSRF) to implement water resource restoration sponsored projects, or [sponsored projects](#), in order to develop watershed-based approaches to water quality improvement. Wastewater treatment facility upgrades are very expensive, and the CWSRF provides a source of capital for these infrastructure improvements. In a sponsored project, an overall interest rate reduction on the CWSRF loan allows the utility to use saved capital to fund nonpoint source water quality improvement practices within the same watershed as the wastewater facility. Use of a sponsored project to fund agricultural/rural practices that improve water quality requires coordination with a wastewater treatment plant upgrade, but can provide two projects for the price of one and establish and strengthen upstream-downstream partnerships within the watershed. The City of Charles City has submitted an application to the Iowa CWSRF program for a sponsored project with the intent of funding both urban and agricultural BMPs to improve water resources within its upstream watershed in addition to its corporate limits.



## 12. Roles and Responsibilities

Watershed improvement is an ambitious undertaking that requires commitment, collaboration and coordination among multiple entities. Clearly defined roles and duties can facilitate task assignments and improve the efficiency and effectiveness of the watershed project. The following list describes the general responsibilities of various groups in the Charles City Watershed.

- **Farmers.** Engage with watershed plan implementation; farm, field and subfield evaluation; conservation practice implementation; and knowledge sharing.
- **Landowners.** Engage with tenants on conservation planning, incorporation of conservation addendums to lease agreements and conservation practice implementation.
- **City of Charles City.** Provide project partnership and leadership, communicate with urban and rural citizens and provide opportunity to utilize sponsored project funds both within city limits and the upstream Charles City Watershed.
- **Floyd Soil and Water Conservation District commissioners.** Provide project leadership, participate in project meetings and events, hire staff as needed, advocate for project goals and promote project locally and regionally.
- **Natural Resources Conservation Service.** Provide conservation practice design and engineering services, project partnership, house project staff as needed and provide associated office space, computer, phone and vehicle as available.
- **Upper Cedar Watershed Management Improvement Authority.** Identify opportunities for complimentary programming and supplementary funding and communicate with member entities.
- **Iowa State University Extension and Outreach.** Engage farmers and landowners through agronomic and water quality programming, provide outreach opportunities to project and promote relevant university research.
- **Iowa Department of Agriculture and Land Stewardship.** Provide technical support to project, provide the opportunity to receive state funding for soil and water conservation, provide support for urban storm water BMP technical assistance, and provide a contact for the Iowa CREP program.
- **Iowa Department of Natural Resources.** Provide technical assistance and advice and water quality monitoring as necessary.
- **Floyd County Conservation Board.** Provide project partnership, easement management and public education.
- **Floyd County supervisors.** Engage with project to determine and pursue mutual benefits.
- **Agribusinesses.** Engage project partners and promote project goals and opportunities to members and customers.
- **Commodity and farm groups.** Engage project partners, promote project goals and opportunities to members and provide agronomic and environmental services as appropriate.
- **Conservation organizations.** Engage project partners, provide planning services and promote practices that have habitat, recreational and water quality benefits.
- **Media.** Develop stories related to the watershed project and maintain contact with local sources of information.

# Appendix A: Conceptual Plan Maps

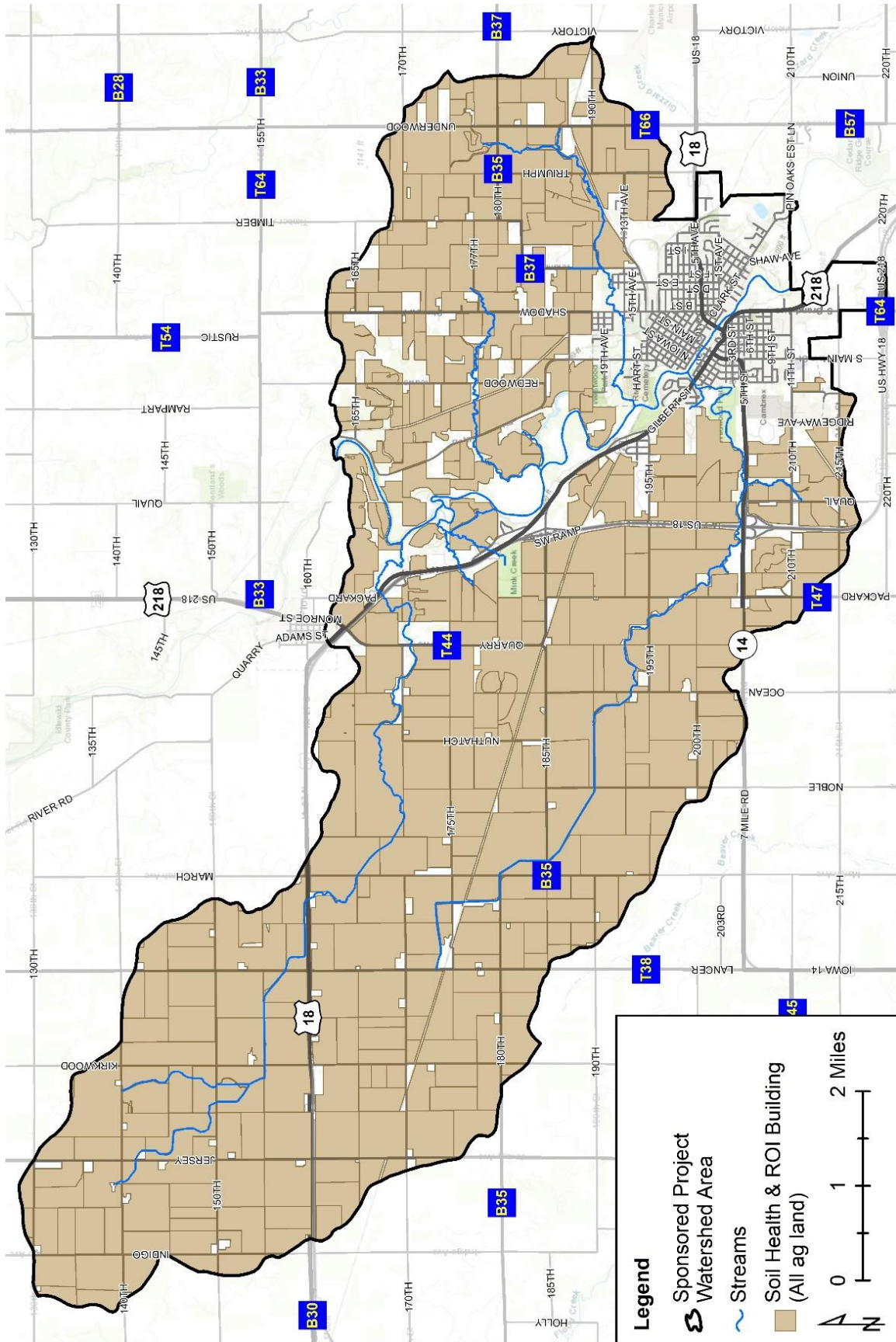


Figure A.1. No-till/strip-till, cover crops and nutrient management will build soil health and long-term returns on investment for all agricultural land.

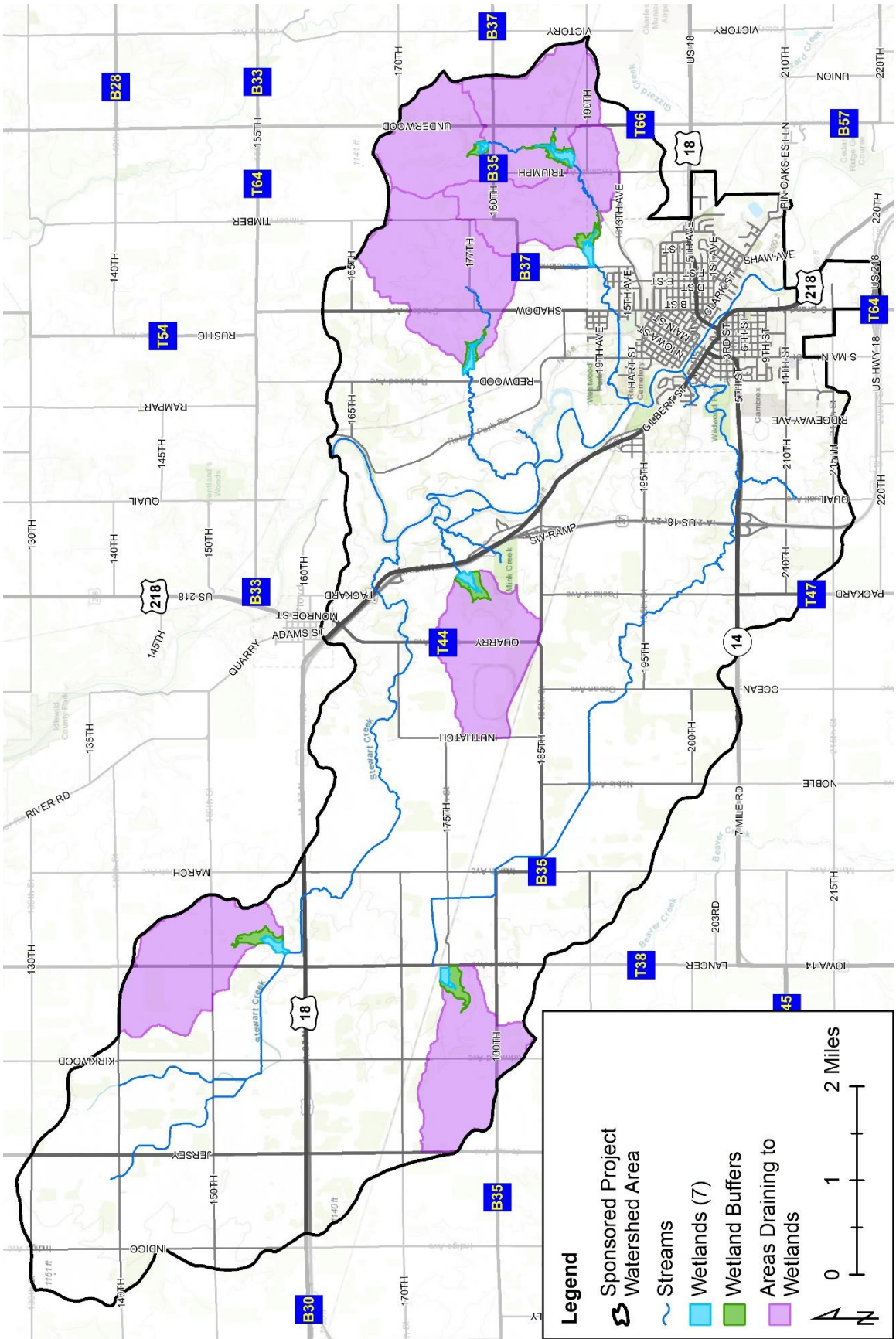


Figure A.2. Potential locations for constructed wetlands.



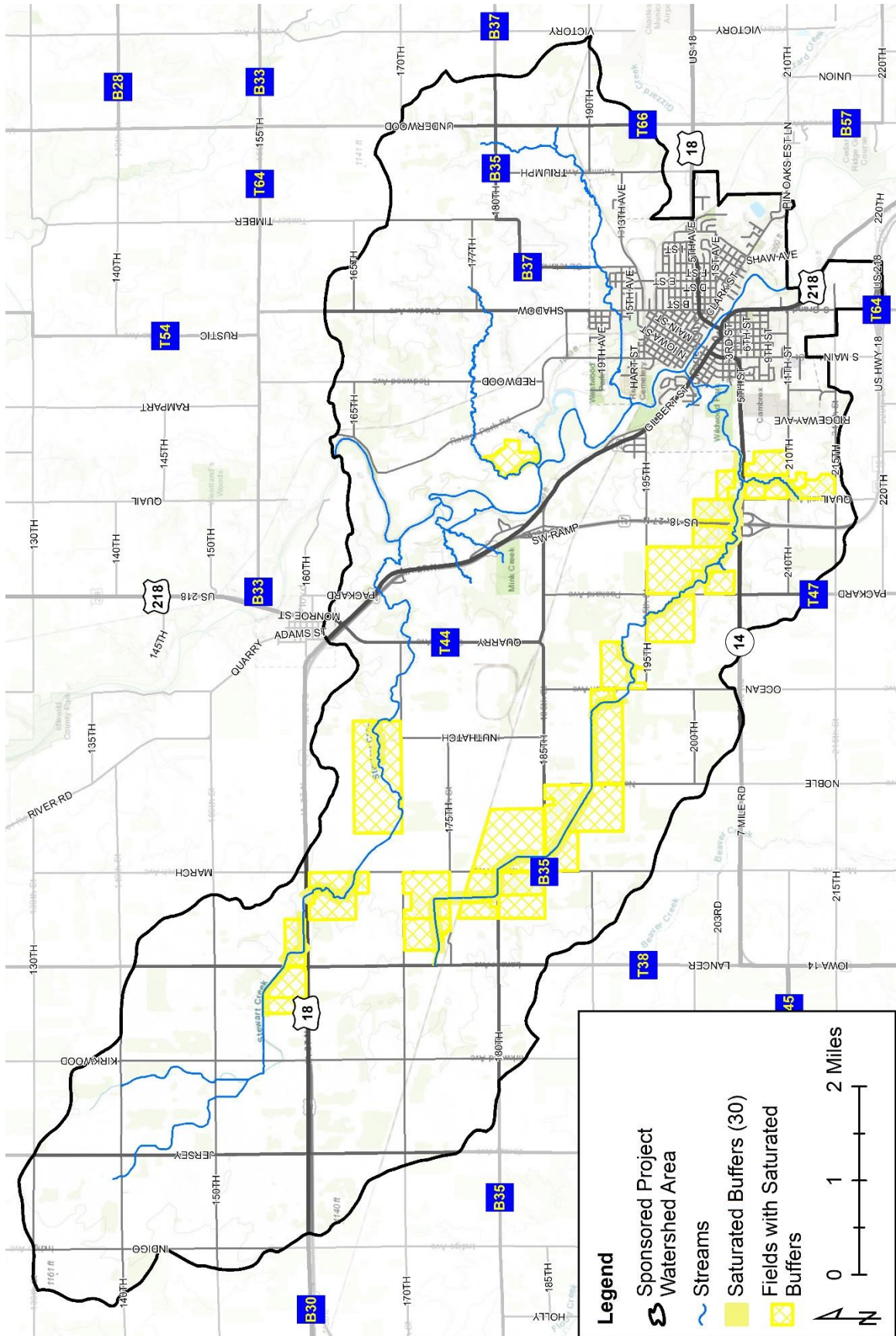


Figure A.3. Priority locations for saturated buffers are located primarily along Stewart Creek and Drainage Ditch 3.



