Winterset Municipal Waterworks
Source Water Protection Plan

Winterset Municipal Waterworks

Madison County

PWSID: 6171029

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Table of Contents

Purpose and Background

Iowa Department of Natural Resources defines source water as drinking water in its original environment, either at the surface or below ground, before being treated and distributed by a water system. Source water protection is preventing contaminants from entering public drinking water sources by managing the land which drinking water travels through, leading to improved water quality and better protection of the water itself. A community's water source is a valuable resource, which if contaminated or polluted, can impact public health, and restoration or replacement can become a large expense to the community. Preventing or reducing source water contaminants can allow public water systems to avoid costly treatment.

Potential contaminated drinking water costs can include the following:

- Providing emergency replacement water
- Paying for treatment and/or remediation
- Finding and developing new water supplies
- Litigating against responsible parties
- Conducting public information campaigns after an incident
- Reducing property value or tax revenue
- Paying health related costs from exposure to contaminated water, and
- Losing community confidence in drinking water

The benefits of source water protection include:

- Reduced costs or prevented increasing costs for treating source water
- Saved expense of finding a new water source
- Potential decrease in state regulated monitoring
- Opportunities for grants from the state
- Potential for less frequent sanitary surveys by the state

The intent of this document is to help the community to proactively address drinking water quality and quantity concerns. The plan describes the source water supply, identifies potential sources of contamination (PSC) to the water supply, determines the relative risk of the PSCs and provides information on what Winterset Municipal Waterworks has done, is currently doing, and plans to do to protect its source of drinking water. Source water protection activities are outlined in an Action Plan, which identifies specific actions and a timetable for implementation of each action.

As a secondary benefit, the Winterset Source Water Protection Plan works to implement the Iowa Nutrient Reduction Strategy (NRS). The NRS was created in response to a 2008 Action Plan by the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force that called on the 12 states within the Mississippi River watershed to reduce nutrients in surface water that feeds into the Gulf of Mexico. Iowa has been called upon to reduce 29% of phosphorus and 41% of nitrogen loading from non-point, or watershed-based, sources. Specific to Cedar Lake, historical nitrogen and atrazine water quality impairments have been present, however the lake is currently meeting its designated uses for water quality.

Though voluntary in nature, source water protection plans (SWPPs) and the implementation actions are promoted and monitored in Iowa by the Source Water Protection (SWP) Program. Plans and implementation activities are submitted by the community and reviewed by technical staff at Iowa Department of Natural Resources (DNR). After technical review DNR either approves the plan or provides specific recommendations for improvement.

There are seven steps associated with an approvable Iowa Source Water Protection Plan. These are summarized below and form the basis for the organization of this document:

- Step 1: Organize a source water team
- Step 2: Identify your source water areas
- Step 3: Inventory well and contaminant sources, including land uses of concern
- Step 4: Assess and rank contaminant sources
- Step 5: Develop and action plan
- Step 6: Construct or update your emergency response plan
- Step 7: Submit and Implement your SWP Plan

System Information

The Winterset Municipal Waterworks (Public Water Supply ID# 6171029) is a public community water supply serving a population of 5,190, according to the Iowa Source Water Protection Tracker. The U.S. Environmental Protection Agency (USEPA) defines a community water system as an entity that supplies water for human consumption to the same population year-round and to at least 15 service connections or an average of 25 people for at least 60 days a year. The source water for the waterworks is Cedar Lake, which drains a watershed of 10,595 acres. Cedar Lake is in Madison County, Section 19, Township 76 North, Range 27 West, just northeast of the City of Winterset. Land use in the watershed is predominately agricultural. Table 1 summarizes some of the basic system information and any prior source water documentation. The Cedar Lake watershed is shown in Figure 1.

Table 1. Summary of system information and prior source water documentation

Administrative Office Location	3301 Cedar Bridge Rd, Winterset, IA 50273
Date of Most Recent Source Water Assessment	2001
Date of Most Recent Sanitary Survey	2016
Date of Most Recent Prior Source Water Protection Plan	No prior SWPPs
Population Served	5,190
Are There Multiple Source Water Protection Areas	No
List of Source Water Protection Areas	Cedar Lake

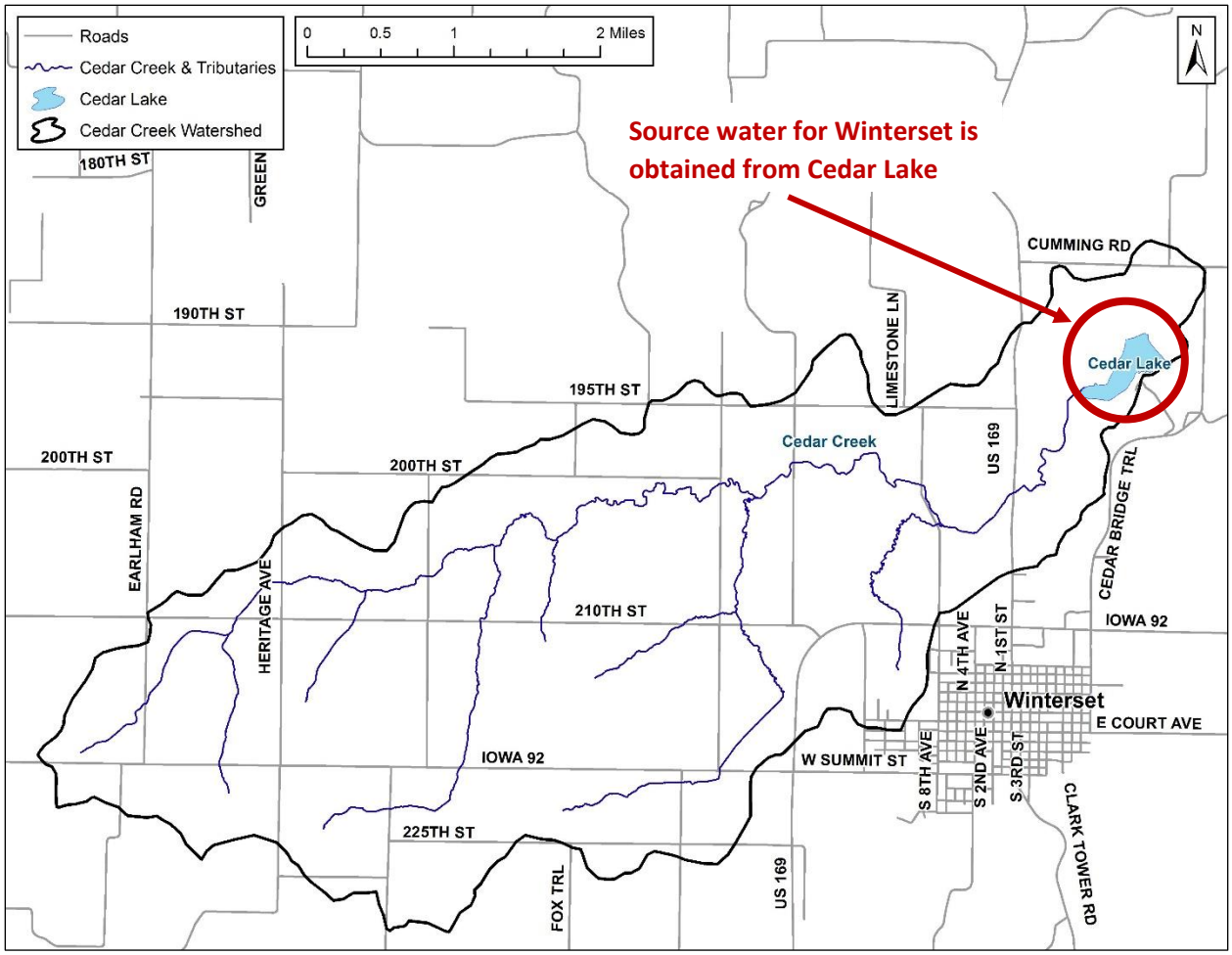

Figure 1. Cedar Lake Watershed near Winterset, Iowa.

Source Water Treatment and Storage

Winterset Municipal Waterworks has assessed their system capacity to provide drinking water and protect public health, including a summary of treatment capacity, storage capacity, and contingency plans. Information about treatment and storage capacity is provided in Table 2.

Table 2. Treatment and storage capacity

Water Treatment Processes	Chlorine dioxide injection to raw water line; sodium permanganate following detention tank; poly-aluminated chloride (PAC) at rapid mixing unit; cationic polymer at slow mix chamber; 2 super pulsator clarifiers; 4 granular activated carbon (GAC) and sand media gravel filters; reverse osmosis for nitrate removal; fluoridation, caustic soda and blended polyphosphate additions; gas chlorination and ammonium sulfate injection
Current Treatment Capacity (gal/day)	2 million
Current Average Production (gal/day)	0.6 million
Maximum Quantity Treated and Produced (gal/day)	1.1 million
Minimum Quantity Treated and Produced (gal/day)	0.3 million
Average Hours of Operation (hours/day)	8-9
Maximum Hours of Operation (per day)	14
Minimum Hours of Operation (per day)	6
Number of Storage Tanks	4
Total Gallons of Treated Water Storage	1.3 MG finished water structure; 80,000 gallon clearwell; 0.5 MG ground storage structure; 0.3 MG and 0.1 MG elevated storage
Total Gallons of Raw Water Storage (gal/day)	450 million

Figure 2. Source water intake at Cedar Lake.

Step 1 - Source Water Team

A strong source water protection team (SWP Team) is necessary to ensure that there is an organizational structure and buy-in to implement the action plan to protect and improve source water conditions. The SWP Team was formed by contacting local agencies, organizations and individuals with a role to play in protecting source water. Table 3 provides a list of the SWP Team members, contact information and roles. Interested parties were convened to discuss the potential threats to Winterset's drinking water supply as well as any concerns that the team members had. From these meetings, a set of source water protection goals were established for Winterset. A summary of each of the SWP Team meetings is provided in Appendix A.

The issues and concerns identified by the SWP Team are summarized in Table 4. Each issue or concern is organized by category, including water quality, water quantity, and education.

Table 3. Source Water Protection Team membership

Name	Email	Phone	Interest/Affiliation
Scott Wesselmann	sswess@cwmu.net	515-462-3601	Municipal Utility General Manager
Steve Benshoof	wmuwater@hotmail.com	515-462-3601	Water Utility Superintendent
Mike Ham	mham484980@aol.com	515-462-3601	Water Utility
Patty Weeks	srpjweeks@msn.com	515-462-1422	Water Utility Board
Gary Emmert	gary.w.emmert@gmail.com	515-462-1422	Water Utility Board
Todd Brown	tbrown@madisoncoia.us	515-462-4255	Madison Co. Emergency Manager
NRCS District Conservationist	--	515-462-2961 ext. 303	NRCS District Conservationist
Jim Hochstetler	bhochstetler212@gmail.com	515-462-2961 ext.3	Madison County SWCD Commissioner
Frederick Martens	Martens197@aol.com	515-462-2961 ext.3	Madison County SWCD Commissioner
Tim Palmer	palmfarm@netins.net	641-431-0078	Madison County SWCD Commissioner
Anna MacDonald-Golightly	anna.golightly@ia.nacdnet.net	515-462-2961 ext.3	Madison County SWCD
Andy Jansen	andy.jansen@dnr.iowa.gov	641-931-6031	DNR Fisheries
Janet Gastineau	janet.gastineau@dnr.iowa.gov	515-725-0334	DNR ESD Field Office
James Martin	James.Martin@iowaagriculture.gov	641-472-8411 ext.308	IDALS Watershed Coordinator
Mark Nitchals	wintersetch@aol.com	515-462-1422	City Manager Winterset
Lisa Walters	lwalters@iowaruralwater.org	800-747-7782	Iowa Rural Water Association
Bill Adams	bcadams@q.com	515-468-1039	Landowner
James Baur	jmb3594@yahoo.com	--	Farmer
Bruce Sawyers	bsaw20vartarg@gmail.com	--	Farmer

Table 4. SWP Team issues and concerns

Issue or Concern	Priority Level	Category		
		Quality	Quantity	Education
Sediment loading and turbidity in Cedar Lake.	High	X	X	
Nitrogen concentrations in source water. The existing reverse osmosis system functions well, however it is costly.	High	X		
Water quantity, particularly during droughts. The city has emergency hookups with nearby rural water supplies however the available capacity is low and rationing would be expected.	High		X	
Maintaining a good relationship with City of Winterset	High			X
Phosphorus and algae in Cedar Lake	Moderate			
Microbial contaminants (bacteria)	Moderate	X		
Herbicides/pesticides	Moderate	X		
Stormwater and urban expansion into the watershed	Moderate	X	X	
Lead associated with an existing gun range and potential to reach source water	Moderate	X		
Hazardous materials and storage	Low	X		X
Abandoned wells	Low	X		X
Highway spills (specifically related to US 169 corridor)	Low	X		X
Watershed protection	Low	X		
Recreational use	Low	X	X	
Cost to individual landowners	Low			X

Goals are provided for the highest priority issues and concerns:

- Identify sources of sediment and reduce sediment loading to Cedar Lake
- Reduce nitrogen loading to Cedar Lake by 41%
- Evaluate potential to expand alternate water supply capacity
- Maintain an excellent working relationship between the system, the City, and the source water protection team

These goals were developed based on input received from the SWP Team, the reduction goals set in the Iowa NRS, and available data. Goals inform specific actions in the Action Plan provided in Step 5.

Step 2 - Source Water Delineation

Cedar Lake, a surface water supply, is the primary source water for Winterset Municipal Waterworks, a stand-by well (the Ranney Well) is also available for additional withdrawals as needed. The Cedar Lake intake (S/EP from Cedar Lake) was built in 1939 and currently serves as the primary intake. The Ranney Well (Well #43145, SDWIS# 2412870) was built in 1931. It is currently bypassed and inactive but still maintained by the Waterworks.

The Lakeview Country Club also withdraws water from an intake in Cedar Lake. This second intake is used for irrigation water at a nearby golf club and is subject to a water use permit (permit #8707) to withdraw at least 25,000 gallons of water in a 24-hour period.

While the entire watershed for Cedar Lake constitutes the source water protection area, the primary protection area is defined as a buffered area of one quarter-mile around Cedar Lake and a buffered area of fifty feet around US Highway 169 (Figure 3). Beyond the primary protection area, the remainder of the watershed is the surface runoff area, which is the portion of the drainage basin contributing to the primary protection area. The major tributary to Cedar Lake is Cedar Creek. There are several unnamed tributaries draining to Cedar Creek. The primary protection area and surface runoff area are 10,506 acres in total.

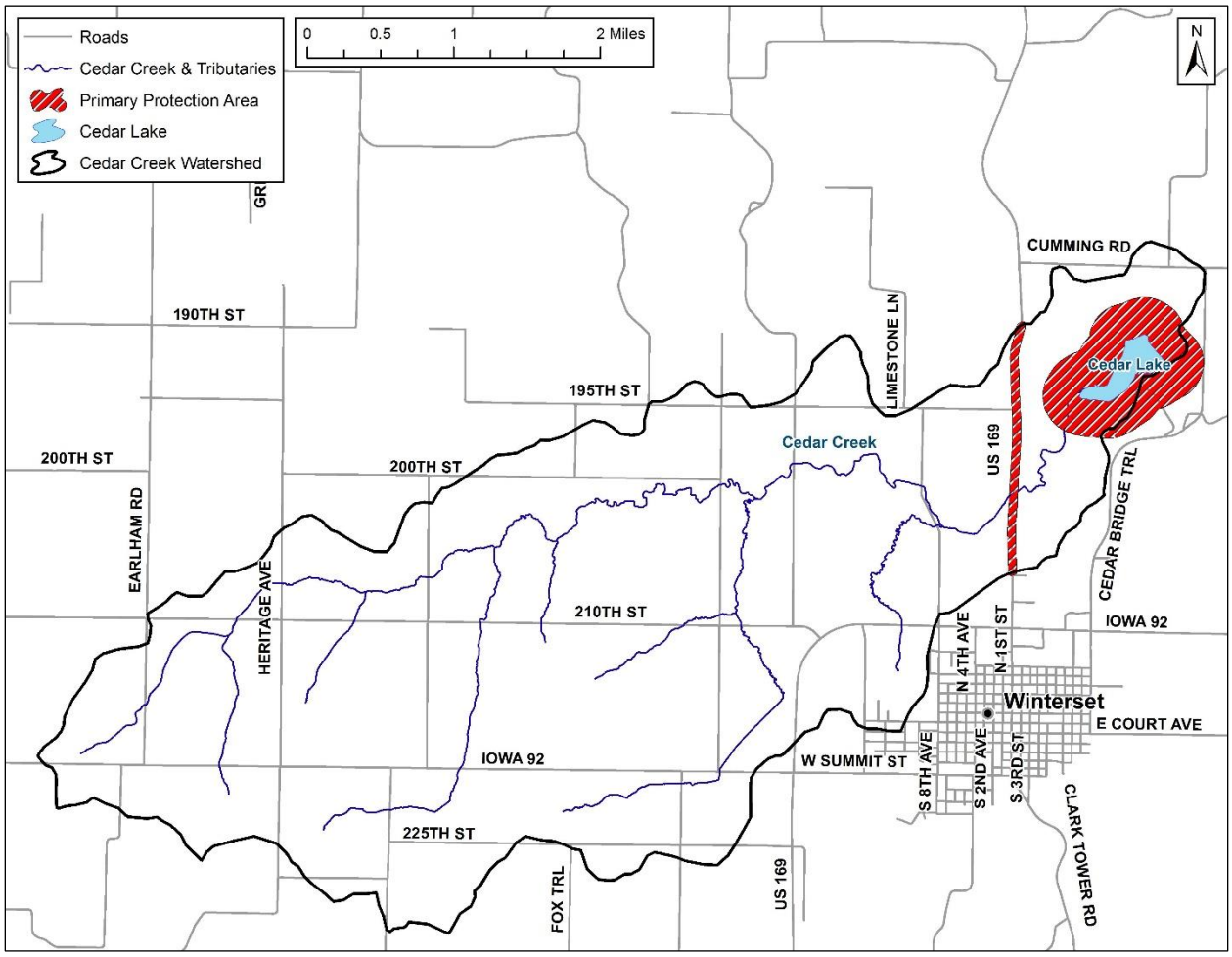

Figure 3. Cedar Lake watershed and primary protection area (the protection area around US 169 has been enlarged for visibility on the map).

Characteristics of the Source Water Protection Area

Land Use

Land use in the Cedar Creek watershed is predominantly agricultural, with 38% of the watershed in corn, 37% in soybeans, and another 4.5% in alfalfa, hay and other row crops. Developed areas, including residential areas and roads, make up only 8.5% of the land in the watershed. The remaining portion of the watershed is grassland, pasture, forest, wetlands and water. Figure 4 shows the land use in the watershed. There are also two confined livestock facilities in the watershed.

