Prepared by: EOR/IVRCD/ISA

For the Middle Cedar Watershed Management Authority

Village of Reinbeck-Black Hawk Creek HUC-12 Subwatershed Plan

March 2020

Cover Image

City of Reinbeck, Iowa (Photo credit: Emmons & Olivier Resources)

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1. INTRODUCTION

The following subwatershed management plan was developed as a component of the Middle Cedar Watershed Management Plan (MCWMP). The MCWMP was funded using federal funds from the U.S. Department of Housing and Urban Development pursuant to Title I of the Housing and Community Development Act of 1974. The Iowa Economic Development Authority (IEDA) was awarded a Community Development Block Grant National Disaster Resilience (CDBG-NDR) Federal award B-13-DS-19-0001 and awarded a portion of those funds to Benton County through grant 13-NDRI-006 to develop the MCWMP.

Development of this subwatershed management plan used a stakeholder engagement process consisting of two meetings with local representatives to discuss issues facing the watershed and approaches for improvements.

The planning team, Emmons & Olivier Resources (EOR), Iowa Valley Resource Conservation and Development (IVRCD) and the Iowa Soybean Association (ISA), would like to extend our sincere thanks to several people who made this plan possible. Iowa Natural Resource and Conservation Services Grundy Center staff, Shaffer Ridgeway, District Conservationist; Nicky Williams, Resource Conservationist. Meeting attendees Jack Wittgreve, Jason Schildroth, Dan Koch, Michael Piltman, Tyler Schildroth, Mark Schildroth Ken Fogt, Frank Wyatt, Victor Devick, and Jack Boyer.

The following plan provides a snapshot of information that will assist watershed planners, resource conservationists, and organized groups in creating targeted strategies for improving this watershed. **Stakeholder Engagement** Process of this report describes the stakeholder engagement process used to develop this plan. **Watershed Characterization** outlines general watershed characteristics, such as, demographics, geographic and political boundaries, and land use. A focus on water resources highlights any stream impairments and lakes within the watershed, with a more detailed analysis of the pollutant assessment included. A narrative describing the issues facing the Middle Cedar Watershed (MCW) and the specific issues facing this Subwatershed is provided in **Watershed Issues** of this plan. The issues summary was developed after the series of meetings with subwatershed residents. The flood mitigation and water quality conservation practices and the recommended adoption rates needed to meet the Iowa Nutrient Reduction Strategy (INRS) targets are summarized in **Implementation Plan**. A cost benefit analysis of the recommended conservation practice adoption rates is provided in Error! Reference source not found.**Implementation schedule** & Milestones. Recommendations for practices and areas within the subwatershed to prioritize implementation are also provided in **Implementation schedule** & Milestones along with maps that can be found in **Appendix A**.

2. STAKEHOLDER ENGAGEMENT PROCESS

Partnering with the Iowa Soybean Association (ISA), the planning team hosted two separate input meetings to engage local landowners and residents. The first meeting focused on prioritizing conservation practices (e.g. grassed waterways, oxbow restoration), and watershed priorities (e.g. agricultural sustainability, recreation). The second meeting discussed the prioritization results and attendees outlined practices that have the greatest potential for adoption in order to achieve the Iowa Nutrient Reduction Strategies goals. Both meetings were held in the City of Reinbeck at the Reinbeck Memorial Building and took place on March 23 and June 29, 2018.

The planning team executed these outreach practices to reach residents:

- A letter sent via U.S. postal mail inviting more than 100 ISA clients in the watershed to join the input sessions.
- Handouts and fliers were mailed to the City of Reinbeck to be posted in local gathering places, such as City Hall and the Public Library.
- Phone calls were made to all attendees of the first meeting, in order to gauge interest and attendance for the second meeting.

It should also be noted that there are unique challenges to getting farmers indoors to attend a meeting. The best time of year to host meetings with farmers is typically in the winter because they are not in their fields, however, then the meetings are subject to severe weather conditions that force cancellations. The first Village of Reinbeck – Black Hawk Creek meeting was cancelled due to a snowstorm that made the roads impassable and was rescheduled for March 23.

The first meeting was held on March 23rd, 2018 and was attended by 10 participants, including individuals who self-identified as farmers, landowners, and soil and water professionals. The meeting's agenda was presented into two parts: part one covered the context and reasoning for the meeting with basic information regarding watersheds, while part two of the meeting engaged the participants to provide input on priorities of focus and conservation practices.

During the first portion of the meeting, planners covered basic watershed information, such as how a watershed is delineated on the landscape and how different land uses impact water quality and soil health. In order to provide context for the series of input meetings, the planning team described the larger MCWMP and outlined the upcoming timeline and deliverables.

During the second portion of the meeting, the planning team led participants through two exercises where attendees ranked their preferences and submitted anonymous ballot sheets to be tallied and analyzed after the meeting. In the first exercise, participants were provided a list of priorities, such as the Iowa Nutrient Reduction Strategy, water quality, and flood risk, and were asked to rank them according to their importance. During this exercise, Stakeholders identified the following issues:

- Stakeholders commented that community wetland restoration and rural-municipal cooperation should be included as priorities.
- Stakeholders identified rural-municipal cooperation centered primarily on the Reinbeck wastewater utility and the allocation of responsibilities between point and non-point sources under the Iowa Nutrient Reduction strategy,

- Stakeholders pointed to innovative projects in Iowa that are linking downstream/municipal partners with upstream farmers and landowners.

In the second exercise, participants ranked conservation practices based off what they believed would have a high adoption rate in their watershed. During the exercise, the planning team explained each item on the list of presented conversation practices, which included, grassed waterways, saturated buffers, and nitrification inhibitors, and also described the specific benefits and challenges of each practice to the participants. Out of this exercise, the group suggested filter/buffer strips as a practice to consider and also helped to identify potential locations that might be suitable for buffer/filter strips along Black Hawk Creek.

The second stakeholder meeting was held on June 29th, 2018. Outreach to residents for the second input meeting included email to all of the original invitees that ISA had contacted for the first input meeting, and for those whose contact information was available, they received a personal follow-up call the week leading up to the meeting. In addition, the attendees from the first meeting were invited by personal follow-up phone calls and/or emails. There were 14 attendees at the second meeting.

The purpose of this meeting was:

- Report and ground-truth the initial ranking results for priorities and practices.
- Introduce modeling data to assist the group in visualizing the impacts of their prioritized practices.
- Create achievable practice implementation goals that meet the INRS.

The planning team kicked off the meeting by reviewing each priority and practice ranking that had been identified in the first input meeting. The planners then asked the participants if they felt these compiled rankings accurately reflected the general experience of individuals living in the watershed. The stakeholders provided the following feedback:

- Stakeholders verified that the ranked priorities of the subwatershed were aligned with what they had experienced. Upon reviewing the results of the prioritized practices, the top three highest priorities selected were grassed waterways, nutrient management, and nitrification inhibitors.
- Participants noted that these practices aligned with what they experienced in the watershed and indicated that it would be difficult to implement different practices without more information, training, and cost-share available.
- Many stakeholders had not heard about the Iowa Nutrient Reduction Strategy (INRS) and expressed their appreciation that it is voluntary and not mandatory.

During group discussion, it was brought to attention of the planning team that a previous watershed-related project had left a bad impression on many area residents. According to the participants, in 2014 the Iowa Department of Natural Resources (Iowa DNR) received an Iowa Water Trail sign grant to promote waterway recreation and failed to include community input on the front end of the project. Many residents were still very upset. Additional issues that were identified by stakeholders during the discussion included:

- Local residents see the water trail as something that invites kayakers/canoers on to their property and they consider this trespassing.

- Black Hawk Creek frequently experiences log jams, making passage impossible, which was just another way in which they felt the project had failed to take local, environmental factors into account.
- Stakeholders expressed that there is a general desire from community members to work together to make watershed-related projects a success; they would rather have input on this watershed plan then be left outside of the decision-making process.
- Stakeholders indicated that new developments in the area lacked sufficient infrastructure and pointed out that retrofits would be costly.

Following the discussion of past experiences in the planning process, participants were then presented with modeling data and discussed implementation goals. In order to achieve the INRS goals of a 41% load reduction in nitrogen and 29% load reduction in phosphorus to meet the overall 45% reduction goal, the planning team introduced the Agricultural Conservation Planning Framework (ACPF). This framework is a data-modelling tool that processes high-resolution topographic data to identify field-scale and edge-of-field practices that can be installed in the watershed. The ACPF helps planners and stakeholders visualize where certain practices can be strategically located to create the greatest benefit to the watershed.

Stakeholder Input

- Riparian buffers, cover crops and filter strips are preferred conservation practices
- Woody debris in streams frequently cause flooding in fields and streambank erosion
- Concern over the lack of enforcement of stormwater infrastructure ordinance for new developments

3. WATERSHED CHARACTERIZATION

3.1. General Background

The Village of Reinbeck – Black Hawk Creek Subwatershed spans Grundy, Tama, and Black Hawk counties (see **Figure 1**). According to the 2010 United States Census, the subwatershed has an estimated population of 1,956, the majority of which (1,664) reside within the City of Reinbeck. The population density of the subwatershed is 115 people per 1000 acres. The Village of Reinbeck – Black Hawk Creek population represents less than 1.0% of the total population of the Middle Cedar Watershed (MCW).

The 16,956 acre area is classified as a HUC-12 Subwatershed (070802050505) in the United States Geological Survey hierarchical system. It is a subdivision of the Headwaters Black Hawk Creek HUC-10 Watershed (0708020505) and the Middle Cedar HUC-8 Subbasin (07080205). A local initiative, the Black Hawk Water and Soil Coalition, was recently formed for the purpose of restoring, improving, preserving and advocating for water quality and soil health. The coalition was formed to address issues in the three Black Hawk Creek HUC-10 Watersheds; Black Hawk Creek Watershed, Headwaters Black Hawk Creek Watershed, and North Fork Black Hawk Creek Watershed. Further information can be found on the Coalition facebook page at https://www.facebook.com/bhcwaterandsoil/.

3.2. Land Cover

The predominant land cover of the Village of Reinbeck – Black Hawk Creek Subwatershed is row crop agriculture. According to the High Resolution Landcover (HRLC) of Iowa 2009 data set the subwatershed is 81% row crop agriculture. The HRLC data was derived from three dates of aerial imagery and elevation information derived from LiDAR (Light Detection And Ranging). The HRLC has a spatial resolution of one meter, and a class resolution of 15 classes, which were combined into the five general categories shown in (**Figure 2**) Additional information, including a link to download the actual data, on the HRLC can be found at https://geodata.iowa.gov/dataset/high-resolution-land-cover-iowa-2009.

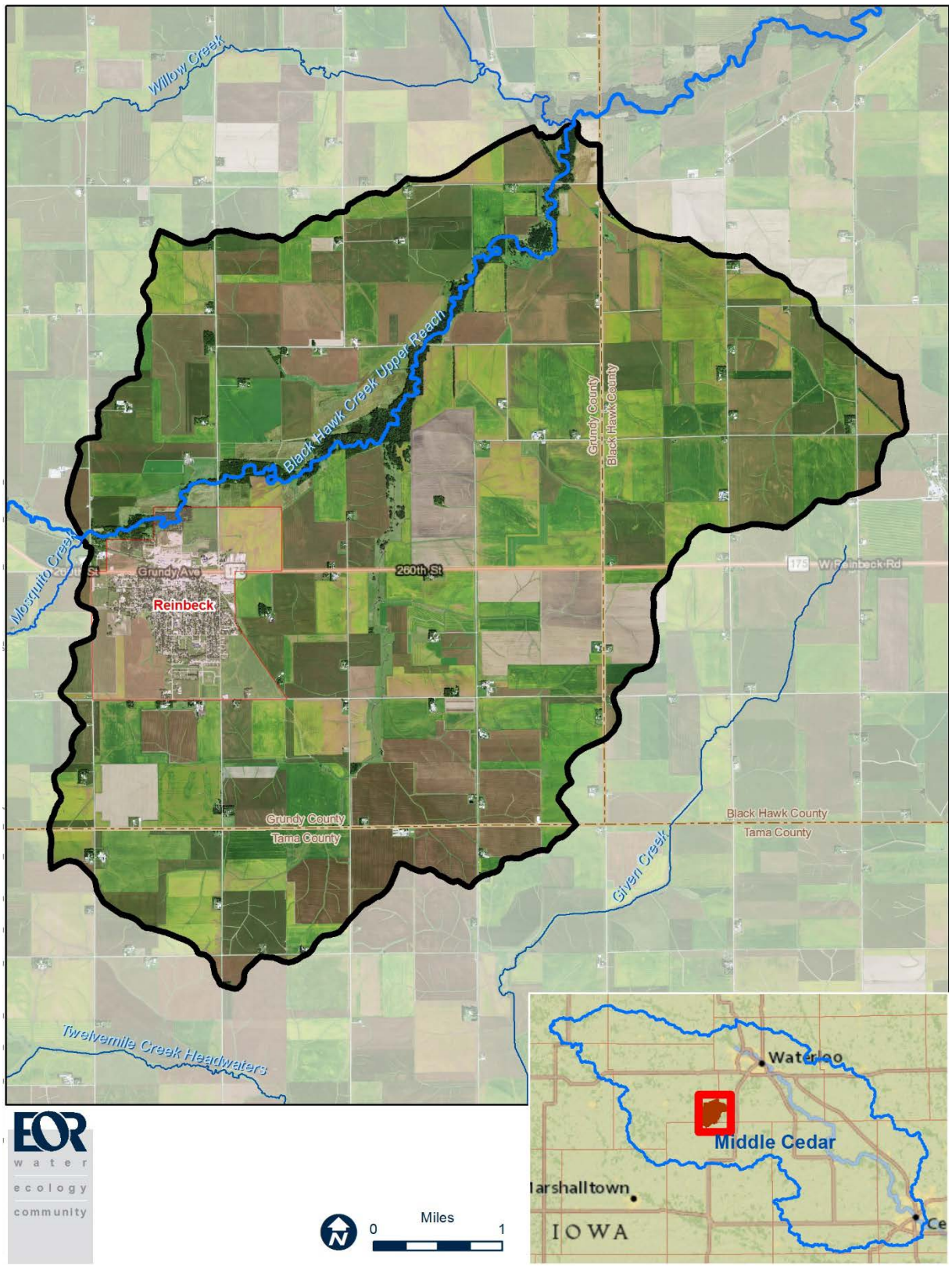

Figure 1. Village of Reinbeck – Black Hawk Creek Subwatershed

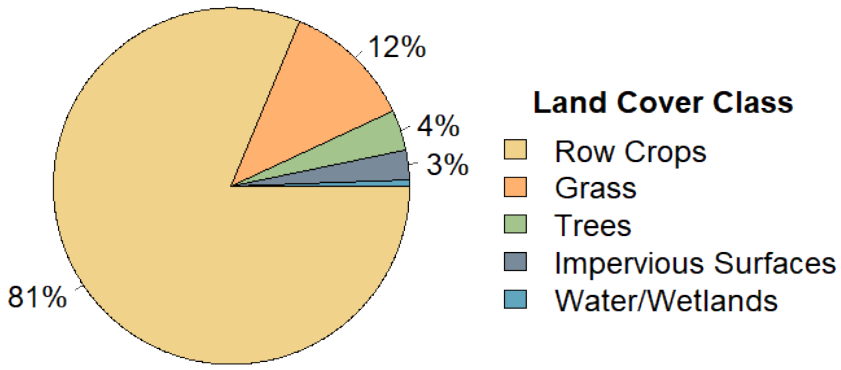

Figure 2. Land Cover of the Village of Reinbeck – Black Hawk Creek Subwatershed

3.3. Streams

The Village of Reinbeck – Black Hawk Creek Subwatershed is home to one primary stream, the Upper Reach of Black Hawk Creek (**Figure 3**). The reach within the subwatershed is an Iowa Designated Stream Reach and is described as the portion of Black Hawk Creek from North Black Hawk Creek (SE1/4, S1, T87N, R15W, Grundy Co.) to the confluence with Mosquito Creek (SE1/4, S20, T87N, R15W Guthrie Co.)

Iowa's surface water classifications are described in IAC 61.3(1) as two main categories, Designated Uses and General Uses. Designated use segments are water bodies which maintain flow throughout the year or contain sufficient pooled areas during intermittent flow periods to maintain a viable aquatic community.

The Upper Reach of Black Hawk Creek has a Designated Use classification of A2 B(WW-1) HH which is defined as follows:

Secondary contact recreational use: Class A2 - Waters in which recreational or other uses may result in contact with the water that is either incidental or accidental. During the recreational use, the probability of ingesting appreciable quantities of water is minimal. Class A2 uses include fishing, commercial and recreational boating, any limited contact incidental to shoreline activities and activities in which users do not swim or float in the water body while on a boating activity.

Warm water Type 1: Class BWW-1 - Waters in which temperature, flow and other habitat characteristics are suitable to maintain warm water game fish populations along with a resident aquatic community that includes a variety of native nongame fish and invertebrate species. These waters generally include border rivers, large interior rivers, and the lower segments of medium-size tributary streams.

Human health: Class HH - Waters in which fish are routinely harvested for human consumption or waters both designated as a drinking water supply and in which fish are routinely harvested for human consumption.

3.4. Lakes

There are no lakes within the Village of Reinbeck – Black Hawk Creek Subwatershed.

3.5. Ground Water

The Village of Reinbeck – Black Hawk Creek Subwatershed does not contain a Highly Susceptible Community Water Supply or a Priority Community Water Supply System.

3.6. Flooding

Flooding occurs within the subwatershed along the entire reach of Black Hawk Creek as well as along a northward-draining tributary ditch located approximately one mile east of Reinbeck. Additional flooding occurs in a drainageway near the outlet of the subwatershed. **Figure 4** shows the areas that become inundated during a 100-year flood event. This information was developed by the Iowa Flood Center (IFC). Further information and interactive tools to display flooding information can be viewed at the Iowa Flood Information System http://ifis.iowafloodcenter.org/ifis/.

The financial impact to buildings and their content as a result from the 100-year storm event within the subwatershed is estimated at $5,651,950 according to the Flood Risk Report for the MCW developed by the Federal Emergency Management Agency (FEMA) (2015). This loss is equivalent to nearly $3,000 per resident of the subwatershed. The Village of Reinbeck – Black Hawk Creek Subwatershed has the 13th highest financial losses due to the 100-year flood event of the 68 subwatersheds within the MCW. **Figure 4** shows areas within the subwatershed that have been determined to have high to very high risk for flood damages according to the FEMA study.

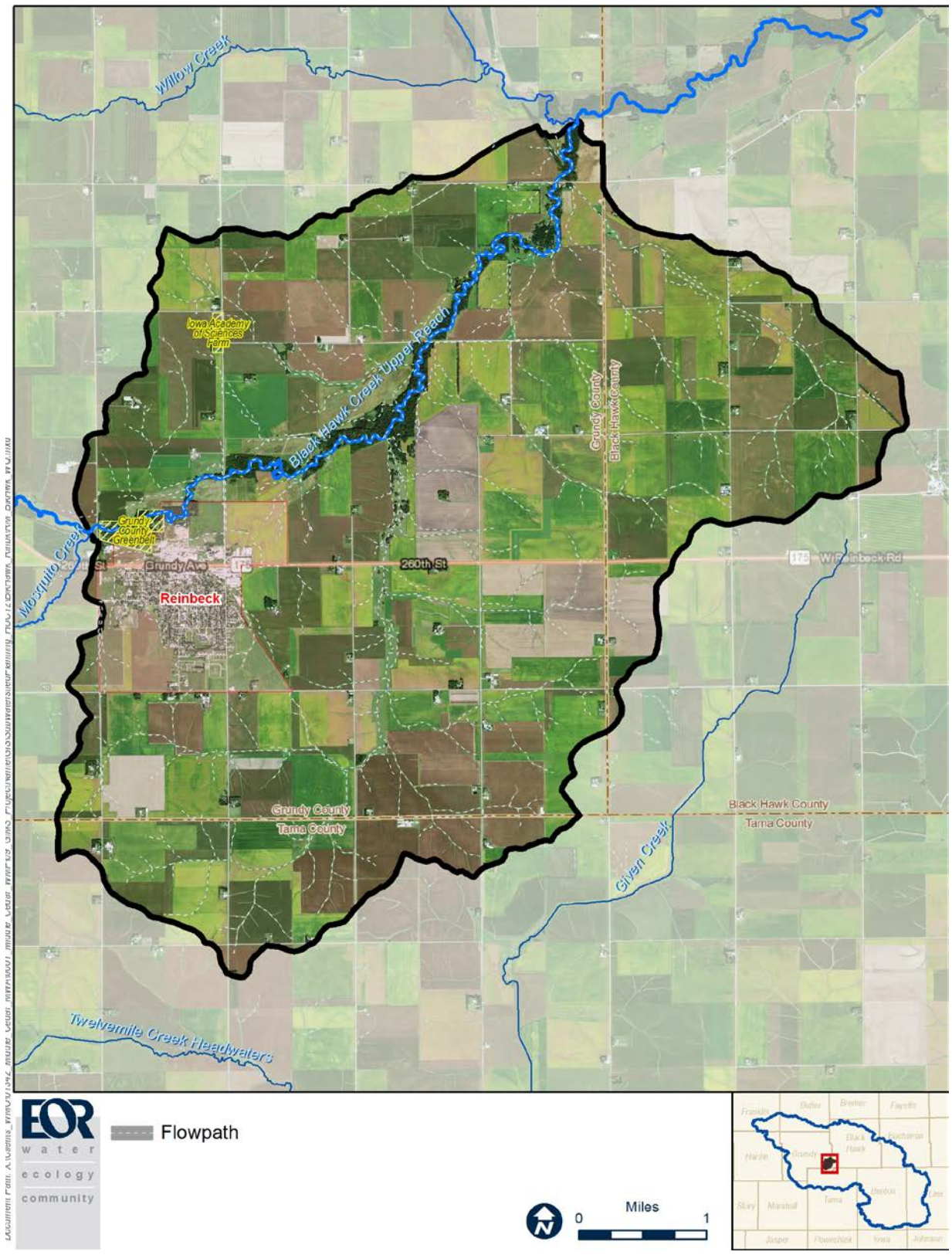

Figure 3. Water Resources of the Village of Reinbeck – Black Hawk Creek Subwatershed

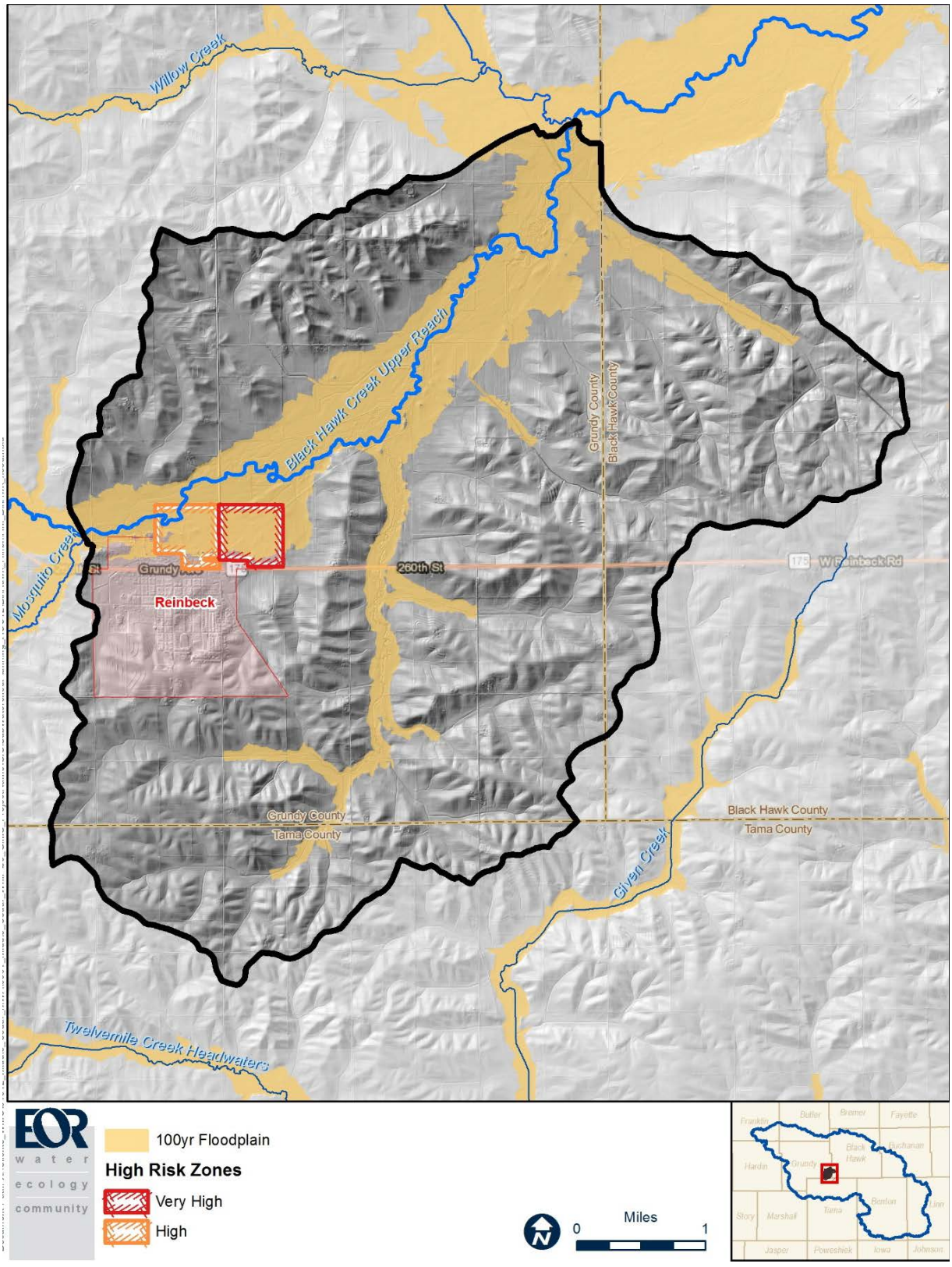

Figure 4. Flooding within the Village of Reinbeck – Black Hawk Creek Subwatershed

3.7. Water Quality

3.7.1. Nonpoint Pollutants

Nonpoint source pollutants traditionally addressed in watershed management plans include sediment, fecal bacteria, and the nutrients nitrogen and phosphorus. These pollutants are derived in varying degrees from natural areas, agricultural land, urban areas, construction sites, roads, parking lots, and other areas. Other common pollutants include pesticides, salts, oil, and grease; as well as a suite of pollutants that are typically referred to as contaminants of emerging concern which include pharmaceuticals and personal care products.

