UPPER CRANE CREEK WATERSHED PLAN

A guide for healthy soil and clean water
in the Upper Crane Creek Watershed

Iowa Soybean Association
Environmental Programs & Services

Iowa Soybean Association Environmental Programs & Services

2018

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Watershed planning partners:

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Bremer County Soil and Water Conservation District

Natural Resources Conservation Service

Iowa State University Extension

Iowa Soybean Association

A guide for healthy soil and clean water in the Upper Crane Creek Watershed

Why was the Upper Crane Creek Watershed Plan developed?

This watershed plan is intended to provide guidance for land and water improvements in the Upper Crane Creek Watershed while simultaneously enhancing agricultural vitality. Environmental improvements are challenging. This plan lays out a phased approach to conservation implementation to facilitate continuous progress towards achieving long-term watershed goals.

Who developed this watershed plan?

The Upper Crane Creek Watershed Plan was authored by the Iowa Soybean Association. Guidance and input were provided by farmers and landowners from the watershed along with representatives of local and federal government and other organizations. The watershed planning process was led by the Iowa Soybean Association with assistance from the Bremer County Soil and Water Conservation District, the Natural Resources Conservation Service and Iowa State University Extension.

Who owns this watershed plan?

This plan is for all stakeholders interested in the Upper Crane Creek Watershed, including farmers, landowners, residents, nongovernmental organizations and local, state and federal units of government. Ultimately, successful implementation of this plan will rest with these stakeholders. Relationships and partnerships established and strengthened through the watershed planning process will be valuable as the Upper Crane Creek watershed plan is implemented.

Not funded by the soybean checkoff

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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 Upper Crane Creek Watershed is comprised of 30,689 acres. The watershed is located in Bremer County, Iowa, and Upper Crane Creek is the primary stream flowing through the watershed. Figure 1.1 shows the location of the Upper Crane Watershed and Figure 1.2 illustrates how watersheds function.

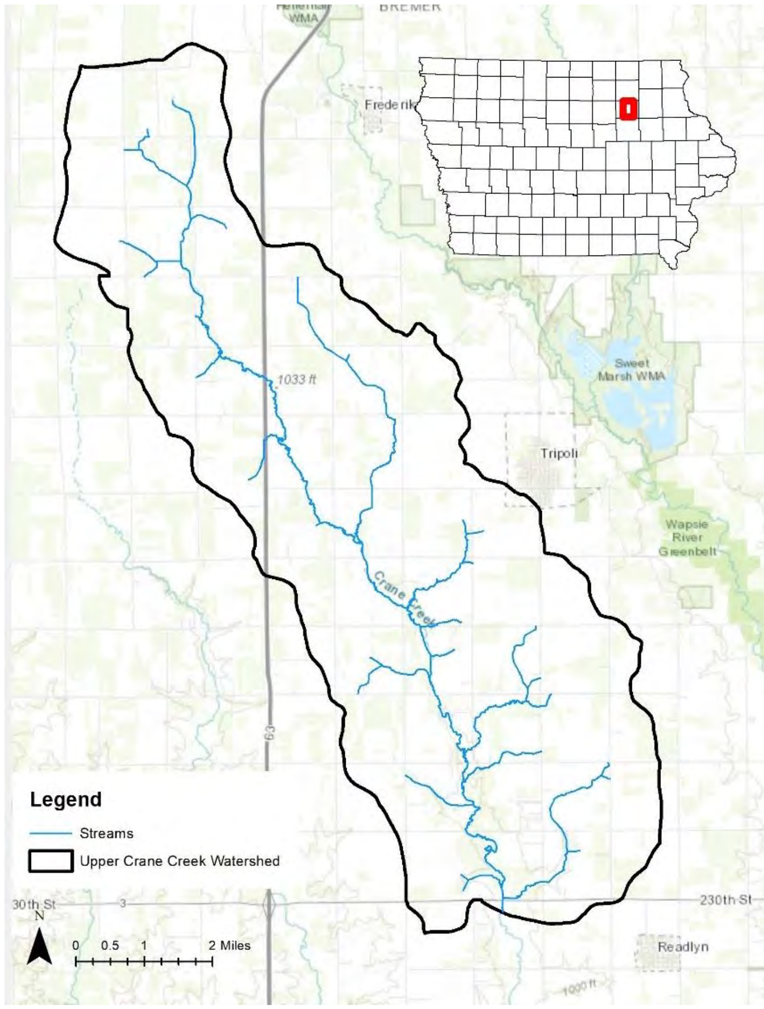

Figure 1.1. Location of the Upper Crane Creek Watershed.

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 USDA-Natural Resources Conservation Service (NRCS) under a Collaboration Conservation Grant. Stakeholders including watershed farmers, landowners, conservation professionals and others contributed knowledge and insights throughout the watershed planning process. The Upper Crane Creek Watershed Plan integrates existing data, citizen and stakeholder input and conservation practice recommendations to meet the goals established through the watershed planning process.

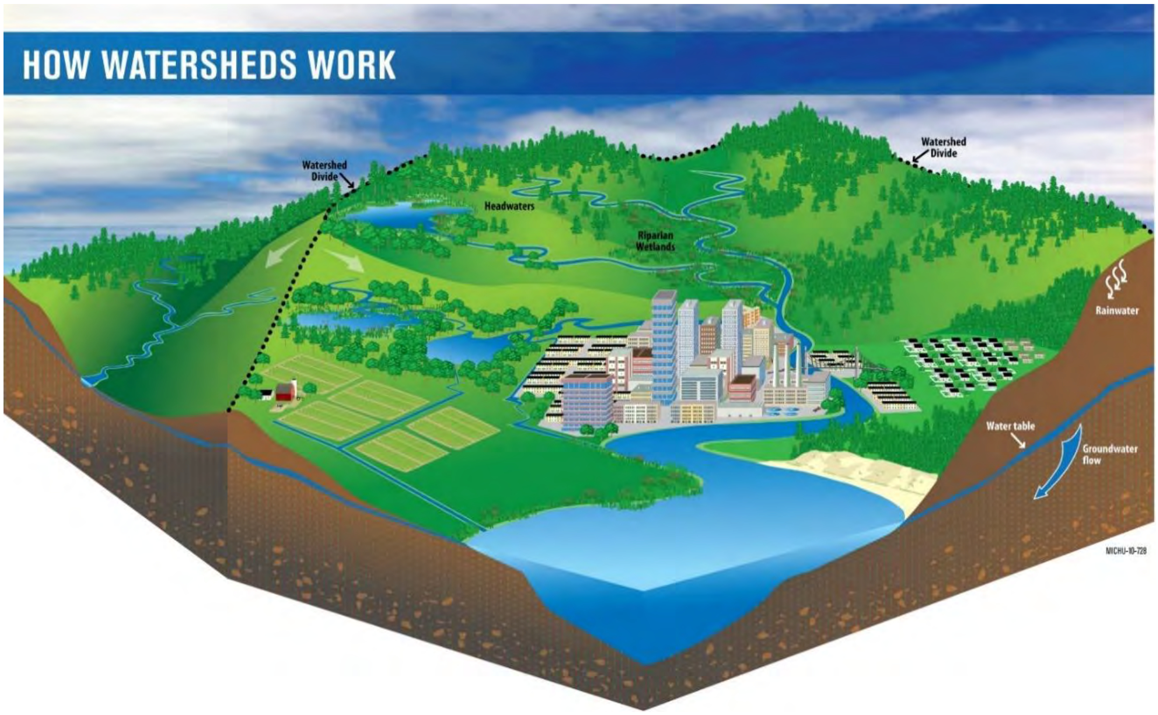

Figure 1.2. A watershed contains the land and water that flow to a common point ([Michigan Sea Grant]).

Figure 1.3. The watershed planning process.

The watershed was identified for watershed planning at the recommendation of the Bremer County Soil and Water Conservation District (SWCD). Relationships have been built and strengthened between the Bremer SWCD, watershed farmers and landowners, the NRCS, and the Iowa Soybean Association. 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 Upper Crane Creek Watershed is a subwatershed of the Wapsipinicon River Watershed. Recent watershed programming and activities within the Wapsipinicon River Watershed have been in support of flood reduction (via the Iowa Watershed Approach) 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.

Goals for the Upper Crane Creek 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 Upper Crane Creek Watershed Plan are to:

- Cost effective
- Profitable and productive agriculture
- Healthy water
- Healthy soils
- Minimize downstream impacts

Public involvement was a key component of the watershed planning process. Watershed planners encouraged participation 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 Upper Crane Creek 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 18-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 2037. The total investment necessary to accomplish the watershed plan goals is estimated to be approximately $1,818,500 for initial infrastructure costs associated with structural practices, up to $490,000 per year for annual costs associated with management practices and an additional $80,000 per year to fund technical assistance, outreach, monitoring and equipment necessary to promote, implement and evaluate 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 Upper Crane Creek Watershed Plan. Many of these practices have additional on-farm and off-farm economic and ecosystem benefits that also should 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 Upper Crane Creek Watershed conceptual plan. Negative unit costs for nutrient management and no-till/strip-till reflect input cost savings. Annualized nitrogen and phosphorus reduction costs reflect typical practice lifespans.

	Practice	Watershed plan goal	Unit	Cost per unit	Total cost	Watershed load reductions		Cost per Pound of Reduction	
						Nitrogen (lb N/yr)	Phosphorus (lb P/yr)	Nitrogen ($/lb N/yr)	Phosphorus ($/ton P/yr)
Annual costs	Cover crops (rye)	12,000	acres	$20	$240,000	93,000	677	$2.58	$0.18
Annual costs	Cover crops (oats)	5,000	acres	$20	$100,000	35,000	282	$2.86	$0.18
Annual costs	MRTN	10,000	acres	($5)	($50,000)	25,000	0	($2.00)	
Annual costs	Conversion of Cropland to Perennial Cover	1,000	acres	$200	$200,000	21,250	146	$9.41	$0.68
Initial costs	Drainage water management (50-year life)	4,500	acres	$63	$283,500	37,125	0	$0.15	
Initial costs	Bioreactors (15-year life)	4	sites	$15,000	$60,000	1,143	0	$3.50	
Initial costs	Saturated buffers (75-year life)	50	sites	$4,000	$200,000	16,616	0	$0.16	
Initial costs	Nitrate removal wetlands (75-year life)	3	sites	$425,000	$1,275,000	30,588	585	$0.56	$1.09

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 Upper Crane Creek Watershed.

2. Watershed Characteristics

2.1. General Information

The Upper Crane Creek Watershed encompasses 30,689 acres (247.9 square miles) used primarily for agricultural production. Row crop agriculture occupies 82 percent of the watershed. Terrain in the watershed is gently rolling. Crane Creek is the major surface water body within the watershed. There are no incorporated communities within the watershed. The majority of the watershed is privately owned. Public land in the watershed includes the Ringneck Wildlife Area which is managed by the Bremer County Conservation Board. Table 2.1.1 lists general information for the watershed.

Table 2.1.1. Watershed and stream information for the Upper Crane Creek Watershed.

Location	Bremer County, Iowa
Waterbody	Crane Creek
Waterbody ID (WBID)	IA 01-WPS-0180_3
Segment classes	A1, B(WW-2)
Designated uses	Primary contact recreation, Warm water aquatic life
Total length of all streams	46.0 miles
Watershed area	30,689 acres
Primary land use	Row crop agriculture
Incorporated communities	None
HUC-8 watershed	Upper Wapsipinicon
HUC-8 ID	07080102
HUC-10 watershed	Crane Creek
HUC-10 ID	0708010204
HUC-12 watershed	Upper Crane Creek
HUC-12 ID	070801020401

2.2. Water and Wetlands

Surface water in the Upper Crane Creek Watershed includes Crane Creek and unnamed tributary streams (Figure 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. Upper Crane Creek Watershed wetland classifications according to the National Wetlands Inventory.

Type	Acres
Intermittently Exposed	29.6
Intermittently Flooded	0.7
Seasonally Flooded	120.1
Semipermanently Flooded	6.3
Temporarily Flooded	37.1
Total	**193.8**

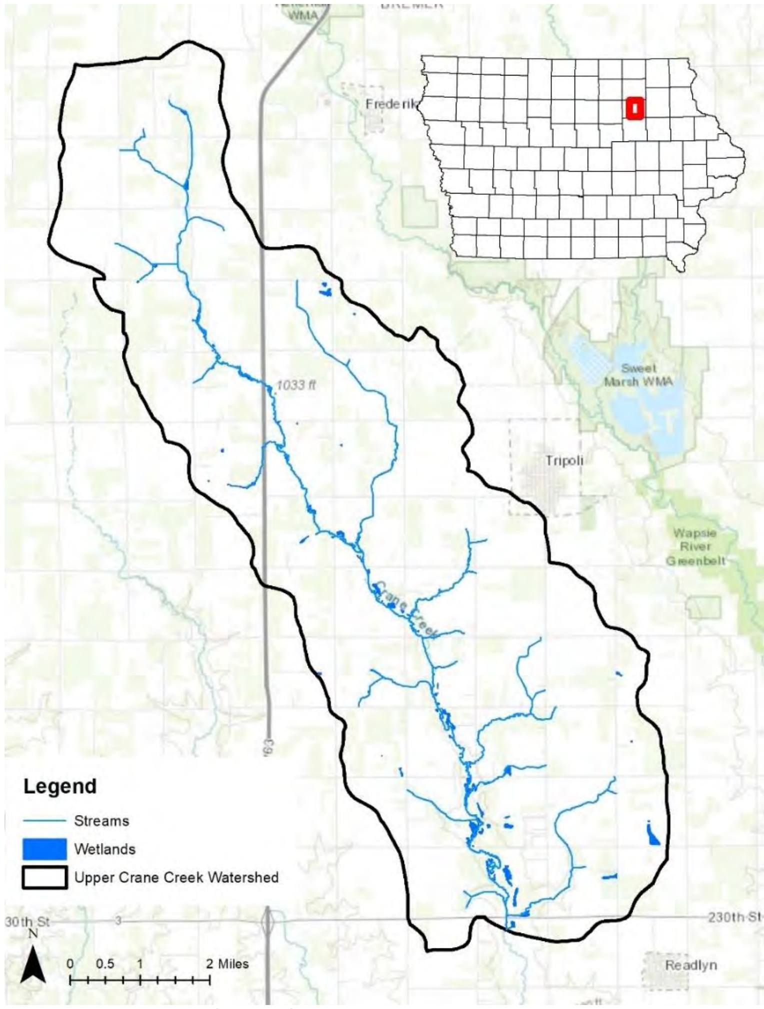

Figure 2.2.1. Wetlands in the Upper Crane Creek Watershed mapped in the National Wetlands Inventory.

2.3. Climate

Precipitation data obtained from the Iowa Environmental Mesonet show annual total precipitation at Tripoli averaged 36.3 inches per year from 2001 through 2016, with a range of 24.01 to 60.6 inches per year for the 16-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 16 years. Monthly precipitation averages are displayed in Figure 2.3.2.

Figure 2.3.1. Total annual precipitation at Tripoli from 2001 through 2016 (Iowa Environmental Mesonet).

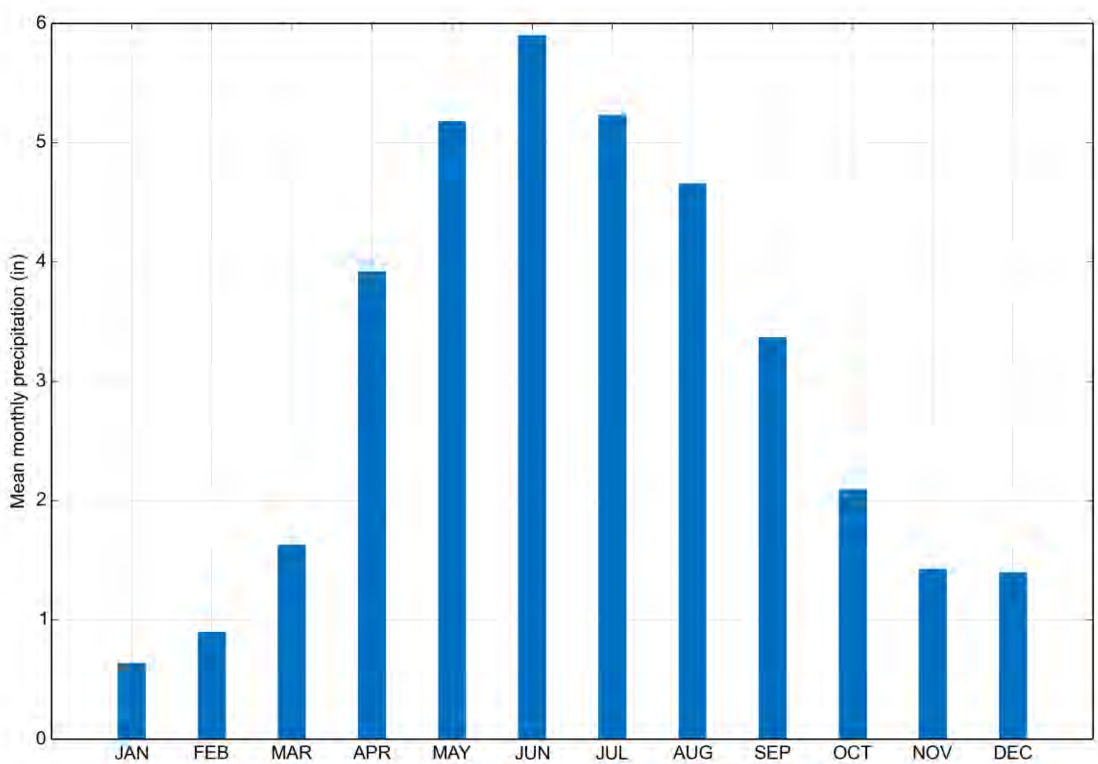

Figure 2.3.2. 2001 to 2016 average precipitation by month at Tripoli (Iowa Environmental Mesonet).

2.4. Geology and Terrain

The Upper Crane Creek Watershed is located within the Iowan Surface landform region. The Iowan 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 9 percent of the watershed contains alluvial deposits, which are located primarily along Upper Crane Creek. The watershed also is located within the Eastern Iowa and Minnesota Till Prairies Major Land Resource Area (MLRA 104).

Land surface elevation in the watershed ranges from 914 to 1,143 feet above sea level. Figure 2.4.1 shows elevations derived from Light Detection and Ranging (LiDAR) data. Figure 2.4.2 displays the spatial distribution of slope classes within the watershed, which are also listed in Table 2.4.1. Ninty-four percent of the watershed has slopes of five percent or less.

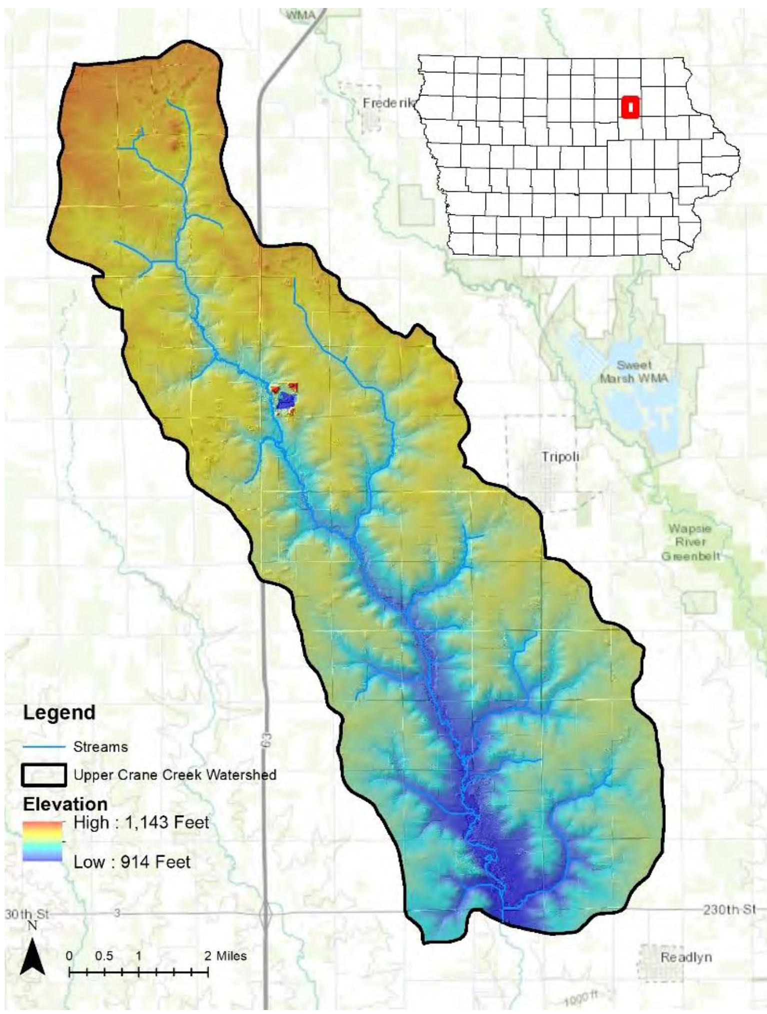

Figure 2.4.1. LiDAR-derived elevations within the Upper Crane Creek Watershed.

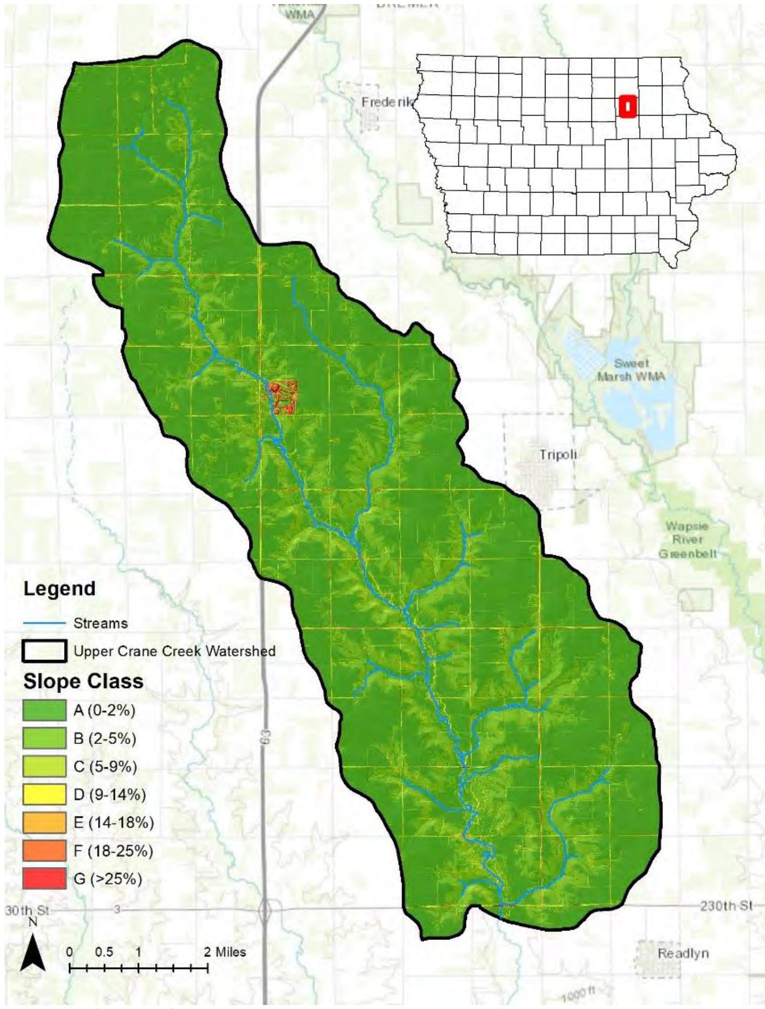

Figure 2.4.2. Upper Crane Creek Watershed slope classifications derived from elevation data.