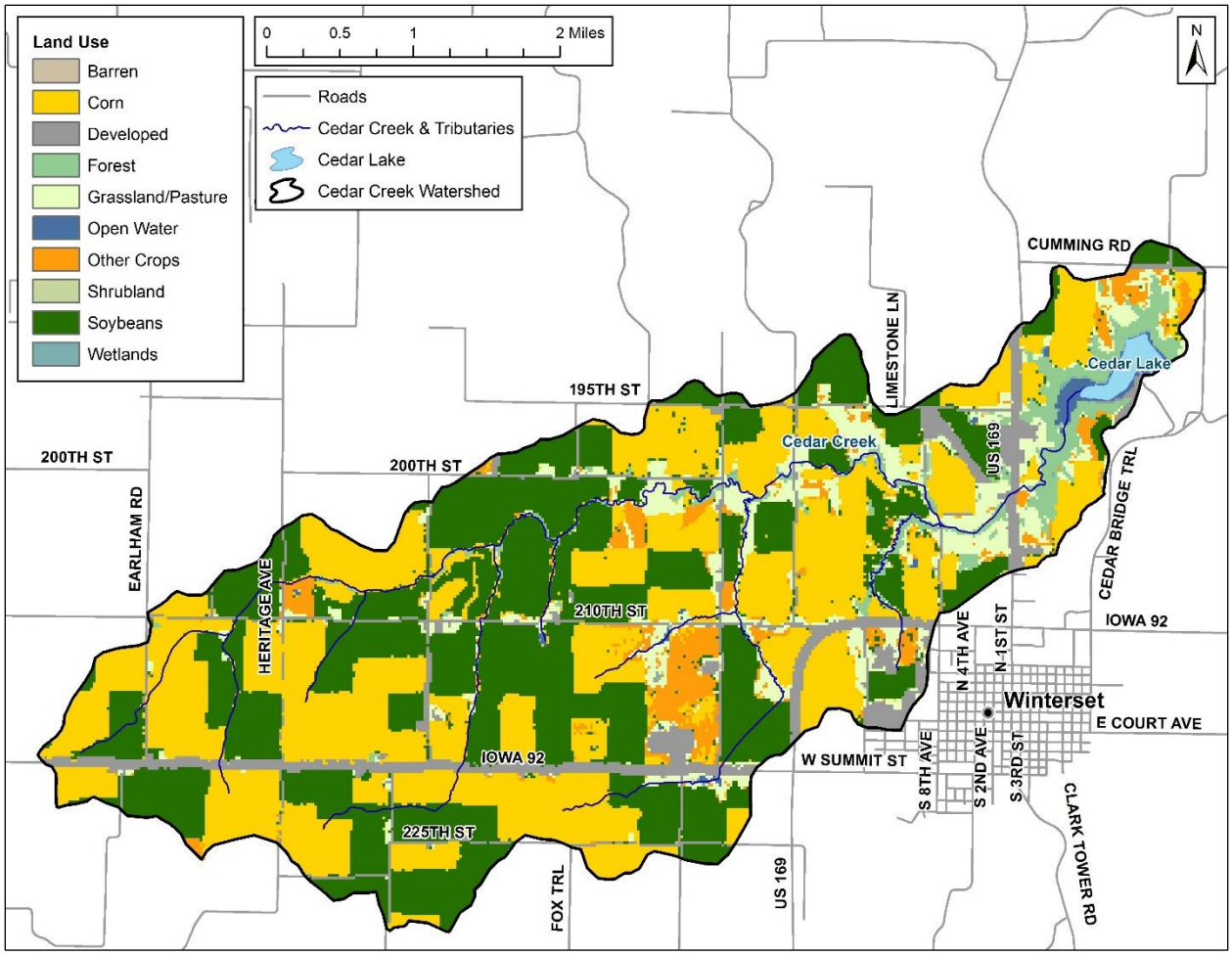

Figure 4. Land uses in the Cedar Lake watershed.

Geology

The Cedar Lake watershed source water protection area lies entirely within the Southern Iowa Drift Plain. This land form is composed of glacial drift, with well-defined stream drainage systems. This area is also known as Tallgrass Prairie. This area is characterized by a history of erosion. A layer of loess up to 10 meters deep was deposited over the glacial till as erosion dissected the landscape. The valleys in the Southern Iowa Drift Plain were formed from flooding as the Wisconsin ice sheet melted. In some places, rivers have eroded the glacial drift sufficiently to reach the underlying sedimentary bedrock[1].

The bedrock in the Cedar Lake watershed is Late Pennsylvanian-Missouri Series, Kansas City group, which is sedimentary rock characterized primarily by limestone and shale[2] and is not a significant aquifer. The depth to bedrock in the watershed is typically less than 75 feet and is often at or near the land surface.

[1] http://www.iowadnr.gov/Conservation/Wildlife-Stewardship/Iowa-Wildlife-Action-Plan/Landform-Regions-of-Iowa

[2] https://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=IAPAkc%3B0

Soils

Soil types can be important because the rate groundwater infiltrates through the soil and the type of plants grown in that soil control the amount of precipitation that reaches the groundwater. Hydrologic soils groups (HSGs) refer to the grouping of soils according to their runoff potential. Soil properties that influence the HSGs include depth to seasonal high water table, infiltration rate and permeability after prolonged wetting, and depth to slow permeable layer. There are four groups of HSGs: Group A, B, C, and Group D. Soil data were obtained from the 2014 Soil Survey Geographic Database (SSURGO) produced by the Natural Resources Conservation Service (NRCS).

The Cedar Lake watershed is underlain primarily by C-type soils, with some B and D-type soils in the stream and riparian zones and the southwestern section of the watershed (Figure 5). C-type soils have low infiltration rates and are sandy clay loams (USDA 1986[3]). B-type soils are characterized by moderately low infiltration rates and are silt loam or loam. D-type soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils, soils with a high water table, and shallow soils over nearly impervious material. The majority of soils in the watershed are sandy clay loam, with larger areas of silt loam and loam towards Cedar Lake.

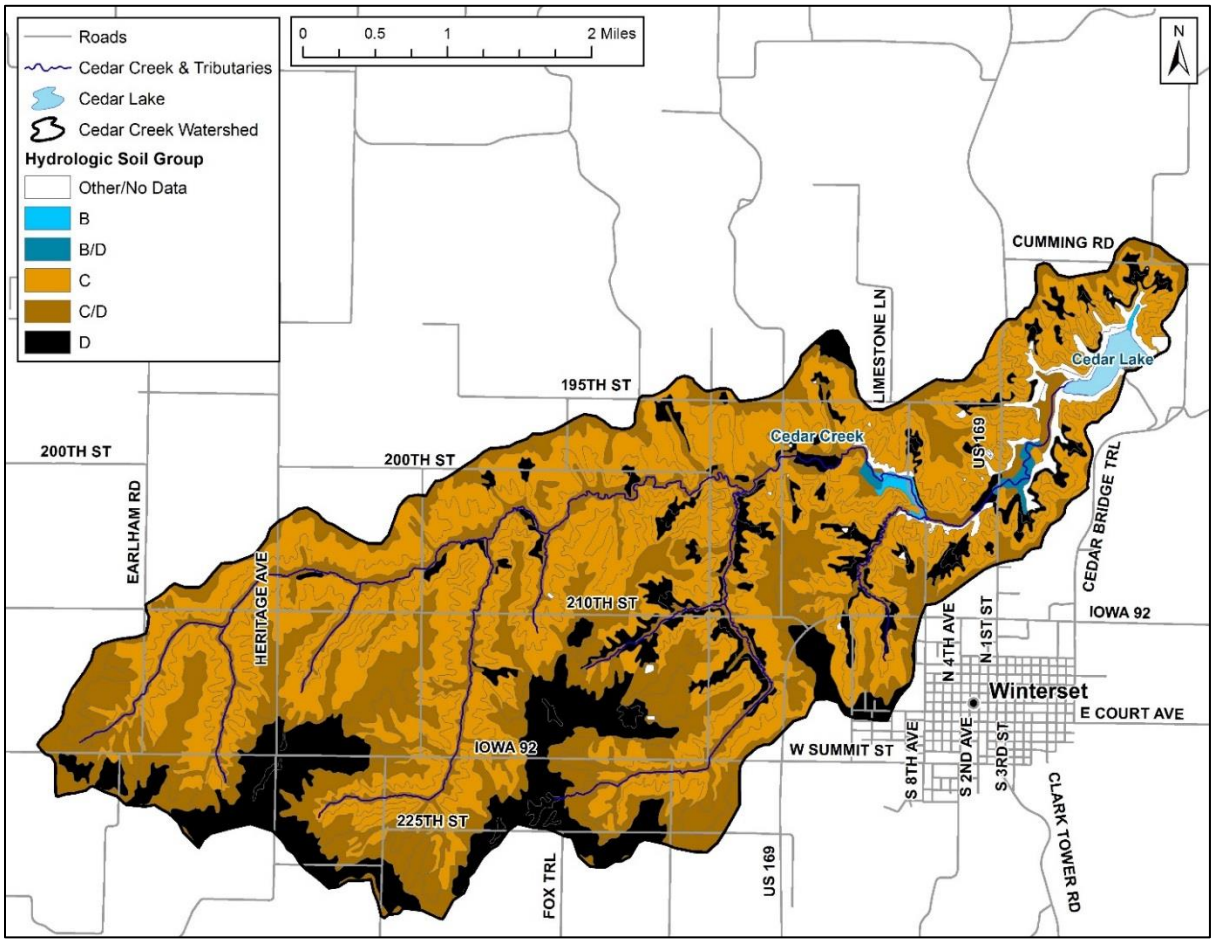

Figure 5. Soil hydrologic groups in the Cedar Lake watershed.

[3] https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044171.pdf

Water Quality in the Source Water Protection Area

Nitrate monitoring data from the Winterset Municipal Waterworks are available for several locations throughout the watershed, including Cedar Creek and several unnamed tributaries (Figure 6). Data were collected at four locations along Cedar Creek (sites #1, 3, 5 and 6) and on three tributaries from 1999-2017 (sites #2, 4 and 7). The largest number of samples were collected in 2001 and 2004 and during the months of April through July.

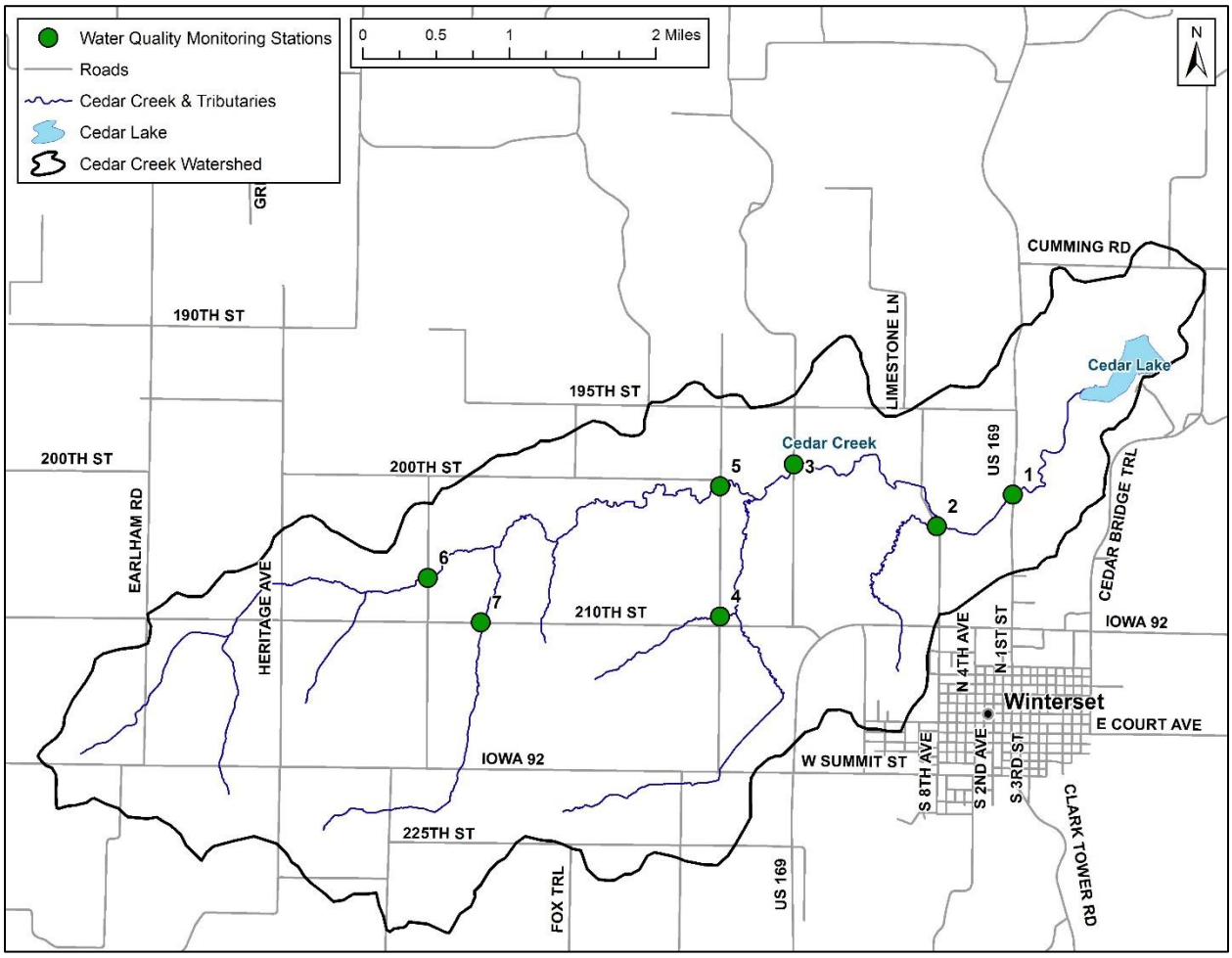

Figure 6. Water quality monitoring stations.

Monitored nitrate concentrations were evaluated across the source water protection area to determine potential nitrate loading hotspots and at monitoring Site #1, closest to the lake, to characterize the nitrate concentrations entering Cedar Lake. The water quality standard for nitrate is 10 mg/L, and while the Winterset Waterworks does provide treatment for removal of nitrate, this process is expensive and opportunities to reduce nitrate in the lake are a priority.

Nitrate concentration at monitoring Site #1 ranges from 0.6 to 20.3 mg/L with average concentration near or above the state water quality standard throughout the monitoring period (Table 5). Of all the samples collected, 56% exceeded the state standard and the highest number of exceedances occurred in 2001 and 2004. During the two years with the most data (2001 and 2004), the annual average reduction needed to meet the water quality standard was 27% and 25%, respectively.

Throughout the year, nitrate concentrations were highest in April through June with 46% of the samples exceeding the standard within the three-month period (Table 6). Data collection was limited in the months of August through March.

Table 5. Annual summary of nitrate data at monitoring Site #1, Cedar Creek

Year	Sample Count	Minimum (mg/L)	Maximum (mg/L)	Average (mg/L)	# of Exceedances of 10 mg/L Standard	Percent of Samples Exceeding Standard	Average Annual Reduction Needed
1999	1	20.3	20.3	20.3	1	100%	51%
2001	15	8.5	16.4	13.7	13	87%	27%
2002	6	0.6	8.9	5.9	0	-	0
2003	8	0.4	17.6	8.9	3	38%	0
2004	19	6.9	17.3	13.4	16	84%	25%
2006	2	9	9.7	9.4	0	-	0
2015	1	8.4	8.4	8.4	0	-	0
2016	5	0.5	9.9	5.5	0	-	0
2017	4	7.3	16.4	10.0	1	25%	0

Table 6. Monthly summary of nitrate data at monitoring Site #1, Cedar Creek (1999-2017)

Month	Sample Count	Minimum (mg/L)	Maximum (mg/L)	Average (mg/L)	# of Exceedances of 10 mg/L Standard	Percent of Samples Exceeding Standard
January	1	7.3	7.3	7.3	0	-
February	1	0.5	0.5	0.5	0	-
March	3	1.9	8.2	6.1	0	-
April	15	0.4	16.4	12.2	11	73%
May	17	6.2	20.3	12.8	10	59%
June	9	4.7	17.3	13.3	7	78%
July	11	0.6	15.5	9.4	6	55%
August	2	6.9	7.6	7.3	0	-
September	1	6.6	6.6	6.6	0	-
December	1	8.4	8.4	8.4	0	-

Nitrate concentrations are similar across all monitoring sites in the spring, with the exception of Site #2 where monitored concentrations are much lower (Figure 7). Site #2 is located on a small tributary to Cedar Creek and has less agricultural land draining to it in comparison to the mainstem. Average nitrate concentrations in April-June are highest at Sites #4 and #6. These sites represent headwater areas and indicate that nitrates are high throughout the stream system.

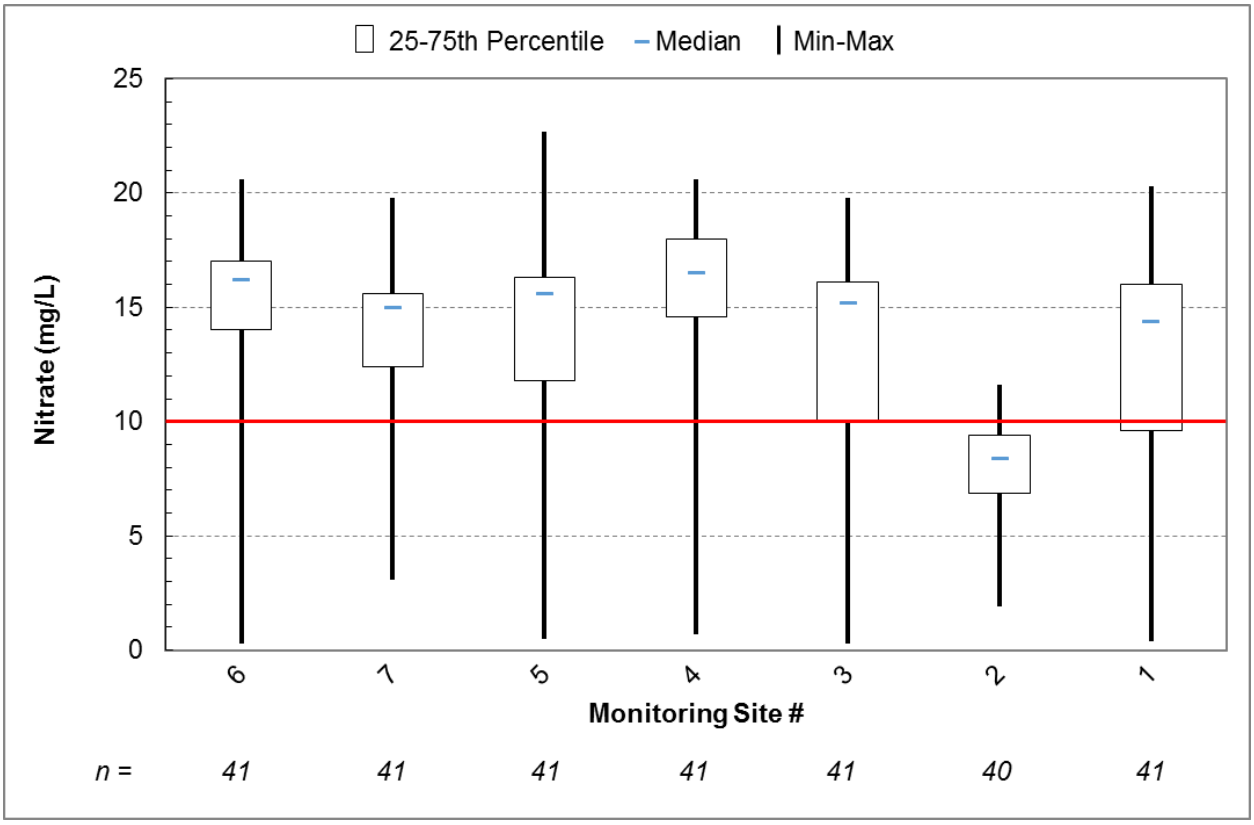

Figure 7. Nitrate concentration (Apr–Jun) in the Cedar Creek watershed (1999-2017). Red line indicates 10 mg/L nitrate standard. n indicates the number of samples being evaluated (40 or 41).

Susceptibility Determination

Since the primary source water is surface water, the surface runoff area, or watershed, can be considered highly susceptible to contamination originating from the land surface.

Step 3 - Inventory of Potential Contaminant Sources

SWPPs should provide a full contaminant and well inventory to identify all potential contaminant sources (PCSs), potential conduits, and land use categories within the source water area. A partial list of PCSs that may be encountered is included in Appendix B. The Phase I Source Water Assessment Plan for Cedar Lake was developed in 2001; however, only a partially complete copy of the plan was made available. The missing pieces included the spatial location of potential contaminant sources, but a table listing PCSs was available. The potential contaminant sources identified in the Phase I Source Water Assessment Plan have been reviewed and included in this Source Water Protection Plan as appropriate.

In Iowa, nonpoint sources of contamination are a prevalent concern for drinking water quality. Fertilizers, chemicals, and manure are all commonly used in row crop agriculture and can reach source water, either through surface runoff or in the shallow aquifer. PCSs were identified based on a review of geospatial databases from DNR, land use data, findings of the 2001 Source Water Assessment, a field survey conducted in 2017, and input from the SWP Team.