Sediment

In Iowa, sediment is the leading nonpoint source pollutant. Most sediment in Iowa comes from erosion on agricultural land, but high levels of sediment also come from erosion of construction sites, streambanks, and lake shorelines. Sediment can be harmful by filling in lakes and depositing on streambeds which covers fish habitat and reduces visibility in the water. Iowa does not have a water quality standard for sediment. While Iowa does not have a numeric criteria for sediment, there is the narrative water quality criteria. Aesthetically objectionable conditions due to sedimentation/siltation or turbidity would lead to a violation of the narrative water quality standards.

Bacteria

Disease producing (pathogenic) organisms are a prevalent nonpoint pollutant that can cause health problems for people coming into contact with contaminated waters. Testing for disease producing organisms is difficult and expensive, so two closely related bacteria groups, fecal coliforms and Escherichia coli (*E. coli*), are commonly used to indicate the presence of pathogens. For simplicity, this pollutant group is then referred to as fecal bacteria. Sources of fecal bacteria to our waters are diverse and include wildlife populations, livestock, pets, and even human sewage. High levels of bacteria have been found in the reach of Black Hawk Creek that runs through the subwatershed (refer to **Impaired Waters** section for description of this impairment), a downstream reach of Black Hawk Creek (refer to **Black Hawk Creek Bacteria TMDL** section) and the Cedar River (refer to the Error! Reference source not found. section). The Iowa DNR has set the following water quality standards for bacteria. For recreational use class A2, the geometric mean of *E. coli* samples should not exceed 126 organisms/100 mL of water, with a single sample maximum of 2880 organisms/100 mL. For classes A1 and A3, the standard is 126 organisms/100 mL for the geometric mean, but only 235 organisms/100 mL for the single sample maximum. These standards apply to samples collected between March 15 and November 15 of a given year.

Nutrients

Nutrients, especially nitrogen and phosphorus, are other major non-point source pollutants in Iowa. Nutrients are naturally occurring within our soils and plant matter, but excess nutrients can be added to our waters from fertilizers (primarily on agricultural land and to a lesser degree, on residential lawns, commercial areas, and golf courses) and from organic sources such as manure and human

sewage. While nitrogen and phosphorus pose similar concerns for the water resources within the watershed, there are fundamental differences that impact our ability to manage them. Nitrogen, in its various forms, is soluble in water whereas the particulate form of phosphorus is often attached to soil particles.

Excessive nutrients in water from either chemical fertilizer or organic matter (including manure) can cause algae blooms in lakes, sometimes making lakes smelly and boating difficult. Algae blooms can reach harmful levels when they pose significant health concerns. Harmful algae blooms are common in lakes during calm, hot summer weather. People and animals can become sick from contact with toxic blue-green algae by swallowing or having skin contact with water or by breathing in tiny droplets of water in the air. Dogs are particularly vulnerable to toxic algae because they are more likely to wade into lakes with algal scum; several have died from blue-green algae exposure.

There are no numeric water quality standards for phosphorus in Iowa. Instead, in Chapter 61.3(2) of the Iowa Administrative Code general water quality criteria are described that are applicable to all surface waters:

> 61.3(2) General water quality criteria. The following criteria are applicable to all surface waters including general use and designated use waters, at all places and at all times for the uses described in 61.3(1)"a."
>
> a. Such waters shall be free from substances attributable to point source wastewater discharges that will settle to form sludge deposits.
> b. Such waters shall be free from floating debris, oil, grease, scum and other floating materials attributable to wastewater discharges or agricultural practices in amounts sufficient to create a nuisance.
> c. Such waters shall be free from materials attributable to wastewater discharges or agricultural practices producing objectionable color, odor or other aesthetically objectionable conditions.
> d. Such waters shall be free from substances attributable to wastewater discharges or agricultural practices in concentrations or combinations which are acutely toxic to human, animal, or plant life.
> e. Such waters shall be free from substances, attributable to wastewater discharges or agricultural practices, in quantities which would produce undesirable or nuisance aquatic life.
> f. The turbidity of the receiving water shall not be increased by more than 25 Nephelometric turbidity units by any point source discharge.
> g. Cations and anions guideline values to protect livestock watering may be found in the "Iowa Wasteload Allocation (WLA) Procedure," as revised on February 21, 2018.
> h. The *Escherichia coli* (*E. coli*) content of water which enters a sinkhole or losing stream segment, regardless of the water body's designated use, shall not exceed a Geometric Mean value of 126 organisms/100 ml or a sample maximum value of 235 organisms/100 ml. No new wastewater discharges will be allowed on watercourses which directly or indirectly enter sinkholes or losing stream segments.

The aesthetically objectionable conditions criteria in 61.3(2)c has been used to address eutrophic conditions in impaired lakes due to excessive algae blooms or Chlorophyll a. These impairments lead to phosphorus TMDLs with loading capacities determined based on the trophic state index of the lake.

In the neighboring state of Minnesota, there is established standards for phosphorus in streams that are unique to nutrient regions across the State (https://www.revisor.mn.gov/rules/?id=7050.0222). The total phosphorus standard for streams in the Southern region of Minnesota is 0.15 mg/l. This number can be used as a reference point for reviewing water quality measurements in the subwatershed. Total phosphorus is made up of several forms of phosphorus; dissolved reactive phosphorus, particulate inorganic phosphorus, dissolved organic phosphorus, and particulate organic phosphorus. Not all of these forms of phosphorus are routinely measured, but the Iowa Soybean Association (ISA) currently monitors dissolved reactive phosphorus (**Table 1**Table 1). A relationship can be established between either of these forms and total phosphorus so a reference point could be developed for the forms that are being measured.

High levels of nutrients can also cause water to be unfit for drinking. A segment of the Cedar River within Cedar Rapids has been designated by the State as a drinking water supply (recreational use C). The Village of Reinbeck – Black Hawk Creek Subwatershed contributes flow to this river segment. Class C waters have been given a water quality standard of less than 10 mg/L of nitrate as nitrogen (NO3-N).

3.7.2. Subwatershed Monitoring Data

The ISA conducts snapshot monitoring at several tributaries to the Cedar River, including a site on Black Hawk Creek within the Village of Reinbeck – Black Hawk Creek Subwatershed. The monitoring site is located at the stream crossing at 230th Street near the outlet of the subwatershed which is defined as the confluence with North Fork Black Hawk Creek. Data from ISA snapshot monitoring for 2017 is shown in (**Table 1**). Monitoring results in bold show elevated levels of nitrate and phosphorus for both sampling dates. *E. coil* levels were below the single measurement standard. ISA continued snapshot monitoring in 2018. A final report is available from the City of Cedar Rapids.

Table 1. ISA Snapshot Monitoring Results, 2017

Site	CR28	CR28
Sample Date	4/25/2017	6/6/2017
Chloride (mg/L)	21.9	21.4
Conductivity (mS/cm)	425	439
Dissolved Oxygen (mg/L)	9.5	9.1
***E.coli* (MPN/100mL)**	**301**	**528**
Fluoride (mg/L)	<0.3	<0.3
Nitrate as N (mg/L)	**12.3**	**12.7**
Nitrite as N (mg/L)	0.47	0.38
pH	8.1	8.14
Dissolved Reactive Phosphorus as P (mg/L)	**0.04**	**0.06**
Dissolved Organic Phosphorus as P (mg/L)	**0.7**	**0.41**

Site	CR28	CR28
Sulfate (mg/L)	15.6	16.2
Temperature (Degrees C)	11.3	17.8
Total Suspended Solids (mg/L)	89.3	74.2
Turbidity (NTU)	37.9	32

3.7.3. Impaired Waters

The State of Iowa has developed State Water Quality Standards that are found in Chapter 61 of the Iowa Administrative Code (https://www.legis.iowa.gov/docs/ACO/chapter/567.61.pdf.) The water quality standards are based on the designated use of the receiving water. As water quality monitoring data is collected on streams and lakes, compliance to these standards determines whether or not given water body is meeting its designated use. In cases where the water body does not meet its designated use it is considered to be an impaired water. This process is prescribed under the Clean Water Act. The State of Iowa develops a list of impaired waters every two years that is presented to the United States Environmental Protection Agency (U.S. EPA). This list, referred to as the Impaired Waters List, includes information on impaired use, the source of impairment, and whether or not a Total Maximum Daily Load (TMDL) study will be required.

The segment of Black Hawk Creek within the subwatershed was assessed by the Iowa DNR and was determined to be impaired. A summary of the assessment can be found in (**Table 2**). The impaired segment has been on the State's list of impaired waters since 2008. Details on the assessment and resulting impairment listing can be found at https://programs.iowadnr.gov/adbnet/Segments/550.

Table 2. Black Hawk Creek Segment 550 Assessment Summary (Iowa DNR ADBNet)

ADB_Name	Black Hawk Creek
Segment ID	550
Cycle List Date	2008
Impaired Designated Use	A1
Support	Non Supporting
Category	5p
Impairment	Bacteria: Indicator Bacteria, *E. coli*
Listing Rating	Geometric mean criterion exceeded
TMDL Priority	Tier III

The reasoning for the impairment as described in Iowa DNR's ABDNet (Iowa DNR 2016):

> The presumptive Class A1 uses remain assessed (monitored) as "not supported" (IR 5p) due to levels of indicator bacteria that exceed water quality criteria. The Class B(WW2) aquatic life uses remain assessed (evaluated) as "fully supported" (IR 2a) based on results of chemical/physical water quality monitoring during 2005. The sources of data for this assessment are:
>
> 1. Section 319 monitoring for indicator bacteria from June 2009 to November 2010 at six stations (BHC 4, BHC 12, BHC 10, BHC 5, BHC 7, and BHC 1); and
> 2. The results of Iowa DNR/UHL water quality monitoring conducted from April through September 2005 at three stations in this assessment segment as part of TMDL monitoring: station 11380005 upstream from 230th Street, station 11380006 at Grundy Center,

and station 11380007 near Holland (no additional monitoring has been conducted at these stations since 2005). This is the same assessment as that developed for previous IR cycles.

The presumptive Class A1 (primary contact recreation) uses remain assessed (monitored) as "not supported" due to violations of Iowa's water quality criteria for indicator bacteria. The geometric means of indicator bacteria (*E. coli*) in the approximately 22 samples collected during the recreational seasons of 2009 and 2010 at each of the six Section 319 monitoring stations in this assessment segment were as follows:

1. BHC-4, 2009 and 2010 geometric means (orgs/100 ml) were 1,349 and 822;
2. BHC-12, 2009 and 2010 geometric means (orgs/100 ml) were 1,278 and 703;
3. BHC-10, 2009 and 2010 geometric means (orgs/100 ml) were 1,257 and 1,042;
4. BHC-5, 2009 and 2010 geometric means (orgs/100 ml) were 1,025 and 873;
5. BHC-7, 2009 and 2010 geometric means (orgs/100 ml) were 1,025 and 1,121; and
6. BHC-1, 2009 and 2010 geometric means (orgs/100 ml) were 578 and 755.

From 83% to 100% of the samples at each site exceeded the Class A1 single-sample maximum criterion of 235 orgs/100 ml. According to U.S. EPA guidelines for Section 305(b) reporting and Iowa DNR's assessment/listing methodology, if a recreation season geometric mean exceeds the respective water quality criterion, the contact recreation uses should be assessed as "impaired" (see pgs 3-33 to 3-35 of U.S. EPA 1997b). Thus, because at least one recreation season geometric mean exceeded criteria for Class A1 uses, these uses remain assessed as "impaired".

The Class B(WW2) aquatic life uses remain assessed (evaluated) as "fully supported" based on results of Iowa DNR/UHL water quality monitoring conducted at three stations in 2005 as part of TMDL development. Results of this monitoring show no violations of Class B(WW2) water quality criteria for dissolved oxygen, pH or ammonia in the combined 21 monthly samples collected from these three stations from April-September 2005.

3.7.4. Total Maximum Daily Load (TMDL) Studies

The Village of Reinbeck – Black Hawk Creek Subwatershed contributes drainage to two downstream impaired streams for which TMDL studies have been developed (**Figure 5**) including:

- The Black Hawk Creek Bacteria TMDL developed for Black Hawk Creek from its mouth at the Cedar River in S22, T89N, R13W to the stream crossing at Highway 58 in E ½, S27, T88N, R14W in Black Hawk County (IA 02-CED-0370 Segment 1),
- The Cedar River Nitrate TMDL developed for the Cedar River, from the confluence with McCloud Run (SW ¼, S16, T83N, R7W, Linn Co.) to the confluence with Bear Creek (NE ¼, S31, T84N, R8W, Linn Co.) (IA 02-CED-0030_2).

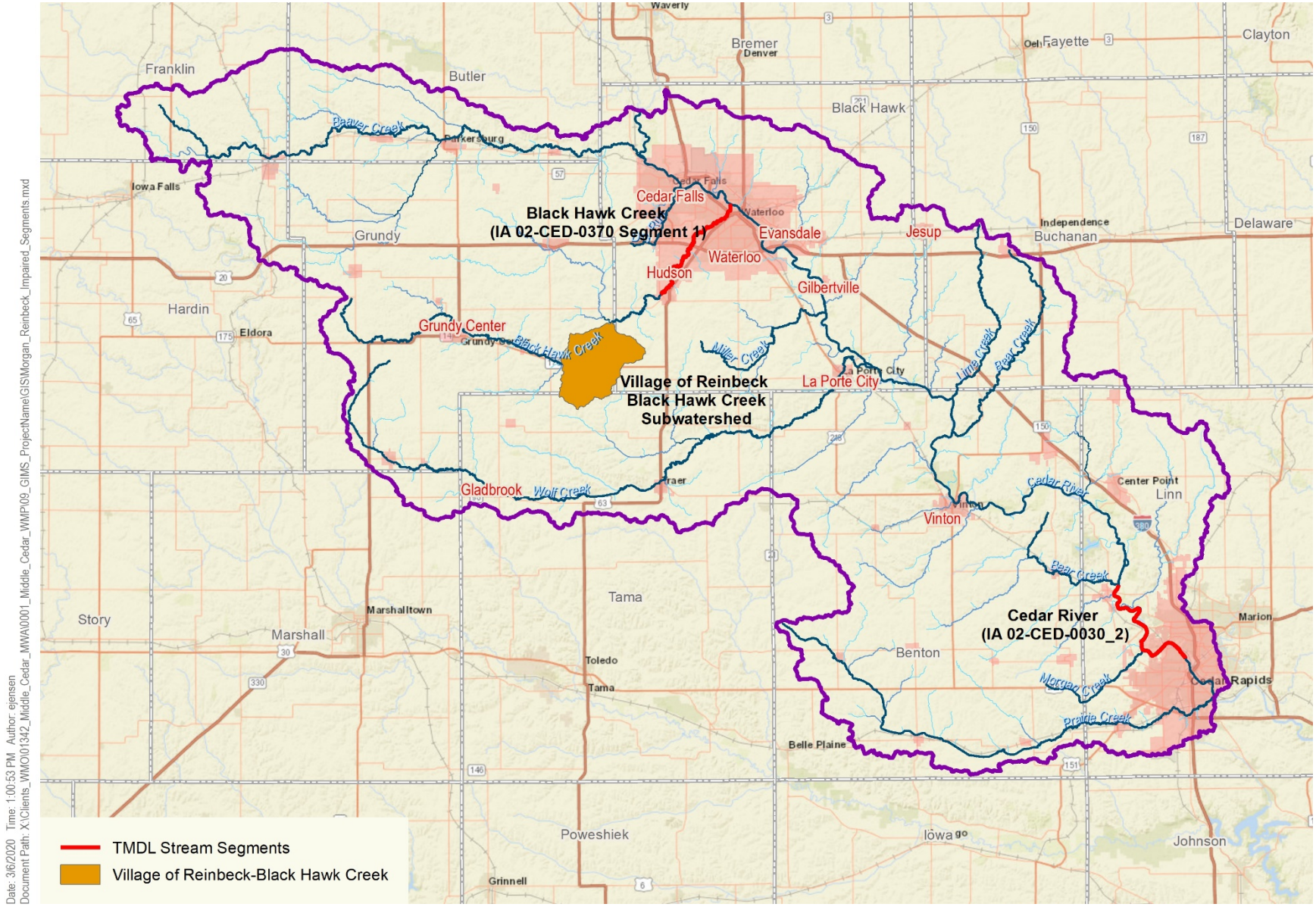

Figure 5. TMDL Stream Segments (Iowa DNR)

A TMDL is a determination of the maximum load of pollutant a given water body can receive and continue to meet water quality standards for that particular pollutant. TMDL studies are conducted on water bodies where pollutant levels have been found to be in excess of water quality standards resulting in that water body failing to meet a designated use (also referred to as having an impairment). TMDL studies determine a pollutant reduction target and allocate a portion of the needed reductions to each source of pollutant. Pollutant sources are characterized as either point sources or nonpoint sources. Point sources receive a wasteload allocation and include all sources that are subject to regulation under the National Pollutant Discharge Elimination System (NPDES) program, e.g. wastewater treatment facilities, stormwater discharges in Municipal Separate Storm Sewer System communities and concentrated animal feeding operations. Nonpoint sources receive a load allocation and include all remaining sources of the pollutant as well as natural background sources.

Black Hawk Creek Bacteria TMDL

The Iowa DNR approved the *Total Maximum Daily Load For Pathogen Indicators Black Hawk Creek, Iowa* in 2006. The TMDL was developed to address a segment of Black Hawk Creek that had been identified as being impaired due to excessive indicator bacteria (fecal coliform). The 11.4 mile impaired segment is defined as the Black Hawk Creek from its mouth at the Cedar River in S22,T89N, R13W to the stream crossing at Highway 58 in E 1/2, S27, T88N, R14W in Black Hawk County. Designated uses for the impaired segment included: primary contact recreation and aquatic life. The Class A (primary contact recreation) uses remain assessed (monitored) as "not supported" due to consistently high levels of indicator bacteria. The Class B(WW) aquatic life uses were assessed (monitored) as "fully supported/threatened." The applicable water quality standards for bacteria are a season geometric mean of 126/100ml for *E. coli* and a single maximum value of 235 counts/100 ml.

The TMDL was written as a phased TMDL. Phasing TMDL studies is an iterative approach to managing water quality that becomes necessary when the origin, nature and sources of water quality impairments are not well understood. In this first phase of the Black Hawk

Creek watershed improvement plan, specific and quantified targets for pathogen indicator concentrations were set for the stream and allowable loads for all sources were allocated. The TMDL states that a future Phase 2 will require the participation of the watershed stakeholders in the implementation of pollutant controls and continued water quality evaluation.

To achieve the *E. coli* water quality standard for this segment of Black Hawk Creek there must be an 85% reduction in rain driven surface runoff loads and a 98% reduction in continuous nonpoint source bacterial loads (e.g., septics and cattle in the stream).

This TMDL does not include an implementation plan but states that "analysis and modeling of the Black Hawk Creek watershed shows that controlling livestock manure runoff and cattle in streams would need to be a large part of a plan to reduce bacteria. Best management practices (BMPs) include feedlot runoff control; fencing off livestock from streams; alternative livestock watering supply; and buffer strips along the stream and tributary corridors to slow and divert runoff. In addition to these sources, failed septic tank systems need to be repaired and wastewater treatment plants (WWTP) need to control the bacteria in their effluent."

Cedar River Nitrate TMDL

The Iowa DNR approved the *Total Maximum Daily Load For Nitrate Cedar River, Linn County, Iowa* in 2006. The TMDL was developed to address a reach of the Cedar River that had been identified as being impaired by excess nitrate. The impaired reach is defined as the Cedar River from its confluence with McCloud Run (S16, T83N, R07W) to the Cedar River confluence with Bear Creek (S21, T84N, R08W). Designated uses for the impaired segment are significant resource warm water (Class B(WW)), primary contact recreational use (Class A1) and drinking water supply (Class C). Excess nitrate loading has impaired the drinking water supply water quality criteria (567 IAC 61.3(3)) and hindered the designated use. The target of this TMDL is the drinking water nitrate concentration standard of less than 10.0 mg/L nitrate-nitrogen.

The TMDL was written as a phased TMDL. Phasing TMDL studies is an iterative approach to managing water quality that becomes necessary when the origin, nature and sources of water quality impairments are not well understood. In this first phase the waterbody load capacity, existing pollutant load in excess of this capacity, and the source load allocations were estimated based on the limited information available. A monitoring plan was then developed to determine if prescribed load reductions result in attainment of water quality standards and whether or not the target values are sufficient to meet designated uses. Monitoring activities may include routine sampling and analysis, biological assessment, fisheries studies, and watershed and/or waterbody modeling. A future phase of the TMDL will consist of implementing the monitoring plan, evaluating collected data, and readjusting target values if needed.

The targeted nitrate reduction is 35%. This would equal a yearly reduction of 9,999 tons nitrate-nitrogen/year from the current loading of 28,561 tons nitrate-nitrogen/year. The TMDL states that the majority (91%) of the nitrate delivered downstream in the watershed is from nonpoint sources and sets a reduction target for nonpoint sources at 37%. The adjusted reduction (from the overall 35% target) accounts for wildlife, atmospheric deposition, and point sources.

The TMDL included an implementation plan that recommended use of incentive-based, BMPs focused on reducing surface water nitrate-nitrogen concentration. These practices include fertilizer reduction, wetland construction, and conservation reserve program enrollment. The implementation plan further recommended focusing more heavily on subbasins that have higher nitrate loading per unit area.

3.8. Recreational Opportunities

Black Hawk Creek is a designated canoe route from the Grundy Center rubble dam to its confluence with the Cedar River. There is one carry-down access point in the Subwatershed located at Strohbehn Park in the City of Reinbeck. Unlike the Cedar River, Black Hawk Creek is not a meandered stream. While the creek is navigable, users should be aware that the bed and banks of the river are in private ownership, and sandbar camping without landowner permission is not encouraged.

For more information on recreational opportunities on Black Hawk Creek and the Cedar River, including maps and access points, see the Cedar Falls Tourism website and http://www.cedarfallstourism.org/webres/File/Trails/Cedar-Valley-Paddlers-Trail-Map-Iowa-DNR.pdf.

3.9. Pollutant Source Assessment

Three separate tools have been developed for the MCW to estimate pollutant loading at the HUC-12 subwatershed level. These tools allow for a comparison between subwatersheds and are used to prioritize subwatershed for future implementation.

