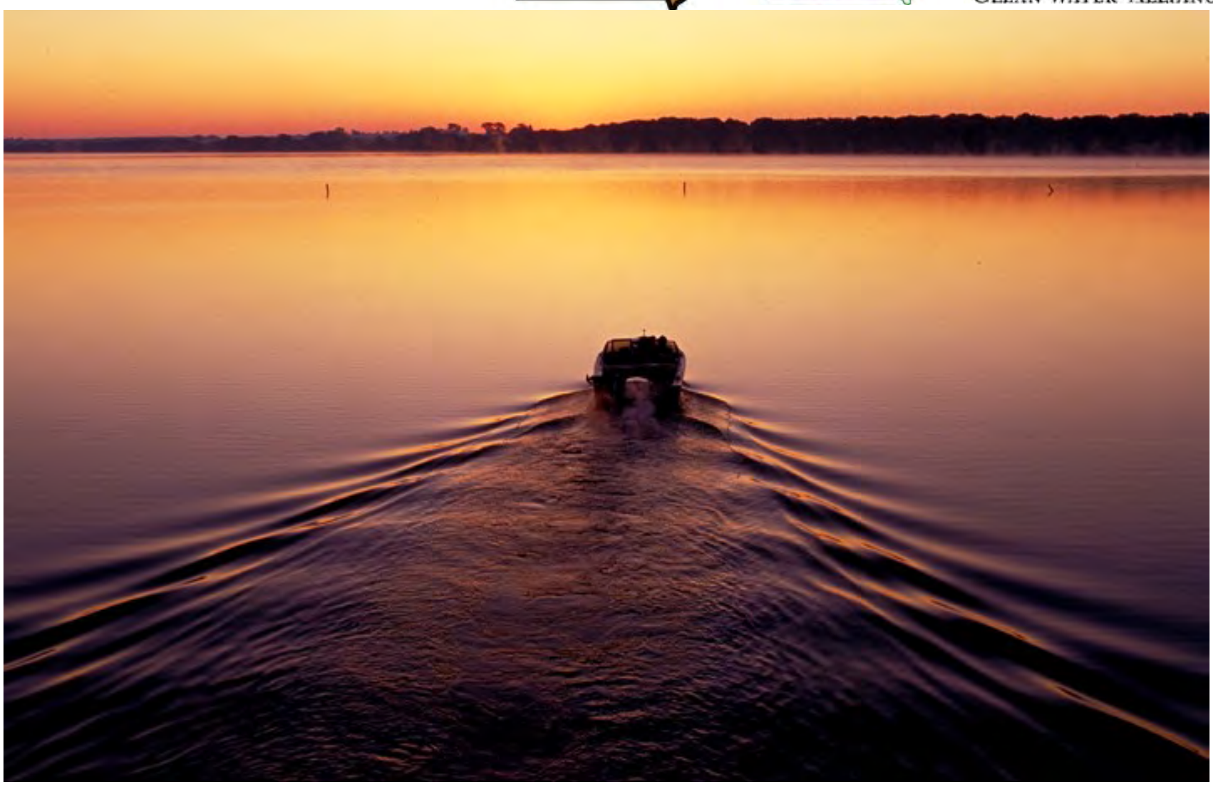
Dickinson Soil and Water Conservation District

Dickinson County Clean Water Alliance

The Iowa Great Lakes Watershed Management



East Okoboji Sunset (David Thoreson, Blue Water Studios)

Water Quality Management Plan for the Iowa Great Lakes Watershed

"The Marshlands that once sprawled over the prairie from the Illinois to the Athabasca are shrinking northward. Man cannot live by marsh alone; therefore, he must needs live marshless. Progress cannot abide that farmland and marshland, wild and tame, exist in mutual toleration and harmony." (Leopold, 1949, p. 162)

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Revisions due in July 2022, 2027, 2032, 2037, 2042, 2047, and 2052

Welcome

This document is intended to aid watershed groups in targeting watershed activities and practices to improve water quality. Planning serves as a road map for turning today's problems into tomorrow's solutions. Water quality improvement is a big task, and trying to tackle it all at once can be daunting. This Management Plan encourages a logical approach to implementation to ensure incremental progress is made within the framework of big picture goals for the watershed.

This Management Plan does not contain an exhaustive list of management alternatives but rather a starting place. The table of contents provides an outline for what is covered in the document. Additionally, examples (hypothetical and/or from past plans) are cited for illustrative purposes.

The more time and effort invested in watershed planning, the greater the chance of success. The planning process consists of fact-finding, analysis, and interpretation of information and trends concerning the local political, social, environmental, and economic aspects of the watershed. The planning process takes into consideration viable alternatives and their cost effectiveness to create recommendations to meet present and future needs in a comprehensive plan. Planning is a continuous process where progress and goals need to be revisited and revised at least every five years.

The following are logos for contact resources and agencies used throughout the plan.