Runoff from construction sites can contain elevated levels of sediment and chemical pollutants. Currently active construction stormwater permits are identified in Table 7, but by the nature of construction sites, this list will evolve over time as construction is completed at some locations and begun at new locations.

Groundwater wells were identified from geospatial data from DNR and include wells from the Iowa Geological Survey (IGS) database, wells registered for testing, private well tracking system and registered abandoned wells. Wells can serve as conduits for surface contamination to move to the groundwater more rapidly and if they are used for irrigation can also serve as a conduit for contaminated groundwater to be applied on the surface. If wells are no longer in use, it is important to properly abandon them. Groundwater well information and locations are provided in Appendix C.

An inventory of all PCSs and land uses of concern is provided in Table 7 and Figure 8. The location numbers in Table 7 correspond to the numbered points in Figure 8.

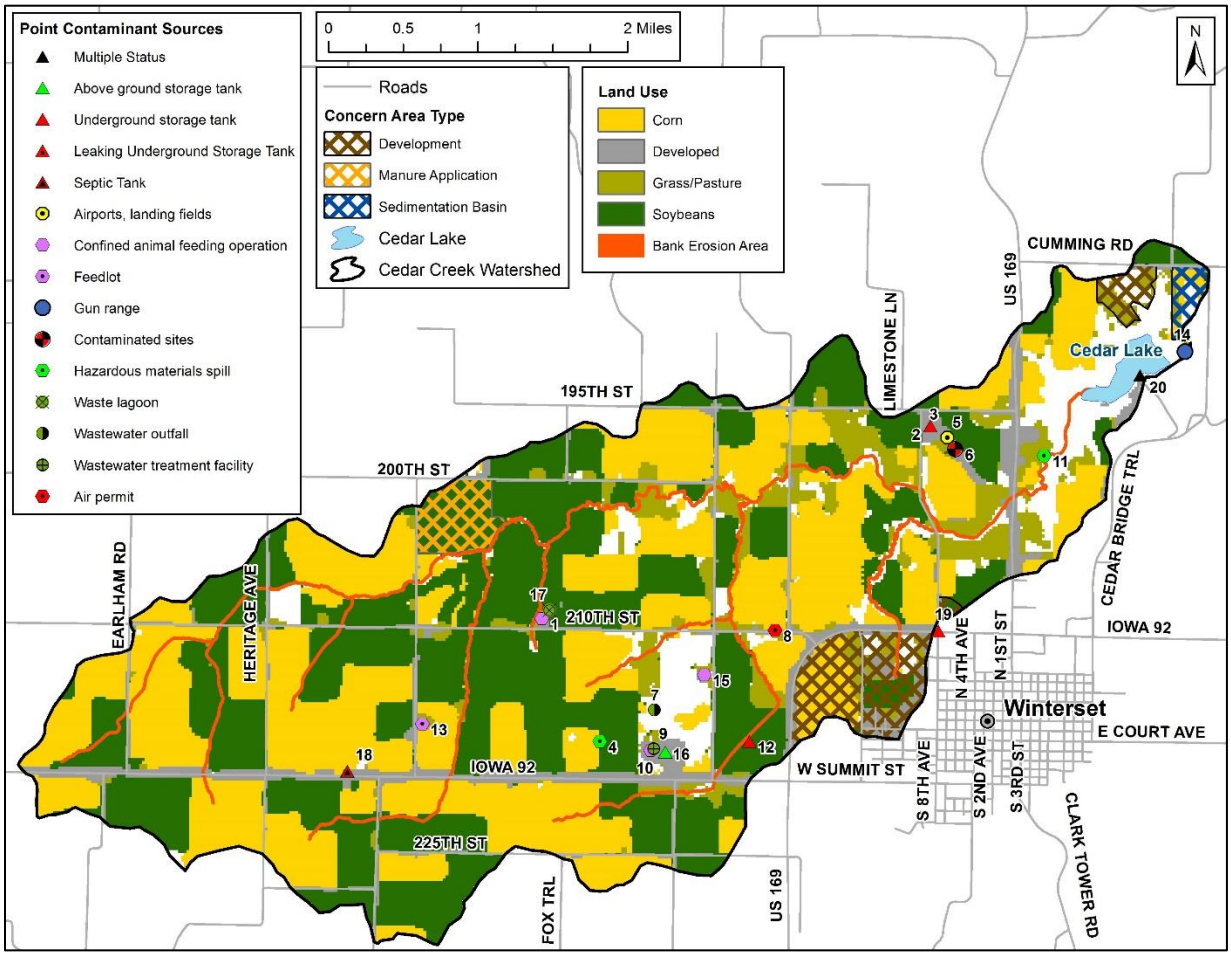

Figure 8. Locally identified potential contaminant sources. Land uses from 2015 Cropland Database.
Specific bank erosion sites are found in Figure 18 .

Table 7. Inventory of potential contaminant sources and land uses of concern

Category (PCS, land use)	Location #	Source (database, field, etc)	Site	Facility Type	Typical or Known Contaminants	Notes
PCS	1	DNR Database	Waldo Farms Sow Unit	CAFO	Nutrients, organic matter, microbes, pesticides, hormones, metals	--
PCS	4	DNR Database	Winterset Egg Farm, Poultry Facility	Hazardous Material Spill	Ammonia	Manure spill
PCS	10, 9, 7	DNR Database	Winterset Egg Farm	NPDES, CAFO, NPDES Outfall	Nutrients, organic matter, microbes, pesticides, hormones, metals	Construction stormwater permit to end 1/2017
PCS	2, 3, 6, 5	DNR Database	Winterset Municipal Airport (Madison County Airport)	LUST, UST, Contaminated Site, Industrial Stormwater permit	Gasoline, Jet fuels, deicers, diesel fuel, solvents, etc.	Contaminated Site Status: closed, 1990 LUST: 8LTC91; stormwater discharges to Cedar Creek
PCS	12	DNR Database	US West	UST	Diesel	Closed, Removed
PCS	19	DNR Database	Bussanmas Inc.	UST	Diesel and gasoline	Closed
PCS	19	DNR Database	8LTC91	UST	Gasoline (0 gallons)	Transferred-Cont. Site
PCS	11	DNR Database	John Wayne Dr. Handling and Storage Spill	Hazardous Materials Spill	2,4-D-esters, 50 gal.	Closed, 2002
PCS	8	DNR Database	Cedar Creek Animal Clinic	Air Permit-Minor	Microbial, radiological wastes, biological wastes, miscellaneous chemicals	--
PCS	none	DNR Database	Agriland Fs. Inc. – Winterset Bulk	Tier II Chemical Storage	Unknown	Input received at the SWP Team meeting indicated this facility was not in the watershed
PCS	none	DNR Database	BB&P Feed and Grain, Inc. Bulk Chemical	Tier II Chemical Storage	Unknown	Input received at the SWP Team meeting indicated this facility was not in the watershed
PCS	20	DNR Database	Winterset WS-Cedar Lake	Multiple Status	Varies	Winterset municipal water works intake

Category (PCS, land use)	Location #	Source (database, field, etc)	Site	Facility Type	Typical or Known Contaminants	Notes
PCS	various	DNR Database	Corkrean & Watts Addition, Plat No. 5	Construction Stormwater	Sediment	Discharges to Cedar Creek
PCS	various	DNR Database	Fareway Stores, Inc	Construction Stormwater	Sediment	Unnamed tributary to Cedar Creek
PCS	various	DNR Database	North Stone Village	Construction Stormwater	Sediment	Unnamed tributary to Cedar Creek
PCS	various	DNR Database	Arbor Park, Plat 2	Construction Stormwater	Sediment	Unnamed tributary to Cedar Creek
PCS	various	DNR Database	Glenwood Plat 1	Construction Stormwater	Sediment	Unnamed tributary to Cedar Creek
PCS	various	DNR Database	Glenwood Villas	Construction Stormwater	Sediment	Unnamed tributary to Cedar Creek
PCS	none	DNR Database	Grulke Quarry	Mines	Sediment	Input received at the SWP Team meeting indicated this facility was not in the watershed
PCS	13	Air photo	--	Feedlot	Nutrients, organic matter, microbes, pesticides, hormones	--
PCS	14	Source Water Team	Madison County Sportsmen's Club	Gun range	Lead	--
PCS	15	Source Water Team	Winterset Pullet Farm	CAFO	Nutrients, organic matter, microbes, pesticides, hormones, metals	--
PCS	16	Source Water Team	Winterset Egg Farm	Above ground storage tank	Propane	--
PCS	17	Source Water Team	--	Animal waste lagoon	Nutrients, organic matter, microbes, pesticides, hormones	Visible on air photo
PCS	18	Source Water Team	--	Septic tank	Nutrients, organic matter, microbes, pharmaceuticals	Known location of septic outlet
PCS	blue hatch	Source Water Team	--	Sedimentation basin	Sediment	Spoils from Cedar Lake dredging
PCS	yellow hatch	Source Water Team	--	Area of manure application	Nutrients, organic matter, microbes, hormones	Known area of application
Land Use	brown hatch	Source Water Team	--	Areas of future development	Sediment, nutrients, herbicides, pesticides	--
Land Use	yellow, forest green	Cropland Database	--	Corn and soybean land covers	Sediment, nutrients, herbicides, pesticides	--

Category (PCS, land use)	Location #	Source (database, field, etc)	Site	Facility Type	Typical or Known Contaminants	Notes
Land Use	light green	Cropland Database	--	Pasture	Sediment, nutrients, microbes	--
Land Use	orange	Field Investigation (see Figure 18)	--	Streambank erosion	Sediment	See Figure 18 for specific locations

-- : no site name
CAFO: Concentrated Animal Feeding Operation
NPDES: National Pollutant Discharge Eliminating System
UST: Underground storage tank
LUST: Leaking underground storage tank

Step 4 - Assessment and Risk Ranking of Potential Contaminant Sources

After PCSs in the source water area are identified, the risk each source poses to the water supply should be determined. Performing a systematic evaluation of the relative risk of contamination from each source allows the SWP Team to determine which potential threats are the greatest and can be used to prioritize implementation actions by focusing first on implementation strategies that impact the pollution sources of greatest risk.

The Iowa DNR Source Water Protection Program has established a statewide source water assessment and ranking system that is used in Phase I Source Water Assessment Plans and can be used in SWPPs as well. The three factors that go into the ranking system are:

- Location of the potential contaminant source
- Source water susceptibility
- Contaminant risk

Risk is calculated as:

Location + Susceptibility + Contaminant Risk = Source Water Risk Ranking

Points are assigned for each of the three factors and a cumulative score is calculated for each PCS.

Location of Potential Contaminant Source

PCSs are ranked either 3 or 5, based on their location within the surface runoff area. A rank of 1 would represent a source outside the surface runoff area. There are no PCS that meet this criterion. A higher number represents a higher risk and closer proximity to the intake. In the case of a surface water source, the primary protection zone would have a higher risk due to the likelihood of direct transport of pollutants to the source water supply. Table 8 summarizes the risk scores for Winterset.

Table 8. Risk scores based on location of potential contaminant source

Location	Risk Score
Outside surface runoff area	1
Surface runoff area	3
Surface runoff area – primary protection zone	5

Source Water Susceptibility

Since Winterset source water is limited to surface water, susceptibility rankings were determined by the amount of separation surface waters have from potential contaminants. Due to the relatively small size of the Winterset watershed and its relatively consistent land use, distance from streams was used as an indicator of susceptibility. Areas within a quarter mile of either side of a streambank and around Cedar Lake's shoreline were delineated as areas with high susceptibility for contaminants of concern. This susceptibility area was extended from the Phase 1 susceptibility area and based on SWP team input (Howard R. Green Company 2001). Tile drains, by design, also create a direct connection between agricultural land and surface waters. Therefore, the area directly surrounding a tile drain (200 feet) is also considered highly susceptible for potential contamination. PCSs rankings are summarized in Table 9. Areas of high source water susceptibility are provided in Figure 9 for PCSs and Figure 10 for groundwater wells. No data were available on tile drain inlet locations in the watershed, however; locations of tile drain inlets can be inferred from known BMP locations assuming one intake per WASCOB or 500 linear feet of terrace. Existing BMPs in the watershed were mapped through an Iowa State University (ISU) mapping project (see Figure 11).

Table 9. Risk score based on source water susceptibility

Delineation	Risk Score
Less than ¼ mile from surface water (stream or lake)	3
Less than 200 feet from tile drain inlet	
Greater than ¼ mile from surface water (stream or lake)	1
Greater than 200 feet from tile drain inlet	

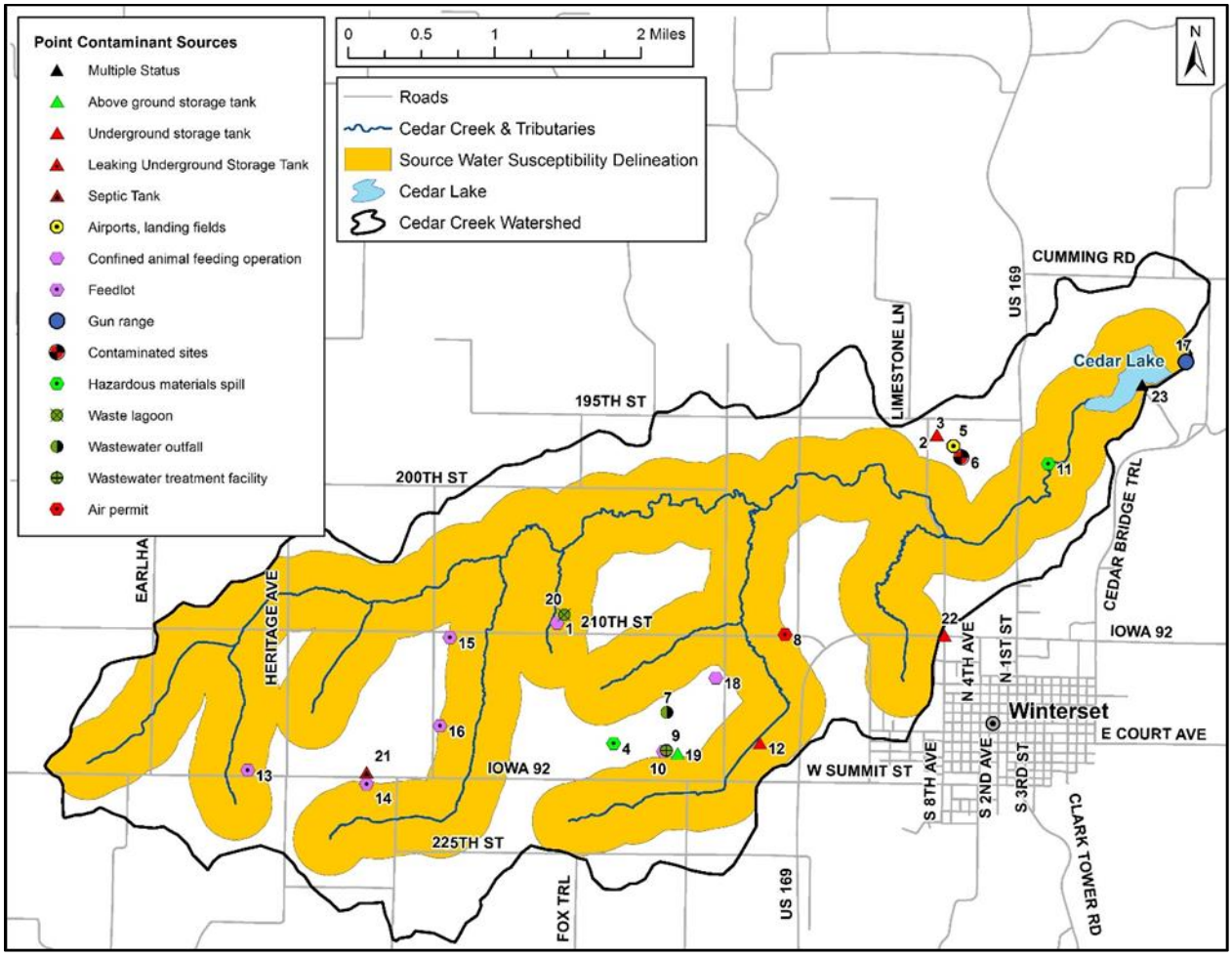

Figure 9. Source water susceptibility delineation (1/4 mile buffer) for PCS.

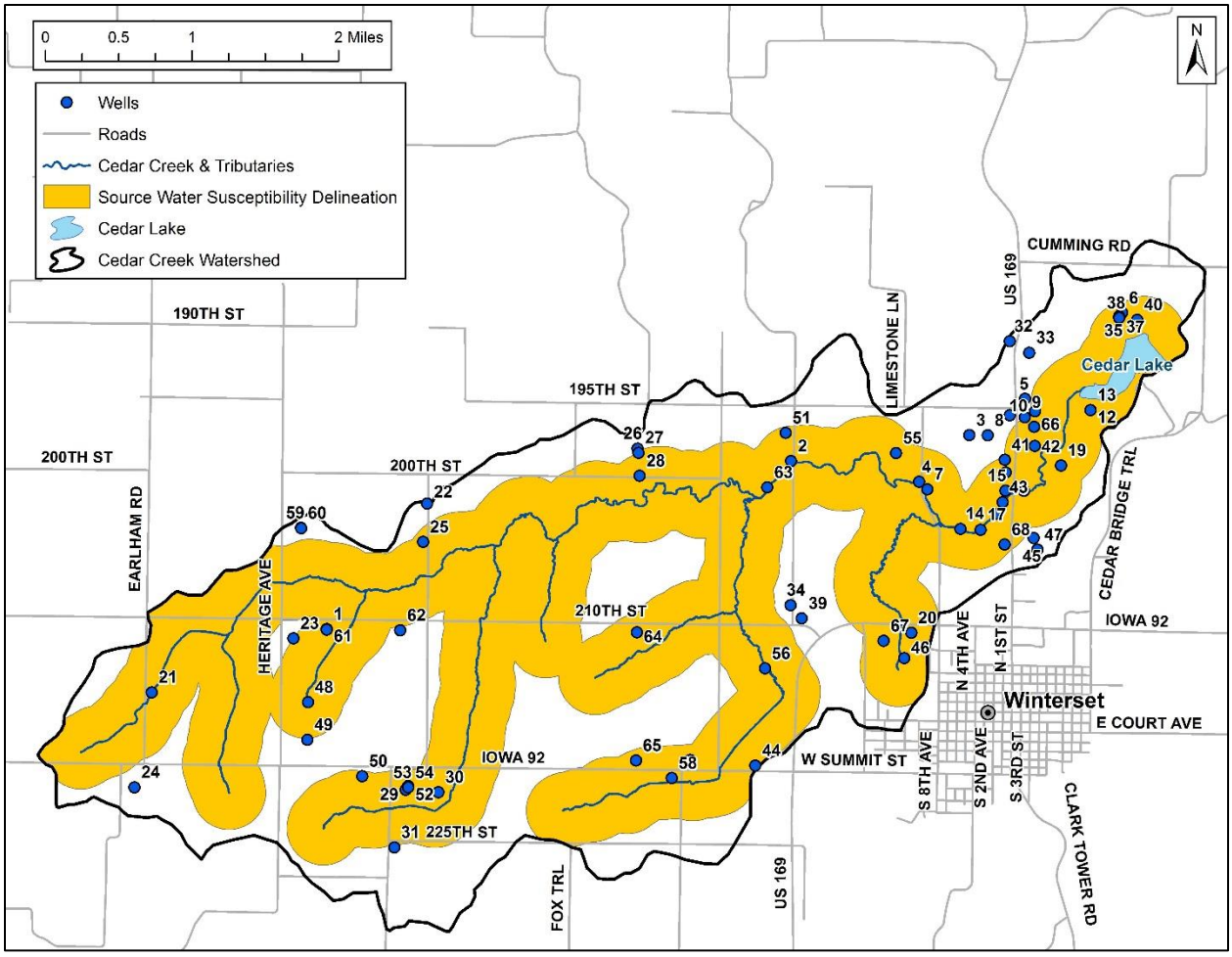

Figure 10. Surface water susceptibility delineation (1/4 mile buffer) for groundwater wells.