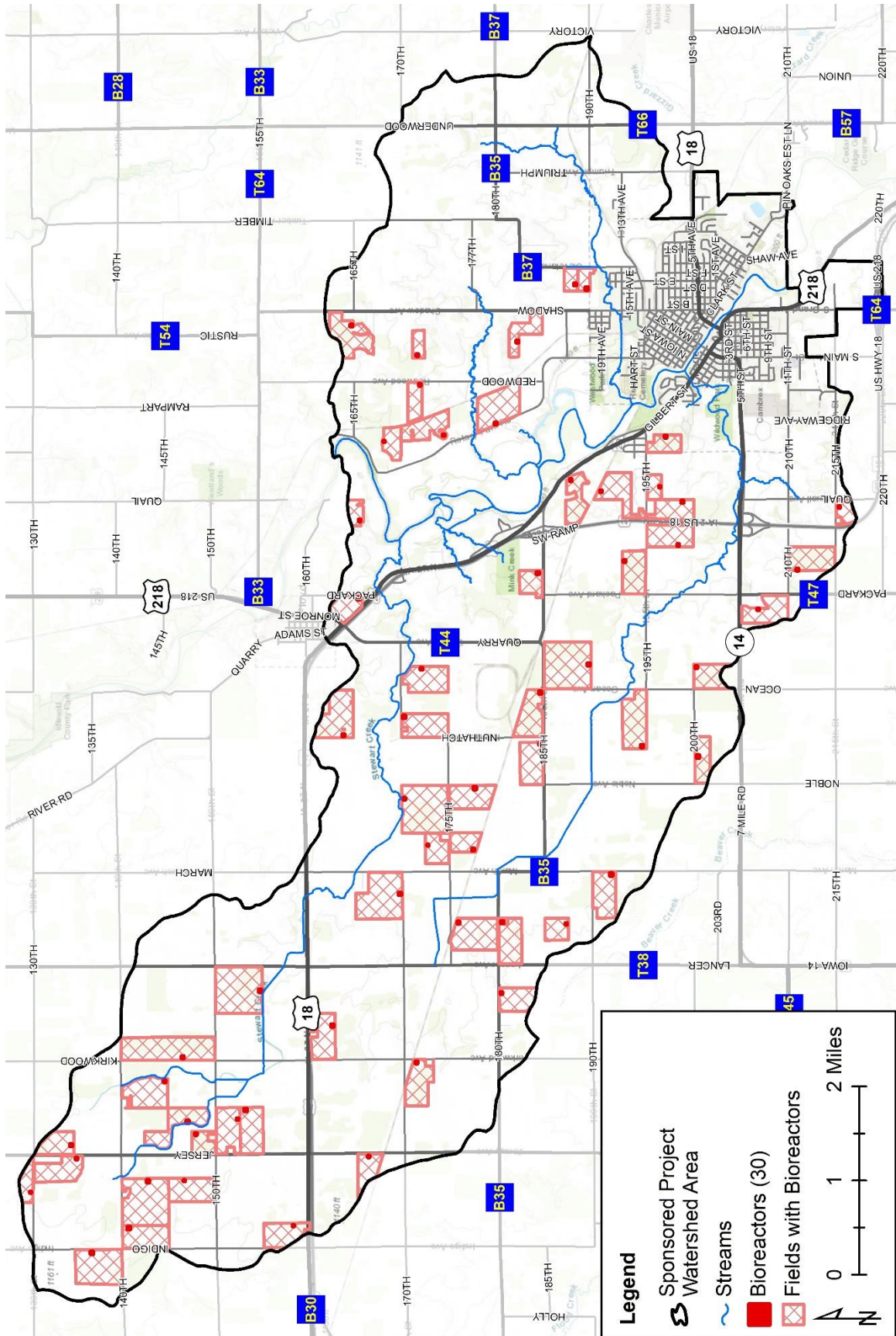


Figure A.4. Potential locations for bioreactors. More are shown than needed, but at least 30 are recommended.

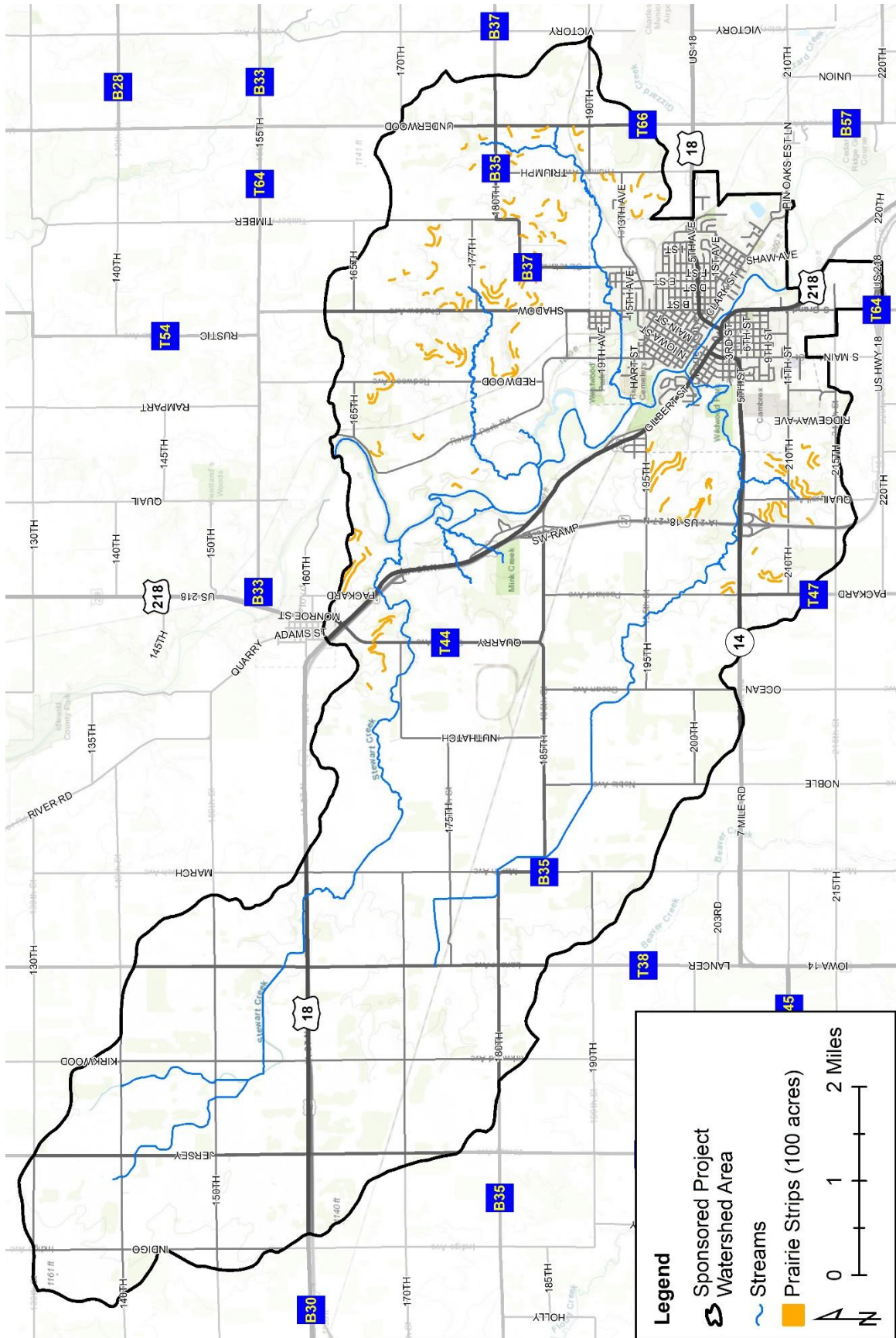


Figure A.5. Priority locations for prairie strips.



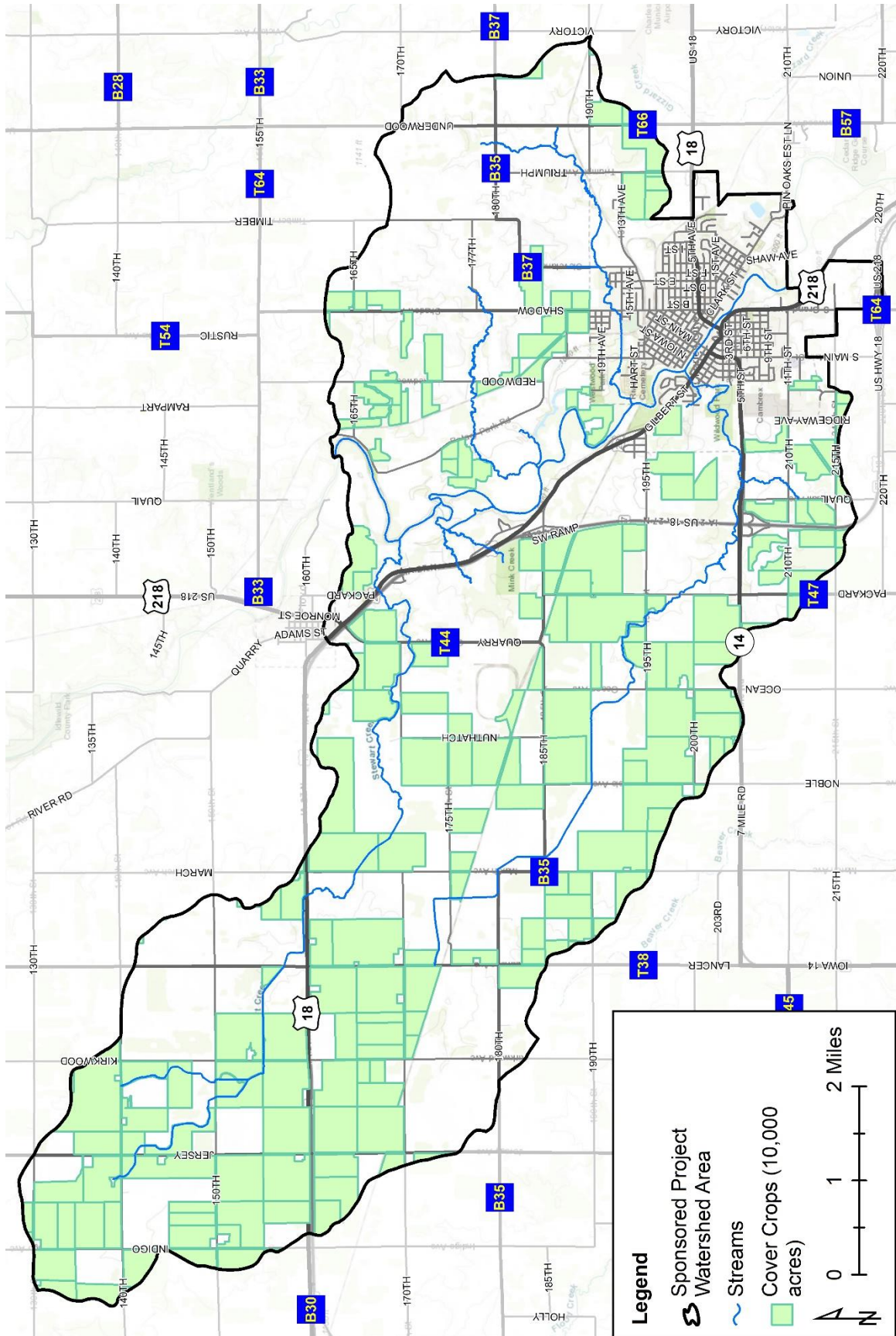


Figure A.6. Priority cover crop fields. While cover crops are beneficial everywhere, these locations would complement the fields recommended for edge-of-field saturated buffers, bioreactors and wetlands.



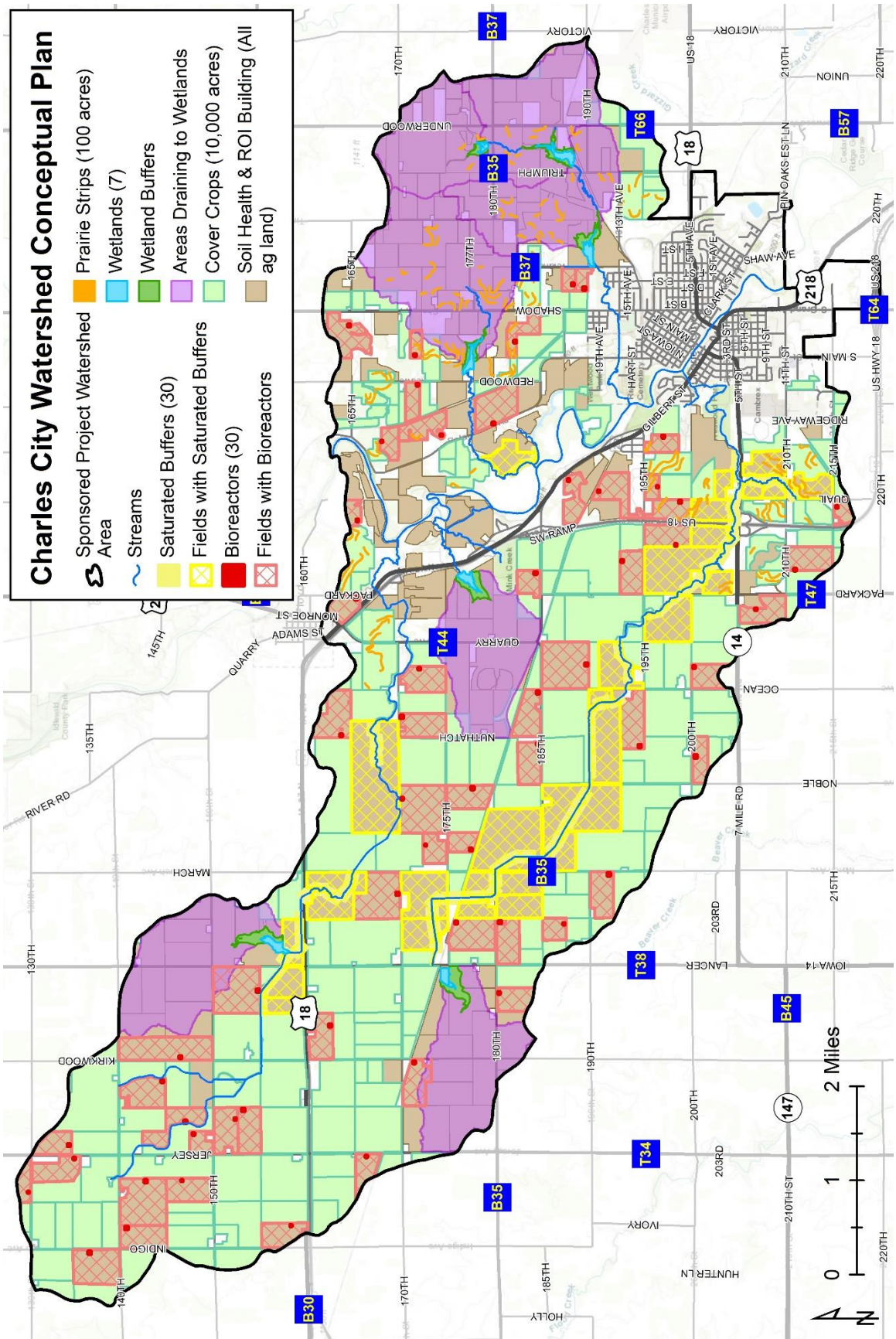


Figure A.7. Charles City Watershed conceptual plan.

# Appendix B: Agricultural Conservation Planning Framework Results Atlas

## Overview

The Agricultural Conservation Planning Framework (ACPF) provides datasets and mapping tools that can be used to identify suitable locations for agricultural conservation practices. The geographic information system (GIS) tools utilize inputs including elevation, land use, and soils data to characterize watersheds and identify appropriate sites for practices that enhance soil health and water quality by improving drainage, runoff, and riparian management. The ACPF was developed by the USDA-Agricultural Research Service National Laboratory for Agriculture and the Environment.

