Prepared by: EOR/IVRCD/ISA

For the Middle Cedar Watershed Management Authority

Morgan Creek HUC-12 Subwatershed Plan

March 2020

water ecology community

Cover Image

Morgan Creek Cedar Rapids, Iowa (Photo credit: Emmons & Olivier Resources)

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1. INTRODUCTION

The following subwatershed plan was developed as a component of the Middle Cedar Watershed Management Plan (MCWMP). The MCWMP was funded through the Iowa Watershed Approach (IWA). 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 IWA is a statewide vision to reduce flood risk, improve water quality, increase resilience, engage stakeholders, and improve the quality of life for those in the state. The Iowa Economic Development Authority (IEDA) was awarded 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 a sincere thank you to the Linn County Conservation staff. This watershed plan greatly benefited from their recent Morgan Creek Park planning process, where Conservation staff generously shared their outreach and education resources. We particularly want to acknowledge Dennis Goemaat, Conservation Director; Jenny Corbett, Naturalist; Shaun Reilly, Park Ranger, and Dana Kellogg, Natural Resource Manager. We would also like to extend our deep appreciation to the residents who shared their time, experiences, and ideas with us, these meeting attendees are: Ellis Vann, Chad Arp, Don and Dorothy Landt, Russ and Judy Blom, Paul Haag, Jayden Pingel, Martin Smith, Dan Voss, Jim O'Connell, Greg Morningstar, Tom and Jay St. Andrew, Bill Robinson, Tim Nance, Polly Horton, Mark Seamans, Kelvin Bronner, Stephanie Vogeler, Randy Buulce, James Houser, Jamie Jonas, Ted Francois, Alex Francois, Lois Deerberg, Ryan Wright, Lee Riece, and Chris Day.

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 subwatershed. **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 the stream impairments within the watershed, with a more detailed analysis of the pollutant assessment included. A narrative describing the issues facing this subwatershed is provided in **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 **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 **Conservation Practice** Prioritization Maps.

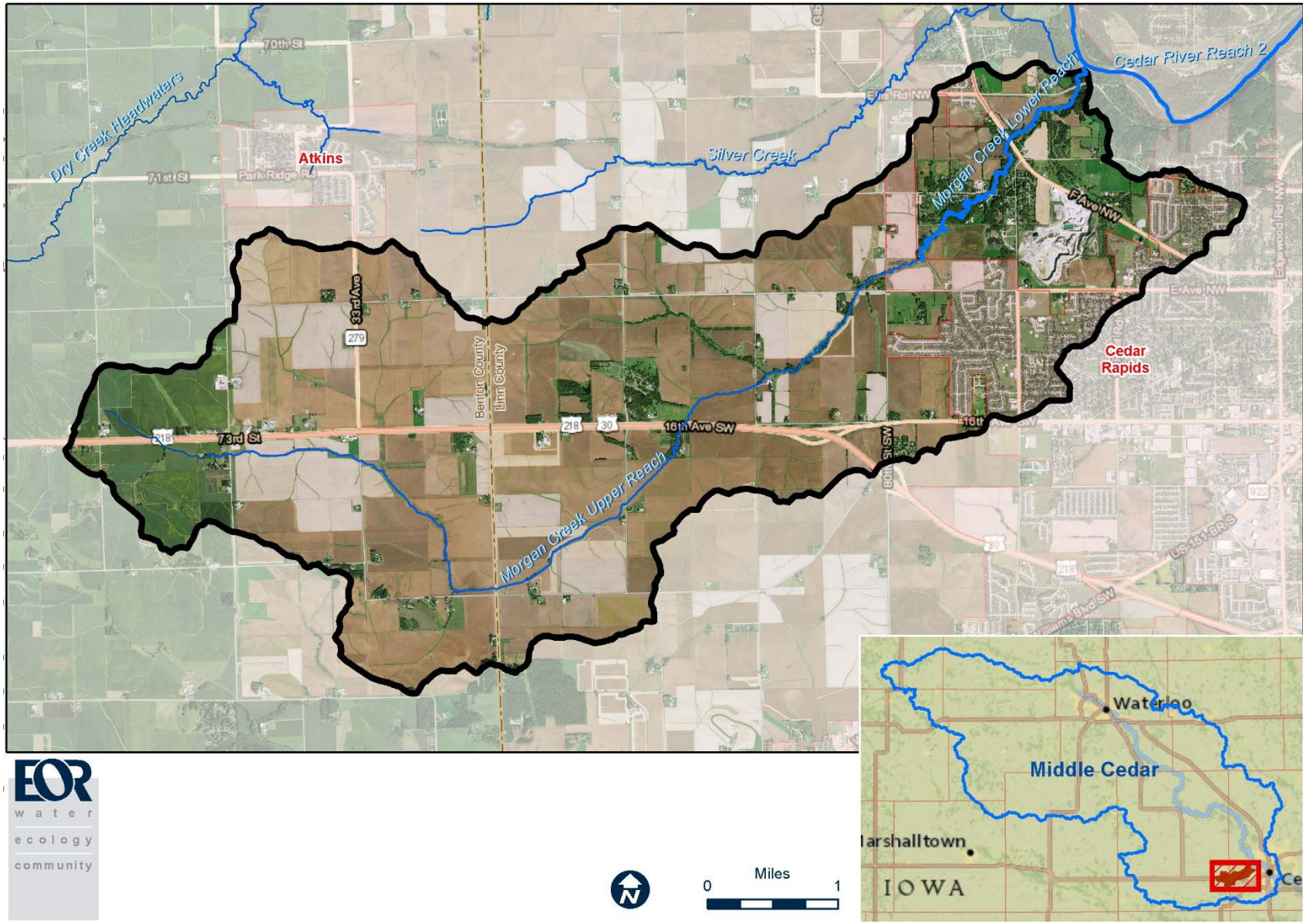

Figure 1. Morgan Creek Subwatershed

2. STAKEHOLDER ENGAGEMENT PROCESS

This subwatershed is located on the western, developing fringe of the City of Cedar Rapids. Land uses in the subwatershed are a mix of agriculture and single family residential areas. As such, the stakeholder engagement process solicited input from residents on both agricultural and urban issues related to water resource management.

The first stakeholder meeting focused on prioritizing conservation practices (e.g. grassed waterways, oxbow restoration, and raingardens), 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 INRS goals. Both meetings were held in Cedar Rapids at the Cedar Hills Community Church and took place on March 13 and April 2, 2018.

The planning team executed a multi-faceted approach to reach residents:

- The watershed planning staff met with the Linn County Conservation Board staff to discuss the upcoming meetings and to gain their ideas and perspectives. The Conservation Board also agreed to disseminate the meeting information throughout their conservation group networks, (e.g. Corridor Conservation Coalition of Linn County and Conservation Partners of Linn County).
- A letter was sent via U.S. postal mail inviting roughly fifty local residents to join the input sessions who were previously engaged in Morgan Creek Park planning efforts with Linn County Conservation Board.
- Informational fliers for the meetings were placed in the virtual backpacks of students at Taft Middle School and Truman, Hoover, Coolidge, and Cleveland Elementary Schools.
- Cedar Rapids placed the events on their Facebook and Twitter social media outlets.
- Linn County Conservation Board staff hung posters in and around Morgan Creek Park.
- Watershed planning staff were invited for two interviews by Justin Roberts, the host of the Mid-Morning Show on AM News radio station 600 WMT (March 15 and April 10, 2018). These interviews provided staff with an opportunity to talk about the watershed planning process and promote information for the input meetings.

Thirty participants, including farmers, landowners, City of Cedar Rapids staff, The Nature Conservancy (TNC) staff, and Linn County staff attended the first meeting. The meeting's agenda was presented in two parts: 1) Covered the context and reasoning for the meeting with basic information regarding watersheds; and 2) 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.

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 INRS, water quality, and flood risk, and were asked to rank them according to their importance. During this exercise, stakeholders identified the following issues:

- Stakeholders wanted to see a list of the waterways that were currently being monitored in the area, and how local citizens would know if there was a problem in the water.
- Stakeholders discussed the drinking water well that is located on Morgan Creek before it feeds into the Cedar River and wanted to know how protected it was from contamination. Cedar Rapids Public Works staff were present to address this question and noted that the City has a separate plan to deal with this shallow water well and can send out information to the group.

In the second exercise, participants ranked conservation practices based off what they believed would have a high adoption rate in their watershed. The planning team explained each item on the list of presented conversation practices and described the specific benefits and challenges of each practice, which included grassed waterways, saturated buffers, and nitrification inhibitors. Out of this exercise, the group identified the following issues:

- Stakeholders wanted to know why residential individuals should adopt practices when commercial areas own more parking lots, sidewalks, and buildings that contribute runoff to nearby streams and creeks.
- Several stakeholders noted that without education about the practices and cost share it was difficult to gauge whether people would implement practices on their property. One suggestion was to host events that displayed local practices to highlight champions in the watershed and provide opportunities for residents to see how the practices function and discuss the process for implementation.
- Stakeholders asked pointed questions about each practice, such as how do bioswales work? Is permeable paving feasible in the Midwest? Are there urban examples of native grasses? Additional discussion included stormwater practices in the new residential housing developments and watershed impacts from the highway construction occurring on the western fringe of Cedar Rapid's municipal border.

Overall, this group of individuals participated in a lively discussion and several individuals discussed forming a "Friends of Morgan Creek Watershed" group to continue the momentum.

Outreach to residents for the second stakeholder engagement meeting included an email to all of the original attendees of the first input meeting. For those whose contact information was available, they also received a personal follow-up call the week leading up to the meeting. Eighteen people were present.

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 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 group felt that the rankings were reasonable and noted that all categories were important. Upon reviewing the results of the prioritized practices, the three highest priorities selected were native landscaping, grassed waterways, soil quality management, and no till/strip till. 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 financial assistance.

During the second half of the meeting, the planning staff presented the group with watershed modeling data and asked everyone to discuss reasonable 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-modeling 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:

- Stakeholders agreed that both urban and rural practices are important.
- County stormwater regulations are not as strict as city regulations and they were worried about development outpacing the regulations.
- Several stakeholders wanted to know if there was specific funding ear-marked for further watershed education in urban areas.
- The representative from the Cedar Rapids Stormwater Program noted that, Cedar Rapids does have a robust stormwater education program that host events, informs policies, and has a cost-share program for residents who want to install best management practices.
- Farmers expressed concern over the amount of land that wetlands take out of production.
- Farmers felt that no till/strip till practices are already occurring in the watershed, which was a practice they felt was reasonable to expand if given the right conditions (e.g. available funding, education).
- Stakeholders agreed that practices which benefit the public but have less benefit for the landowner will really require financial and technical support.

3. WATERSHED CHARACTERIZATION

3.1. General Background

The Morgan Creek Subwatershed spans Linn and Benton County and includes a portion of Cedar Rapids (**Figure 1**). According to the 2010 US Census Bureau data, the estimated population of the subwatershed is 4,707. The population density of the subwatershed is 377 people per 1000 acres. The Morgan Creek Subwatershed population represents approximately 2.0% of the total population of the Middle Cedar Watershed (MCW). The Morgan Creek subwatershed includes Morgan Creek Park, which is located on the northwest side of Cedar Rapids, and is one of the County's premier natural areas.

The 12,175 acre Morgan Creek Subwatershed is classified as a HUC-12 Subwatershed (070802051506) in the United States Geological Survey (USGS) hierarchical system. It is a subdivision of the Blue Creek HUC-10 Watershed (0708020515) and the Middle Cedar HUC-8 Subbasin (07080205).

3.2. Land Cover

The predominant land cover of the Morgan Creek Subwatershed is row crop agriculture. According to the High Resolution Landcover (HRLC) of Iowa 2009 data set the subwatershed is 67% 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.

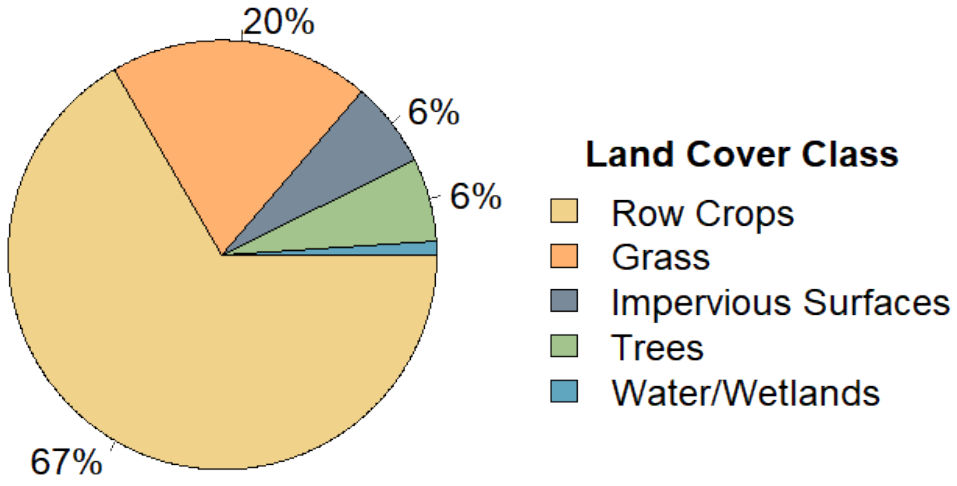

Figure 2. Land Cover of the Morgan Creek Subwatershed

3.3. Streams

The Morgan Creek Subwatershed is home to three distinct segments of Morgan Creek, although for simplicity, we refer to the upper segment as the Upper Reach and the lower two segments as the Lower Reach (see **Figure 3**).

Morgan Creek Upper Reach Defined as the following: From the south boundary of the Morgan Creek Park (south line NW1/4, S22, T83N, R8W, Linn Co.) to the confluence of Unnamed Creek (S34, T83N, R9W, Benton Co.) This reach of Morgan Creek has designated use classification of A2 B(WW-2).

Morgan Creek Lower Reach Segment 1 Defined as the following: From the road crossing (NE1/4, S22, T83N, R8W, Linn Co.) to the south boundary of the Morgan Creek Park (west line of S22, T83N, R8W, Linn Co.). This reach of Morgan Creek has designated use classification of A3 B(WW-2). This is the reach of Morgan Creek within the Morgan Creek Park where recreational use is common.

Morgan Creek Lower Reach Segment 2 Defined as the following: Mouth (S14, T83N, R8W, Linn Co.) to the road crossing (NE1/4, S22, T83N, R8W, Linn Co.). This reach of Morgan Creek has designated use classification of A2 B(WW-2).

The designated uses are 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.

Children's recreational use: Class A3 - Waters in which recreational uses by children are common. Class A3 waters are water bodies having definite banks and bed with visible evidence of the flow or occurrence of water. This type of use would primarily occur in urban or residential areas.

Warm water Type 2: Class BWW-2 - Waters in which flow or other physical characteristics are capable of supporting a resident aquatic community that includes a variety of native nongame fish and invertebrate species. The flow and other physical characteristics limit the maintenance of warm water game fish populations. These waters generally consist of small perennially flowing streams.

3.4. Lakes

There are no lakes in the Morgan Creek subwatershed.

3.5. Ground Water

The Morgan Creek subwatershed contributes drainage to the City of Cedar Rapids drinking water supply wells. Cedar Rapids has been designated by the Iowa Department of Natural Resources (Iowa DNR) as a Highly Susceptible Community Water Supply and a Priority Community Water Supply System. A Source Water Protection Plan is being developed for the City of Cedar Rapids.

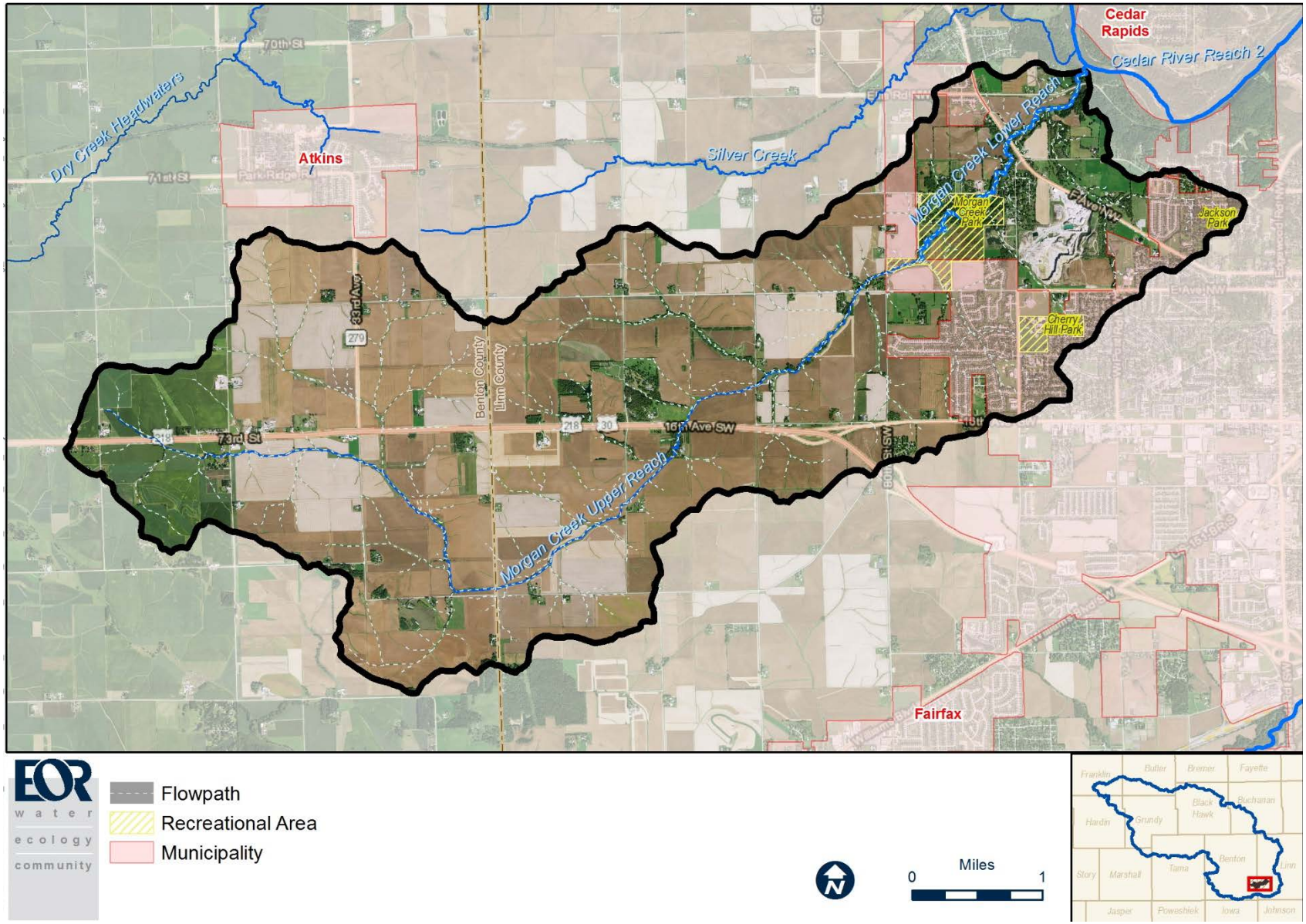

Figure 3. Water Resources of the Morgan Creek Subwatershed

3.6. Flooding

The primary flooding within the subwatershed occurs near the confluence with the Cedar River, although there is some flooding along the upper reach of the creek as well. **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 $628,871 according to the Flood Risk Report for the Middle Cedar River developed by the Federal Emergency Management Agency (FEMA) (2015). This loss is equivalent to roughly $130 per resident of the subwatershed. The Morgan Creek subwatershed has the 42nd 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.