Federal Agencies:

United States Environmental Protection Agency

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

State Agencies:

DNR

Iowa Department of Agriculture and Land Stewardship

Iowa State University
University Extension

Local Agencies and groups:

United to keep our lakes alive!
Dickinson County Clean Water Alliance

Okoboji Protective Association
Since 1905

Dickinson Soil and Water Conservation District

List of Acronyms/Abbreviations

Term	Acronym/Abbreviation
Agricultural Environmental Management Plans	AEM
Best Management Practice	BMP
Colony Forming Unit	CFU
Chain Of Custody	COC
Cooperative Lakes Area Monitoring Project	CLAMP
Clean Water Alliance	CWA
County Conservation Board	CCB
Data Quality Objective	DQO
Department of Natural Resources	DNR
Dickinson County Conservation Board	DCCB
Dissolved Oxygen	DO
East Okoboji Beach	EOB
Environmental Protection Agency	EPA
Geographic Information System	GIS
Iowa Lakes Community College	ILCC
Iowa Department of Natural Resources	IDNR
Iowa Great Lakes Watershed	IGLW
Iowa Lakeside Laboratory	ILL
Iowa Watershed Improvement Review Board	WIRB
IOWATER Program	IOWATER
Nephelometric Turbidity Unit	NTU
Nitrate Nitrogen	NO_3-N
Natural Resources Conservation Services	NRCS
Quality Assurance Coordinator	QAC
Quality Assurance Manual	QAM
Quality Assurance/Quality Control	QA/QC
Quality Assurance Project Plan	QAPP
Resource Conservation and Development	RCD
Resource Management Area	RMA
Relative Percent Difference	RPD
Relative Standard Deviation	RSD
Standard Operating Procedure	SOP
Standard Methods	SM
Soil and Water Conservation District	SWCD
STORage and RETrieval	STORET
Total Maximum Daily Load	TMDL
Total Phosphorus	TP
Total Suspended Solids	TSS
United States Department of Agriculture	USDA
University of Iowa Hygienic Laboratory	UHL
Watershed Management Plan	WMP

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EXECUTIVE SUMMARY

The last re-write of the Iowa Great Lakes Watershed Management Plan (WMP) was completed in 2013 and the purpose of that plan was to develop a method and plan to treat the watershed in a logical manner. Prior to that, the Iowa Great Lakes Watershed was treated in a random manner for many years with much good being done to treat the watershed and its water bodies. The lakes of the watershed had shown steady improvement to chemical and physical change over 20 years of intensive watershed treatment. That change has taken 25 years to be realized. The WMP that was written in 2013 was meant to target the work of the watershed in a way that provides the greatest benefit in the areas of the greatest pollutant production so as to achieve the greatest benefit per dollar spent and provides for a quick turn around for impacts to chemical and physical changes to water quality in the watershed.

This WMP is an improvement from the last plan in that load reductions are targeted for specific areas of the watershed along with estimated costs. In the past, the efforts within the Iowa Great Lakes have been managed in a fashion that allowed for watershed work to be complete but did not target any one specific area. As a result of this lack of targeting, many projects were complete and much good was done within the watershed, but no chemical or physical results were seen in the chemical or physical properties of the lakes within the watershed.

This WMP has 18 separate agricultural Resource Management Areas (RMA's) that have been identified as having larger pollutant loads to the lake specific resource concerns, or similar characteristics. The WMP gives an end result for what needs to happen in each of these RMA's. This WMP is specific in giving dates and practices that will be completed using the best science available as well as a cost estimate based on pounds of Phosphorus removed, the primary pollutant of concern in the Iowa Great Lakes. In addition, the Iowa Nutrient Reduction Strategy (NRS) is being used as the basis for this plan. Thus the Iowa Great Lakes plan is in concert with the NRS at all levels. In addition the plan has identified 3 urban Resource Management Areas that specifically target urban areas with a large amount of impervious surface and runoff potential.

In a study completed in 2010 by Dr. John Downing on the Lower Gar Lake chain of lakes, which consists of Upper Gar Lake, Lake Minnewashta, and Lower Gar Lake it was determined that more than 81% of the total Phosphorus (TP) loads within these lakes originate above the Minnewashta channel to Lower Gar Lake. Because these TP loads are coming from other locations than within the Lower Gar Watershed it is not possible to reach the 45% reduction in TP called for in the Total Maximum Daily Load for Lower Gar Lake without improving the water quality of East Okoboji Lake, West Okoboji Lake, and Big Spirit Lake along with the waterbodies feeding these lakes. (John A. Downing, Kelly Poole, Christopher Filstrup, 2010, p. 3)

This WMP lays out a specific and quantifiable plan from 2018 to 2050 to reduce the primary pollutant, phosphorus, that enters the lakes of this watershed. Using modeling and approximations, we can estimate a reduction of phosphorus that enters these lakes of 98,385 pounds during these 32 years of the project. The phosphorus that is being reduced is targeted in specific watersheds and with specific practices. The WMP should not be thought of as a set standard for what will happen within the Iowa Great Lakes. If no additional Phosphorus is added to the Iowa Great Lakes, reducing the P by the amounts planned within this WMP will improve all the bodies of water to include those that are listed as impaired on the States 303(d) list or those that have a Total Maximum Daily Load assigned to it.