## Results

The results of applying ACPF tools to a watershed provide a suite of potential conservation practice opportunities. Results should be refined based on local and expert input to develop actionable watershed plans that address local conditions and goals. ACPF output is therefore best utilized as scientific data to support decision making and planning in agricultural watersheds. The following atlas of ACPF result maps for this watershed display all conservation practice outputs derived from analysis of the watershed with the GIS toolbox. Practices are mapped based on site suitability and may or may not reflect existing conservation infrastructure.

The following maps include watershed assessments of land use, tile drainage, and runoff risk derived with ACPF tools. The remaining maps are arranged into three sections: drainage practices, runoff practices, and riparian management. For each section, one map displays a watershed overview and the subsequent pages contain detailed maps for each township that contains a portion of the watershed. Conservation drainage practices include bioreactors, saturated buffers, carbon-enhanced saturated buffers, drainage water management, nitrate removal wetlands, and perennial cover or tile intake buffers in topographic depressions. Runoff control practices include contour buffer strips, grassed waterways, and water and sediment control basins. Practices such as nutrient management, no-till/reduced tillage, and cover crops are not explicitly mapped by ACPF tools according to the philosophy that such soil health building practices are appropriate for all agricultural land. The final section of maps includes the results of applying the ACPF riparian function assessment to the stream channels in the watershed. Recommended riparian functions are classified as critical zone (high potential for runoff control and denitrification), multi-species buffer (moderate potential for both runoff control and denitrification), deep-rooted vegetation (denitrification prioritized), stiff stemmed grasses (runoff control prioritized), and streambank stabilization.

## Map Index

1. Watershed Overview
2. Land Use
3. Tile Drainage
4. Runoff Risk
5. Drainage Treatment Practices: Entire Watershed & Individual Townships
6. Runoff Control Practices: Entire Watershed & Individual Townships
7. Riparian Management Practices: Entire Watershed & Individual Townships

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**ACPF manual:** Porter, S.A., M.D. Tomer, D.E. James, and K.M.B. Boomer. 2015. Agricultural Conservation Planning Framework: ArcGIS®Toolbox User's Manual. USDA Agricultural Research Service, National Laboratory for Agriculture and the Environment, Ames Iowa. <http://northcentralwater.org/acpf/>

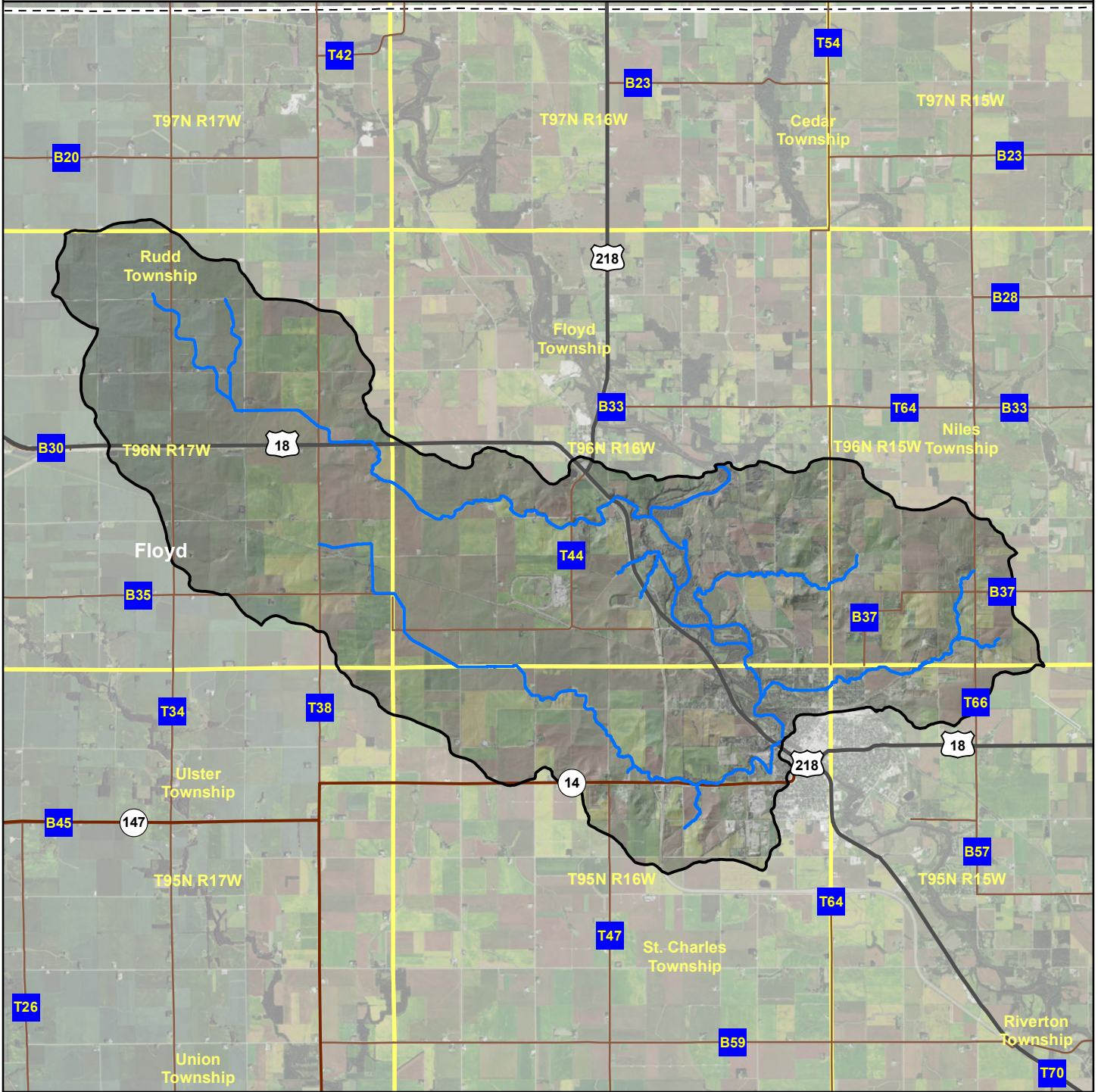
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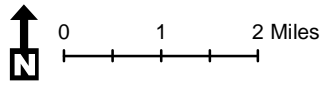
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# Charles City Sponsored Project Watershed Agricultural Conservation Planning Framework Results Atlas

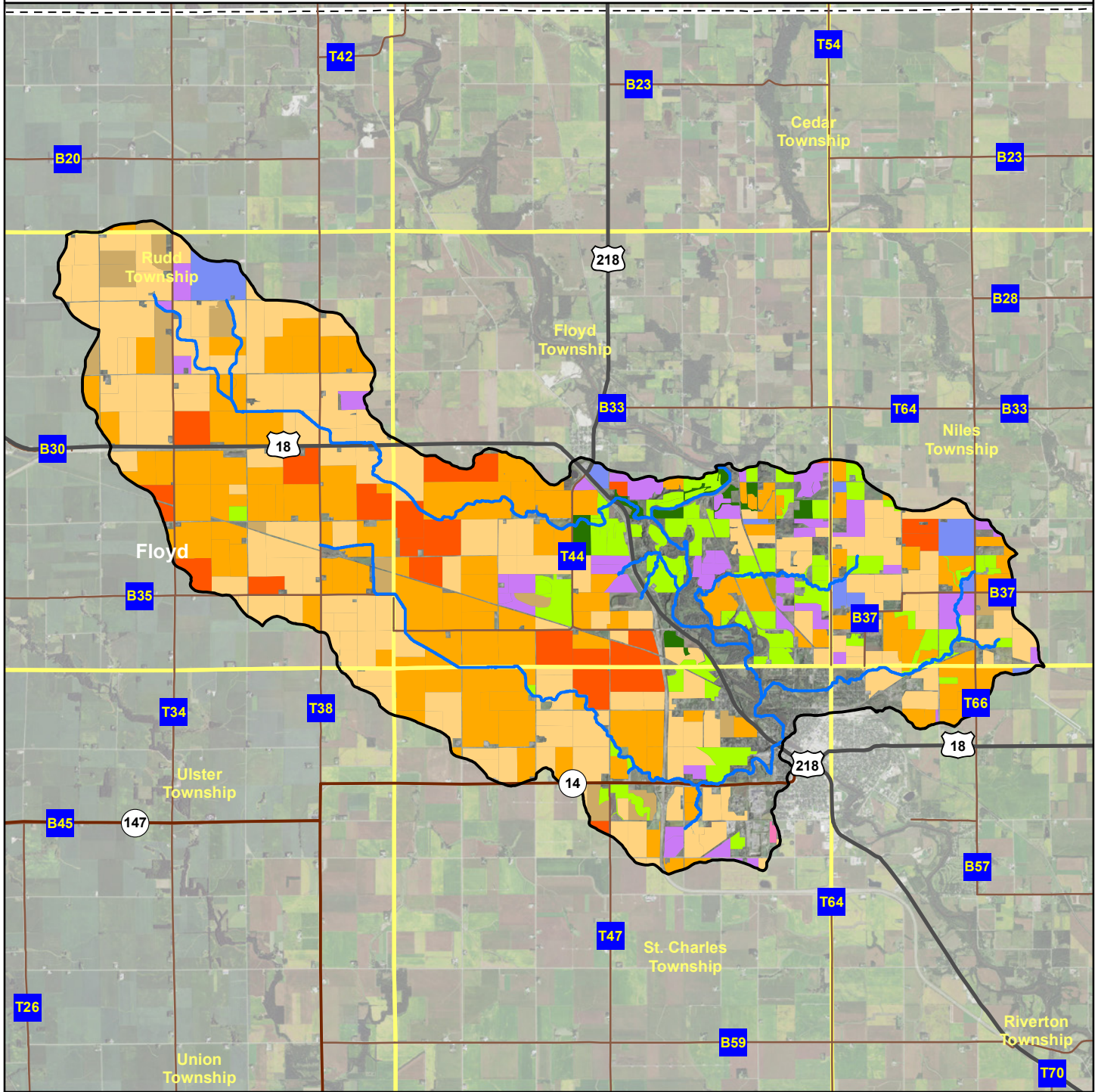


 Watershed Boundary  
 Streams

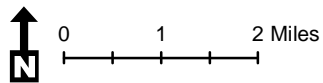




# Charles City Sponsored Project Watershed Agricultural Conservation Planning Framework Land Use



- |                              |                            |
|------------------------------|----------------------------|
| Watershed Boundary           | C/S/Annual Rotation        |
| Streams                      | C/S/Perennial Rotation     |
| <b>Land Use</b>              | Corn/Perennial Rotation    |
| Corn/Soybeans                | Soybean/Perennial Rotation |
| C/S with Continuous Corn     | Pasture                    |
| Continuous Corn              | Forest                     |
| C/S with Continuous Soybeans |                            |