3.7. Water Quality

3.7.1. Nonpoint Pollutants

Nonpoint source pollutants traditionally addressed in watershed management plans include sediment, fecal bacteria, 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 (CECs), 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.

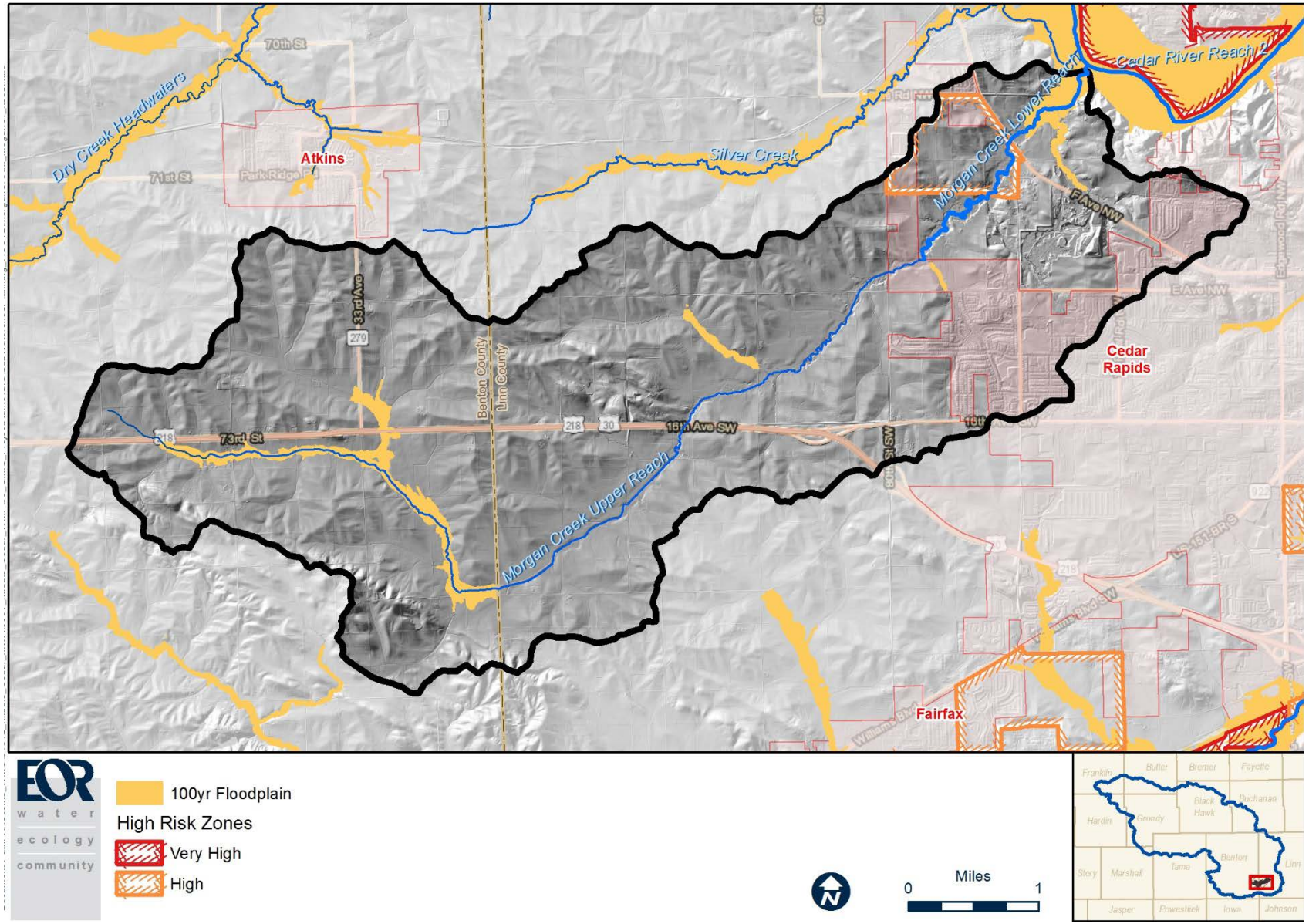

Figure 4. Flooding within the Morgan Creek Subwatershed

Bacteria

Disease producing (pathogenic) organisms are a prevalent nonpoint source 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 lower reach of Morgan Creek and several segments of the Cedar River (refer to the **Cedar River Watershed Bacteria TMDL** section). The Morgan Creek Subwatershed contributes to an impaired segment of the Cedar River. The segment is defined as the Cedar River from Highway 30 Bridge at Cedar Rapids to Confluence with Prairie Creek.

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. A relationship can be established dissolved reactive phosphorus and total phosphorus for comparison to the Minnesota stream standard.

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 class C). The Morgan Creek Subwatershed discharges directly into this segment of the Cedar River. Class C waters have been given a water quality standard of less than 10 mg/L of nitrate as N (NO3-N).

3.7.2. Subwatershed Monitoring Data

Coe College, in cooperation with the City of Cedar Rapids has conducted water quality monitoring since 2012 on several tributaries of the Cedar River including Morgan Creek. The monitoring is conducted once a month for the months May through August. Monitoring results show elevated levels of nitrate, dissolved reactive phosphorus, and *E. coli* (see **Table 1** and **Table 2**)

Table 1. Coe College Snapshot Monitoring Results: Nitrate, DRP and TSS, 2012-2016

	Average Monthly Concentration				Annual Average Concentration
	May	June	July	August	
Nitrate Nitrogen (mg/L)	10.2	10.8	7.6	5.7	8.6
Dissolved Reactive Phosphorus (mg/L)	0.25	0.24	0.14	0.12	0.19
Total Suspended Solids (mg/L)	74.4	33.2	12.4	9.4	32.4

Table 2. Coe College Snapshot Monitoring Results: *E. coli*, 2012-2016

	Annual Geometric Mean					Average Annual Geometric Mean
	2012	2013	2014	2015	2016	
E. coli (geometric mean - MPN/100mL)	391	416	902	982	820	702

The ISA conducted snapshot monitoring during 2018 at several tributaries to the Middle Cedar River, including a site on Morgan Creek at Covington Road. ISA snapshot monitoring for 2018 is shown in **Table 3**. Monitoring results in bold indicate elevated levels of dissolved reactive phosphorus and *E. col*. A final report summarizing the findings of the 2018 monitoring is available from the City of Cedar Rapids.

Table 3. ISA Snapshot Monitoring Results for Morgan Creek (Site: CR56), 2018 Averages

Parameter	Average Concentration
Total Suspended Solids (mg/L)	17.5
***E. coli* (MPN/100mL)**	**1,000**
Nitrate as N (mg/L)	5.57
Dissolved Reactive Phosphorus as P (mg/L)	**0.063**

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 a 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 U.S. 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 lower reach of Morgan Creek has been assessed by the Iowa DNR and determined to be impaired. A summary of the assessment is found in **Table 4**. Details on the assessment and resulting impairment listings can be found at the following link: https://programs.iowadnr.gov/adbnet/Segments/513.

Table 4. Morgan Creek Segment 513 Assessment Summary (Iowa DNR ADBNet)

Impairment Code	5p - Impairment occurs on a waterbody with a presumptive A1 or B(WW1) use.
Cause Magnitude	High
Status	Continuing
Source	Unknown: Source Unknown
Source Confidence	N/A
Cycle Added	2014
Impairment Rationale	Geometric mean criterion exceeded (*E. coli*)
Data Source	Special project/study - Worchester Road (STORET station 15570009); May 2010 - July 2011

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

> The presumptive Class A1 (primary contact recreation) uses remain assessed (monitored) as "not supported" based on levels of indicator bacteria that exceeded state water quality criteria. The geometric means of indicator bacteria (*E. coli*) in the 12 samples collected during the recreation season of 2010 (730 orgs/100 ml), and the geometric mean of the 12 samples collected during the recreation season of 2011 (1,152 orgs/100 ml) both exceeded the Class A1 criterion of 126 orgs/100 ml. All of the combined 24 samples (100%) exceeded Iowa's 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 the geometric mean is greater than 126 orgs/100 ml, the primary contact recreation uses should be assessed as "impaired" (see pages 3-33 to 3-35 of U.S. EPA 1997b).
>
> Despite impairment of the Class A1 uses, results of ambient water quality monitoring at station 15570009 in 2010 and 2011 indicate good chemical water quality in this stream segment and "full support" of the Class B(WW2) aquatic life uses. No violations of Class B(WW2) water quality criteria for pH or temperature occurred in the 24 samples analyzed from May 2010 to July

2011. One of the 24 samples (4%) violated the Class B(WW2) criterion for dissolved oxygen. The sample collected on August 4, 2010 at 8:30 AM contained 4.7 mg/l of dissolved oxygen, thus violating the criterion of 5.0 mg/l. According to U.S. EPA guidelines for Section 305(b) reporting, if more than 10% of samples exceed state criteria for conventional parameters such as dissolved oxygen, the aquatic life uses should be assessed as "impaired" (see pgs 3-33 to 3-35 of U.S. EPA 1997b). According to Iowa DNR's assessment/listing methodology, however, the results from station 15570009 do not indicate that significantly greater than 10% of the samples exceed the Class B(WW2) criterion for dissolved oxygen. Thus, the results of chemical/physical water quality monitoring in 2010 and 2011 at station 15570009 suggest that the Class B(WW2) aquatic life uses should be assessed (monitored) as "fully supported."

3.7.4. Total Maximum Daily Load (TMDL) Studies

The Morgan Creek Subwatershed drains to Cedar River from McCloud Run (S16, T83N, R07W) to the confluence with Bear Creek (S21, T84N, R08W) (IA 02-CED-0030_2), an impaired stream segments for which a TMDL study has been developed for Nitrate and *E. coli* (Figure 5). 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 (WLA) 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 (MS4) Communities and concentrated animal feeding operations (CAFOs). Nonpoint sources receive a load allocation (LA) and include all remaining sources of the pollutant as well as natural background sources.

Cedar River Watershed Bacteria TMDL

Environmental Protection Agency (EPA) Region 7 developed the *Total Maximum Daily Load Cedar River Watershed, Iowa for Indicator Bacteria, Escherichia coli (E. coli)* in 2010. The TMDL covers the entire Cedar River watershed and includes four impaired segments of the Cedar River within the MCW. Two additional reaches of the Cedar River downstream of the Middle Cedar are included in the TMDL which is relevant because the entire MCW drains to these impaired reaches and, therefore, is subject to the TMDL. The primary contact recreation (Class A1) uses for each stream reach were determined to be impaired by the indicator bacteria *E. coli*. Based on a review of the flow and water quality data available throughout the watershed, it was determined that bacterial concentrations were primarily a function of flow, therefore a flow-variable daily load was selected to represent these TMDL studies. The TMDL establishes the level of bacteria reductions over a range of flows that would be needed for each reach to meet water quality standards.

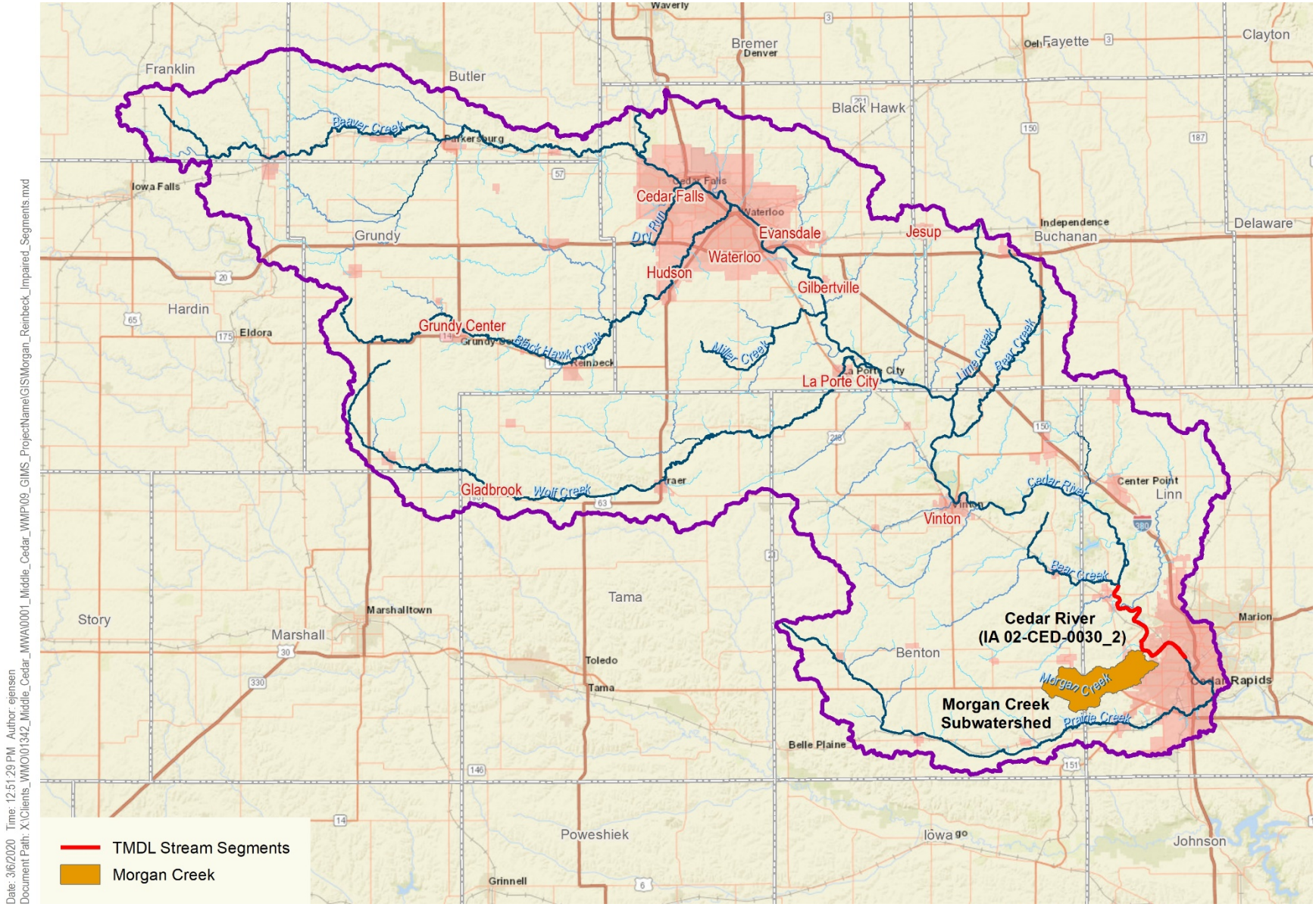

Figure 5. TMDL Stream Segment.

The TMDL includes an informational implementation plan. An implementation plan is not a requirement for a TMDL but EPA Region 7 developed a model (Hydrologic Simulation Program Fortran (HSPF)) to test potential scenarios. The model determined that the following scenario will result in the river reaches meeting the Iowa water quality standards. This scenario assumes that all wastewater treatment plants (WWTP) effluent and rivers entering Iowa will have bacteria concentrations less than or equal to the Iowa water quality standard.

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

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-N.

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. The 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-N/year from the current loading of 28,561 tons nitrate-N/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, best management practices (BMPs) focused on reducing surface water nitrate-N concentration. These practices include fertilizer reduction, wetland construction, and conservation reserve program (CRP) enrollment. The implementation plan further recommended focusing more heavily on subbasins that have higher nitrate loading per unit area.