3.9.1. SWAT Model

The World Wildlife Federation along with researchers at the University of Minnesota developed a Soil and Water Assessment Tool (SWAT) model for the MCW. SWAT is a river basin scale model developed to quantify the impact of land management practices in large, complex watersheds. SWAT is a public domain software enabled model actively supported by the United States Department of Agriculture (USDA) Agricultural Research Service (ARS). It is a hydrology model with the following components: weather, surface runoff, return flow, percolation, evapotranspiration, transmission losses, pond and reservoir storage, crop growth and irrigation, groundwater flow, reach routing, nutrient and pesticide loading, and water transfer.

The Middle Cedar SWAT model simulates a 10-year period from 1/1/2004 to 12/31/2013 and has a fairly course level of resolution. Limited data was available at the time of model construction for use in calibration so the most appropriate use of this model is for making comparisons between subwatersheds. The loading rates estimated by the SWAT model are appropriate for evaluating relative differences between subwatershed and not for determining absolute values. The SWAT model is well suited for rural watersheds. It does not adequately simulate hydrology or nutrient loading dynamics that occur in urban areas.

The SWAT model estimates loading rates at the subwatershed scale for total nitrogen, nitrate from tile drainage, phosphorus, and sediment with results reported in terms of average annual loads per acre (**Table 3**).

Table 3. SWAT Model Results for the Village of Reinbeck - Black Hawk Creek Subwatershed

Total Nitrogen		Total Phosphorus		Tile Nitrate		Sediment	
Load (lbs/ac/yr)	MC Rank (# of 68)	Load (lbs/ac/yr)	MC Rank (# of 68)	Load (lbs/ac/yr)	MC Rank (# of 68)	Load (tons/ac/yr)	MC Rank (# of 68)
25.7	35	2.5	14	16.2	29	1.6	16

3.9.2. Daily Erosion Project

The Daily Erosion Project (DEP) tool developed by the Department of Agronomy at Iowa State University that allows users to understand how fast soil is being lost off the land. The tool takes precipitation data provided by the Next Generation Weather Radar and estimates the amount of soil erosion taking place on the land based on soil type, vegetative cover and slope on a daily basis. The tool also estimates the amount of hillslope soil loss using the Water Erosion Prediction Project Model. Further documentation can be found at: https://www.dailyerosion.org/documentation.

The DEP was run for the 68 HUC-12 subwatersheds in the MCW for the 10-year period 2008-2017. The output from the DEP analysis is used to show the average annual soil detachment and hillslope soil loss in terms of tons/acre (**Table 4**).Note that this is a different measurement than the sediment loading estimate derived from the SWAT Model.

Table 4. Daily Erosion Project Results for the Village of Reinbeck - Black Hawk Creek Subwatershed

Average Annual Soil Detachment		Average Annual Hillslope Soil Loss	
Tons/Acre	MC Rank (# of 68)	Tons/Acre	MC Rank (# of 68)
6.0	7	5.7	7

3.9.3. Bacteria Source Assessment

Humans, pets, livestock, and wildlife all contribute bacteria to the environment. These bacteria, after appearing in animal waste, are dispersed throughout the environment by an array of natural and man-made mechanisms. Bacteria fate and transport is affected by disposal and treatment mechanisms, methods of manure reuse, imperviousness of land surfaces, and natural decay and die-off due to environmental factors such as ultraviolet exposure and detention time in the watershed.

Typically, sources of bacteria in a watershed are broken down into permitted and nonpermitted sources. Permitted sources of *E. coli* are usually regulated under an NPDES permit and include WWTP, and Iowa DNR Animal Feeding Operations (AFO). According to the Iowa DNR AFO permit database, there are an estimated 3,798 animal units within the subwatershed. This number does not include any animals that are not included on AFO permits. There is one WWTP in the subwatershed (see **Figure 6**). The City of Reinbeck operates a waste water treatment plan under Iowa NPDES Permit #3870001 which sets performance standards in terms of discharges limits for several pollutants including; *E. coli*, CBOD5, total suspended solids, nitrogen, dissolved oxygen, and pH. In addition, Grundy Center WWTP Iowa NPDES Permit #3833001 and Holland WWTP Iowa NPDES Permit #38390001 have similar permits in the Black Hawk Creek watershed upstream of the Village of Reinbeck – Black Hawk Creek Subwatershed.

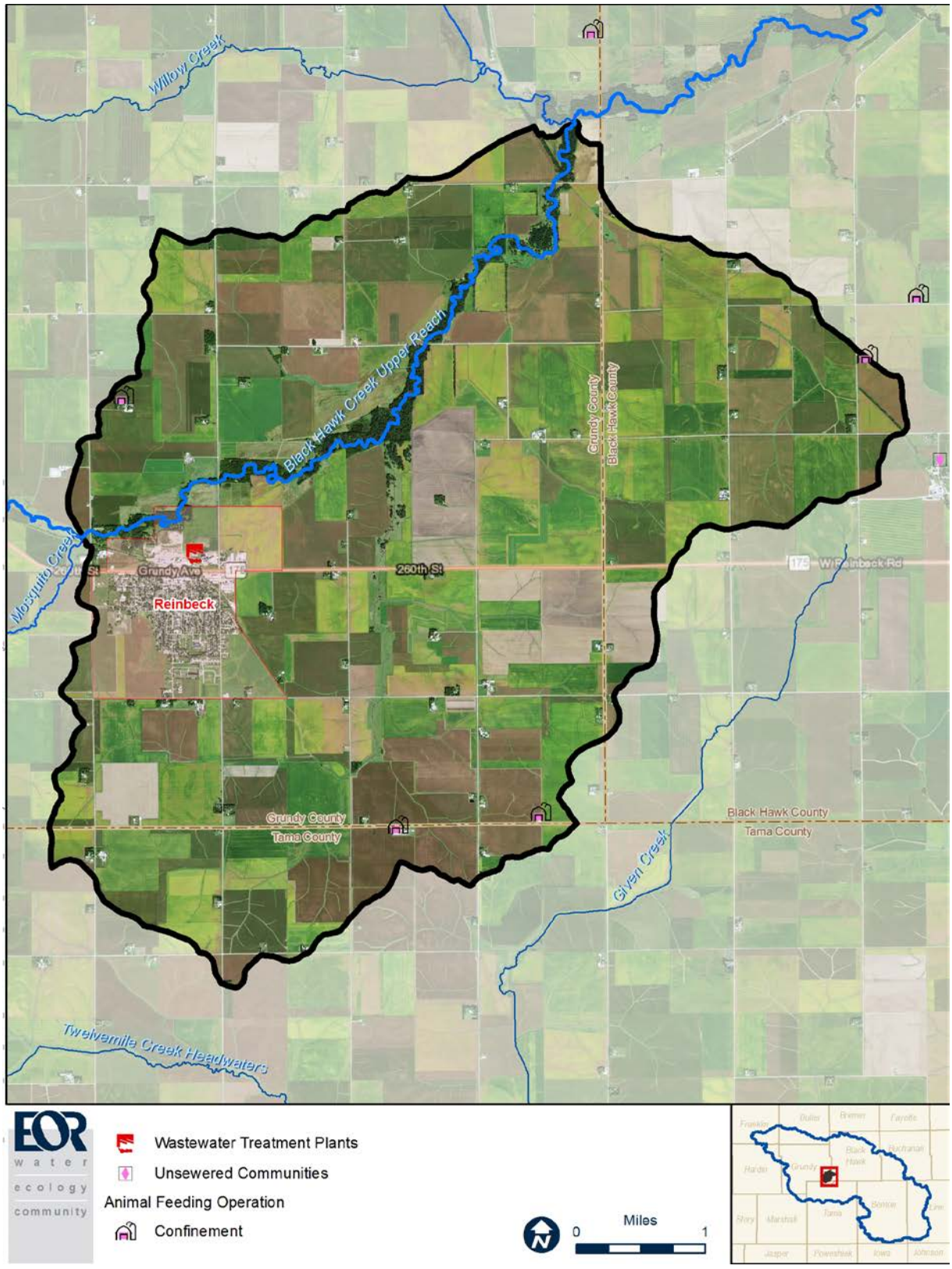

Figure 6. Wastewater Treatment Plants, Unsewered Communities and Animal Feeding Operations in the Village of Reinbeck – Black Hawk Creek Subwatershed

Nonpermitted sources of *E. coli* are more difficult to quantify and can vary considerably within a watershed. Nonpermitted sources of *E. coli* include failing septic systems, runoff from urban areas, wildlife, and agricultural land. For this project a detailed assessment of potential bacteria sources from the Black Hawk Creek Bacteria TMDL was used along with estimates of failing septic systems based on percentages in the TMDL and 2010 US Census information. The estimated number of failing septic systems is shown in **Table 5**. The TMDL determined that the nonpoint sources of *E. coli* bacteria in the Black Hawk Creek watershed include:

- Land application of hog and cattle manure
- Land application of poultry litter
- Grazing animals
- Cattle contributions directly deposited in stream
- Failing septic systems
- Urban runoff

The TMDL study found that cropland and pastureland were the predominant land uses associated with *E. coli* contribution. Hog manure application was found to be the main source of *E. coli* for cropland and beef cattle grazing was determined to be the main source of *E. coli* on pastureland (**Figure 7**).

Table 5. Failing Septic Systems in Black Hawk Creek (U.S. Department of Commerce 2010)

	Population	Number of Households	Number of Failing Septic Systems
Black Hawk Creek	604	1437	463

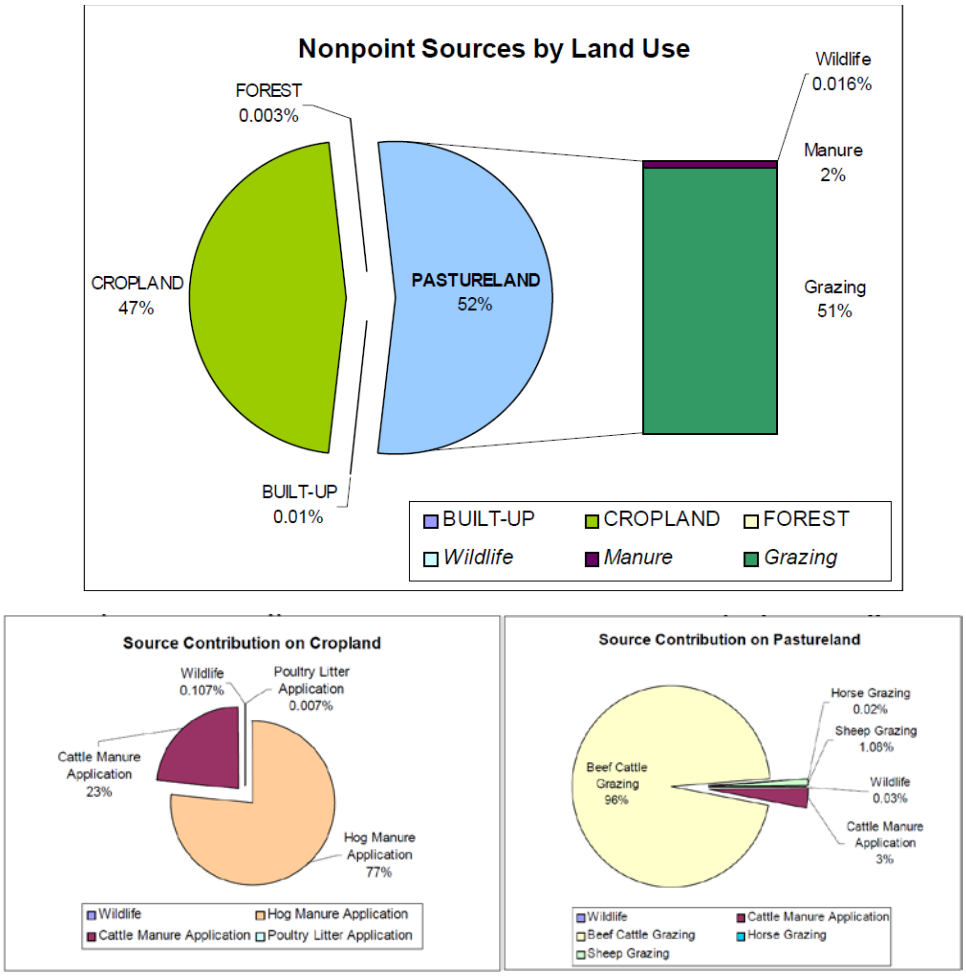

Figure 7. Nonpoint Sources of E. coli by Landuse, Cropland E. coli Source Contribution, Pastureland E. coli Source Contribution; Black Hawk Creek Subwatershed. Source: Total Maximum Daily Load for Pathogen Indicators Black Hawk Creek, Iowa. Iowa DNR 2006.

For the Village of Reinbeck – Black Hawk Creek, subwatershed partitioning of nonpoint sources in the watershed included land cover changes between data available in 2006 and data available in 2019, the 2016 National Land Cover Dataset (NLCD). Estimates from the 2016 NLCD were that approximately 76% of the Black Creek Watershed upstream of the subwatershed was cropland and the majority of the remaining land cover as pastureland (24%). Forest and built up land cover remained roughly the same. With these changes, the *E. coli* load components were estimated for the watershed using the assumptions in the Black Hawk Creek TMDL (**Table 6**)

). The largest source of *E. coli* was hog manure application followed by beef cattle grazing. This is further supported by the estimated number of animals in the Black Hawk Creek Watershed upstream of the subwatershed based on the USDA 2012 Animal Census in **Table 7**. Largest population of animals is hogs.

Table 6 Estimated Existing Load Allocation for *E. coli* in the Village of Reinbeck – Black Hawk Creek.

Black Hawk Creek Village of Reinbeck Existing Load Components		Flow Regime				
		Very High (cfs)	High (cfs)	Mid (cfs)	Low (cfs)	Very Low (cfs)
		495	167	78	29	9.7
		E. coli (billion org. per day)				
Existing Load		***32,956***	***3,047***	***1,844***	***943***	***183***
Point Sources	*Reinbeck WWTP*	*2.3*	*2.3*	*2.3*	*2.3*	*2.3*
	Grundy Center WWTP	*5.7*	*5.7*	*5.7*	*5.7*	*5.7*
	Holland WWTP	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
	Total Point Sources	**8.2**	**8.2**	**8.2**	**8.2**	**8.2**
Nonpoint Sources	*Failing Septics Systems*	*28*	*28*	*28*	*28*	*28*
	Urban Runoff	*8*	*0.7*	*0.4*	*0.2*	*0.04*
	Hog Manure Application	*19,233*	*1,759*	*1,056*	*530*	*85*
	Cattle Manure Application on Cropland	*5,735*	*524*	*315*	*158*	*25*
	Poulty Litter Application	*2*	*0.2*	*0.1*	*0.05*	*0.01*
	Beef Cattle Grazing	*7,587*	*694*	*417*	*209*	*34*
	Cattle Manure Application on Pasture	*237*	*22*	*13*	*7*	*1*
	Sheep Grazing	*85*	*8*	*5*	*2*	*0.4*
	Horse Grazing	*2*	*0.1*	*0.1*	*0.04*	*0.007*
	Wildlife	*31*	*3*	*2*	*1*	*0.1*
	Total Nonpoint Sources*	**32,948**	**3,039**	**1,836.7**	**935.3**	**175.6**

*Numbers are rounded to the nearest tenth.

Table 7. Number of Animals in the Village of Reinbeck - Black Hawk Creek Subwatershed (Gronberg & Arnold 2017)

Animal Type	Number of Animals
Horses	132
Beef Cattle	7,392
Dairy Cattle	166
Sheep	243
Hogs	599,27
Poultry	168

4. WATERSHED ISSUES

As noted in the **Stakeholder Engagement Process** section, participants in both input meetings helped to identify important issues to them and their community. In particular, in both meetings, participants emphasized the importance of increased communication with the community at-large in regards to the watershed planning underway and future watershed-related projects. It is important that community members are asked for their input early on, as demonstrated with the first input meeting with stakeholders. Other important issues brought up and identified by participants are:

- Improved infrastructure for cover crops: Specifically, participants identified need for growers of crop seed, shared storage, grant money for high-clearance interseeders, or other planting equipment.
- Wetland restoration: Participants expressed the desire to utilize the 1-acre wetland that already exists within the watershed to implement a program that allows farmers to seed wetlands.
- Consider filter strips/buffer strips: Participants believed there are less barriers to implementing this practice and therefore feel that they are more likely to be adapted. Additionally, saturated buffers were scored as the most likely edge-of-field practice.
- Potential for areas for oxbow restorations: Participants identified some locations along Black Hawk Creek that could be suitable for oxbow restorations.
- Strategic approach to targeted conservation: There was discussion among participants interested in strategically targeting areas with specific conservation practices that would benefit the overall community by affecting multiple farms, fields, or landowners with one practice. For example, although oxbows were rated as relatively unlikely to be adopted, there was some discussion regarding the community benefits of targeted oxbows that can reduce nutrient loss from multiple fields, farmers, or landowners.
- Rural-municipal cooperation: Participants feel strongly about cooperation on a variety of issues including the importance of the Reinbeck waste water utility and the allocation of responsibilities between point and nonpoint pollution sources under the INRS.
- Link downstream/upstream communities: Participants would like to see innovative projects that are linking downstream and municipal partners with upstream farmers and landowners.
- Log Jams: Participants felt the debris from trees led to localized flooding issues. Follow up and coordination will be needed with the Iowa DNR, County, and private landowners to address tree-falls within the stream.
- Stormwater infrastructure ordinance: Participants raised a concern about the effectiveness and level of enforcement of stormwater management ordinances. The enforcement of stormwater management ordinances in new developments is addressed by the MCWMP on a watershed-wide scale.

5. GOALS AND OBJECTIVES

The following specific goals and objectives have been identified for the Village of Reinbeck – Black Hawk Creek Subwatershed. These goals and objectives were developed through the following:

- Input received by local subwatershed resident in stakeholder engagement meetings.
- The goals and objectives framework established for the MCWMP.
- Goals established in approved TMDL studies.

5.1.1. Flooding/Water Quantity Goals

Flooding in the Village of Reinbeck – Black Hawk Creek results in significant financial losses. Over $5 million dollars in damage to buildings and their content results from the 100-year (1% annual chance) flooding event within the watershed (see **Flooding** section for further information).

The goal for this subwatershed is to reduce flooding and minimize financial losses due to flooding.

The Generic Hydrologic Overland-Subsurface Toolkit (GHOST) Hydrologic & Hydraulic model, developed by the IFC, will be used to estimate the flood reduction benefits resulting from implementation of a suite of conservation practices across the watershed. This will be accomplished by comparing the peak flood stage that occurred on Black Hawk Creek within the City of Reinbeck during the June 30th, 2014 flooding event with the flood stages predicted by the GHOST model for various implementation scenarios.

5.1.2. Water Quality Goals

The INRS serves as a foundation for the water quality goals in the MCW. Specifically, the load reduction goal for nitrogen is a 41% reduction from non-point sources and the load reduction goal for phosphorus is a 29% reduction from non-point sources by the year 2035.

A further water quality goal has been established of having all waters within the subwatershed meet their designated uses. This goal is applied to waters within the subwatershed and streams to which the subwatershed contributes.

Currently, four stream segments that receive drainage from the Village of Reinbeck – Black Hawk Creek Subwatershed do not meet their designated uses.

Upper Reach Black Hawk Creek: This is the segment of Black Hawk Creek within the Subwatershed. As described in the **Impaired Waters** section, this segment is impaired due to elevated levels of indicator bacteria. A TMDL has not been established for this stream segment. However, as part of this watershed plan preliminary reduction estimates were quantified by multiplying the water quality standard (126 org./100 mL) by the flow duration curve. The full loading capacity for the subwatershed along with estimates of the existing loads are shown in **Figure 8**. Based on these methods the estimated reduction in *E. coli* load to meet the water quality standard ranges from 83% to 95% with the reductions coming from nonpoint sources and the elimination of failing septic systems (**Table 8**).

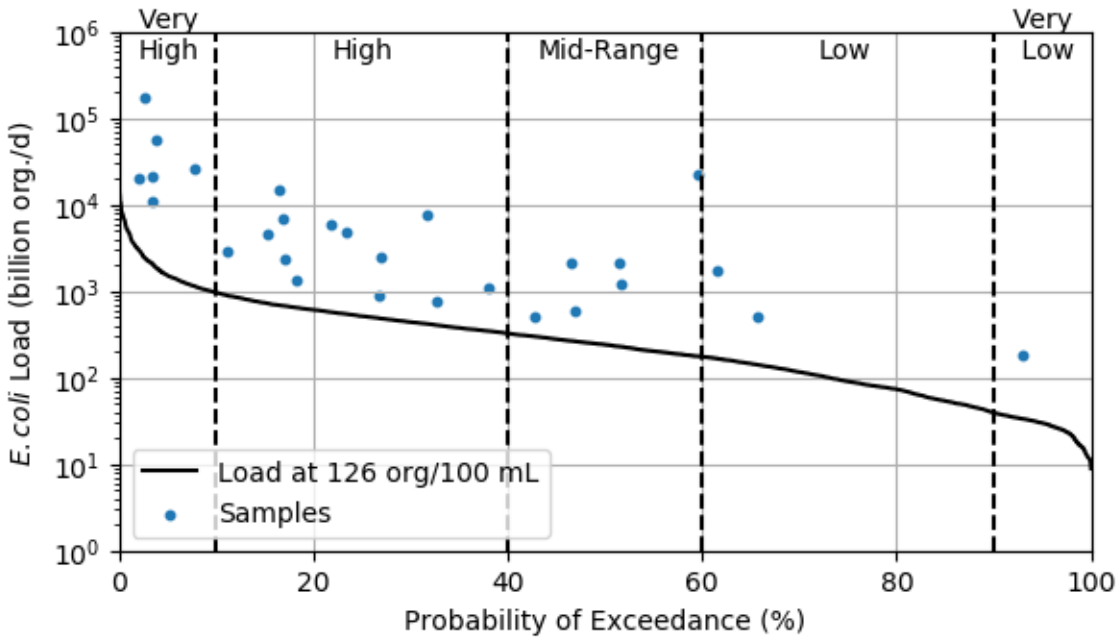

Figure 8. *E. coli* load duration curve.

Table 8. *E. coli* Load Allocations and Reduction Estimates.

Black Hawk Creek Village of Reinbeck Goal Load Components		Flow Regime				
		Very High (cfs)	High (cfs)	Mid (cfs)	Low (cfs)	Very Low (cfs)
		495	167	78	29	9.7
		E. coli (billion org. per day)				
Existing Load		***32,956***	***3,047***	***1,844***	***943***	***183***
Point Sources	*Reinbeck WWTP*	*2.3*	*2.3*	*2.3*	*2.3*	*2.3*
	Grundy Center WWTP	*5.7*	*5.7*	*5.7*	*5.7*	*5.7*
	Holland WWTP	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
	Total Point Sources	**8.2**	**8.2**	**8.2**	**8.2**	**8.2**
Nonpoint Sources	*Failing Septics Systems*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
	Agricultural and Urban Sources	*1,486*	*505*	*231.1*	*82*	*21.7*
	Wildlife	*30.8*	*2.8*	*1.7*	*0.8*	*0.1*
	Total Nonpoint Sources	**1,516.8**	**507.8**	**233**	**82.8**	**22**
Total Loading Capacity		**1,525**	**516**	**241**	**91**	**30**
Estimated Load Reduction Needed		*31,431*	*2,531*	*1,603*	*852*	*153*
		95%	*83%*	*87%*	*90%*	*84%*

Lower Reach Black Hawk Creek: This segment of Black Hawk Creek (Black Hawk Creek from its mouth at the Cedar River in S22,T89N, R13W to the stream crossing at Highway 58 in E 1/2, S27, T88N, R14W in Black Hawk County) is impaired due to elevated levels of indicator bacteria. A TMDL was developed in 2006, which determined that in order to achieve the *E. coli* water quality standard for this segment of Black Hawk Creek there must be an 85% reduction in rain driven surface runoff loads and a 98% reduction in continuous nonpoint source bacterial loads (e.g., septics and cattle in the stream).

Cedar River from Wolf Creek to Bridge Crossing in LaPorte City: This segment of the Cedar River is impaired due to elevated levels of *E. coli* bacteria. A TMDL was developed for all impaired reaches of the Cedar River in 2010. The TMDL determined that the following objectives were needed for this Cedar River segment to achieve the *E. coli* water quality standard:

- Unpermitted feedlots will control/capture the first one-half inch of rain.
- Cropland bacteria loading will be reduced by 40% through proper timing and application of animal waste.
- Cattle in streams will be reduced by 40%.
- Leaking septic systems will be eliminated.

Cedar River from McCloud Run to Bear Creek. This segment of the Cedar River is impaired due to levels of nitrate above the State standard for drinking water. A TMDL was developed for this segment of the Cedar River that established a 37% loading reduction target for nonpoint sources of nitrate.