Table 2.4.1. Extent of each slope class within the Upper Crane Creek Watershed.

Slope Class	Range	Acres	Percent of Watershed
A	0-2%	21,087	69%
B	2-5%	7,789	26%
C	5-9%	1,054	3%
D	9-14%	433	1%
E	14-18%	170	< 1%
F	18-25%	100	< 1%
G	> 25%	57	< 1%

2.5. Soils

The most common soil series in the watershed are Tripoli, Readlyn and Clyde. The predominant parent material is loess on ridges and sideslopes. Native vegetation for these soils was tall grass prairie and some deciduous trees. These soils range from well drained to poorly drained, and tile drainage is common for some soils in this association. Descriptions of the 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 NRCS.

Table 2.5.1. Descriptions of common soils in the watershed (NRCS Official Soil Series Descriptions).

Soil Series	Description
Tripoli	The Tripoli series consists of very deep, poorly drained soils that formed in 30 to 70 centimeters of loamy sediments and the underlying till. Tripoli soils are on nearly level or slightly concave positions on dissected till plains of low relief on the Iowan Erosion Surface. Slope ranges from 0 to 2 percent.
Clyde	The Clyde series consists of 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 interfluves on dissected till plains. Slope ranges from 0 to 4 percent.
Readlyn	The Readlyn series consists of 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 Iowan Erosion Surface. Slope ranges from 0 to 5 percent.

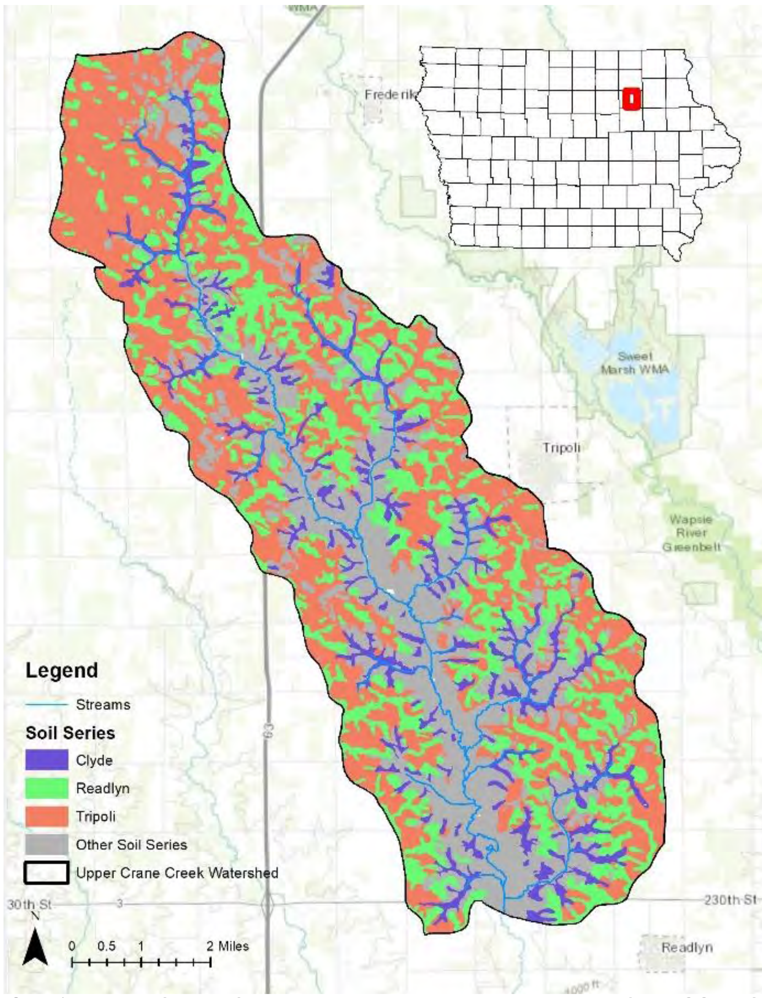

Figure 2.5.1. Upper Crane Creek Watershed soil map derived from SSURGO data.

Soil drainage properties affect surface and subsurface water movement within the watershed. These characteristics are summarized in Table 2.5.2. Approximately 51 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 drained soils may be hydric. Hydric soils within the watershed are mapped in Figure 2.5.2.

Table 2.5.2. *Extent, productivity (Corn Suitability Rating 2) and drainage properties of common soils in the watershed.*

Soil Series	Acres	Percent	CSR2	Drainage Class	Hydrologic Group	Hydric Class
Tripoli	12,029	39%	90	Poorly drained	B/D	All hydric
Readlyn	7,492	25%	90	Somewhat poorly drained	B	Partially hydric
Clyde	2,774	9%	87	Poorly drained	B/D	All hydric

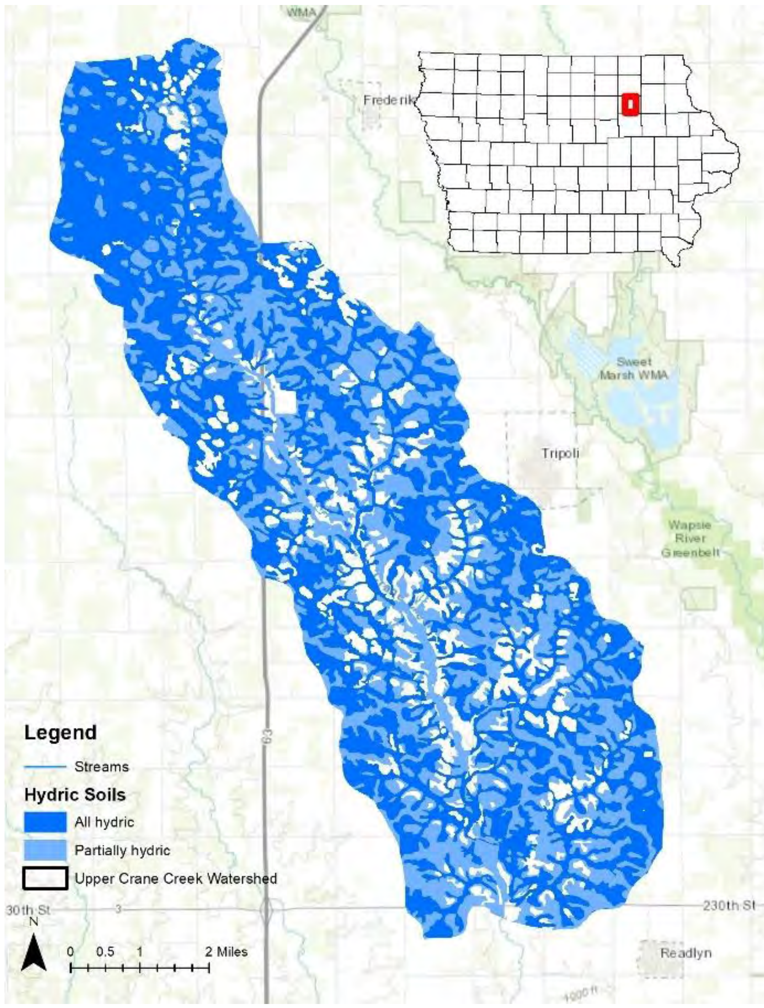

Figure 2.5.2. Soil map units in the Upper Crane Creek Watershed that are classified as hydric.

Most 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.

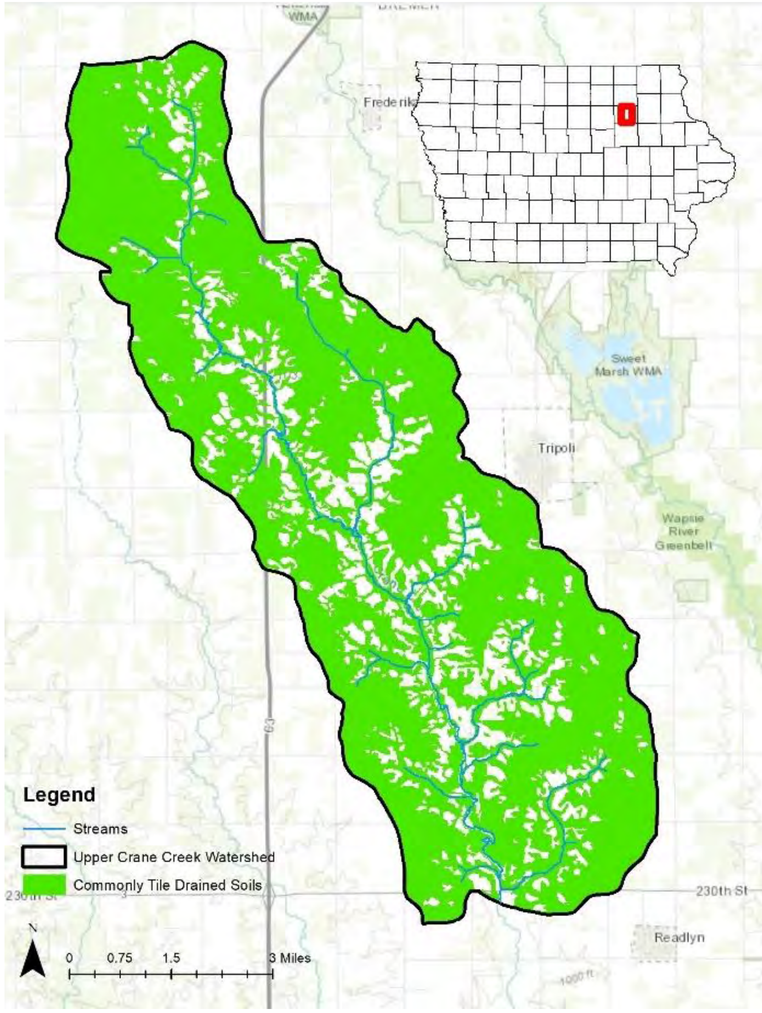

Figure 2.5.3. Areas in the Upper Crane Creek Watershed with likely tile drainage to optimize agricultural production.

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 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, tile drainage where necessary, no negative effects from flooding and no land leveling or terracing.

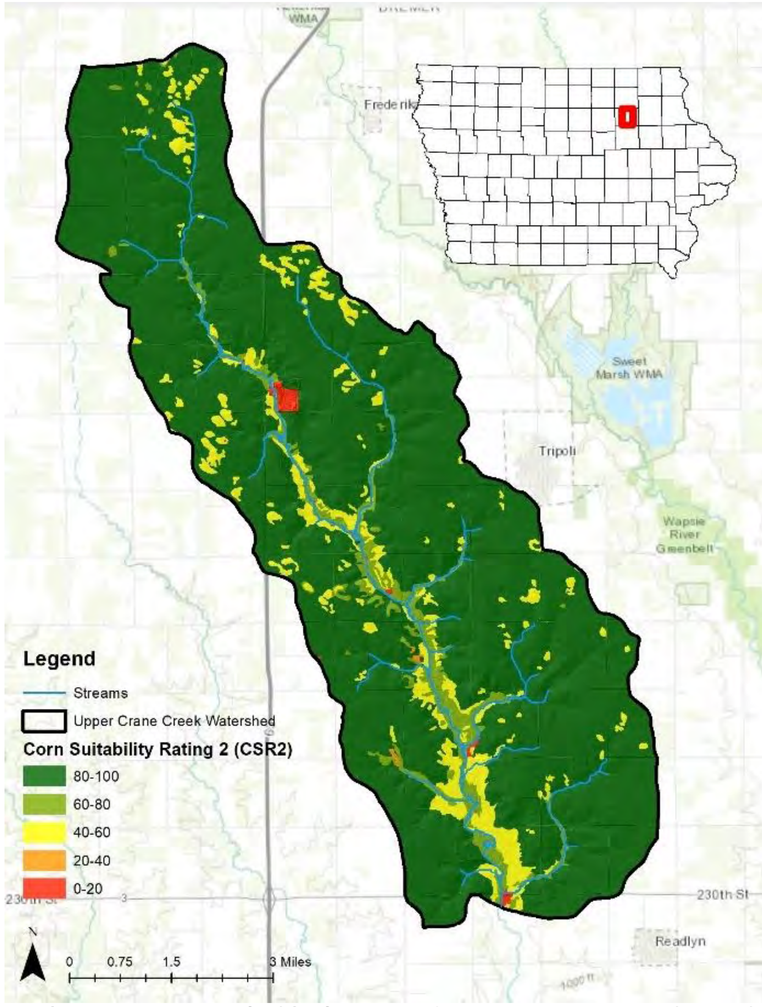

Figure 2.5.4. Corn Suitability Rating 2 (CSR2) values for land in the Upper Crane Creek Watershed.

2.6. Land Use and Management

Land in the Upper Crane Creek Watershed is used primarily for row crop agriculture. 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 nearly 100 percent prairie.

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 2.6.1. The IDNR land use information was developed from aerial imagery and LiDAR elevation data. This dataset reflects the most recent comprehensive, high-resolution Iowa land use mapping effort. A summary of the high-resolution IDNR land use data is presented in Table 2.6.1 and Figure 2.6.2. On average since 2007, 82 percent of the watershed has been used for corn and soybean production.

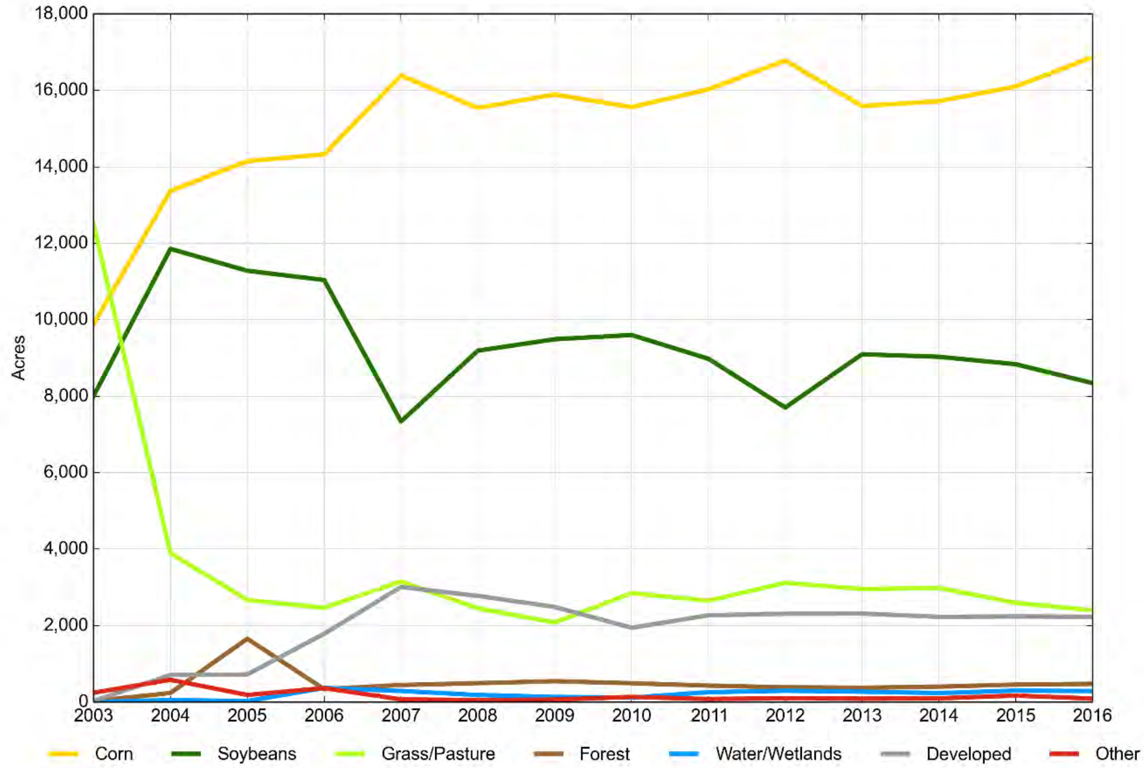

Figure 2.6.1. Upper Crane Creek Watershed 2003 through 2016 land use according to CDL data.

Table 2.6.1. Upper Crane Creek Watershed 2009 high-resolution land use according to IDNR data.

Land Use	**Acres**	**Percent of Watershed**
Water	56	< 1%
Wetland	51	< 1%
Deciduous Short	135	< 1%
Deciduous Medium	265	< 1%
Deciduous Tall	283	< 1%
Grass 1	1,520	5%
Grass 2	2,160	7%
Corn	14,883	48%
Soybeans	10,552	34%
Barren / Fallow	9	< 1%
Structures	65	< 1%
Roads / Impervious	617	2%
Shadow / No Data	32	< 1%
Total	**30,689**	

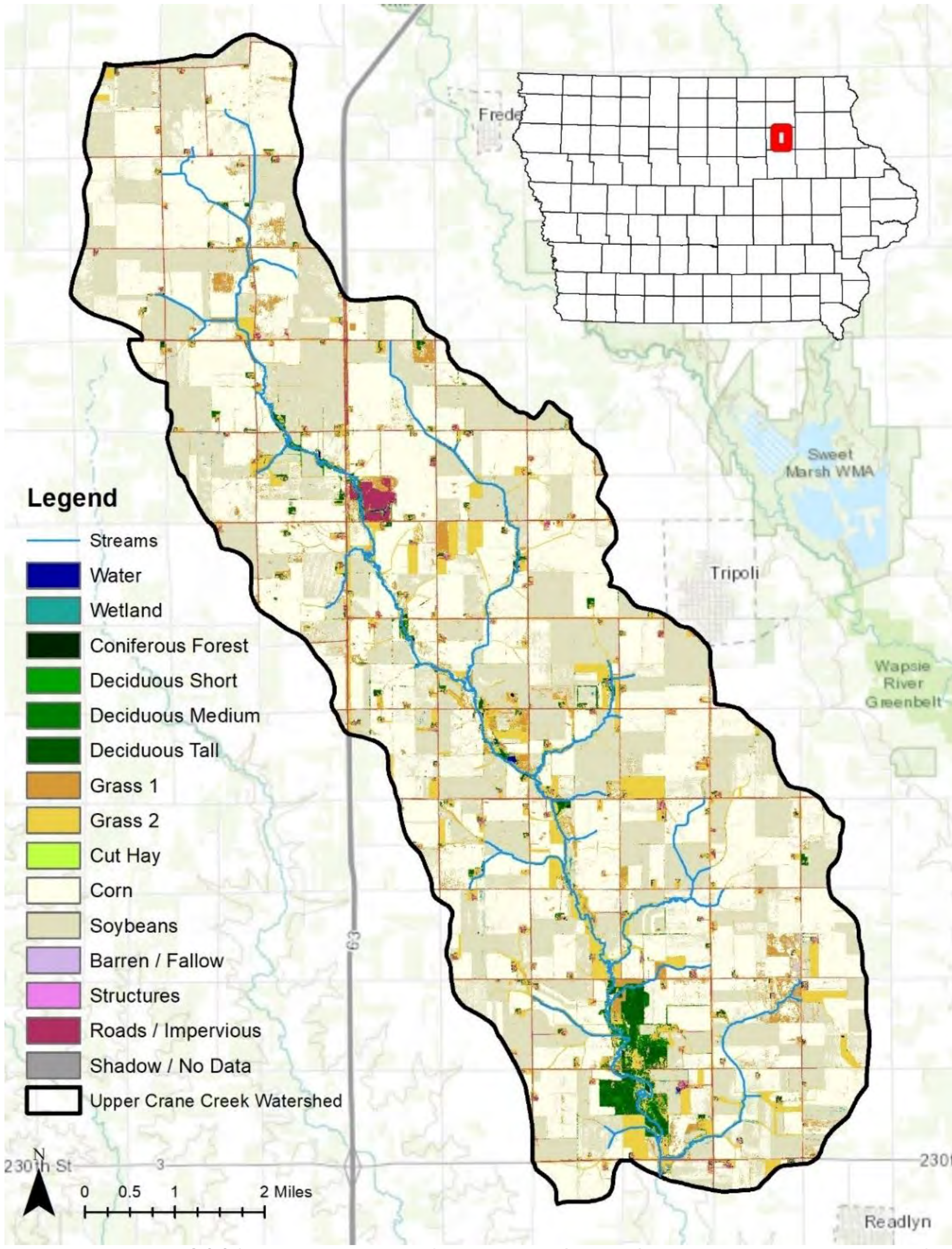

Figure 2.6.2. High-resolution 2009 land use map of the Upper Crane Creek Watershed derived from IDNR data.

2.7. Population and Demographics

A small portion of Tripoli is the only incorporated community within the watershed. According to U.S. Census Bureau data, in 2016 Tripoli had a population of 1,340. The estimated 2010 population in the watershed was 582 people. An analysis of publicly available land ownership data showed that approximately 4 percent of land in the watershed is owned by landowners outside of Iowa. There are 389 different landowners within the watershed. Fifty percent of the land area of the watershed is owned by 14% of the watershed landowners.

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 2018.

Table 2.8.1 Inventory of Upper Crane Creek Watershed existing conservation practices as of 2018.