3.8. Recreational Opportunities

There are currently no formal water-based recreational uses of Morgan Creek within the subwatershed other than passive use associated with Morgan Creek Park. There are several recreation opportunities in the region, particularly on the downstream Cedar River. For more information on 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 subwatersheds for future implementation.

3.9.1. SWAT Model

The World Wildlife Federation (WWF) along with researchers at the University of Minnesota (UMN) 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 USDA Agricultural Research Service. 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-yr period from 1/1/2004 to 12/31/2013 and has a fairly coarse 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 subwatersheds 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 5**).

Table 5. SWAT Model Results for the Morgan 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)
20.4	55	2.5	15	8.5	51	1.6	13

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 6**). Note that this is a different measurement than the sediment loading estimate derived from the SWAT Model.

Table 6. Daily Erosion Project Results for the Morgan Creek Subwatershed

Average Annual Soil Detachment		Average Annual Hillslope Soil Loss	
Tons/Acre	MC Rank (# of 68)	Tons/Acre	MC Rank (# of 68)
4.2	24	3.9	24

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 wastewater treatment facilities and Iowa DNR Animal Feeding Operations. Neither of these types of facilities were identified in the Morgan 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. During the summer of 2019 a windshield survey was conducted to identify potential sources of pollutants in the watershed. Land use identified as part of the survey were grouped into five categories based on the types of sources for each land use (Figure 6). The most widespread potential source based on area was crop sources. The main sources for *E. coli* in cropland is through improper manure management and cattle grazing after harvest. Areas in the subwatershed where there may be a high density of animals are part of farmstead sources and pasture sources. Farmstead sources include the potential for open feedlots and failing septic systems. In total there were 51 active farmsteads. However, there was an estimated 125 failing septic systems in the subwatershed, based on failure rates reported in the Cedar River Bacteria TMDL and housing estimates from the 2010 US Census (**Table 7**). The other areas where there may be high density of animals in the growing season are pasture sources. These areas were identified as some type of grass

or brush. Pasture sources include runoff from the pasture and animals in the stream. There were few areas identified as having the potential to be pasture. Therefore, the amount of animals that have direct access to the stream is most likely limited. The amount of animals in the subwatershed were based on area weighting of the USDA 2012 Animal Census estimates (**Table 8**). Similar to pasture, the amount of natural source area was limited. Potential sources within natural areas are mainly from high density of wildlife such as deer and birds. The last group was from urban sources. The main source of *E. coli* from urban areas is from pet waste.

Table 7. Failing Septic Systems in Morgan Creek Subwatershed (U.S. Department of Commerce 2010)

	Population	Number of Households	Number of Failing Septic Systems
Morgan Creek	611	250	125

Table 8 Number of Animals in Morgan Creek Subwatershed (Gronberg & Arnold 2017)

Animal Type	Number of Animals
Horses	29
Beef Cattle	886
Dairy Cows	61
Sheep	45
Hogs	8,235
Poultry	10

Estimates of *E. coli* loading in the stream were quantified similarly to a TMDL using monitoring stations within the subwatershed. Flow measurements were recorded at Morgan Creek near Covington Iowa (USGS 05464475), from April 16, 2019 to the present. Water quality measurements were taken at Morgan Creek at Worchester Rd. over the growing seasons of 2008 through 2011. To estimate the loads outside of the stream gage monitoring, the discharge percentile percentile discharge (QPPQ) method was used with Rapid Creek near Iowa City, IA (USGS 05454000) serving as a reference station (Lorenz and Ziegweid 2016). Rapid Creek near Iowa City, IA was within the recommended drainage area ratio, (0.66 compared to 0.25) and distance (24.4 miles compared to 50 miles). Furthermore, the overlapping flow records had a high correlation based on a Spearman's rho score of 0.89 (**Figure 7**).

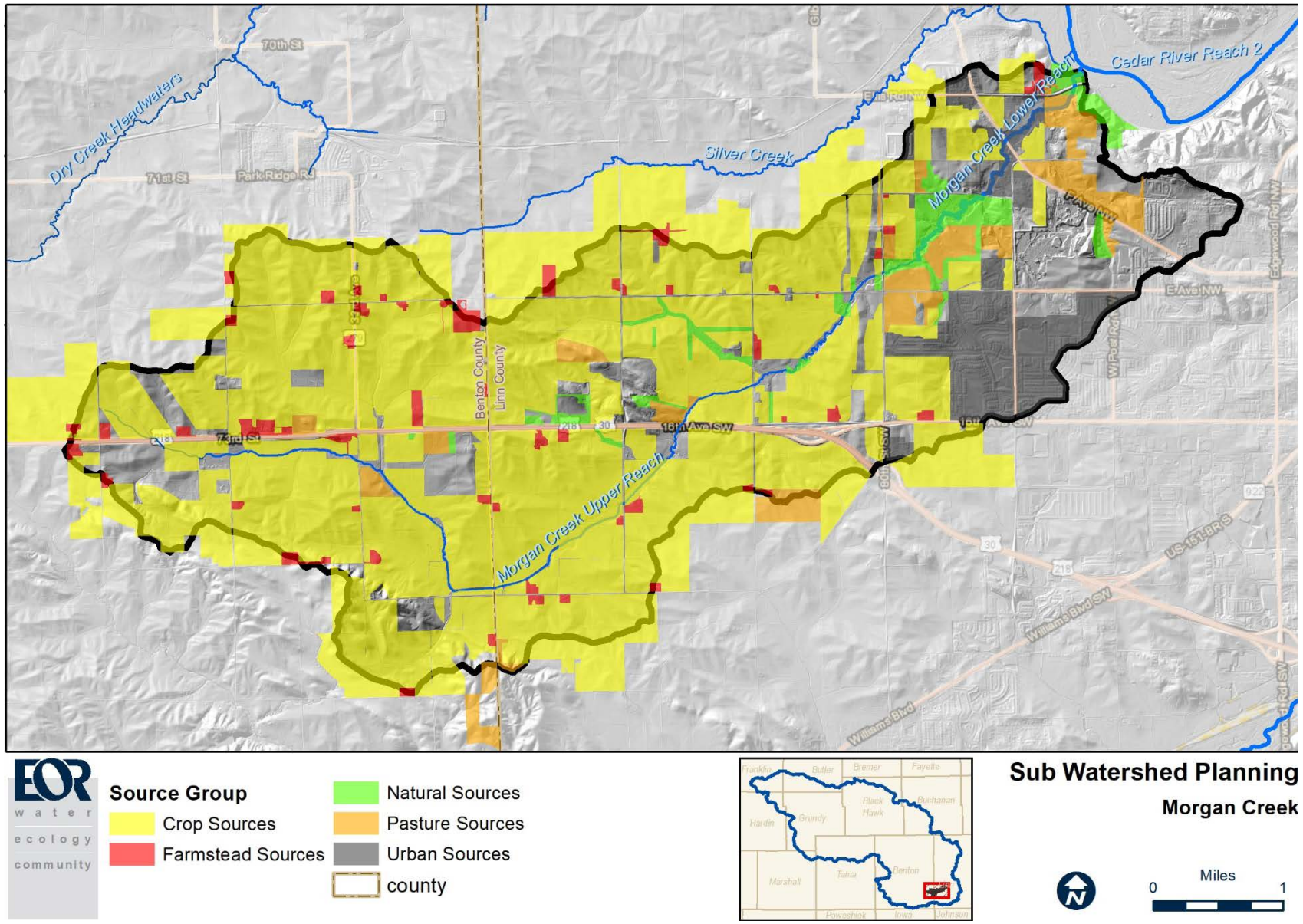

Figure 6. Potential sources in the Morgan Creek Subwatershed.

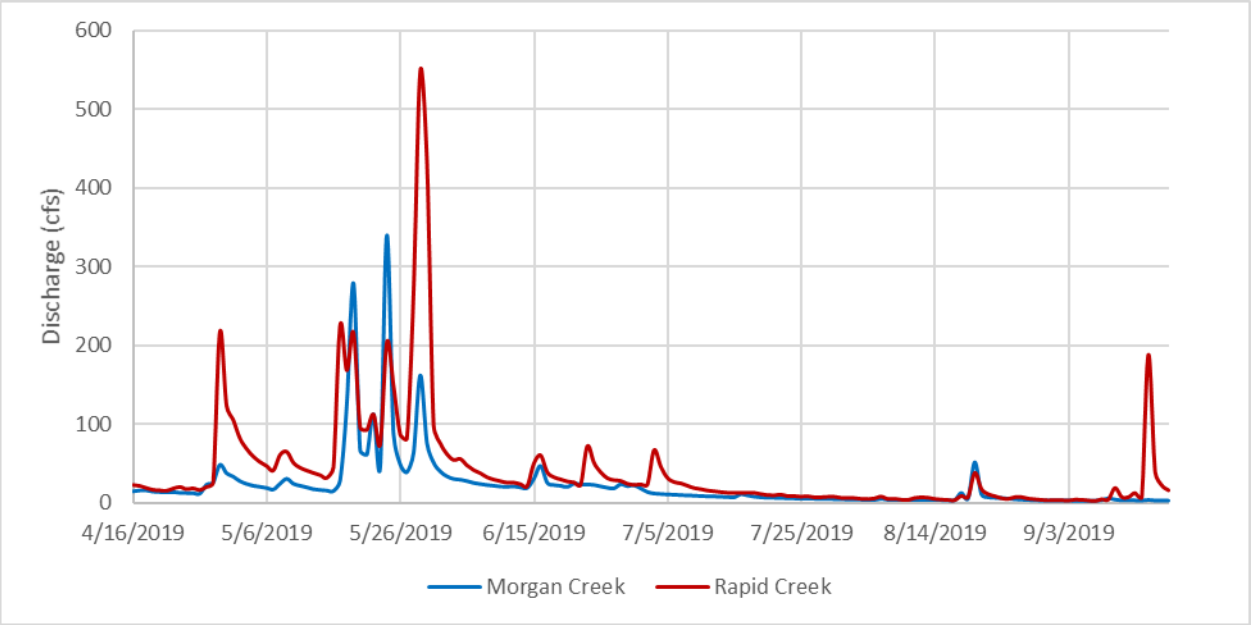

Figure 7. Morgan Creek and Rapid Creek Hydrograph Comparison.

Estimates of the median existing *E. coli* load for each flow regime are shown in **Table 9**. The loading from failing septic systems were based on the US 2010 Census and assumptions in the Cedar River *E. coli* TMDL (EPA 2010) which assumed a septic system failure rate of 50% and per person *E. coli* load of 0.0265 billion org./person-day. The remainder of the existing load was grouped as watershed runoff which includes runoff from urban sources, natural sources, crop sources, and pasture sources.

Table 9. Estimated Existing Load Allocation for *E. coli* in Morgan Creek.

Morgan Creek Existing Load Components		Flow Regime				
		Very High (cfs)	High (cfs)	Mid (cfs)	Low (cfs)	Very Low (cfs)
		67.0	23.3	12.5	4.5	2.9
		E. coli (billion org. per day)				
Existing Load		***2,467.8***	***416.9***	***303.3***	***n/a***	***n/a***
Permitted Sources	**Total Permitted Sources**	**0**	**0**	**0**	**0**	**0**
Nonpermitted Sources	*Failing Septics Systems*	*8.3*	*8.3*	*8.3*	*8.3*	*8.3*
	Watershed Runoff	*2,459.5*	*408.6*	*295.0*	*n/a*	*n/a*
	Total Nonpermitted Sources	**2467.8**	**416.9**	**303.3**	**n/a**	**n/a**

4. ISSUES

As noted in the Stakeholders Engagement Process, stakeholders in both input meetings helped to identify important issues to them and their community. In particular, 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 streambank stabilization: Specifically, participants identified the need for farm fields to control runoff rates in their fields before it reaches the creek, there are large areas where the streambank is deteriorated.
- Well-water protection: Stakeholders expressed the desire to know more about how the drinking water well located on the Morgan Creek is being protected.
- Tree buffer: Stakeholders expressed a strong desire to keep the trees in the Morgan Creek Arboretum.
- Public access to information: Stakeholders stated that they want the data from the watershed planning process to remain public so they can hold decision-makers accountable.
- Creek clean-up/group formation: Several stakeholders expressed concern for the amount of debris located in and around Morgan Creek. A few people suggested forming a Friends of Morgan Creek group to formalize participation and organize a strategy to improve the creek.
- Monitoring: Stakeholders wanted to see a list of the waterways that were currently being monitored in the area, and how local citizens would know if there was a problem in the water.
- Education/Outreach: Several stakeholders noted that without education about the practices and cost share it was difficult to gauge whether people would implement practices on their property. One suggestion was to host events that displayed local practices to highlight champions in the watershed and provide opportunities for residents to see how the practices function and discuss the process for implementation. Cedar Rapids does have a robust stormwater education program that host events, informs policies
- Best Management Practices: Stakeholders asked pointed questions about each practice, such as how do bioswales work? Is permeable paving feasible in the Midwest? Are there urban examples of native grasses? Additional discussion included stormwater practices in the new residential housing developments and watershed impacts from the highway construction occurring on the western fringe of Cedar Rapid's municipal border. Residents wanted to know why residential individuals should adopt practices when commercial areas own more parking lots, sidewalks, and buildings that contribute runoff to nearby streams and creeks. Participants agreed that both urban and rural practices are important. Farmers expressed concern over the amount of land that wetlands take out of production. And felt that no till/strip till practices are already occurring in the watershed, which was a practice they felt was reasonable to expand if given the right conditions (e.g. available funding, education

- Regulations: Stakeholders felt that County stormwater regulations are not as strict as city regulations and they were worried about development outpacing the regulations.
- Funding: Several stakeholders wanted to know if there was specific funding ear-marked for further watershed education in urban areas. Cedar Rapids has a cost-share program for residents who want to install best management practices. Stakeholders agreed that practices which benefit the public but have less benefit for the landowner will really require financial and technical support.

5. GOALS AND OBJECTIVES

The following specific goals and objectives have been identified for the Morgan 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 Morgan Creek subwatershed results in significant financial losses. Over $600,000 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 the Morgan Creek Subwatershed is to reduce flooding and minimize financial losses due to flooding.

The GHOST Hydrologic & Hydraulic model, developed by the Iowa Flood Center, 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 Morgan Creek within the City of Cedar Rapids (above the confluence with Cedar River) during the June 12th, 2008 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, three stream segments that receive drainage from the Morgan Creek Subwatershed do not meet their designated uses.

Morgan Creek Lower Reach. Mouth (S14, T83N, R8W, LINN CO.) to Confluence with Unnamed Tributary in SW 1/4, S22, T83N, R8W, LINN CO. is impaired due to elevated levels of *E. coli* bacteria. A TMDL has not been developed for this stream, however as part of this watershed plan preliminary reduction estimates were quantified similar to a TMDL by developing a load duration curve. The load duration curve was estimated by multiplying the water quality standard (126 org./100 mL) by the flow duration curve. The full loading capacity for Morgan Creek 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 water quality standards range from 83% to 92% (**Table 10**). The goals for each load component are shown in **Table 10**. These goals are similar to the Cedar River *E. coli* TMDL which assumes that failing septic systems will be eliminated in the watershed.

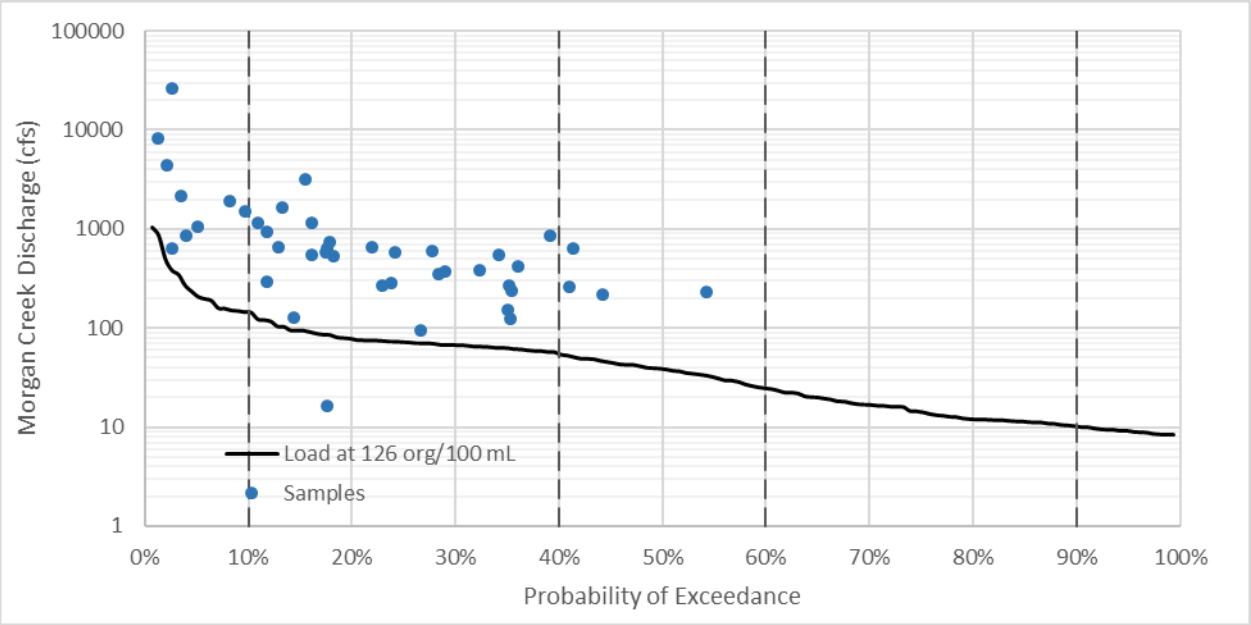

Figure 8. Load duration curve for Morgan Creek.