6. IMPLEMENTATION PLAN

6.1. Existing Conservation Practices

The Iowa Department of Natural Resources (Iowa DNR), Iowa Department of Agriculture and Land Stewardship, Iowa Nutrient Research Center at Iowa State University, National Laboratory for Agriculture and the Environment, and Iowa Nutrient Research and Education Council are currently developing an inventory of the conservation practices across the State. The effort is referred to as the Iowa Best Management Practice (BMP) Mapping Project. The goal of the project is to provide a complete baseline set of BMPs dating from the 2007-2010 timeframe for use in watershed modeling, historic occurrence, and future practice tracking. The BMPs mapped are: terraces, water and sediment control basins (WASCOB), grassed waterways, pond dams, contour strip cropping, and contour buffer strips. The Iowa BMP Mapping Project data can be accessed at https://athene.gis.iastate.edu/consprac/consprac.html.

The existing conservation practices of the Village of Reinbeck – Black Hawk Creek Subwatershed are shown in **Figure 9**. In addition to the Iowa BMP Mapping Project conservation practice locations provided by participants in the stakeholder engagement meetings are also shown.

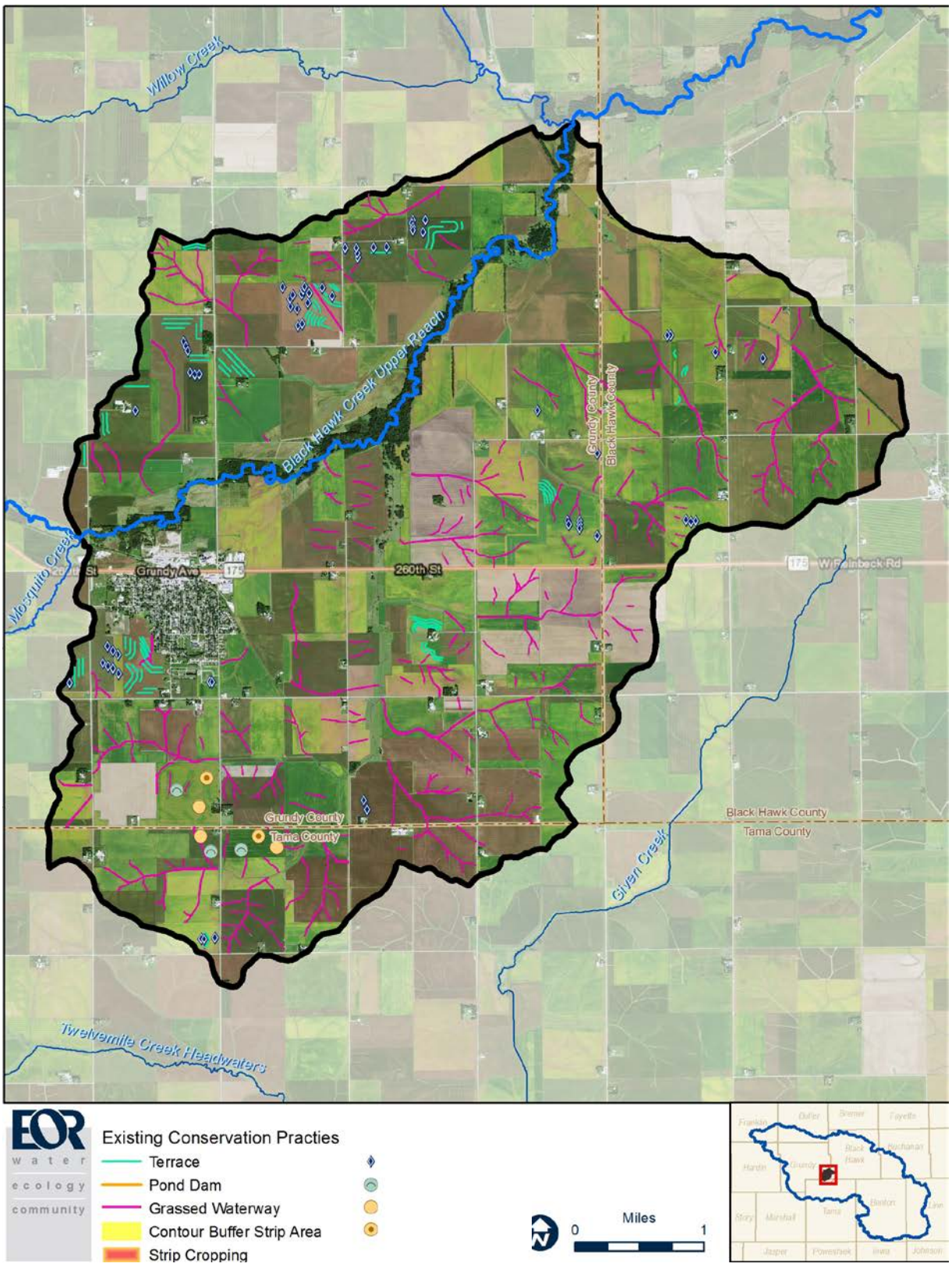

Figure 9. Existing Conservation Practices in the Village of Reinbeck – Black Hawk Creek Subwatershed

6.2. Potential Agricultural Conservation Practices

The ACPF Version 2.2 was run for the Village of Reinbeck – Black Hawk Creek Subwatershed. The ACPF is a GIS-based tool developed by the Agricultural Research Service (USDA-ARS) that analyzes "soils, land use, and high-resolution topographic data to identify a broad range of opportunities to install conservation practices in fields and in watersheds". The ACPF tools identify suitable locations for terrain-dependent conservation practices:

- Grassed Waterways
- Contour Buffer Strips
- Nutrient Removal Wetlands
- Edge-of-Field Bioreactors
- WASCOB
- Drainage Water Management
- Saturated Buffers
- Riparian Buffers

Additional conservation practices that are not terrain-dependent have also been identified as potential options for reducing nutrient and sediment loading within the subwatershed. The following section describes the suite of conservation practices recommended for implementation recommended for the subwatershed organized by tier of the conservation pyramid as shown in **Figure 10**. The conservation practices sited by the ACPF analysis are shown in Error! Reference source not found..

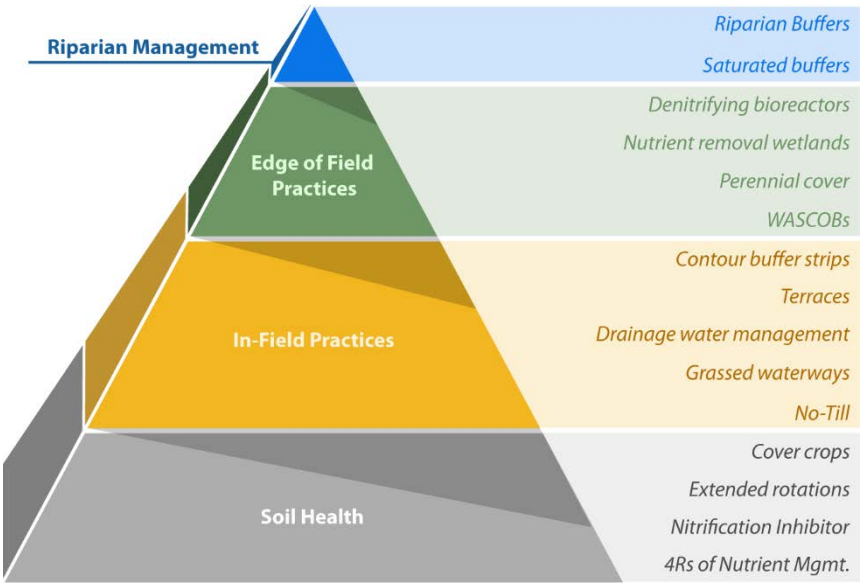

Figure 10. Conservation Pyramid (adapted from Tomer et al. 2013)

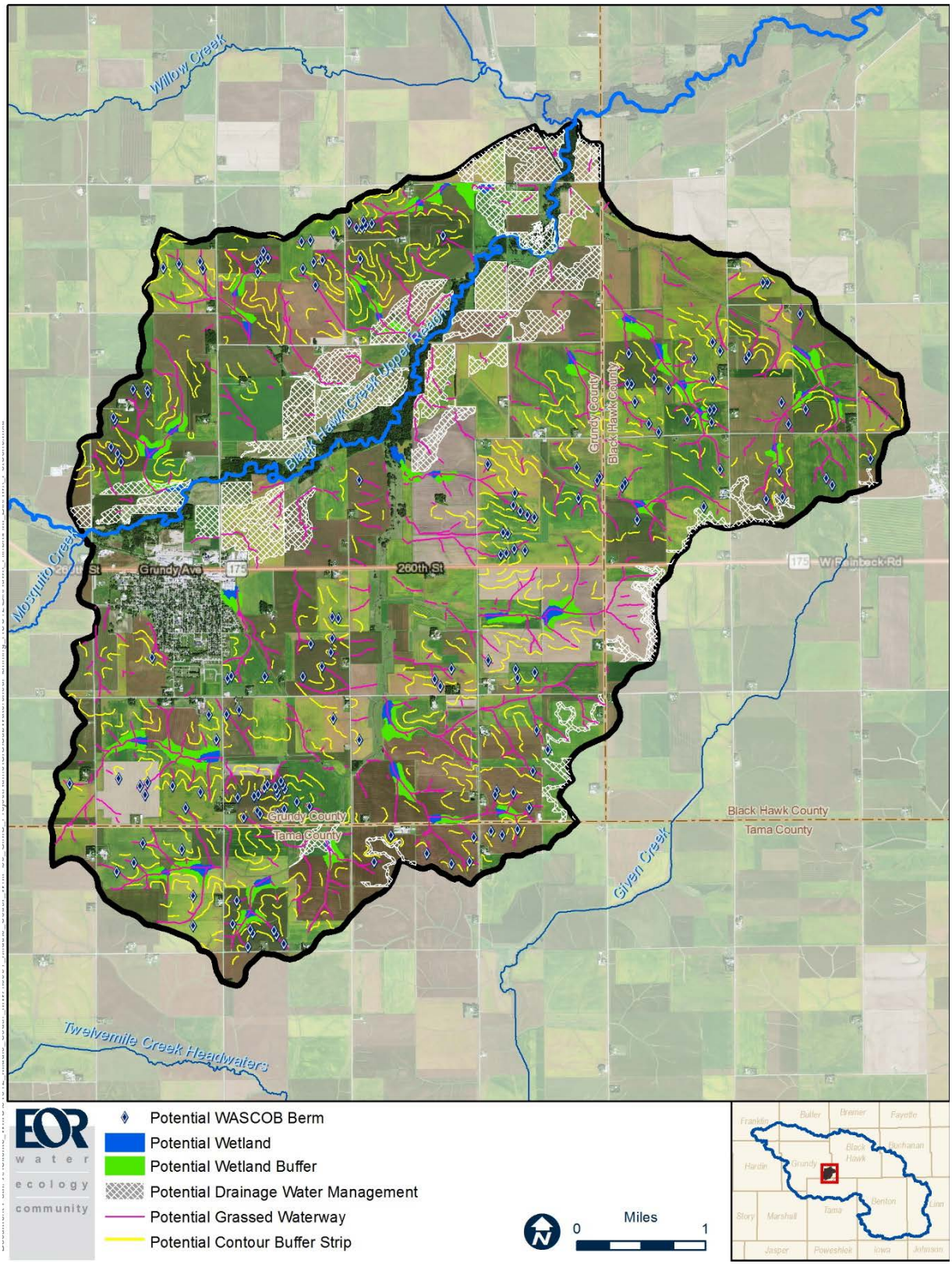

Figure 11. Potential Conservation Practices in the Village of Reinbeck – Black Hawk Creek Subwatershed

6.2.1. Soil Health Practices

Starting at the base of the conservation pyramid, the following practices reduce nutrient and sediment runoff from fields while also building soil health.

Cover Crops: Cover crops is a term to describe any crop grown primarily for the benefit of the soil rather than the crop yield. Cover crops are typically grasses or legumes (planted in the fall between harvest and planting of spring crops) but may be comprised of other green plants. Cover crops prevent erosion, improve the physical and biological properties of soil, supply nutrients, suppress weeds, improve the availability of soil water, and break pest cycles, in addition to a wide range of additional benefits. More information on cover crop use in Iowa can be found at:

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_005818.pdf

Extended Crop Rotations: An extended crop rotation is a farming practice that includes a rotation of corn, soybean, and two to three years of alfalfa or legume-grass mixtures managed for hay harvest. Extended rotations reduce the application and loss of both nitrate-N and phosphorus. By growing nitrogen-fixing legumes three years in a row, very little, if any nitrogen needs to be applied in the subsequent corn year. Additional information can be found at:

https://www.cleanwateriowa.org/extended-crop-rotation/

Nitrification Inhibitors: When ammonia or ammonium nitrogen is added to the soil, it is subject to a process called nitrification. Soil bacteria converts the ammonia (NH_3) or ammonium (NH_4) to nitrate (NO_3). This conversion is strongly temperature dependent and occurs quickly under warm soil temperature conditions. Using a nitrification inhibitor with applications of ammonia or ammonium nitrogen will slow the conversion to nitrate until it can be readily used by crops. This will allow the crop to uptake more of the nitrogen at critical times in the growing season. To learn more, visit: https://www.cleanwateriowa.org/new-page-1

4Rs of Nutrient Management: The 4Rs of nutrient management refer to fertilizer application techniques focused on minimizing the risk of nutrient loss from the field. The principles of the 4R framework include:

- Right Source – Ensure a balanced supply of essential nutrients, considering both naturally available sources and the characteristics of specific products, in plant available forms.
- Right Rate – Assess and make decisions based on soil nutrient supply and plant demand.
- Right Time – Assess and make decisions based on the dynamics of crop uptake, soil supply, nutrient loss risks, and field operation logistics.
- Right Place – Address root-soil dynamics and nutrient movement, and manage spatial variability within the field to meet site-specific crop needs and limit potential losses from the field.

Recently a program called 4R Plus was developed by a coalition of organizations dedicated to conservation stewardship for Iowa's farmers. 4R Plus is a nutrient management and conservation program to make farmers aware of practices that bolster production, build soil health and improve water quality in Iowa. The program is guided by a coalition of more than twenty-five organizations, including agribusinesses, conservation organizations, commodity and trade associations, government agencies and academic institutions. To learn more, visit:

https:www.4RPlus.org/.

Soil health practices can be implemented on areas of row crop production throughout the subwatershed regardless of topographic setting.

In the Village of Reinbeck – Black Hawk Creek Subwatershed there are currently approximately 13,756 row crop acres. Soil health practices are already in place on many of these acres. Assumptions for existing adoption rates for soil health practices within the subwatershed reviewed are shown in **Table 9**. These assumptions are based on professional judgement, communication with local Soil & Water Conservation Districts and Natural Resources Conservation Service staff members, and input from local farmers who participated in the stakeholder engagement meetings

Table 9. Soil Health Management Conservation Practice Existing Adoption Rate Assumptions for the Village of Reinbeck – Black Hawk Creek Subwatershed

Conservation Practice		Existing Adoption Rate	Existing Adoption Acres
	Cover crops	2%	275
	Extended rotations	1%	138
	Nitrogen management: nitrification inhibitor	50%	6,878
4Rs	Nitrogen management: rate control	10%	1,376
	Nitrogen management: source control	20%	2,751
	Nitrogen management: timing control	50%	6,878
	Phosphorus management: placement control	50%	6,878
	Phosphorus management: rate control	50%	6,878
	Phosphorus management: source control	50%	6,878

6.2.2. In-field Conservation Practices

The following conservation practices are categorized as in-field management practices because they are implemented directly within the actively farmed area of a field. Note that in the case of no-till, this practice can also improve soil health. These practices have benefits for both water quality improvement as well as flood mitigation, since the practices help to slow down runoff rates while also filtering out pollutants.

Contour Buffer Strips: Contour buffer strips are strips of grass, or a mixture of grasses and legumes, that run along the contour of a farmed field. Buffer strips are installed in rows down the slope of a field, alternating with wider cropped strips. Established contour buffer strips can significantly, reduce sheet and rill erosion, slow runoff, and trap sediment. Contaminants such as sediment, nutrients, and pesticides are removed from the runoff as they pass through a buffer strip. Buffer

strips may also provide food and nesting cover for wildlife and pollinators. Additional information can be found at:
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/null/?cid=nrcseprd413956

Terraces: A terrace is an earth embankment, channel, or a combination ridge and channel constructed across the slope to intercept runoff water. This practice generally applies to cropland but may also be used on other areas where field crops are grown such as wildlife or recreation lands. Terraces serve several purposes, including reducing slope length for erosion control, intercepting and directing runoff, and preventing gully development. Additional information can be found at:
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_026229.pdf

Drainage Water Management: Controlled drainage describes the practice of installing water level control structures within the drain tile system. This practice reduces nitrogen loads by raising the water tables during part of the year, thereby reducing overall tile drainage volume and nitrate load. The water table is controlled through the use of gate structures that are adjusted at different times during the year. When field access is needed for planting, harvest or other operations, the gate can be opened fully to allow unrestricted drainage. When the gate is used to raise local water table levels after spring planting season, this may allow more plant water uptake during dry periods, which can increase crop yields. Controlled drainage may be used on fields with flat topography, typically one percent or less slope. Additional information can be found at:
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081603.pdf

Grassed Waterways: Grassed waterways are constructed channels, seeded with grass, that drain water from areas of concentrated flow. The vegetation slows down the water and the channel conveys the water to a stable outlet at a non-erosive velocity. Grassed waterways should be used where gully erosion is a problem. These areas are commonly located between hills and other low-lying areas on hills where water concentrates as it runs off the field (USDA-NRCS 2012). The size and shape of a grassed waterway is based on the amount of runoff that the waterway must carry, the slope, and the underlying soil type. Although a limited function, it is important to note that grassed waterways also have an ability to trap sediment entering them via field surface runoff and in this manner performs similarly to riparian buffer strips. Additional information on grassed waterways can be found at:
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_026051.pdf

No-till: No-till is a way of growing crops or pasture from year to year without disturbing the soil through tillage. No-till increases the amount of water that infiltrates into the soil, the soil's retention of organic matter and its cycling of nutrients. It can also reduce or eliminate soil erosion and increase the amount and variety of life in and on the soil. The most powerful benefit of no-tillage is improvement in soil biological fertility, making soils more resilient to degradation and erosion (NWRM 2015). Additional information on the use of no-till can be found at:
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_015627.pdf

The current extent of in-field management practices in the subwatershed was estimated by reviewing the Iowa DNR BMP Mapping Project (see **Figure 9**), and through professional judgement as described for the soil health management practices (**Table 10**).

Table 10. In-field Conservation Practice Existing Adoption Rate Assumptions for the Village of Reinbeck – Black Hawk Creek Subwatershed

Conservation Practice	Existing Adoption Rate	Adoption Rate Estimate Source
Contour buffer strips	0%	Comparison of ACPF output to BMP Mapping Project findings
Terraces	100%	Comparison of ACPF output to BMP Mapping Project findings
Drainage Water Management	0%	Professional Judgement
Grassed Waterways	43%	Comparison of ACPF output to BMP Mapping Project findings
No-Till	20%	Professional Judgement

6.2.3. Edge of Field Conservation Practices

The following conservation practices are categorized as edge of field practices due to their typical location just off the edge of a farm field. Note that conversion to perennial cover is included in this group. The rationale is that the converted area would no longer be an actively farmed area, it would essentially be converted to a field edge.

Denitrifying bioreactors: Denitrifying bioreactors are trenches in the ground packed with carbonaceous material, such as wood chips, which allow colonization of soil bacteria that convert nitrate in drainage water to nitrogen gas. Installed at the outlet of tile drainage systems, bioreactors are typically capable of treating 40-60 acres of farmland. These have limited benefits for flood mitigations, but they can be highly beneficial for water quality improvement. According to the INRS, bioreactors can achieve an average nitrate reduction of 43 percent for water going through the bioreactor. Additional information on denitrifying bioreactors can be found at: https://www.nrcs.usda.gov/wps/portal/nrcs/ia/newsroom/factsheets/NRCSEPRD414822/

Nutrient Removal Wetlands: This conservation practice is a shallow depression created in the landscape where aquatic vegetation is typically established. Nutrient removal wetlands can be a cost-effective approach to reducing nitrogen loadings in watersheds dominated by agriculture and tile drainage. A 0.5 percent to 2 percent range in wetland pool-to-watershed ratio permits the wetlands to efficiently remove nitrogen runoff from large areas and data has shown that at times 40 percent to 90 percent of the nitrate flowing into the wetland can be removed. These wetlands and surrounding grassland buffers also provide environmental benefits beyond water quality improvement such as increases in wildlife habitat, carbon sequestration, and minor flood water retention (Crumpton et al. 2006). Additional information on nutrient removal wetlands can be found at: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_025770.pdf

In addition to the siting analysis completed using the ACPF tool, Linn County Conservation developed an evaluation of opportunities for nutrient removal wetlands beyond those identified by the ACPF. The evaluation was performed for areas within Morgan Creek Park and also within the drainage area to the Park. The feasibility study is available from Linn County Conservation. Maps depicting these additional opportunities are included in Appendix A.

Perennial Cover: Perennial cover refers to the practice of converting cropland to a permanent perennial vegetative cover and/or trees to accomplish any of the following: reduce soil erosion and sedimentation, improve water quality and quantity, improve infiltration, enhance wildlife habitat,

improve soil quality, or manage plant pests. Additional information on the use of perennial cover for conservation can be found at:
https://store.extension.iastate.edu/product/The-Iowa-Watershed-Approach-Perennial-Cover

Water and Sediment Control Basin (WASCOB): Water and sediment control basins are small earthen ridge-and-channel or embankments built across a small watercourse or area of concentrated flow within a field. They are designed to trap agricultural runoff water, sediment and sediment-borne phosphorus as it flows down the watercourse; this keeps the watercourse from becoming a field gully and reduces the amount of runoff and sediment and phosphorus leaving the field. WASCOB's are usually created through construction of a small, grassed berm that is just long enough to bridge an area of concentrated flow. The runoff water detained in a WASCOB is released slowly, usually via infiltration or a pipe outlet and tile line. These practices also have benefits for water storage/flood risk reduction. Additional information on WASCOBs can be found at:
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_025622.pdf

The current extent of edge of field conservation practices in the subwatershed was estimated by reviewing the Iowa DNR BMP Mapping Project (see **Figure 9**), and through professional judgement as described for the soil health management practices.

Table 11. Edge of-field Conservation Practice Existing Adoption Rate Assumptions for the Village of Reinbeck – Black Hawk Creek Subwatershed

Conservation Practice	Existing Adoption Rate	Adoption Rate Estimate Source
Denitrifying bioreactors	0%	Professional Judgement
Nutrient removal wetlands	0%	Comparison of ACPF output to BMP Mapping Project findings
Perennial cover	1%	Professional Judgement
WASCOBs	38%	Comparison of ACPF output to BMP Mapping Project findings

6.2.4. Riparian Area Management

The final tier of the conservation pyramid is management practices within the areas adjacent to existing waterways. These practices are commonly referred to as riparian area conservation practices. An evaluation of the existing riparian area throughout the subwatershed was conducted. The land cover types within 50 feet on either side of each stream (the riparian area) within the subwatershed were inventoried to determine the current condition. Areas where natural land cover types (forests, wetlands, etc.) were found within the riparian area were determined to have an existing buffer. The existing adoption rates shown in **Riparian Buffers**: The ACPF tools identify a variety of riparian buffers types based on the primary function they serve. The riparian buffer types are as follows:

- Critical Zone- sensitive areas: identified as areas with a high level of surface runoff delivery
- Deep-rooted Vegetation – for areas with saturated soils
- Multi-species – for water uptake, nutrient and sediment trapping
- Stiff stemmed grasses – for areas with overland runoff where sediment can be trapped
- Stream stabilization – for areas where bank stability is the emphasis

Additional information on riparian buffer types can be found at:
https://www.cleanwateriowa.org/stream-buffers

Saturated Buffers: Saturated buffers are vegetated areas, typically in a riparian area along a stream or ditch where drain tile water is dispersed in a manner that maximizes its contact with the soils and vegetation of the area. Drain tile lines that typically discharge directly to the ditch or stream are intercepted and routed into a new drain tile pipe that runs parallel to the ditch or stream. This allows drain water to exfiltrate and saturate the buffer area. The contact with soil and vegetation results in denitrification. Additional information on saturated buffers can be found at:
https://www.ars.usda.gov/midwest-area/ames/nlae/news/what-are-saturated-buffers/

Table 12 are the percentage of natural cover types within each type of riparian area management as sited in the ACPF tools.