Contaminant Risk

Contaminant risk describes the combination of the potential to release contaminants with an estimate of the toxicity of the contaminants that may be released from a given facility or land use. Iowa DNR provides a contaminant risk guide based on land use type. As with the location of PCSs, it is appropriate to modify the risk scores to account for local water quality conditions and known issues and because the source water supply is a surface waterbody. The risk score for the field crop land use is increased to reflect the historical and potential future impacts of agricultural activities on the drinking water source supply. The risk scores also rank higher those activities that have the potential to discharge nutrients. The risk scores are relative rankings of potential for contaminant risk, not absolute risk scores. A summary of the risk scores for Winterset are shown in Table 10.

Table 10. Contaminant risk scores by land use type. Higher scores are higher risk

Winterset Risk Score	Land Use Type
1	Land surrounding a well or reservoir owned by a water company
1	Permanent open space dedicated to recreation
2	Active and properly abandoned wells
3	Municipal or private parks
3	Field crops: pasture, hay, vegetables
4	Areas of disturbed soil and sediment (e.g., sediment basin)
4	Developed land uses: residential, commercial, institutional, and areas of future development
4	Agricultural production: nurseries, orchards, berries
5	Field crops: corn, soybeans, tiled fields
5	Agricultural production: dairy, livestock, poultry
5	Improperly abandoned wells
5	Wastewater: sewage treatment facilities and disposal, permitted confined animal feeding operations, feedlots and manure application areas, and private septic systems
5	Industrial: all forms of manufacturing and processing, research facilities
5	Underground storage of chemicals, petroleum
5	Waste disposal: pits, ponds, lagoons; injection wells used for waste disposal; landfills; hazardous waste treatment, storage, and disposal sites

Total Risk

Table 11 through Table 13 provide a summary of the PCSs, groundwater wells, and land uses with the highest risk, based on the individual location, susceptibility and contaminant risk scores. The total risk score for each is used to help determine implementation of the action plan. Appendix D contains the individual risk scores for all identified PCSs, groundwater wells and land use types in the watershed.

Table 11. Highest risk PCSs in the Cedar Lake watershed

Land Use or Operation of Concern (PCS)	ID	Risk Score			Total Risk Score
		Location of PCS	Source Water Susceptibility	Contaminant Risk	
Waldo Farms Sow Unit	1	3	3	5	11
US West	12	3	3	5	11
John Wayne Dr. Handling and Storage Spill	11	3	3	5	11
Cedar Creek Animal Clinic	8	3	3	4	10
Feedlot	13	3	3	5	11
Feedlot	14	3	3	5	11
Feedlot	15	3	3	5	11
Feedlot	16	3	3	5	11
Madison County Sportsmen's Club	17	5	3	4	12
Winterset Egg Farm	19	3	3	4	10
Animal waste lagoon	20	3	3	5	11
Sediment basin	Blue hatch	5	3	4	12

Table 12. Highest risk groundwater wells in the Cedar Lake watershed

Groundwater Well Type	Risk Score			Total Risk Score
	Location	Source Water Susceptibility	Contaminant Risk	
Within ¼ quarter buffer of surface water and within primary protection area	5	3	2	10

Table 13. Highest risk land use types in the Cedar Lake watershed

Land Use Type		Risk Score			Total Risk Score
		Location	Source Water Susceptibility	Contaminant Risk	
Crops (pasture and hay)	Within ¼ quarter buffer of surface water and primary protection area	5	3	3	11
Crops (corn/soy)	Within ¼ quarter buffer of surface water and primary protection area	5	3	5	13
	Within ¼ buffer of surface water	3	3	5	11
Developed	Within ¼ quarter buffer of surface water and primary protection area	5	3	4	12
	Within ¼ buffer of surface water	3	3	4	10

Step 5 - Action Plan

The action plan outlines the methods for addressing the issues and concerns of the SWP Team and the threats to drinking water posed by each major PCS. The overall goal of the action plan is to reduce or mitigate the potential for contamination of the water supply. In addition, the action plan will provide the watershed with the tools, direction, and ability to implement pollutant load reductions set in the Iowa NRS. Step 5 includes a summary of recommended actions as well as information on a potential watershed-wide education and outreach program, monitoring, anticipated level of implementation, and the financial and technical resources available to support successful implementation.

A wide range of actions are necessary to address priority issues and threats to drinking water supply on a watershed-wide level. The action plan and schedule for the source water protection plan is provided in Table 14 along with the responsible entity. The following sections provide additional information on select watershed-wide implementation actions and potential locations for implementation when available.

A rapid stream assessment was completed within the Cedar Lake watershed January 29-31, 2018 to inform Action Plan recommendations. The assessment was completed in partnership with the DNR and the Madison County Soil and Water Conservation District.

Table 14. Action Plan and schedule

Activity	Completion Date	Responsible Entity	Comments
Hold annual SWP Team meetings	Annually by Dec.	Winterset Municipal Waterworks	List of SWP Team members available in Step 1.
Form a watershed management authority or similar such as a Watershed Advisory Board and a Watershed Technical Advisory Board	Dec 2018	SWP Team members	See Programmatic and Regulatory Actions section below for further information.
Develop and formalize cost share program between Waterworks and landowners for installation of recommended actions	Mar 2019	Winterset Municipal Waterworks, SWP Team members	
Identify potential sources of funding and apply for grants	Annually by Dec.	SWP Team members	See Technical and Financial Assistance section below and Table 18 for further information.
Conduct education and outreach pre-campaign survey and identify target audiences and messages	Dec 2019	SWCD	See Watershed-Wide Education and Outreach Program section below for further information.
Conduct education and outreach activities	Annually by Dec.	SWCD	See Watershed-Wide Education and Outreach Program section below for further information.
Bring on additional staff or FTE to lead implementation of source water plan	Mar 2019	SWCD, NRCS	Responsibility of plan implementation can then be shifted to this individual or FTE.
Identify gaps in existing ordinances and building codes and incorporate new language to protect water quality of Cedar Lake from nutrient, sediment, and bacteria loading, if necessary	Dec 2019 – gaps analysis Dec 2020 – updated ordinances	City of Winterset, Madison County	See Programmatic and Regulatory Actions section below for further information.
Develop emergency action plan for spills along US Hwy 169	Dec 2018	Madison County Emergency Management	
Determine need for source prohibitions or other action for priority PCSs, implement if necessary	Dec 2019	Winterset Municipal Waterworks, Madison County	See Table 11, Table 12 and Table 13
Identify percentage and location of owner operated and rented fields in the watershed	Dec 2019	SWCD, NRCS	
Update farm plans to address nitrogen management	Update 4 farm plans per calendar year	Local farmers, SWCD, NRCS	
Inspect/audit farm plans once every 5 years to ensure implementation	Every 5 years (2019, 2024, 2029, etc.)	SWCD, NRCS	
Inspect and maintain existing agricultural BMPs to ensure their effectiveness	Annually	SWCD, NRCS	See Figure 11.
Identify opportunities for farm demonstrations within watershed	Dec 2019	SWCD, NRCS, IDALS	
Implement three demonstration agricultural BMP projects that address nitrates	One project every 2 years starting in 2020	SWCD, NRCS, IDALS, Winterset Municipal Waterworks	See Agricultural Best Management Practices below and Table 16 for further information.

Activity	Completion Date	Responsible Entity	Comments
Identify opportunity for collaboration on agricultural BMP implementation. Develop partnerships with agricultural stakeholders	On-going	SWCD, NRCS, IDALS, Winterset Municipal Waterworks, City of Winterset, Madison County	Combing resources such as equipment and technical knowledge can reduce costs and increases efficiency.
Implement agricultural BMPs, beginning in high priority areas	On-going	SWCD, NRCS, IDALS	See Agricultural Best Management Practices below for further information.
Determine baseline erosion from Cedar Creek using tools such as the Revised Universal Soil Loss Equation (RUSLE2).	Dec 2018	DNR	
Determine landowner willingness to participate in stream bank, agricultural, and onsite wastewater BMPs	Dec 2018	DNR. SWCD, Madison County	
Update and refine monitoring approach in Cedar Lake and its watershed; implement annually	Apr 2018 – updated approach; monitoring is annually	Winterset Municipal Waterworks	See Monitoring and Adaptive Management below for further information.
Implement recommendations in the 2016 Sanitary Survey, as funding becomes available	Jun 2019, or as funding becomes available	Winterset Municipal Waterworks	Document can be found here https://programs.iowadnr.gov/sourcewater/SystemDetail.aspx?pwsid=6171029.
Implement stream restoration practices on priority areas for stream restoration	One project every 2 years starting in 2020	DNR, SWCD, NRCS	See Streambank Restoration below for further information.
Evaluate options to manage carp in Cedar Lake and implement, if necessary	Dec 2020 – evaluate options Dec 2023 – implement if turbidity levels unchanged from watershed improvements	DNR Fisheries	See Fisheries Management below for further information.
Assess need for lead best management practices and implement as needed	As need arises	Winterset Municipal Waterworks	See Lead Best Management Practices below for further information.
Review plan on a bi-annual basis and update as needed using adaptive management framework	Every 2 years starting in 2020	Winterset Municipal Waterworks SWP Team members	
Continue inspection on identified PCSs	On-going	DNR, SWCD, NRCS, Madison County	See Table 7 and Figure 8.
Locate and determine activity status of wells listed in the statewide database (W#4314, W#43148, W#43149, W#43150, W#43151, W#43151)	Dec 2018	Madison County	

Agricultural Best Management Practices

Agricultural best management practices (BMPs) address the following source water protection issues: sediment loading and turbidity in Cedar Lake, nitrogen concentrations in source water, and microbial contaminants (bacteria). The Winterset watershed is largely agricultural and many BMPs to minimize runoff exist on the landscape such as terraces, grassed waterways, and WASCOBs. These BMPs can be effective at removing phosphorus and sediment from runoff, but are not very effective at nitrogen removal. Therefore, in order to protect source water from phosphorus, sediment, and nitrogen, additional agricultural BMPs are necessary.

Several types of agricultural BMPs are suitable to address source water protection concerns in the watershed. They include:

- **Controlled drainage** or drainage water management systems utilize stoplogs to control water table depth under drain-tiled agricultural fields and can improve water quality by reducing water volume and nutrient transport rates. Controlled drainage has a small effect on nitrate concentrations, but the flow volume reduction they provide reduces nitrate loads with a negligible effect on crop yields (IDALS et al. 2016).
- **Edge-of-field bioreactors** are excavated pits that denitrify water from subsurface drainage by providing a carbon source (often wood chips) for denitrifying bacteria, which in turn convert nitrate to nitrogen.
- **Saturated riparian buffers** remove some water from tile drainage and infiltrates it into groundwater within a riparian area. Related to controlled drainage, saturated buffers use a stoplog system to create an elevated water table that allows denitrification to occur in organic soils (IDALS et al. 2016).
- **Nutrient removal wetlands** or treatment wetlands are engineered to mimic natural wetlands and designed to filter and treat nutrients and sediment in runoff. Wetlands remove approximately 20 to 75% of total phosphorus loads (IDALS et al. 2016) and about 40 to 90% of nitrate-nitrogen loads (Porter et al. 2017).
- **Grassed waterways** are placed in agricultural fields where flows are concentrated and use vegetative cover to prevent erosion (IDALS et al. 2016). Reduced sediment loads of about 95% have been recorded, as have reduced water volumes and minor filtration of nutrients (Miller et al. 2012).
- **Contour buffer strips** are strips of permanent vegetation planted perpendicular to the slope of a field in between wider strips of row crops. Buffer strips can have a large impact on soil erosion reduction, but can also provide some nutrient reduction.
- **Water and sediment control basins (WASCOB)** are embankments that restrict flow through a waterway. Placed perpendicular to flow paths, these berms slow overland flow and reduce soil erosion, suspended sediment loads, and sediment-bound particle loads, such as attached phosphorus.
- **Nutrient management strategies** such as soil testing and variable application of fertilizer can reduce the level of fertilizer applied, save application costs for the producer, and increase crop yields. Several types of strategies exist including:
    - Reducing nitrogen application rates to the recommended Maximum Return to Nitrogen rate

  - Sidedressing spring applied nitrogen
  - Use of nitrogen inhibitors with fall applied fertilizer
  - Apply all liquid swine manure and anhydrous during spring pre-plant

- **Conservation tillage** is any tillage practice that results in at least 30% coverage of the soil surface by crop residuals after planting. Several types of tillage systems are commonly used:

  - No-till systems disturb only a small row of soil during planting, and typically use a drill or knife to plant seeds below the soil surface.
  - Mulch till systems are any practice that results in at least 30% residual surface cover, excluding no-till and ridge till systems.
  - Reduced till systems are any farming practice which involves fewer cultivations than used in conventional fallowing.

  Corn residues are more durable and capable of sustaining the required 30% cover. Soybeans generate less residue, the residue degrades more quickly.

- **Cover crops** may include crops such as rye or oats. They reduce soil erosion by providing ground cover and improving soil structure, stability, and permeability with their root structures. The effectiveness of cover crops in reducing erosion is related to the soil cover achieved and cover is most important in the spring months when most runoff events occur.

- **Riparian buffer and filter strips** are composed of vegetation that is tolerant of intermittent flooding and/or of saturated soils located in the between upland areas and aquatic habitats. Riparian buffers and filter strips that include perennial vegetation and trees can filter runoff from adjacent cropland, provide shade and habitat for wildlife, and reinforce streambanks to minimize erosion. The root structure of the vegetation used enhances infiltration of runoff and subsequent trapping of pollutants. They are only effective in this manner, however, when the runoff enters the BMP as a slow moving, shallow “sheet”; concentrated flow in a ditch or gully, will quickly pass through the vegetation offering minimal opportunity for retention and uptake of pollutants. Similarly, tile lines can often allow water to bypass a buffer or filter strip, thus reducing its effectiveness.

- **Exclusion fencing and alternate watering systems** can limit or eliminate livestock access to a stream or waterbody. Fencing can be used with controlled stream crossings to allow livestock to cross a stream while minimizing disturbance to the stream channel and streambanks. Providing alternative water supplies for livestock allow animals to access drinking water away from the stream, thereby minimizing the impacts to the stream and riparian corridor. Some researchers have studied the impacts of providing alternative watering sites without structural exclusions and found that cattle spend 90% less time in the stream when alternative drinking water is furnished (USEPA 2003). USEPA (2003) estimates that fecal coliform reductions from 29-46% can be expected; nutrient and sediment load reductions are also achieved.

Agricultural BMP guidance and technical notes can be found on the Iowa NRCS website. The effectiveness of agricultural BMPs to remove pollutants vary. Most of the recommended agricultural BMPs remove either nitrogen or phosphorus and sediment. Wetlands and cover crops are the only practices that significantly remove all nutrients (nitrogen and phosphorus) and sediment (Table 15). Selection of BMPs will therefore require a suite of practices to meet the goals of the SWPP.

Table 15. Targeted pollutant(s)

BMP	BMP target pollutant(s)			
	Sediment	Phosphorus	Nitrate	Bacteria
Controlled drainage	--	--	++	--
Bioreactors	--	--	++	--
Saturated riparian buffers	--	--	++	--
Nutrient removal wetlands	++	++	++	++
Grassed waterways	++	++	--	--
Contour buffer strips	++	++	--	--
Water and sediment control basin	++	++	--	--
Nutrient management	--	++	++	--
Conservation tillage	++	++	--	--
Cover crops	++	++	++	--
Riparian buffer and filter strips	++	++	--	++
Exclusion fencing and alternate watering systems	++	++	--	++

-- low level of reduction
++ high level of reduction

Existing Agricultural BMPs

Existing agricultural BMP locations were provided by the Iowa BMP Mapping Project (Figure 11). The Iowa BMP Mapping Project is led by Iowa State University and is making progress toward providing a complete baseline set of BMPs dating from the 2007-2010 timeframe for use in watershed modeling, historic occurrence, and future practice tracking. BMPs included in the Mapping Project include:

- Terraces
- Water and sediment control basins (WASCOB)
- Grassed waterways
- Pond dams
- Contour strip cropping
- Contour buffer strips

Other BMPs such as conservation tillage and nutrient management and those practices that cannot be identified using air photography are not included in the Mapping Project.

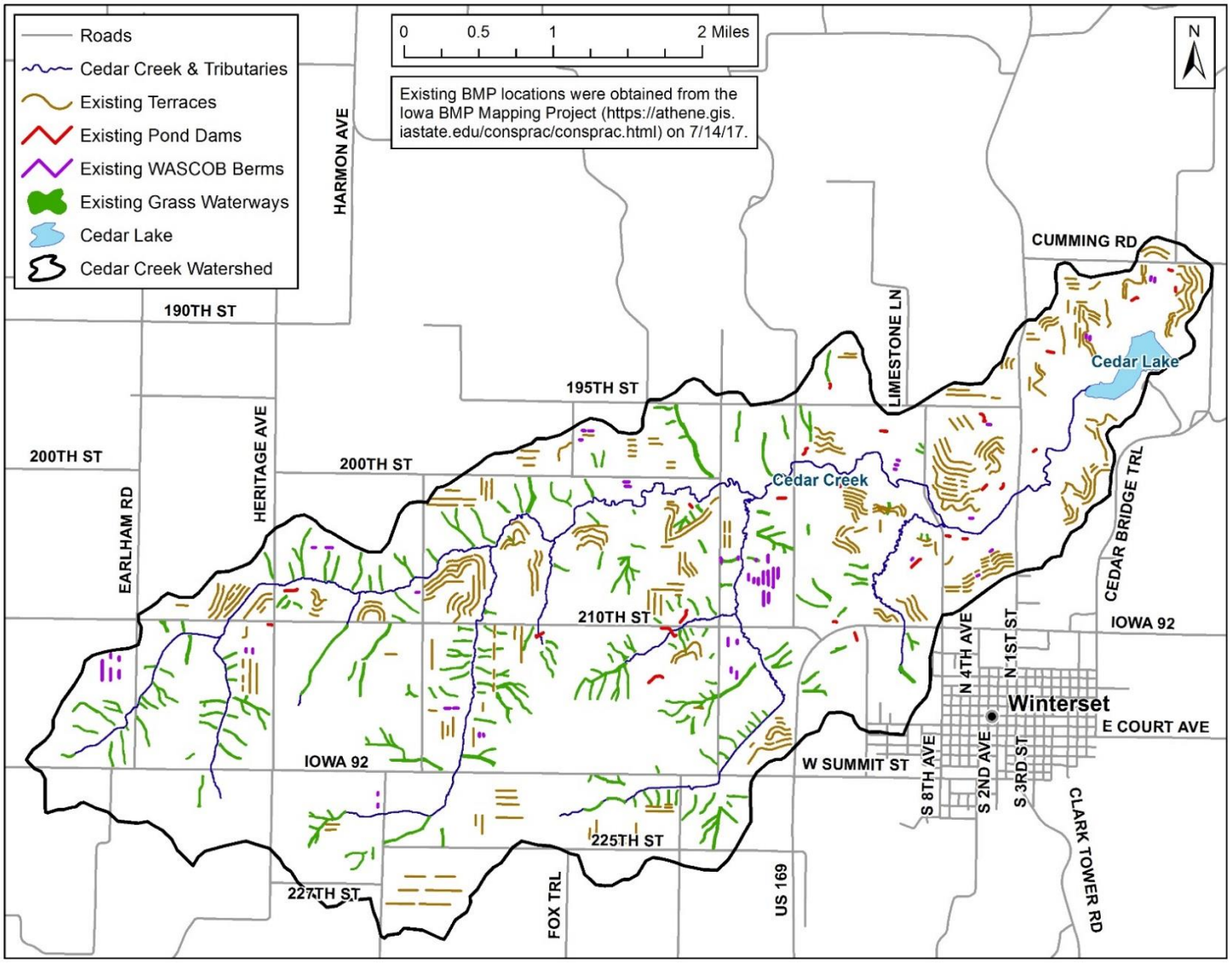

Figure 11. Existing BMPs in the Cedar Creek watershed (Iowa BMP Mapping Project).