Table 10. *E. coli* Loading Goals and Reductions for each component in Morgan Creek

Morgan Creek Goal Load Components		Flow Regime				
		Very High (cfs)	High (cfs)	Mid (cfs)	Low (cfs)	Very Low (cfs)
		67.0	23.3	12.5	4.5	2.9
		E. coli (billion org. per day)				
Existing Load		**2,467.8**	**416.9**	**303.3**	**n/a**	**n/a**
Permitted Sources	**Total Permitted Sources**	**0**	**0**	**0**	**0**	**0**
Nonpermitted Sources	*Failing Septic Systems*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
	Watershed Runoff	*206.6*	*72.0*	*38.4*	*14.0*	*9.1*
	Total Nonpoint Sources	**206.6**	**72.0**	**38.4**	**14.0**	**9.1**
Total Loading Capacity		**206.6**	**72.0**	**38.4**	**14.0**	**9.1**
Estimated Load Reduction		**2261.2**	**344.9**	**264.9**	**n/a**	**n/a**
		92%	**83%**	**87%**	**n/a**	**n/a**

Cedar River from Highway 30 Bridge at Cedar Rapids to Confluence with Prairie Creek: 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 percent through proper timing and application of animal waste.
- Cattle in streams will be reduced by 40 percent.

- 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 water quality 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 Morgan Creek Subwatershed are shown in **Figure 9**. In addition to the Iowa BMP Mapping Project conservation practices, locations provided by participants in the stakeholder engagement meetings have been included. Existing stormwater management practices within the subwatershed were not included.

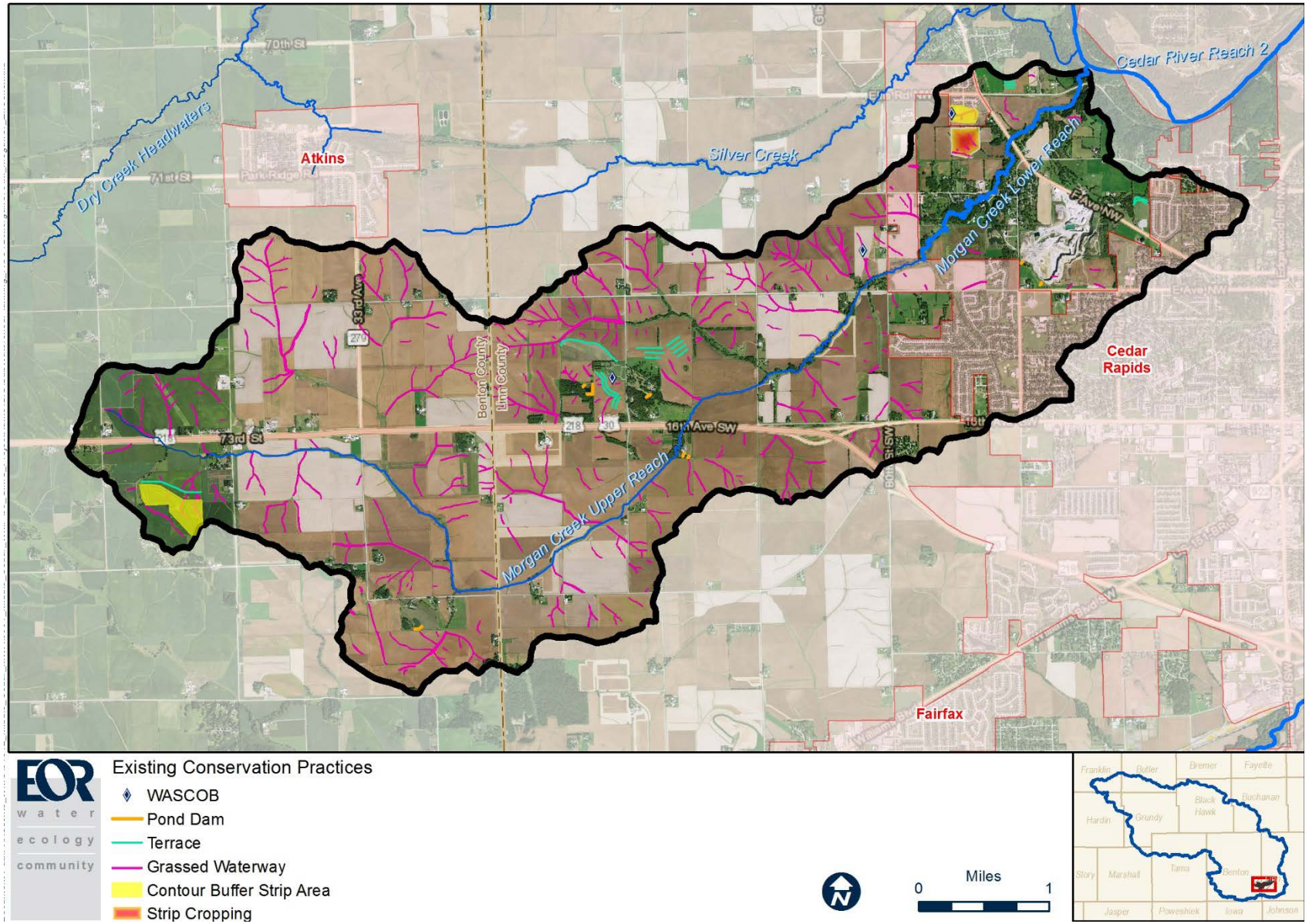

Figure 9. Existing Conservation Practices in the Morgan Creek Subwatershed

6.2. Potential Agricultural Conservation Practices

The ACPF Version 2.2 was run for the Morgan 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 the following 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 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 **Figure 11**.

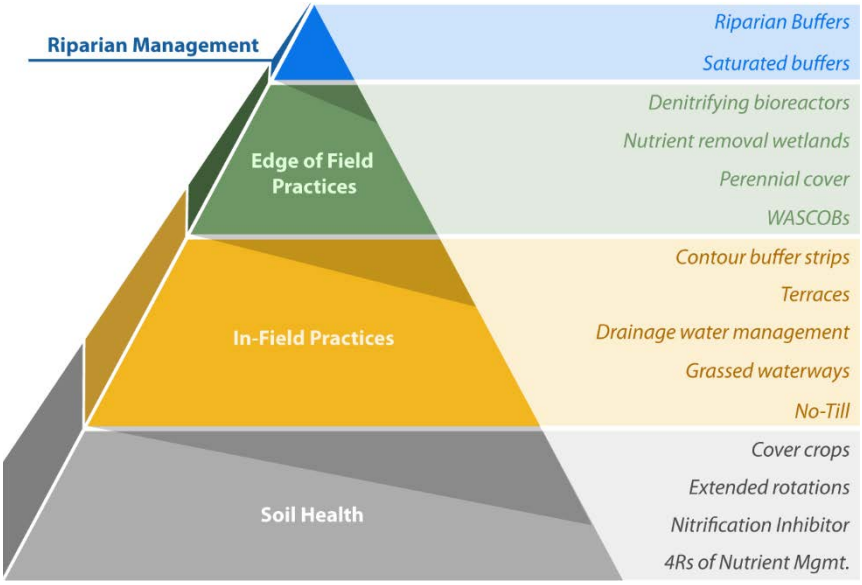

Figure 10. Conservation Pyramid (adapted from Tomer et al. 2013)

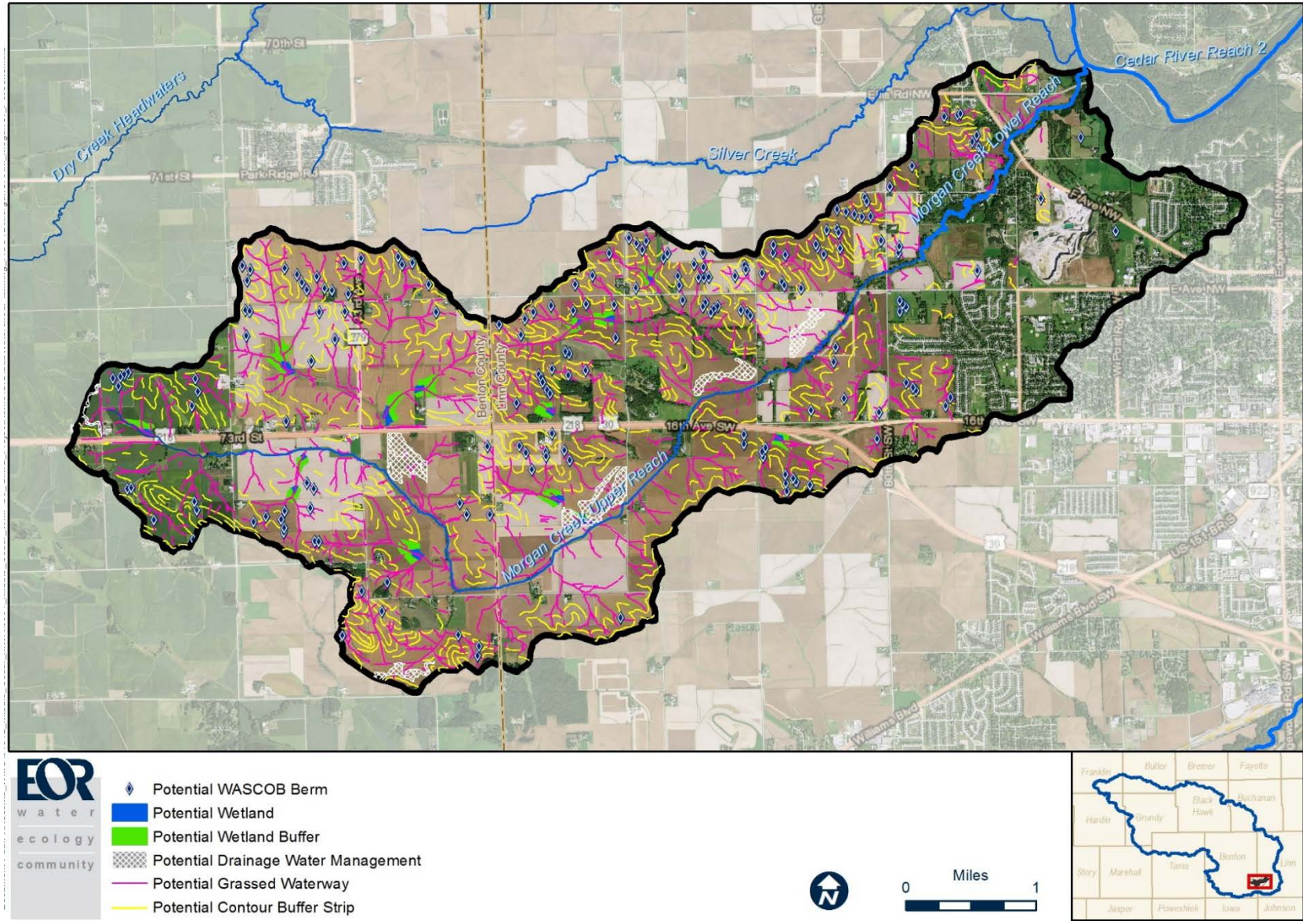

Figure 11. Potential Agricultural Conservation Practices in the Morgan Creek Subwatershed

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 Morgan Creek Subwatershed there are currently approximately 8,000 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 11**. 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 11. Soil Health Management Conservation Practice Existing Adoption Rate Assumptions for the Morgan Creek Subwatershed

Conservation Practice		Existing Adoption Rate	Existing Adoption Acres
	Cover crops	2%	160
	Extended rotations	1%	80
	Nitrogen management: nitrification inhibitor	50%	3,999
Rs	Nitrogen management: rate control	10%	800
	Nitrogen management: source control	20%	1,600
	Nitrogen management: timing control	50%	3,999
	Phosphorus management: placement control	50%	3,999
	Phosphorus management: rate control	50%	3,999
	Phosphorus management: source control	50%	3,999

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 12**).

Table 12. In-field Conservation Practice Existing Adoption Rate Assumptions for the Morgan 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	84%	Comparison of ACPF output to BMP Mapping Project findings
Drainage Water Management	0%	Professional Judgement
Grassed Waterways	46%	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 (**Figure 9**), and through professional judgement as described for the soil health management practices (**Table 13**).

Table 13. Edge of field Conservation Practice Existing Adoption Rate Assumptions for the Morgan 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	46%	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 Table 14 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
- 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 14. Riparian Area Management Practice Existing Adoption Rate Assumptions for the Morgan Creek Subwatershed

Conservation Practice	Existing Adoption Rate	Adoption Rate Estimate Source
Critical zone riparian buffer	40%	Evaluation using High Resolution Land Cover Mapping Data and Stream Riparian Areas
Deep-rooted vegetation riparian buffer	78%	
Multi-species riparian buffer	78%	
Stiff stem grass riparian buffer	78%	
Stream stabilization riparian buffer	80%	
Saturated buffers	0%	Professional Judgement

6.3. Urban Conservation Practices

Potential urban BMPs were quantified for the portion of the Morgan Creek Subwatershed within the City of Cedar Rapids. Parcel data from the county was used to assist in screening for potential BMP implementation opportunities. Many specific parcels were excluded from the analysis, including railyards, airports, golf courses, water treatment facilities, and salvage yards, along with other agricultural and industrial land uses. A total of 17 categories were initially identified to help determine the appropriateness of assessment BMP implementation, including: agricultural, cemetery, commercial, county, environmental organization, federal, hospital, industrial, institutional, mixed, municipal, railroad, religious, residential, state, tax exempt (other), and other. These low-level categories were aggregated into six high-level categories: commercial, private institution, public, public institution, residential, and other. Together with a seventh category, right-of-way, which was assumed to be represented by the empty space between parcels, the first five categories (commercial, private institution, public, public institution, and residential) were used in the next stage of screening.

After categorizing the parcel data, the Iowa High Resolution Landcover (HRLC) data was reclassified into three classes: pervious (e.g. turf grass, trees), impervious (e.g. rooftops, roads, parking lots), and other (e.g. row crops, open water, wetlands). The recategorized parcels data was intersected with the reclassified HRLC data and the approximate distribution of impervious and pervious land covers was

determined. These distributions were then used in WinSLAMM to determine approximate phosphorus loading rates from each land use.

Finally, potential phosphorus removal rates assuming full BMP implementation (i.e. treatment of 100% of the drainage areas) were estimated by assuming a unique combination of retention and detention practices within each land use. For example, in commercial areas, runoff from impervious areas was assumed to be treated by an even split of detention and retention practices, and remediation of compacted soils was assumed on all pervious areas. Additionally, each type of treatment had an appropriate effectiveness assigned to it. For example, retention practices were assumed to be 72% effective at removing phosphorus, while detention practices were assumed to be 50% effective.

The most effective manner in which to address stormwater management for proposed land use development is to have a comprehensive stormwater ordinance in place. Through the development of this watershed management plan, recommendations for reviewing and updating ordinances pertaining to erosion and sedimentation control and stormwater management were developed.

Low impact development (LID) practices are another tool to manage stormwater. Use of LID practices should be encouraged in new development projects as well as public works improvements such as road reconstruction projects throughout the watershed. LID practices are an effective means to achieve surface water protection, stormwater volume control, and infiltration or groundwater recharge. Various LID practices are described below, including the typical land use settings in which they are applicable, and the mechanisms used to treat runoff. LID approaches are preferred over traditional stormwater management techniques because they provide a wider range of benefits for the community and environment. They increase resiliency in the landscape and typically emphasize infiltrating stormwater runoff which reduces volumes.

Bioretention Basins: Multiple types of LID practices are considered bioretention practices but are referred to with more specific names that describe the particular landscape, scale, and vegetation settings where they are applied. Bioretention basins are shallow landscaped depressions filled with sandy amended soil, topped with a layer of mulch, and planted with suitable vegetation. Stormwater runoff flows into the depression, with some water stored in the soil profile and the remainder slowly percolates through the soil, or engineered filter media, (which acts as a filter) and into the groundwater at a rate dependent on the underlying soils. Some of the stored water is also taken up by the plants. This important technique uses soil, plants, and microbes to treat stormwater before it is infiltrated or discharged.

Bioretention areas are usually designed to allow ponded water 6 to 12 inches deep, with an overflow outlet to prevent flooding during heavy storms. Where soils are compacted or infiltration is otherwise limited, a perforated underdrain connected to the storm sewer or alternative discharge should be utilized to draw down water levels within an acceptable period of 24 to 48 hours. Practices with an underdrain are sometimes referred to as biofiltration practices since the main treatment mechanism will be filtration, not retention (infiltration). Maintaining the unsaturated soil zone above a perched underdrain system when needed can enhance the performance of bioretention practices, such as higher removal rates for nitrogen.

Bioretention areas provide comprehensive pollutant load reduction through physical, chemical, and biological mechanisms. Infiltration provides the most effective mechanism for pollutant load reduction and should be encouraged where practical. Further information on bioretention basins can be found at:
https://iowastormwater.org/green-infrastructure/bioretention-cells/

Bioswale: Bioswales, also called vegetated swales, are a variation of bioretention basins that utilize slope and earthen dams to temporarily detain flows, which allows infiltration through the sandy soil layer. They are shallow, open vegetated channels designed to provide non-erosive conveyance with longer detention time and slower velocities than traditional curbs and gutter or ditch systems. These practices are effective for pre-treatment of concentrated flows before discharge to a downstream LID practice. Although grass swales provide generally limited pollutant removal through gravity separation, they can be designed to enhance their stormwater pollutant removal effectiveness. High sediment load reductions have been observed in well-constructed swales.