Practice	**Quantity**	**Unit**
No-till/Strip-till (As observed in spring ’18)	12,500+/-	acres
Cover crops	140+/-	acres
Nutrient management	Unknown	acres
Grassed waterways	145	acres
Terraces/Basins	31,400	feet
Perennial cover (CRP)	300+/-	acres
Stream buffers	66	% not row crop
Perennial Cover (Grass/Trees)	4,414	acres

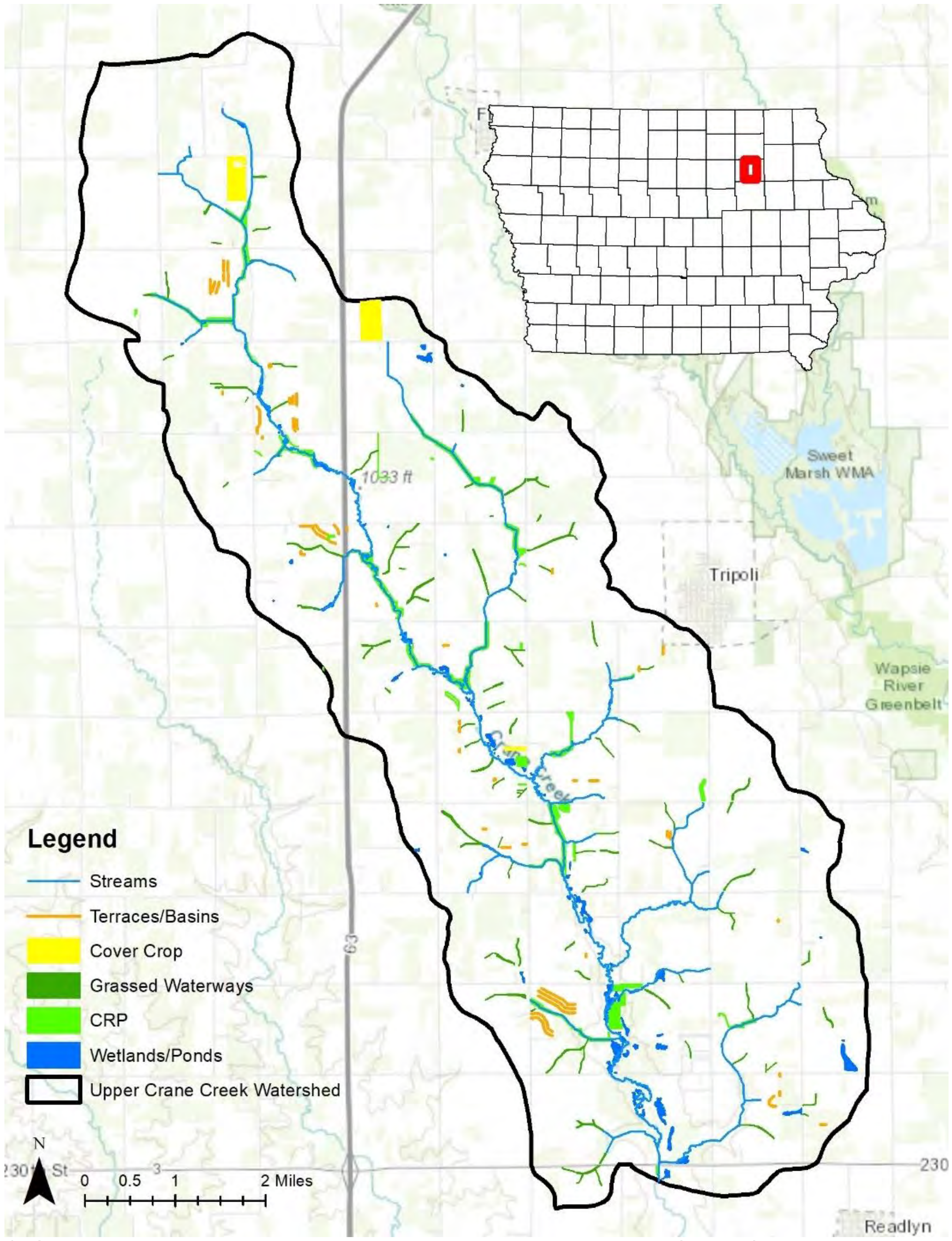

Figure 2.8.1. Conservation practices with known locations in the Upper Crane Creek Watershed as of 2018.

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. The distribution of soil erosion rates across the watershed based on the RUSLE2 analysis is shown in Figure 2.9.1. The average annual sheet and rill erosion rate from the watershed is 1.1 tons per acre per year. According to the Daily Erosion Project (DEP), hillslope soil loss averaged 1.0 tons per acre per year in the watershed from 2008 through 2017. Figure 2.9.2

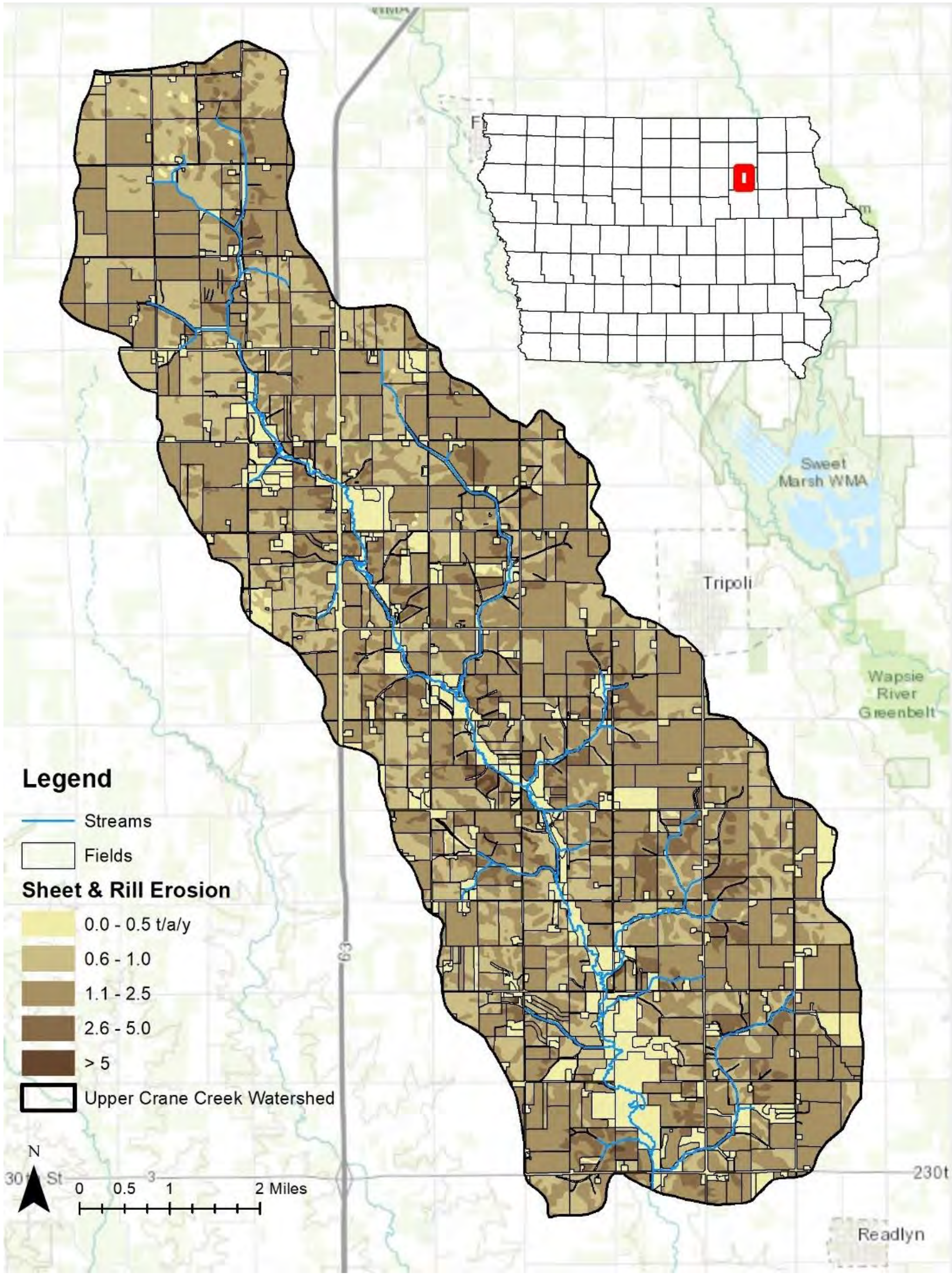

Figure 2.9.1. Estimated sheet and rill erosion rates based on soil types, topography and land use in the Upper Crane Creek Watershed.

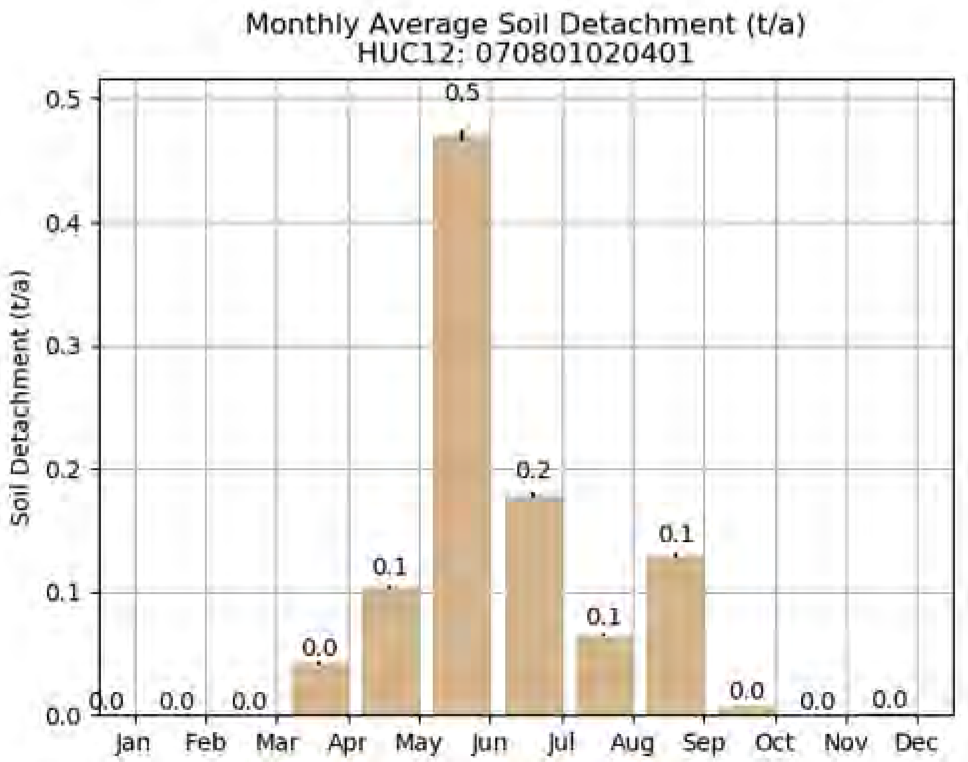

Figure 2.9.2. Estimated soil detachment rates (tons/acre) by month from 2007-2018. Source Iowa Daily Erosion Project.

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 for any given field depends on location within the water, watershed size and shape, stream network density and conditions and topography. The SDR for each field in the Upper Crane Creek Watershed was estimated using tools from ARS. The total sediment load derived from sheet and rill erosion that is transported through the watershed is estimated to be 18,600 tons per year. Figure 2.9.3 shows areas of low and high sediment delivery to streams.

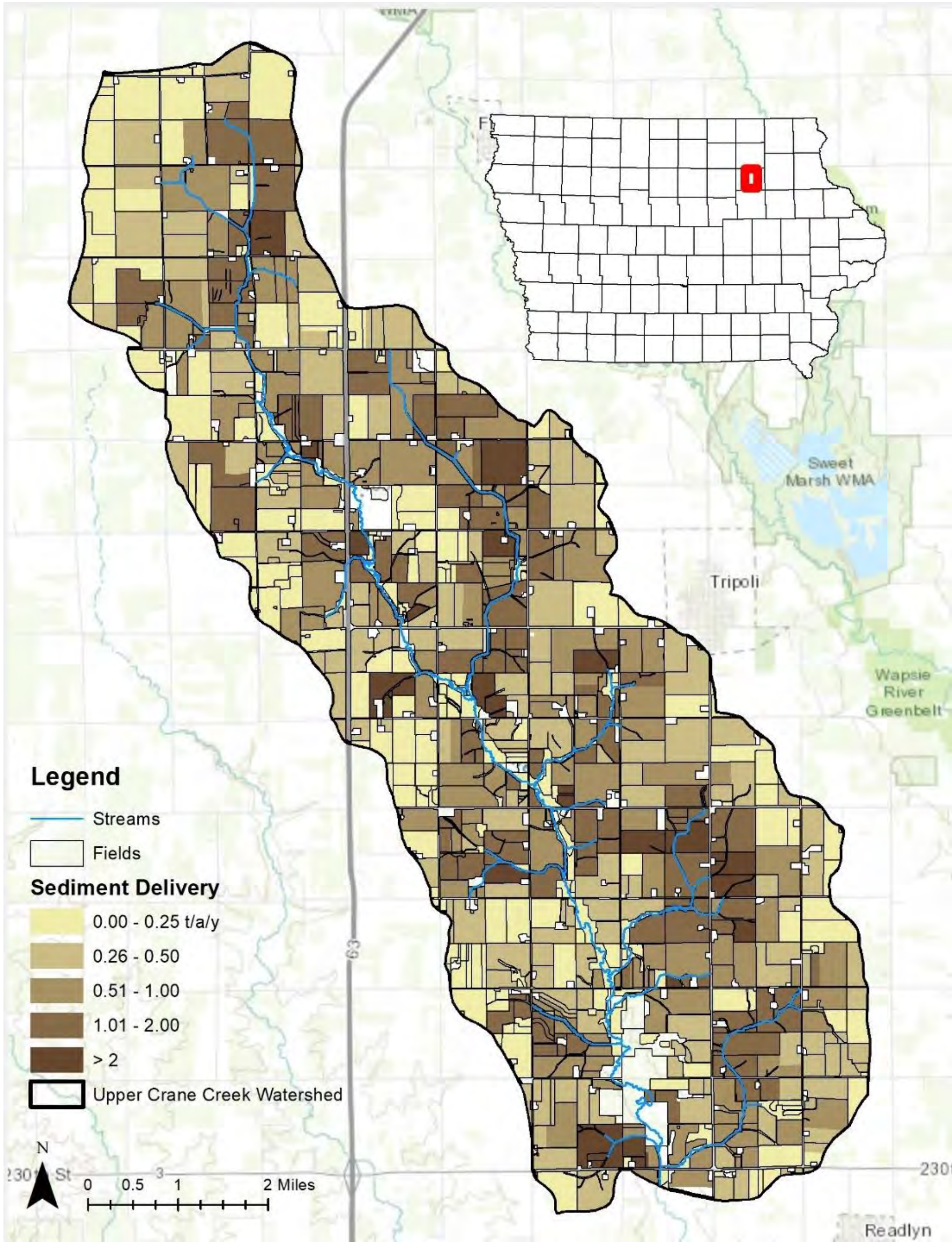

Figure 2.9.3. Estimated rates of upland sediment delivery to streams in the Upper Crane Creek Watershed.

3. Water Quality and Conditions

3.1. Upper Cedar & Wapsipinicon River Water Quality

The Upper Crane Creek Watershed is a subwatershed of the Wapsipinicon River Watershed. The Wapsipinicon River downstream of the Upper Crane Creek watershed is impaired for indicator bacteria that exceeded the state's standards. The impairment is impacting the primary contact use of the river segments. No Water Quality Improvement Plans (or total maximum daily load, TMDL) have been developed for the impaired segments.

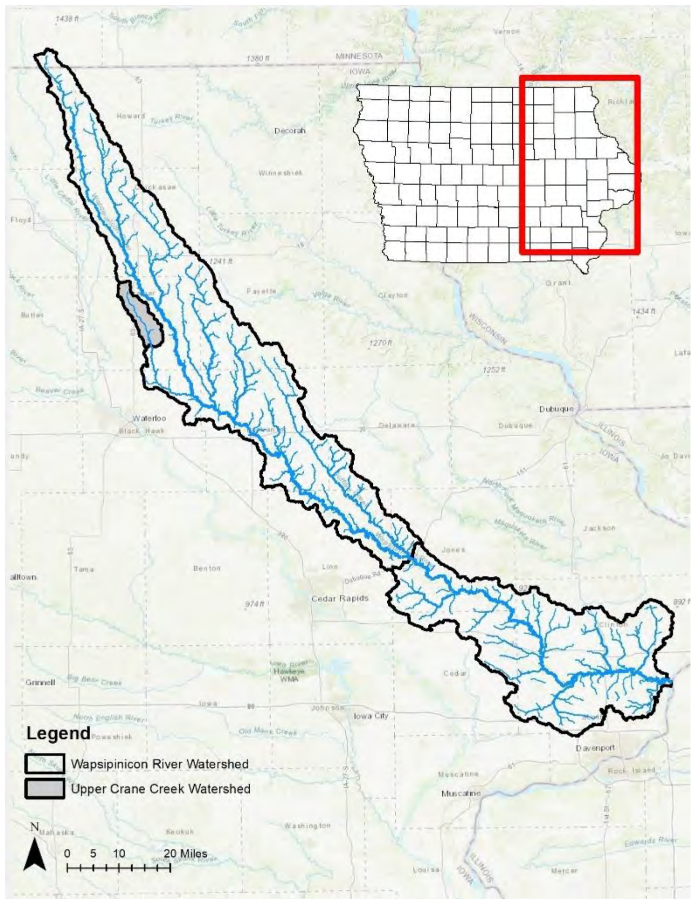

Figure 3.1.1. Location of the Upper Crane Creek watershed within the Wapsipinicon River watershed.

3.2. Upper Crane Creek Water Quality

One reach of Crane Creek is a designated stream by the IDNR however no data is available to determine if stream uses are being supported.

There is no publically available water quality data for Crane Creek in the IDNR Water Quality Monitoring Database (AQUIA).

3.3. Point and Nonpoint Sources

The INRS incorporates both point and nonpoint sources, however there are no point source dischargers within the Upper Crane Creek watershed.

4. Goals and Objectives

This watershed plan is a guiding document. Water and soil quality will improve only 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 context for goal development by stakeholders in the Upper Crane Creek 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 agricultural 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 Upper Crane Creek Watershed (Section 5) 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 Upper Crane Creek Watershed and were prioritized by stakeholders:

- **Cost effective**
- **Profitable and productive agriculture**
- **Healthy water**
- **Healthy soils**
- **Minimize downstream impacts**

This watershed plan uses the year 2010 as the baseline for conservation practice implementation and determining progress towards reaching goals by 2037 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 Upper Crane 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 (2018) and future rates of nitrate, phosphorus and sediment loading from agricultural land in the Upper Crane Creek Watershed.

	Baseline	2018	2023	2028	2033	2037
Nitrate-N (lb/yr)	630,325	629,240	573,430	487,798	422,625	370,603
Phophorus (lb/yr)	4,908	4,900	4,507	3,936	3,479	3,216

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

	Baseline	2018	2023	2028	2033	2037
Nitrate-N (lb/yr)	-	<1%	9%	23%	33%	41%
Phophorus (lb/yr)	-	<1%	8%	20%	29%	35%

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. 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 2039 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 Upper Crane Creek Watershed are expected to be reduced by 23 percent and 20 percent, respectively, by 2027, which would short of the interim milestone recommended by the HTF.

5. Conceptual Plan

Best management practices (BMPs) are part of the foundation for achieving watershed goals. BMPs include conservation 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. Watershed planning facilitators asked stakeholders to score BMPs based on likelihood of implementation or adoption. From an initial list of potential practices, priority practices were identified by comparing those practices most acceptable to watershed stakeholders with potential impacts, or the ability to help achieve watershed goals. The results of this exercise are shown in Figure 5.1.

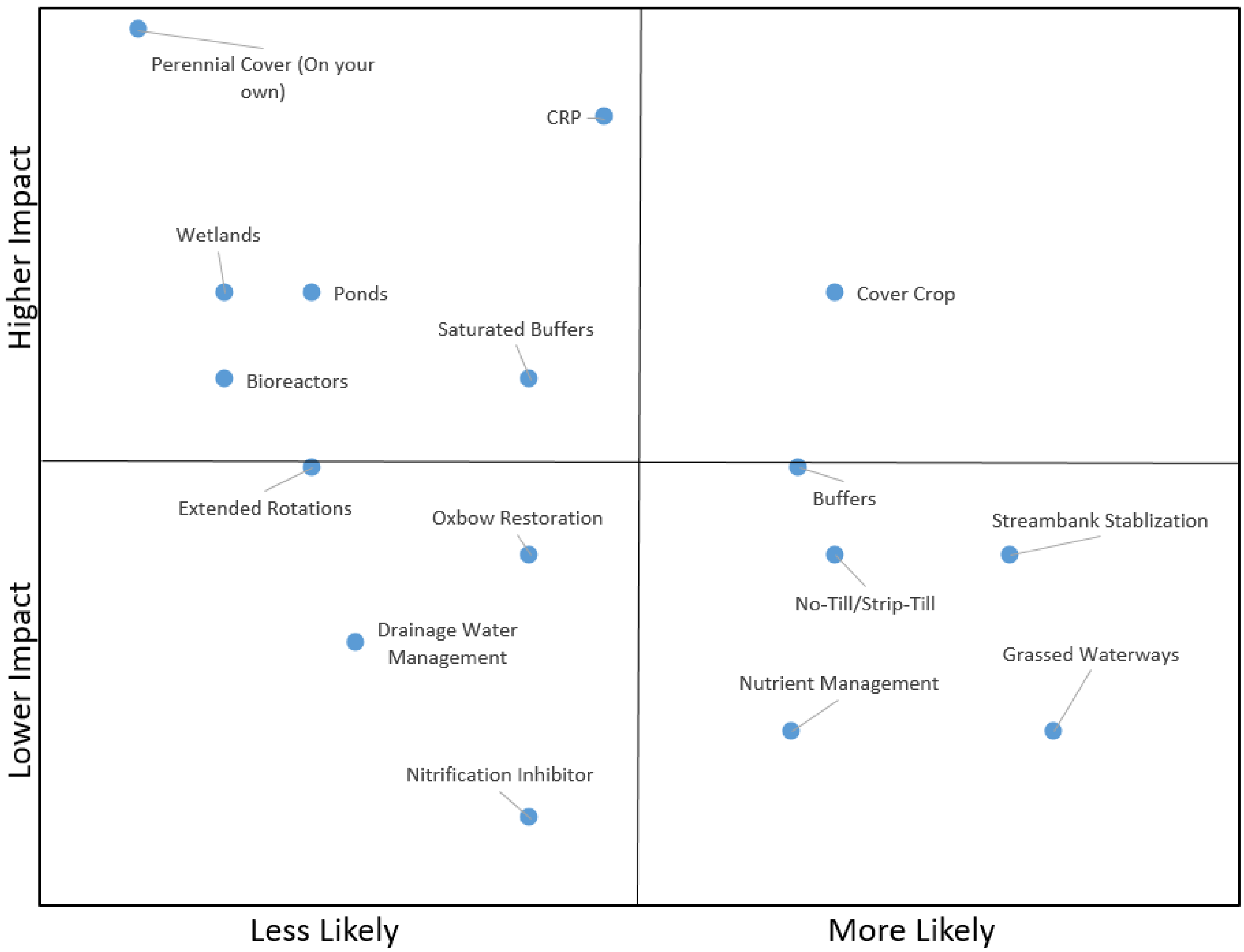

Figure 5.1. Results of the BMP prioritization. Stakeholders rated adoption likelihood (horizontal axis) which was compared against potential to impact overall watershed goals (vertical axis). BMPs plotted farther to the right and top of the chart are higher priorities.

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. Integrating these factors to identify the best locations within the watershed for the best practices to consider resulted in a conceptual plan for the Upper Crane Creek Watershed. Figure 5.2 provides a map of a conceptual BMP implementation scenario that sites BMPs in locations intended to achieve maximum benefit.