Agricultural BMP Opportunities

Opportunities in the watershed for implementation of suitable agricultural BMPs were identified during a rapid stream assessment and by using the Agricultural Conservation Planning Framework (ACPF) version 2.2 and knowledge of existing BMP locations. The ACPF Toolbox was developed by the United States Department of Agriculture's (USDA) Agricultural Research Service. It is a set of ArcGIS® tools that locate potential BMP placement in a given watershed (Porter et al., 2017). Of the suitable agricultural BMPs, the ACPF model is able to site the following:

- Controlled drainage (drainage water management)
- Edge-of-field bioreactors
- Saturated riparian buffers
- Nutrient removal wetlands
- Grassed waterways
- Contour buffer strips
- Water and sediment control basins (WASCOB)

Figure 12 through Figure 17 provide potential location opportunities for BMPs that were sited in ACPF and/or sited during the rapid field assessment. Since saturated buffers are connected to tile lines, outfall locations recorded during the rapid stream assessment were compared with the ACPF-determined saturated buffers to eliminate candidate sites which had no observed tile outfalls. Additionally, candidate sites where steep streambanks or proximity to bedrock make saturated buffers difficult to implement were also removed (Figure 16). Opportunities for exclusion fencing and alternative water systems were also sited during the rapid stream assessment (Figure 17). The remaining agricultural BMPs (nutrient management, conservation tillage, cover crops, and riparian buffer and filter strips) can be implemented throughout the agricultural fields in the watershed.

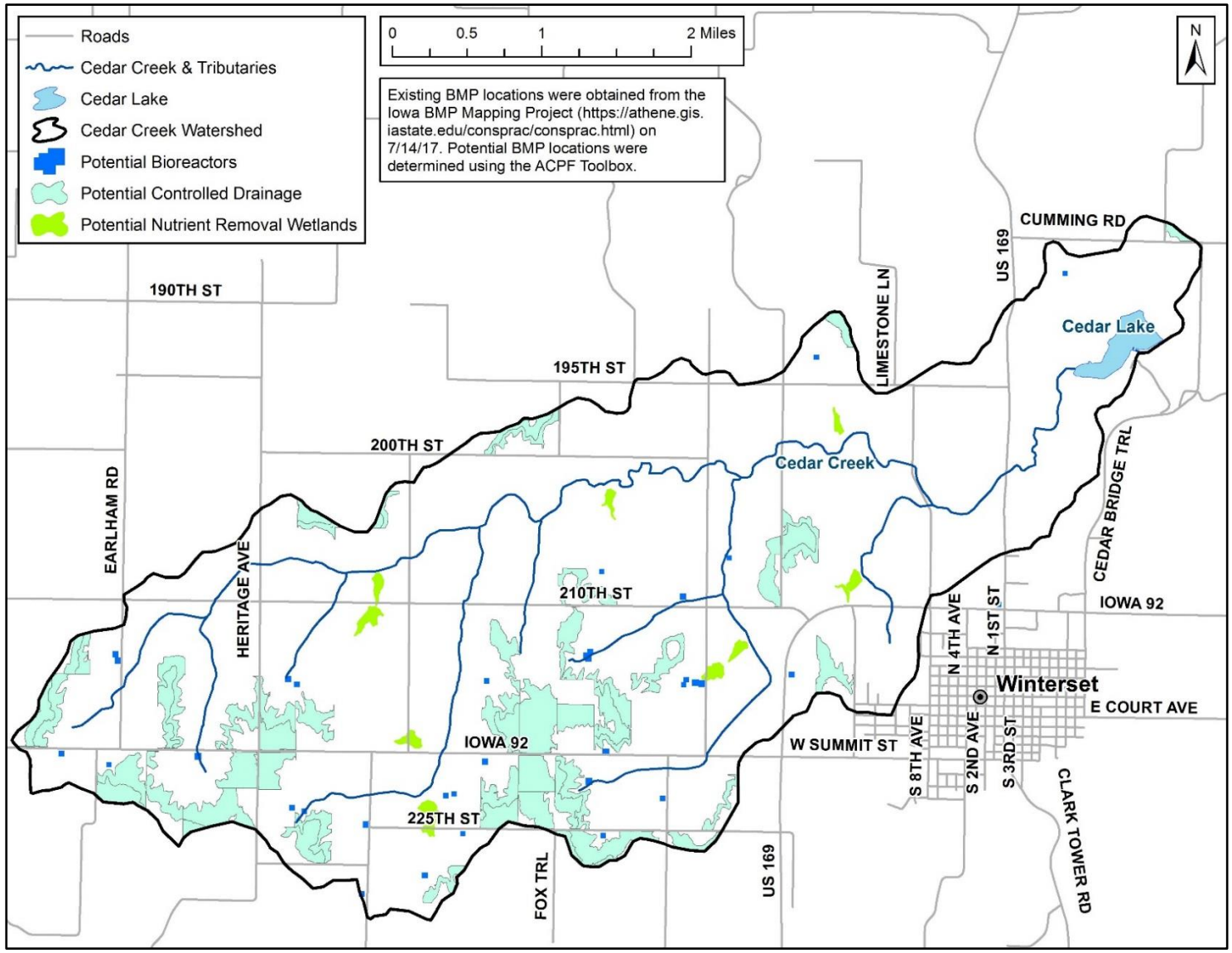

Figure 12. Potential locations for bioreactors, nutrient removal wetlands, and controlled drainage from ACPF.

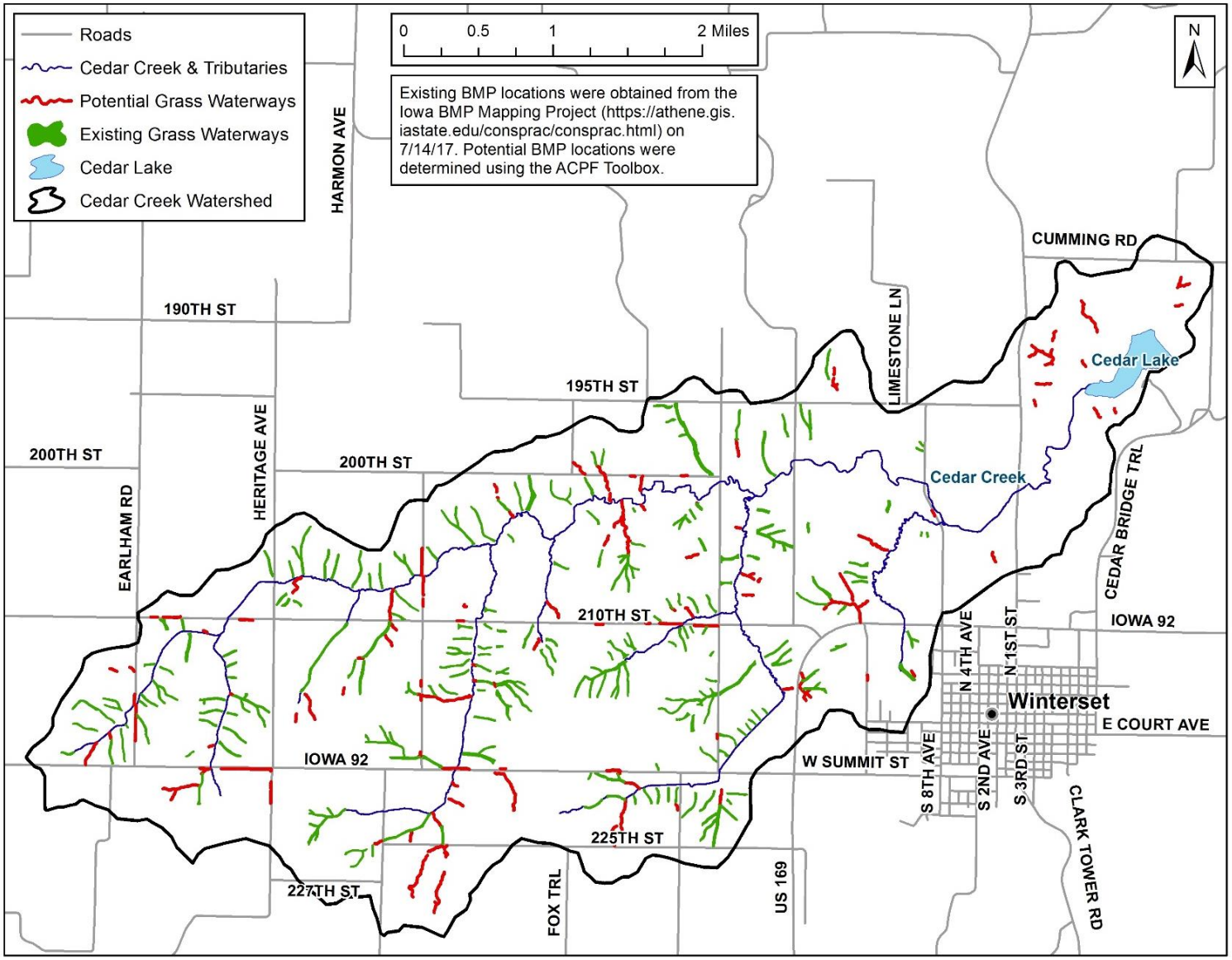

Figure 13. Potential locations for grassed waterways from ACPF.

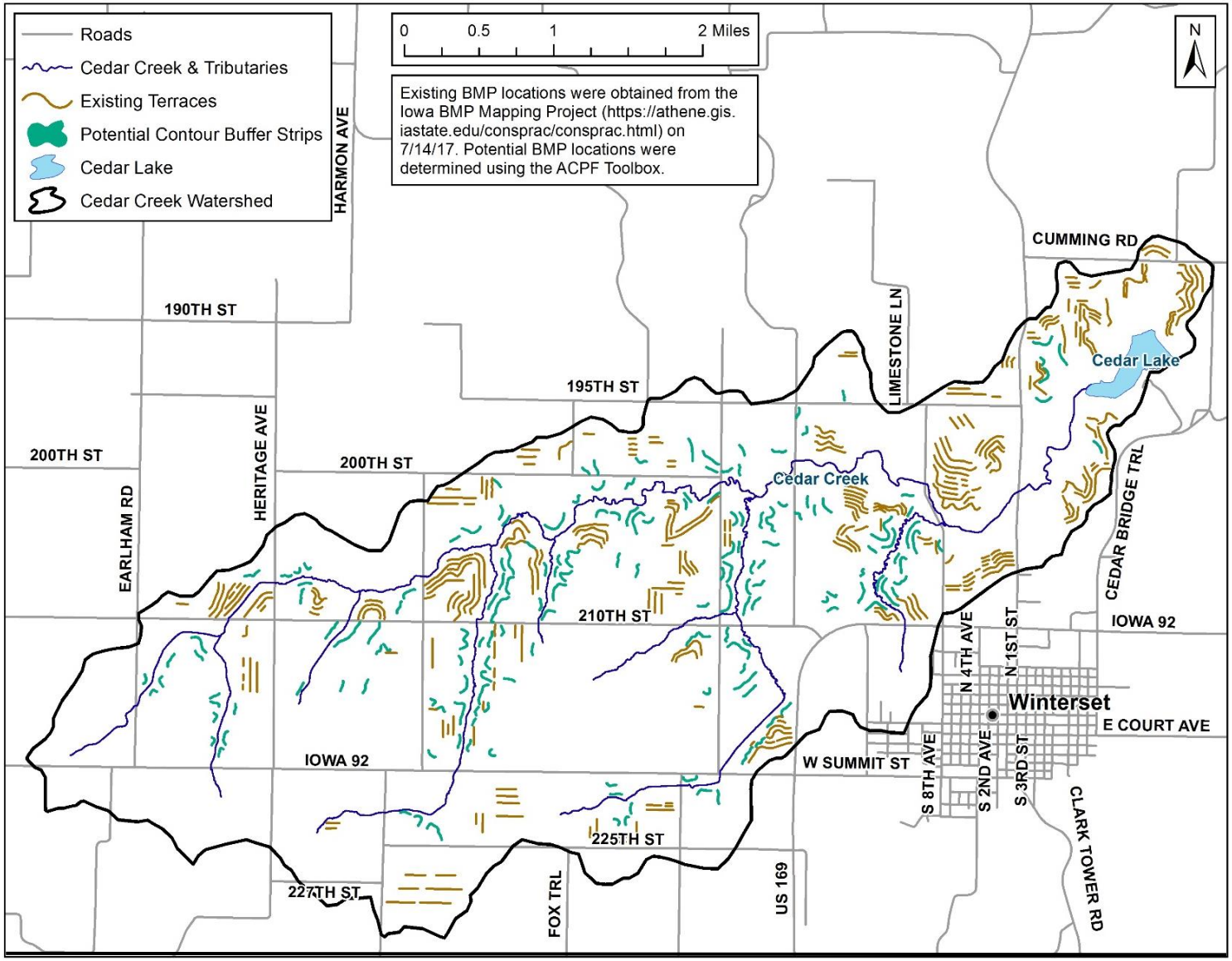

Figure 14. Potential locations for contour buffer strips from ACPF.

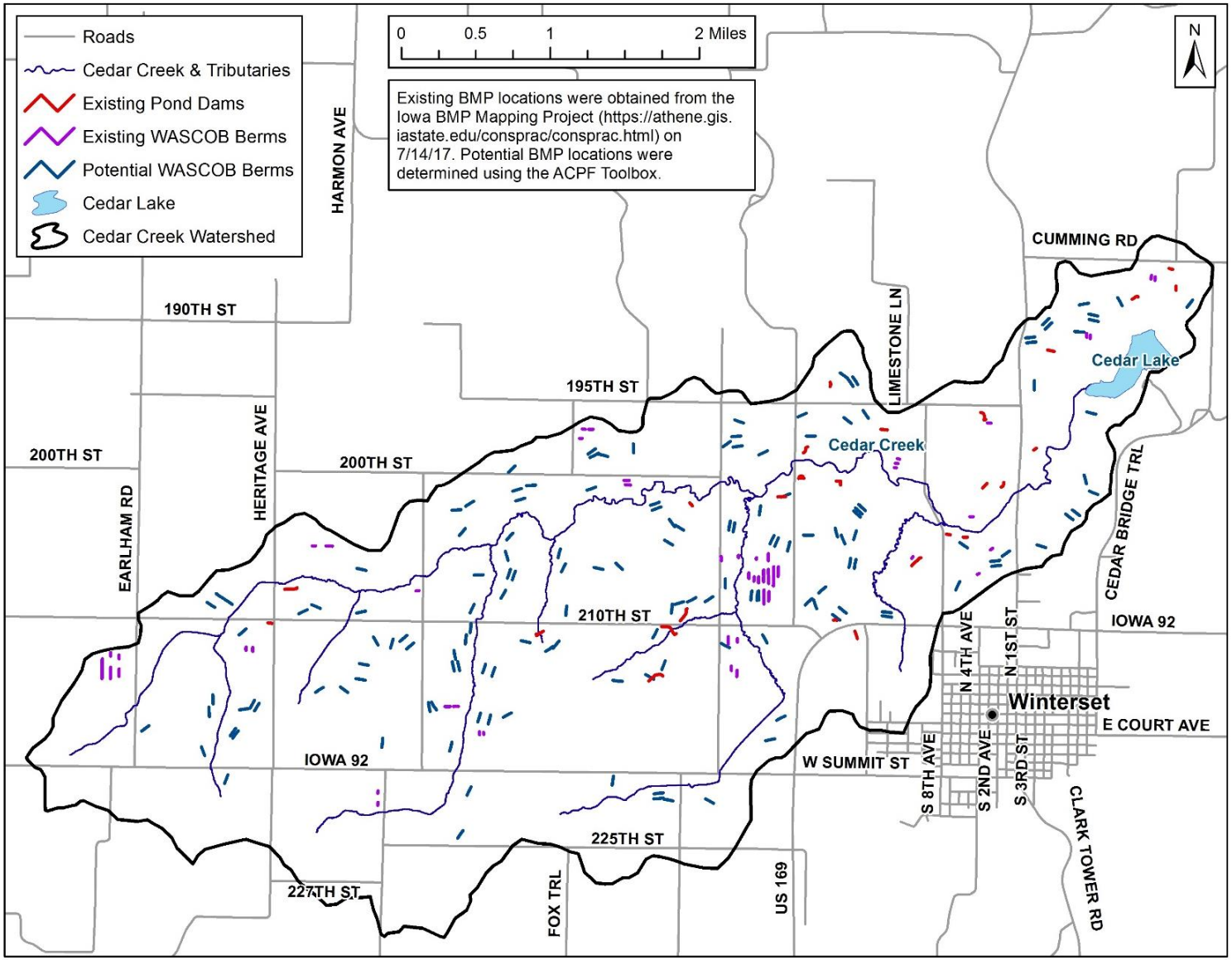

Figure 15. Potential locations for water and sediment control basins (WASCOBs) from ACPF.

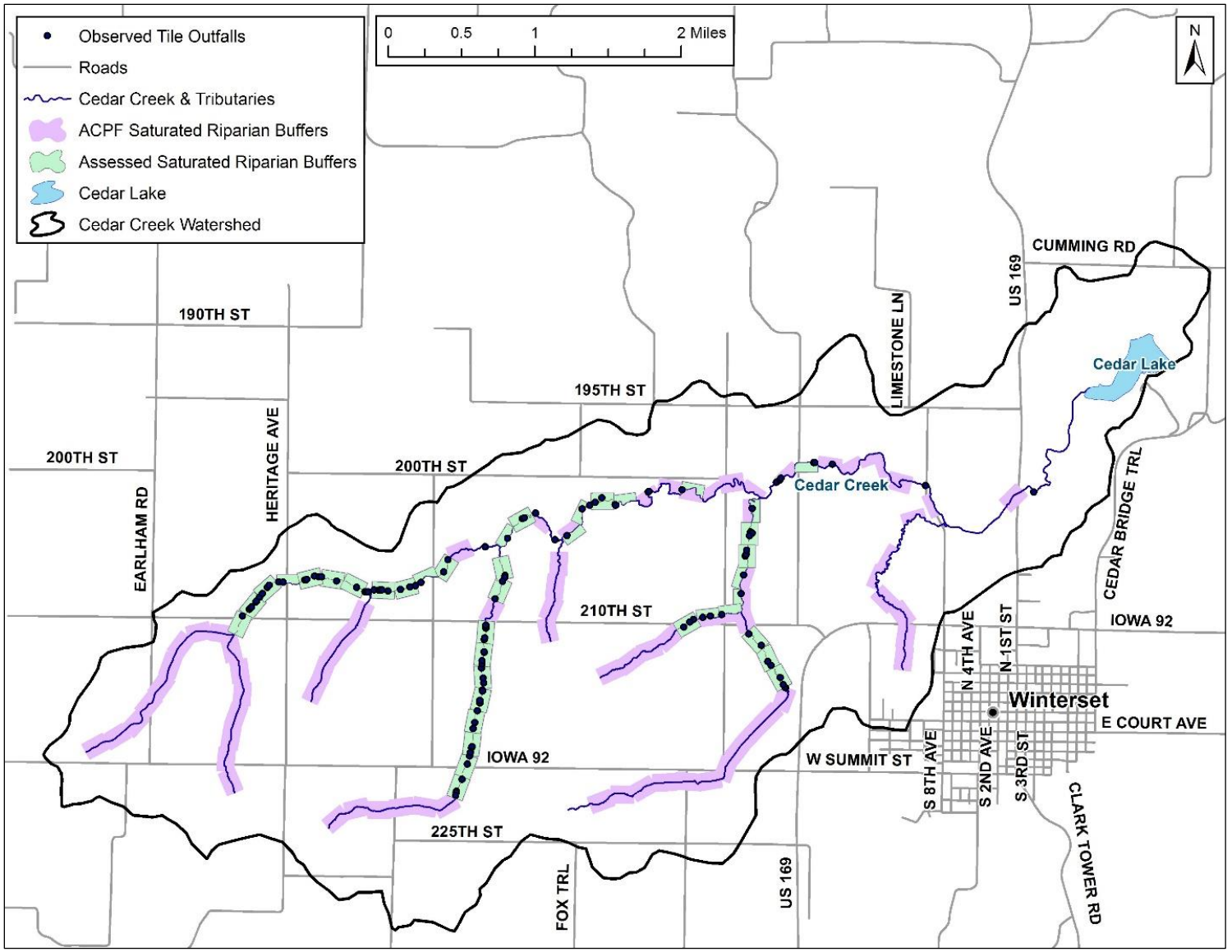

Figure 16. Potential sites for saturated buffers sited by ACPF and field verified.