Riparian Buffers: The ACPF tools identify a variety of riparian buffers types based on the primary function they serve. The riparian buffer types are as follows:

- Critical Zone- sensitive areas: identified as areas with a high level of surface runoff delivery
- Deep-rooted Vegetation – for areas with saturated soils
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- Stream stabilization – for areas where bank stability is the emphasis

Additional information on riparian buffer types can be found at:
https://www.cleanwateriowa.org/stream-buffers

Saturated Buffers: Saturated buffers are vegetated areas, typically in a riparian area along a stream or ditch where drain tile water is dispersed in a manner that maximizes its contact with the soils and vegetation of the area. Drain tile lines that typically discharge directly to the ditch or stream are intercepted and routed into a new drain tile pipe that runs parallel to the ditch or stream. This allows drain water to exfiltrate and saturate the buffer area. The contact with soil and vegetation results in denitrification. Additional information on saturated buffers can be found at:
https://www.ars.usda.gov/midwest-area/ames/nlae/news/what-are-saturated-buffers/

Table 12. Riparian Area Management Practice Existing Adoption Rate Assumptions for the Village of Reinbeck – Black Hawk Creek Subwatershed

Conservation Practice	Existing Adoption Rate	Adoption Rate Estimate Source
Critical zone riparian buffer	87%	Evaluation using High Resolution Land Cover Mapping Data and Stream Riparian Areas
Deep-rooted vegetation riparian buffer	82%	
Multi-species riparian buffer	80%	
Stiff stem grass riparian buffer	85%	
Stream stabilization riparian buffer	74%	
Saturated buffers	0%	Professional Judgement

The conservation practices described in the previous section were compiled for the Village of Reinbeck – Black Hawk Creek Subwatershed and processed using a custom set of scripts written in

the R programming language. Essentially, these scripts aggregated the individual BMP features and created a summary for the Village of Reinbeck – Black Hawk Creek HUC-12 containing the total potential extent for each BMP type along with the total footprint and drainage area served (

).

A tool was developed in Microsoft Excel that uses the BMP summaries to apply pollutant loading values to the drainage areas, along with pollutant reduction values that are unique to each BMP. The pollutant reduction estimates were derived from a combination of sources, but were primarily taken from the INRS. Existing BMP adoption rates were estimated using a combination of sources, including feedback for specific watersheds from the Black Hawk SWCD and the Iowa Soybean Association (ISA), as well as using the results from the Iowa BMP Mapping Project as described in the previous section. After consideration of the existing pollutant reductions provided by BMPs currently in place, the Excel tool provides an overall estimate for the subwatershed of the expected maximum nitrogen and phosphorus reduction potential assuming a 100% implementation rate of each individual BMPs. The results of this analysis are shown in **Table 13.**

Table 13. Maximum Potential Load Reduction by BMP for the Village of Reinbeck – Black Hawk Creek Subwatershed

	Conservation Practice	Existing Adoption	Full Adoption	Load Reduction %	
				N	P
Soil Health Management	Cover crops	2%	100%	24.6%	23.1%
	Extended rotations	1%	100%	33.7%	0.0%
	Nitrogen management: nitrification inhibitor	50%	100%	3.7%	0.0%
	Nitrogen management: rate control	10%	100%	7.3%	0.0%
	Nitrogen management: source control	20%	100%	2.6%	0.0%
	Nitrogen management: timing control	50%	100%	2.2%	0.0%
	Phosphorus management: placement control	50%	100%	0.0%	12.2%
	Phosphorus management: rate control	50%	100%	0.0%	6.9%
	Phosphorus management: source control	50%	100%	0.0%	18.7%
In-Field Management	Contour buffer strips	0%	100%	0.0%	49.4%
	Terraces	100%	100%	0.0%	0.0%
	Drainage water management	0%	100%	3.4%	0.0%
	Grassed waterways	43%	100%	0.0%	29.7%
	No-Till	20%	100%	0.0%	58.4%
Edge-of-Field Management	Denitrifying bioreactors	0%	100%	7.4%	0.0%
	Nutrient removal wetlands	0%	100%	37.4%	0.0%
	Perennial cover	1%	100%	68.3%	60.2%
	WASCOBs	38%	100%	0.0%	5.8%
Riparian Management	Riparian buffer: Critical zone buffer	87%	100%	0.1%	0.1%
	Riparian buffer: Deep-rooted vegetation buffer	82%	100%	0.1%	0.1%
	Riparian buffer: Multi-species buffer	80%	100%	0.3%	0.2%
	Riparian buffer: Stiff stem grass buffer	85%	100%	0.0%	0.1%
	Riparian buffer: Stream stabilization buffer	74%	100%	0.0%	0.0%
	Saturated buffers	0%	100%	8.5%	0.0%

6.3. Strategies to Address Bacteria Loading

Identify, map, and monitor sources: The most important step is to identify potential and known sources of bacteria. Determining the most likely sources is typically a desktop exercise using mapping to identify where bacteria could be introduced to waterbodies such as pastures/agricultural land where manure is applied, feedlots, and residential onsite wastewater treatment system near waterbodies, at dog parks, and areas where wildlife congregate near waterbodies such as fields and golf courses. Mapping bacteria conveyance systems (e.g. stormwater and ditches) is also important. Mapping known and potential sources will ensure that these areas are regularly monitored and inspected. Field monitoring will also identify sources and should be conducted to regularly inspect known sources.

A cursory mapping of potential sources of bacteria in the subwatershed is presented in the **Watershed Characterization** section of this plan but additional investigation would be beneficial in refining the bacteria source assessment and to guide future management decisions. A wind shield survey should be conducted to identify potential sources of *E. coli* in the watershed.

Federal, State, and Local Requirements: Ensuring state laws and local ordinances are up-to-date and enforced is also a cost effective and efficient way to reduce bacteria loading into waterbodies. Specifically, local ordinances that address manure management and land use regulations should be coordinated with State-level water resource regulations that protect water resources and minimize potential release of bacteria.

Outreach/Education: It is very important that residents are aware of and understand the state and local water and land use regulations, as well as steps they can take to reduce bacteria entering water resources. For example, outreach and education can ensure that landowners and residents understand the regulations governing water resources such as collection of pet waste or bans on wildlife feeding in order to comply with them. Residents should also be aware of the BMPs and opportunities available to minimize sources of bacteria on their property.

Best Management Practices (BMPs) that Limit Introduction of Bacteria: The most effective method to reduce loads and meet long-term water quality goals is to address the sources that directly contribute bacteria to waterbodies. Source controls are BMPs that focus on limiting the introduction of bacteria into the landscape where it could be transported to waterbodies. Incorporating source controls into local ordinances is a very effective method to reduce release of bacteria into the watershed. Source control activities that reduce bacteria releases from direct sources include excluding livestock from surface waterbodies, effective manure management, regular onsite wastewater treatment system maintenance, pet waste collection, and green infrastructure practices that reduce stormwater runoff rates, volumes, and associated pollutants. A summary of the effectiveness of these practices is shown in **Table 14**. Local county conservation staff should schedule meetings with landowners of the active farm steads in the watershed to discuss their manure management practices and discuss opportunities to improve their manure management.

Table 14. Source Reduction Best Management Practice (BMP) Effectiveness for Bacteria Removal.

Practice	Source	Reduction
Manure Management	Simon and Makarewicz 2009	93%
Pasture Land Management	EPA 2003 Meals 2001	40% 29% to 46%
Open Feedlot Improvements	EPA 2003	55% to 90%
Pet Waste Ordinances	Caraco 2013	20%

Best Management Practices (BMPs) that Reduce Bacteria Loading to Waters: Source control and the methods mentioned above should be the first step of reducing bacterial loading as these methods are the most cost efficient and effective. Source control, however, is not always feasible and there are a number of BMPs that can reduce bacteria-laden runoff to waterbodies. Based on available data, some conventional stormwater BMPs reduce bacterial loads to receiving waters by:

- treating stormwater and removing bacteria from discharged water; or

- reducing total water discharge along with the associated bacterial load.

In some cases, multiple BMPs, including pre-treatment, may be necessary to achieve significant reductions in bacteria concentrations. Additionally, many BMPs are designed to reduce the loading of several pollutants at the same time.

Prior to evaluating BMP performance or selecting BMP strategies to target bacteria, it is important to understand basic fate and transport mechanisms as well as treatment processes anticipated to be effective for removing or inactivating bacteria. Inactivating bacteria refers to a natural process in which bacteria die-off or fail to reproduce due to existing environmental factors such as pH. Bacteria can thus be controlled without being removed. However, bacteria population can also increase without further bacteria loading if environmental conditions are conducive to population growth within the conveyance or receiving waters.

Properly designed BMPs that reduce the total volume of agricultural or urban runoff (e.g., infiltration BMPs) to receiving waters can effectively reduce the bacteria load by an amount equivalent to that contained in the reduced volume. They may also reduce the frequency of bacterial discharges to receiving waters if volume reductions are sufficient to retain runoff from most events.

BMPs that filter and/or reduce the rate or frequency of runoff (e.g., filtration or other BMPs that do not reduce volumes but do provide treatment) may reduce bacteria concentrations in this runoff and thereby reduce loading to receiving waters. Filtration and similar BMPs should, however, be carefully planned and investigated before implementation as they are sometimes ineffective and may even result in increased bacteria concentrations in discharges.

Overall, data on BMP effectiveness mentioned above varies widely (**Table 15**). In some studies the BMPs removed almost all of the *E. coli* from the streams while other studies indicated that they were sources of *E. coli* under a variety of conditions. Therefore, for the purposes of this plan *E. coli* was not used in prioritizing BMPs in the subwatershed. However, it is expected that these BMPs will generally have a positive benefit on *E. coli* concentrations in the watershed.

Table 15. Best Management Practices (BMPs) Effectiveness at Removing Bacteria

Practice	Source	Effectiveness
Wetlands	Bavor et. al 2001 Gerba et. al 1999 Rifai 2006 Clary et al. 2008 Mendez et al. 2009 MPCA 2008	79% 98% 88.3% -45% to 98% -260% to 98% 75%
Detention and Retention Ponds	Krometis et al. 2009 Munfasavalli and Viraghavan 2006 Clary et al. 2008 Schueler and Holland 2000 Pennington et al. 2003 MPCA 2008 Rifai 2006 Pennington et al. 2003 Clary et al. 2008	15% to 20% 56% & 86% 42% to 99% (Wet) 5% to 98% 70% (Wet) 70% 90% 78% (Dry) -995% to 93% (Dry)
Biofiltration/Filtration Practices	Pennington et al. 2003 Schueler and Holland 2000 Clary et al. 2008 MPCA 2008	70% -68% to 97% -146% to 96% 35%
Vegetated Buffers/Filter Strips	Coyne et al. 1998 Fajardo et al. 2001 Pennington et al. 2003 Rifai 2006	75% & 91% 64% & 87% 37% 32%
Swales	Rifai 2006 Pennington et al. 2009 Schueler and Holland 2000 Clary et al. 2008	-338% -25% -58% -185% to 83%

The strategies described above provide a general outline and description for the first steps of reducing bacterial loads through source controls. However, there are inherent differences in how to reduce bacteria loadings from urban as opposed to rural subwatersheds.

6.4. Recommended Conservation Practice Adoption Rates

A specific scenario for conservation practice implementation/adoption rates was developed for each of the sixty-eight subwatersheds of the MCW. The objective for the scenario was to meet the nutrient reduction targets established in the INRS for non-point sources of 41% reduction in nitrogen and 29% reduction for phosphorus for each subwatershed. The recommended scenario for the Village of Reinbeck – Black Hawk Creek Subwatershed is shown in **Table 16**. The table indicates the recommended adoption rate of each practice with the corresponding acreage or quantity and the percentage of the subwatershed 'treated' by that practice. The table also includes the estimated subwatershed nutrient load reduction provided as a result of the recommended adoption rate of each specific practice. The conservation practice scenario was developed through an iterative process using a cost-benefit analysis. Over 50% of the nitrogen removal and over 70% of the phosphorus

removal in this subwatershed is achieved through the use of soil health practices. The recommended conservation practice scenario results in an estimated total reduction of over 179,000 pounds per year of nitrogen and over 12,000 pounds per year of phosphorus.

Table 16. Recommended Adoption Rates for Conservation Practices in the Village of Reinbeck – Black Hawk Creek Subwatershed

Conservation Practice	Existing Adoption	Target Adoption			Load Reduction (lbs/year)	
		Rate	Quantity		N	P
Cover crops*	2%	58%	7,549	acres	60,160	5,480
Extended rotations*	1%	2%	135	acres	1,455	0
Nitrogen management: nitrification inhibitor	50%	75%	3,370	acres	7,797	0
Nitrogen management: rate control*	10%	50%	5,392	acres	13,862	0
Nitrogen management: source control*	20%	36%	2,427	acres	2,495	0
Nitrogen management: timing control*	50%	51%	3,438	acres	5,302	0
Phosphorus management: placement control*	50%	60%	1,348	acres	0	1,012
Phosphorus management: rate control*	50%	60%	1,348	acres	0	574
Phosphorus management: source control*	50%	36%	2,427	acres	0	2,794
Contour buffer strips*	0%	10%	10	miles	0	2,055
Terraces*	100%	100%	0	miles	0	0
Drainage water management	0%	50%	19	fields	7,285	0
Grassed waterways	43%	44%	2	miles	0	217
No-Till	20%	25%	674	acres	0	1,518
Denitrifying bioreactors	0%	25%	14	reactors	7,942	0
Nutrient removal wetlands*	0%	40%	15	wetlands	63,874	0
Perennial cover*	1%	2%	138	acres	2,546	117
WASCOBs*	38%	39%	2	basins	0	39
Riparian buffer: Critical zone buffer*	87%	100%	0	miles	495	31
Riparian buffer: Deep-rooted vegetation buffer*	82%	100%	3	miles	521	32
Riparian buffer: Multi-species buffer*	80%	100%	1	miles	1,395	87
Riparian buffer: Stiff stem grass buffer*	85%	86%	0	miles	0	2
Riparian buffer: Stream stabilization buffer*	74%	75%	0	miles	0	0
Saturated buffers	0%	50%	7	miles	18,524	0

*BMPs that may remove *E. coli* from runoff

6.5. Flood Benefits

To demonstrate the flood damage reduction benefits achieved through implementing the recommended suite of conservation practices throughout the subwatershed, a flood damage reduction reporting location was established. at the stream crossing at T65/W Avenue north of the City of Reinbeck.

The flood damage reduction benefits associated with BMP implementation were estimated using results from modeling that was performed as part of the IFC / IIHR's MCW Hydrologic Assessment. As a continuous simulation was used for these model runs – in part because design storm simulations lose their meaningfulness at such a large scale – a specific simulated flood event was chosen for analysis. The event was chosen to be as close to the ten-year recurrence interval (return period) as possible for several reasons:

1. The most significant flood events (e.g. floods with magnitudes equal to or above the 100-year recurrence interval) may not be significantly impacted by the types of controls that the proposed BMPs provide; and
2. Minor flood events (e.g. floods with magnitudes equal to or below the five-year recurrence interval) are perhaps not significant enough in terms of damages to be meaningful for reporting risks and/or benefits.

Conversely, the approximate ten-year recurrence interval flood is both large enough to have significant flood damages and small enough to show significant flood damage reductions resulting from BMP implementation, and as such provides a convenient metric that will be meaningful to stakeholders.

The flood event used for the Village of Reinbeck – Black Hawk Creek Subwatershed was 08/28/2015.

By implementing the recommended conservation practices, the flood benefits that would have been achieved during this particular flood event is $360,000 in reduced losses and a 0.2 foot flood stage reduction. Therefore, it is inferred that this reduction in losses would be achieved if an event similar to this one were to happen in the future, assuming all recommended conservation practices were implemented. Maintaining the assumption of full implementation, it is also estimated that the subwatershed would see annual reduced flood losses of $130,000 if annual flood events conform to predicted patterns.

6.6. Prioritized Implementation

The prioritization of conservation practice implementation within the subwatershed is determined using two primary criteria: 1) the existing threat of land topography on water quality, and 2) the value of the land's resource production capacity. The first criteria guides practice implementation toward areas that will produce the most benefit to the overall subwatershed, while the second criteria guides it toward areas that will minimize financial barriers to implementation.

For the first criterion, runoff risk was applied to the landscape to expose regions with the greatest need for practice implementation. Runoff risk is a function of the proximity to a stream and the steepness of a slope. The proximity to a stream establishes the potential conveyance of sediment into

the water – ultimately leading to increased pollution. A higher runoff risk indicates a higher priority for implementation. The runoff risk for this subwatershed is shown below in **Figure 12**.

For the second criterion, the Corn Suitability Rating 2 Index (CSR2) tool was used. This is a rating applied to different soils based on row-crop productivity. This information indicates the value certain land has to a farmer's productivity. The values are ranked from high to low based on their relation to other land within the subwatershed. A lower CSR2 indicates a higher priority for implementation. The CSR2 for this subwatershed is shown below in **Figure 13**.

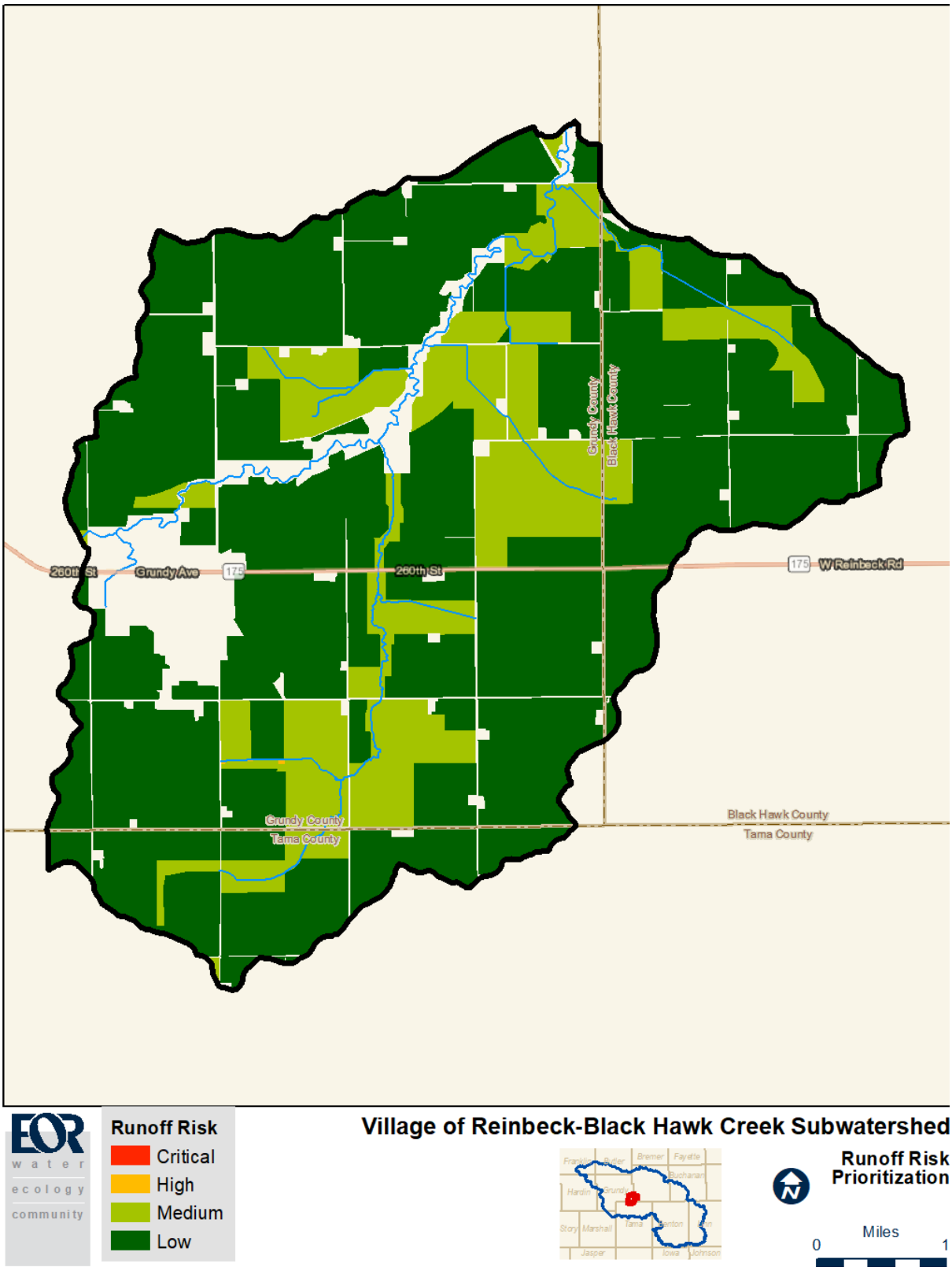

Figure 12: Runoff Risk for Village of Reinbeck – Black Hawk Creek Subwatershed

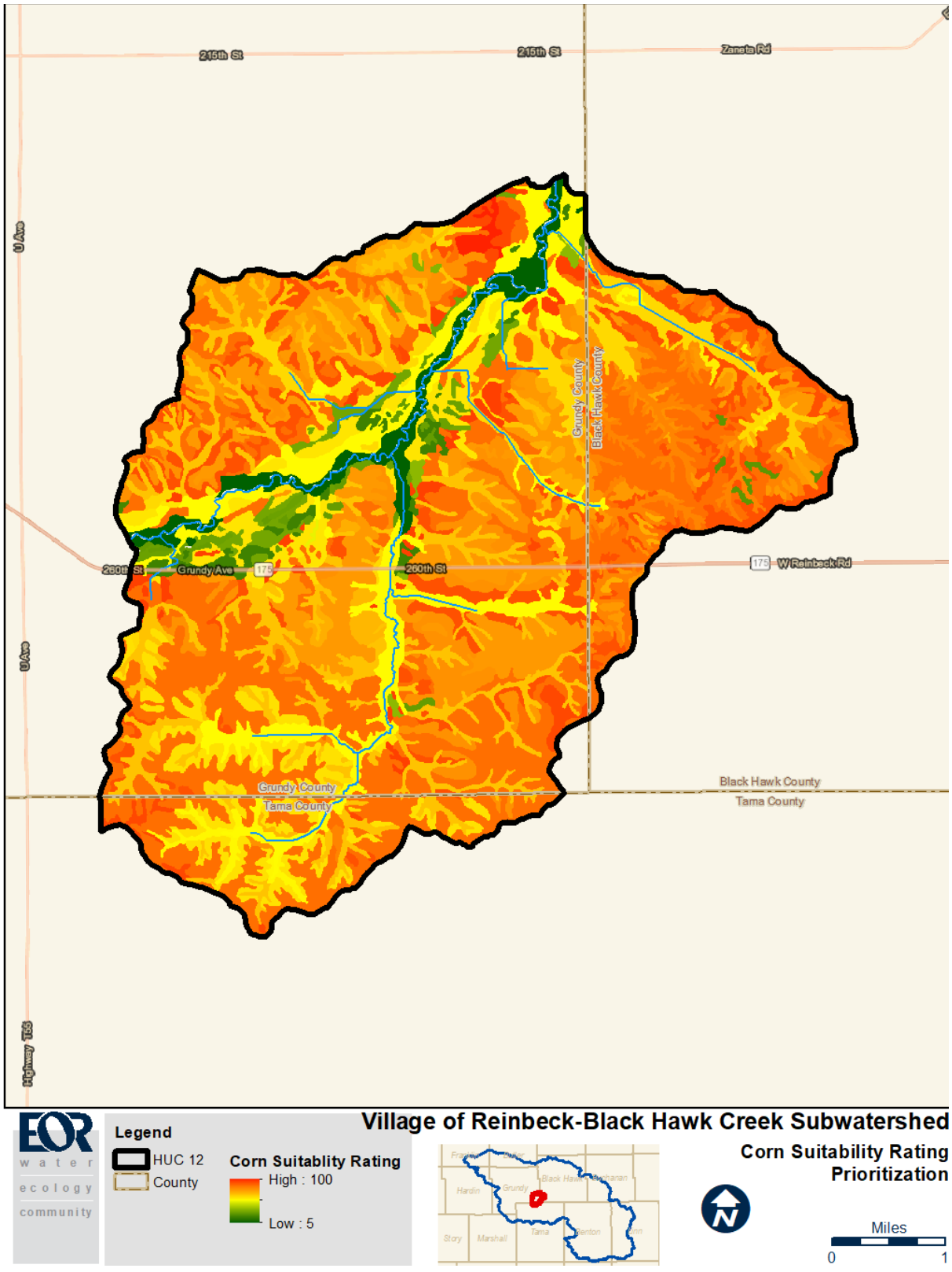

Figure 13: Corn Suitability Rating2 for Village of Reinbeck – Black Hawk Creek Subwatershed

Four maps are provided as a guide for implementation within the Village of Reinbeck – Black Hawk Creek Subwatershed. Each map contains information for the prioritization of different conservation practices. These maps are located in **Appendix A**. The implementation process for this subwatershed should utilize these maps and tables as a guide for conservation practice prioritization.