Properly designed grass swales are ideal when used adjacent to roadways or parking lots, where runoff from the impervious surfaces can be directed to the swale via sheet flow. As the vegetative cover is an integral component to the function of grass swales, flow depth should not exceed the height of the vegetation on a regular basis (i.e., small storms). As routing meltwater over a pervious surface will yield some reduction in flow and improved water quality, these practices have been shown to be very effective in cold climate conditions. The effectiveness of the practice can be further enhanced by using engineered soil mix as the substrate and installing an underdrain. The presence of such designed under layers are the differentiating characteristic of bioswales in comparison to grass swales. Further information on bioswales can be found at: https://iowastormwater.org/green-infrastructure/bioswales/

Box Planter: Box planters are another variation of bioretention practices that feature hard side-walls due to their placement in highly urbanized environments, such as along sidewalks in a downtown core. Due to their small size, multiple box planters should be installed at regularly spaced intervals along a project corridor in order to treat the contributing drainage area. Constructed of various materials, box planters can be built close to buildings and are ideal for constrained sites with setback limitations, poorly draining soils, steep slopes, or contaminated areas. Tree trenches are a specific type of box planter that is differentiated by the soil and vegetation components. Further information on box planters can be found at:
https://www.go-gba.org/resources/green-building-methods/stormwater-planters/

Green Roof: Green roofs effectively reduce runoff volume by intercepting rainfall through a layer of growing media and vegetation that are installed and planted on the rooftop. Rainwater captured in the growing media evaporates or is transpired by plants back into the atmosphere. Rainwater not captured by the growing media is detained in a drainage layer below and then flows to roof drains and downspouts. These systems are highly effective at reducing or eliminating rooftop runoff from small to medium storm events. Green roofs can be incorporated into new construction or added to existing buildings during renovation or re-roofing. Green roofs can be designed as extensive, shallow-media systems or intensive, deep-media systems depending on the design goals, roof structural capacity, and available funding.

In addition to stormwater volume reduction, green roofs offer an array of benefits, including extended roof life span (due to additional sealing, liners, and insulation), improved building insulation and energy use, reduced urban heat island effects, increased opportunities for recreation and rooftop gardening, attenuated noise, and improved aesthetics. Further information on green roofs can be found at:
https://iowastormwater.org/green-infrastructure/green-roofs/

Permeable Pavement: Permeable pavement is a durable, load-bearing paved surface with small voids or aggregate-filled joints that allow water to drain through to an aggregate reservoir. Stormwater stored in the reservoir layer can then infiltrate underlying soils or drain at a controlled rate through underdrains to other downstream stormwater control systems. Permeable pavement allows streets, parking lots, sidewalks, and other impervious covers to retain the infiltration capacity of underlying soils while maintaining the structural and functional features of the materials they replace. When designed and installed properly, permeable pavement systems consistently reduce concentrations and loads of several stormwater pollutants, including heavy metals, oil and grease, sediment, and some nutrients (US EPA and Tetra Tech 2014). The aggregate sub-base improves water quality through filtering, but the primary pollutant removal mechanism is typically load reduction by infiltration.

Permeable pavement can be developed using modular paving systems (e.g., permeable interlocking concrete pavers, concrete grid pavers, or plastic grid systems) or poured in place solutions (e.g., pervious concrete or porous asphalt). In many cases, especially where space is limited, permeable pavement is a cost-effective solution relative to other practices because it serves stormwater control and transportation purposes. Permeable pavement can be successful in cold climates when properly installed and maintained. To make sure permeable pavements function properly, it is particularly important to eliminate sand application in the winter. Further information on permeable pavements can be found at:
https://iowastormwater.org/green-infrastructure/rainscapes/permeable-pavement/

Naturalized Drainage Ways: Naturalized drainage ways are often used in place of storm sewer trunks to provide a stormwater conveyance function while also creating amenities for surrounding neighborhoods. The drainage ways are larger than grassed swales, more engineered than natural waterways and may look like a small creek due to base flows maintained by contributing drainage systems. The primary treatment mechanisms include (1) slowed velocities through channel roughness and drop structures and (2) evapotranspiration. Infiltration is typically limited by the saturated soils and proximity to groundwater. Further information on naturalized drainage ways can be found at:
https://www.edmonton.ca/city_government/environmental_stewardship/naturalized-drainage-ways.aspx

Rainwater/Stormwater Harvesting for Reuse: Rainwater/stormwater harvesting is the capture and storage of rooftop runoff, and in some cases from other surfaces, for use in irrigating landscaped area and other non-potable uses. The captured stormwater can be effectively released for irrigation or alternative grey water uses with various control devices in between storm events. Rainwater/stormwater harvesting is an especially useful method for reducing stormwater runoff

volumes in urban areas where site constraints limit the use of other best management practices (BMPs).

There are different options for how to store the runoff. Cisterns are large storage systems that often require a pump for water removal. Cisterns can be self-contained above or below ground and can collect water from one or more downspouts. Another option is storing the runoff in ponds where there is space available for such features. Rain barrels are smaller storage systems discussed separately.

Because most rainwater/stormwater harvesting systems collect rooftop runoff, which tends to have relatively low levels of physical and chemical pollutants, pollutant reduction mechanisms of tanks are not yet well documented. However, rainwater/stormwater harvesting systems can be equipped with filters to improve water quality and have also been shown to reduce pollutant loads when stored rainwater slowly infiltrates into surrounding soils using a low-flow drawdown configuration. The use of stored rainwater and stormwater for alternative purposes, such as irrigation, has also been shown to reduce stormwater pollutants. This practice has been proven to be effective in cold climate conditions, however, barrels need to be drained each fall to avoid ice build-up unless collection occurs below frost line. Further information on rainwater/stormwater harvesting for reuse can be found at:
https://www.extension.iastate.edu/smallfarms/rainwater-catchment-and-reuse

Rain Barrels: Rain barrels are small scale rainwater/stormwater harvesting systems that typically direct rooftop runoff through a downspout into a barrel that holds less than 100 gallons. The water stored in the barrel can then be used for irrigating gardens or lawns. Drip irrigation outlet systems may also be installed to slowly draw down the water levels in the rain barrel between rainfall events.

Rain Gardens: Rain gardens are small versions of the bioretention basins described previously. Due to their scale, rain gardens typically treat runoff from small contributing drainage areas such as rooftops, driveways, sidewalks, and portions of the adjacent road. Bump-out rain gardens include the extension of a road's curb into the street so that the garden can be constructed in the space between the extended curb and the original curb line. Curb cuts are commonly used to direct drainage from the road into the depression. Rain gardens also typically include an overflow pathway designed to safely convey drainage beyond the rain garden's capacity to exit or bypass the facility.

Residential rain gardens can look very similar to a conventional planting bed. The main difference between rain gardens and conventional gardens is that the rain gardens are design with at least a depression and engineered soil layer to capture and treat rainwater. Further information on rain barrels can be found at: https://iowastormwater.org/rainscaping/rainwater-harvesting/

Tree Trenches: Tree trenches are a type of bioretention box planters (discussed earlier) that can be modular or dug along the length of roads or pathways and filled with a highly permeable aggregate integrated with relatively minimal soil. Impervious surfaces, or in some design permeable pavers, overlie the infiltration media. Trees are planted in designed, usually square, openings of the top layer, which thrive in the well-watered, oxygenated environment. Runoff is directed from surrounding impervious surfaces through curb cuts and surface drains to the tree trench where it percolates through the soil media to the underlying ground or underdrain. If the runoff exceeds the design capacity, the underdrain directs the excess stormwater to a storm sewer or downstream LID

practices. Ideal for redevelopment or in the ultra-urban setting, tree trenches have been implemented around paved streets, parking lots, and buildings. Monitoring has indicated that tree trenches are capable of consistent and high pollutant removal for sediment, metals, and organic pollutants.

Trees reduce the volume of stormwater runoff in neighborhoods and ultimately community wide. This function and benefit is especially important in developed settings with increased quantities of impervious surfaces, such as roads, driveways, homes, and parking areas, and in areas in close proximity to surface waters. A tree's surface area, particularly leaf and trunk surfaces, intercept and store rainfall. The tree's root system absorbs soil-stored water, thereby decreasing runoff. Trees also reduce stormwater runoff by intercepting raindrops before they hit the ground, thus, reducing soil compaction rates and improving soil absorptive properties. Additionally, trees intercept suburban contaminants such as oils, solvents, pesticides, and fertilizers which are often part of stormwater runoff, reducing pollutant discharges into vital waterways. Healthy tree canopies in urban setting offer many other ancillary benefits including reduced heat island effects, air filtering, aesthetics, inviting streetscapes, and natural habitat. Further information on tree trenches can be found at: https://iowastormwater.org/green-infrastructure/tree-boxes-trenches/

Conversion of Turf Grass to Native Prairie: Restoring native prairie in urban areas is a type of practice that is growing in popularity because of its cost savings and ecosystem benefits. Converting turf grass to native prairie reduces ongoing maintenance costs from frequent mowing to occasional maintenance of the prairie. Prairies also provide multiple ecosystem benefits, such as reduced runoff, cleaner runoff, increased bird habitat, increased pollinators, and educational opportunities, in addition to aesthetic benefits.

It should be noted that while use of native vegetation and native prairie is ideal and the preferred alternative in conversions, if the site conditions, social norms, or local ordinances make that difficult to accomplish, other natural plantings can still be employed and be very beneficial in many aspects. For instance, conversion to open space that contains deep rooted and larger canopy plants, such as tall grasses, forbs, shrubs, and trees, whether native or not, can provide many of the benefits desired with converting surface areas. Further information on conversion of turf grass to native prairie can be found at:
https://tallgrassprairiecenter.org/plant-iowa-native

Conversion of Impervious Surface to Native Prairie: Reducing impervious coverage of land is another method to reduce runoff volumes and is combined in this practice with the benefits of restoring native prairies as described in the previous section. This practice may be feasible on properties with excess or un-used paved surfaces, such as abandoned parking lots. The practice could also be implemented where roads, sidewalks, or parking lots could be retrofitted to reduce the total impervious area while providing the same required functionality. This can be achieved by downsizing the required minimum geometry impervious surfaces, such as lane widths, keeping in mind that there are minimum requirements that must be met for fire, snow plow and school bus operation. Less impervious cover directly translates into less stormwater runoff and pollutant loads generated at the site. While converting impervious surfaces to native prairie will provide many benefits, conversion to turf grass or natural plantings may be more appropriate than native prairie in some settings.

Further information on conversion of impervious surface to native prairie can be found at: https://iowastormwater.org/rainscaping/native-landscaping/

Enhanced Treatment using Sand Filters: A sand filter is a flow-through system designed to improve stormwater quality by slowly filtering runoff through sedimentation and filtration chambers. Stormwater is first directed to the sedimentation chamber where larger particles settle with increased detention time. The removal of dissolved phosphorous is significantly enhanced when the sand is amended with iron, calcium, aluminum, or magnesium (Erickson, Weiss, & Gulliver, 2013). Then the filtration chamber below removes pollutants and enhances water quality as the stormwater is strained through a layer of sand. The treated effluent is collected by underdrain piping and discharged to the existing stormwater collection system or downstream LID practice. Sand filters can be used in areas with poor soil infiltration rates, where groundwater concerns restrict the use of infiltration, or for areas with high pollutant loads.

Sand filters are capable of removing a wide variety of pollutant concentrations in stormwater by settling, filtering, and adsorption processes. Sand filters have been a proven technology for drinking water treatment for many years and now have been demonstrated to be effective in removing urban stormwater pollutants including total suspended solids, particulate-bound nutrients, biochemical oxygen demand, fecal coliform, and metals (Impellitteri et al. 2014). Sand filters are volume-based and intended primarily for treating the water quality design volume. In most cases, sand filters are enclosed concrete or block structures with underdrains; therefore, only minimal volume reduction occurs by evaporation as stormwater percolates through the filter to the underdrain. Further information on enhanced treatment using sand filters can be found at: https://stormwater.pca.state.mn.us/index.php/Overview_for_iron_enhanced_sand_filter

The agricultural and urban conservation practices described in the previous section were compiled for the Morgan 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 Morgan Creek HUC-12 containing the total potential extent for each BMP type along with the total footprint and drainage area served (see **Table 15**).

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 local SWCD staff 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 below in **Table 15**.

Table 15. Maximum Potential Load Reduction by BMP for the Morgan Creek Subwatershed

	Conservation Practice	Existing Adoption	Full Adoption	Load Reduction %	
				N	P
Soil Health Management	Cover crops	2%	100.0%	20.2%	18.9%
	Extended rotations	1%	100.0%	27.6%	0.0%
	Nitrogen management: nitrification inhibitor	50%	100.0%	3.0%	0.0%
	Nitrogen management: rate control	10%	100.0%	6.0%	0.0%
	Nitrogen management: source control	20%	100.0%	2.2%	0.0%
	Nitrogen management: timing control	50%	100.0%	3.0%	0.0%
	Phosphorus management: placement control	50%	100.0%	0.0%	10.0%
	Phosphorus management: rate control	50%	100.0%	0.0%	5.6%
	Phosphorus management: source control	50%	100.0%	0.0%	25.0%
In-Field Management	Contour buffer strips	0%	100.0%	0.0%	51.1%
	Terraces	84%	100.0%	0.1%	0.1%
	Drainage water management	0%	100.0%	0.5%	0.0%
	Grassed waterways	46%	100.0%	0.0%	27.2%
	No-Till	20%	100.0%	0.0%	47.8%
Edge-of-Field Management	Denitrifying bioreactors	0%	100.0%	9.4%	0.0%
	Nutrient removal wetlands	0%	100.0%	13.8%	0.0%
	Perennial cover	1%	100.0%	47.3%	22.3%
	WASCOBs	46%	100.0%	0.0%	6.9%
Riparian Management	Riparian buffer: Critical zone buffer	40%	100.0%	0.1%	0.1%
	Riparian buffer: Deep-rooted vegetation buffer	78%	100.0%	0.2%	0.1%
	Riparian buffer: Multi-species buffer	78%	100.0%	0.8%	0.5%
	Riparian buffer: Stiff stem grass buffer	78%	100.0%	0.0%	0.8%
	Riparian buffer: Stream stabilization buffer	80%	100.0%	0.0%	0.3%
	Saturated buffers	0%	100.0%	9.6%	0.0%
Urban BMPs	Commercial	0%	100.0%	0.0%	0.0%
	Public	0%	100.0%	0.0%	0.3%
	Right-of-Way	0%	100.0%	0.0%	0.1%
	Residential	0%	100.0%	0.0%	0.1%
Urban Programs	Residential Good Housekeeping	0%	100.0%	0.0%	0.2%
	Municipal Good Housekeeping	0%	100.0%	0.0%	0.4%
Urban Policy	Redevelopment	0%	100.0%	0.0%	0.0%

6.4. 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, residential onsite wastewater treatment systems 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 such as, a windshield survey would be beneficial in refining the bacteria source assessment and to guide future management decisions.

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 best management practices and opportunities available to minimize sources of bacteria on their property.

Best Management Practices 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 best management practices 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 the 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 16. Local Soil and Water Conservation District staff should schedule meetings with landowners of the 51 active farmsteads identified during the 2019 windshield survey to discuss their manure management practices and discuss opportunities to improve their manure management.

Table 16 Source Reduction Best Management Practice 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 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 (a) treating stormwater and removing bacteria from discharged water, or (b) 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 (see **Table 17**). 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 17. Best Management Practices 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.

6.5. Recommended Conservation Practice Adoption Rates

A specific scenario for conservation practice implementation/adoption rates was developed for each of the 68 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 of nitrogen and 29% reduction of phosphorus for each subwatershed. The specific conservation scenario developed for the Morgan Creek Subwatershed is shown in **Table 18**. 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. Nearly 70% of the nitrogen removal and nearly 75% 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 approximately 102,000 pounds per year of nitrogen and over 9,000 pounds per year of phosphorus.