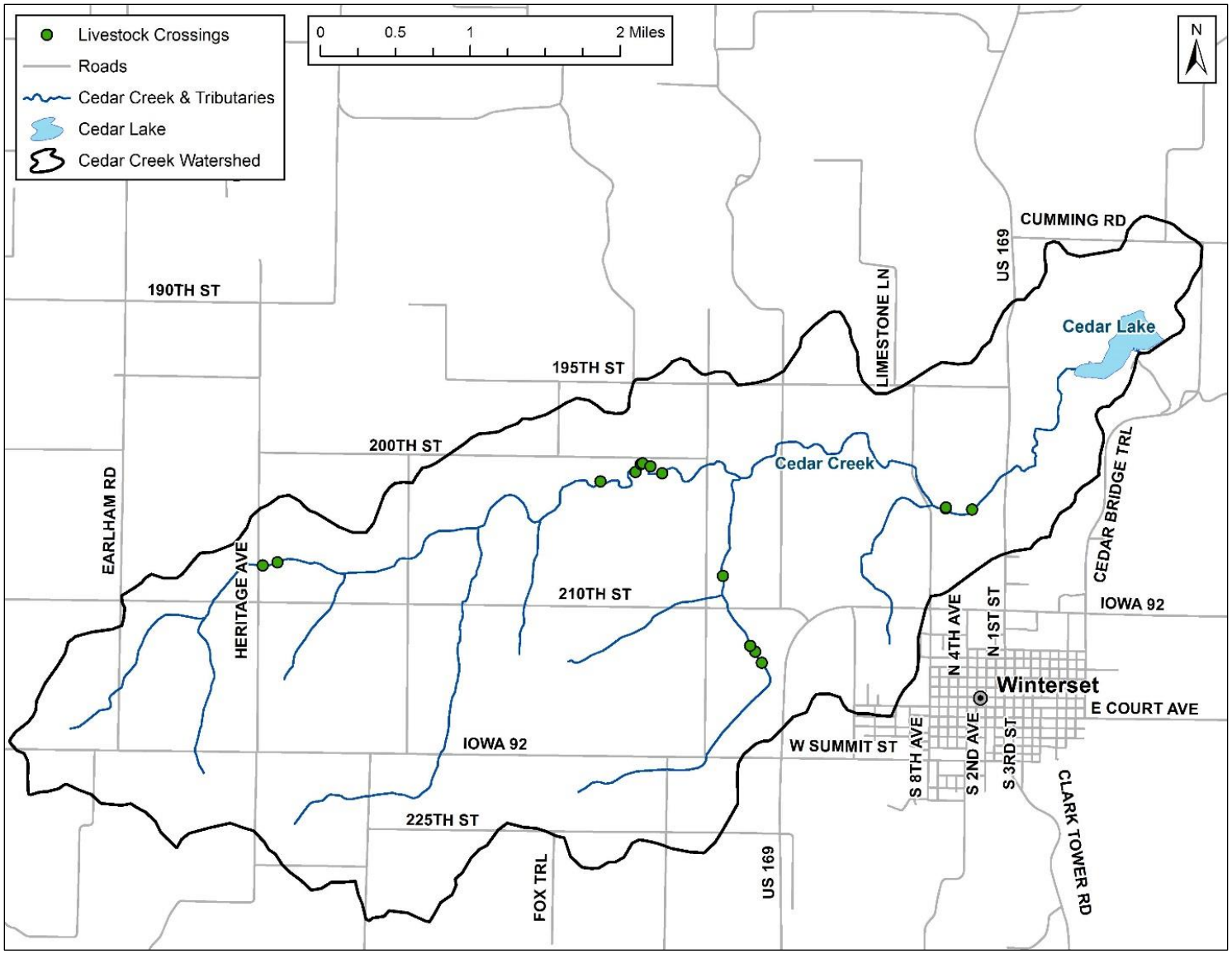

Figure 17. Potential sites for exclusion fencing and alternative watering systems identified during rapid stream assessment.

Agricultural BMP Scenarios

Scenarios were developed to determine the extent of agricultural BMP implementation needed to reduce nitrogen loads. The Iowa NRS goal for a 41% reduction in nitrogen for watershed sources is applied to the Cedar Lake Watershed. A nitrogen reduction of 41% (18,337 kg/year in the Cedar Lake Watershed based on a loading rate of 4.22 kg/acre/year as provided in the Iowa NRS) can be met in a variety of ways but factors such as costs, treatment opportunity, and nitrogen removal efficiencies of agricultural BMPs should all be considered prior to selection. Table 16 summarizes these factors for nitrogen removing agricultural BMPs. To provide potential examples of implementation, two different scenarios were developed: (1) Realistic adoption rate scenario (Table 17) and (2) least cost scenario (Table 18). Actual implementation of agricultural BMPs will likely vary.

Table 16. Costs, treatment opportunity, and nitrogen removal efficiencies for nitrogen removing BMPs

BMP	Cost/acre/ year [a]	Potential area draining to BMP (ac) [b]	% of watershed that could be treated	Nitrogen removal efficiency
Bioreactor	$10.23	1,590	15%	43%
Controlled Drainage	$9.86	3,446	33%	33%
Saturated Buffer	$256.53	3,446	33%	50%
Nutrient Removal Wetland	$14.95	1,757	17%	52%
Nutrient Management	$(1.67)	7,848	74%	Varies (13% used in calculations)
Cover Crops	$32.50	7,848	74%	31% (rye) 28% (oat)
Riparian Buffers	$13.96	785	7%	90% [c]

a. Source: Iowa NRS. Cost is equal annualized cost (50 year life and 4% discount rate) factors in the cost of any corn yield impact as well as the cost of physically implementing the practice.
b. As provided in the ACPF. Note that the potential area draining to saturated buffers is based on ACPF results. Area to field verified sites is likely less.
c. Reduction for water that reaches the active zone of the buffer. Due to the high level of tiling that will effectively bypass the buffer, this value is small.

Table 17. Realistic adoption rate scenario to achieve NRS nitrogen reduction goal in Cedar Lake

BMP	% Adoption on suitable acres	Acres treated	Reduction (kg N/yr)	Cost/year
Bioreactor	20%	318	577	3,252.88
Controlled Drainage	77%	2,653	3,694	26,161.11
Saturated Buffer	10%	345	727	88,400.24
Nutrient Removal Wetland	25%	439	964	6,566.58
Nutrient Management	90%	7,063	3,875	(11,771.79)
Cover Crops	60%	4,709	5,862	153,033.31
Riparian Buffers	90%	706	2,712	9,860.05
		Totals	**18,412**	**$275,502**

Note: actual adoption will vary depending on land owner willingness and available funds.

Table 18. Least cost alternative scenario to achieve NRS reduction goal in Cedar Lake

BMP	% Adoption on suitable acres	Acres treated	Reduction (kg N/yr)	Cost/year
Bioreactor	100.0%	1,590	2,885	16,264.39
Controlled Drainage	100.0%	3,446	4,799	33,975.47
Saturated Buffer	0.0%	-	0	-
Nutrient Removal Wetland	87.0%	1,529	3,354	22,851.71
Nutrient Management	100.0%	7,848	4,305	(13,079.77)
Cover Crops	0.0%	-	0	-
Riparian Buffers	100.0%	785	3,014	10,955.62
		Totals	**18,357**	**$70,967**

Note: actual adoption will vary depending on land owner willingness and available funds.

Stream Restoration

Stream restoration activities can address the source water protection issue of sedimentation and turbidity in Cedar Lake. Stream instability from failing banks, sloughing, and channelization can all contribute to excess sediment loading in the watershed. Areas of severe streambank erosion were identified along Cedar Creek and several incoming tributaries during the rapid stream assessment. Specific problem areas that significantly impact sediment loading to Cedar Lake are identified as potential stream restoration projects in Figure 18 and Table 19. Land owner participation and willingness will inform the order in which sites are addressed.

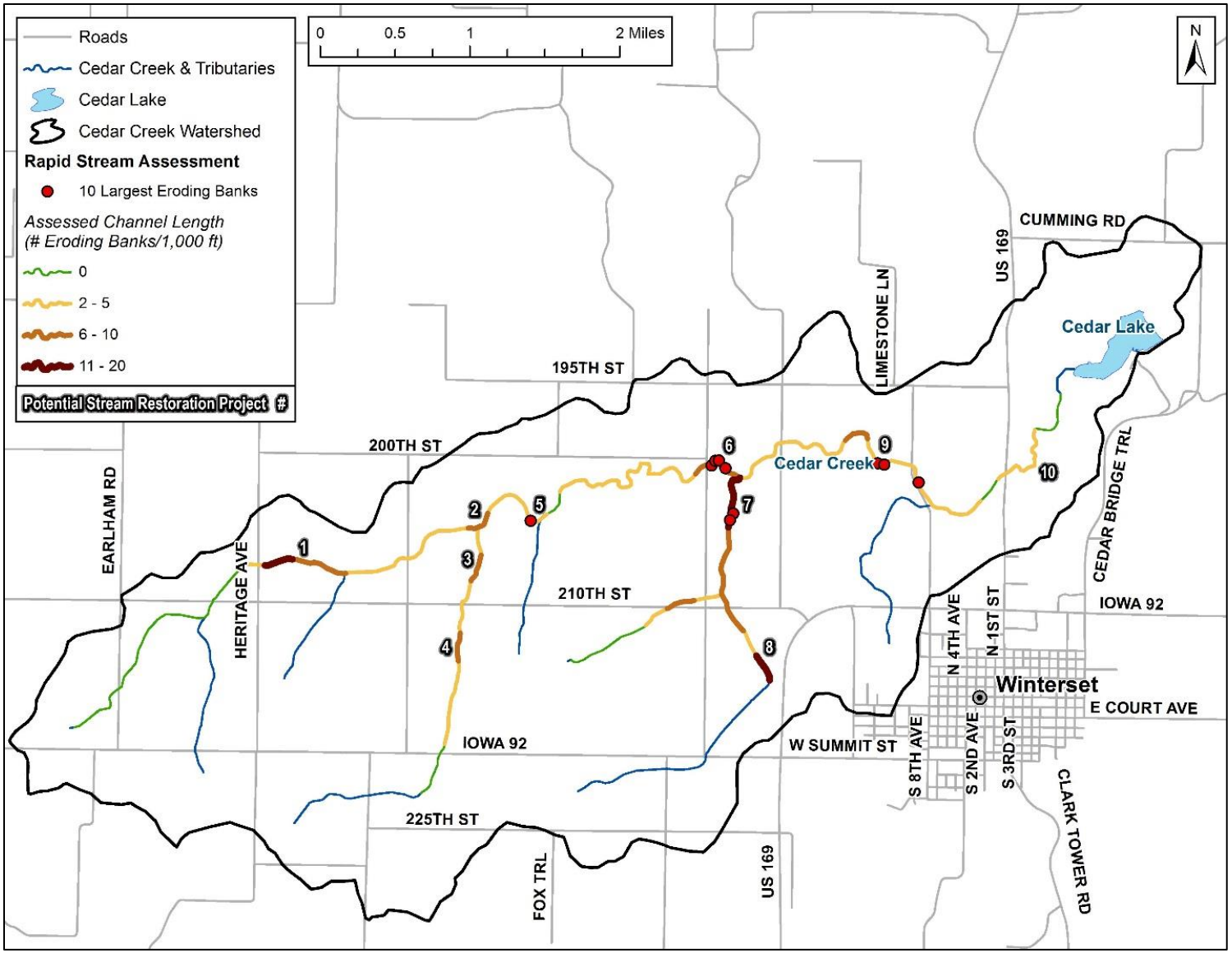

Figure 18. Potential stream restoration sites.

Table 19. Potential stream restoration projects identified by the rapid stream assessment

Project Number	Description	Example Photo
1	Erosion assessment and streambank stabilization along channel	
2	Streambank stabilization or movement of channel away from existing non-vegetated bank	

Project Number	Description	Example Photo
3	Erosion assessment and streambank stabilization along channel	
4	Streambank stabilization and reestablishment of riparian buffer	

Project Number	Description	Example Photo
5	Streambank stabilization or movement of channel away from existing non-vegetated bank	
6	Erosion assessment and streambank stabilization along channel	

Project Number	Description	Example Photo
7	Erosion assessment and streambank stabilization along channel	
8	Erosion assessment and streambank stabilization along channel	

Project Number	Description	Example Photo
9	Streambank stabilization or movement of channel away from existing non-vegetated bank	
10	Erosion assessment and potential movement of channel away from unvegetated banks	

Several BMPs can be used to stabilize stream channels impacted by erosion and reduce sediment loading to waterways. Such BMPs include engineering controls, vegetative stabilization, and restoration of riparian areas.

- **Engineering controls** include armoring with materials that straighten the banks and deflection of the water course with rock or log structures. Example practices include stone toes and stream barbs.
- **Vegetative stabilization** and **restoration of riparian areas** can reduce peak flows from runoff areas and channel velocities directing runoff. Using vegetative controls also enhances infiltration, which reduces high flows that cause erosion. Riparian buffers are composed of vegetation that is tolerant of intermittent flooding and/or saturated soils located in the transitional zone between upland and aquatic habitats (NRCS 2003). Riparian buffers that include perennial vegetation and trees can filter runoff from adjacent cropland, provide shade and habitat for wildlife, and reinforce streambanks to minimize erosion. The root structure of the vegetation used enhances infiltration of runoff and subsequent trapping of pollutants. They are only effective in this manner, however, when the runoff enters the BMP as a slow moving, shallow "sheet"; concentrated flow in a ditch or gully, will quickly pass through the vegetation offering minimal opportunity for retention and uptake of pollutants. Similarly, tile lines can often allow water to bypass a buffer or filter strip, thus reducing its effectiveness.

Fisheries Management

Fishery management on Cedar Lake can also be used to address the source water protection issue of sedimentation and turbidity in Cedar Lake. According to the DNR, 57 common carp have been captured during standard fish population surveys since 2010. Common carp are bottom dwelling and feeding fish species that naturally disturb and resuspend sediment into the water column. Because of this, there is typically a positive correlation between turbidity levels and number of carp in waterbodies (Drenner et al. 1997). Common carp can cause negative impacts to more popular sport fish populations such as Largemouth Bass and Bluegill (Wolfe et al. 2009). Carp removal and/or fisheries management (stocking etc.) in Cedar Lake can reduce turbidity levels In addition, fish habitat enhancements (rock reefs, gravel spawning, fallen tree habitat, etc.) will help to improve the sportfish community in Cedar Lake, improving the experiences of lake users and potentially increasing community interest and concern about its water quality.

Lead Best Management Practices

While lead is not currently detected in the drinking water supply, several best management practices can be implemented to address the source water protection issue of lead associated with an existing gun range, and reduce the risk of potential future contamination. The existing gun range can implement additional lead management along with their current practices.

A full range of possible management practices can be found in the EPA manual for best management practices for lead at outdoor shooting ranges (available here: https://www.epa.gov/sites/production/files/documents/epa_bmp.pdf). Example practices include:

- **Lead reclamation/ clean up.** Lead reclamation activities (hand racking and sifting, vacuuming, soil washing, wet screening) are common maintenance for gun ranges. Lead can be physically removed and recycled off site. This can be done in house or by an outside lead reclamation

company. The National Rifle Association recommends a frequency of one to five years for lead cleanup, even on ranges with minimal use (NRA 1991).

- **Runoff controls**. Similar to agricultural best management practices to prevent nutrient runoff, several activities can prevent lead from traveling into surface waters including vegetative controls (mulching and composting, vegetative cover), physical barriers such as surface covers, and engineered controls (filter beds, dams and dikes, detention ponds, etc.).
- **Soil amendments.** Monitoring and adjusting soil pH can reduce lead migration from a gun range property. Acidic conditions increase lead mobility, therefore the EPA (2005) recommends keeping soil pH between 6.5 and 8.5.

EPA also stresses the importance of record keeping and documentation to effectively manage lead on outdoor gun ranges. Proper record keeping can help accelerate the response effort if future contamination is found. In addition, records can help a gun range show they are doing their part to help prevent lead mitigation off-site and be stewards of the environment. Effective record keeping:

- Documents all activities related to lead (recycling and BMPs)
- Includes company name and dates of all services
- Be kept for the life of the range

Programmatic and Regulatory Actions

Programmatic and regulatory actions can address the following source water protection issues: pollutant reduction, water quantity, building and maintaining municipal partnerships, managing water levels in Cedar Lake, controlling herbicide and pesticide use, and addressing stormwater and urban expansion in the watershed. Programmatic and regulatory actions provide formalized approaches to watershed-wide management.

Watershed Management Authorities

In 2010, Iowa lawmakers passed legislation authorizing the creation of Watershed Management Authorities. A Watershed Management Authority (WMA) is a mechanism for cities, counties, SWCDs and stakeholders to cooperatively engage in watershed planning and management. WMAs have been formed across Iowa for a variety of reasons. While the driving motivation for WMA formation may be water quality improvement and/or flood risk reduction, there are multiple benefits to cooperating with other jurisdictions within a watershed:

- Conduct planning on a watershed scale, which has greater benefits for water quality improvement and flood risk reduction
- Foster multi-jurisdictional partnership and cooperation
- Leveraging resources such as funding, technical expertise
- Facilitate stakeholder involvement in watershed management

The formation of a watershed management authority can aid in formalizing watershed planning and implementation and leverage technical and financial resources.

Ordinance Development

Ordinance development and improvement can be used to prevent untreated runoff from developing areas. The City of Winterset has existing ordinances and codes to prevent development on waterways

and prevent flooding. Components that may be incorporated into the existing municipal code to strengthen prevention of source water contamination include:

- Stormwater quality treatment requirements
- Stronger new development ordinance language
- Stricter construction erosion and stormwater ordinance language
- Provisions that encourage green infrastructure as a method of meeting runoff, volume control and stormwater detention requirements

Iowa Stormwater Education Partnership has several model and existing city ordinances on their website (http://www.iowastormwater.org/en/resources/communities/ordinances/). Ordinance changes and improvements will be most effective in developed and areas with development pressures.

Watershed-Wide Education and Outreach Program

Successful implementation of the action plan will rely heavily on effective public education and outreach activities that will encourage participation and change behaviors. An education and outreach program can address all source water protection issues in the watershed. This section presents recommendations related to developing and implementing a coordinated watershed-wide public education and outreach program.