Map #1 includes practices with a specified location, but no rank. These include drainage water management practices (in-field), denitrifying bioreactors (edge of field), and saturated buffers (riparian area management). These practices do not have a specific criteria that would provide a helpful guide for implementation. However, the CSR map may serve as a first step for assessing implementation potential of the practices. The locations suitable for implementing each of these practices, as determined by the ACPF analysis are shown in this map.

Map #2 includes practices with a specified location that have been ranked individually using different parameters. These practices include grassed waterways (in-field), nutrient removal wetlands (edge of field), and riparian buffers (riparian area management).

- Grassed waterways are beneficial in locations where gullies are most likely to form in streams. Moore's Stream Power Index (SPI) is applied to these practices to determine ideal locations for implementation. The SPI determines which locations for these practices have the highest stream power, therefore determining areas where gullies are more likely to form. Therefore, the grassed waterways in locations with the highest relative SPI were ranked in highest priority. All grass waterways shown in red should be prioritized for implementation.
- Riparian buffers are ranked based on the relative runoff risk associated with the area draining to each practice. Riparian buffers located in areas of relatively high runoff risk should be prioritized over those in areas with a smaller runoff risk.
- The Nutrient Removal Wetlands are ranked based on the CSR because of the large cost and amount of land associated with wetlands. These wetlands are labeled based on CSR mean, starting with the lowest CSR mean at #1. The ranked wetlands are listed in **Table 17.**

Map #3 includes practices ranked based on the relative slope steepness within the subwatershed. These include contour buffer strips (in-field) and terraces (in-field). Their implementation is prioritized based on slope steepness rather than runoff risk because such practices are found all across the landscape and not just adjacent to streams. Both contour buffer strips and terraces reduce sheet and rill erosion, which is why they are most valuable on steeper slopes. Therefore, these practices should be prioritized in locations where slopes are steepest in relation to the subwatershed's landscape.

Map #4 prioritizes practices based on runoff risk. These practices include all the soil health practices (cover crops, extended rotations, nitrogen management, and phosphorus management), no-till (in-field), perennial cover (edge of field), and WASCOBs (edge of field). All of these practices are recommended across the watershed and are very valuable in reducing the pollutant loads in runoff. Therefore, land with a relatively higher runoff risk should be prioritized for these practices.

Table 17: Nutrient Removal Wetland Rankings for Village of Reinbeck – Black Hawk Creek Subwatershed

Rank	Mean CSR	Basin Size (HA)	Drainage Area (HA)	Rank	Mean CSR	Basin Size (HA)	Drainage Area (HA)
1	57.72	4.78	83.73	20	80.35	4.84	159.96
2	72.20	7.47	158.78	21	80.63	6.82	323.39
3	73.54	15.20	300.38	22	80.67	5.39	88.49
4	73.55	4.69	78.42	23	80.72	2.51	64.33
5	73.61	3.61	69.94	24	81.26	8.22	162.06
6	73.91	4.59	102.21	25	82.19	3.25	60.03
7	74.95	10.73	200.73	26	83.87	7.27	139.67
8	75.91	2.82	126.39	27	83.90	7.22	246.70
9	76.24	10.64	342.63	28	84.43	3.96	66.29
10	76.38	4.36	136.16	29	84.51	4.12	139.53
11	76.42	6.93	202.71	30	85.20	3.16	98.47
12	76.65	3.56	169.96	31	86.44	5.58	169.32
13	77.45	5.63	241.52	32	87.82	4.09	124.90
14	77.49	2.40	92.05	33	87.91	3.30	77.59
15	78.50	3.53	74.96	34	89.15	3.33	99.15
16	78.90	4.61	100.20	35	89.94	3.60	60.58
17	79.80	2.71	60.24	36	90.29	2.96	76.49
18	79.85	1.96	75.64	37	93.83	6.41	96.83

Only one wetland per wetland train should be implemented in the initial process. Use **Table 18** to determine which wetlands to implement first. In addition, the area of each wetland and drainage area can be used a secondary measure for prioritization.

Table 18: Prioritization of wetlands based on groupings

Grouping	Implement first
1, 36	1
5, 2	2
24, 3	3
4, 6	4
13, 7	7
14, 8, 21	8
9, 27, 30, 25	9
10	10
11, 31, 32, 33	11
19, 12	12
17, 15, 37	15
16	16
23, 18, 29	18
20, 26, 28	20
22	22

7. IMPLEMENTATION SCHEDULE & MILESTONES

The implementation schedule for the BMPs identified in the **Implementation Plan** section are shown in **Table 19** and **Table 20**. Soil management practices, no-till, and urban good housekeeping that need to be implemented annually are planned to be phased in during the first five years of the 20-year timeline. The remainder of the built practices were divided equally throughout the timeline (**Table 19** and **Table 20**) practices should be prioritized based on the prioritization areas in Appendix A.

Over the course of the implementation schedule there are three milestones where water quality improvements and number of practices built in the subwatershed will be evaluated. The first milestone is after five years when all of the annual practices will be phased in and approximately a quarter of the built practices should be constructed. The second milestone is after ten years when approximately half of the built practices should be constructed. Finally, the last milestone is at the end of the 20-year timeline when all of the practices should have been built and the water quality goals reached. A summary of the number of practices built and the predicted reduction at each of the milestones are shown in **Table 21** and **Table 22** respectively. The majority of the predicted benefit is from the annual soil management practices therefore the predicted nutrient benefits are weighted towards the first half of the schedule.

E. coli reductions at each milestone were based on dividing the reduction needed to achieve the goal throughout the 20-year implementation schedule. The load reduction by flow regime in Table 8 were expressed as one reduction goal by multiplying the concentration reduction needed by the average flow from 2002 through 2018. The bacteria reductions will be achieved through the implementation of practices that will reduce the delivery of manure runoff to the creek. This includes both livestock/manure management practices and conservation practices listed in **Table 19** and **Table 20.** The amount of livestock management practices available in the watershed to meet the reduction gaols is not known. Instead, local county conservation should schedule a windshield survey to identify sources of *E. coli* in the watershed and identify active farmsteads. After the windshield survey, local county conservation staff should schedule meetings with landowners with active farmsteads to discuss their manure management practices and identify opportunities for them to build practices that will limit manure runoff from entering the streams, An equal number of meetings should be conducted for each year in the implementation schedule. The benefits of conservation practices to reduce E. coli loads in streams are discussed in in Section 6.4. If at any of the milestones water quality trends or the number of practices, being built is not on track with the plan, then adaptive management should be applied by changing and refining implementation strategies to meet the goals.

Table 19. First 10 Years of the Implementation Schedule

		Year									
Conservation Practices	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Windshield Survey	#	1	0	0	0	0	0	0	0	0	0
Land owner meetings	#	Depends on the result of the windshield survey.									
Cover crops	Acres	1510	3020	4529	6039	7549	7549	7549	7549	7549	7549
Extended rotations	Acres	27	54	81	108	135	135	135	135	135	135
Nitrogen management: nitrification inhibitor	Acres	674	1348	2022	2696	3370	3370	3370	3370	3370	3370
Nitrogen management: rate control	Acres	1078	2157	3235	4314	5392	5392	5392	5392	5392	5392
Nitrogen management: source control	Acres	485	971	1456	1941	2427	2427	2427	2427	2427	2427
Nitrogen management: timing control	Acres	688	1375	2063	2750	3438	3438	3438	3438	3438	3438
Phosphorus management: placement control	Acres	162	324	485	647	809	809	809	809	809	809
Phosphorus management: rate control	Acres	270	539	809	1078	1348	1348	1348	1348	1348	1348
Phosphorus management: source control	Acres	485	971	1456	1941	2427	2427	2427	2427	2427	2427
Contour buffer strips	Miles	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Terraces	Miles	0	0	0	0	0	0	0	0	0	0
Drainage water management	Fields	0	1	1	1	1	1	1	1	1	1
Grassed waterways	Miles	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
No-Till	Acres	135	270	404	539	674	674	674	674	674	674
Denitrifying bioreactors	Reactors	0	1	0	2	0	1	0	2	0	1
Nutrient removal wetlands	Wetlands	1	1	1	0	1	1	1	0	1	1
Perennial cover	Acres	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
Wascobs	Basins	0	0	0	0	1	0	0	0	0	0
Riparian buffer: Critical zone buffer	Miles	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Riparian buffer: Deep-rooted vegetation buffer	Miles	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
Riparian buffer: Multi-species buffer	Miles	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
Riparian buffer: Stiff stem grass buffer	Miles	0.01	0	0	0	0	0	0	0.01	0	0
Riparian buffer: Stream stabilization buffer	Miles	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Saturated buffers	Miles	0.365	0.365	0.365	0.365	0.365	0.365	0.365	0.365	0.365	0.365

Table 20. Second 10 Years of the Implementation Schedule.

		Year									
Conservation Practices	Unit	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Windshield Survey	#	0	0	0	0	0	0	0	0	0	0
Land owner meetings	#	Depends on the results of the windshield survey.									
Cover crops	Acres	7549	7549	7549	7549	7549	7549	7549	7549	7549	7549
Extended rotations	Acres	135	135	135	135	135	135	135	135	135	135
Nitrogen management: nitrification inhibitor	Acres	3370	3370	3370	3370	3370	3370	3370	3370	3370	3370
Nitrogen management: rate control	Acres	5392	5392	5392	5392	5392	5392	5392	5392	5392	5392
Nitrogen management: source control	Acres	2427	2427	2427	2427	2427	2427	2427	2427	2427	2427
Nitrogen management: timing control	Acres	3438	3438	3438	3438	3438	3438	3438	3438	3438	3438
Phosphorus management: placement control	Acres	809	809	809	809	809	809	809	809	809	809
Phosphorus management: rate control	Acres	1348	1348	1348	1348	1348	1348	1348	1348	1348	1348
Phosphorus management: source control	Acres	2427	2427	2427	2427	2427	2427	2427	2427	2427	2427
Contour buffer strips	Miles	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Terraces	Miles	0	0	0	0	0	0	0	0	0	0
Drainage water management	Fields	1	1	1	1	1	1	1	1	1	1
Grassed waterways	Miles	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
No-Till	Acres	674	674	674	674	674	674	674	674	674	674
Denitrifying bioreactors	Reactors	0	2	0	1	0	2	0	1	0	1
Nutrient removal wetlands	Wetlands	1	0	1	1	1	0	1	1	1	0
Perennial cover	Acres	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
Wascobs	Basins	0	0	0	0	1	0	0	0	0	0
Riparian buffer: Critical zone buffer	Miles	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Riparian buffer: Deep-rooted vegetation buffer	Miles	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
Riparian buffer: Multi-species buffer	Miles	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
Riparian buffer: Stiff stem grass buffer	Miles	0	0	0	0.01	0	0	0	0	0	0
Riparian buffer: Stream stabilization buffer	Miles	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Saturated buffers	Miles	0.365	0.365	0.365	0.365	0.365	0.365	0.365	0.365	0.365	0.365

Table 21. Proposed Implementation Goals at each Milestone.

BMP Name	Unit	5 Year Goal	10 year Goal	20 Year Goal
Cover crops	Acres	7549	7549	7,549
Extended rotations	Acres	135	135	135
Nitrogen management: nitrification inhibitor	Acres	3370	3370	3,370
Nitrogen management: rate control	Acres	5392	5392	5,392
Nitrogen management: source control	Acres	2427	2427	2,427
Nitrogen management: timing control	Acres	3438	3438	3,438
Phosphorus management: placement control	Acres	809	809	809
Phosphorus management: rate control	Acres	1348	1348	1,348
Phosphorus management: source control	Acres	2427	2427	2,427
Contour buffer strips	Miles	0.25	0.5	1
Terraces	Miles	0	0	0
Drainage water management	Fields	4	9	19
Grassed waterways	Miles	0.5	1	2
No-Till	Acres	674	674	674
Denitrifying bioreactors	Reactors	3	7	14
Nutrient removal wetlands	Wetlands	4	8	15
Perennial cover	Acres	34.5	69	138
Wascobs	Basins	1	1	2
Riparian buffer: Critical zone buffer	Miles	0.03	0.06	0.12
Riparian buffer: Deep-rooted vegetation buffer	Miles	0.875	1.75	3
Riparian buffer: Multi-species buffer	Miles	0.265	0.53	1
Riparian buffer: Stiff stem grass buffer	Miles	0.01	0.02	0.03
Riparian buffer: Stream stabilization buffer	Miles	0.025	0.05	0.09
Saturated buffers	Miles	1.825	3.65	7

Table 22. Predicted Load Reductions at each Milestone

Water Quality Parameter	5 year Reductions	10 year Reductions	20 year Reductions
Phosphorus load reduction (lb/yr)	10,302	10,423	10,622
Nitrogen load reduction (lb/yr)	126,827	146,815	179,213
E. coli Average Load reduction (billion org./day)	2,164	4,328	8,657

8. FUNDING NEEDS

Table 23 shows the total implementation costs over a 20-year period for meeting the INRS targets for nitrogen and phosphorus for the subwatershed, listed by conservation practice. The annualized total cost for meeting the INRS targets within the subwatershed is $298,000. This total annual cost includes conservation practice expenditures of $792,000 per year and conservation practices that result in a savings of $494,000 per year. Note that the cost provided are for conservation practices only and are based on values from the INRS, Iowa State University Extension Swine Manure Calculator, and Environmental Quality Incentives Program (EQIP) FY19 payment schedule for Iowa.

In addition to the cost for conservation practices, a subwatershed coordinator will be needed. The role of the coordinator will be to:

- Direct work with government agencies and other project partners
  - Help focus work on the goals/approaches outlined in the subwatershed plan
- Outreach to agricultural producers
- Communication hub with local partners – coordinating center for requests and tracking accomplishments
- Assemble and distribute educational materials
- Managing studies to better focus implementation
- Finding grants and preparing grant applications
- Grant administration and reporting
- Managing projects
- Tracking conservation practice adoption rates in the subwatershed
- Tracking pollutant reductions and success of projects built in the subwatershed
- Monitoring coordination
- Annual reporting

The annual cost for a subwatershed coordinator will be $75,000.

Table 23. 20-Year Total Implementation Costs and Cost/lbs Removed/Year by Conservation Practices

BMP Name	Target Adoption (%)	Quantity		Total Cost
Cover crops	58%	7,549	acres	$5,000,000
Extended rotations	2%	135	acres	$55,000
Nitrogen management: nitrification inhibitor	75%	3,370	acres	-$137,000
Nitrogen management: rate control	50%	5,392	acres	-$147,000
Nitrogen management: source control	36%	2,427	acres	-$2,650,000
Nitrogen management: timing control	51%	3,438	acres	-$934,000
Phosphorus management: placement control	56%	809	acres	$165,000
Phosphorus management: rate control	60%	1,348	acres	-$202,000
Phosphorus management: source control	36%	2,427	acres	-$2,649,000
Contour buffer strips	10%	10	miles	$14,000
Terraces	100%	0	miles	$0

BMP Name	Target Adoption (%)	Quantity		Total Cost
Drainage water management	50%	19	fields	$103,000
Grassed waterways	44%	2	miles	$171,000
No-Till	25%	674	acres	$110,000
Denitrifying bioreactors	25%	14	reactors	$93,000
Nutrient removal wetlands	40%	15	wetlands	$1,358,000
Perennial cover	2%	138	acres	$729,000
WASCOBs	39%	2	basins	$100,000
Riparian buffer: Critical zone buffer	100%	0	miles	$5,000
Riparian buffer: Deep-rooted vegetation buffer	100%	3	miles	$142,000
Riparian buffer: Multi-species buffer	100%	1	miles	$43,000
Riparian buffer: Stiff stem grass buffer	86%	0	miles	$1,000
Riparian buffer: Stream stabilization buffer	75%	0	miles	$4,000
Saturated buffers	50%	7	miles	$2,405,000

9. EVALUATION AND MONITORING

Monitoring in the Village of Reinbeck – Black Hawk Creek Subwatershed is valuable information which can be used to detect trends over time and support future resource management decisions. These decisions may be based on a comparison of monitored conditions to standards, changes detected from completed restoration and protection measures, or changing climate and land uses. The ability of future monitoring efforts to detect such changes and the reliability of comparisons depends upon the nature and design of the recommended monitoring program. Existing monitoring in the Village of Reinbeck – Black Hawk Creek Subwatershed includes water quality and water quantity monitoring.

Water quality monitoring in the Black Hawk Creek Subwatershed is collected by the Iowa Soybean Association (ISA), in cooperation with the City of Cedar Rapids. They collect snapshot water quality monitoring through grab samples. Water samples from the creek are sampled for nitrates, phosphorus, total suspended solids, and *E. coli*. More information about their recent results from the 2018 monitoring season can be found by visiting the Middle Cedar Watershed Tributary Monitoring Results Story Map. This monitoring provides vital information that can be used to detect trends in water quality and help prioritize conservation effort. The ISA monitoring should be continued into the future as a minimum level of water quality monitoring.

Water levels and discharge of Black Hawk Creek are currently monitored by a USGS stream gage, USGS 05463500 Black Hawk Creek at Hudson, IA. Water quantity monitoring should continue in the watershed as it provides information about future flooding in the watershed and is needed to estimate pollutant loads in Black Hawk Creek.

The existing monitoring in the Village of Reinbeck – Black Hawk Creek Subwatershed provides a baseline monitoring that should be expanded in the future. Future monitoring in the Village of Reinbeck – Black Hawk Creek Subwatershed should include new "Sentinel site" monitoring with continuous water quality sensors that will be useful for detecting long-term trends. These sensors could be provided by either the USGS or IIHR. Data collected by the water quality sensors include the following parameters depending upon the specific configuration of the station; nitrate (NO3-N) + nitrite (NO2-N), chlorophyll-A, dissolved oxygen, pH, specific conductance, temperature and turbidity. The sensors are typically deployed in the spring and removed from the stream in the fall to prevent damage from ice. Data from the water quality sensors deployed at sentinel sites will be used to detect long-term trends and seasonal variability, provide nitrate drinking water standard exceedance alerts and to develop pollutant load calculations. In addition to the water quality sensors bi-monthly grab sampling should be conducted throughout the growing season to collect parameters that are not collected by the sensor including nitrate, total phosphorus, dissolved phosphorus, TSS, and *E. coli*. The bi-monthly grab samples will also support the water quality sensor by validating the calibration of the sensor.

Results from monitoring efforts should be reported as quickly as possible. Monitoring that occurs annually should be summarized with an annual report that discusses general observations based on the data collected including, review of compliance against water quality standards and reference conditions, comparisons between sites, trends throughout the year, and reporting of any unexpected

results or difficulties in monitoring activities. Annual pollutant loads should be estimated for every year with adequate data. Every five years, a more detailed monitoring report should be developed that will focus on trend detection and progress towards goals. As part of this plan intensive monitoring should be conducted at year 5, 10, and 20 to evaluate the progress toward the goals in this plan.

Regular review periods will help to determine whether conditions in the subwatershed are improving if progress is being made toward meeting the goals

The subwatershed coordinator should complete an annual report summarizing progress being made toward achieving the recommended conservation practice adoption rates. The report should itemize adoption rates for each of the proposed conservation practices in the subwatershed and an analysis of the benefits being achieved. This analysis can be completed by using the same methodology and tools used to develop the subwatershed plan.

To evaluate the amount of education and outreach in the subwatershed plan, the amount of outreach needs to be tracked. This includes keeping track of the number of meetings held, number of people attending each meeting, and the number mailings sent out to the community. At the 5, 10, and 20 year milestones, a community survey should be conducted to evaluate the community's knowledge of watershed issues and engagement.

The annual report should also summarize that year's monitoring results including average, minimum and maximum pollutant concentrations, and flow data. Annual load of measured pollutants should be determined.

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10. EDUCATION AND OUTREACH

Iowa State University Extension and Outreach developed a detailed education and outreach plan for the Middle Cedar Watershed Management Plan that is applicable to this subwatershed. The education and outreach plan is located in Appendix B.

The following are general strategies to engage urban residents in the subwatershed:

- Get information posted to the Morgan Creek Park parking area. This is a great opportunity to capture the attention of people walking their dogs or going for a hike.
- Host a neighborhood meeting to get a Friends of Morgan Creek Park group started. This is a great way to build community and a platform to start protecting and enhancing the local watershed.
- Partner with TNC has been very active in the Morgan Creek Watershed restoring oxbows in the creek. Get involved with their local activities to help spread the word.
- Partner with the local elementary schools for an opportunity to engage youth in a nature hike and include information on watershed protection.
- Reach out to the press to do press releases and interviews. This watershed plan included a watershed interview with Justin Roberts who hosts a morning talk show on iHeart radio station 600 WMT. This is a great way to reach different audiences, don't be shy!

The Iowa Department of Natural Resources and the Environmental Protection Agency also have some general guidelines for public outreach that can be helpful:

- Involving stakeholders builds trust and support for the process and outcome.
- Successful watershed groups actively recruit members from diverse backgrounds and perspectives to take advantage of their unique skills and ideas.
- Forming a technical advisory team is helpful to provide further watershed-related data and analysis. They are usually comprised of subject matter experts, such as fisheries biologists, regional watershed Basin Coordinators, and Natural Resources Conservation Service staff.
- Coming together and assessing the watershed as a community provides the most current knowledge of water quality problems, generates an understanding how resources are valued, and garners support for the project.
- Pose simple questions to begin: Where are we now and where do we want to go? How do we get there? How will we know that we have arrived?