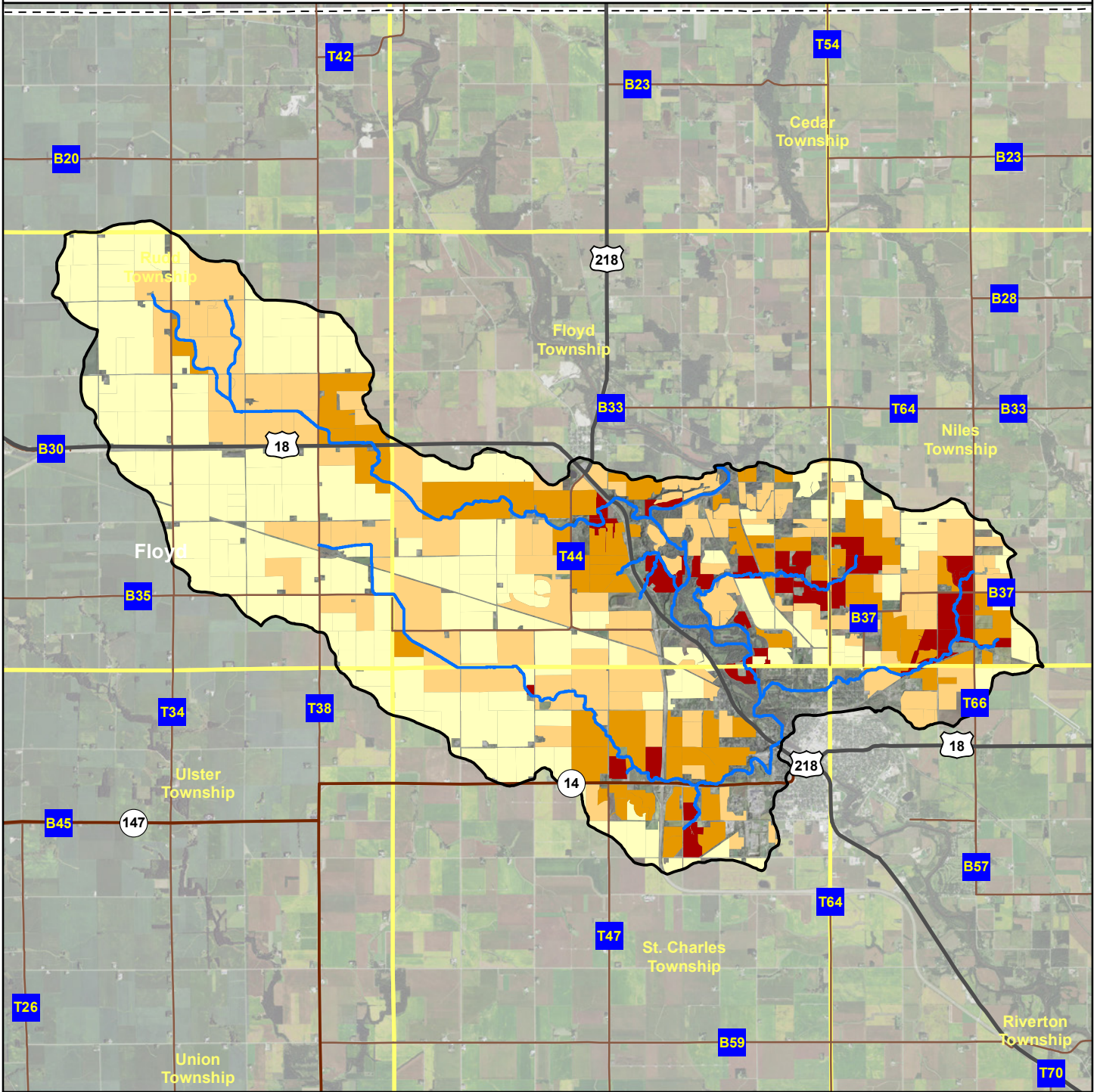









# Charles City Sponsored Project Watershed Agricultural Conservation Planning Framework Runoff Risk

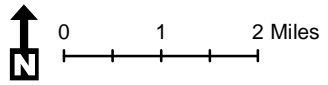


 Watershed Boundary

 Streams

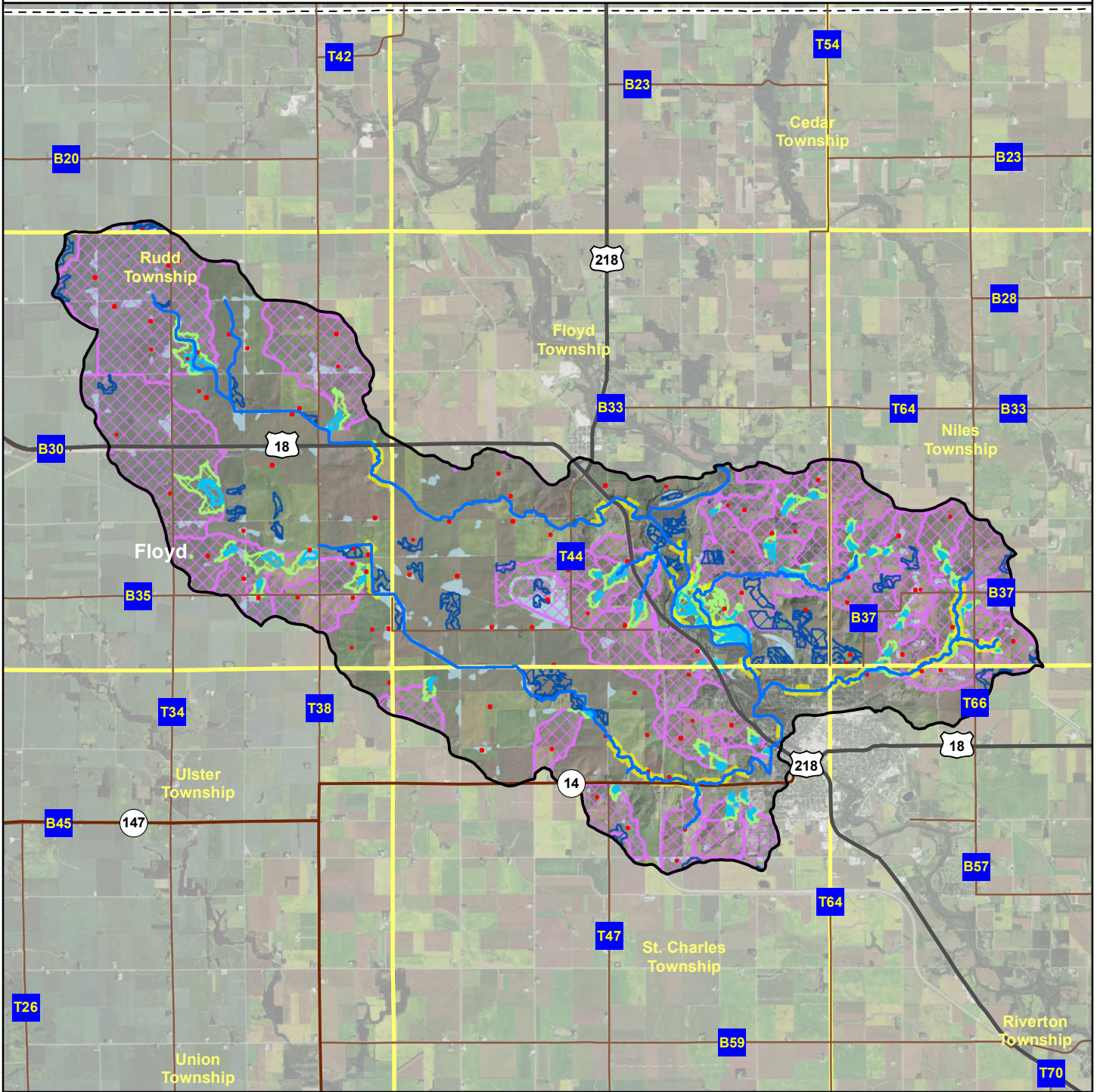
**Runoff Risk**

-  Critical
-  Very High
-  High
-  Present

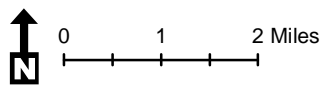




# Charles City Sponsored Project Watershed Agricultural Conservation Planning Framework Drainage Treatment Practices

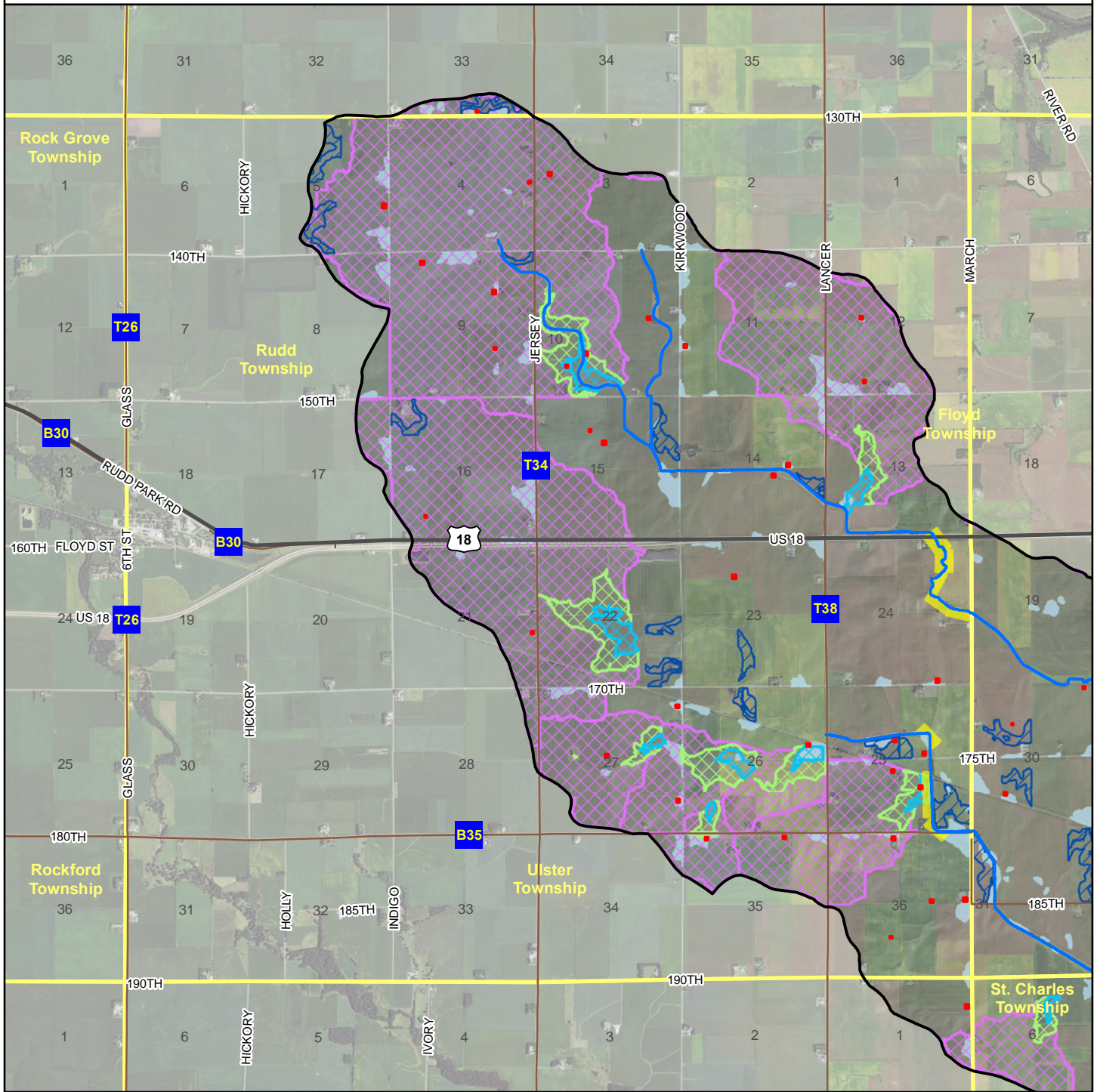


- |                           |   |
|---------------------------|---|
| Watershed Boundary        | Nitrate Removal Wetlands                      |
| Streams                   | Wetland Buffers                               |
| Bioreactors               | Wetland Drainage Areas                        |
| Saturated Buffers         | Depressions (Perennial Cover, Intake Buffers) |
| Drainage Water Management |   |

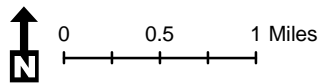




# Charles City Sponsored Project Watershed T96N R17W Agricultural Conservation Planning Framework Drainage Treatment Practices

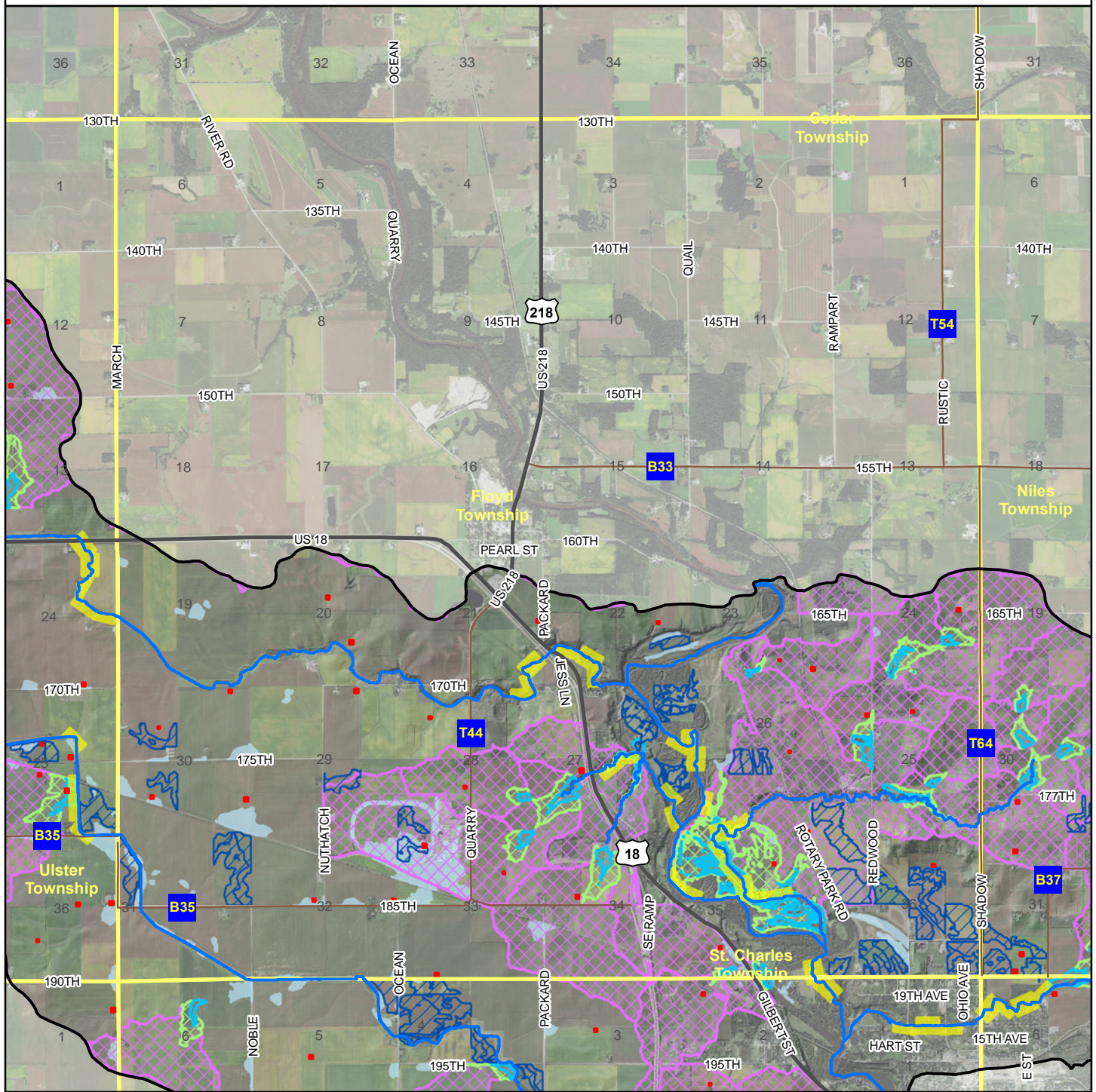


- |                           |   |
|---------------------------|---|
| Watershed Boundary        | Nitrate Removal Wetlands                      |
| Streams                   | Wetland Buffers                               |
| Bioreactors               | Wetland Drainage Areas                        |
| Saturated Buffers         | Depressions (Perennial Cover, Intake Buffers) |
| Drainage Water Management |   |

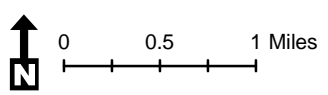




# Charles City Sponsored Project Watershed T96N R16W Agricultural Conservation Planning Framework Drainage Treatment Practices

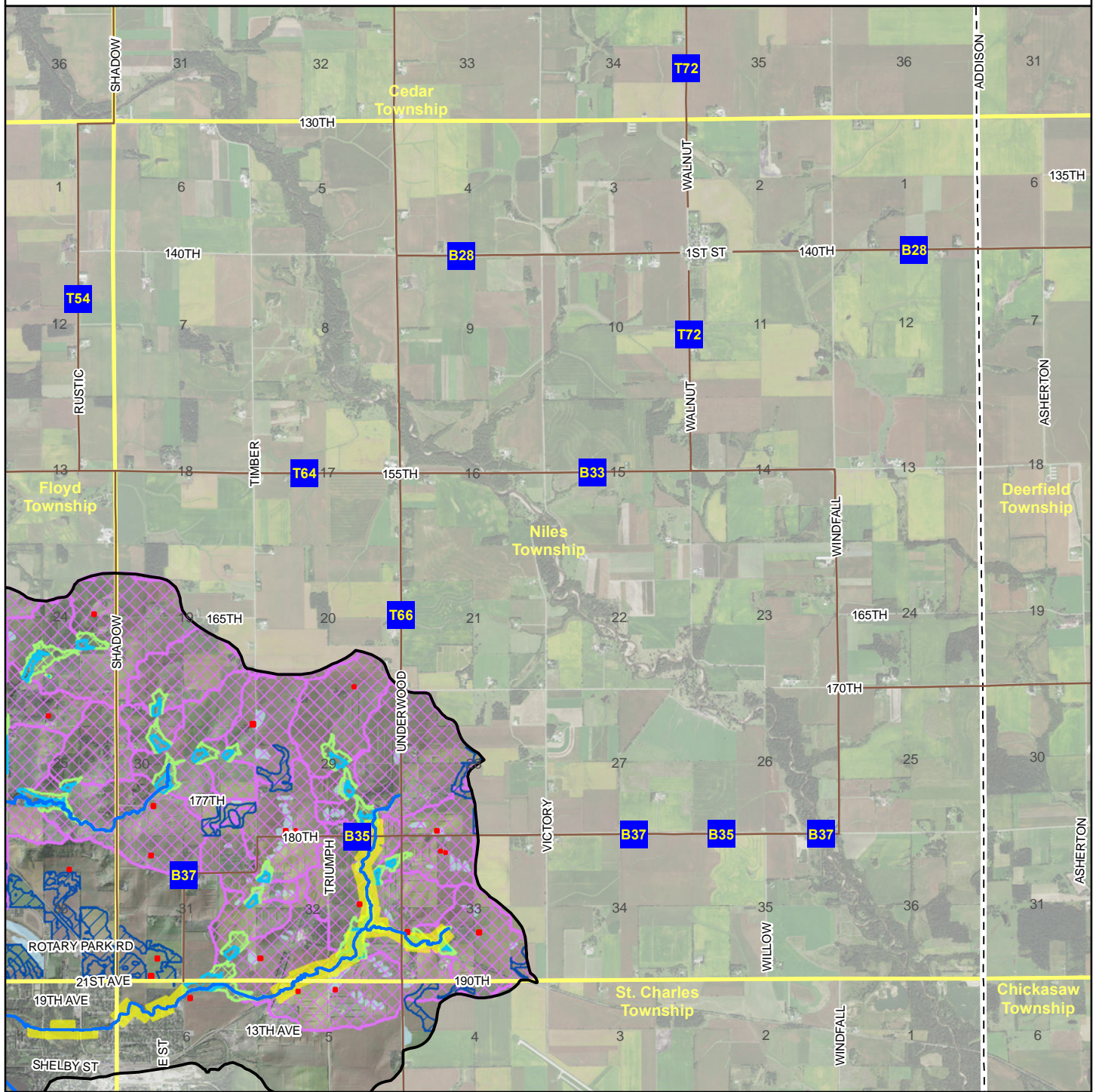


-  Watershed Boundary
-  Streams
-  Bioreactors
-  Saturated Buffers
-  Drainage Water Management
-  Nitrate Removal Wetlands
-  Wetland Buffers
-  Wetland Drainage Areas
-  Depressions (Perennial Cover, Intake Buffers)