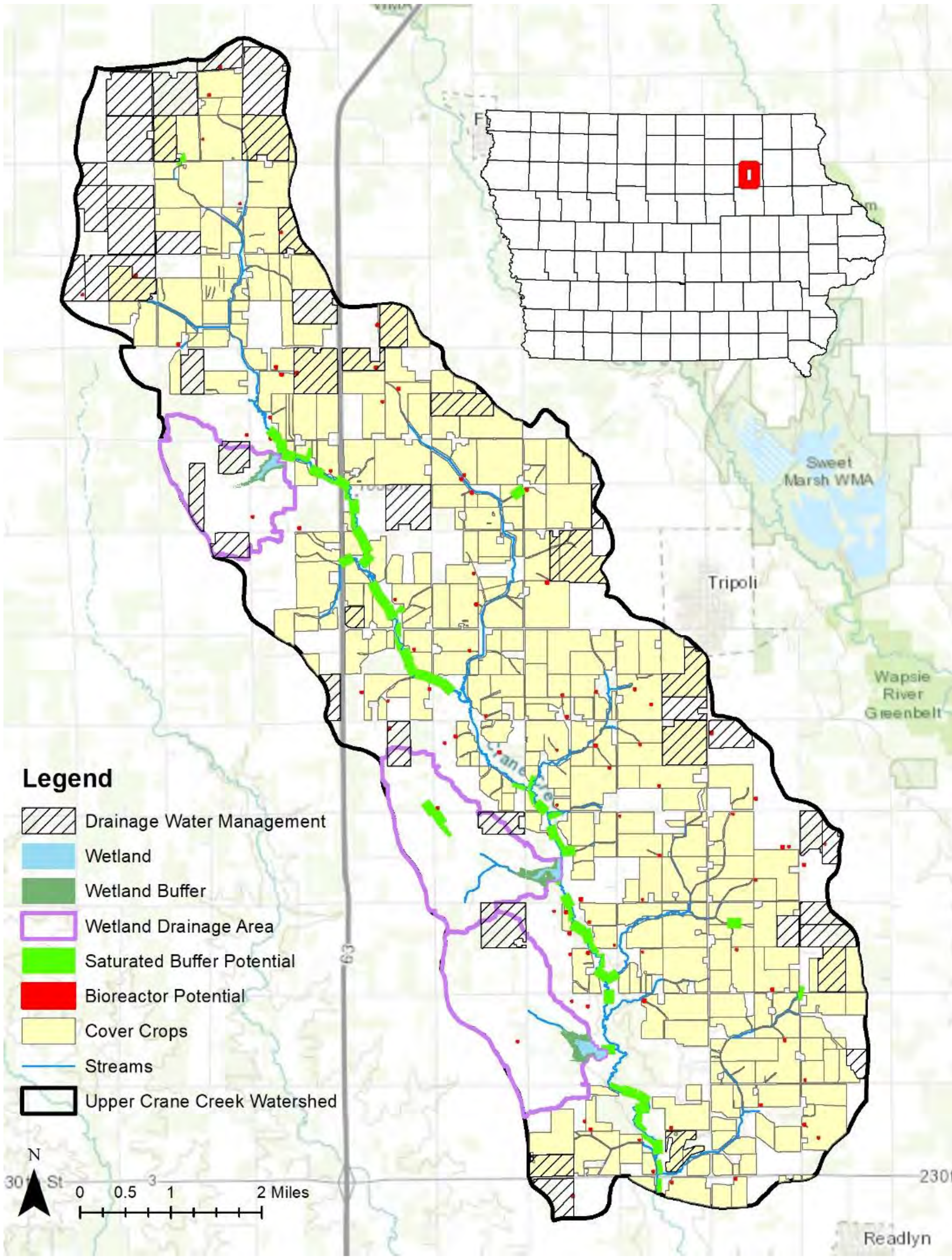

Figure 5.2. Conceptual plan for agricultural BMP implementation in the Upper Crane Creek Watershed.

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 5.2 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.

The ACPF includes a software mapping toolbox to identify potential locations for conservation practice adoption. Selected results of applying these siting tools to the Upper Crane Creek Watershed have been incorporated into this conceptual plan. Appendix A 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 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. For example, additional opportunities for wetlands and saturated buffers were identified by the ACPF software.

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 Upper Crane Creek Watershed. The recommended practices will mitigate some risk of bacteria transport to Crane Creek and Wapsipinicon River, but additional practices should be adopted where applicable in order to address the local bacteria impairments.

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 19-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 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 four project phases for the Upper Crane Creek Watershed.

Practice	Unit	Existing	2019-2023	2024-2028	2029-2033	2034-2037	Watershed Plan Goal
Nitrogen management (MRTN)	acres	Unknown	2,000	4,000	3,000	3000	**10,000**
No-till/Strip-till	acres	Unknown	Maximum acres possible				
Cover crops rye	acres	140	2,000	4,000	3,000	3000	**12,000**
Cover crops oats	acres	0	1,000	2,000	1,000	1000	**5,000**
Perennial cover (CRP)	acres	300	250	250	250	250	**1,000**
Drainage Water Management	acres	0	500	1,000	2,000	1000	**4,500**
Bioreactors	sites	0	2	1	1	0	**4**
Saturated Buffers	sites	0	10	15	15	10	**50**
Wetlands	sites	0	1	1	1	0	**3**

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 Upper Crane Creek Watershed. 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 Crane Creek and tributary streams. Location information for these sites is detailed in Table 7.1.1.

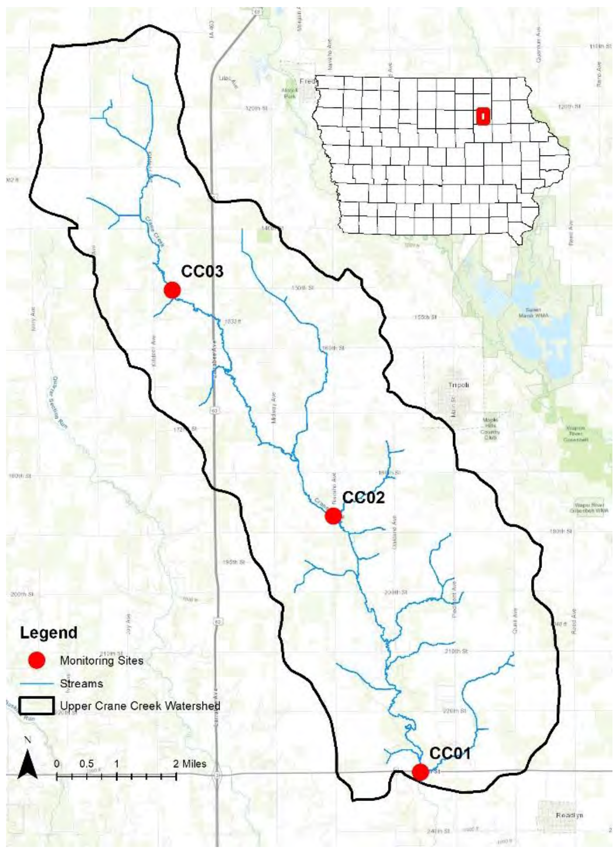

Figure 7.1.1. Recommended locations for collection of stream water samples in the Upper Crane Creek Watershed.

Table 7.1.1. Location information for stream monitoring sites.

Site	Longitude	Latitude	Note
CC01	-92.26999	42.71496	At Highway 3
CC02	-92.29804	42.77743	At Navaho Ave
CC03	-92.3507	42.83279	At 150th St

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 nutrient and sediment 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 (e.g., the USGS StreamEst web tool) could be used to estimate stream discharge for loading calculations.

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 practices. 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 tends to be more 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 periodically should be used to assess awareness and attitudes regarding water quality in the Upper Crane Creek 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 watershed projects. To cause changes in behavior, goal-based outreach must address the actual and perceived needs of stakeholders. It is important to leverage preexisting relationships and successes to build a community of support and knowledge around producers and landowners who implement conservation practices. Barriers to conservation implementation may be overcome by providing adequate education and outreach regarding how land management practices influence local and downstream natural resources. Knowledge increases awareness, which may then motivate changes in behavior.

A goal-based outreach plan will address and facilitate the goals set by stakeholders. With a 19-year watershed plan 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 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. Table 8.1 lists potential outreach tools. The project also should be promoted through local and regional media including The Tripoli Leader, Waverly County Independent and the Waterloo-Cedar Falls Courier along with local radio stations. Regional news and farm publications like the Farm Bureau Spokesman, commodity organization publications and Iowa State University Extension materials also should promote the watershed project. Outreach events and materials should balance consistency and variety to maximize impressions.

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

Partnerships are a key element of successful watershed projects. Cooperation between farmers; landowners; government agencies such as Bremer SWCD, the Iowa Department of Agriculture and Land Stewardship (IDALS), the IDNR, the local NRCS field office and the Wapsipinicon WMA; non-government organizations, commodity organizations and other agricultural groups; and public universities will be essential. While such relationships and partnerships must be coordinated, the potential impact is worth the investment.

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 B.

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.
- **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, stories and social media posts related to the project.

9.3. Performance

- **Practice adoption.** Locations of implemented practices should be tracked over the life of the project. Practice adoption levels 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 famers, 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 should 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 partners to estimate soil and water improvements resulting from practice implementation. For example, Appendix C 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 $490,000 per year and initial structural costs are estimated to be $1,818,500. 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 Upper Crane Creek Watershed BMP implementation level goals.

Practice	Goal	Unit	Cost per Unit	Cost
Nitrogen management	10,000	acres/year	-$5	-$50,000
No-till/Strip-till	Max. Possible	acres/year	-$10	TBD
Cover crops – rye	12,000	acres/year	$20	$240,000
Cover crops – oats	5,000	acres/year	$20	$100,000
Perennial Cover	1,000	acres/year	$200	$200,000
Bioreactors	4	sites	$15,000	$60,000
Controlled drainage	4500	acres	$63	$283,500
Saturated buffers	50	sites	$4,000	$200,000
Wetlands	3	sites	$425,000	$1,275,000

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 and machinery 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 controlled drainage and saturated buffers 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 (controlled drainage, saturated buffers, bioreactors and wetlands) is estimated at $1,818,500. Annual investments are necessary to maintain and increase adoption of in-field management practices (nutrient management, no-till/strip-till, cover crops and prairie strips). The estimated yearly net total for these practices fully implemented is $490,000 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, state or federal government agencies, other local or regional stakeholders and conservation organizations. Section 11 describes additional potential funding sources.

Additional costs associated with watershed improvement are estimated to begin at approximately $80,000 per year to fund salary, benefits and training for a watershed project 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 D 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 Bremer SWCD 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. One solution would be 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 land.
- **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 watershed plan would be of most benefit. A standard conservation addendum could be developed and shared with all absentee landowners in the Upper Crane Creek 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 into 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. 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 with the goal of attaining desired reductions at an overall lower cost. 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 (e.g., SWCD, local cooperatives) 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.
- **Pay for performance.** Sometimes called reverse auctions, 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. Verification of environmental outcomes is also an important component of pay for performance programs.

- **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 Upper Crane Creek Watershed may prove to be more successful than existing groups working together without formal organization. The existing Black Hawk Creek Water and Soil Coalition and the Middle Cedar Watershed Management Authority may be appropriate organizations to serve this purpose. At a minimum, the farmers, landowners and partners 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 2035 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 or 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.
- **Whole-farm accounting.** Long-term business planning for farm operations could account for long-term benefits of conservation practices. For example, factoring in benefits of cover crops like soil and nutrient retention or decreased herbicide use can significantly alter the balance sheet and better inform decision making. Such an approach can be used to justify investments in conservation practices and build the business case for natural resource stewardship.

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 recommends general responsibilities for various groups in the Upper Crane Creek Watershed. An organizational chart is shown in Figure 12.1 to illustrate how relationships between project stakeholders and partners could function in the Upper Crane Creek Watershed project.

- **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.
- **Bremer 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.
- **Wapsipinicon River Watershed Management Authority.** Identify opportunities for complimentary programming and supplementary funding and communicate with member entities.
- **Universities.** 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 and provide a contact for the Iowa CREP program.
- **Iowa Department of Natural Resources.** Provide technical assistance and water quality monitoring as necessary.
- **Bremer County Conservation Board.** Provide project partnership, easement management and public education.
- **Bremer 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 and water quality benefits.
- **Media.** Develop stories related to the watershed project and maintain contact with local sources of information.

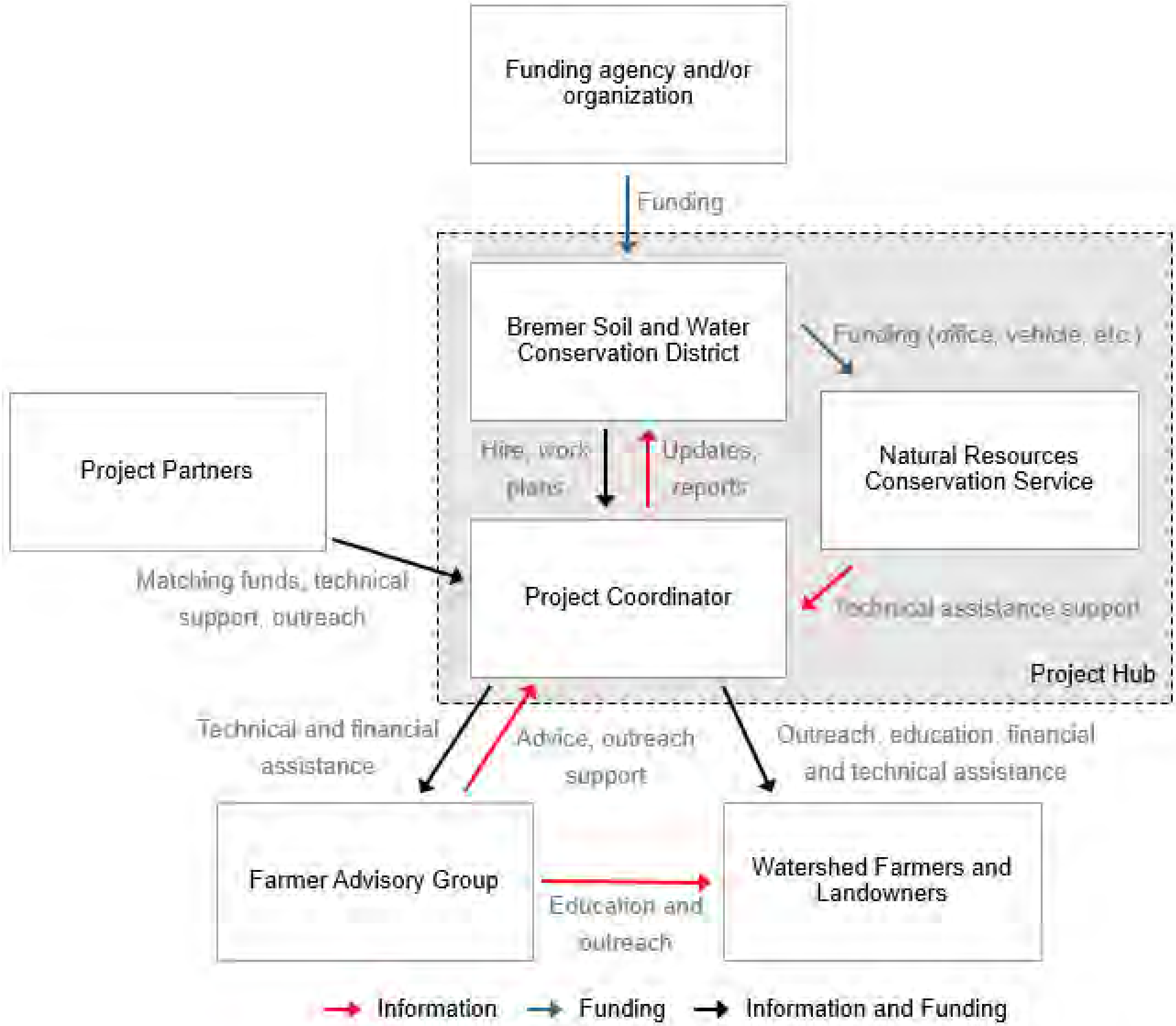

Figure 12.1. Organizational chart for the Upper Crane Creek Watershed project. Red, blue and black arrows denote transfer of information, funds and both, respectively.

Appendix A: ACPF Atlas

Appendix A: 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. ACPF analysis for the Upper Crane Creek Watershed was completed by the Iowa Soybean Association.

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 two subsequent pages contain detailed maps for the west and east portions 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. Conservation Drainage Practices
6. Runoff Control Practices
7. Riparian Management Practices

References

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/

General concepts behind the ACPF: Tomer, M.D., S.A. Porter, D.E. James, K.M.B. Boomer, J.A. Kostel, and E. McLellan. 2013. Combining precision conservation technologies into a flexible framework to facilitate agricultural watershed planning. Journal of Soil and Water Conservation 68:113A-120A. http://www.jswconline.org/content/68/5/113A.full.pdf+html

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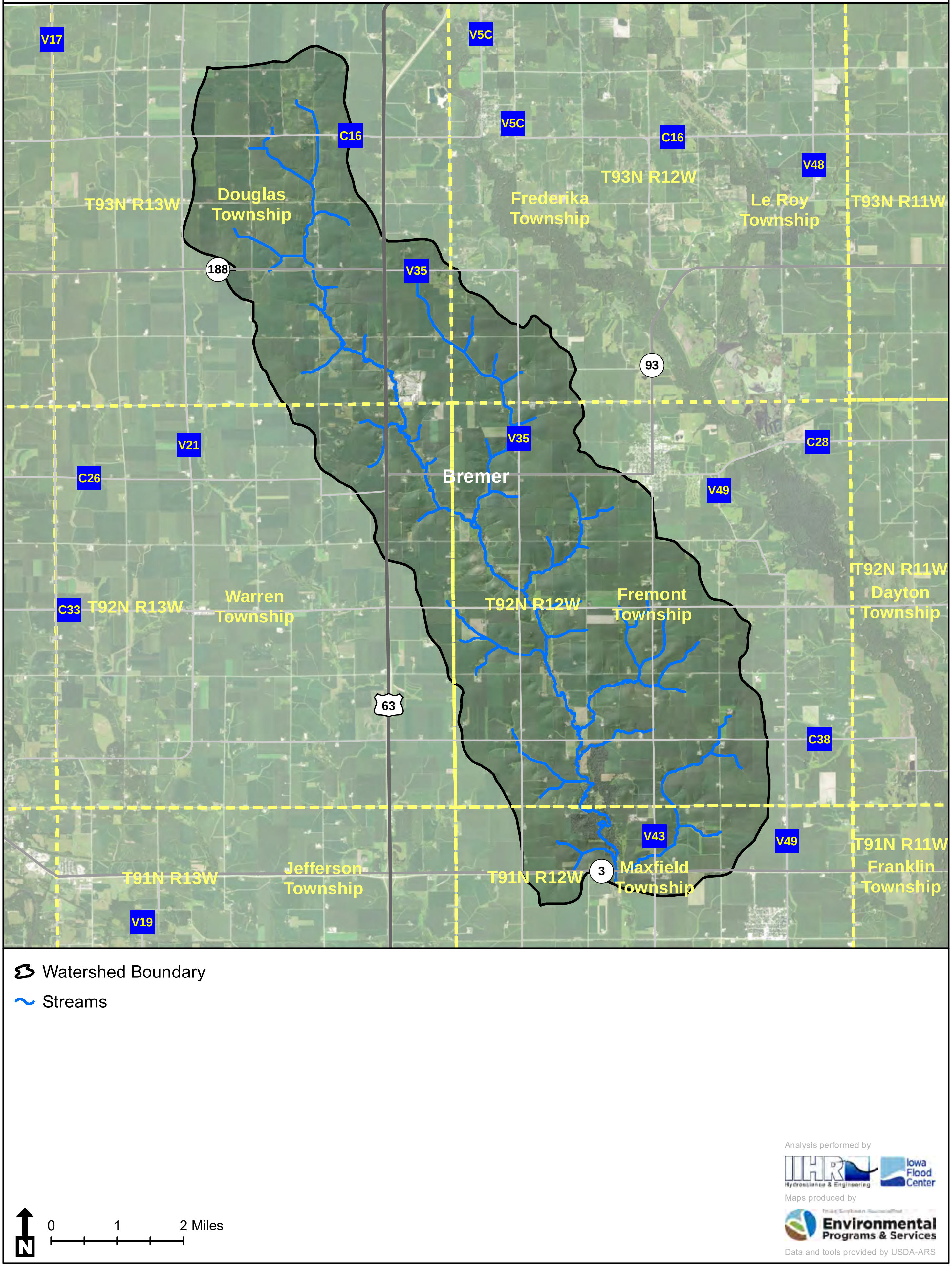
Upper Crane Creek Watershed (070801020401)
Agricultural Conservation Planning Framework Results Atlas

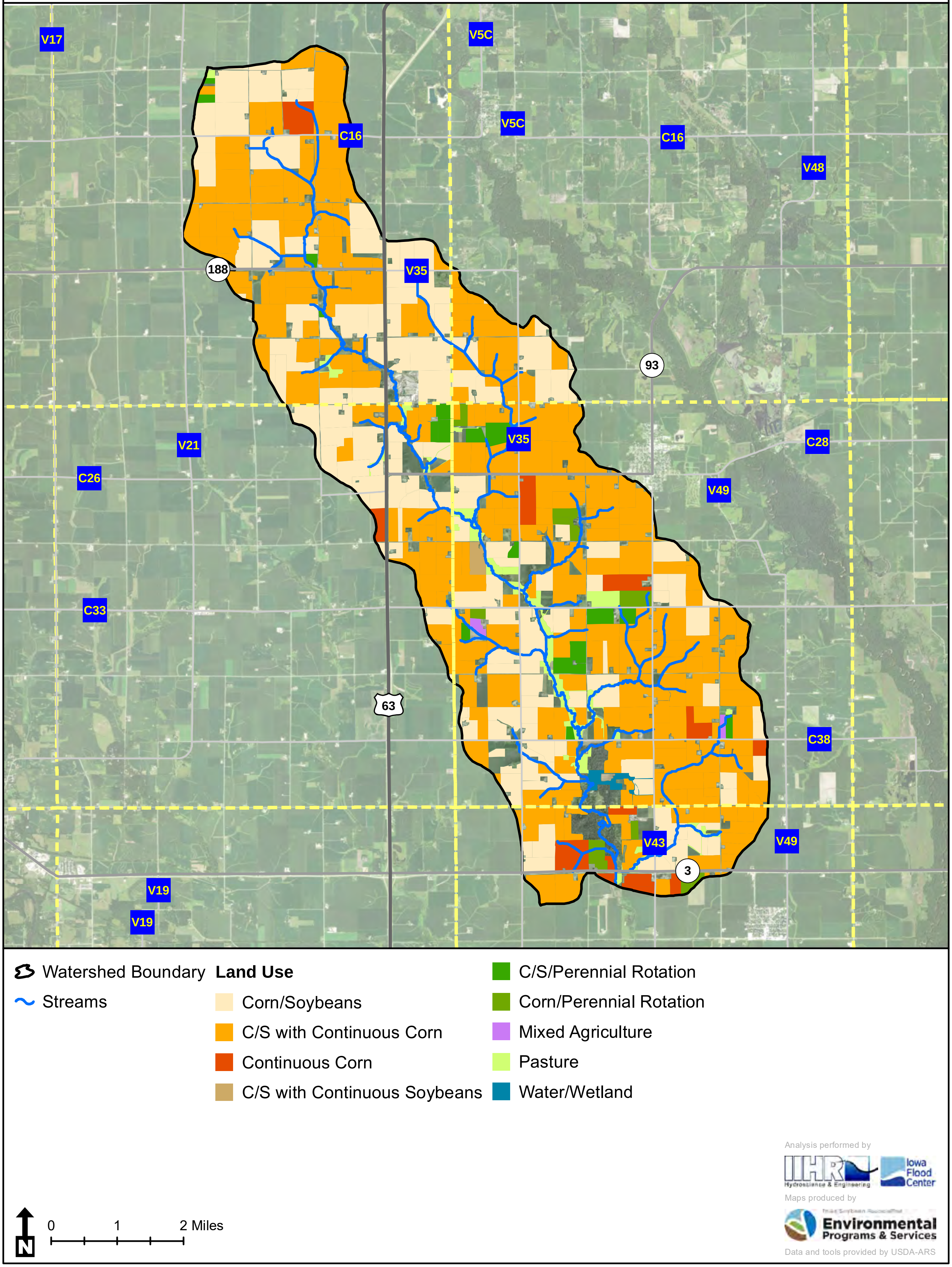


Analysis performed by IIHR Hydroscience & Engineering; Iowa Flood Center

Maps produced by Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401)
Agricultural Conservation Planning Framework Land Use