It is imperative to raise stakeholder's awareness about issues in the watershed and develop strategies to change stakeholders' behavior in a manner that will promote voluntary participation. Changes in awareness and behavior are surrogate indicators for longer-term changes in water quality. For example, demonstration farms with nutrient reducing BMPs may encourage neighboring farmers to also implement BMPs, and those farmers' neighbors in turn. Fortunately, several organizations within the watershed are already conducting education and outreach on important water quality issues. While there exist multiple regional education and outreach efforts, implementation of the source water protection plan may provide the opportunity for these entities to work together to ensure a consistent and overarching marketing campaign across the watershed. Some of these entities are identified below:

- Winterset Municipal Waterworks
- City of Winterset
- Madison County SWCD
- Madison County Emergency Management
- Iowa DNR
- IDALS (Iowa Department of Agriculture and Land Stewardship)
- Local producers
- Iowa Stormwater Education Partnership
- Iowa State University Extension and Outreach
- Natural Resource Conservation District (NRCS)
- US Fish and Wildlife Services

The outreach and education campaign could include a variety of activities including newspaper articles, social media campaigns, newsletters, radio spots, website content, workshops, demonstration projects and tours. A variety of activities can be undertaken in order to reach the various stakeholders and should address each audience appropriately. A stakeholder survey could be an initial activity related to a

watershed-wide education and outreach campaign. This type of survey (e.g., a pre-campaign survey) will help to establish a baseline of public awareness and behaviors that will help watershed outreach campaign organizers to further develop tailored outreach messages. Key topics for education and outreach could include:

- General watershed management principles
- Watershed friendly riparian uses and activities
- Agricultural BMP demonstration field days (e.g., cover crops, conservation tillage)
- Water conservation
- Municipal operations
- Septic system maintenance and compliance
- Feedlot and livestock management
- Proper disposal of household hazardous wastes
- Emergency response protocol and procedure
- Funding and technical assistance opportunities

Monitoring and Adaptive Management

Monitoring will help determine whether the implementation actions have improved water quality in Cedar Lake and support future source water protection actions. Long term monitoring of nitrates has occurred at several locations along Cedar Creek and its tributaries (Figure 6). It is recommended that current monitoring is continued and expanded to include phosphorus and turbidity levels. There are several entities that can assist with monitoring needs within the watershed. These entities include:

- Iowa DNR
- Local NRCS
- SWCD
- Winterset Municipal Waterworks

Water quality monitoring efforts may also be supported through volunteer citizen monitoring efforts that typically allow for more frequent monitoring at a lower cost. More information on locally lead citizen monitoring can be found on the DNR webpage: http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Volunteer-Water-Monitoring. Home nitrate test kits, for example, could be provided to local producers to determine the nitrate levels in their own tile drainage.

In addition to monitoring for water quality improvements, to ensure management decisions are based on the most recent knowledge, the SWP Team may wish to use an adaptive management framework for implementing the action plan. Adaptive management is a commonly used strategy to address natural resource management that involves a temporal sequence of decisions (or implementation actions), in which the best action at each decision point depends on the state of the managed system. USEPA (2008) recognizes that the processes involved in watershed assessment, planning, and management are iterative.

As a structured iterative implementation process, adaptive management offers the flexibility for responsible parties to monitor implementation actions, determine the success of such actions and ultimately, base management decisions upon the measured results of completed implementation actions and the current state of the system. This process, depicted in Figure 19, enhances the understanding and estimation of predicted outcomes and ensures refinement of necessary activities to

increase the likelihood of desirable results. In this way, understanding of the resource can be enhanced over time, and management can be improved.

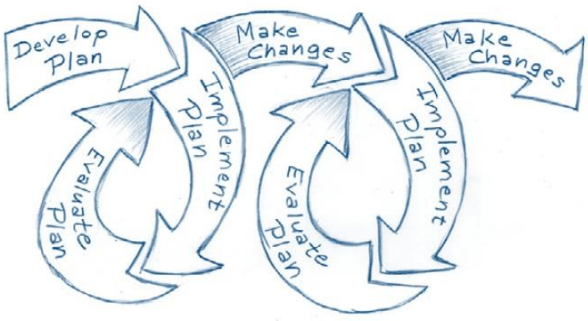

Figure 19. Adaptive management iterative process (USEPA 2008).

Evaluation for adaptive management can include a variety of evaluation components to gain a comprehensive understanding of implementation progress. An implementation evaluation determines if practices and activities have been implemented according to schedule. An evaluation can also be developed that focuses on changes to behaviors and water quality as a result of implementation actions. This type of evaluation looks at changes in stakeholder behavior and awareness, BMP performance, and changes to ambient water quality. Results from these evaluations should inform any changes or adaptations to the action plan. For example, if after engaging with local producers, one of the recommended BMPs is determined to be unfeasible for the vast majority of the watershed, implementers of the plan should revisit and re-evaluate potential BMPs for the area.

Technical and Financial Assistance

Implementing the required actions for this source water protection plan will require financial and technical support from a variety of sources. Table 20 summarizes the available funding sources. In addition to these resources, the staff from local organizations such as Practical Farmers of Iowa (http://www.practicalfarmers.org/), Iowa Stormwater Education Partnership (http://www.iowastormwater.org/), Pheasants Forever (http://iowapf.net/), Ducks Unlimited and the local NRCS office can provide assistance with finding funding opportunities and grants. Winterset Municipal Waterworks water user fees may also provide a source of funding for implementation. These fees are used at the discretion of the Water Utility Board.

Table 20. Available funding sources for Action Plan implementation

Program	Type	Entity	Information	More information
Regional Conservation Partnership Program	Cost share	NRCS	RCPP provides funds for producers to install and maintain conservation activities. The program is not a grant program but partners can leverage RCPP funding in their programs.	https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/farmbill/rcpp/?cid=nrcseprd1308280
Environmental Quality Incentive Program (EQIP)	Cost share	NRCS	Farmers in livestock, agricultural, or forest production who utilize NRCS approved conservation practices are eligible for cost share up to 75% of project cost. Contracts are typically 3+ years.	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/
Environmental Education Grants Program	Grant	USEPA	Environmental education programs that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This program is currently waiting on the Fiscal Year 2018 budget before issuing a request for proposals. Local, state, non-profit, noncommercial, tribal and college/university programs are eligible.	https://www.epa.gov/education/environmental-education-ee-grants
Healthy Watersheds Consortium Grant	Grant	USEPA, NRCS, U.S. Endowment for Forestry Communities	Healthy watershed program development projects that aim to preserve and protect natural areas, or local demonstration/trainings. Conservation easements are not eligible. Grants awarded are generally within three categories: 1. Short term funding to leverage larger financing for targeted watershed protection 2. Funds to help build the capacity of local organizations for sustainable, long term watershed protection 3. New replicable techniques or approaches that advance the state of practice for watershed protection.	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/forests/
Cost share programs	Cost share	IDALS, SWCD	Cost share dollars are available for temporary and permanent practices including conservation tillage, grass strips, terracing, windbreaks, tree planting, buffers, grass waterways, and diversions.	http://www.iowaagriculture.gov/FieldServices/financialAssistance.asp
Watershed Protection Program	Technical services and grants	IDALS	IDALS Regional Coordinators provide technical assistance and training on watershed development, planning and implementation to soil and water conservation districts and others. Grants are available to assist with watershed planning efforts that address identified environmental issues in a specific watershed.	http://www.iowaagriculture.gov/waterResources/watershedProtection.asp
Conservation Reserve Enhancement Program (CREP)	Payments	USDA Farm Service Agency, local SWCDs	CREP is a major state/federal initiative to develop wetlands. Financial incentives are provided to private landowners to develop and restore wetlands that intercept tile drainage from agricultural watersheds. Landowners receive annual land payments for up to 15 years and reimbursement for costs of wetland and buffer establishment. Easements to maintain the wetlands and buffers are required for a minimum of 30 years with permanent easements offered as well.	http://www.iowaagriculture.gov/waterResources/CREP.asp

Program	Type	Entity	Information	More information
Conservation Reserve Program (CRP)	Cost share	USDA Farm Service Agency	Farmers in the program are paid a yearly rental payment for the environmentally sensitive areas they remove from agricultural production. Contracts range for 10-15 years or in perpetuity. Goals of the program are to reestablish land cover to improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.	http://www.iowadnr.gov/Conservation/Wildlife-Landowner-Assistance/Conservation-Reserve-Program
Resource Enhancement and Protection Program (REAP)	Cost share	DNR, IDALS and others	Funded through the state's Environment First Fund and from sales of natural resource license plates.	http://www.iowadnr.gov/Conservation/REAP
Section 319 Nonpoint Source	Grant	USEPA, IDALS	Projects are designed to reduce pollutants from nonpoint sources, typically row crop agriculture. Priority given to projects that implement cost-effective corrective and preventative BMPs on a watershed scale. Also available for BMPs on a non-watershed scale and the development of information/education nonpoint source pollution control programs. Projects that meet requirements of a NPDES permit are not eligible for 319 funding	http://www.iowaagriculture.gov/FieldServices/waterQualityLoanFund.asp
Mississippi River Basin Initiative funds.	Cost share	NRCS	MRBI offers agricultural producers in priority watersheds the opportunity for voluntary technical and financial assistance through the NRCS. A maximum score is given to applications that support the development of a Conservation Activity Plan (CAP).	https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ia/programs/landscape/?cid=nrcs142p2_007958
Water Quality Initiative (WQI)	Grant	IDALS and partners	The WQI was established in 2013 to help implement the Nutrient Reduction Strategy. It combines public and private support to implement best management practices to achieve necessary load reductions.	https://www.cleanwateriowa.org/water-quality-initiative
Iowa Water Quality Loan Fund (State Revolving Loan Fund)	Loan	USEPA, IDALS	Available to assist and encourage landowners to address non-point source pollution. Applications are accepted year round for projects such as: terraces, grade stabilization structures, WASCOBs, grassed waterways and filter strips, Filed borders and buffers, waste storage facilities, and manure control structures.	http://www.iowaagriculture.gov/FieldServices/waterQualityLoanFund.asp
Drinking Water State Revolving Fund (SRF)	Low interest loan	DNR	State Revolving Fund loans usually fund changes that are related to upgrades to infrastructure or new wells. However, there are also funds available for soil erosion control practices, land easements, manure management, etc.	http://www.iowasrf.com/program/drinking_water_loan_program/
Iowa Water and Sewer Fund	Grant	Iowa Economic Development	Annual competitive program to assist cities and counties with sanitary sewer, water, wastewater, stormwater, and rural water systems. Funding request limits are determined by community population. Projects must benefit primarily moderate and low income persons.	https://www.iowaeconomicdevelopment.com/CDBG

Step 6 - Emergency Response Plan Affidavit

Every approved Source Water Protection Plan (SWPP) or Wellhead Protection Plan (WHPP) and every community water supply serving over 3,300 people must have an Emergency Response Plan. Many systems may have generated such a document in response to the 2002 Bioterrorism Act, in which case the DNR accepts an affidavit in lieu of generating a duplicate Emergency Response Plan. While the DNR does not require submission of this document within the SWPP, Appendix E contains the affidavit attesting to its existence.

At a minimum, the Emergency Response Plan must include contact information for the following entities:

- City personnel including mayors, city clerks, and water or wastewater operators
- Industry professionals including the city's power company, a professional electrician, a professional plumber, and an equipment repair company
- Critical users including hospitals, nursing homes schools, etc.
- Local media including newspapers, radio, and television stations
- Emergency partners including certified laboratories, local emergency contacts, state and local health departments, the National Guard, DNR's 24-hour emergency contact, and the local DNR field office

Additionally, the Emergency Response Plan must include a procedure for immediate notification to identified critical users.

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Appendix A – Source Water Protection Team Meetings

Two source water protection team meetings were held during the development of the Source Water Protection Plan. Meeting dates were November 8, 2017 and January 8, 2018. Meeting agendas and notes are provided on the following pages.

Winterset Municipal Waterworks

Source Water Protection Team Meeting

Wednesday, November 8, 2017
1-3 pm
City of Winterset, Council Chambers

Agenda

1. Introduction (All)
2. Project purpose and role of the team (Iowa DNR)
3. Source Water Protection Planning Part 1 (Tetra Tech)
4. Small group breakout – potential contaminant sources (All)
5. Source Water Protection Planning Part 2 (Tetra Tech)
6. Small group breakout – opportunities for protection and improvement (All)
7. Next steps (Iowa DNR/Tetra Tech)

Project Purpose

Provide technical assistance and support to the state of Iowa in providing needed technical assistance for communities to begin implementing Source Water Protection plans, which includes assistance in identifying resources for implementation of the Plan and coordinating partners. Specific source water protection activities will be different according to the communities and watersheds selected, but will include nutrient reduction efforts utilizing Iowa's Nutrient Reduction Strategy, along with other potential efforts such as emergency response protocols for hazardous spills, and mitigation and understanding of harmful algal bloom outbreaks in lakes.

Contact Information

Adam Schnieders, Iowa DNR adam.schnieders@dnr.iowa.gov (515) 725-8403	Jennifer Olson, Tetra Tech jennifer.olson@tetratech.com (651) 340-4266
Aileen Molloy, Tetra Tech aileen.molloy@tetratech.com (703) 385-2037	Mark Greve, Tetra Tech mark.greve@tetratech.com (651) 340-4266

Iowa Source Water Protection Plan

Winterset Waterworks Source Water Plan Team Meeting #1

11/8/2017, Winterset, Iowa

Madison County SWCD	Jim Hochstetler
	Anna MacDonald-GoLightly
Farmer	James Baur
	Bruce Sawyers
Winterset Water Utility Board	Patty Weeks
	Gary Emmert
Madison County Emergency Management	Todd Brown
Iowa DNR	Adam Schnieders
	Janet Gastineau
	Andy Jansen
City of Winterset	Mark Nitchals
Winterset Waterworks	Scott Wesselmann
	Mike Hamm
IDALS	James Martin
Tetra Tech	Jennifer Olson
	Mark Greve

Note: Janet Gastineau suggested adding Lisa Walters (Rural Waters Association) to the project team

Agenda

1. Introduction (All)
2. Project purpose and role of the team (Iowa DNR)
3. Source Water Protection Planning Part 1 (Tetra Tech)
4. Small group breakout – issues and challenges and potential contaminant sources (All)
5. Source Water Protection Planning Part 2 (Tetra Tech)
6. Small group breakout – opportunities for protection and improvement (All)
7. Next steps (Iowa DNR/Tetra Tech)

Jennifer Olson and Adam Schnieders provided an introduction to the project. Adam described the project context as relates to the Nutrient Reduction Strategy and the overall goals and timeline.

The group discussed overall watershed issues and concerns and history of the lake and water quality. Scott Wesselmann and Mike Hamm discussed the dredging work completed for Cedar Lake and the treatment of algae in the lake. They also discussed monitoring data available for the watershed.

BMPs have been placed throughout the watershed at a very high coverage rate. In addition, several projects, developments, and improvement opportunities were identified by the group on provided maps.

Jennifer and Mark G. presented slides (provided as part of meeting notes). The following was discussed:

Data

- Cedar Lake and its watershed have been sampled for nitrate on a monthly basis for at least one year.
- 20 years of historical data for Cedar Lake can be provided by Mike Hamm.
- DNR fisheries data for Cedar Lake can be provided by Andy Jansen.
- Lake treated once per week with sodium bicarbonate to kill algae (formerly copper sulfate)

Issues and Concerns

- Nitrates are the greatest concern since reverse osmosis treatment is expensive. Tile drainage was confirmed as prevalent in the watershed.
- Sedimentation is also high priority, though concern centers more on lake sediments than watershed source, especially since historically large deposits form at the inlet to Cedar Lake. Resuspension of these sediments occurs during large events. Streambank erosion was noted during a windshield survey of the watershed.
- Water quantity, particularly during droughts. The city has emergency hookups with nearby rural water supplies.
- Microbial contaminants
- Atrazine and pesticides
- Stormwater
- Low priority issues and concerns:
    - Education on storage tanks, hazardous chemicals, abandoned wells, highway spills
    - Cost to individual landowners
    - Watershed protection
    - Recreation
- Specific areas of concern:
    - Urban area and future expansion
    - Gun range (no lead has been found in the lake/water supply)
    - Spills on US 169 (All spills on 169 must be immediately reported to the DNR field office per law, and this should be reflected in an emergency response plan)
    - The plan should seek to maintain a good relationship with the city.

Potential Contaminant Sources

The group added points and notes to maps for potential contaminant sources. These included areas of development on the northwest side of Winterset and northwest of Cedar Lake, propane tanks on the egg farm, a waste lagoon in the center of the watershed, a new pond on the northern edge of the city, fields with land-applied animal wastes, and a known septic location in the southwestern portion of the watershed.

Priority Areas

- General agreement that the US 169 corridor and a ¼ mile buffer around Cedar Lake should be considered the highest priority for source water protection.

- The watershed itself is already considered a priority area by the State of Iowa.

Opportunities

Based on ACPF model results, opportunity exists for drainage water management, bioreactors, and saturated buffers. These practices, along with nutrient removal wetlands, are the best of ACPF-sited BMPs for removing nitrates. Many terraces, grassed waterways, and WASCOBs have been added already, thus there is little opportunity to add more. In addition to the modeled BMPs from the ACPF Toolbox, some watershed improvements can be implemented.

- Nutrient management strategies, especially related to manure, could reduce nitrogen loads. Soil testing and variable application should be considered as possible strategy improvements.
- Conservation tillage and residue management could be emphasized to reduce sediment loads.
- Compliance with farm plans is needed. Also need to determine which BMPs fit into each operator's plan.
- Watershed-wide education on water quality practices should be increased.
- Need to determine responsible entities for each portion of project and identify a project coordinator for plan implementation.
- Need to create an action plan that will increase engagement and ensure the project is progressing.

Could be beneficial to walk stream and determine failing bank locations, sediment sources or sinks in the creek, bank restoration candidate sites, and sediment BMP performance and implementation strategies. Iowa State is also exploring a tool to estimate sedimentation from streambanks and bed loads that could have some utility in the watershed.

Winterset Municipal Waterworks

Source Water Protection Team Meeting

Monday, January 8, 2018
1-4 pm
ISU Extension Office, Winterset

Agenda

1. Introductions
2. Update on Progress to Date
3. Review Steps 1-4 of Plan
4. Step 5 – Action Plan
    a. Recommended actions
    b. Schedule
    c. Responsible entities
5. Agricultural Best Management Practices
6. Prioritizing and Targeting Implementation Activities
7. Proposed Stream Erosion Assessment
8. Review Process
    a. Additional input needed by January 12
    b. Updated plan by end of January for final review

Contact Information

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Iowa Source Water Protection Plan

Winterset Waterworks Source Water Plan Team Meeting #2

01/8/2018, Winterset, Iowa

Madison County SWCD	Jim Hochstetler
	Anna MacDonald-GoLightly
Farmer	James Baur
	Bruce Sawyers
Winterset Water Utility Board	Gary Emmert
Madison County Emergency Management	Todd Brown
Iowa DNR	Adam Schnieders
	Janet Gastineau
	Andy Jansen
	Chad Fields
City of Winterset	Mark Nitchals
Winterset Waterworks	Scott Wesselmann
IDALS	James Martin
Iowa Rural Water Association	Lisa Walters
Tetra Tech	Jennifer Olson
	Kaity Taylor

Agenda

1. Introduction and updates (All)
2. Update on Progress to Date (Tetra Tech)
3. Review Steps 1-4 of Plan (Tetra Tech)
4. Review Step 5–Action Plan (Tetra Tech)
5. Agricultural Best Management Practices
6. Prioritizing and Targeting Implementation Activities
7. Proposed Stream Erosion Assessment (Iowa DNR)
8. Review Process

Jennifer Olson provided updates on the project. Adam Schnieders and others provided update on the planned stream assessment and information on a grant application to fund an additional NRCS technical staff in the watershed.

Jennifer and Kaity presented slides on the draft plan that was sent to the team for review on Jan 4, 2018. The following updates were discussed:

<u>Plan Steps 1-4</u>

- Current list of Team members is good. Consensus on addition of Madison County Environmental Health Department to list.