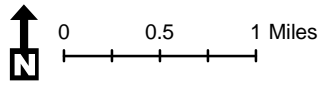




# Charles City Sponsored Project Watershed T96N R15W Agricultural Conservation Planning Framework Drainage Treatment Practices

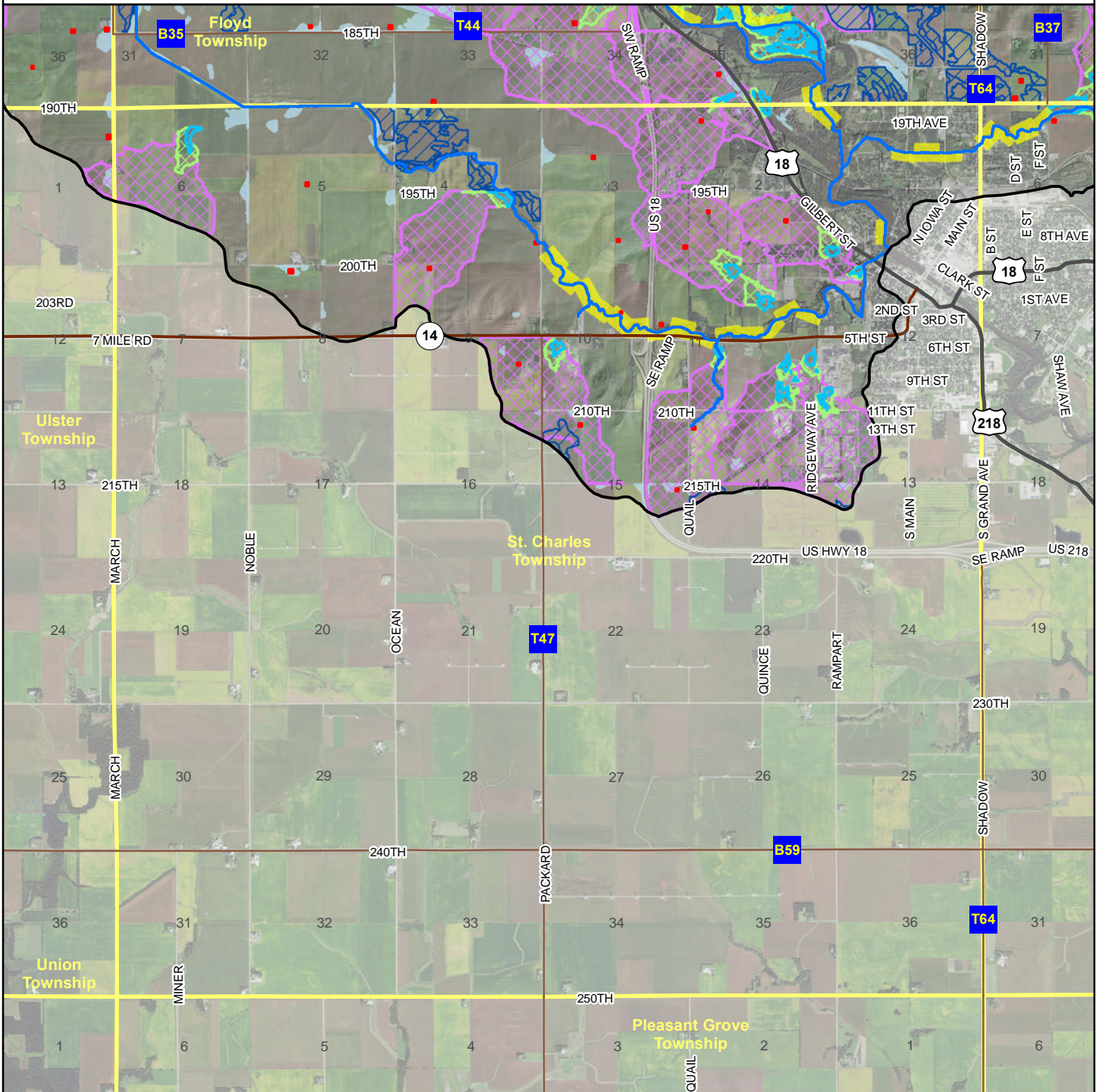


- |                           |   |
|---------------------------|---|
| Watershed Boundary        | Nitrate Removal Wetlands                      |
| Streams                   | Wetland Buffers                               |
| Bioreactors               | Wetland Drainage Areas                        |
| Saturated Buffers         | Depressions (Perennial Cover, Intake Buffers) |
| Drainage Water Management |   |

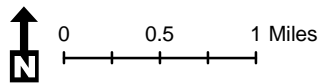




# Charles City Sponsored Project Watershed T95N R16W Agricultural Conservation Planning Framework Drainage Treatment Practices

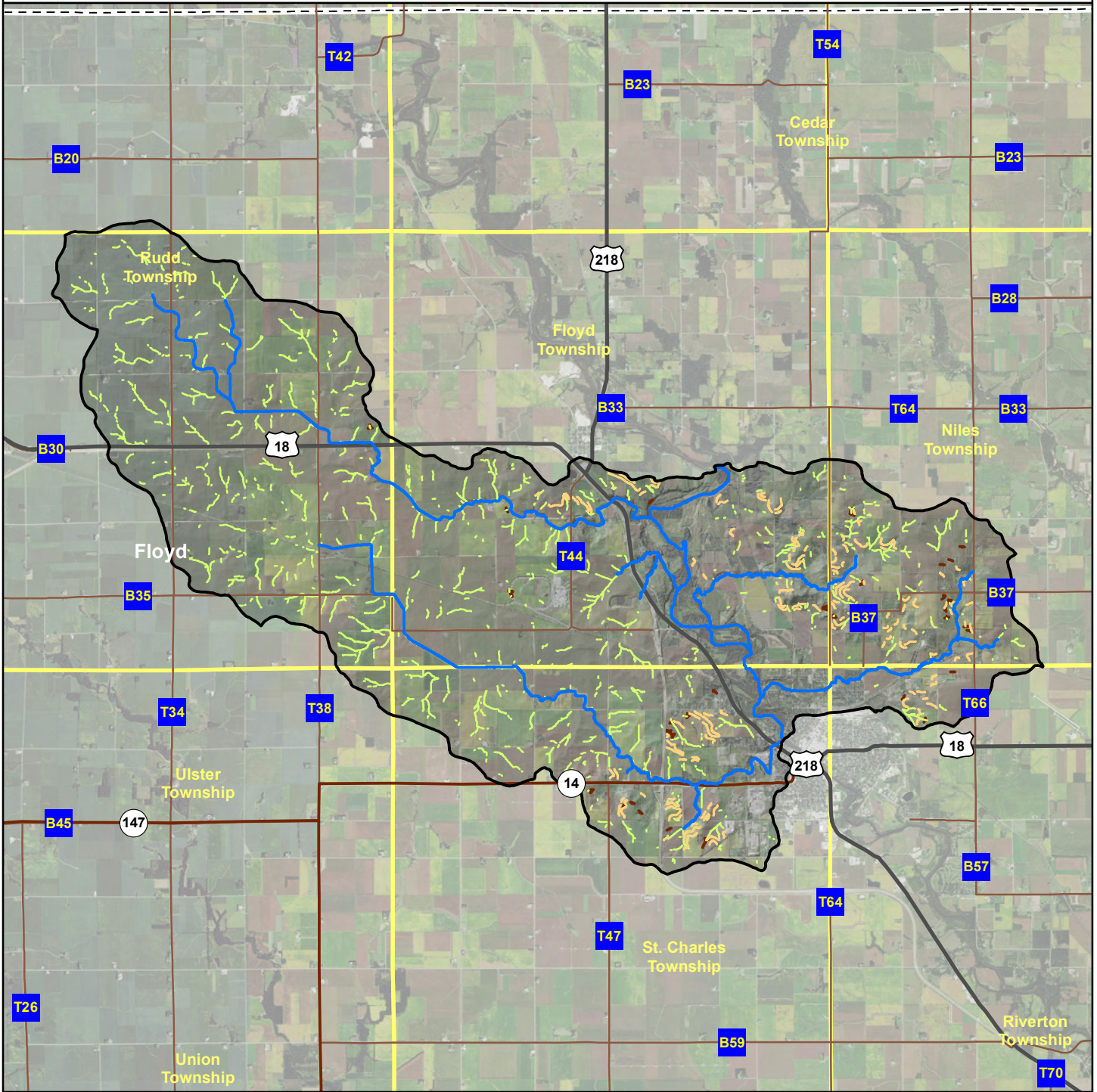







- |                           |   |
|---------------------------|---|
| Watershed Boundary        | Nitrate Removal Wetlands                      |
| Streams                   | Wetland Buffers                               |
| Bioreactors               | Wetland Drainage Areas                        |
| Saturated Buffers         | Depressions (Perennial Cover, Intake Buffers) |
| Drainage Water Management |   |

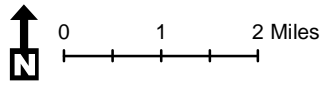




# Charles City Sponsored Project Watershed Agricultural Conservation Planning Framework Runoff Control Practices

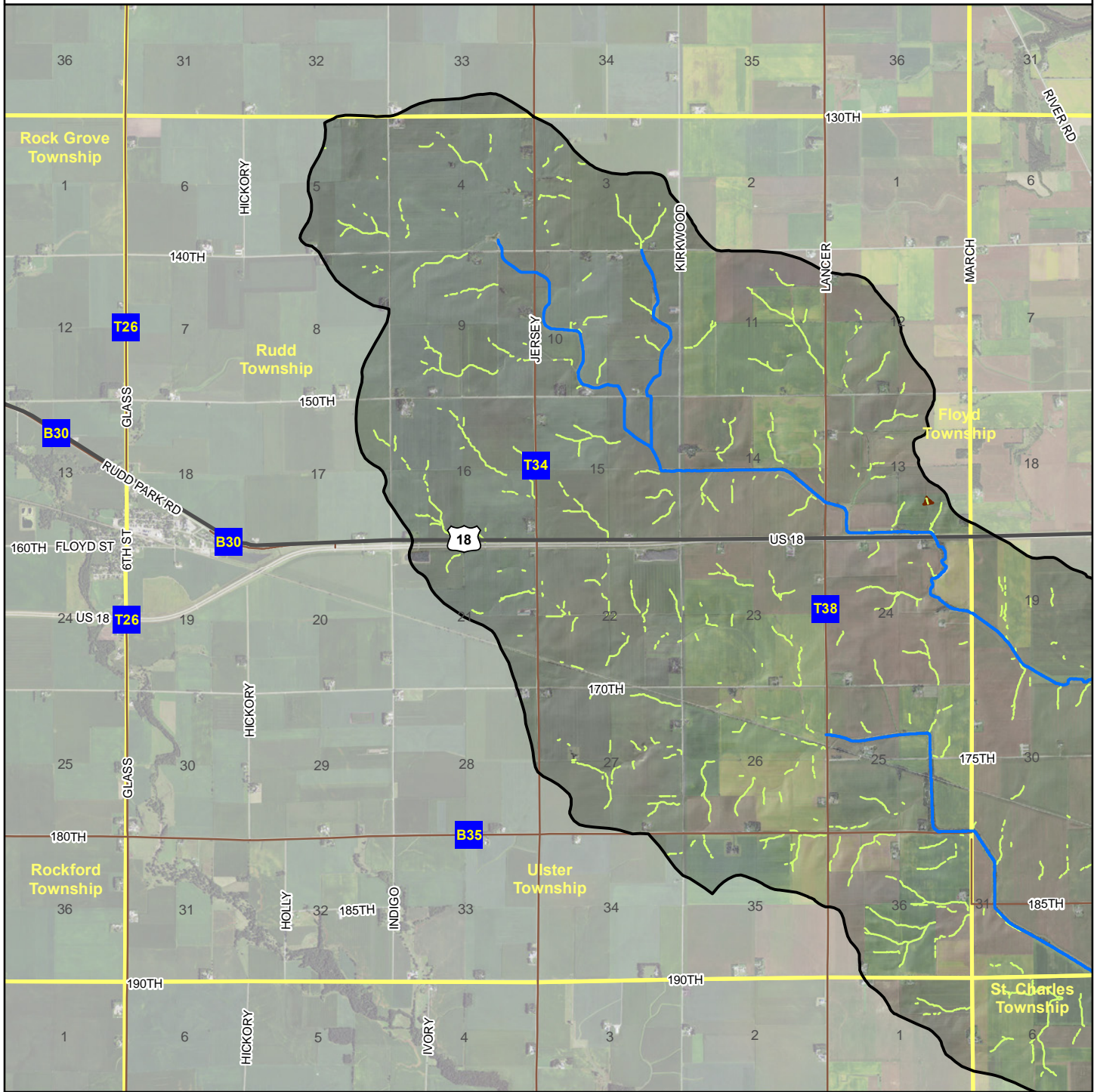


-  Watershed Boundary
-  Streams
-  Contour Buffer Strips
-  Grassed Waterways
-  Water and Sediment Control Basins

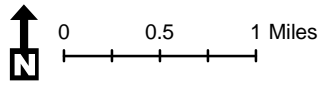




# Charles City Sponsored Project Watershed T96N R17W Agricultural Conservation Planning Framework Runoff Control Practices