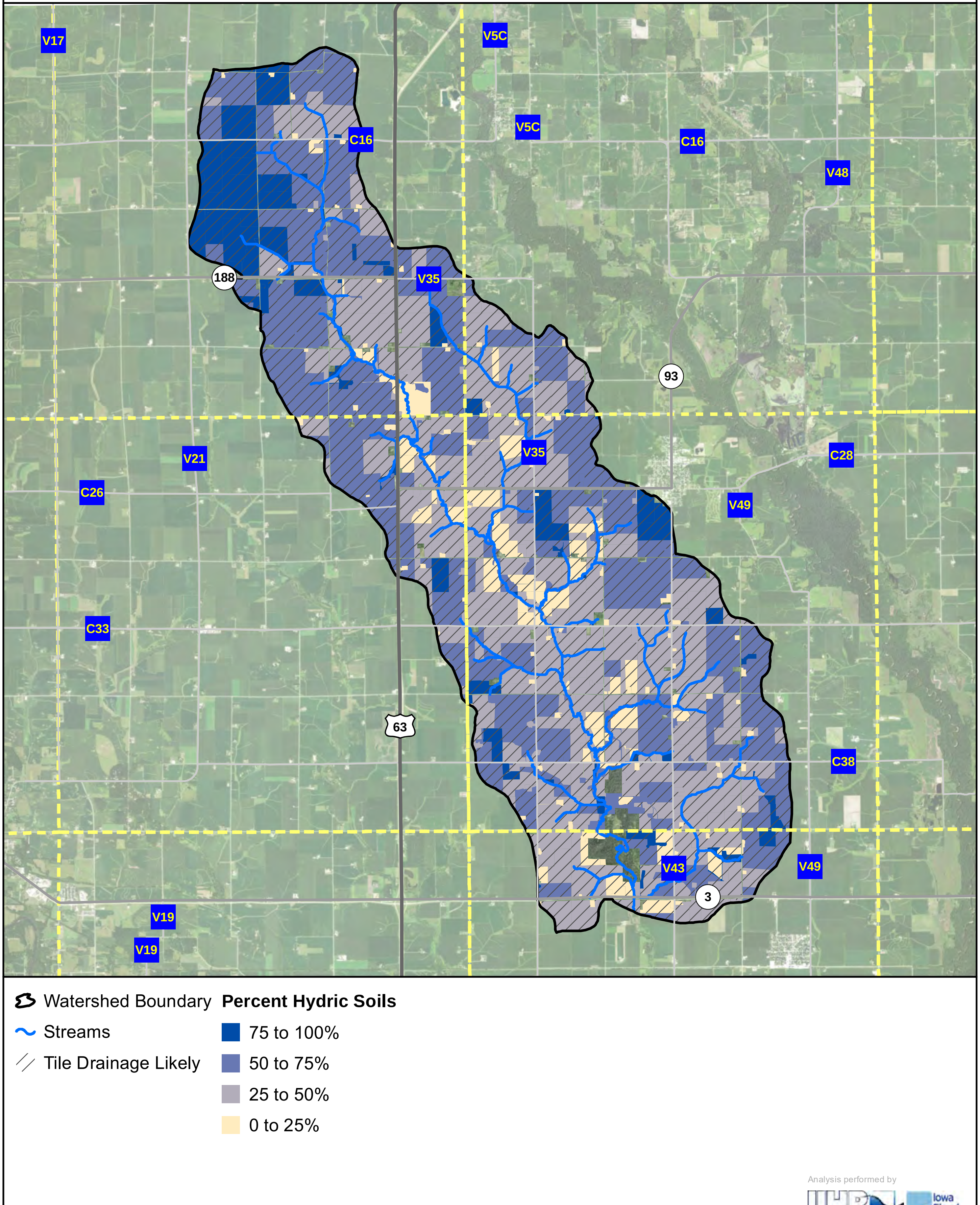


Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

Maps produced by Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401)
Agricultural Conservation Planning Framework Tile Drainage

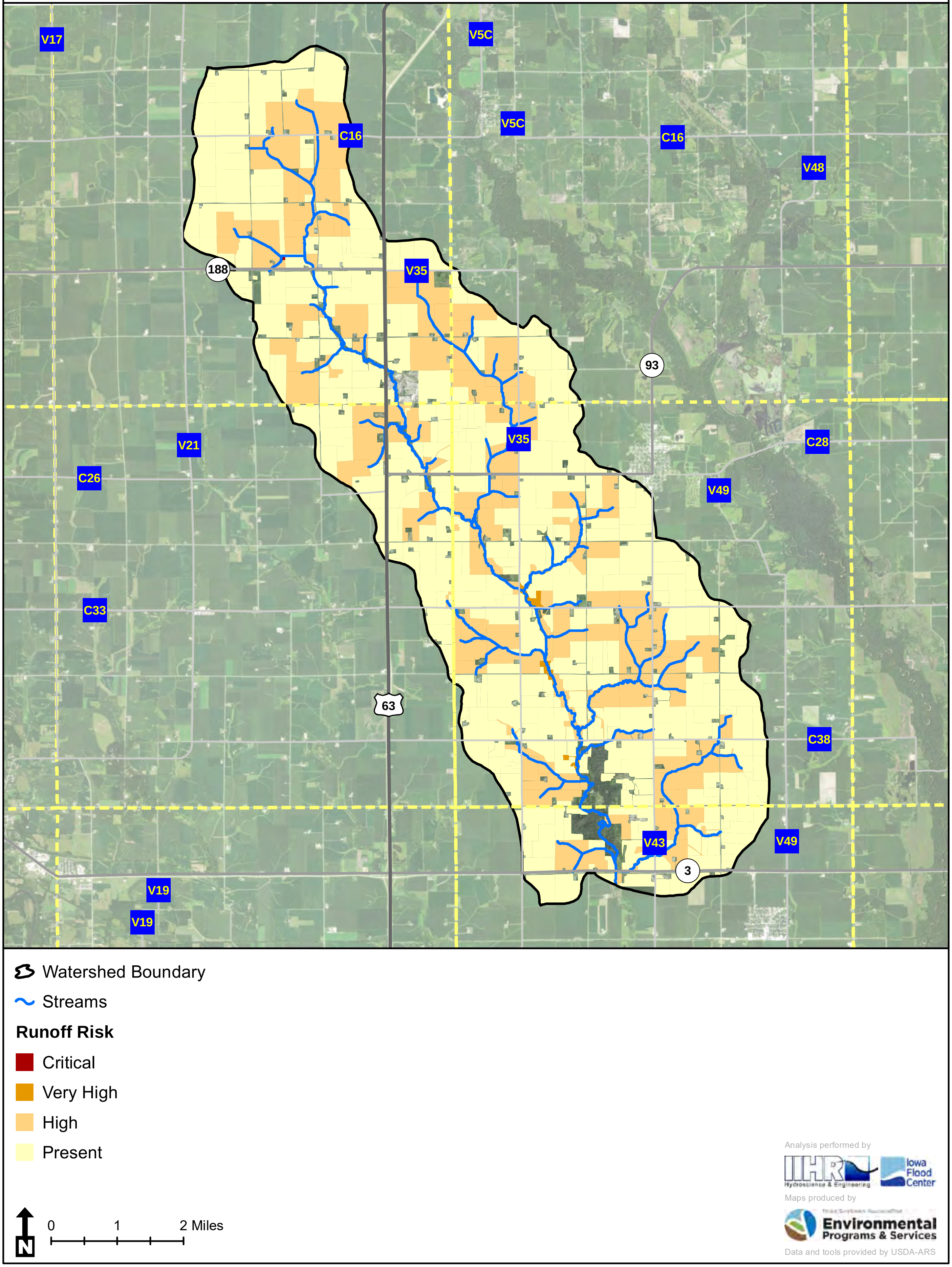


Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

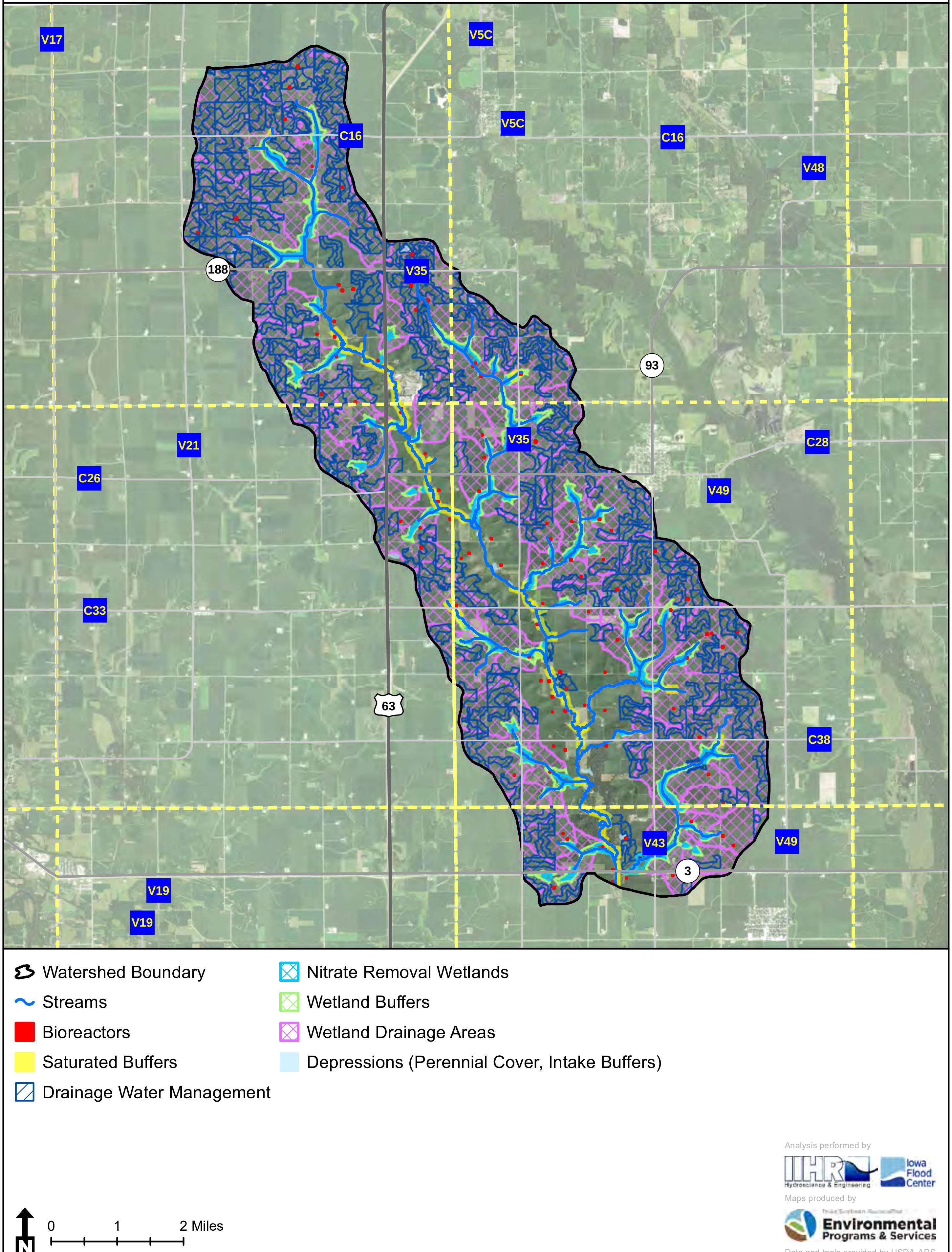
Maps produced by Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401)
Agricultural Conservation Planning Framework Runoff Risk



Upper Crane Creek Watershed (070801020401)
Agricultural Conservation Planning Framework Conservation Drainage Practices

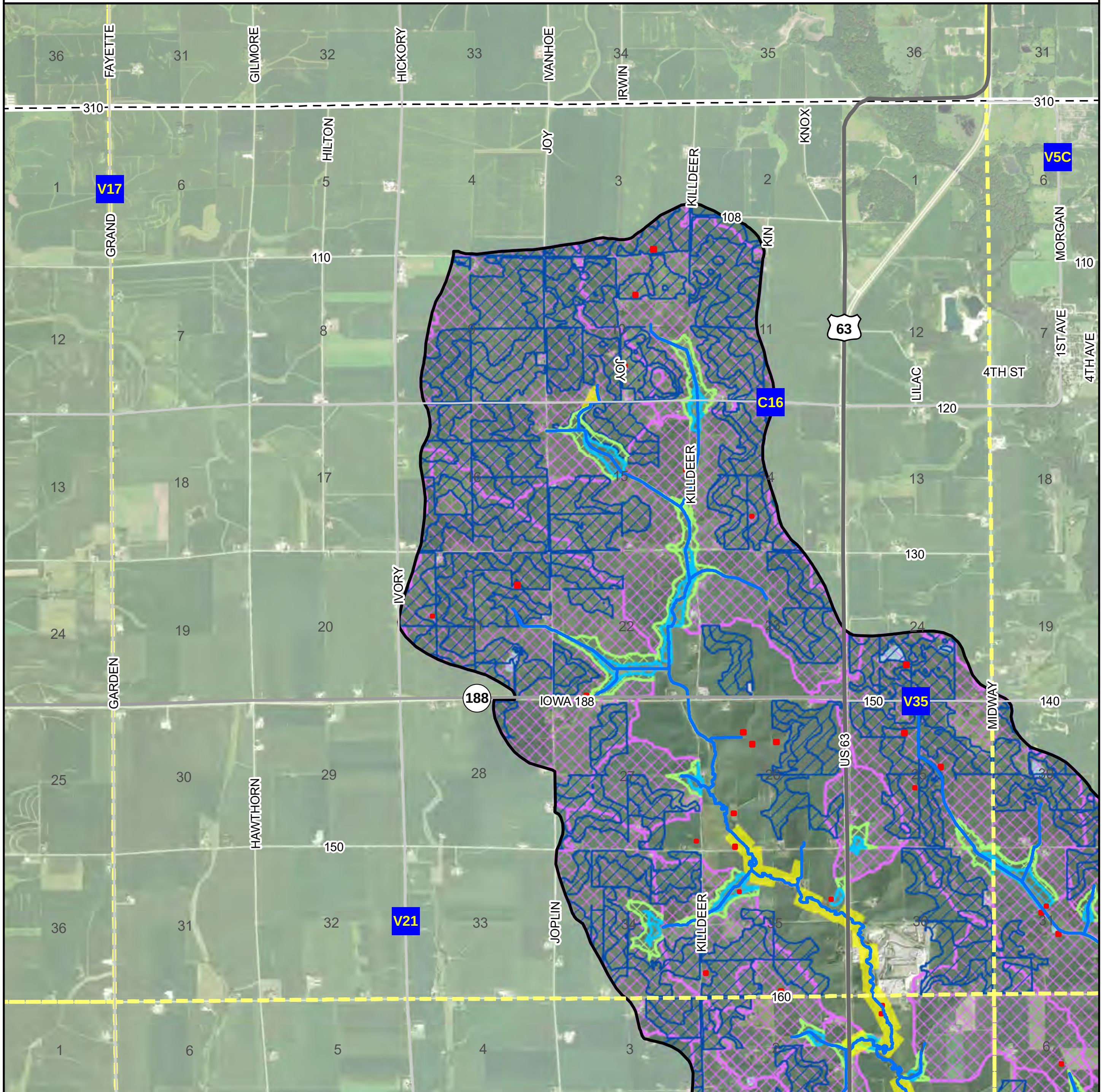


Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

Maps produced by Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T93N R13W
Agricultural Conservation Planning Framework Conservation Drainage Practices

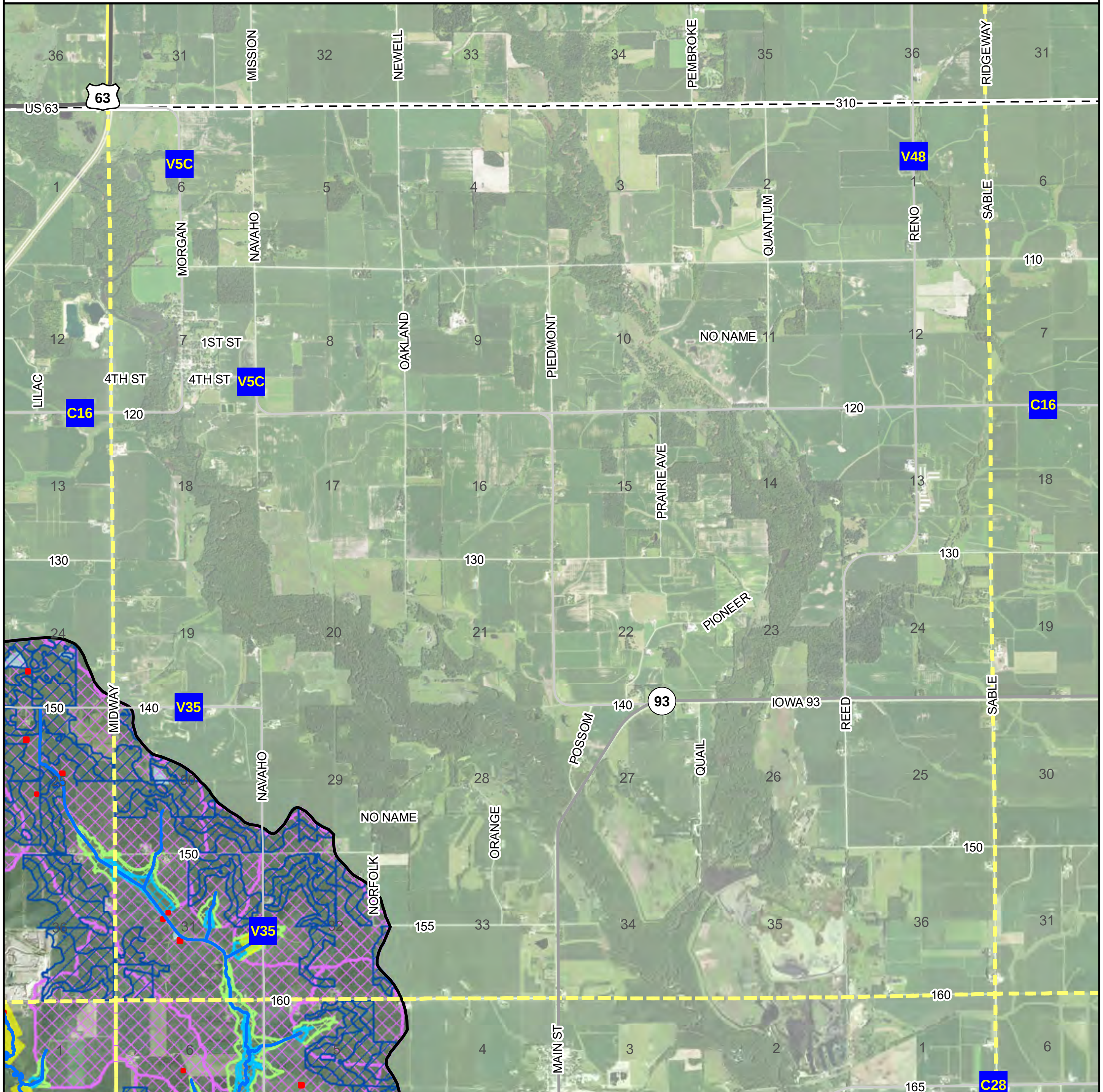


Watershed Boundary
Streams
Bioreactors
Saturated Buffers
Drainage Water Management
Nitrate Removal Wetlands
Wetland Buffers
Wetland Drainage Areas
Depressions (Perennial Cover, Intake Buffers)

N
0 0.5 1 Miles

Analysis performed by
IIHR Hydroscience & Engineering
Iowa Flood Center
Maps produced by
Environmental Programs & Services
Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T93N R12W
Agricultural Conservation Planning Framework Conservation Drainage Practices



Watershed Boundary

Streams

Bioreactors

Saturated Buffers

Drainage Water Management

Nitrate Removal Wetlands

Wetland Buffers

Wetland Drainage Areas

Depressions (Perennial Cover, Intake Buffers)