Table 18. Recommended Adoption Rates for Conservation Practices in the Morgan Creek Subwatershed

Conservation Practice	Existing Adoption	Target Adoption			Load Reduction (lbs/year)	
		Rate	Quantity		N	P
Cover crops*	2%	82%	6,333	acres	40,129	4,512
Extended rotations*	1%	2%	79	acres	680	0
Nitrogen management: nitrification inhibitor	50%	75%	1,979	acres	3,641	0
Nitrogen management: rate control*	10%	50%	3,167	acres	6,472	0
Nitrogen management: source control*	20%	36%	1,425	acres	1,165	0
Nitrogen management: timing control*	50%	51%	2,019	acres	2,476	0
Phosphorus management: placement control*	50%	55%	396	acres	0	292
Phosphorus management: rate control*	50%	60%	792	acres	0	331
Phosphorus management: source control*	50%	36%	1,425	acres	0	1,610
Contour buffer strips*	0%	1%	1	miles	0	177
Terraces*	84%	84%	0	miles	0	0
Drainage water management	0%	50%	3	fields	584	0
Grassed waterways	46%	46%	1	miles	0	71
No-Till	20%	25%	396	acres	0	875
Denitrifying bioreactors	0%	25%	11	reactors	5,720	0
Nutrient removal wetlands*	0%	40%	6	wetlands	13,419	0
Perennial cover*	1%	2%	81	acres	1,189	67
WASCOBs*	46%	47%	1	basins	0	24
Riparian buffer: Critical zone buffer*	40%	100%	0.19	miles	216	17
Riparian buffer: Deep-rooted vegetation buffer*	78%	100%	1.43	miles	522	40
Riparian buffer: Multi-species buffer*	78%	100%	0.61	miles	1,920	147
Riparian buffer: Stiff stem grass buffer*	78%	78%	0.01	miles	0	1
Riparian buffer: Stream stabilization buffer*	80%	81%	0.2	miles	0	5
Saturated buffers	0%	50%	7.8	miles	11,931	0
Commercial	0%	7%	4	acres	0	9
Public	0%	18%	54	acres	0	25
Right-of-Way	0%	18%	35	acres	0	29
Residential	0%	4%	19	acres	0	10
Residential Good Housekeeping*	0%	100%	598	acres	0	35
Municipal Good Housekeeping*	0%	100%	494	acres	0	60
Redevelopment	0%	100%	598	acres	0	210

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

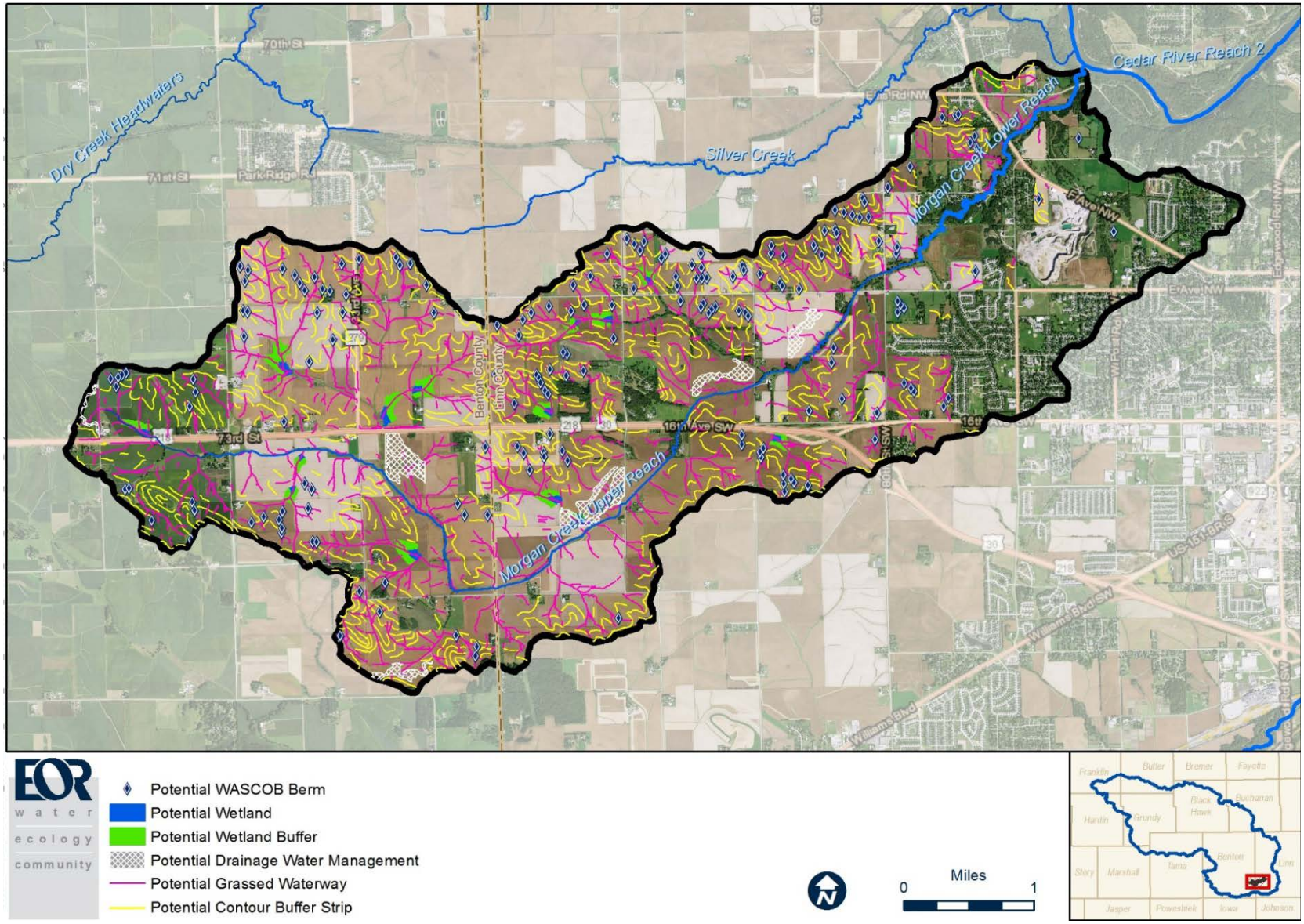

Figure 12. Potential Agricultural Conservation Practices in the Morgan Creek Subwatershed

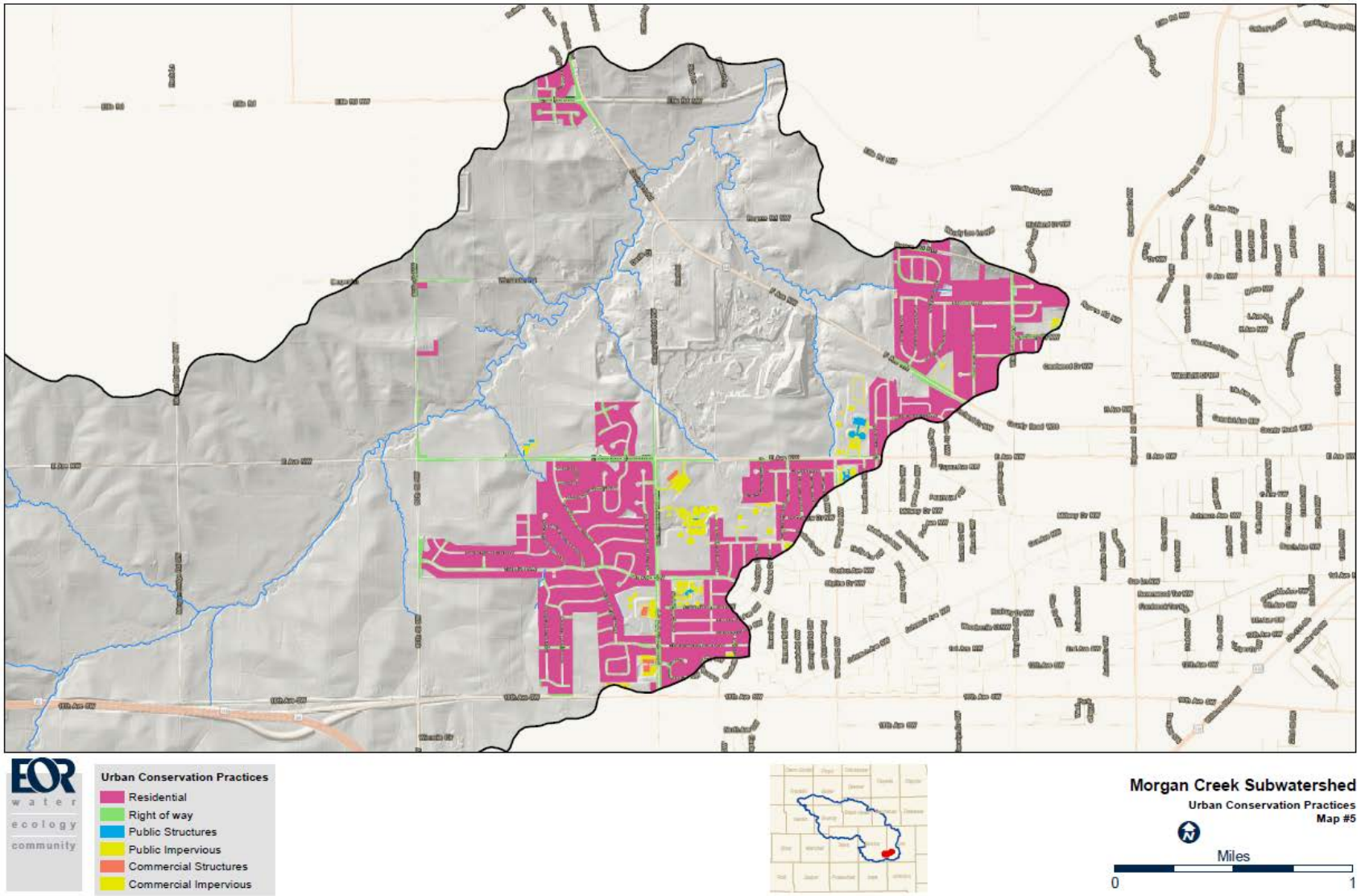

Figure 13. Potential Urban Conservation Practices in the Morgan Creek Subwatershed

6.6. 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. The flood damage reduction reporting location for the Morgan Creek Subwatershed is located at the stream crossing above Covington Road in the City of Cedar Rapids. Siting of this reporting location was difficult because of the influence the Cedar River has on flooding in the lower reaches of Morgan Creek. This reporting station was located higher up along Morgan Creek into an area that is relatively steeply sloped. Flood damage reductions, as determined through the analysis described below, are minor as a result.

6.7. 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 in **Figure 14**.

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 15**.

Four maps are provided as a guide for implementation within the Morgan 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.

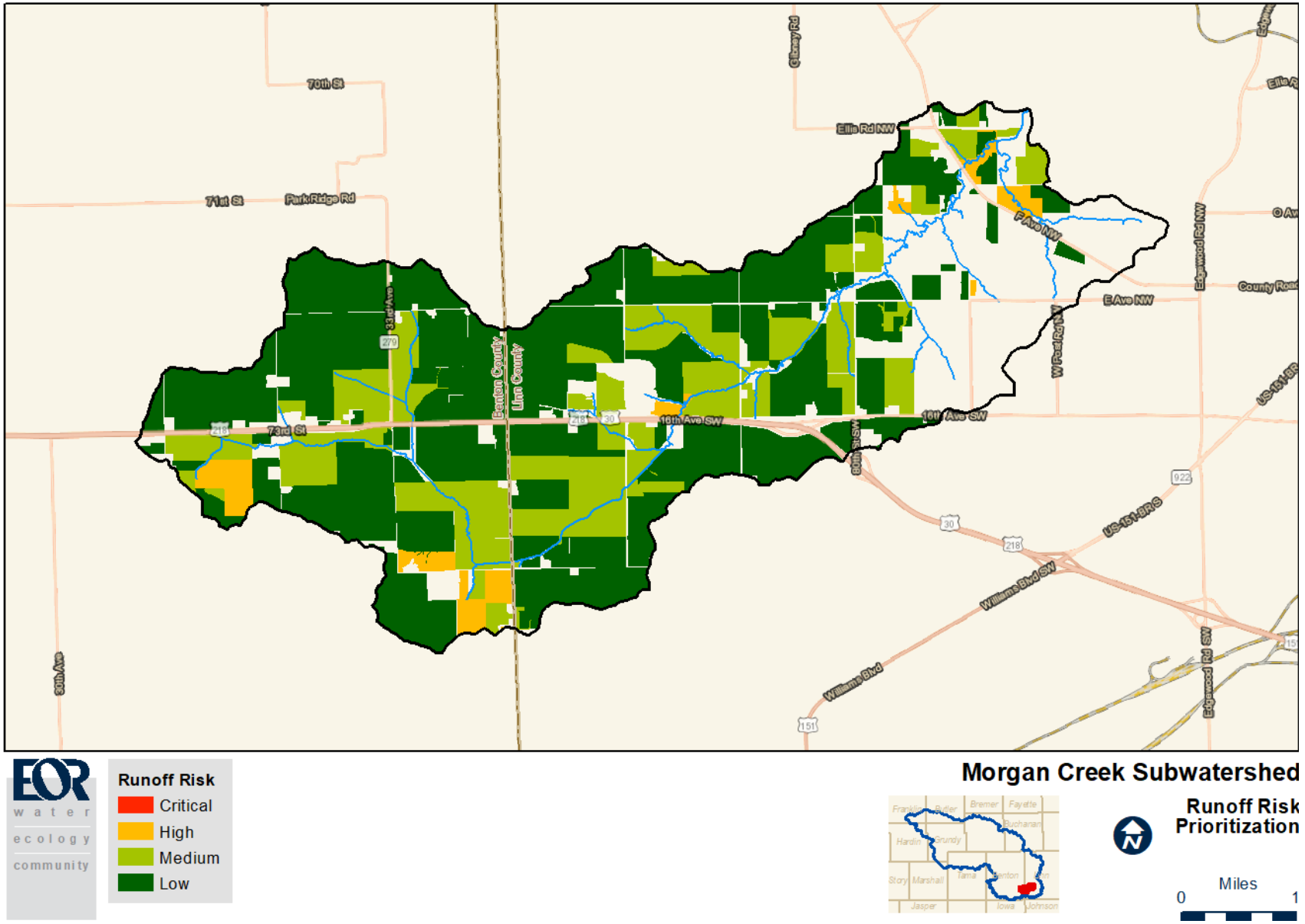

Figure 14: Runoff Risk for Morgan Creek Subwatershed

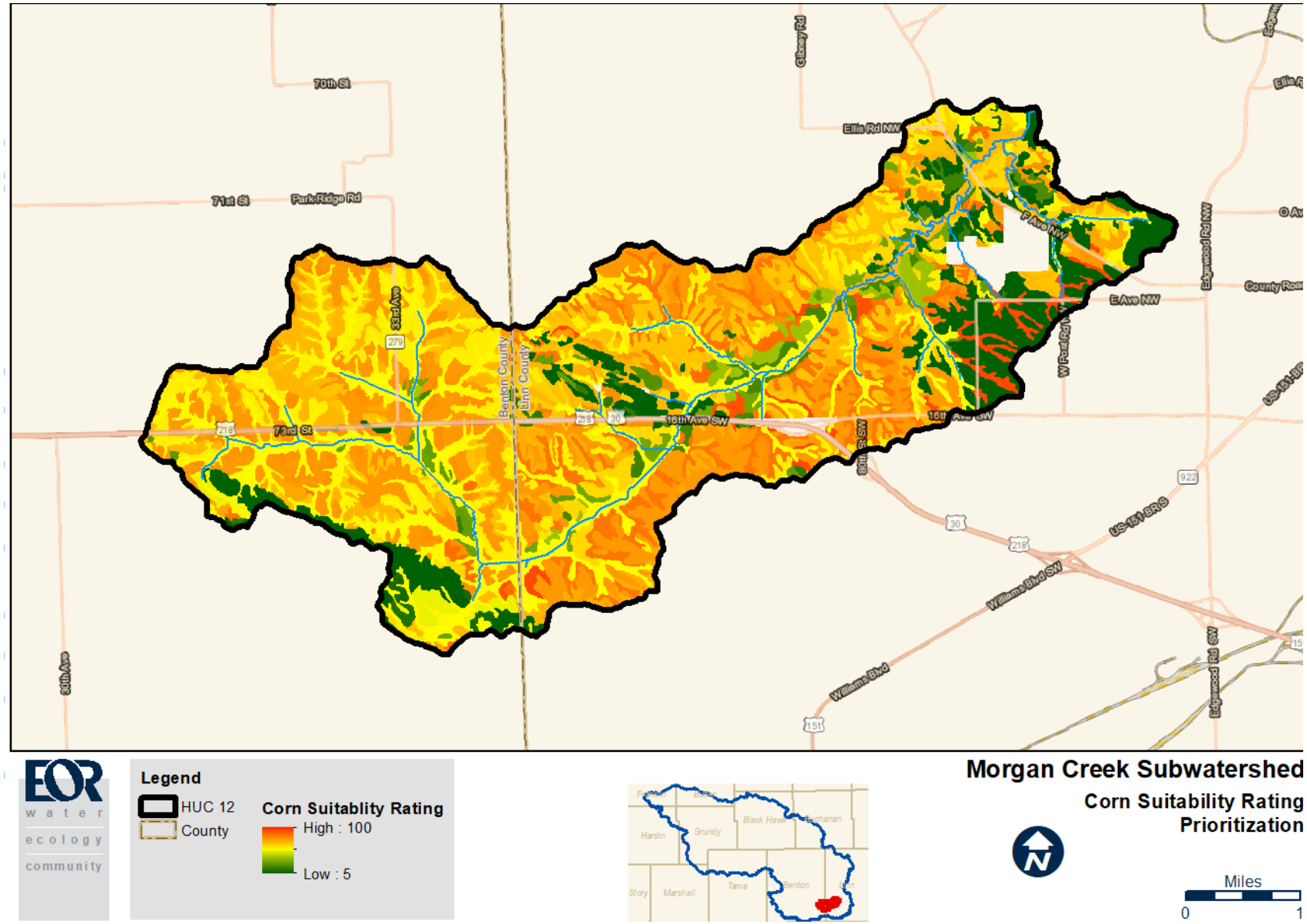

Figure 15: Corn Suitability Rating 2 for Morgan Creek Subwatershed

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 criterion 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 the 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 CSR2 because of the large cost and amount of land associated with wetlands. These wetlands are labeled based on CSR2 mean, starting with the lowest CSR2 mean at #1. The ranked wetlands are listed in **Table 19**.

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 19: Nutrient Removal Wetland Rankings for Morgan Creek Subwatershed

Rank	Mean CSR2	Basin Size (HA)	Drainage Area (HA)	Rank	Mean CSR2	Basin Size (HA)	Drainage Area (HA)
1	62.77	2.59	97.75	8	74.64	3.40	60.58
2	71.66	1.79	78.66	9	75.03	2.05	76.55
3	71.96	4.99	121.61	10	75.14	3.25	65.12
4	72.56	2.23	62.81	11	76.75	5.17	90.76
5	73.71	5.70	106.39	12	78.38	4.40	91.67
6	73.97	3.75	114.45	13	81.29	2.94	66.21
7	73.99	8.07	209.00	14	87.01	2.94	61.65

Only one wetland per wetland train should be implemented in the initial process. Use **Table 20** to determine which wetlands to implement first. In addition, the area of each wetland and drainage area can be used as a secondary measure for prioritization.