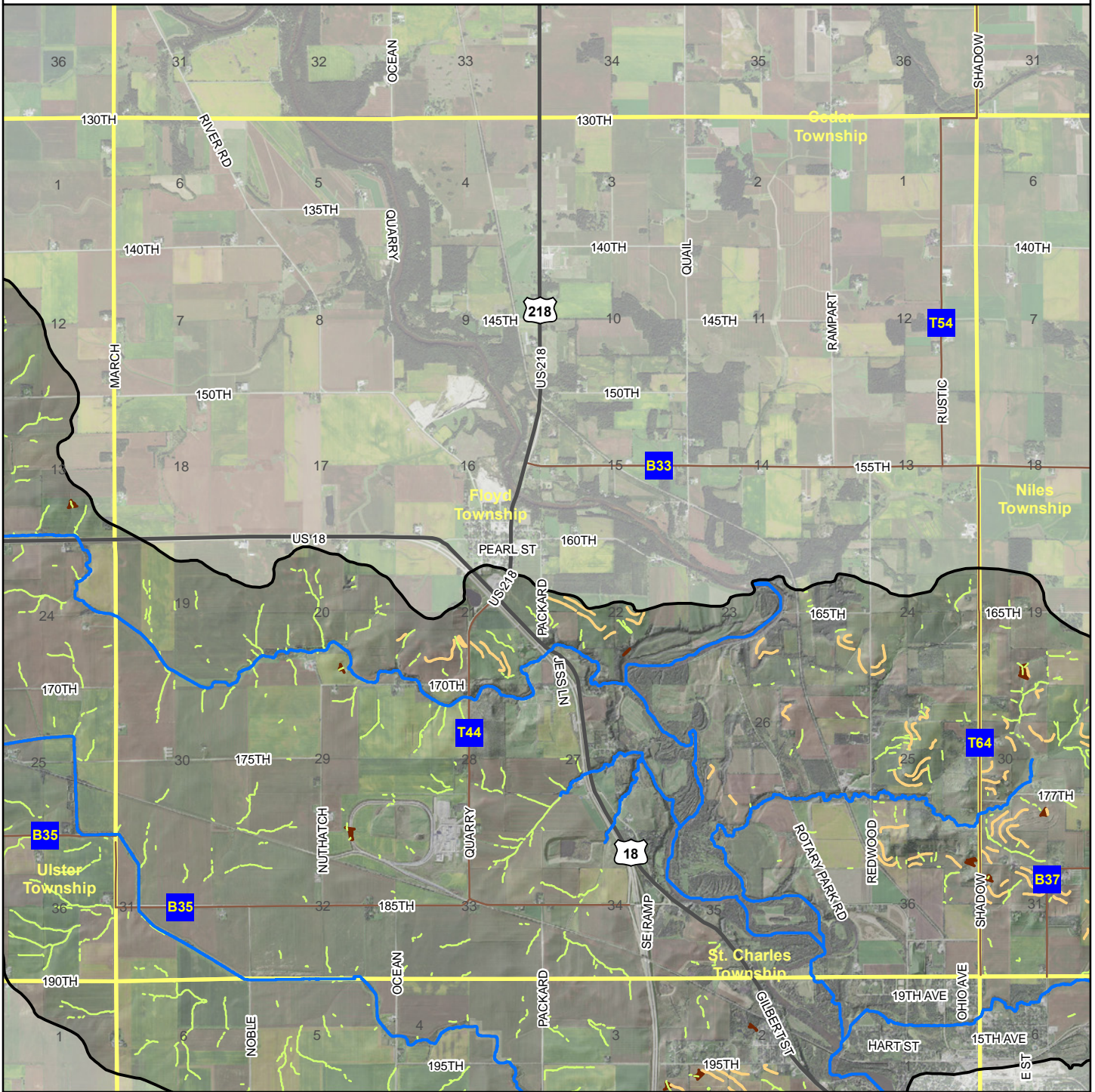


- Watershed Boundary
- Streams
- Contour Buffer Strips
- Grassed Waterways
- Water and Sediment Control Basins

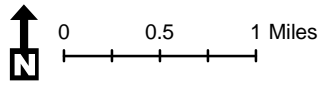




# Charles City Sponsored Project Watershed T96N R16W Agricultural Conservation Planning Framework Runoff Control Practices

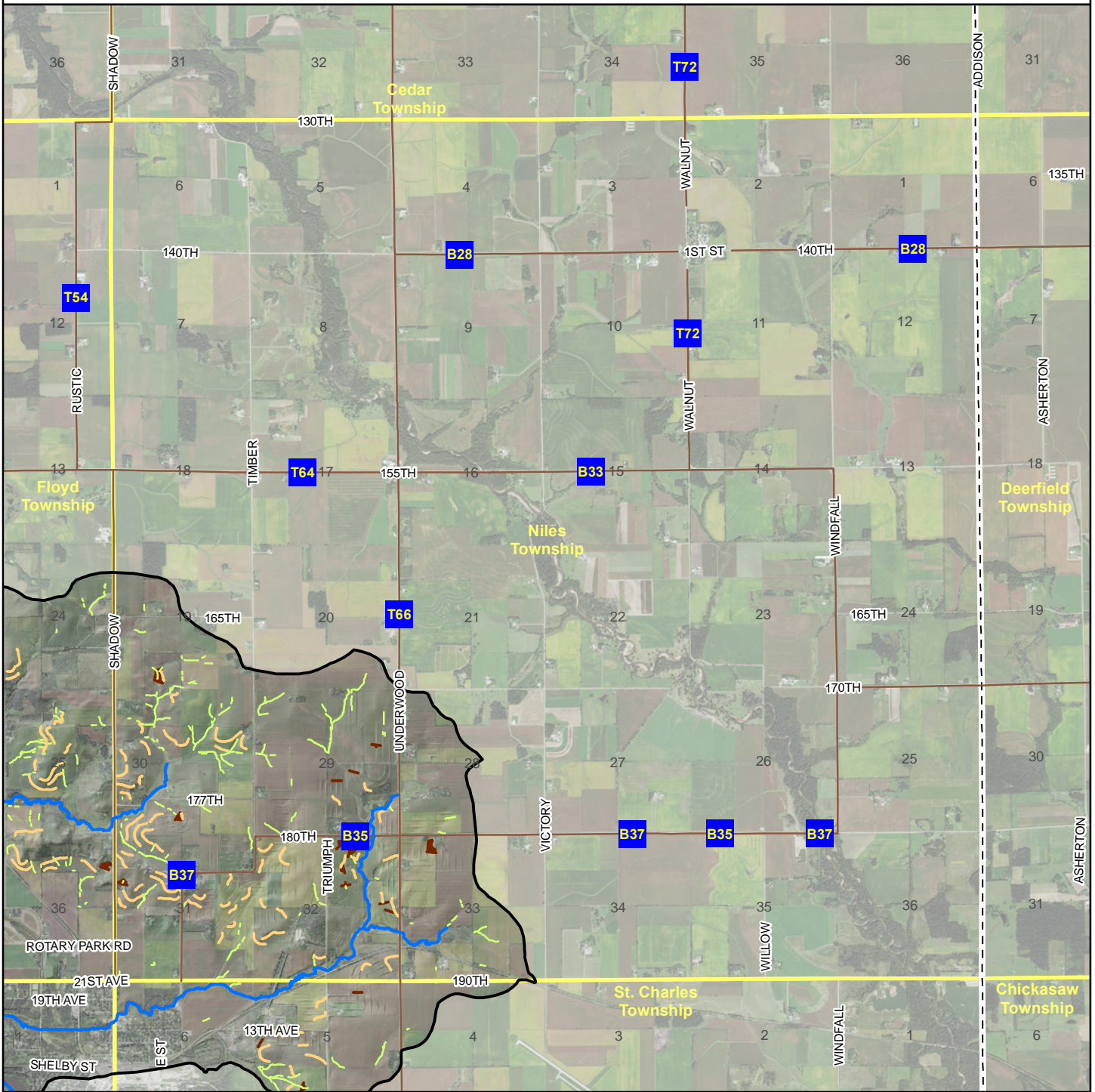


- Watershed Boundary
- Streams
- Contour Buffer Strips
- Grassed Waterways
- Water and Sediment Control Basins

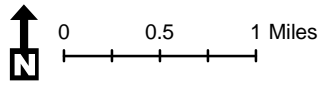




# Charles City Sponsored Project Watershed T96N R15W Agricultural Conservation Planning Framework Runoff Control Practices

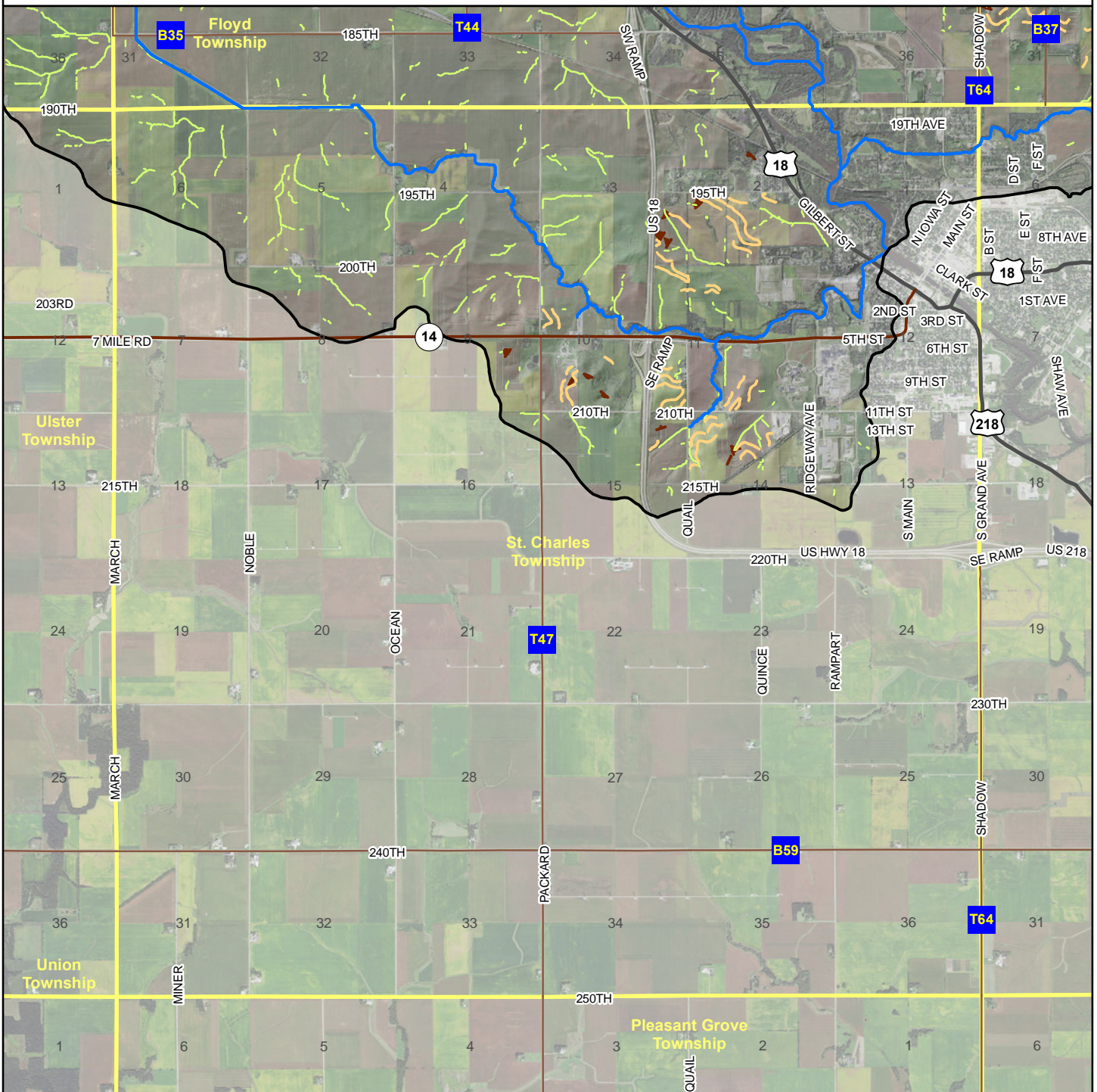







- Watershed Boundary
- Streams
- Contour Buffer Strips
- Grassed Waterways
- Water and Sediment Control Basins

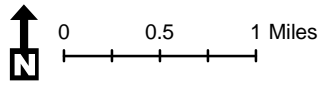




# Charles City Sponsored Project Watershed T95N R16W Agricultural Conservation Planning Framework Runoff Control Practices

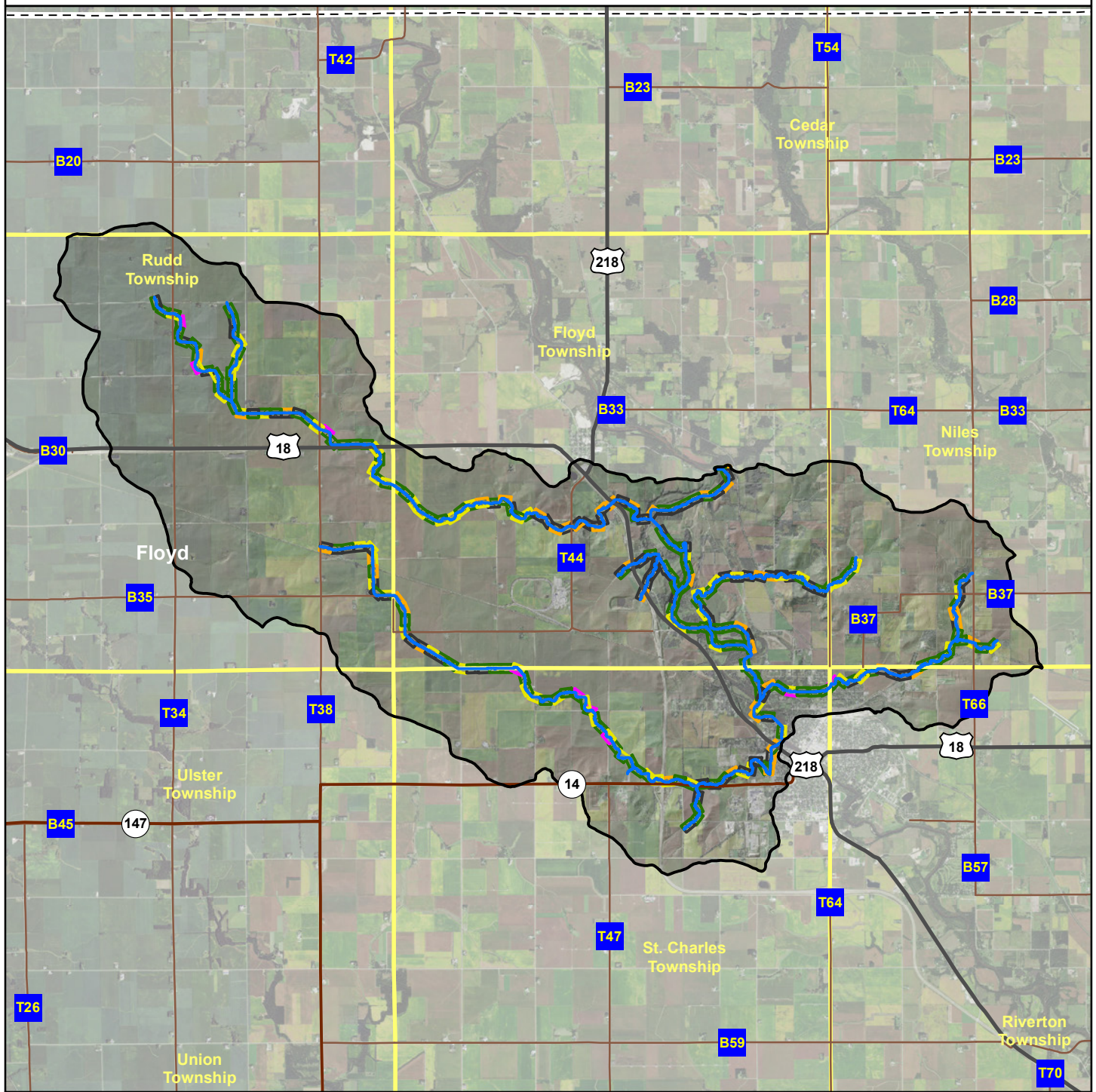


-  Watershed Boundary
-  Streams
-  Contour Buffer Strips
-  Grassed Waterways
-  Water and Sediment Control Basins