There are many additional educational resources available from other states and agencies that can be found online, including:

- Iowa Stormwater Education Partnership
- "Welcome to your Watershed" Poster and Game (Maryland Department of Agriculture)
- Growing the Next Generation of Watershed Stewards (Missouri Watershed Education Network)
- "A Watershed Moment: The Delaware River Watershed" (short film)

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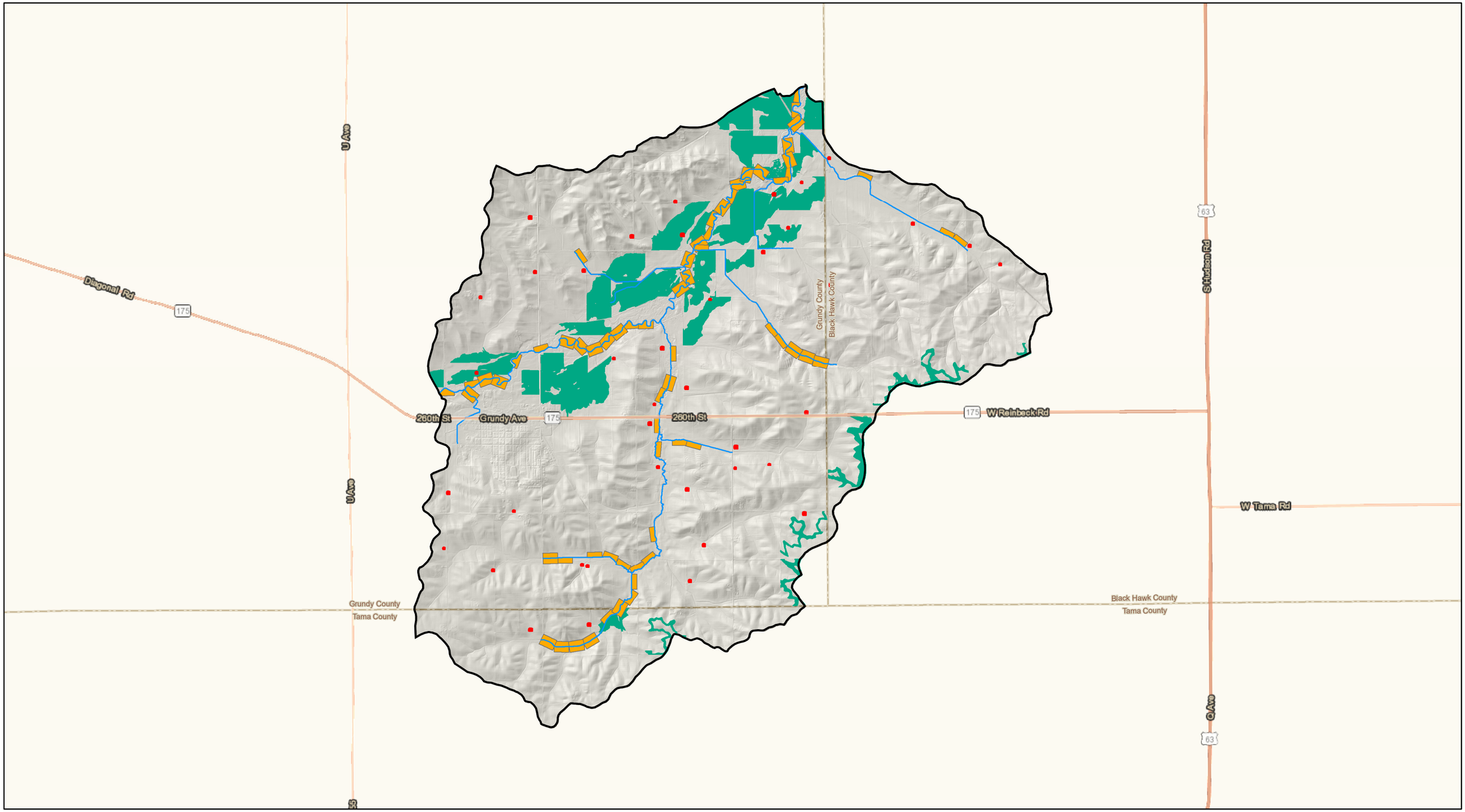
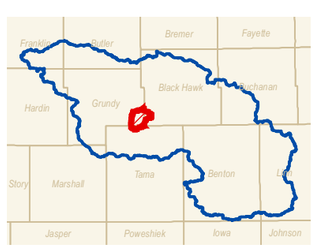
APPENDIX A: CONSERVATION PRACTICE PRIORITIZATION MAPS



EOR water ecology community

Non-prioritized Conservation Practice Locations

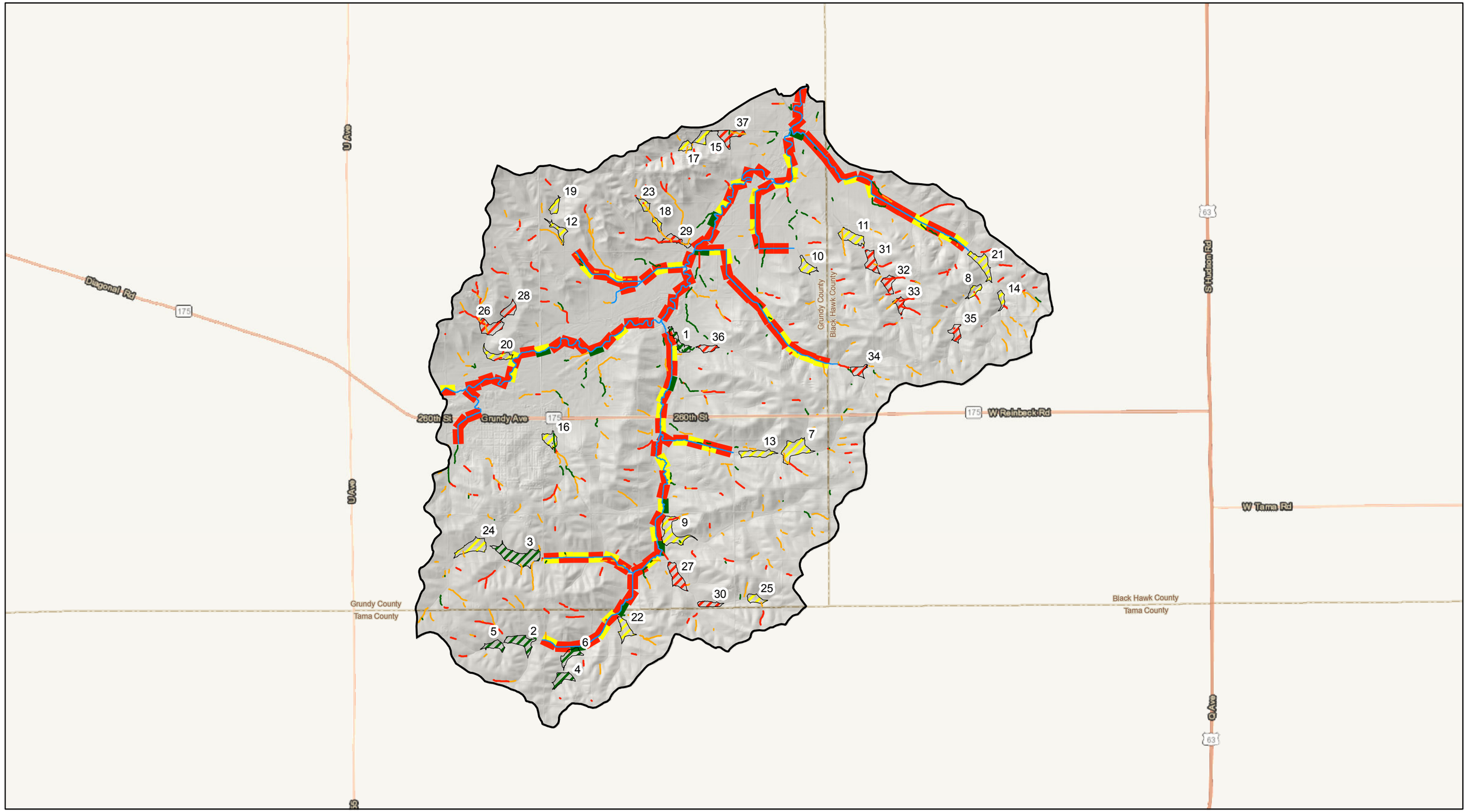
- Denitrification Bioreactor
- Saturated Buffer
- Drainage Water Management



Village of Reinbeck-Black Hawk Creek Subwatershed

Conservation Practice Prioritization
Map #1

Miles
0 1 2



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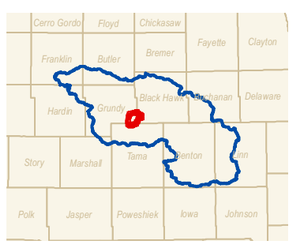
EOR water ecology community

Prioritization of Conservation Practices

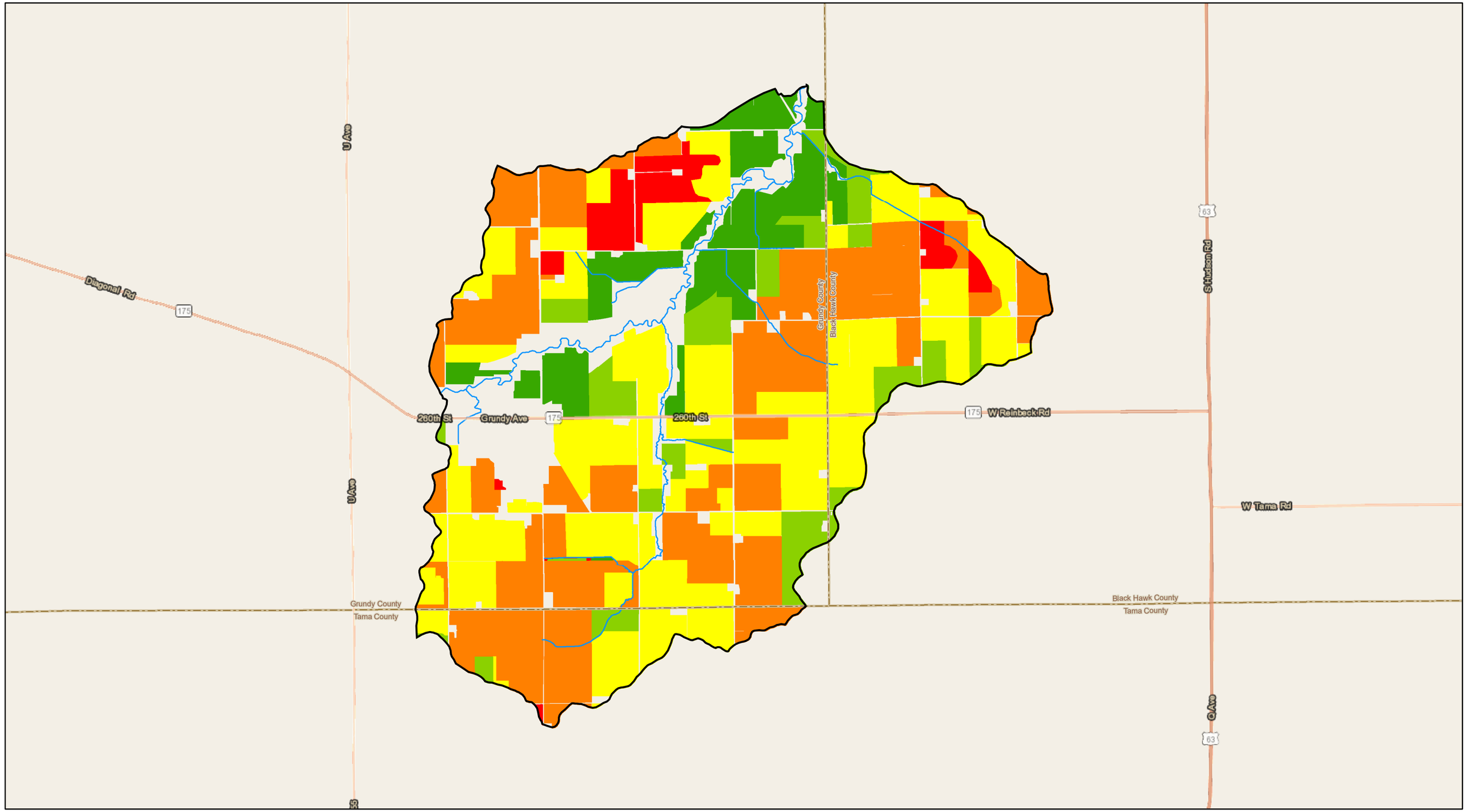
Saturated Buffer	Grass Waterway	Nutrient Treatment Wetland
High runoff risk	Low	Low CSR
Med runoff risk	Medium	Medium CSR
Low runoff risk	High	High CSR



Village of Reinbeck-Black Hawk Creek Subwatershed

Conservation Practice Prioritization
Map #2

Miles
0 1 2



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EOR water ecology community

Prioritization of Conservation Practices: Contour Buffer Strips and Terraces

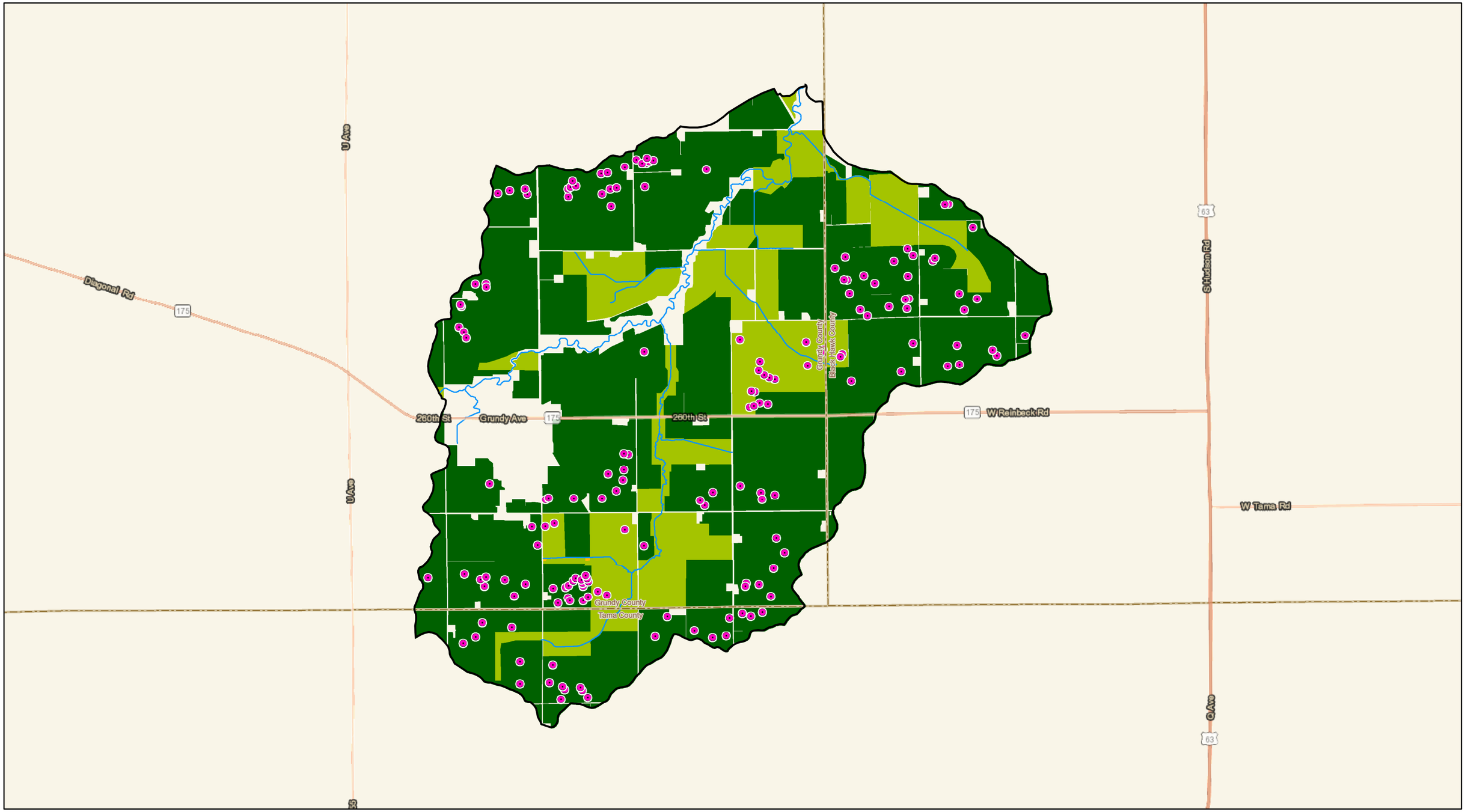
Slope Steepness

- Low
- Medium
- High

Village of Reinbeck-Black Hawk Creek Subwatershed

Conservation Practice Prioritization
Map #3

Miles
0 1 2



EOR
water
ecology
community

Prioritization of Conservation Practices:
Soil Health practices, no-till, perennial cover & WASCOBs

- WASCOB

Run off Risk

- Low
- Medium
- High
- Critical

Village of Reinbeck-Black Hawk Creek Subwatershed

Conservation Practice Prioritization
Map #4

Miles
0 1 2

APPENDIX B. EDUCATION AND OUTREACH ACTION PLAN

The following education and outreach action plan was developed by Iowa State University Extension and Outreach for the Middle Cedar Watershed Management Plan.

It contains strategies and resources that are directly applicable to the Village of Reinbeck – Black Hawk Creek Subwatershed.

Education and Outreach Action Plan

Introduction

The purpose of this plan is to help implement the goals of the future watershed plan for the Middle Cedar Watershed. The education and outreach strategies included in this document have been identified as a result of a one-on-one meeting with the project coordinator and subsequent conversations about project status and needs in the watershed.

This plan provides specific action steps that will help guide the project coordinator in engaging stakeholders and promoting flood reduction and water quality improvement in the watershed. This document will provide the coordinator with a "road map for implementation" over the course of the project. This document will be updated as needed to reflect project coordinator needs and progress.

Action Steps – Early Project Outreach

The following goals, objectives and action steps will support project implementation during 2018 and beyond.

Goal 1: Increase cooperation and communication with key stakeholders

Objective 1: Increase outreach to agricultural stakeholders

Action 1:
Reach out to agricultural organizations once applications are ready and cost-share information is available. Distribute information and seek names of farmers who might be interested in cost-share or who may host small gatherings or outreach events. Seek personal interactions with agricultural organization gatekeepers such as regional directors.

Action 2:
Set up short face-to-face with meetings with local co-op agronomists and agricultural retailers. Ask if a promotional poster or set of resources could be displayed at their business. Alternatively, stop by with doughnuts in the morning or cookies in the afternoon during cold or rainy days when they will likely be in the office. Use the short meetings to describe the project and ask if they are hosting upcoming meetings or events where you could speak or share information with farmers.

Objective 2: Increase partnership with local NRCS/SWCD offices

Action 1:
Ride along with office representative from NRCS serving in priority sub-watersheds on field visit.

Action 2:

Work with the local office to determine if there are interested farmers or landowners in target priority sub-watersheds that may already be on a waiting list for one of the IWA priority practices.

Goal 2: Perform general project outreach to farmers and landowners about new opportunities for cost-share

Objective 1: Initiate project communication with farmers and landowners and host open houses

Action 1:

Host several "Open House" meetings as part of the watershed planning process. Include background on the project, eligible practices, FAQs and begin distributing applications for assistance.

Action 2:

Host field days with organizations that have common goals and valuable event planning experience such as Iowa Learning Farms, Iowa Soybean Association, and Iowa Corn Growers.

Action 3:

Follow up with interested producers to host smaller group conversations. Ask interested farmers to invite 3-4 farmer or landowner neighbors to attend.

Objective 2: Target landowners/producers through Iowa Soybean Association small watershed planning process

Action 1:

Partner with Iowa Soybean Association and collaborate on selecting producers for the planning events

Action 2:

Stay in contact with producers who participate

Objective 3: Target project communication at already-existing events that attract producers

Action 1:

Attend local and regional meetings to network with farmers and landowners. For a list of upcoming events and organization event pages, see below.

Action 2:

If general project communication is received favorably, follow up with interested producers to host smaller group conversations.

Objective 4: Create list of landowners and producers

Action 1:

Collect information from all participants of previously-mentioned outreach events. Always have a pad of paper (name, address, contact info) at your outreach events. Invite producers to sign up to receive more information.

Action 2:

Work with partners who helped plan outreach events (Iowa Learning Farms, Iowa Soybean Association, Iowa Corn Growers, etc.) to determine how they distributed information about events.

Action 3:

Inquire if the NRCS office is willing to provide information about producers in priority sub-watersheds

Action 4:

Use already available data, including parcel shapefiles, Beacon website and possible existing lists from COG.

Goal 3: Perform targeted outreach to producers in priority sub-watersheds

Objective 1: Create targeted practice outreach strategy

Action 1: Make a map.

Consider total number of practices that you will need to place in your watershed for the duration of the grant. Divide those numbers among your priority sub-watersheds based on data from your watershed plan and any other data you find helpful from project partners or tools. Does one sub-watershed have the capacity to place more practices? Create a targeted practice map of your ideal placement. Then, multiply each number by three. You will likely need to reach three farmers or landowners for every one practice that you will ultimately see placed.

Action 2: Use project leads from general outreach and new partnerships.

General mailings, open houses, speaking at existing events, utilizing existing connections and networking with more groups will have given you some leads. Are these leads in your target areas? If not, can they make an introduction to someone who is? Can they host a small group meeting?

Action 3: Plan it out.

Make a timeline of how much interaction and outreach you will need to perform, and where, to reach your goals.

Action 4: Evaluate progress.

Keep a log of targeted outreach. Include who has already been reached, how, when, what message was used and a sense of how you think your message was received. Record questions asked. Adjust your timeline as you get into targeted outreach, and call on partners who can help you with the technical information.

Objective 2: Engage producers in small group conversations. Options include:

Action 1:

Send targeted mailings with information about practices to high priority areas within the sub-watersheds. This will start building awareness in the areas you want to place those practices.

Action 2:

Partner with Iowa Learning Farms and local commodity groups to host a field day in your area about those practices.

Action 3:

Prepare for informal meetings with farmers during harvest. Create a map of farmers that have shown interest in the project and stop by their farms during harvest. Ride along in the combine to discuss harvest progress and opportunities for practice implementation on their farms. Offer them small gestures of candy bars and soda, fruit and Gatorade, a sack lunch or warm meal.

Action 4:

Host a small listening circle with a trusted producer in your watershed. Ask him or her to invite neighbors for an informal learning and discussion session.

Action 5:
Gain access to an informal local event where producers can be casual (ie: church event, social gathering, pancake breakfast, coffee group).

Objective 3: Develop an outreach strategy to non-operator landowners and absentee landowners

Action 1:
Isolate contact information for non-operator landowners from operator landowners. The local NRCS office might be able to help.

Action 2:
Perform personalized outreach to tell them about the project. Call landowners about the project, even if you know they don't live in town. Write them a hand-written note to tell them about the project.

Action 3:
Target absentee landowners with at least one absentee landowner-focused event. For counties with more than 50% absentee landowners, have multiple events/strategies. See below for the percentage of farmland rented by county.

Goal 4: Guide plan implementation and general project communication

Objective 1: Generate needed materials for project outreach

Action 1: *Create large poster to hang at NRCS office on entry desk or wall*

Action 2: *Create desktop poster (travel-friendly) for booths at conferences and events*

Action 3: *Create letters and pamphlets for mailings, reach out to partners for assistance with design, if needed*

Action 4: *Gather needed project materials from partners – 1-page overview of project from Iowa Flood Center, practice-specific infographic publications from Iowa State University Extension*

Action 5: *Create "kit" of materials needed for outreach at meetings, banquets and other outreach events. Are there materials you still need help from project partners in creating?*

Objective 2: Complete necessary paperwork to begin plan implementation and seek board approval

Action 1: *Solicit RFQ for engineering procurement*

Action 2: *Complete practice ranking and prioritization*

Action 3: *Complete participant application for assistance*

Action 4: *Complete landowner agreement*

Action 5: *Complete maintenance agreement*

Objective 3: Establish written communication networks for project

Action 1: *Create a Facebook and Twitter account for the Middle Cedar Watershed*

Action 2: *Use Buffer.com to create scheduled content on social media*

Action 3: *Launch newsletter and begin compiling distribution list*

Action 4: *Write one press release or article per quarter that documents success/generates interest*

Action 5: *Track project communication and outreach and evaluate impact*

Messaging Themes

- Did you know that your land would make a great site for a practice? Target producers based on modeling data
- We have 75% cost share available, and certain practices can have stacked cost-share
- We can all be a part of improving water quality in the Middle Cedar
- We have a great opportunity with substantial resources to reduce flooding and water quality downstream. The work that we do will have measurable benefits, and you can be a part of it.
- Do it for the next generation!
- Do it for our community and economic development opportunities
- Compile a list of all of the common reasons cited for not implementing a conservation practice. Address those reasons (a yeah, but messaging campaign)

Watershed Stakeholders and Partners

Communities In and Near Watershed

Cities					Counties
Ackley	Dike	Grundy Center	Mount Auburn	Stout	**Benton**
Aplington	Dunkerton	Holland	Newhall	Traer	**Black Hawk**
Atkins	Dysart	Hudson	New Hartford	Urbana	**Buchanan**
Beaman	Elk Run Heights	Independence	Norway	Van Horne	**Butler**
Blairstown	Evansdale	Jesup	Parkersburg	Vinton	**Franklin**
Brandon	Fairfax	Keystone	Polo	Walker	**Grundy**
Cedar Falls	Garrison	La Porte City	Reinbeck	Waterloo	**Hardin**
Center Point	Gilbertville	Lincoln	Robins	Wellsburg	**Linn**
Cedar Rapids	Gladbrook	Luzerne	Rowley	Wolford	**Marshall**
Conrad		Morrison	Shellsburg		**Tama**

Co-Ops, Implements, Sales and Equipment Repair

Business	City	Contact
Advance Tillage Systems	Reinbeck	319-345-6419
Blairstown Feed Mill Inc	Blairstown	319-454-6433
B&B Farm Store	Jesup	http://www.bandbfarmstore.com/
Bloes Seeds	Jesup	http://bloesseeds.com/mike_bloes_004.htm
Bodensteiner Implement Company	Rowley	https://www.bodimp.com/
Crop Production Services Fertilizer	Reinbeck	319-345-2123
Dunkerton Cooperative Elevator	Dunkerton	http://www.dunkertoncoop.com/
East Central Iowa Co-Op	Cedar Falls, Hudson, La Porte City, Waterloo	http://www.ecicoop.com/
Fertilizer Dealer Supply	Jesup	https://fertilizerdealer.com/products
FJ Krob & Company Fertilizer Building	Rowley	http://www.fjkrob.com/
Heartland Cooperative	Lincoln, Reinbeck,	Lincoln: 641-473-2640 Reinbeck: 319-788-6831
Interstate Grain Service	Center Point	http://igselevator.webs.com/
John Deere PEC	Waterloo	319-292-8000
Kruger Seeds	Dike	http://www.krugerseed.com/Pages/default.aspx
Landus Cooperative	Dike, New Hartford	Dike: 319-989-2416 New Hartford: 319-983-2259
Linn Coop Oil Company	Newhall	
Muchmore Equipment Inc	Rowley	319-938-2624
Murphy Tractor and Equipment Co	Waterloo	http://murphytractor.com/
New Century FS Inc	Gladbrook, Van Horne, Vinton	Gladbrook: 641-473-2475 Van Horne: 319-228-8221 Vinton: 319-472-2394
P & J Equipment	La Porte City	319-342-3542
P & K Midwest- Local John Deere	Hiawatha	http://www.pkmidwest.com/
Remington Seed Company	Vinton	
Ritchie Industries Inc Farm Equipment Supplier	Conrad	https://ritchiefount.com/
Schminke Equipment	Shellsburg	http://schminkeequipment.com/
Tama Benton Coop	Clutier, Dysart, Vinton	http://www.tamabentoncoop.com/