Table 20: Prioritization of wetlands based on groupings

Grouping	Implement first
1, 12	1
2, 4	2
3, 11	3
5	5
6, 9	6

7. IMPLEMENTATION SCHEDULE & MILESTONES

The implementation schedule for the BMPs identified in Chapter 6 are shown in **Table 21** and **Table 22**. Soil management practices, no-till and urban good housekeeping that need to be implemented annually are planned to be phased in during the first 5 years of the 20 year timeline. The remainder of the built practices were divided equally throughout the timeline (**Table 21** & **Table 22**). 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 5 years when all of the annual practices should be phased in and approximately a quarter of the built practices should be constructed. The second milestone is after 10 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 23** and **Table 24**. 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 10 were expressed as one reduction goal by multiplying the concentration reduction needed by the average flow in Morgan Creek from 4/16/2019 through 9/19/2019. 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 21** and **Table 22**. The amount of livestock management practices available in the watershed to meet the reduction goals is not known. Instead, local county conservation staff should schedule meetings with landowners of the 51 active farmsteads identified in 2019. These meetings will provide the opportunity to discuss methods landowners can take to improve their manure management and identify opportunities to build practices that will limit manure runoff from entering the stream. The benefits of conservation practices to reduce *E. coli* loads in streams are discussed 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 21. First 10 Years of the Implementation Schedule

		Year									
Conservation Practice	**Unit**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Land owner meetings	#	2	3	2	3	2	3	2	3	2	3
Cover crops	Acres	1267	2533	3800	5067	6333	6333	6333	6333	6333	6333
Extended rotations	Acres	16	32	48	63	79	79	79	79	79	79
Nitrogen management: nitrification inhibitor	Acres	396	792	1188	1583	1979	1979	1979	1979	1979	1979
Nitrogen management: rate control	Acres	633	1267	1900	2533	3167	3167	3167	3167	3167	3167
Nitrogen management: source control	Acres	285	570	855	1140	1425	1425	1425	1425	1425	1425
Nitrogen management: timing control	Acres	404	808	1211	1615	2019	2019	2019	2019	2019	2019
Phosphorus management: placement control	Acres	79	158	238	317	396	396	396	396	396	396
Phosphorus management: rate control	Acres	158	317	475	633	792	792	792	792	792	792
Phosphorus management: source control	Acres	285	570	855	1140	1425	1425	1425	1425	1425	1425
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	0	0	0	0	0	0	1	0	0
Grassed waterways	Miles	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
No-Till	Acres	79	158	238	317	396	396	396	396	396	396
Denitrifying bioreactors	Reactors	0	1	0	1	0	1	0	1	0	1
Nutrient removal wetlands	Wetlands	0	0	1	0	0	1	0	0	1	0
Perennial cover	Acres	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05
Wascobs	Basins	0	0	0	0	0	0	0	0	0	1
Riparian buffer: Critical zone buffer	Miles	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095
Riparian buffer: Deep-rooted vegetation buffer	Miles	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715
Riparian buffer: Multi-species buffer	Miles	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305
Riparian buffer: Stiff stem grass buffer	Miles	0.01	0	0	0	0	0	0	0	0	0
Riparian buffer: Stream stabilization buffer	Miles	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Saturated buffers	Miles	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Commercial	Acres	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Public	Acres	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7

		Year									
Conservation Practice	**Unit**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Right-of-Way	Acres	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Residential	Acres	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Residential Good Housekeeping	Acres	120	239	359	479	598	598	598	598	598	598
Municipal Good Housekeeping	Acres	99	198	297	396	494	494	494	494	494	494
Redevelopment	Acres	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9

Table 22. Second 10 Years of Implementation Schedule

		Year									
Conservation Practice	**Unit**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**
Land owner meetings	#	3	3	2	3	2	3	2	3	2	3
Cover crops	Acres	6333	6333	6333	6333	6333	6333	6333	6333	6333	6333
Extended rotations	Acres	79	79	79	79	79	79	79	79	79	79
Nitrogen management: nitrification inhibitor	Acres	1979	1979	1979	1979	1979	1979	1979	1979	1979	1979
Nitrogen management: rate control	Acres	3167	3167	3167	3167	3167	3167	3167	3167	3167	3167
Nitrogen management: source control	Acres	1425	1425	1425	1425	1425	1425	1425	1425	1425	1425
Nitrogen management: timing control	Acres	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019
Phosphorus management: placement control	Acres	396	396	396	396	396	396	396	396	396	396
Phosphorus management: rate control	Acres	792	792	792	792	792	792	792	792	792	792
Phosphorus management: source control	Acres	1425	1425	1425	1425	1425	1425	1425	1425	1425	1425
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	0	0	0	1	0	0	0	0	0
Grassed waterways	Miles	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
No-Till	Acres	396	396	396	396	396	396	396	396	396	396
Denitrifying bioreactors	Reactors	0	1	0	1	0	2	0	1	0	1
Nutrient removal wetlands	Wetlands	0	1	0	0	1	0	0	1	0	0
Perennial cover	Acres	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05
Wascobs	Basins	0	0	0	0	0	0	0	0	0	0
Riparian buffer: Critical zone buffer	Miles	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095	0.0095

		Year									
Conservation Practice	**Unit**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**
Riparian buffer: Deep-rooted vegetation buffer	Miles	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715	0.0715
Riparian buffer: Multi-species buffer	Miles	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305	0.0305
Riparian buffer: Stiff stem grass buffer	Miles	0	0	0	0	0	0	0	0	0	0
Riparian buffer: Stream stabilization buffer	Miles	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Saturated buffers	Miles	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Commercial	Acres	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Public	Acres	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Right-of-Way	Acres	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Residential	Acres	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Residential Good Housekeeping	Acres	598	598	598	598	598	598	598	598	598	598
Municipal Good Housekeeping	Acres	494	494	494	494	494	494	494	494	494	494
Redevelopment	Acres	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9

Table 23. Proposed Implementation Goals at each Milestone.

BMP Name	Unit	5 Year Goal	10 year Goal	20 Year Goal
Cover crops	Acres	6,333	6,333	6,333
Extended rotations	Acres	79	79	79
Nitrogen management: nitrification inhibitor	Acres	1,979	1,979	1,979
Nitrogen management: rate control	Acres	3,167	3,167	3,167
Nitrogen management: source control	Acres	1,425	1,425	1,425
Nitrogen management: timing control	Acres	2,019	2,019	2,019
Phosphorus management: placement control	Acres	396	396	396
Phosphorus management: rate control	Acres	792	792	792
Phosphorus management: source control	Acres	1,425	1,425	1,425
Contour buffer strips	Miles	0.25	0.5	1
Terraces	Miles	0	0	0
Drainage water management	Fields	1	2	3
Grassed waterways	Miles	0.25	0.5	1
No-Till	Acres	396	396	396
Denitrifying bioreactors	Reactors	2	5	11
Nutrient removal wetlands	Wetlands	1	3	6
Perennial cover	Acres	20.25	40.5	81
Wascobs	Basins	0	1	1
Riparian buffer: Critical zone buffer	Miles	0.0475	0.1	0
Riparian buffer: Deep-rooted vegetation buffer	Miles	0.3575	0.72	1
Riparian buffer: Multi-species buffer	Miles	0.1525	0.31	1
Riparian buffer: Stiff stem grass buffer	Miles	0.01	0.01	0
Riparian buffer: Stream stabilization buffer	Miles	0.05	0.1	0
Saturated buffers	Miles	1.95	3.9	8
Commercial	Acres	1	2	4
Public	Acres	13.5	27	54
Right-of-Way	Acres	8.75	17.5	35
Residential	Acres	4.75	9.5	19
Residential Good Housekeeping	Acres	598	598	598
Municipal Good Housekeeping	Acres	494	494	494
Redevelopment	Acres	149.5	299	598

Table 24. Predicted Load Reductions at each Milestone

Water Quality Parameter	5 year Reductions	10 year Reductions	20 year Reductions
Phosphorus load reduction (lb/yr)	7,464	7,823	7,860
Nitrogen load reduction (lb/yr)	101,993	101,993	101,993
E. coli load reduction (billion org./day)	129.6	258.6	517.2

8. FUNDING NEEDS

Table 25 shows the total implementation costs by conservation practice over a 20 year period for meeting the Iowa Nutrient Reduction Strategy (INRS) targets for nitrogen and phosphorus for the subwatershed and for reducing bacteria loading to Morgan Creek by breaking the delivery network of polluted runoff. The annualized total cost for meeting the INRS targets within the subwatershed is $546,000, of which $332,000 is for agricultural practices and $214,000 is for urban practices. This total annual cost includes agricultural conservation practice expenditures of $836,000 per year and conservation practices that result in a savings of $290,000 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 25. 20-Year Total Implementation Costs by Conservation Practices

Conservation Practice	Target Adoption			Total Cost
	Rate	Quantity		
Cover crops	82%	6,333	acres	$4,220,000
Extended rotations	2%	79	acres	$32,300
Nitrogen management: nitrification inhibitor	75%	1,979	acres	-$81,000
Nitrogen management: rate control	50%	3,167	acres	-$86,000
Nitrogen management: source control	36%	1,425	acres	$1,600,000
Nitrogen management: timing control	51%	2,019	acres	-$549,000
Phosphorus management: placement control	60%	396	acres	$81,000

Conservation Practice	Target Adoption			Total Cost
	Rate	Quantity		
Phosphorus management: rate control	60%	792	acres	-$118,000
Phosphorus management: source control	36%	1,425	acres	$1,560,000
Contour buffer strips	9%	1	miles	$17,000
Terraces	84%	0	miles	$700
Drainage water management	50%	3	fields	$16,000
Grassed waterways	46%	1	miles	$76,000
No-Till	25%	396	acres	$65,000
Denitrifying bioreactors	25%	11	reactors	$76,000
Nutrient removal wetlands	40%	6	wetlands	$514,000
Perennial cover	2%	81	acres	$428,000
WASCOBs	47%	1	basins	$70,000
Riparian buffer: Critical zone buffer	100%	0.19	miles	$8,000
Riparian buffer: Deep-rooted vegetation buffer	100%	1.43	miles	$58,000
Riparian buffer: Multi-species buffer	100%	0.61	miles	$25,000
Riparian buffer: Stiff stem grass buffer	78%	0.01	miles	$300
Riparian buffer: Stream stabilization buffer	81%	0.2	miles	$8,000
Saturated buffers	50%	7.8	miles	$2,560,000
Commercial	7%	4	acres	$172,000
Public	18%	54	acres	$833,000
Right-of-Way	18%	35	acres	$463,000
Residential	4%	19	acres	$1,440,000
Residential Good Housekeeping	100%	598	acres	$0
Municipal Good Housekeeping	100%	494	acres	$0
Redevelopment	82%	6,333	acres	$0

9. EVALUATION AND MONITORING

Monitoring in the Morgan 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 Morgan Creek Subwatershed includes water quality and water quantity monitoring

Water quality monitoring in the Morgan Creek Subwatershed is collected by Coe College and the ISA, in cooperation with the City of Cedar Rapids. They collect snapshot water quality monitoring through grab samples on Morgan Creek at Covington Road. 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 in Morgan Creek are currently monitored by a USGS stream gage, USGS 05464475 Morgan Creek near Covington. 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 the Morgan Creek.

The existing monitoring in the Morgan Creek Subwatershed provides a baseline monitoring that should be expanded in the future. Future monitoring in the Morgan 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.

10. EDUCATION AND OUTREACH

The Morgan Creek subwatershed is uniquely peri-urban, meaning there are rural and urban land uses influencing the subwatershed. Located in the subwatershed is the Linn County, Morgan Creek County Park, which contains portions of Morgan Creek and is a beloved natural area that attracts outdoor enthusiasts year-round. Linn County Conservation does an excellent job of maintaining the park and recently completed a master plan. This watershed plan greatly benefitted from the relationships that were established during the park master planning process and it is highly encouraged that any education and outreach include Linn County Conservation staff.

While there is a significant amount of land in agricultural land use, many of the farmers who showed up to the meetings indicated that the landowners who were interested in improving the watershed were already implementing practices on their fields. This anecdotal information suggests that perhaps farmers will interact with their Soil and Water Conservation District / Natural Resources Conservation Service offices to install practices on their land.

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

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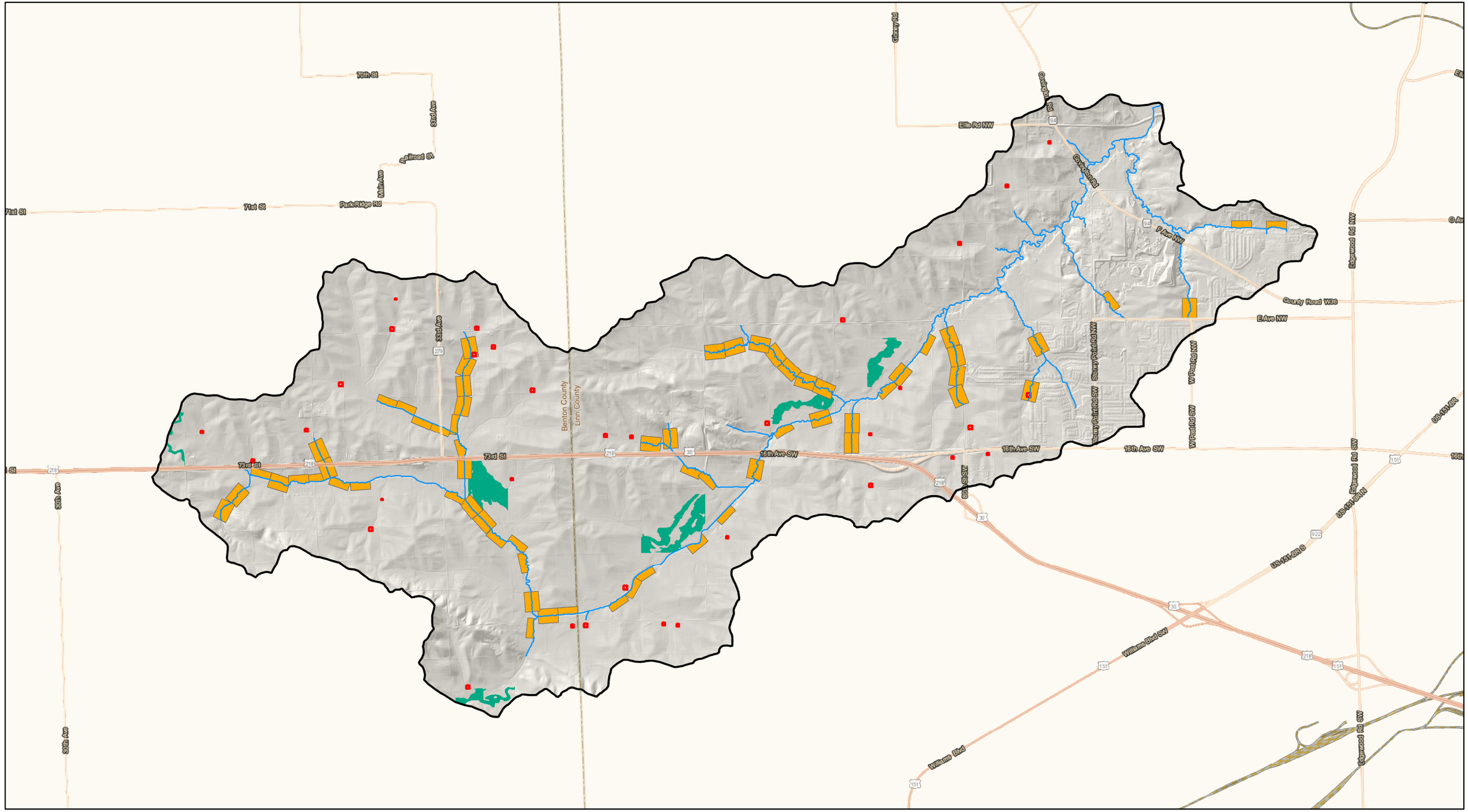