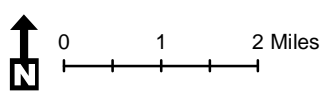




# Charles City Sponsored Project Watershed Agricultural Conservation Planning Framework Riparian Management Practices

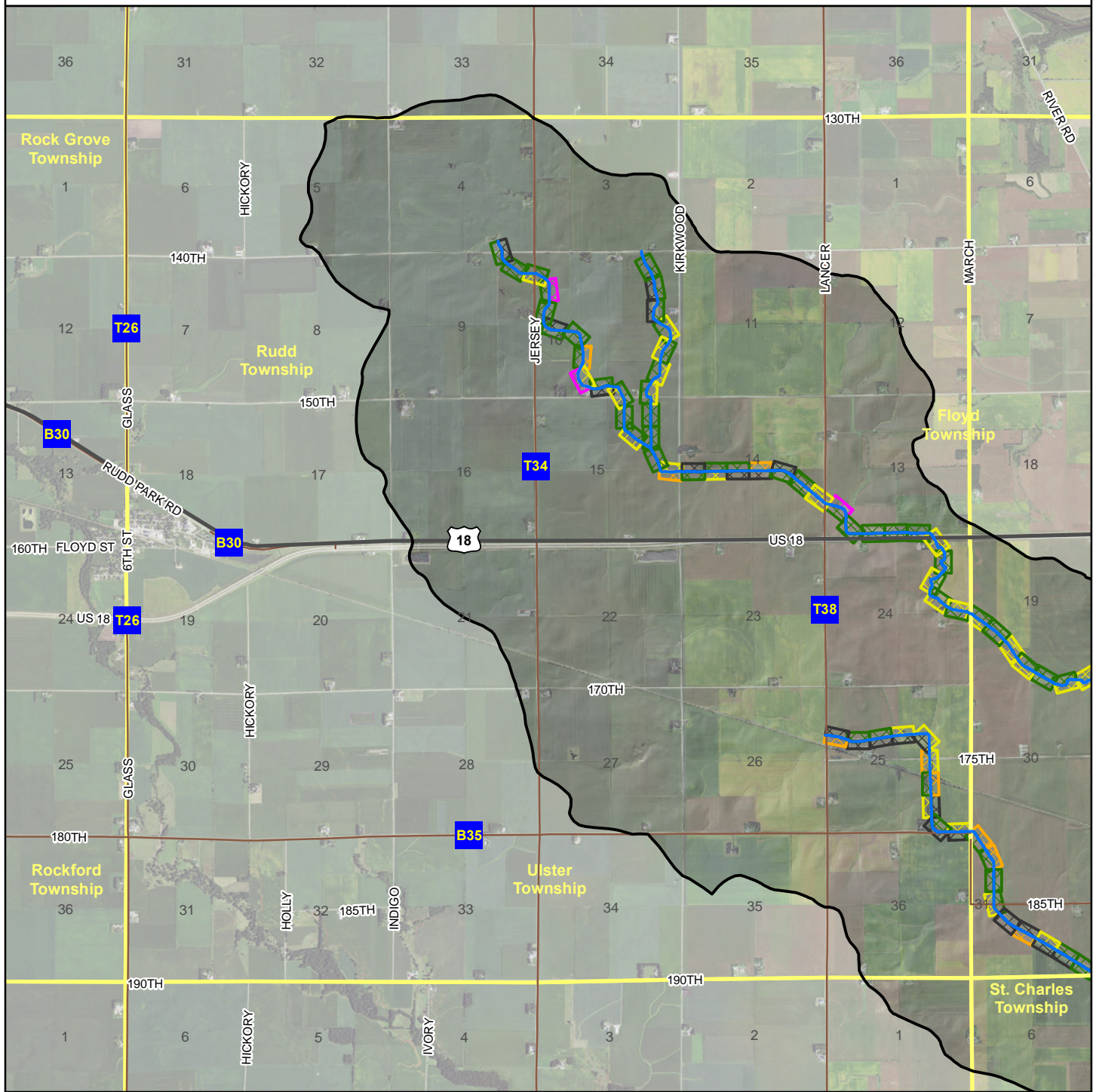


- |                    |                           |
|--------------------|---------------------------|
| Watershed Boundary | <b>Riparian Function</b>  |
| Streams            | Critical Zone             |
|                    | Multi Species Buffer      |
|                    | Deep Rooted Vegetation    |
|                    | Stiff Stemmed Grasses     |
|                    | Stream Bank Stabilization |

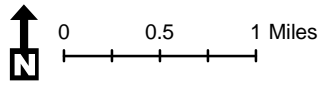




# Charles City Sponsored Project Watershed T96N R17W Agricultural Conservation Planning Framework Riparian Management Practices

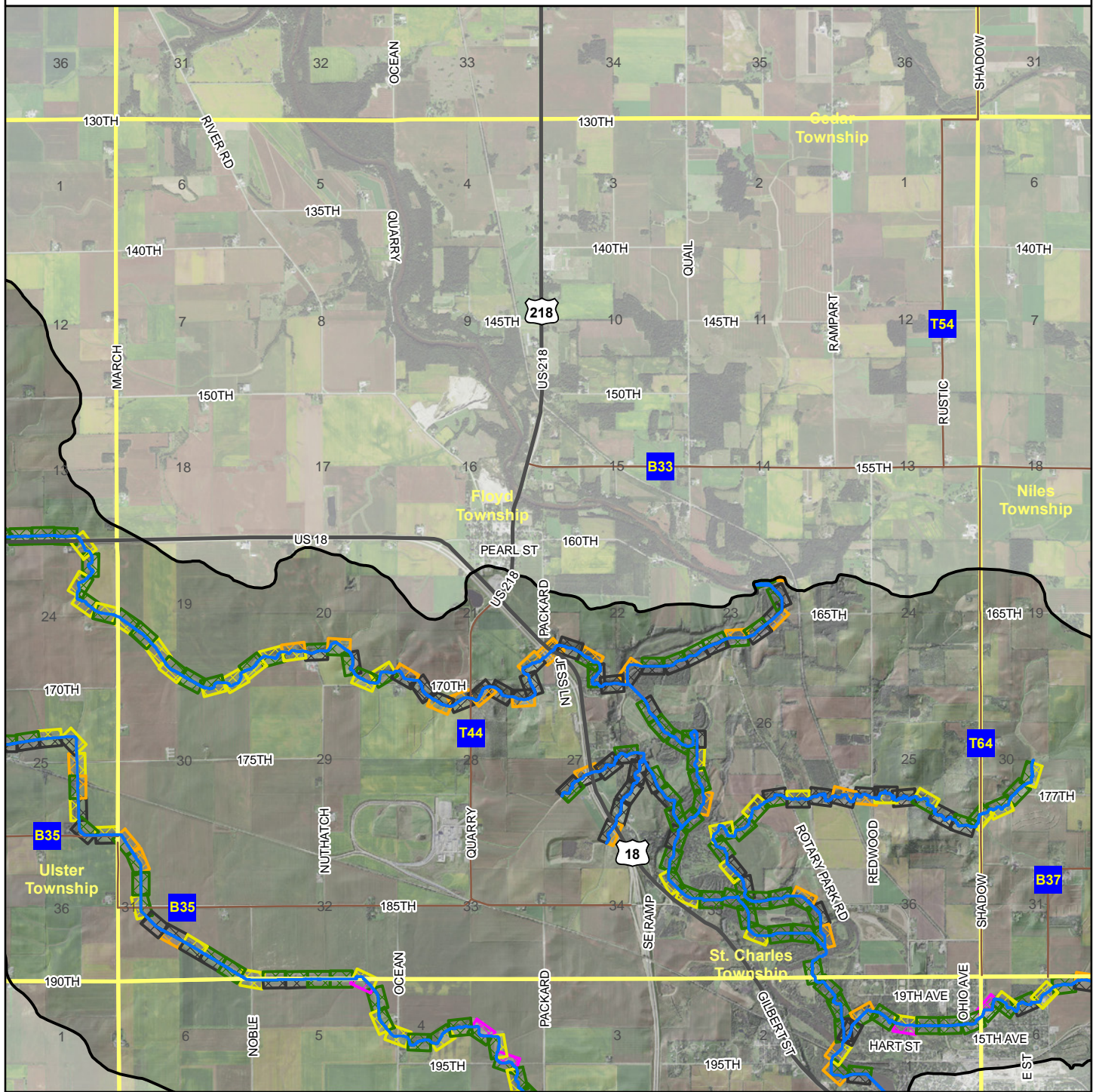









- |                    |                           |
|--------------------|---------------------------|
| Watershed Boundary | <b>Riparian Function</b>  |
| Streams            | Critical Zone             |
|                    | Multi Species Buffer      |
|                    | Deep Rooted Vegetation    |
|                    | Stiff Stemmed Grasses     |
|                    | Stream Bank Stabilization |

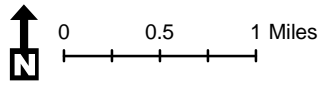




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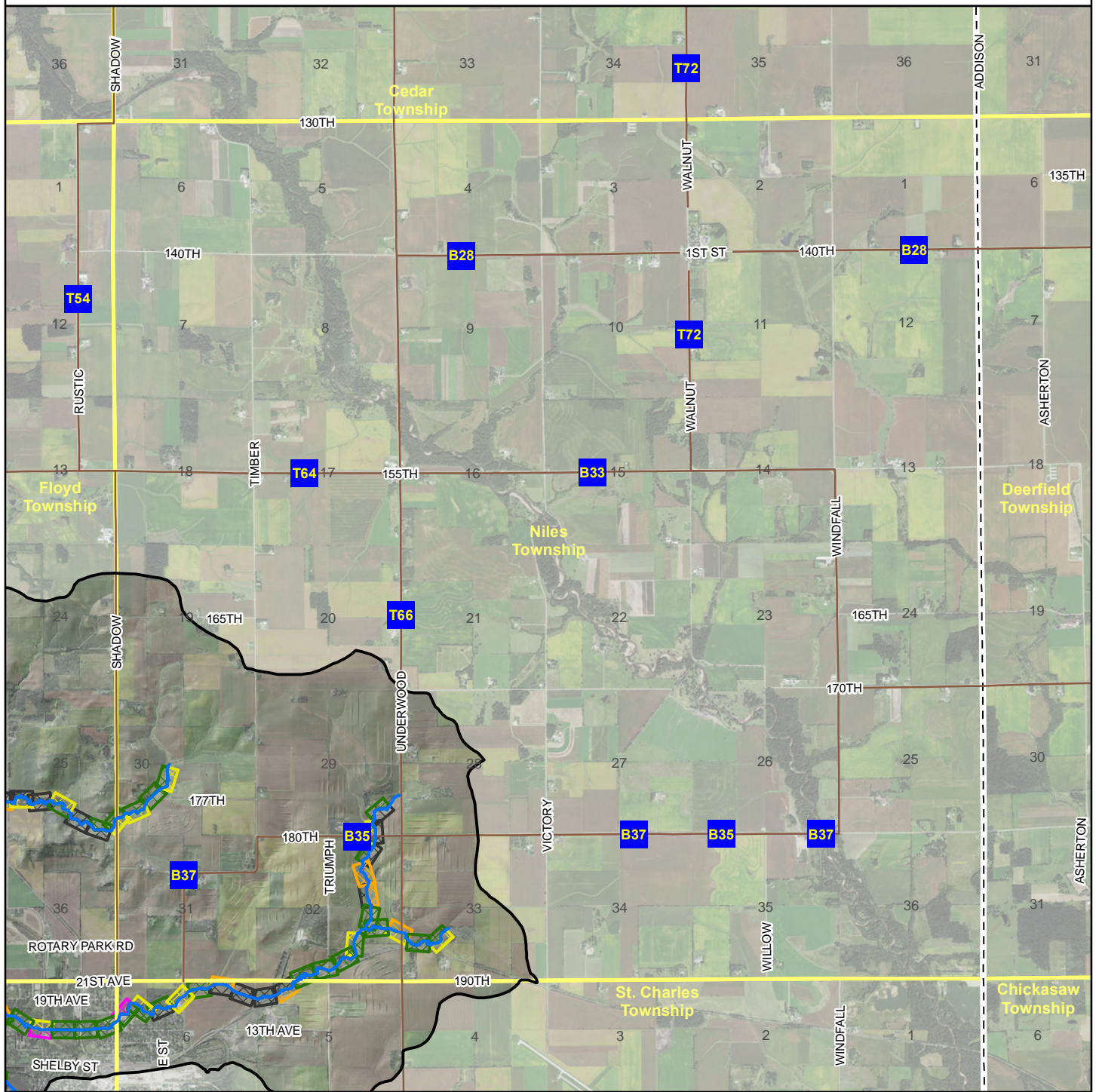









- |  |   |
|--|---|
|  Watershed Boundary | <b>Riparian Function</b>  |
|  Streams            |  Critical Zone             |
|  |  Multi Species Buffer      |
|  |  Deep Rooted Vegetation    |
|  |  Stiff Stemmed Grasses     |
|  |  Stream Bank Stabilization |

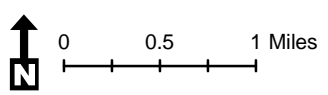




# Charles City Sponsored Project Watershed T96N R15W Agricultural Conservation Planning Framework Riparian Management Practices

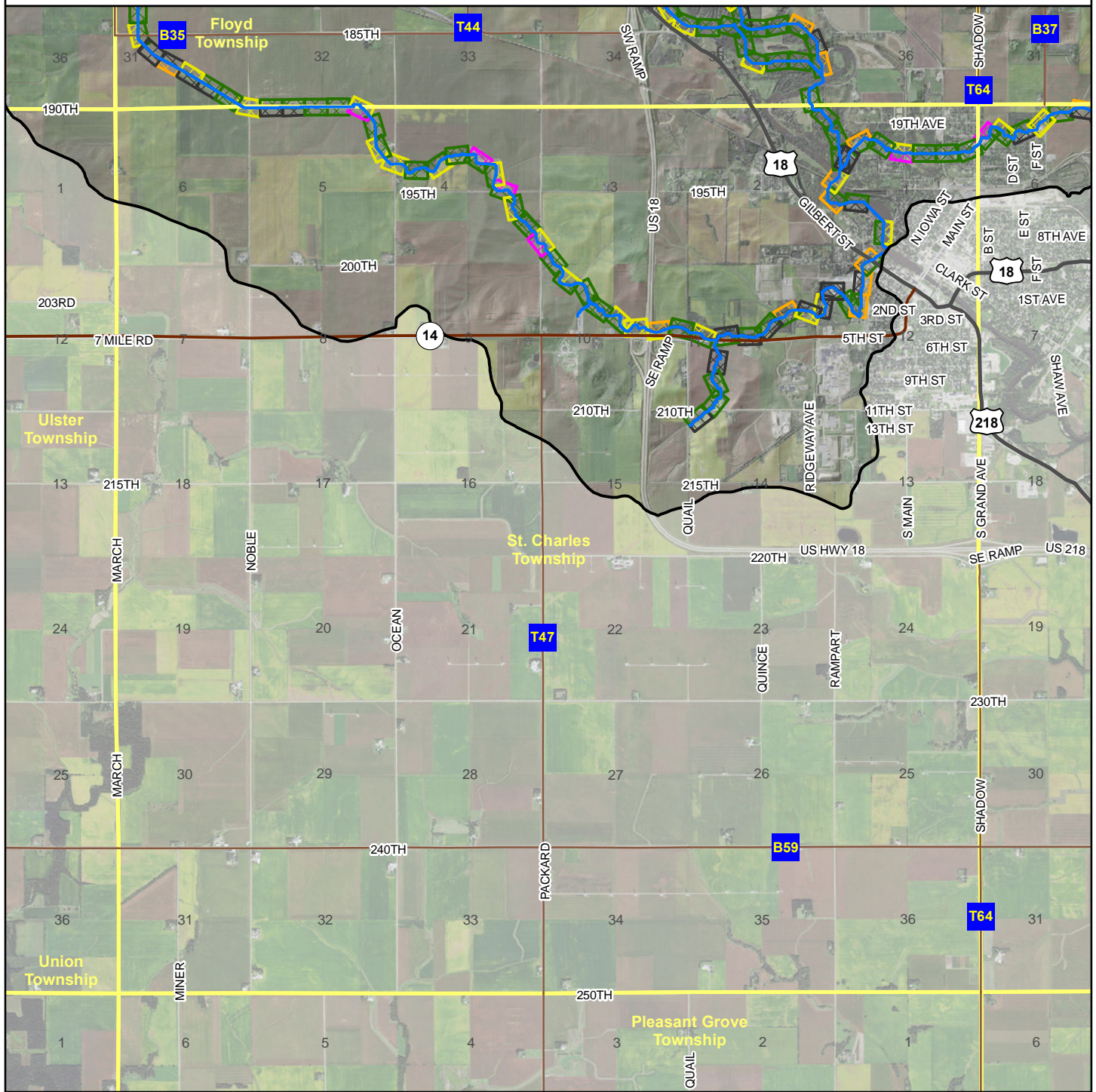









- |  |   |
|--|---|
|  Watershed Boundary | <b>Riparian Function</b>  |
|  Streams            |  Critical Zone             |
|  |  Multi Species Buffer      |
|  |  Deep Rooted Vegetation    |
|  |  Stiff Stemmed Grasses     |
|  |  Stream Bank Stabilization |