N

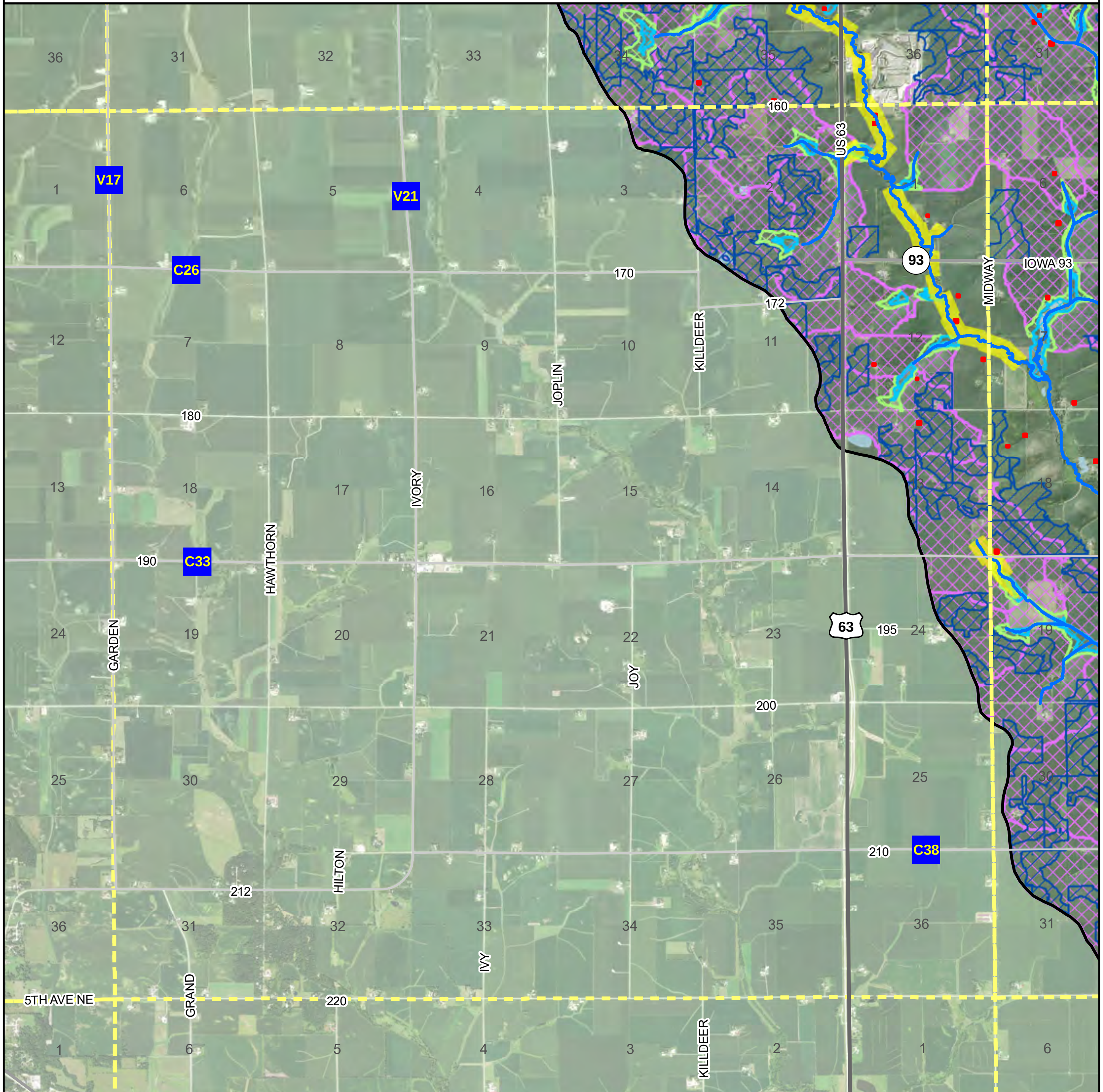
0 0.5 1 Miles

Analysis performed by

Maps produced by

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T92N R13W
Agricultural Conservation Planning Framework Conservation Drainage Practices



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

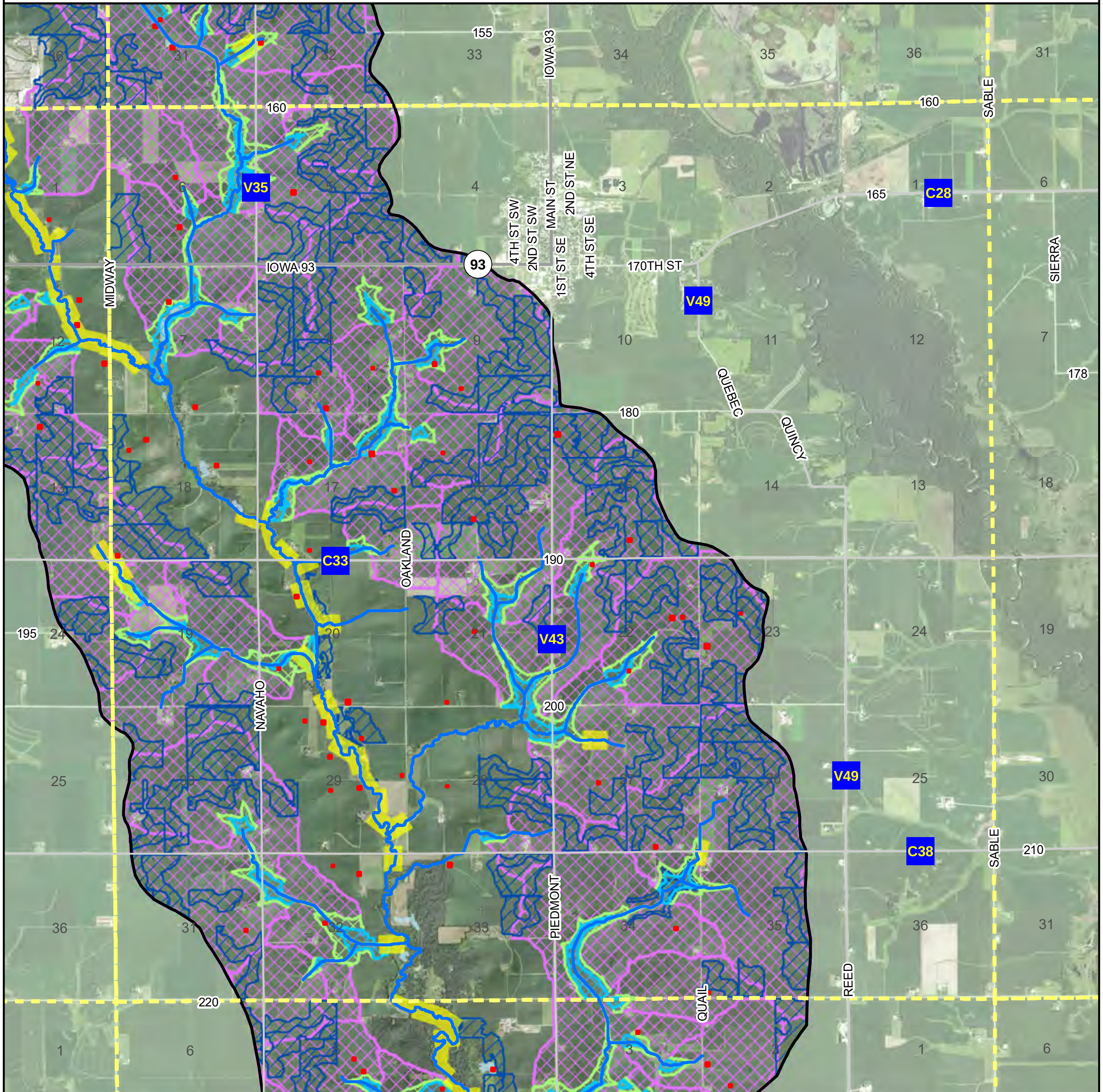
0 0.5 1 Miles

Analysis performed by

Maps produced by

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T92N R12W
Agricultural Conservation Planning Framework Conservation Drainage Practices



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

0 0.5 1 Miles

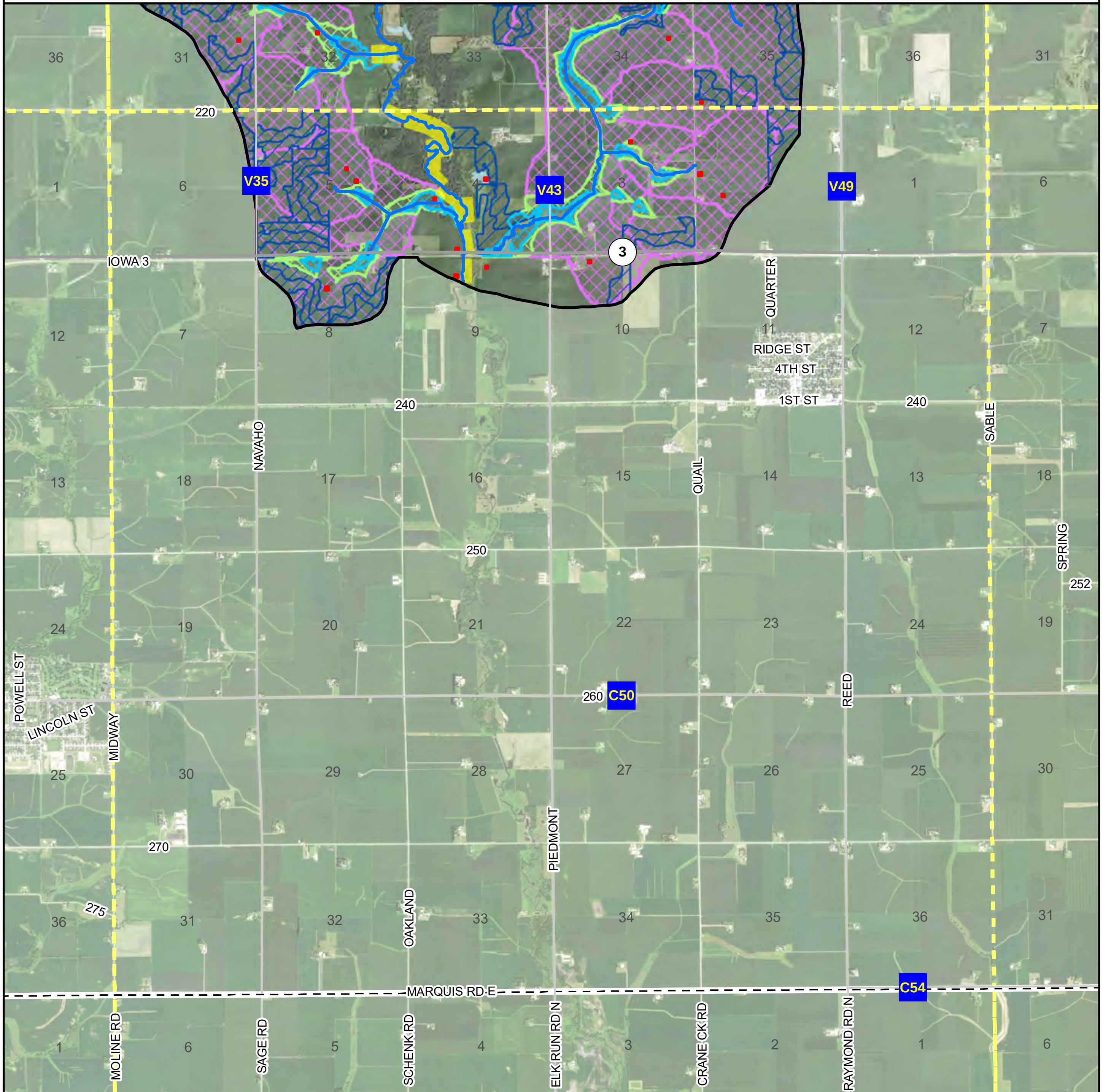
N

Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

Maps produced by Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T91N R12W
Agricultural Conservation Planning Framework Conservation Drainage Practices



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

0 0.5 1 Miles

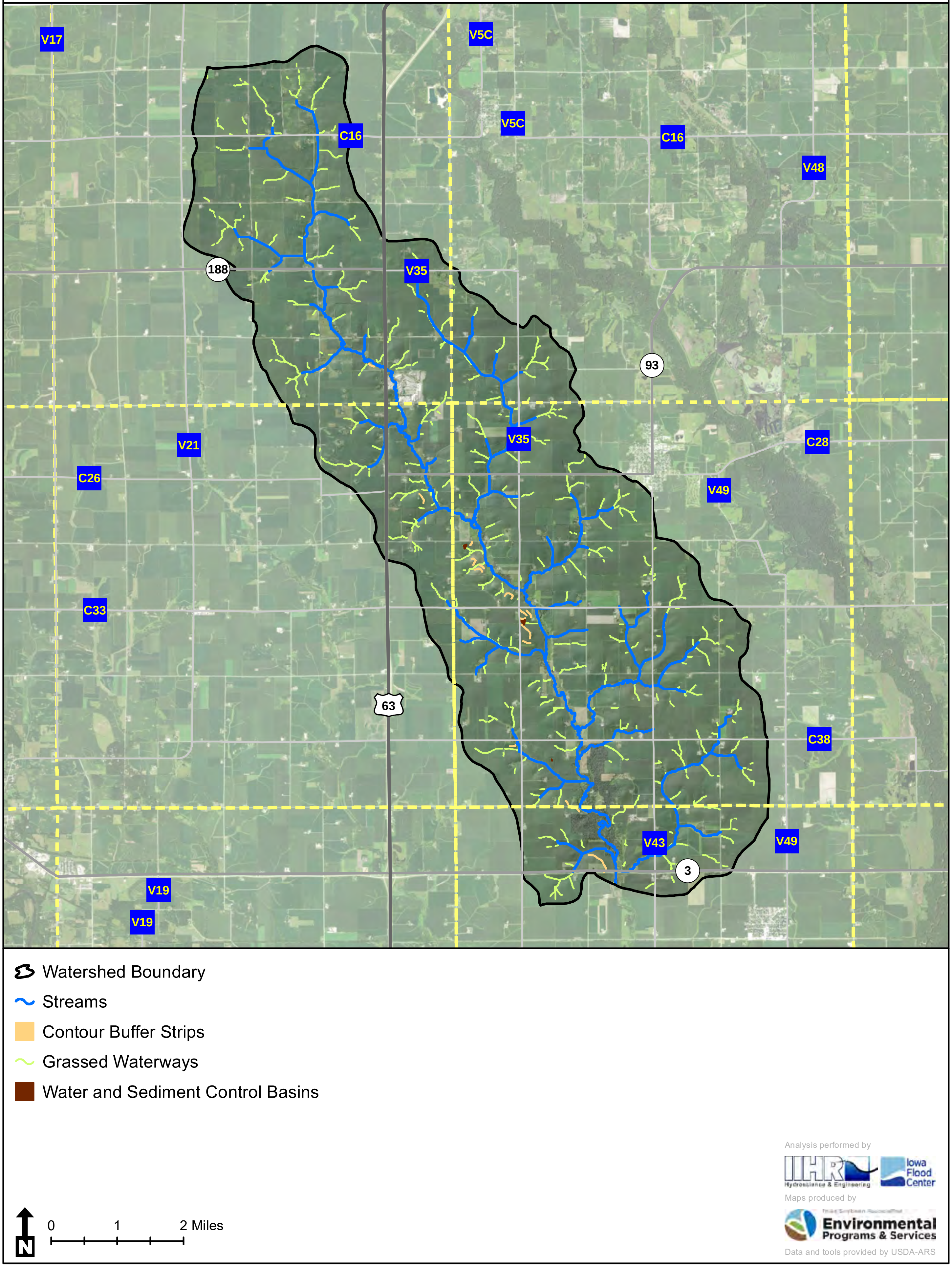
N

Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

Maps produced by Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401)
Agricultural Conservation Planning Framework Runoff Control Practices



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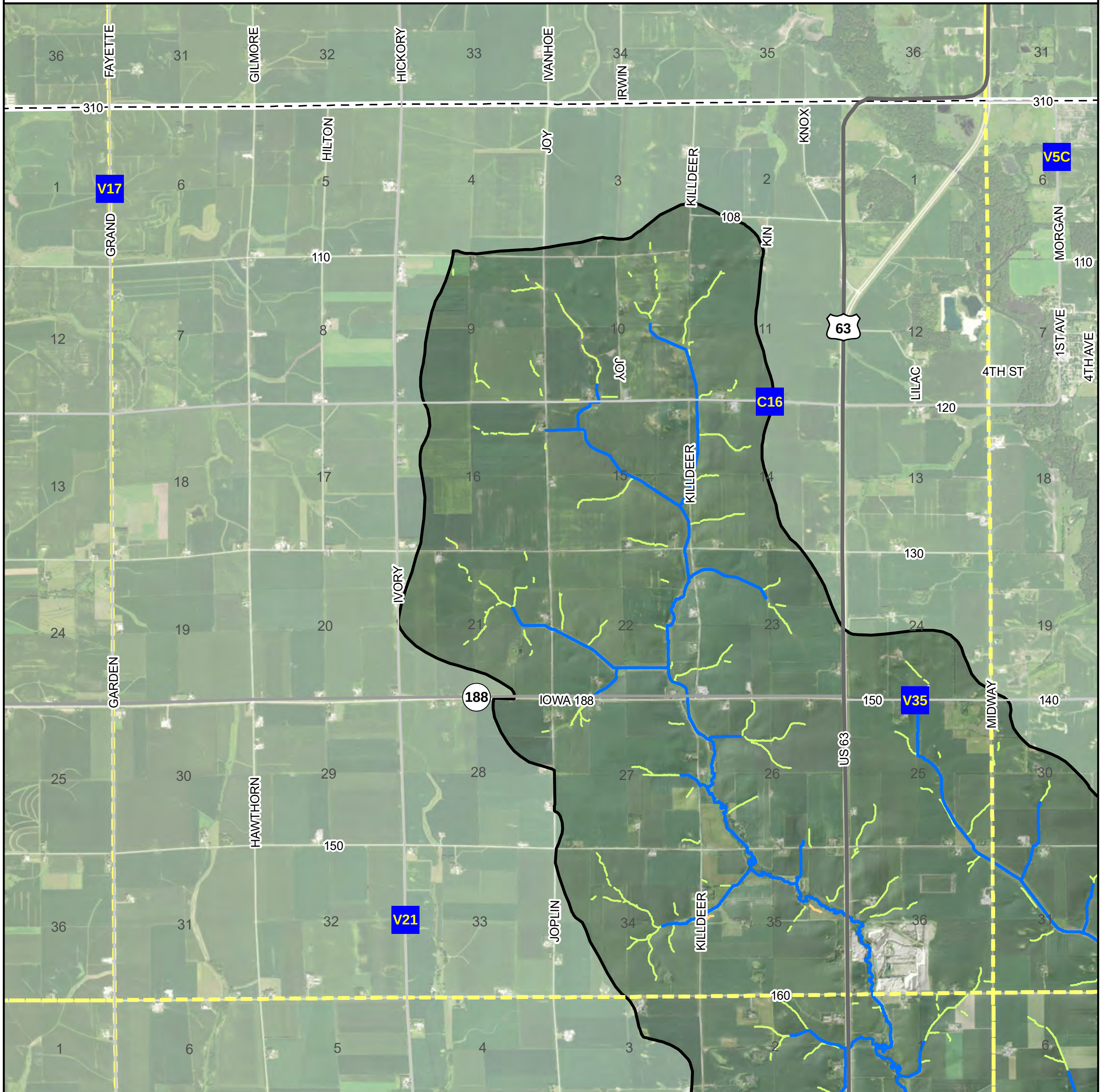
Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T93N R13W
Agricultural Conservation Planning Framework Runoff Control Practices



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

0 0.5 1 Miles

N

Analysis performed by
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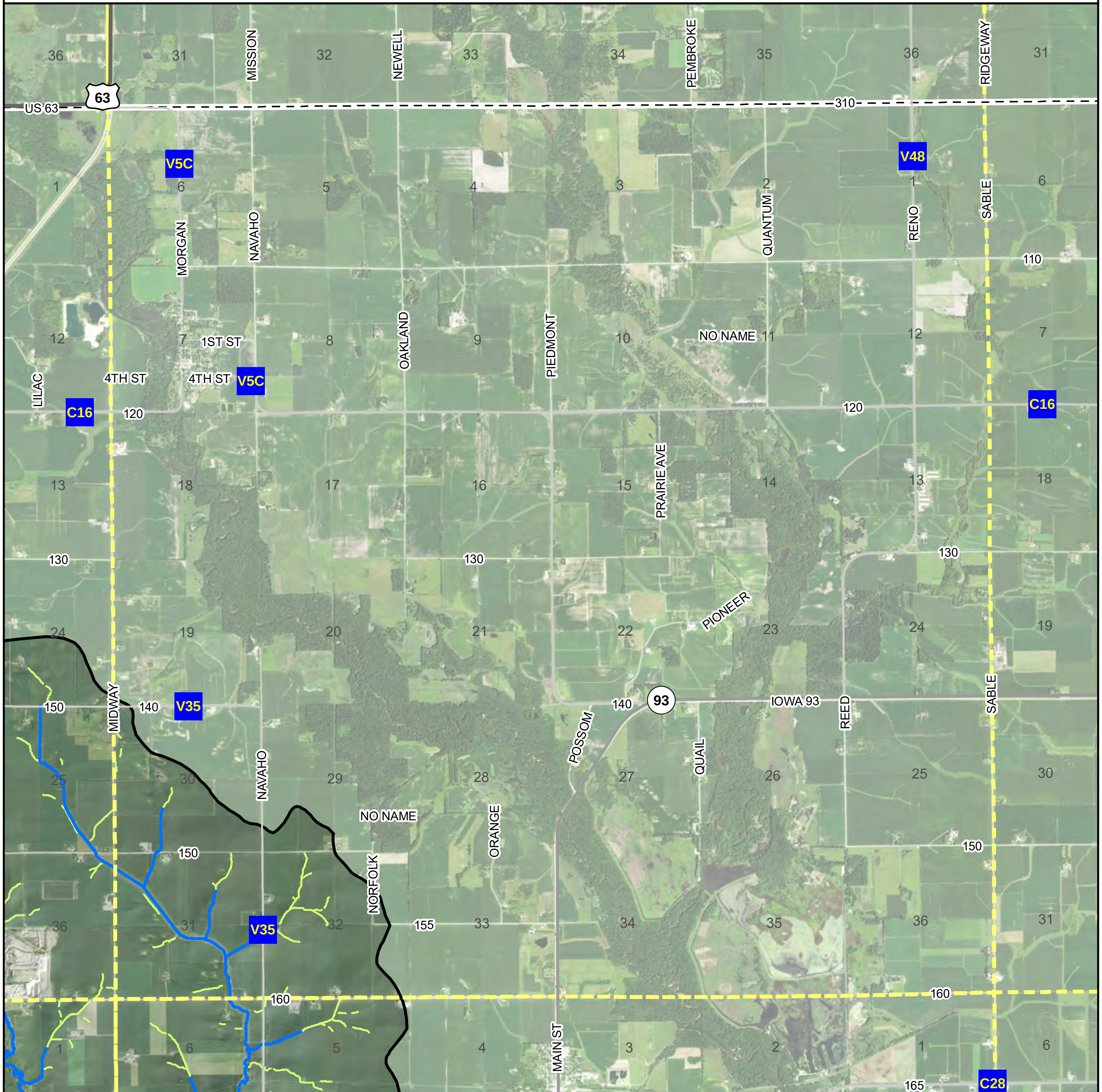
Iowa Flood Center
Maps produced by
Environmental Programs & Services
Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T93N R12W
Agricultural Conservation Planning Framework Runoff Control Practices