- Draft table of potential contaminants presented. Jennifer asked for confirmation on some PCSs provided in the state database.
- Bruce Sawyers pointed out some inconsistencies with feedlots identified in plan and his understanding of feedlot locations. Tetra Tech will investigate and confirm feedlot locations.
- Chad suggested to move lists of groundwater wells and some PCSs to an appendix of the plan.
- Location of monitoring sites confirmed by group.
- 20 years of historical data for Cedar Lake can be provided by Mike Hamm.
- DNR fisheries data for Cedar Lake can be provided by Andy Jansen.
- Lake treated once per week with sodium bicarbonate to kill algae (formerly copper sulfate)

Plan Step 5: Action Plan

- Jennifer gave an overview of the ACPF results and specifics about agricultural BMPs. The group had lots of interest in bioreactors, saturated buffers, and tips for cover crop success.
- It was noted that there is more potential for grassed waterways near Cedar Lake.
- Kaity presented the draft Action plan table and asked for a thorough review.
- Group would like to see specific months for schedule
- The formation of a watershed management authority was discussed

Prioritizing and Targeting Implementation Activities

- The group requested the addition of quantifiable goals and targets for implementation (i.e., acres or stream miles)
- Bruce suggested that the first step be looking into current BMPs and farm plans to ensure compliance and effectiveness

Review Process

- Feedback requested from group by January 12th

Appendix B – List of Common Potential Contaminants

Agricultural

Row crop acreage
Agricultural drainage wells
Animal burial areas
Animal feedlots
Animal research facilities
Chemical storage areas
Chemical application (e.g., pesticides, fungicides, and fertilizers)
Grain storage
Irrigation
Manure spreading and pits
Tank loading and rinsing areas

Commercial

Agricultural chemical dealers
Airports
Auto: repair, machinery, service shops
Boat yards / marinas
Car washes
Cemeteries / funeral services
Construction areas
Dry-cleaning establishments
Educational institutions (e.g. labs, lawns, and chemical storage)
Fuel pipelines
Gas stations
Golf courses (chemical applications and storage)
Grain storage
Degreasing operations
Hardware stores
Jewelry and metal plating
Junk yards
Laundromats
Lumber yards
Material transport (trucks and railroads)
Medical facilities
Paint shops
Photography establishments
Printing / copy shops
Railroad tracks and maintenance yards
Stormwater drains and retention basins
Road maintenance depots
Storage tanks and pipes (above and below ground)

Industrial

Asphalt plants
Chemical manufacturing, warehousing, and distribution activities
Construction activities
Degreasing operations
Electrical and electronic products and manufacturing
Electroplating and metal fabrication
Foundries
Former manufactured gas plants
Lagoons, pits, holding ponds
Machine and metalworking shops
Manufacturing and distribution sites for cleaning supplies
Mining (surface and underground), mine drainage, and waste piles
Petroleum products production, storage and distribution centers
Pipelines (e.g. oil, gas, coal, and slurry)
Radioactive materials production, distribution, and storage
Storage tanks (above and below ground)
Toxic and hazardous spills
Wells, operating and abandoned (e.g. oil, gas, water, injection, monitoring, exploration)
Wood preserving facilities

Residential

Cesspools
Fuel storage sites
Furniture and wood strippers and refinishers
Hazardous products (cleaners, paint, oil)
Lawns (chemical applications)
Septic systems
Sewer lines
Stormwater drains and retention basins
Swimming pools (e.g. chlorine)
Water softeners
Waste Management
Fire training facilities
Hazardous waste management units (e.g., landfills, land treatment areas, surface impoundments, waste piles, incinerators, treatment tanks)
Leaky sewers
Municipal incinerators
Municipal landfills
Municipal wastewater and sewer lines
Open burning sites
Recycling and waste-reduction facilities

Modified from US-EPA 1989, Wellhead Protection Programs: Tools for Local Governments. EPA 440/6-89-002

Appendix C – Groundwater Well Information and Locations

Wells in the Cedar Lake watershed are identified in Table 23 and Figure 20. The location numbers in Table 23 correspond to the numbered points in Figure 20.

Table 21. Summary of private and agency-owned wells in the Cedar Lake watershed

Well ID	Location #	Well Type	Depth	Date	Owner's Name	Other Information
1082	1	IGS well database	475	unkn	Niblo, Mrs.	Bedrock depth: 68; Well type: Unknown
70288	2	IGS well database	0	unkn	Iowa Geological Survey	Bedrock depth: 0; Well type: Unknown
60572	3	IGS well database	200	6/9/2005	Sss Services	Bedrock depth: 50; Well type: Other
70292	4	IGS well database	0	unkn	Iowa Geological Survey	Bedrock depth: 0; Well type: Unknown
55868	5	IGS well database	200	12/3/2001	Pashek, Shone	Bedrock depth: 95; Well type: Heat Pump
72627	6	IGS well database	140	3/1/2009	Sievers, Allen & Connie	Bedrock depth: 42; Well type: Heat Pump
70189	7	IGS well database	0	unkn	Iowa Geological Survey	Bedrock depth: 0; Well type: Unknown
58235	8	IGS well database	200	11/27/2003	Shahan, Jeff	Bedrock depth: 35; Well type: Heat Pump
61252	9	IGS well database	200	8/18/2005	Johnston, Thomas	Bedrock depth: 18; Well type: Heat Pump
70289	10	IGS well database	0	unkn	Iowa Geological Survey	Bedrock depth: 1; Well type: Unknown
57922	11	IGS well database	200	7/1/2003	Switzer, Mark	Bedrock depth: 30; Well type: Heat Pump
43146	12	IGS well database	0	unkn	Winterset, City of	Bedrock depth:0; Well type: Municipal
43150	13	IGS well database	28	1/1/1927	Winterset, City of	Bedrock depth:0; Well type: Municipal
70188	14	IGS well database	0	unkn	Iowa Geological Survey	Bedrock depth: 30; Well type: Unknown

Well ID	Location #	Well Type	Depth	Date	Owner's Name	Other Information
43453	15	IGS well database	175	6/10/1997	Lavitzer, Mark	Bedrock depth: 17; Well type: Other
73099	16	IGS well database	0	10/9/1926	Bailey, W.	Bedrock depth: 0; Well type: Unknown
70290	17	IGS well database	0	unkn	Iowa Geological Survey	Bedrock depth: 4; Well type: Unknown
59807	18	IGS well database	200	7/27/2004	Schwertfeger, Jerry	Bedrock depth: 20; Well type: Heat Pump
70291	19	IGS well database	0	unkn	Iowa Geological Survey	Bedrock depth: 5; Well type: Unknown
62862	20	IGS well database	200	9/25/2006	Frease, Kim And Dorothy	Bedrock depth: 47; Well type: Heat Pump
2115674	21	Private well tracking system	27	1/1/1900	A C Construction	Status: Plugged
2158337	22	Private well tracking system	37	1/1/1900	Allen, Charles & Joann	Status: Plugged
2115670	23	Private well tracking system	35	1/1/1900	Bauer, Malissa	Status: Plugged
2106443	24	Private well tracking system	18	1/1/1900	Fraizer, Richard	Status: Plugged
2075210	25	Private well tracking system	unkn	unkn	Sawyers, Mark	Status: Retired
2153319	26	Private well	48	1/1/1900	Kiburz, Kent	Status: Plugged

Well ID	Location #	Well Type	Depth	Date	Owner's Name	Other Information
		tracking system				
2153318	27	Private well tracking system	34	1/1/1900	Kiburz, Kent	Status: Plugged
2153317	28	Private well tracking system	28	1/1/1900	Kiburz, Kent	Status: Plugged
2107993	29	Private well tracking system	33	1/1/1900	Baur Farms	Status: Plugged
2107953	30	Private well tracking system	32	1/1/1900	Baur Farms	Status: Plugged
2107991	31	Private well tracking system	9	1/1/1900	Baur Farms	Status: Plugged
2092338	32	Private well tracking system	unkn	unkn	Switzer, Mark	Status: Retired
2170539	33	Private well tracking system	12	1/1/1980	Molln, Dustin & Tiffany	Status: Active
2116305	34	Private well tracking system	20	1/1/1900	Donadio, Lisa	Status: Plugged
2150092	35	Private well	150	3/1/2009	Sievers, Allen & Connie	Status: Active Logged

Well ID	Location #	Well Type	Depth	Date	Owner's Name	Other Information
		tracking system				
2096377	36	Private well tracking system	unkn	unkn	Shahan, Jeff	Status: Retired
2163430	37	Private well tracking system	200	9/18/2012	Meade, Robert & Susan	Status: Active Logged
2149587	38	Private well tracking system	200	8/1/2009	Jackson, Joel & Shawna	Status: Active Logged
2133808	39	Private well tracking system	200	12/1/2007	Holcomb, John & Gretchen	Status: Active Logged
2166020	40	Private well tracking system	180	11/6/2012	Macumber, Kirk & Michelle	Status: Active Logged
2111285	41	Private well tracking system	200	6/9/2005	Sss Services	Status: Active
2113403	42	Private well tracking system	200	8/18/2005	Johnston, Thomas	Status: Active
2097416	43	Private well tracking system	16	1/1/1950	Root, Elton	Status: Active
2141131	44	Private well	47	1/1/1900	Thompson, Theodore	Status: Plugged

Well ID	Location #	Well Type	Depth	Date	Owner's Name	Other Information
		tracking system				
2106527	45	Private well tracking system	200	7/11/2004	Schwertfeger, Jerry	Status: Active
2123795	46	Private well tracking system	200	9/25/2006	Frease, Kim & Dorothy	Status: Active
2133906	47	Private well tracking system	200	6/10/2007	Busch, Curtis & Elsha	Status: Active Logged
47445	48	Wells registered for testing	40	1945	Egy, Mrs. Joe	Drilling method: Bored; Known well depth
46549	49	Wells registered for testing	30	1935	Egy, Mrs. Joe	Drilling method: Bored; Known well depth
39388	50	Wells registered for testing	35	1976	Madison County Motors	Drilling method: Drilled; Known well depth
39356	51	Wells registered for testing	60	unkn	Raymond, Ray	Drilling method: Bored; Known well depth
34043	52	Wells registered for testing	24	1920	Libby, Harold	Drilling method: Bored; Known well depth
34042	53	Wells registered for testing	24	1920	Libby, Harold	Drilling method: Bored; Known well depth
34041	54	Wells registered for testing	24	1920	Libby, Harold	Drilling method: Bored; Known well depth

Well ID	Location #	Well Type	Depth	Date	Owner's Name	Other Information
34048	55	Wells registered for testing	50	1988	Holt, Lynn	Drilling method: Bored; Known well depth
45566	56	Wells registered for testing	30	unkn	Thompson, Ted	Drilling method: Bored;
34077	57	Wells registered for testing	30	unkn	Acres, Rose	Drilling method: Dug; Known well depth
34044	58	Wells registered for testing	28	1920	Libby, Harold	Drilling method: Bored; Known well depth
19200	59	Registered abandoned wells	38	n.a.	Hochstetler, James	Well plugged: 4/5/1994; Well type: > 18"" dia.
16130	60	Registered abandoned wells	38	n.a.	Hochstetler, James	Well plugged: 4/5/1994; Well type: > 18"" dia.
7162	61	Registered abandoned wells	28	n.a.	Smith, Kenneth	Well plugged: 9/14/1992; Well type: > 18"" dia.
10599	62	Registered abandoned wells	24	n.a.	Crawford, Charles	Well plugged: 6/23/1993; Well type: > 18"" dia.
13069	63	Registered abandoned wells	50	n.a.	Algreen, Bill	Well plugged: 12/3/1993; Well type: > 18"" dia.
15085	64	Registered abandoned wells	35	n.a.	Rose Acre Farms	Well plugged: 2/1/1990; Well type: > 18"" dia.
15086	65	Registered abandoned wells	35	n.a.	Rose Acre Farms	Well plugged: 2/1/1990; Well type: > 18"" dia.

Well ID	Location #	Well Type	Depth	Date	Owner's Name	Other Information
4421	66	Registered abandoned wells	52	n.a.	Iowa D.O.T., Iowa D.O.T.	Well plugged: 9/12/1990; Well type: > 18"" dia.
9326	67	Registered abandoned wells	35	n.a.	Nelson, Jim	Well plugged: 8/6/1992; Well type: > 18"" dia.
1913	68	Registered abandoned wells	29	n.a.	Casper, Et Al, Gretchen M.	Well plugged: 5/2/1990; Well type: > 18"" dia.

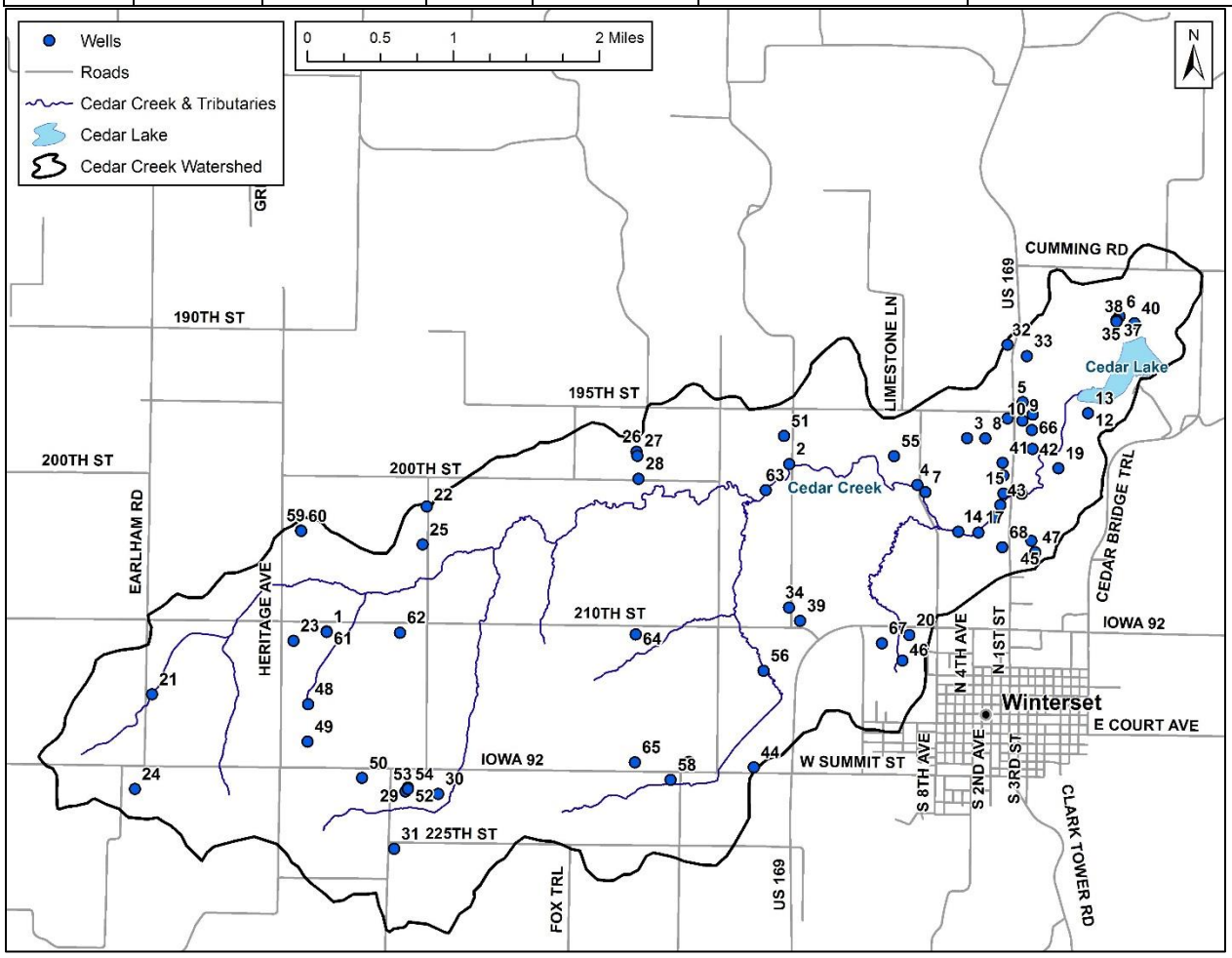

Figure 20. Private and agency owned wells in the Cedar Lake watershed.

Appendix D –Risk Scores for all PCSs, Groundwater Wells, and Land Uses

Table 22 though Table 24 provide a summary of each PCS, groundwater well, or land use and their total risk score, based on the individual location, susceptibility and contaminant risk scores. The total risk score for each is used to help determine implementation of the action plan.

Table 22. Risk scores of potential contaminant sources

Land Use or Operation of Concern (PCS)	ID	Risk Score			Total Risk Score	Priority
		Location of PCS	Source Water Susceptibility	Contaminant Risk		
Waldo Farms Sow Unit	1	3	3	5	11	High priority
Winterset Egg Farm, Poultry Facility	4	3	1	5	9	
Winterset Egg Farm	10	3	1	5	9	
Winterset Egg Farm	9	3	1	5	9	
Winterset Egg Farm	7	3	1	5	9	
Winterset Municipal Airport (Madison County Airport)	2	3	1	5	9	
Winterset Municipal Airport (Madison County Airport)	3	3	1	5	9	
Winterset Municipal Airport (Madison County Airport)	6	3	1	5	9	
Winterset Municipal Airport (Madison County Airport)	5	3	1	5	9	
US West	12	3	3	5	11	High priority
Bussanmas Inc.	22	3	1	5	9	
Winterset WS-Cedar Lake	23	5	3	1	9	
John Wayne Dr. Handling and Storage Spill	11	3	3	5	11	High priority
Cedar Creek Animal Clinic	8	3	3	4	10	High priority
Feedlot	13	3	3	5	11	High priority
Feedlot	14	3	3	5	11	High priority
Feedlot	15	3	3	5	11	High priority
Feedlot	16	3	3	5	11	High priority
Madison County Sportsmen's Club	17	5	3	4	12	High priority
Winterset Pullet Farm	18	3	1	5	9	
Winterset Egg Farm	19	3	3	4	10	High priority
Animal waste lagoon	20	3	3	5	11	High priority
Septic tank	21	3	1	4	8	
Sediment basin	Blue hatch	5	3	4	12	High priority
Groundwater wells	See below					
Land use types	See below					

Table 23. Groundwater well risk scores

Groundwater Well Type	Location	Source Water Susceptibility	Contaminant Risk	Total Risk Score	Priority
Within ¼ quarter buffer of surface water and primary protection area	5	3	2	10	High Priority
Within ¼ buffer of surface water	3	3	2	8	
Outside ¼ mile buffer and primary protection area	3	1	2	6	

Table 24. Land use risk scores

Land Use Type		Location	Source Water Susceptibility	Contaminant Risk	Total Risk Score	Priority
Crops (pasture and hay)	Within ¼ quarter buffer of surface water and primary protection area	5	3	3	11	High priority
	Within ¼ buffer of surface water	3	3	3	9	
	Outside ¼ mile buffer and primary protection area	3	1	3	7	
Crops (corn/soy)	Within ¼ quarter buffer of surface water and primary protection area	5	3	5	13	High priority
	Within ¼ buffer of surface water	3	3	5	11	High priority
	Outside ¼ mile buffer and primary protection area	3	1	5	9	
Developed	Within ¼ quarter buffer of surface water and primary protection area	5	3	4	12	High priority
	Within ¼ buffer of surface water	3	3	4	10	High priority
	Outside ¼ mile buffer and primary protection area	3	1	4	8	

Appendix E – Emergency Response Plan Affidavit

Emergency Response Plan Affidavit

The Safe Drinking Water Act amendments of 1986 and 1996 established the concept of wellhead protection, and subsequently the Source Water Protection Program. The program is currently overseen by the Iowa Department of Natural Resources (DNR) and attempts to prevent potential contaminants from entering source waters and prepare for situations in which drinking water may be impaired through contamination, power outage and treatment or distribution system interruptions. In order to ensure a public water supply's preparedness in such events, a Contingency/Emergency Plan has been required in every approved Source Water Protection Plan (SWPP) or Wellhead Protection Plan (WHPP). Due to recent and growing concerns over water system security and due to many systems having previously prepared such a plan under the provisions of the 2002 Bioterrorism Act, the DNR is now allowing an affidavit in lieu of including a completed Contingency/Emergency Plan within the submitted SWPP/WHPP. Although public water supplies do not need to send DNR completed plans, each must have an accessible and up-to-date plan in case a catastrophic event occurs within their system. It is necessary for the completed water supply Contingency/Emergency Plan to contain the following information, at a minimum:

- Contact information for the city's mayor, city clerk, water/wastewater operator.
- Contact information for the city's power company, a professional electrician, a professional plumber and an equipment repair company.
- System's critical users must be identified and a plan for immediate notification must be created. (i.e. hospitals, nursing homes, schools, etc.)
- Contact information for local media, including newspaper, radio and television.
- Contact information for a certified laboratory, local emergency contacts, state and local public health departments and the National Guard.
- Contact information for the DNR's 24 hour emergency contact and the local DNR field office.

I, Todd W. Brown, representing Madison County Emergency Management Agency certify that a Contingency / Emergency Plan has been created for our public water supply system and that this information can be presented to the DNR upon request.

Jan. 09, 2018

Modified from the Iowa Source Water Protection Program Workbook Page 19 DNR Form 54