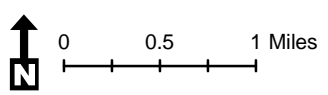




# Charles City Sponsored Project Watershed T95N R16W Agricultural Conservation Planning Framework Riparian Management Practices



- |  |   |
|--|---|
|  Watershed Boundary | <b>Riparian Function</b>  |
|  Streams            |  Critical Zone             |
|  |  Multi Species Buffer      |
|  |  Deep Rooted Vegetation    |
|  |  Stiff Stemmed Grasses     |
|  |  Stream Bank Stabilization |



## Appendix C: Watershed Project Self-Evaluation Worksheet

### Purpose

This self-evaluation worksheet is a means to assess annual watershed project progress and to identify areas of strength and weakness. The evaluation worksheet should be completed annually by project leaders and partners. Results should be compiled and shared with all project partners.

**Evaluation Watershed Project:** \_\_\_\_\_

**Evaluator Name:** \_\_\_\_\_

**Evaluation Date:** \_\_\_\_\_

**Evaluation Time Period:** \_\_\_\_\_ to \_\_\_\_\_

<b>Project Administration</b>	<b>Exceeds</b>	<b>Meets</b>	<b>Partially Meets</b>	<b>Does Not Meet</b>	<b>NA</b>
Project annual review meeting held.					
Watershed partners represent a broad and diverse membership and most interests in the watershed.					
Watershed partners understand their responsibilities and roles.					
Watershed partners share a common vision and purpose.					
Watershed partners are aware of and involved in project activities.					
Watershed partners understand decision making processes.					
Watershed meetings are well-organized and productive.					
Watershed partners advocate for the mission.					

<b>Attitudes and Awareness</b>	<b>Exceeds</b>	<b>Meets</b>	<b>Partially Meets</b>	<b>Does Not Meet</b>	<b>NA</b>
Positive changes in attitudes, beliefs and practices have occurred in the watershed.					
Field days and other events have been held in the watershed.					
Watershed project has received publicity via local and regional media outlets.					



<b>Performance</b>	<b>Exceeds</b>	<b>Meets</b>	<b>Partially Meets</b>	<b>Does Not Meet</b>	<b>NA</b>
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
The majority of implemented conservation practices have been retained after cost-share payments ended.					

<b>Results</b>	<b>Exceeds</b>	<b>Meets</b>	<b>Partially Meets</b>	<b>Does Not Meet</b>	<b>NA</b>
Monitoring of _____ (insert variable) has shown progress towards reaching plan goals.					
Monitoring of _____ (insert variable) has shown progress towards reaching plan goals.					
Monitoring of _____ (insert variable) has shown progress towards reaching plan goals.					
Impact (financial or other) to farmers and landowners has been positive or minimal.					
Modeled impacts on _____ (insert variable) have shown progress towards reaching plan goals.					
Modeled impacts on _____ (insert variable) have shown progress towards reaching plan goals.					
Modeled impacts on _____ (insert variable) have shown progress towards reaching plan goals.					

## Strengths, Weaknesses, Opportunities and Threats Analysis

Thinking about the goals of the watershed plan, brainstorm the strengths, weaknesses, opportunities and threats (SWOTs) relevant to the project. Identification of SWOTs is important as they help shape successful watershed plan implementation.

<b>Strengths</b>	<b>Opportunities</b>
<b>Weaknesses</b>	<b>Threats</b>



## Appendix D: Nitrogen Reduction Calculation Worksheet

This worksheet can be used to estimate nitrate load reduction at the watershed outlet based on the number of acres treated with best management practices (BMPs). Along with water monitoring results, this estimate can give an indication of water quality trends.

### Instructions

1. Enter acres treated with or drained into BMPs into "Acres Treated" column for each BMP.
2. Multiply "Acres Treated" by "Multiplier" for each BMP and enter result into "N Load Reduction" column.
3. "Total N Load Reduction" equals the sum of the BMP rows in the "N Load Reduction" column.
4. Obtain "Baseline N Load" value from watershed plan document (Table 4.1).
5. Calculate "Percent N Reduction" as "Total N Load Reduction" divided by "Baseline N Load" multiplied by a factor of 100.

Best Management Practice	Acres Treated	Multiplier	N Load Reduction
Cover crops, below EOF*		8.0	
Cover crops, above EOF*		3.9	
Nutrient management**		2.6	
Prairie strips		22.1	
Bioreactors		11.2	
Saturated buffers		13.0	
Wetlands		13.5	
<b>Total N Load Reduction (lb/yr)</b>			
<b>Baseline N Load (lb/yr)</b>			624,000
<b>Percent N Reduction (%)</b>			

\*The location of cover crops relative to edge-of-field (EOF) practices is important. Cover crops "below", or downstream of, EOF practices result in greater nitrate-nitrogen reduction than cover crops located "above", or upstream of, EOF practices.

\*\*Include only acres treated with nutrient management (e.g., MRTN application rate, nitrification inhibitor) that do not also have cover crops.

## Appendix E: Potential Funding Sources

### Public Funding Sources

Program	Description	Agency/Organization
Iowa Financial Incentives Program	50 percent cost-share available to landowners through 100 SWCDs for permanent soil conservation practices.	IDALS-DSCWQ
No-Interest Loans	State administered loans to landowners for permanent soil conservation practices.	IDALS-DSCWQ
District Buffer Initiatives	Funds for SWCDs to initiate, stimulate, and incentivize signup of USDA programs, specifically buffers.	IDALS-DSCWQ
Iowa Watershed Protection Program	Funds for SWCDs to provide water quality protection, flood control, and soil erosion protection in priority watersheds; 50-75 percent cost-share.	IDALS-DSCWQ
Conservation Reserve Enhancement Program	Leveraging USDA funds to establish nitrate removal wetlands in north central Iowa with no cost to landowner.	IDALS-DSCWQ
Soil and Water Enhancement Account - REAP Water Quality Improvement Projects	REAP funds for water quality improvement projects (sediment, nutrient and livestock waste) and wildlife habitat and forestry practices; 50-75 percent cost-share. Used as state match for EPA 319 funding. Tree planting, native grasses, forestry, buffers, streambank stabilization, traditional erosion control practices, livestock waste management, ag drainage well closure and urban storm water.	IDALS-DSCWQ
State Revolving Loans	Low interest loans provided by SWCDs to landowners for permanent water quality improvement practices; subset of DNR program.	IDALS-DSCWQ
Watershed Improvement Fund	Local watershed improvement grants to enhance water quality for beneficial uses, including economic development.	IDALS-DSCWQ
General Conservation Reserve Program	Encourages farmers to convert highly erodible land or other environmentally sensitive land to vegetative cover; farmers receive annual rental payments.	USDA-FSA
Continuous Conservation Reserve Program	Encourages farmers to convert highly erodible land or other environmentally sensitive land to vegetative cover, filter strips or riparian buffers; farmers receive annual rental payments.	USDA-FSA
Farmable Wetland Program	Voluntary program to restore farmable wetlands and associated buffers by improving hydrology and vegetation.	USDA-FSA
Grassland Reserve Program	Provides funds to grassland owners to maintain, improve and establish grass. Contracts of easements up to 30 years.	USDA-FSA
Environmental Quality Incentives Program	Provides technical and financial assistance for natural resource conservation in environmentally beneficial and cost-effective manner; program is generally 50 percent cost-share.	USDA-NRCS
Wetland Reserve Program	Provides restoration of wetlands through permanent and 30 year easements and 10 year restoration agreements.	USDA-NRCS
Emergency Watershed Protection Program	Flood plain easements acquired via USDA designated disasters due to flooding.	USDA-NRCS
Wildlife Habitat Incentives Program	Cost-share contracts to develop wildlife habitat.	USDA-NRCS
Farm and Ranchland Protection Program	Purchase of easements to limit conversion of ag land to non-ag uses. Requires 50 percent match.	USDA-NRCS
Cooperative Conservation Partnership Programs	Conservation partnerships that focus technical and financial resources on conservation priorities in watersheds and airsheds of special significance.	USDA-NRCS
Conservation Security Program	Green payment approach for maintaining and increasing conservation practices.	USDA-NRCS



Conservation Collaboration Grants	National and state grants for innovative solutions to a variety of environmental challenges.	USDA-NRCS
Regional Conservation Partnership Program	Grants from national, state or Critical Conservation Area funding pools to promote formation of partnerships to facilitate conservation practice implementation. Each partner within a project must make a significant cash or in-kind contribution.	USDA-NRCS
Conservation Stewardship Program	Encourages farmers to begin or continue conservation through five-year contracts to install and maintain conservation practices and adopt conservation crop rotations.	USDA-NRCS
Aquatic Ecosystem Restoration — Section 206	Restoration projects in aquatic ecosystems such as rivers, lakes and wetlands.	US Army Corps
Habitat Restoration of Fish and Wildlife Resources	Must involve modification of the structures or operations of a project constructed by the Corps of Engineers.	US Army Corps
Section 319 Clean Water Act	Grants to implement NPS pollution control programs and projects in watersheds with EPA approved watershed management plans.	EPA/DNR
Iowa Water Quality Loan Fund	Source of low-cost financing for farmers and landowners, livestock producers, community groups, developers, watershed organizations and others.	DNR
Sponsored Projects	Wastewater utilities can finance and pay for projects, within or outside the corporate limits, that cover best management practices to keep sediment, nutrients, chemicals and other pollutants out of streams and lakes.	DNR/Iowa Finance Authority
Resource Enhancement and Protection Program	Provides funding for enhancement and protection of the State's natural and cultural resources.	DNR
Streambank Stabilization and Habitat Improvement	Penalties from fish kills used for environmental improvement on streams impacted by the kill.	DNR/IDALS-DSCWQ
State Revolving Fund	Provides low interest loans to municipalities for waste water and water supply; expanding to private septic systems, livestock, storm water and nonpoint source pollutants. Sponsored Projects can be used to leverage wastewater infrastructure investments to create additional funding for nonpoint source/agricultural water quality improvement.	DNR
Watershed Improvement Review Board	Comprised of representatives from agriculture, water utilities, environmental organizations, agribusiness, the conservation community and state legislators and provides grants to watershed and water quality projects.	WIRB
Iowa Water Quality Initiative	Initiated by IDALS-DSCWQ as a demonstration and implementation program for the Nutrient Reduction Strategy. Funds are targeted to nine priority HUC-8 watersheds.	IDALS-DSCWQ
Fishers and Farmers Partnership	Fishers & Farmers Partnership for the Upper Mississippi River Basin is a self-directed group of nongovernmental agricultural and conservation organizations, tribal organizations and state and federal agencies working to achieve the partnership's mission "... to support locally-led projects that add value to farms while restoring aquatic habitat and native fish populations."	US Fish and Wildlife Service and others

## Private Funding Sources

Program	Description	Website
Field to Market® Alliance	Field To Market® is a diverse alliance working to create opportunities across the agricultural supply chain for continuous improvements in productivity, environmental quality and human well-being. The group provides collaborative leadership that is engaged in industry-wide dialogue, grounded in science and open to the full range of technology choices.	<a href="https://www.fieldtomarket.org/members/">https://www.fieldtomarket.org/members/</a>
International Plant Nutrition Institute (IPNI)	The IPNI is a not-for-profit, science-based organization dedicated to the responsible management of plant nutrition for the benefit of the human family.	<a href="http://www.ipni.net">http://www.ipni.net</a>
Iowa Community Foundations	Iowa Community Foundations are nonprofit organizations established to meet the current and future needs of our local communities.	<a href="http://www.iowacommunityfoundations.org/">http://www.iowacommunityfoundations.org/</a>
Iowa Natural Heritage Foundation	Private nonprofit conservation organization working to ensure Iowans will always have beautiful natural areas — to bike, hike and paddle; to recharge, relax and refresh; and to keep Iowa healthy and vibrant.	<a href="http://www.inhf.org">http://www.inhf.org</a>
McKnight Foundation — Mississippi River Program	Program goal is to restore the water quality and resiliency of the Mississippi River.	<a href="http://www.mcknight.org/grant-programs/mississippi-river">http://www.mcknight.org/grant-programs/mississippi-river</a>
National Fish and Wildlife Foundation (NFWF)	NFWF provides funding on a competitive basis to projects that sustain, restore and enhance our nation's fish, wildlife and plants and their habitats.	<a href="http://www.nfwf.org">http://www.nfwf.org</a>
National Wildlife Foundation	Works to protect and restore resources and the beneficial functions they offer.	<a href="http://www.nwf.org">http://www.nwf.org</a>
The Fertilizer Institute (TFI)	TFI is the leading voice in the fertilizer industry, representing the public policy, communication and statistical needs of producers, manufacturers, retailers and transporters of fertilizer. Issues of interest to TFI members include security, international trade, energy, transportation, the environment, worker health and safety, farm bill and conservation programs to promote the use of enhanced efficiency fertilizer.	<a href="http://www.tfi.org">http://www.tfi.org</a>
The Nature Conservancy (TNC)	TNC is the largest freshwater conservation organization in the world — operating in 35 countries with more than 300 freshwater scientists and 500 freshwater conservation sites globally. TNC works with businesses, governments, partners and communities to change how water is managed around the world.	<a href="http://www.nature.org">http://www.nature.org</a>
Trees Forever — Working Watersheds Program	Annually work with 10-15 projects in Iowa that emphasize water quality through our Working Watersheds: Buffers and Beyond program.	<a href="http://www.treesforever.org/">http://www.treesforever.org/</a>
Walton Family Foundation — Environmental Program	Work to achieve lasting change by creating new and unexpected partnerships among conservation, business and community interests to build durable solutions to big problems.	<a href="http://www.waltonfamilyfoundation.org/environment">http://www.waltonfamilyfoundation.org/environment</a>