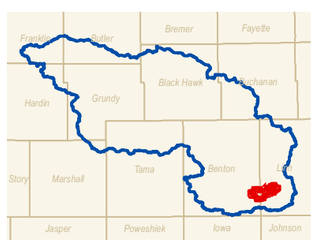

Non-prioritized Conservation Practice Locations

- Denitrification Bioreactor
- Saturated Buffer
- Drainage Water Management

Morgan Creek Subwatershed

Conservation Practice Prioritization Map #1

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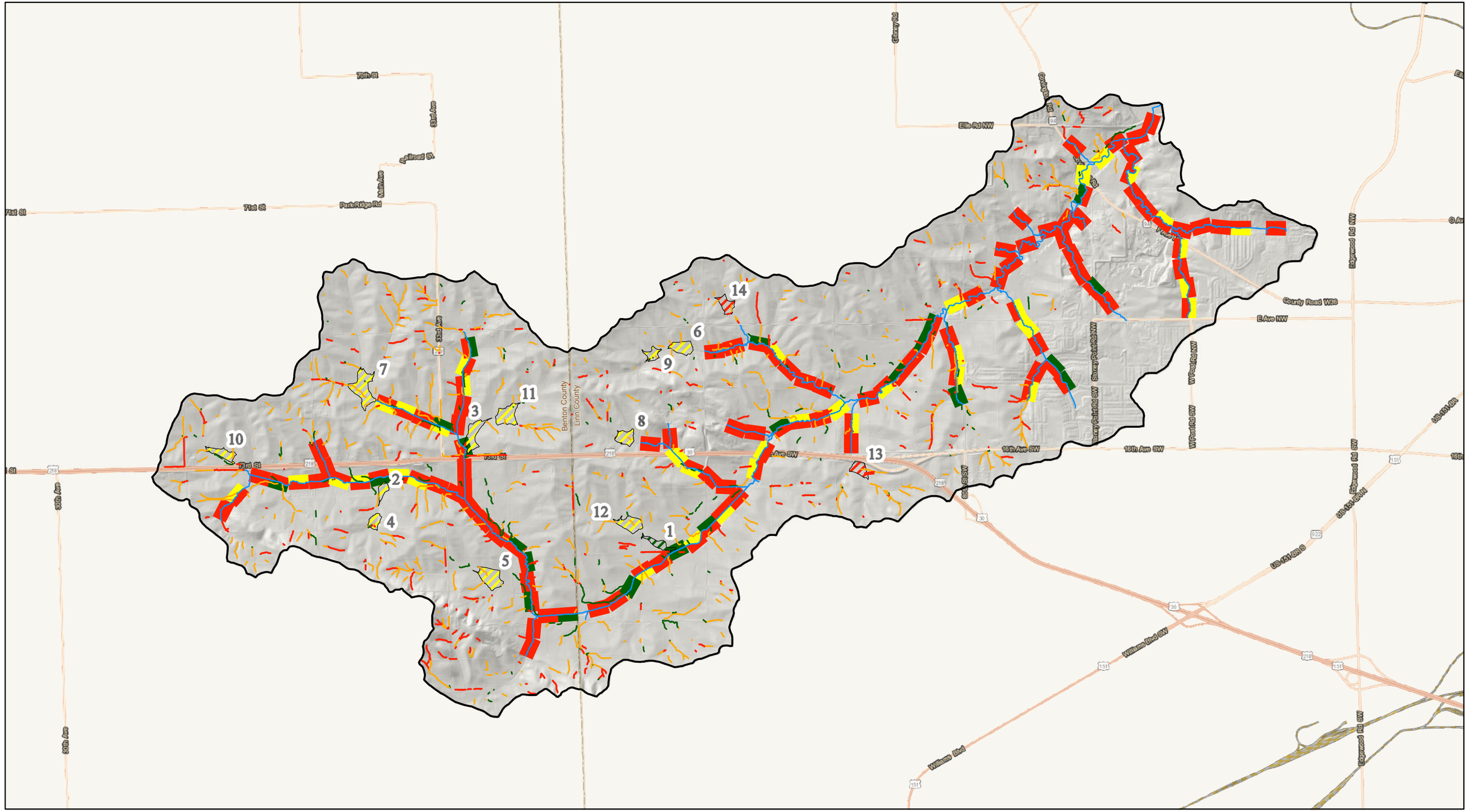
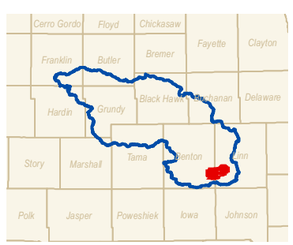


Prioritization of Conservation Practices

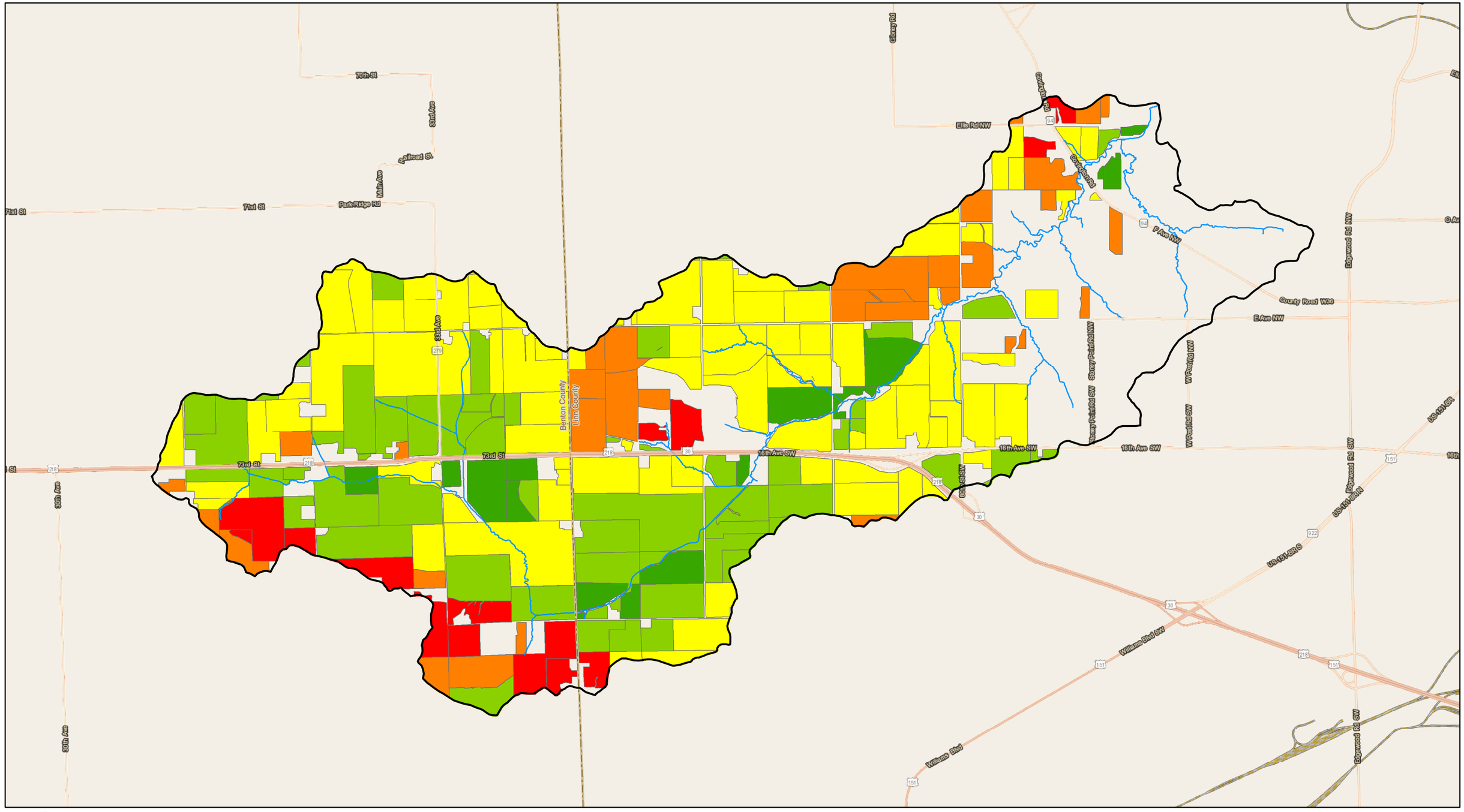
Saturated Buffer	Grass Waterway	Nutrient Treatment Wetland
High runoff risk	Low	Low CSR
Med runoff risk	Medium	Medium CSR
Low runoff risk	High	High CSR

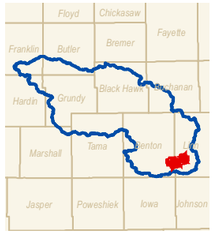


Morgan Creek Subwatershed

Conservation Practice Prioritization
Map #2

Miles
0 1 2





EOR water ecology community

Prioritization of Conservation Practices: Contour Buffer Strips and Terraces

Slope Steepness

- Low
- Medium
- High

Morgan Creek Subwatershed

Conservation Practice Prioritization
Map #3

Miles
0 1 2

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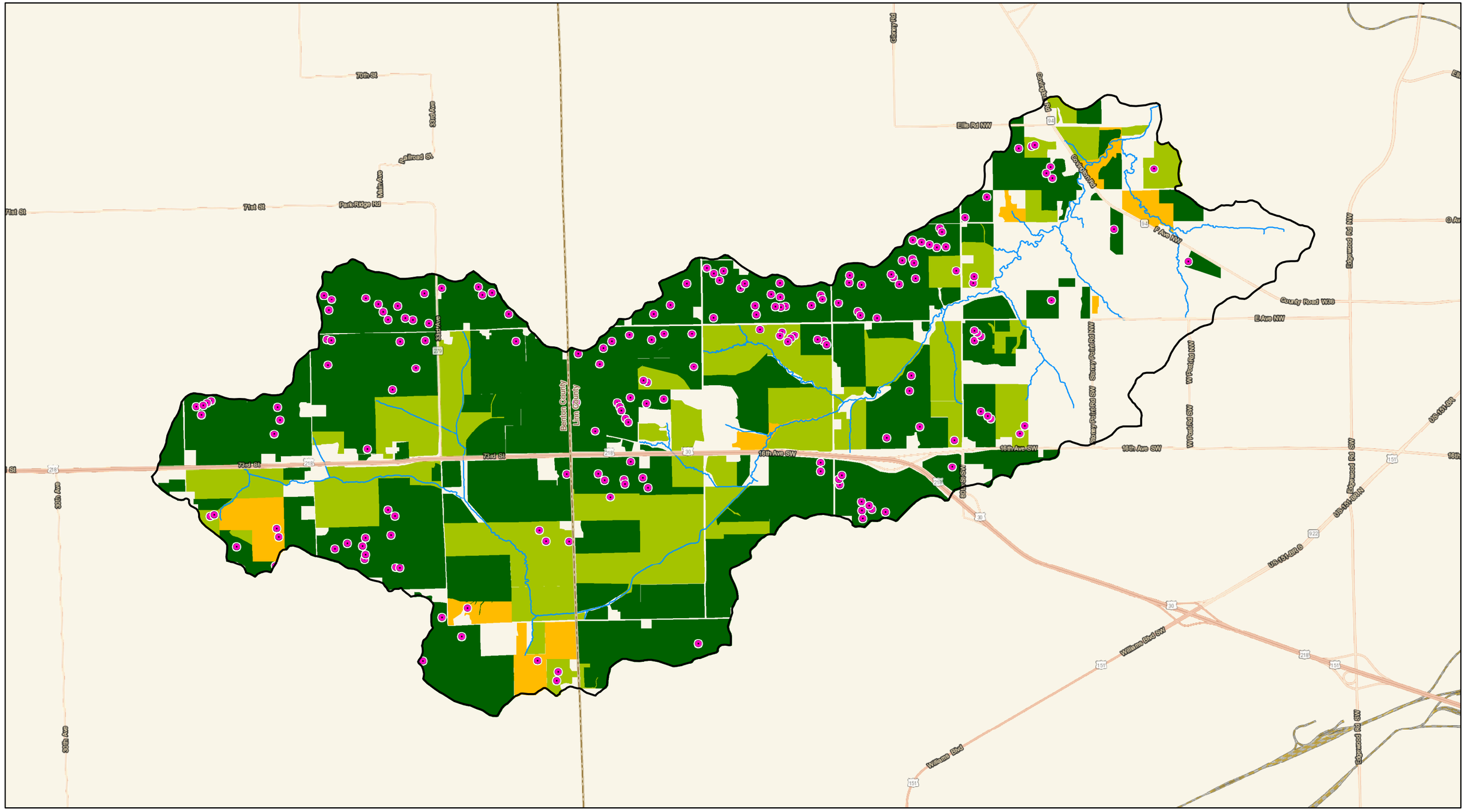


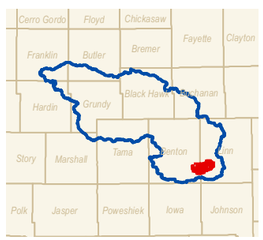
EOR water ecology community

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

- WASCOB

Run off Risk

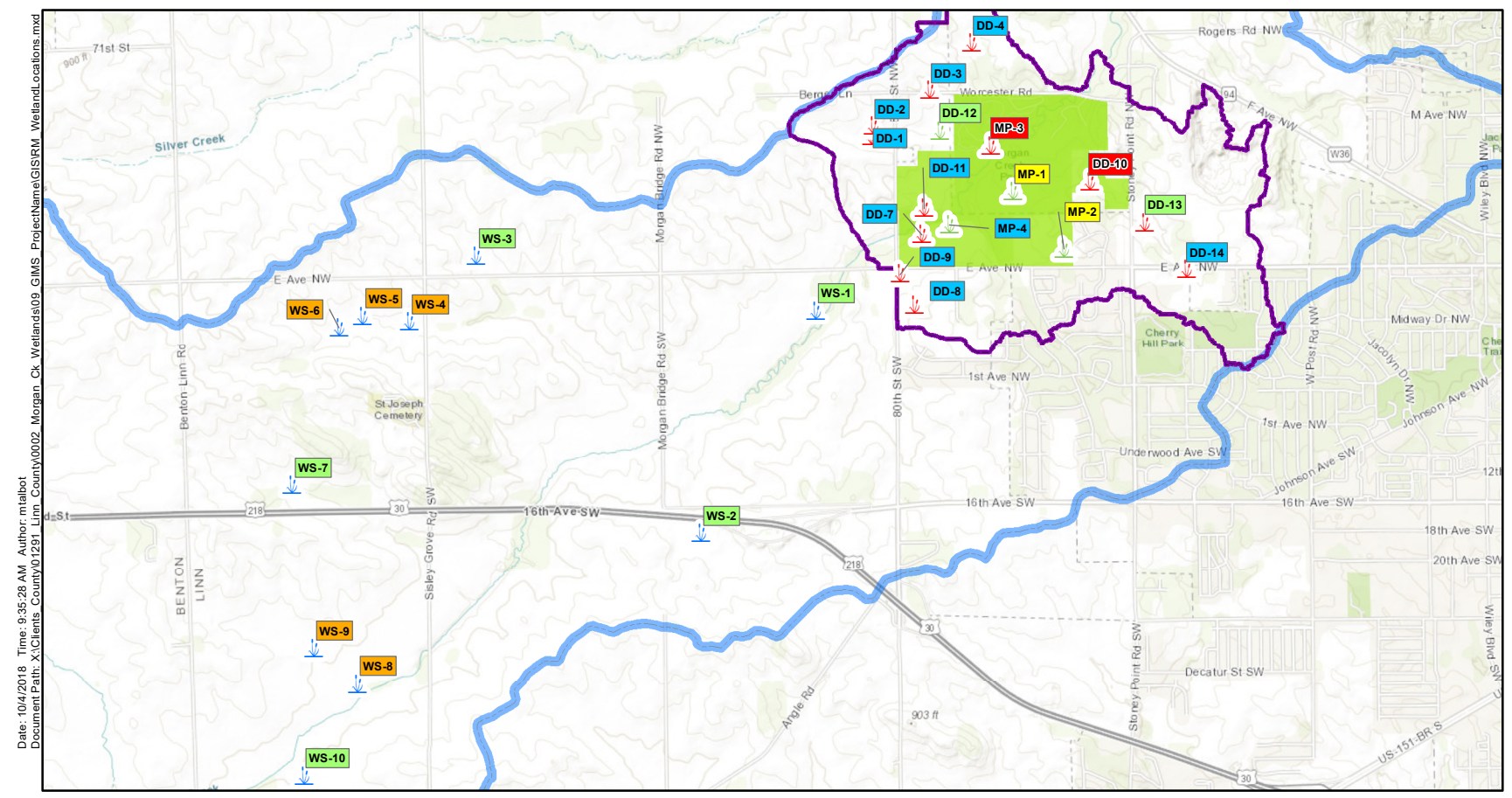
- Low
- Medium
- High
- Critical



Morgan Creek Subwatershed

Conservation Practice Prioritization
Map #4

Miles
0 1 2



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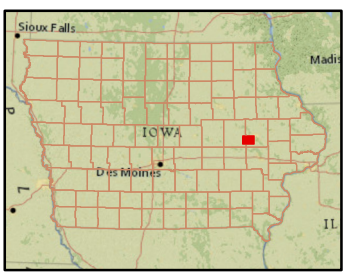
EOR water ecology community

Direct Drainage Area
Morgan Creek Park
Morgan Creek Watershed

Project Tier

Tier 1
Tier 2
Tier 3
Tier 4
Tier 5



Morgan Creek Park

Potential Wetland Mitigation Sites

Morgan Creek Watershed

N

0 1,700 3,400 Feet

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 Morgan 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

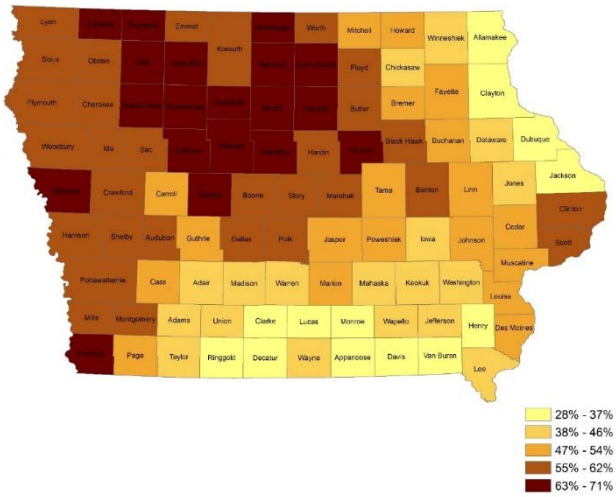
Organization	Location	Contact

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-