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

0 0.5 1 Miles

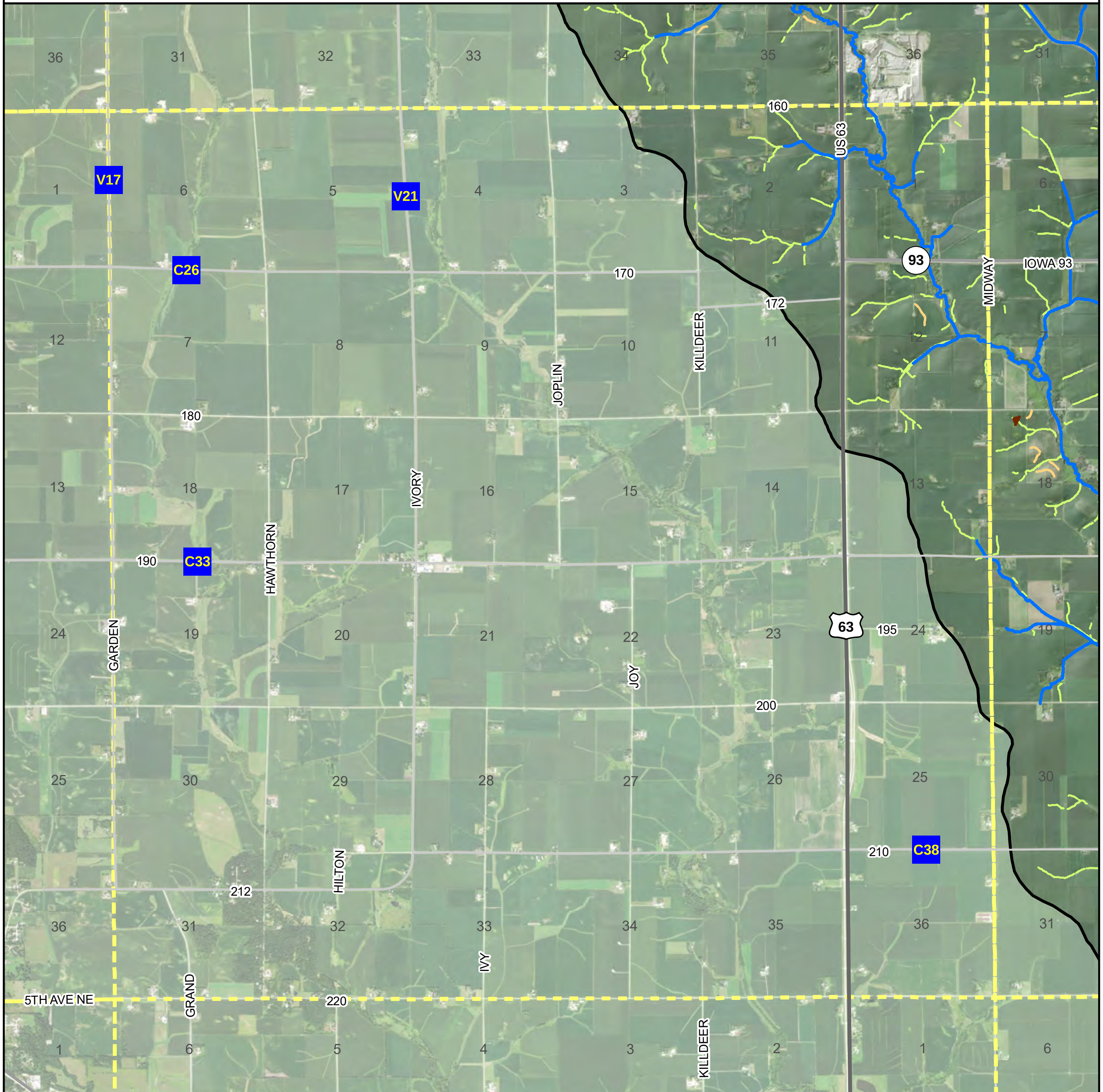
N

Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

Maps produced by Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T92N R13W
Agricultural Conservation Planning Framework Runoff Control Practices



Watershed Boundary

Streams

Contour Buffer Strips

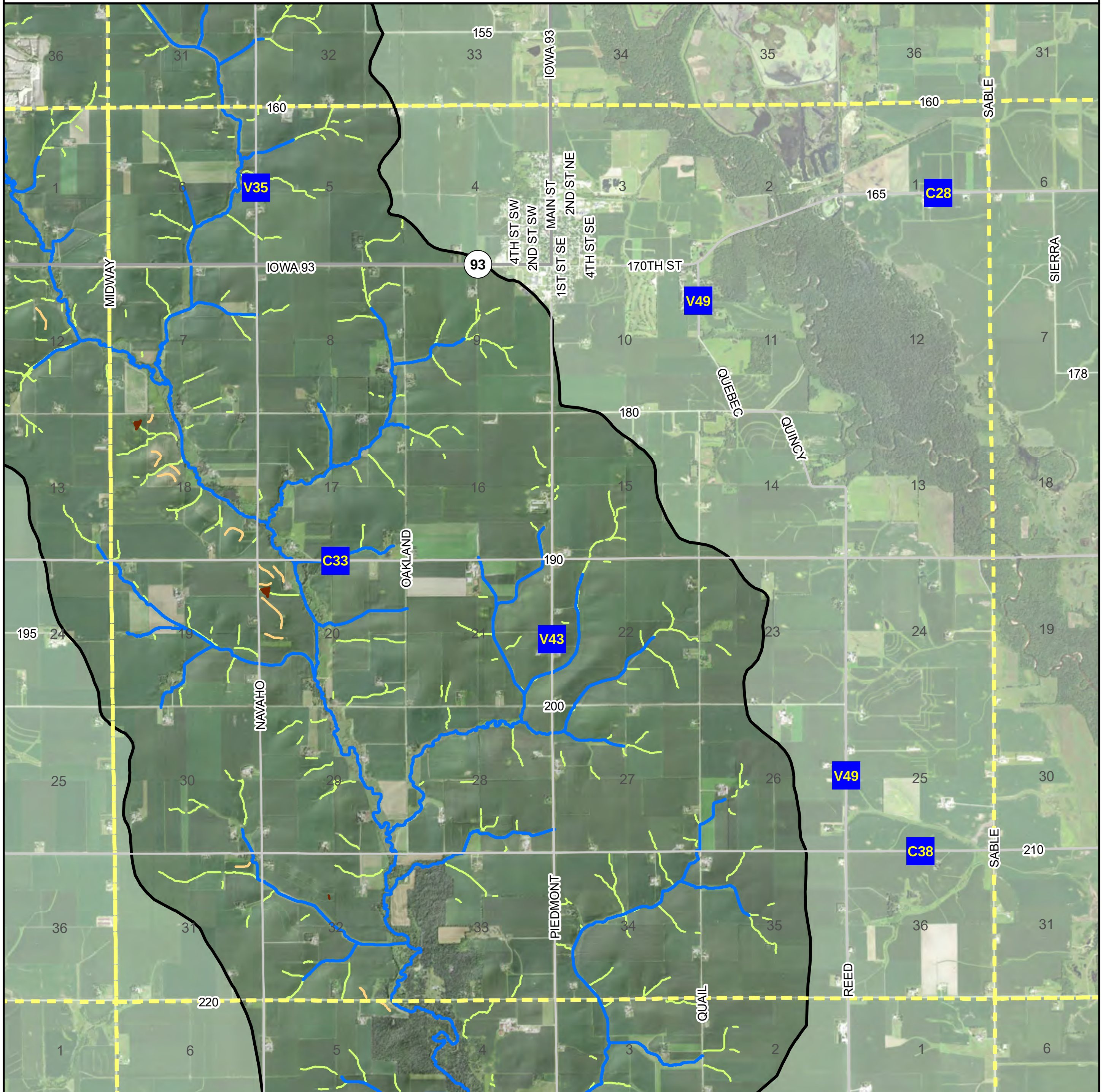
Grassed Waterways

Water and Sediment Control Basins

N

0 0.5 1 Miles

Upper Crane Creek Watershed (070801020401) T92N R12W
Agricultural Conservation Planning Framework Runoff Control Practices



Watershed Boundary

Streams

Contour Buffer Strips

Grassed Waterways

Water and Sediment Control Basins

0 0.5 1 Miles

N

Analysis performed by

IIHR Hydroscience & Engineering

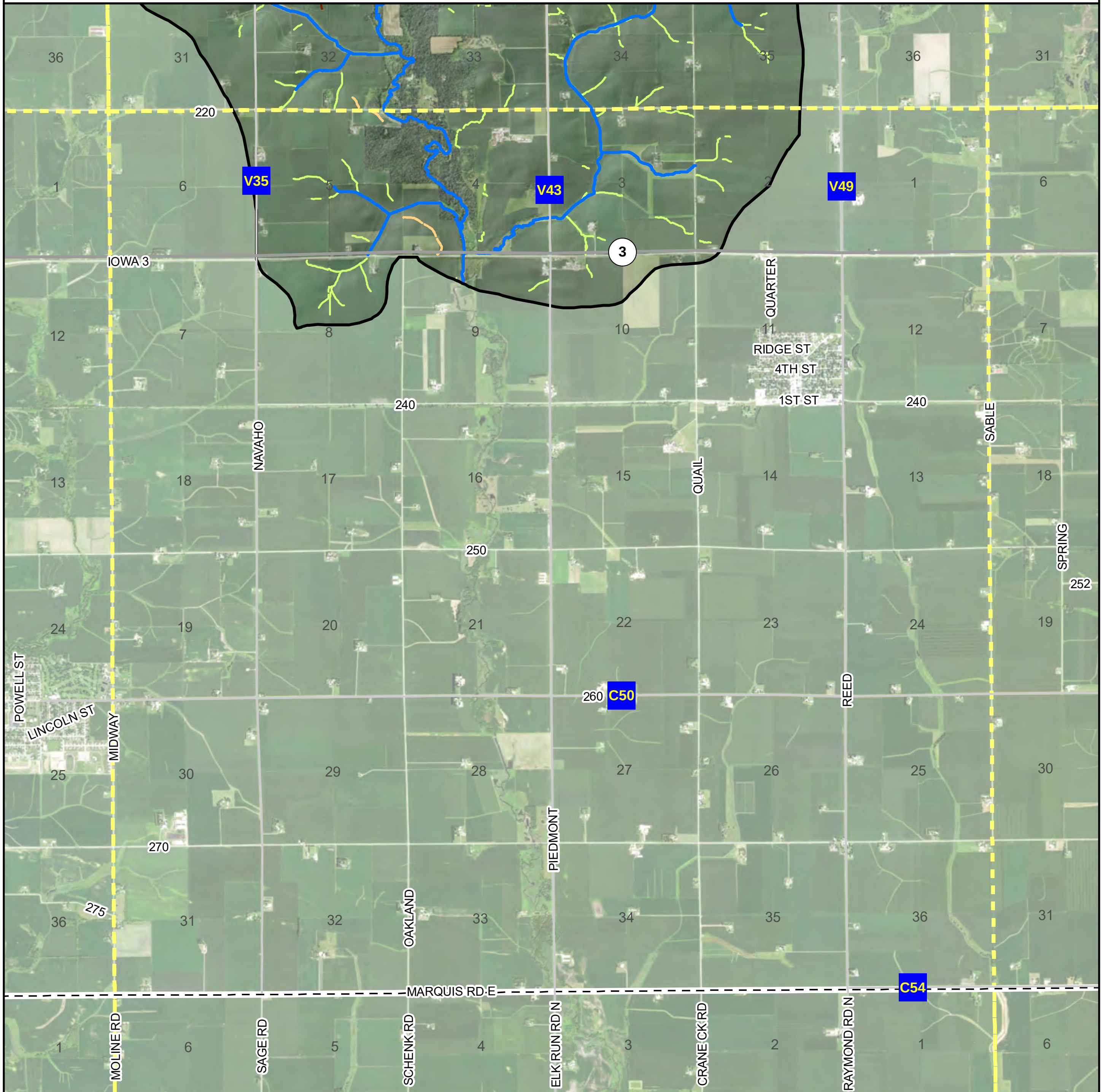
Iowa Flood Center

Maps produced by

Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T91N R12W
Agricultural Conservation Planning Framework Runoff Control Practices



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

N

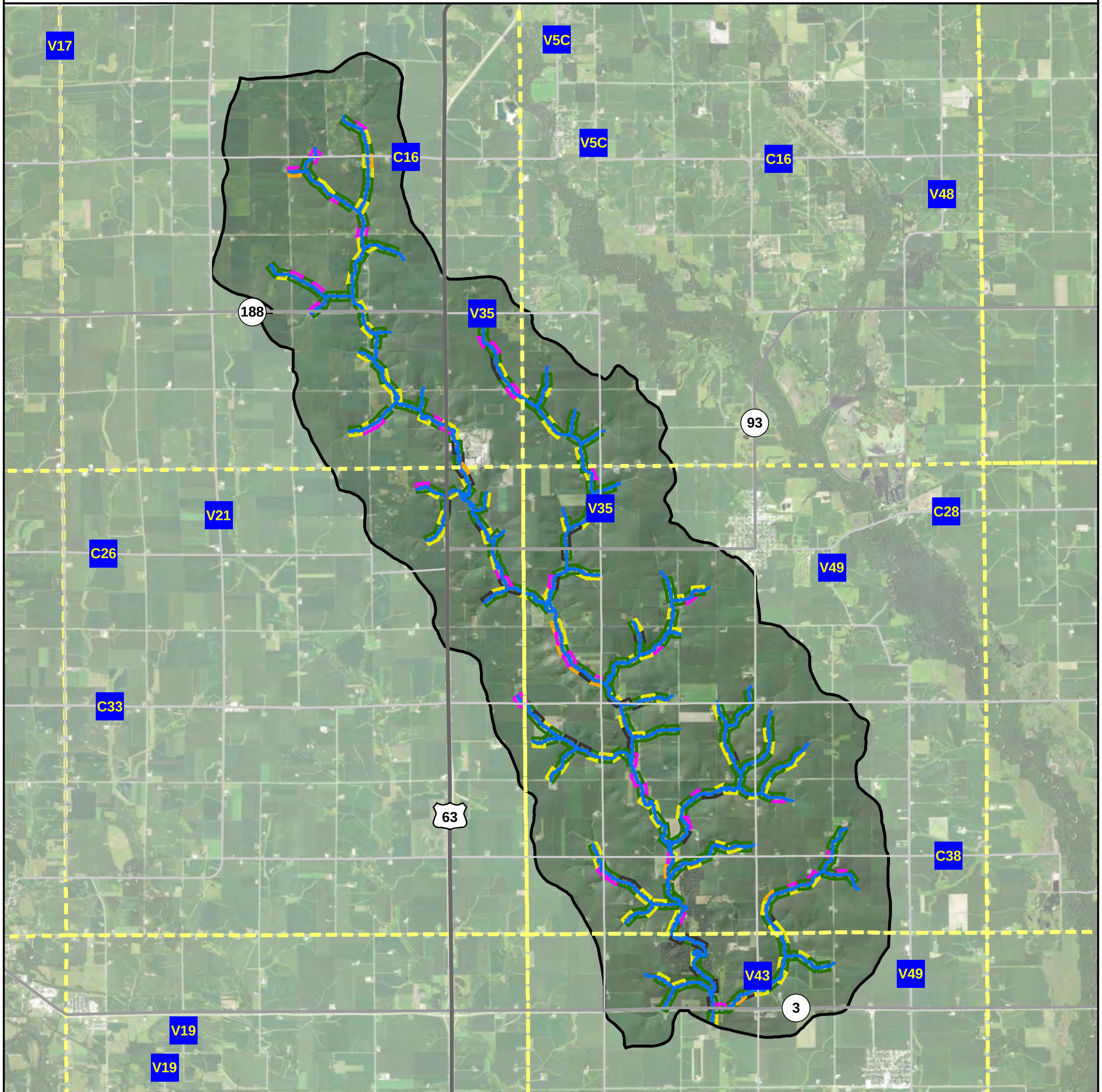
0 0.5 1 Miles

Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

Maps produced by Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401)
Agricultural Conservation Planning Framework Riparian Management Practices



Watershed Boundary

Streams

Riparian Function

- Critical Zone
- Multi Species Buffer
- Deep Rooted Vegetation
- Stiff Stemmed Grasses
- Stream Bank Stabilization

N

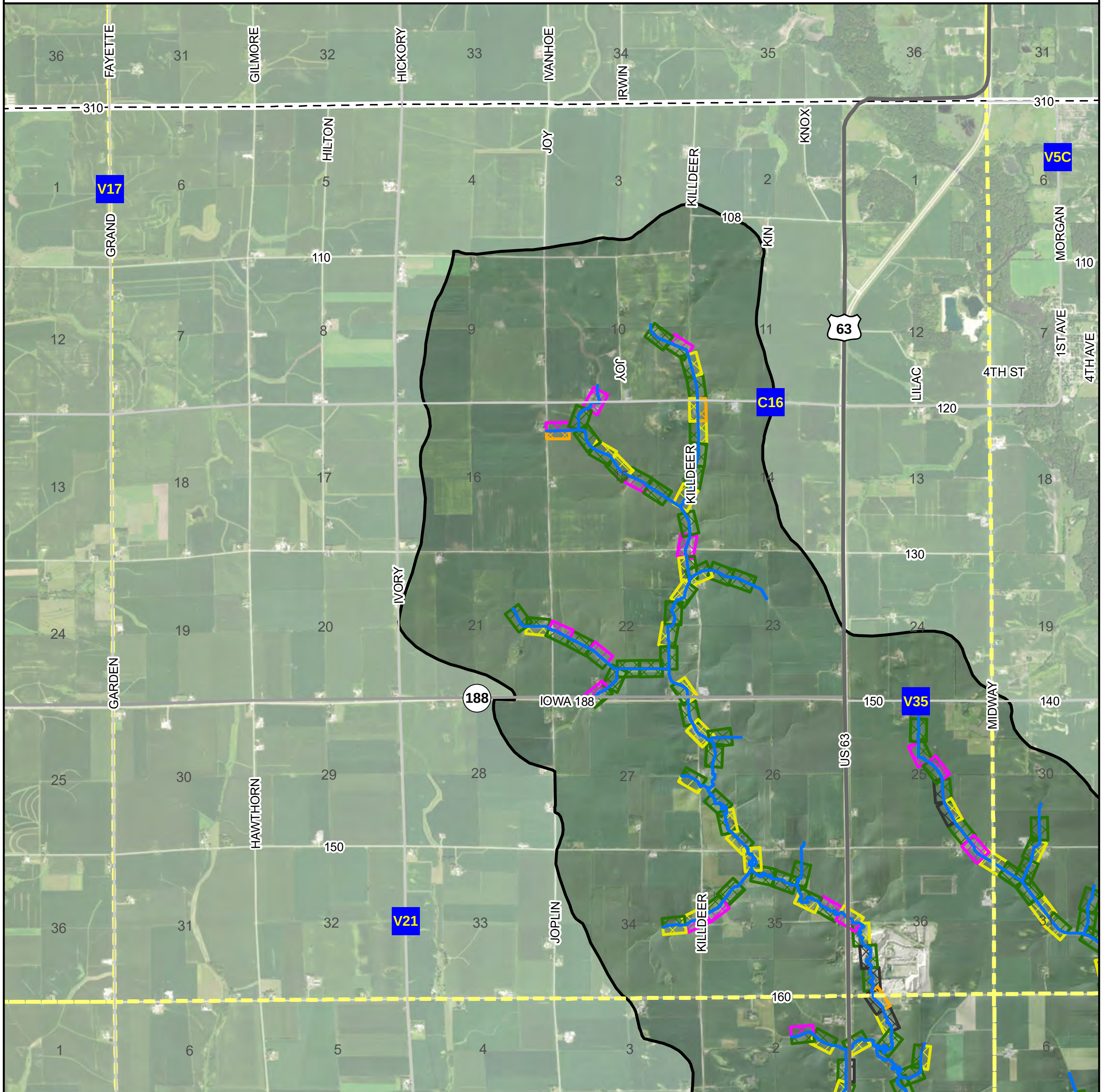
0 1 2 Miles

Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

Maps produced by Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T93N R13W
Agricultural Conservation Planning Framework Riparian Management Practices



Watershed Boundary

Streams

Riparian Function

Critical Zone

Multi Species Buffer

Deep Rooted Vegetation

Stiff Stemmed Grasses

Stream Bank Stabilization

N

0 0.5 1 Miles

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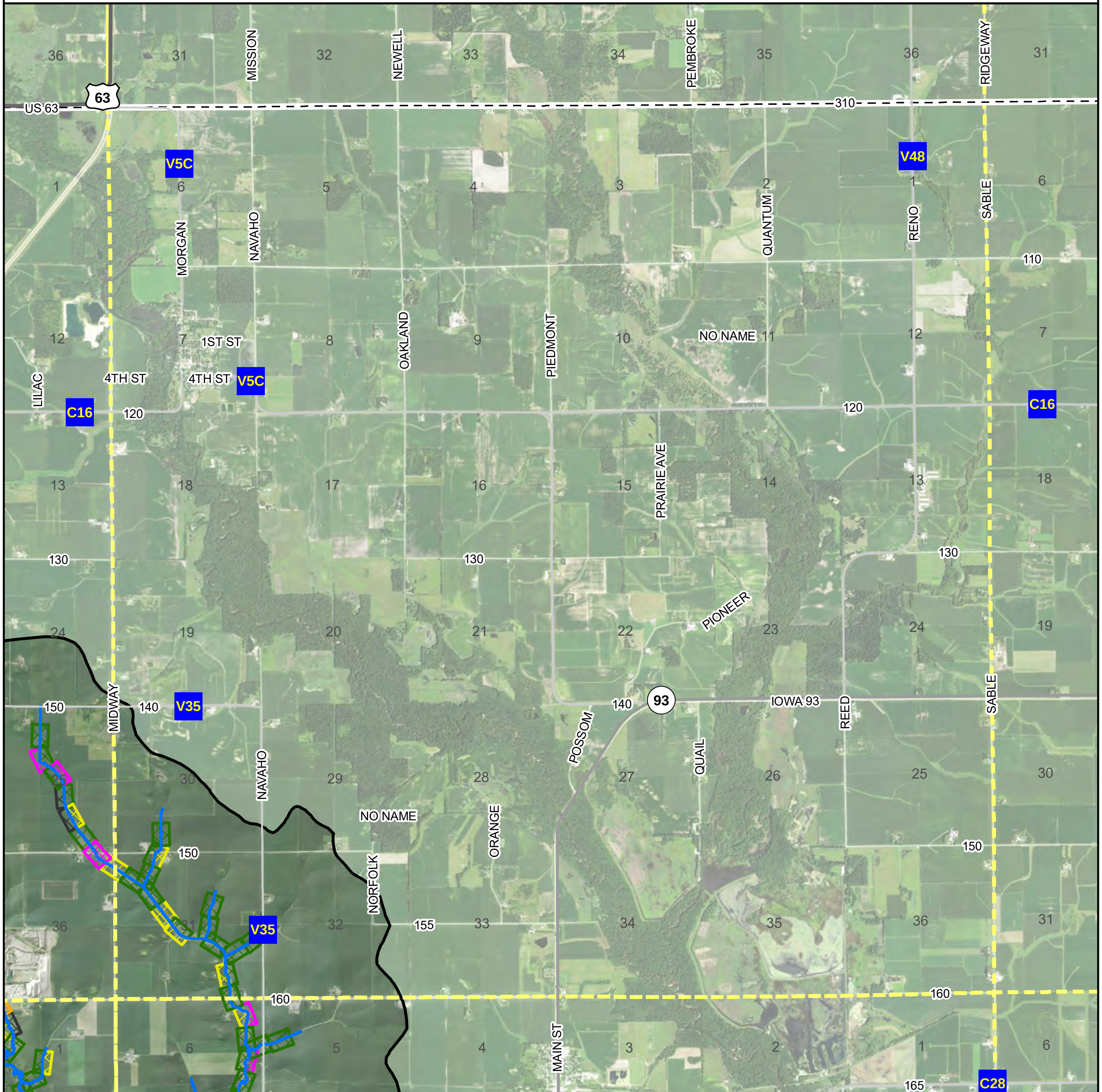
Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T93N R12W
Agricultural Conservation Planning Framework Riparian Management Practices