Extension Specialists in Your Area

Contact Information for Extension Staff by County

- *https://www.extension.iastate.edu/countyservices/*

County Extension Staff Specialists by Region

- Agricultural Engineering Field Specialists: *https://www.extension.iastate.edu/ag/agricultural-engineering*
- Beef Field Specialists: *https://www.extension.iastate.edu/ag/beef*
- Crop Field Specialists: *https://www.extension.iastate.edu/ag/crops*
- Dairy Field Specialists: *https://www.extension.iastate.edu/ag/dairy*
- Swine Field Specialists: *https://www.extension.iastate.edu/ag/swine*

List of Extension Specialists Serving Your Watershed

Name	Specialty, Region	E-mail / Phone
Meaghan Anderson	Agronomist, Region 9	mjanders@iastate.edu / 319-337-2145
Kapil Arora	Agricultural Engineer, Region 2	pbtiger@iastate.edu / 515-382-6551
Terry Basol	Agronomist, Region 4	tlbasol@iastate.edu / 641-435-4864
Jennifer Bentley	Dairy Field Specialist, Region 2	jbentley@iastate.edu / 563-382-2949
Greg Brenneman	Agricultural Engineer, Region 4	gregb@iastate.edu / 319-337-2145
Russ Euken	Livestock Field Specialist, Region 2	reuken@iastate.edu / 641-231-1711
Mark Johnson	Agronomist, Region 7	markjohn@iastate.edu / 515-979-9578
Angie Rieck-Hinz	Agronomist, Region 3	amrieck@iastate.edu / 515-231-2830
Joe Sellers	Beef Program Specialist	sellers@iastate.edu / 641-203-1270
Denise Schwab	Beef Program Specialist	dschwab@iastate.edu / 319-721-9624
Mark Storlie	Swine Program Specialist	mstorlie@iastate.edu / 563-425-3331
Larry Tranel	Dairy Field Specialist Region 3, Eastern Iowa	jbentley@iastate.edu / 563-382-2949

Agricultural Organizations

Organization	Contact
4-H	Location of Clubs: https://www.extension.iastate.edu/benton/page/join-4-h *Benton County Extension Contact* *Black Hawk County Extension Contact* *Buchanan County Extension Contact* *Butler County Extension Contact* *Franklin County Extension Contact* *Grundy County Extension Contact* *Hardin County Extension Contact* *Linn County Extension Contact* *Marshall and Tama County Extension Contact*
Cattlemen's Association	Iowa Cattlemen's Association: 515-296-2266 Call the general number for Iowa Cattlemen's Association and they will direct you to the appropriate contacts in your desired county. Benton County: Facebook

	Buchanan County: Facebook Franklin County: Facebook Hardin County: Facebook
Certified Crop Advisers	Find a CCA by zip code to locate firms in area
Corn Growers	Iowa Corn by District: https://www.iowacorn.org/about/local-iowa-corn-boards/ District 2 Information District 3 Information District 5 Information District 6 Information
Farm Bureau	Benton County: Facebook Contact: 319-472-4710, benton.county@ifbf.org Black Hawk County: Facebook Contact: 319-234-2747, blackhawk.county@ifbf.org Buchanan County: Facebook Contact: 319-334-2561, buchanan.county@ifbf.org Butler County: Facebook Contact: 319-267-2784, butler.county@ifbf.org Franklin County: Facebook Contact: 641-456-4767, franklin.county@ifbf.org Grundy County: Facebook Contact: 319-824-5212, grundy.county@ifbf.org Hardin County: none Contact: 641-939-5428, hardin.county@ifbf.org Linn County: Facebook Contact: 319-393-3276, linn.county@ifbf.org Marshall County: Facebook Contact: 641-753-6637, marshall.county@ifbf.org Tama County: Facebook Contact: 641-484-3361, tama.county@ifbf.org
FFA	Iowa FFA Chapter Locator: http://www.iowaffa.com/chapterlocator.aspx
Iowa Land Improvement Contractors	https://ialica.com/ Social Media: Facebook, Twitter
Iowa Learning Farms	www.iowalearningfarms.org Social Media: Facebook, Twitter
Iowa Soybean Association	The watershed is in ISA Districts 2, 3, 5, and 6 https://www.iasoybeans.com/about/director-listing/ District 2 Directors: April Hemmes, Casey Schlichting District 3 Directors: Rick Juchems, Suzanne Shirbroun District 5 Director: Morey Hill District 6 Director: Robb Ewoldt
Iowa State Dairy Association	http://www.iowadairy.org/
Pork Producers	Iowa Pork Producers Association: 800-372-7675 Contact Iowa Pork Producers and they will direct you to the appropriate contact in your desired county. The watershed is in Districts 3, 4, 7 and 8. District 3 Director: none District 4 Director: James Hogan (Monticello) District 7 Director: David Calderwood (Traer) District 8 Director: Heather Hora (Washington)

	http://www.iowapork.org/about-the-iowa-pork-producers-association/board-of-directors-2/ Benton County: Facebook Buchanan County: Facebook
Practical Farmers of Iowa	http://www.practicalfarmers.org/ Social Media: Facebook, Twitter
Prairie STRIPS Team, Iowa State University	https://www.nrem.iastate.edu/research/STRIPS/ Twitter: https://twitter.com/prairiestrips
Soil Health Partnership (SHP)	http://soilhealthpartnership.org/ Social Media: Facebook, Twitter
Women, Land and Legacy Program	https://womenlandandlegacy.wordpress.com/ Social Media

Conservation, Recreation and Environmental Organizations

Organization	Contact
Benton County Conservation Board	http://www.bentoncountyiowa.org/departments/community-services/county-conservation/ Social Media: Facebook
Black Hawk County Conservation Board	http://www.co.black-hawk.ia.us/176/Conservation Social Media: Facebook
Buchanan County Conservation Board	http://buchanancountyiowa.org/services/conservation/index.php Social Media: none
Butler County Conservation Board	https://www.butlercoiowa.org/index.php/departments/conservation Social Media: Facebook
Ducks Unlimited (Iowa)	http://www.ducks.org/Iowa Social Media: Facebook
Franklin County Conservation Board	https://franklincountyconservation.org/site Social Media: Facebook
Grundy County Conservation Board	https://www.grundycounty.org/departments/conservation Social Media: none
Hardin County Conservation Board	https://www.hardincountyconservation.com/ Social Media: Facebook
Linn County Conservation Board	http://www.linncounty.org/131/Linn-County-Conservation Social Media: Facebook
Marshall County Conservation Board	http://www.co.marshall.ia.us/departments/conservation Social Media: Facebook
Pheasants Forever	http://iowapf.net/ Social Media: Facebook PF Staff: http://iowapf.net/Staff.aspx Find a Chapter: http://iowapf.net/FindAChapter.aspx
Tama County Conservation Board	http://www.tamacounty.org/conserv.html Social Media: none
The Nature Conservancy	https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/iowa/index.htm Social Media: Facebook, Twitter Staff: https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/iowa/contact/index.htm

Specialty Crops Farmers and Organic Producers

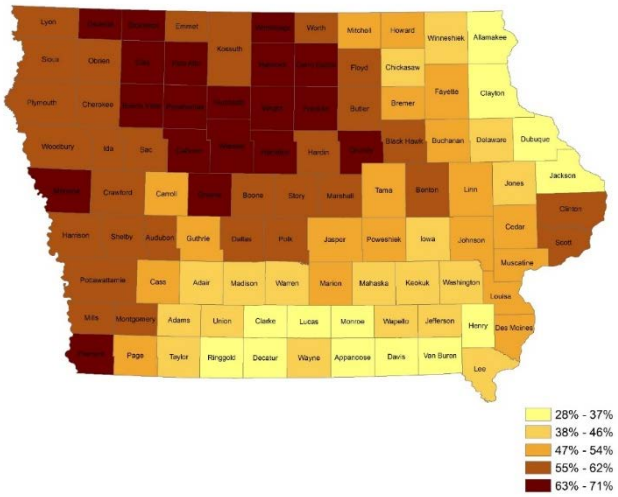
Organization	Location	Contact

Iowa Christmas Tree Growers	Statewide	http://www.iowachristmastrees.com/
Iowa CSA Directory	Statewide	https://www.extension.iastate.edu/localfoods/iowa-csa-directory/
Local Harvest Directory	Nationwide	www.localharvest.org
Pepper Joe's – Home of the World's Hottest Pepper Seeds	Urbana	https://pepperjoe.com/
Practical Farmers of Iowa Local Food Directory	Statewide	http://practicalfarmers.org/member-priorities/local-foods/
USDA Organic Integrity Database – Search "IDALS" as certifier	Nationwide	https://organic.ams.usda.gov/Integrity/

Other Partners and Resources

Organization
Benton, Black Hawk, Buchanan, Butler, Franklin, Grundy, Hardin, Linn, Marshall, Tama County Emergency Management
Benton, Black Hawk, Buchanan, Butler, Franklin, Grundy, Hardin, Linn, Marshall, Tama County Engineer
Benton, Black Hawk, Buchanan, Butler, Franklin, Grundy, Hardin, Linn, Marshall, Tama County NRCS
Coe College
SWCD District Commissioners

Percent Farmland Rented



County	Percent Farmland Rented
Grundy	63%-71%
Benton	55%-62%
Black Hawk	55%-62%
Butler	55%-62%
Franklin	63%-71%
Hardin	55%-62%
Buchanan	47%-54%
Linn	47%-54%
Marshall	55%-62%
Tama	47%-54%

List of Local and Regional Meetings

Below is a list of local and regional events. We hope that you can take advantage of existing events in your area that reach your target audience without having to spend valuable time planning, organizing and marketing for a new event. We suggest that you use these events to get your message out and make initial contact with interested parties and then follow up using smaller group outreach strategies. We will assist in updating this list quarterly in order to give you the most up-to-date and relevant information possible.

Organization	Event	Date and Time	Location	More Information
Ducks Unlimited	Benton County Flyway Dinner	1/27/18 @ 6 PM	Wildcat Dewn Golf Club, Shellsburg IA	http://www.ducks.org/iowa/events/48893/benton-county-flyway-dinner
Iowa Soybean Association	ISA DAC Day	1/30/18	Embassy Suites, Des Moines, IA	https://www.iasoybeans.com/calendar/
Iowa Farm Bureau	Annual Young Farmer Conference	2/2-3/2018	Meadows Conference Center, Altoona	https://www.iowafarmbureau.com/Farmer-Resources/Farm-Bureau-Leaders/Young-Farmer-Program
Ducks Unlimited	Beeds Lake Dinner	2/3/18 @ 5:30 PM	Franklin county Convention Center, Hampton IA	http://www.ducks.org/iowa/events/48848/beeds-lake-dinner
Iowa Soybean Association	ISA Research Conference	2/6-7/18	Iowa Events Center, Des Moines, IA	https://www.iasoybeans.com/calendar/
Iowa Soybean Association	ISA Winter Meeting	2/27/18 @ 9 AM – 11 AM	1555 255th St. (Sukup Mfg.), Sheffield, IA	https://www.iasoybeans.com/calendar/
Iowa Soybean Association	ISA Winter Meeting	3/6/18 @ 9 AM – 11 AM	2223 250th St, Washington, IA	Iowa Soybean Association Calendar
Iowa Soybean Association	ISA Winter Meeting	3/8/18 @ 9 AM – 11 AM	Kirkwood College, Cedar Rapids, IA	Iowa Soybean Association Calendar
Iowa Cattlemen	Tama Feedlot Forum	3/8/18		http://www.iacattlemen.org/events.aspx
National Wild Turkey Federation	Red Cedar Talkin Toms Chapter Meeting	3/10/18 @ 5 PM	Best Western Longbranch, Cedar Rapids IA	http://www.nwtf.org/events
National Wild Turkey Federation	Blue Creek Springtime Monarchs	3/17/18 @ 5 PM	Wildcat Country Club, Shellsburg IA	http://www.nwtf.org/events

	Chapter Meeting			

Other Resources for Events

Ducks Unlimited Iowa Events – http://www.ducks.org/Iowa/events

Iowa Cattleman's Association – http://www.iacattlemen.org/events.aspx

Iowa Corn Growers Events – https://www.iowacorn.org/events/

Iowa Learning Farms Events – https://www.iowalearningfarms.org/page/events

Iowa Land Improvement Contractors Association – https://ialica.com/calendar/

Iowa Pheasants Forever Events – Banquet Calendar

Iowa Pork Producers – http://www.iowapork.org/purebred-swine-council/calendar/

Iowa Soybean Association Events – https://www.iasoybeans.com/calendar/

Iowa Turkey Federation 2018 Summer Meeting – https://www.facebook.com/iowaturkey

Local Farm Bureau Chapter Meetings (contact locally) – https://www.iowafarmbureau.com/Contact-Us

Practical Farmers of Iowa Events – http://www.practicalfarmers.org/news-events/events/

National Wild Turkey Federation, Iowa Chapter – http://www.nwtf.org/events

List of Newspapers and Radio Stations by County

A list of newspapers and radio stations that will reach the target audiences within the watershed are included in this section. Search for a local Iowa newspaper by city or county using the Iowa Newspaper Association website at https://inanews.com/membership/find-an-iowa-newspaper/. Search for local radio station within the Brownfield Ag News network at http://brownfieldagnews.com/radio-stations/iowa-affiliates/.

Benton County

Publication	Contact	Publish Days	Circulation and Readership
Belle Plaine - The Star Press Union 832 12th St Belle Plaine, IA 52208	Phone: 319-444-2520 Fax: 319-444-2522 Website: www.yourweeklypaper.com Email: jibrown@dmreg.com	Wednesday	Circulation: 1,257 Readership: 2,550
Vinton - Cedar Valley Times 108 E 5th St Vinton, IA 52349	Phone: 319-472-2311 Fax: 319-472-4811 Website: www.vintonnewspapers.com Email: debweigel@oelweindailyregister.com	Friday	Circulation: 1,108 Readership: 2,320
Vinton - The Vinton Eagle 108 E 5th St Vinton, IA 52349	Phone: 319-472-2311 Website: www.vintonnewspapers.com Email: debweigel@oelweindailyregister.com	Tuesday	Circulation: 1,100 Readership: 2,292

Black Hawk County

Publication	Contact	Publish Days	Circulation and Readership
Hudson - Hudson Herald 411 Jefferson St Hudson, IA 50643	Phone: 319-988-3855 Website: www.hudherald.com Email: hudherald@gmail.com	Thursday	Circulation: 842 Readership: 1,684

La Porte City - The Progress-Review 213 Main St La Porte City, IA 50651	Phone: 319-342-2429 Fax: 319-342-2433 Website: www.theprogressreview.co Email: grl591@lpctel.net	Wednesday	Circulation: 558 Readership: 1,152
Waterloo - The Courier 100 E 4th Street Waterloo, IA 50703	Phone: 319-291-1400 Fax: 319-291-4014 Website: www.wcfcourier.com	Monday, Tuesday, Wednesday, Thursday, Friday	Circulation: 19,241 Readership: 46,966

Radio station: KCNZ-AM 1650 out of Watoloo/Cedar Falls

Butler County

Publication	Contact	Publish Days	Circulation and Readership
Allison - Butler County Tribune-Journal 422 N Main St Allison, IA 50602	Phone: 319-267-2731 Fax: 319-267-2731 Website: www.butlercountytribune.com Email: miraschmittcash.map@gmail.com	Thursday	Circulation: 690 Readership: 1,392
Clarksville - The Clarksville Star 114 S Main St Clarksville, IA 50619	Phone: 319-278-4641 Fax: 319-278-4641 Website: www.butlercountytribune.com Email: butlersales.map@gmail.com	Thursday	Circulation: 680 Readership: 1,386
Greene - The Greene Recorder 103 E Traer St Greene, IA 50636	Phone: 641-816-4525 Fax: 641-816-4765 Website: www.greenerecorder.com Email: news@greenerecorder.com	Wednesday	Circulation: 828 Readership: 1,656
Parkersburg - Eclipse-News-Review 503 Coates St	Phone: 319-346-1461 Fax: 319-346-1461	Wednesday	Circulation: 1,348 Readership: 2,696

Parkersburg, IA 50665	Website: www.parkersburgeclipse.com Email: eclipse@midamericapub.com		

Franklin County

Publication	Contact	Publish Days	Circulation and Readership
Hampton - Hampton Chronicle 9 2nd St NW Hampton, IA 50441	Phone: 641-456-2585 Fax: 641-456-2587 Website: www.hamptonchronicle.com Email: ryanharvey@iowaconnect.com	Wednesday	Circulation: 1,626 Readership: 3,442
Sheffield - The Sheffield Press 305 Gilman St Sheffield, IA 50475	Phone: 641-892-4636 Fax: 641-892-4636 Website: www.thesheffieldpress.com Email: jzpress@frontiernet.net	Thursday	Circulation: 453 Readership: 968

Radio station: KLMJ-FM 104.9 out of Hampton

Grundy County

Publication	Contact	Publish Days	Circulation and Readership
Grundy Center - The Grundy Register 601 G Ave Grundy Center, IA 50638	Phone: 319-824-6958 Fax: 319-824-6288 Website: www.thegrundyregister.com Email: grundypublisher@midamericapub.com	Thursday	Circulation: 1,885 Readership: 3,770
Reinbeck - Reinbeck Courier 414 Main St Reinbeck, IA 50669	Phone: 319-345-2031 Fax: 319-345-6767 Website: www.reinbeckcourier.com	Friday	Circulation: 425 Readership: 916

	Email: mschlesinger@timesrepublican.com		

Hardin County

Publication	Contact	Publish Days	Circulation and Readership
Ackley - The Ackley World Journal 736 Main St Ackley, IA 50601	Phone: 641-847-2592 Fax: 641-847-3010 Website: www.ackleyworldjournal.com Email: markhh@iafalls.com	Wednesday	Circulation: 838 Readership: 1,718
Eldora - The Hardin County Index 1513 Edgington Ave Eldora, IA 50627	Phone: 641-939-5051 Fax: 641-939-5541 Website: www.eldoranewspapers.com Email: sports@eldoranewspaper.com	Friday	Circulation: 1,057 Readership: 2,116
Eldora - Eldora Herald-Ledger 1513 Edgington Ave Eldora, IA 50627	Phone: 641-939-5051 Fax: 641-939-5541 Website: www.eldoranewspapers.com Email: sports@eldoranewspaper.com	Tuesday	Circulation: 1,035 Readership: 2,114
Hubbard - South Hardin Signal-Review 307B E Maple Hubbard, IA 50122	Phone: 641-864-2288 Email: signalreview@netins.net	Wednesday	Circulation: 661 Readership: 1,322
Iowa Falls - Times-Citizen 406 Stevens St Iowa Falls, IA 50126	Phone: 641-648-2521 Fax: 641-648-4765 Website: www.timescitizen.com Email: jgoossen@iafalls.com	Wednesday, Saturday	Circulation: 2,665 Readership: 5,494

Marshall County

Publication	Contact	Publish Days	Circulation and Readership
Marshalltown - Times Republican 135 W Main St Marshalltown, IA 50158	Phone: 641-753-6611 Fax: 641-753-8813 Website: www.timesrepublican.com Email: mschlesinger@timesrepublican.com	Monday, Tuesday, Wednesday, Thursday, Friday	Circulation: 6,801 Readership: 14,408
State Center - Mid Iowa Enterprise 201 W Main St State Center, IA 50247	Phone: 641-483-2120 Website: www.midiaenterprise.com Email: midiaenterprise@partnercom.net	Thursday	Circulation: 707 Readership: 1,502

Radio station: KFJB-AM 1230 out of Marshalltown

Linn County

Publication	Contact	Publish Days	Circulation and Readership
Cedar Rapids - The Gazette 500 3rd Ave SE Cedar Rapids, IA 52401	Phone: 319-398-8222 Fax: 319-398-5848 Website: www.TheGazette.com Email: Chris.Edwards@gazcomm.com	Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday	Circulation: 34,623 Readership: 85,212
Central City - Linn News-Letter 38 N 4th St Central City, IA 52214	Phone: 319-438-1313 Fax: 319-438-1838 Email: linnnewsletter@iowatelecom.net	Tuesday	Circulation: 2,057 Readership: 4,114
Marion - Marion Times 808 6th St Ste 1 Marion, IA 52302	Phone: 319-377-7037 Fax: 319-377-9535 Website: www.mariontoday.org Email: news@mariontimesonline.com	Thursday	Circulation: 1,500 Readership: 3,000
Mount Vernon - Mount Vernon-Lisbon Sun 108 1st Street W Mount Vernon, IA 52314	Phone: 319-895-6216 Fax: 319-895-6217 Website: http://www.mvlsun.com/ Email: stuartc108@aol.com	Thursday	Circulation: 1,880 Readership: 3,816

Tama County

Publication	Contact	Publish Days	Circulation and Readership
Dysart - The Dysart Reporter 317 Main St Dysart, IA 52224	Phone: 319-476-3550 Fax: 319-476-2813 Website: www.dysartreporter.com Email: mschlesinger@timesrepublican.com	Friday	Circulation: 247 Readership: 646
Gladbrook - Northern-Sun Print 423 2nd St Gladbrook, IA 50635	Phone: 641-473-2102 Fax: 641-473-1004 Website: www.northernsunprint.com Email: mschlesinger@timesrepublican.com	Friday	Circulation: 486 Readership: 1,078
Tama - The Tama News-Herald 220 W 3rd St Tama, IA 52339	Phone: 641-484-2841 Fax: 641-484-5705 Website: www.tamatoledonews.com Email: mschlesinger@timesrepublican.com	Friday	Circulation: 1,165 Readership: 2,736
Toledo - Toledo Chronicle 220 W 3rd St Tama, IA 52339	Phone: 641-484-2841 Fax: 641-484-5705 Website: www.tamatoledonews.com Email: mschlesinger@timesrepublican.com	Wednesday	Circulation: 1,107 Readership: 2,610
Traer - The Traer Star-Clipper 625 2nd St Traer, IA 50675	Phone: 319-478-2323 Fax: 319-478-2818 Website: www.traerstarclipper.com	Friday	Circulation: 596 Readership: 1,344

	Email: mschlesinger@timesrepublican.com		

Iowa-specific newspapers/publications that reach Iowa farmers: Wallaces Farmer, Morning Ag Clips, Agrinews, Iowa Farmer Today, Brownfield Ag News, Iowa Agribusiness Radio Network, Iowa Farm Bureau Spokesman, Farm News, Agriculture.com, Agri View, Corn and Soybean Digest, and Farm Journal Magazine/AgWeb.com

Sample Press Release and Best Practices

Logo Here

"Name of Organization: Slogan or Tagline"

NEWS RELEASE

Contact: Contact Name, Job Title, Phone Number
Organizationwebsiteaddress.com

For Immediate Release
Date:

Direct and Short Title That Includes Key Words

CITY, State – Capture the why (first sentence hook that will lead into your topic) followed by the who, what, when and where in the first paragraph. Remember that you are selling your event or project to someone who may be hearing about it for the first time. Have someone proof your press release for clarity, if possible.

"Never underestimate the power of quotes, which can draw the reader's attention to that area of the article and can be a great way to package your key messages," some communications experts say. Quotes are also a great way to break you press release into small paragraphs, which are more easily readable in a newspaper or magazine format.

Always provide the necessary details on how readers can participate in your event or project within the press release. Readers might not follow through and seek more information about your event after they finish reading the article. Refer readers to a website for more information if it's available, just in case. Keep your press release to 500 words or less. Set up Google alerts for your organizational name, and track who publishes your stories.

Include your "boilerplate" as the last paragraph of the press release. Sometimes organizations also list their project partners or funders. Including a "-30-" at the end of each press release signifies to news organizations that your story is over. When distributing your press release, some experts say to avoid mass-emailing the release to a large group of recipients. Some also suggest copying and pasting the press release below the body of your email as well as attaching it to the email as a Word document.-30-