Watershed Boundary

Streams

Riparian Function

- Critical Zone
- Multi Species Buffer
- Deep Rooted Vegetation
- Stiff Stemmed Grasses
- Stream Bank Stabilization

N

0 0.5 1 Miles

Analysis performed by

IIHR Hydroscience & Engineering

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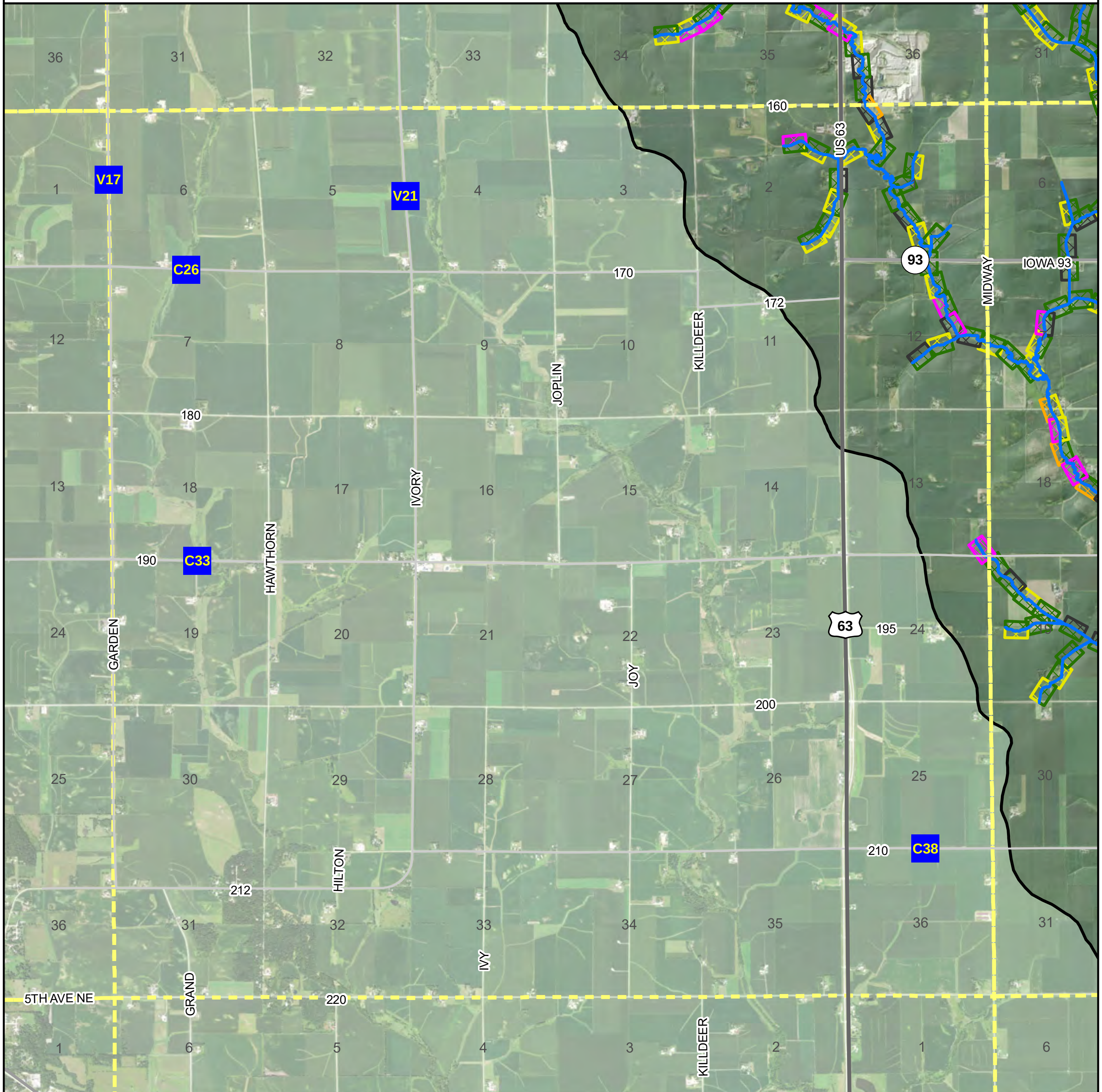
Upper Crane Creek Watershed (070801020401) T92N R13W
Agricultural Conservation Planning Framework Riparian Management Practices



Watershed Boundary

Streams

Riparian Function

- Critical Zone
- Multi Species Buffer
- Deep Rooted Vegetation
- Stiff Stemmed Grasses
- Stream Bank Stabilization

0 0.5 1 Miles

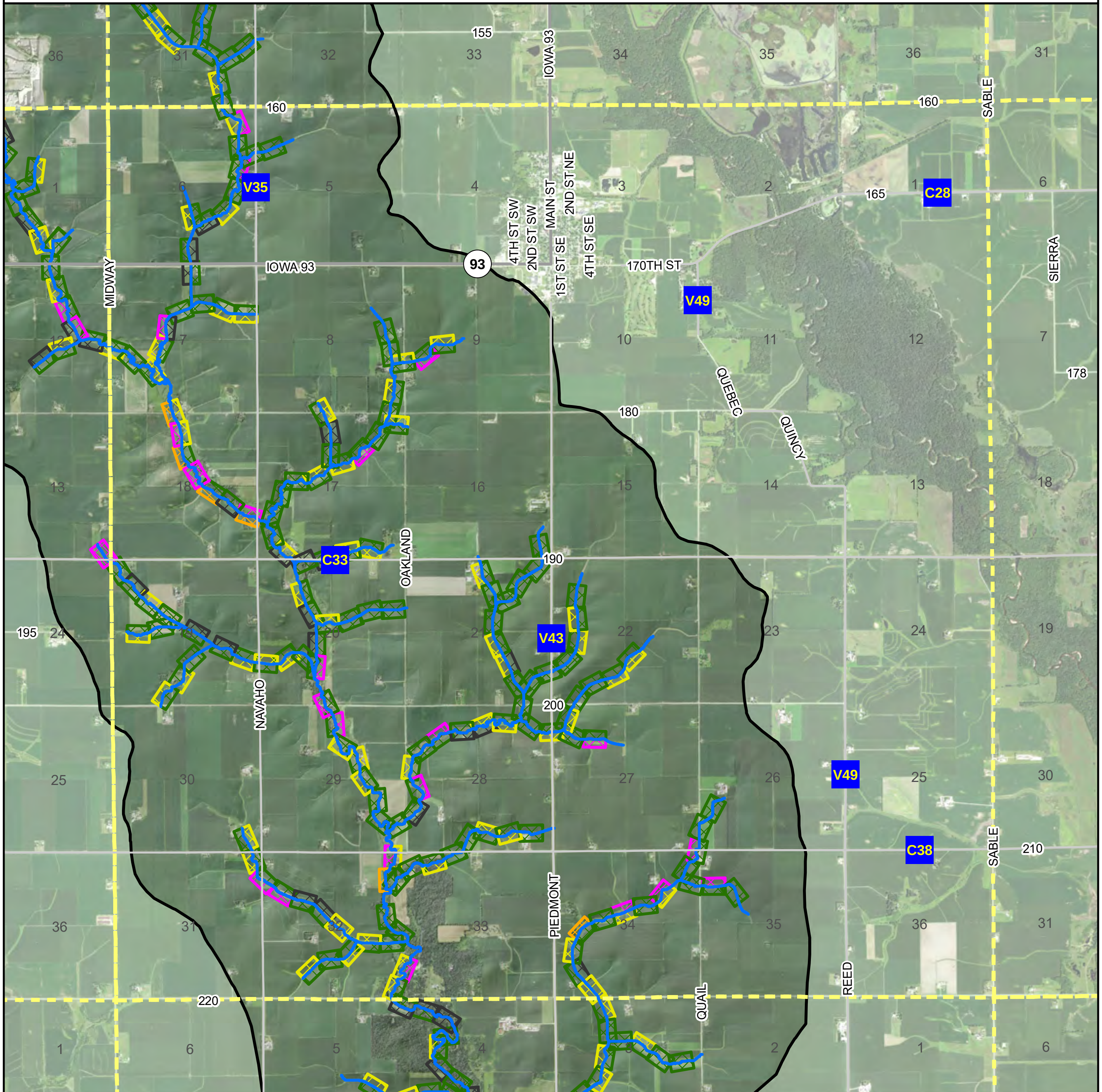
N

Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

Maps produced by Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T92N R12W
Agricultural Conservation Planning Framework Riparian Management Practices



Watershed Boundary

Streams

Riparian Function

Critical Zone

Multi Species Buffer

Deep Rooted Vegetation

Stiff Stemmed Grasses

Stream Bank Stabilization

0 0.5 1 Miles

N

Analysis performed by

IIHR Hydroscience & Engineering

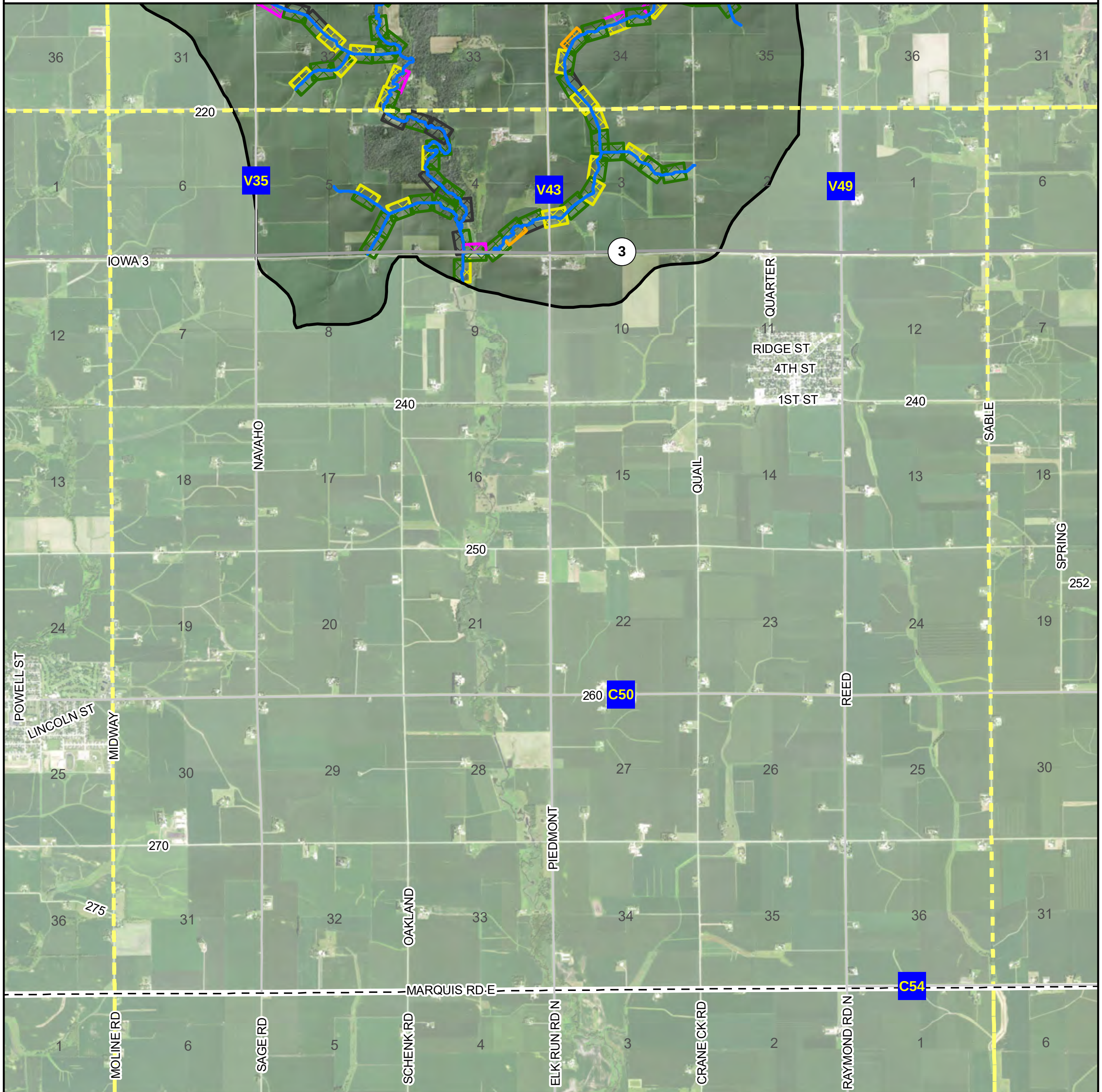
Iowa Flood Center

Maps produced by

Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Upper Crane Creek Watershed (070801020401) T91N R12W
Agricultural Conservation Planning Framework Riparian Management Practices



Watershed Boundary

Streams

Riparian Function

- Critical Zone
- Multi Species Buffer
- Deep Rooted Vegetation
- Stiff Stemmed Grasses
- Stream Bank Stabilization

0 0.5 1 Miles

N

Analysis performed by IIHR Hydroscience & Engineering, Iowa Flood Center

Maps produced by Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Appendix B: Watershed Project Self Evaluation Worksheet

Appendix B: 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.

Watershed Project: ______________________________

Evaluator Name: ________________________________

Evaluation Date: ________________________________

Evaluation Time Period: _________________ to _________________

Project Administration	Exceeds	Meets	Partially Meets	Does Not Meet	NA
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.					

Attitudes and Awareness	Exceeds	Meets	Partially Meets	Does Not Meet	NA
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.					

Performance	Exceeds	Meets	Partially Meets	Does Not Meet	NA
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.					

Results	Exceeds	Meets	Partially Meets	Does Not Meet	NA
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, identify the strengths, weaknesses, opportunities and threats (SWOTs) relevant to the project. Identification of SWOTs is important as they help shape successful watershed plan implementation.

Strengths	Opportunities
Weaknesses	**Threats**

Appendix C: Nitrogen Reduction Calculation Worksheet

Appendix C: 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. 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
Nitrogen management*		2.5	
Cover crops - rye		7.75	
Cover crops - oats		7.0	
Perennial Cover		21.25	
Controlled drainage		8.25	
Bioreactors		8.31	
Saturated buffers		8.31	
Wetlands		8.64	
Total N Load Reduction (lb/yr)			
Baseline N Load (lb/yr)			630,325
Percent N Reduction (%)			

*Include only acres treated with nitrogen management (e.g., maximum return to nitrogen application rate, nitrification inhibitor) that do not also have cover crops.

Appendix D: Potential Funding Sources

Appendix D: 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.	https://www.fieldtomarket.org/members/
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.	http://www.ipni.net
Iowa Community Foundations	Iowa Community Foundations are nonprofit organizations established to meet the current and future needs of our local communities.	http://www.iowacommunityfoundations.org/
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.	http://www.inhf.org
McKnight Foundation — Mississippi River Program	Program goal is to restore the water quality and resiliency of the Mississippi River.	http://www.mcknight.org/grant-programs/mississippi-river
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.	http://www.nfwf.org
National Wildlife Foundation	Works to protect and restore resources and the beneficial functions they offer.	http://www.nwf.org
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.	http://www.tfi.org
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.	http://www.nature.org
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.	http://www.treesforever.org/
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.	http://www.waltonfamilyfoundation.org/environment

Appendix E: Watershed Plan Factsheet

Upper Crane Creek
Watershed Plan

What is a watershed?

A watershed is an area of land that drains to a common point. The Upper Crane Creek watershed contains 30,068 acres of Bremer County.

Why is there a watershed plan for the Upper Crane Creek Watershed?

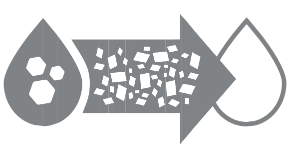
The Upper Crane Creek watershed was nominated by the Bremer SWCD as priority watershed. The Iowa Soybean Association, with funding from the NRCS, developed a watershed plan to identify conservation practice opportunities in the watershed. Farmers and landowners along with other watershed stakeholders provided input to the planning process. The watershed plan goals are to:

1. Identify cost effective solutions
2. Provide for profitable and productive agriculture
3. Create conditions for healthy soils and water
4. Minimize downstream impacts

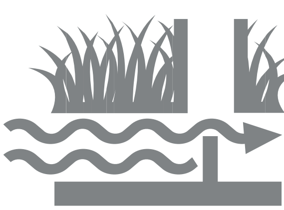
What conservation practices are included in the watershed plan?

Due to the ambitious watershed plan goals, conservation practice adoption will be necessary throughout the entire watershed. The following practices along with their target implementation levels are included in the watershed conceptual plan (see map on reverse).

Saturated Buffers (50 structures) Tile water is routed into a riparian buffer. Plants and microbes in the buffer naturally remove nitrates from water as it percolates towards the stream.



Bioreactors (4 structures) Tile water is routed into a trench filled with wood chips. Microbes living in the wood chips remove nitrates from the water through a process called denitrification. The treated water is then returned to the stream with less nitrates.



Drainage Water Management (4,500 acres) A control structure is used to temporarily raise the water table. This reduces the overall amount of drainage throughout the year. Excess water can be drained before field operations by managing the control structure.

Nitrate Removal Wetlands (3 sites) Restored or constructed wetlands can benefit water quality by removing nitrates and sediment. Wetlands also reduce flooding by temporarily holding excess water during and after major precipitation events.

Cover Crops (17,000 acres) Cover crops sequester nitrogen when cash crops are not actively growing. Cover crops also reduce soil erosion and phosphorus loss.

No-Till/Strip-Till (As many acres as possible) Reducing or eliminating tillage improves soil health, reduces soil erosion and decreases phosphorus loss.

Nutrient Management (Min of 10,000 acres) Managing the rate, timing, source and stability of nutrient applications can simultaneously improve both return on investment through increased yield and water quality through decreased nutrient loss.

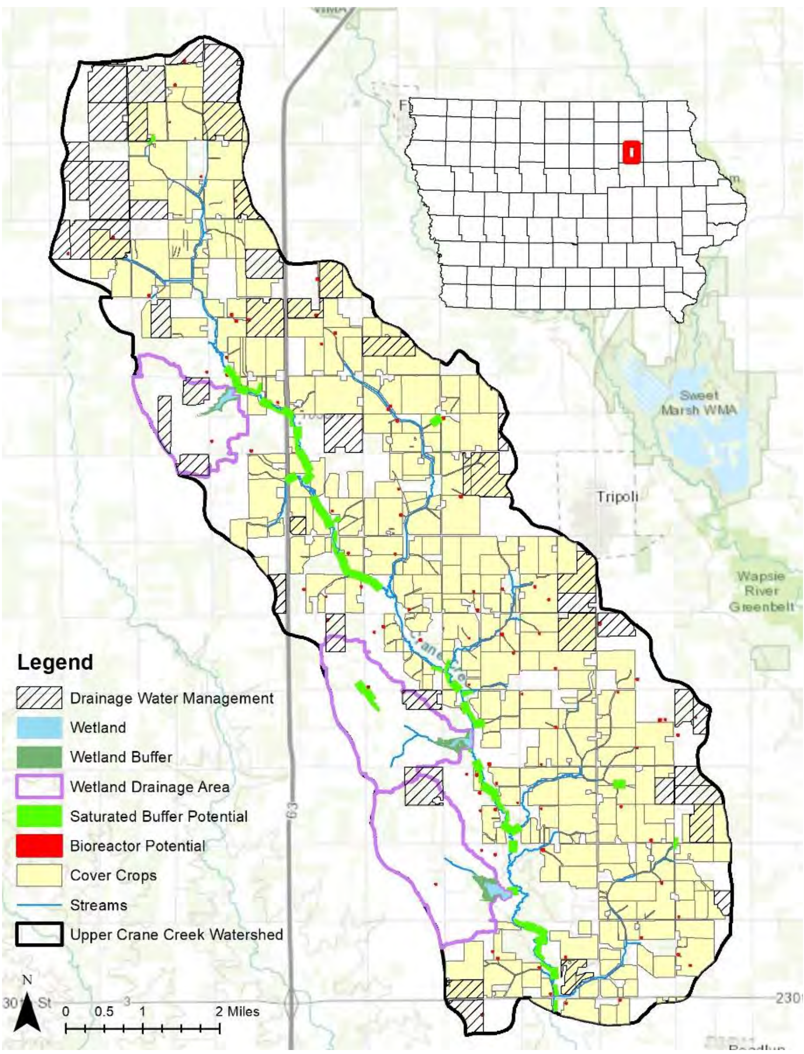
Perennial Cover (maintain existing acres plus 1,000 additional acres) Perennial grasses, shrubs and trees provide many benefits including wildlife habitat and reduced nutrient loss. Existing cover should be maintained to continue these ecosystem services.

Conservation isn't cheap! How much will it cost?

While some changes may result in cost savings, others can impose significant one-time or annually recurring costs.

	Practice	Watershed plan goal	Unit	Cost per unit	Total cost	Watershed load reductions		Cost per Pound of Reduction	
						Nitrogen (lb N/yr)	Phosphorus (lb P/yr)	Nitrogen ($/lb N/yr)	Phosphorus ($/ton P/yr)
Annual costs	Cover crops (rye)	12,000	acres	$20	$240,000	93,000	677	$2.58	$0.18
	Cover crops (oats)	5,000	acres	$20	$100,000	35,000	282	$2.86	$0.18
	MRTN	10,000	acres	($5)	($50,000)	25,000	0	($2.00)	
	Conversion of Cropland to Perennial Cover	1,000	acres	$200	$200,000	21,250	146	$9.41	$0.68
Initial costs	Drainage water management (50-year life)	4,500	acres	$63	$283,500	37,125	0	$0.15	
	Bioreactors (15-year life)	4	sites	$15,000	$60,000	1,143	0	$3.50	
	Saturated buffers (75-year life)	50	sites	$4,000	$200,000	16,616	0	$0.16	
	Nitrate removal wetlands (75-year life)	3	sites	$425,000	$1,275,000	30,588	585	$0.56	$1.09

Total estimated cost to fully implement the Upper Crane Creek Watershed plan are $490,000 for annual management practice costs plus $1,818,500 for one-time infrastructures costs. Cost share is available for many of the practices.



Where are practices needed?

The conceptual plan shown below is one of a variety of potential combinations of practices to reach the watershed plan goals. The locations shown on the map are believed to be the most suitable for practice installation, especially for the structural practices. Site surveys will be required to determine true installation potential.

Who do I contact for more information about the watershed plan?

Feel free to contact Adam Kiel, Operations Manager of Water Resources at the Iowa Soybean Association. Adam can be reached at 515-334-1022 or akiel@iasoybeans.com.

Or

Contact the Bremer SWCD or NRCS at 319-352-4037.