This WMP will call for the treatment of the entire Iowa Great Lakes Watershed, in an effort to treat the lake on the bottom end of the Watershed, Lower Gar Lake. Each of the Resource Management Areas (RMA) throughout the Iowa Great Lakes have been assigned a total amount of Phosphorus to be removed. Each RMA also has a set number of practices that can remove that much Phosphorus; the important fact is not to rely on the installation of a set number of practices, but rather in the amount of Phosphorus reduced.

This plan calls for a total reduction of over 98,385 pounds of Phosphorus even though the amount needed for Lower Gar is actually only 4,000 from the watershed above Lower Gar in addition to the 4,000 from the Lower Gar Watershed. Not all the Phosphorus from the lakes, streams, and watershed above Lower Gar will reach the Lower Gar Lake so the reduction must be much greater than the 4,000 pounds that is actually needed in order to see the change that is required.

The second largest RMA, Loon Lake RMA, is located in Minnesota and is responsible for the second largest reduction in Phosphorus at over 30,000 lbs. Since it is located the furthest from Lower Gar and it has the second largest land mass (next to "other un-named RMA), it is reasonable to expect the reduction from Loon Lake RMA to be more significant. The largest reduction is called for on Other, non-identified areas simply because it is the largest land mass. The most significant reductions, however can come from the named RMA's as they are the largest producers of sediment and Phosphorus. Thus any targeted approach in the Named RMA's will bring the biggest change and the largest "bang for the buck".

This plan has the most up-to-date pollutant load reduction calculations and figures. One thing that needs to be re-run is the wetland priority calculations. Some of the original priority wetlands from the previous writing of the WMP have been built and some wetlands that were not priority or were created should have changed the priority wetlands in some RMA's. Due to the winter and spring challenges from this year, that has not been done. It is our intention to re-run the wetland prioritization or to create a new method in which to do that.

We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.
Aldo Leopold

INTRODUCTION

The Iowa Great Lakes Watershed consists of approximately 90,631 acres in Northwest Iowa and Southwest Minnesota. The purpose of this management plan is to provide a logical and focused plan to treat the entire watershed. It is understood, however, that the plan includes the information for the Minnesota portion watershed. The plan will not work without the simultaneous cooperation from Minnesota agencies of the watershed including the Minnesota Pollution Control Agency and EPA Region 5, because it is not reasonable to assume the Iowa agencies including the Iowa Department of Natural Resources and EPA Region 7 can effectively manage land outside of its jurisdiction.

The management plan has been written to assist with any water quality work that individuals, public or private groups and governmental entities wish to do within the watershed. This management plan will continue to evolve to allow for new technologies and studies that are still yet to come; to be taken into consideration for improvements that will greatly help the efforts to clean up the water flowing into and out of the lake system. The release of the Iowa NRS, which this document draws upon a great deal, has been crucial in accessing science based, factual data that we can use as a baseline. The areas of the watershed are broken down by lakes and watersheds here and further broken down and described as listed later:

Lake	Total Size (acre)	Total Watershed Size (acre)	Page
Lower Gar	242	11,374	27
Minnewashta	126	289	27
Upper Gar	37	217	27
East Okoboji	1,835	12,212	39
West Okoboji	3,847	13,668	56
Center	263	612	107
Big Spirit	5,684	34,471	117
Little Spirit	618	1,444	173

Table 1 Lakes of the Iowa Great Lakes and size information

Each of the lakes in the region has specific watersheds that have been broken down into smaller, more manageable sub-watersheds or Resource Management Areas (RMA's). These RMA's are more easily monitored for water quality improvements and protection. The coversheet for each lake lists the RMA's that will have immediate impact for improvements and protection on that lake. The indirect RMA's flow into another lake that either flows directly into the lake of choice or eventually has water flow that reaches the lake of choice listed. The work to be completed in an indirect RMA will show improvements to a lake but the impacts will not be seen as fast as they would be in a direct RMA.

Some chains of lakes listed above have been grouped under one lake. This has been done because of the minimal impact a small watershed may have on a particular secondary lake as compared to the major impacts of a principal lake that drains directly into the secondary lake. An example of this would be the Gar Lake Chain where Upper Gar has a relatively small Watershed affecting the water quality, but is majorly impacted by East Lake Okoboji because it drains directly into Upper Gar Lake. Upper Gar has no phosphorus load allocation identified by the TMDL from the RMA, but the lake must be addressed because of the phosphorus source of East Lake. Upper Gar then flows into Minnewashta and Lower Gar which has a very large Watershed that affects the lake so the three lakes have been grouped into one lake chain.

A variety of resources were used in the writing of this plan. The main resources that were used to develop this plan were the State of Iowa's NRS, which was published for public comment in late 2012 and the Lower Chain of Lakes Diagnostic Feasibility Study, conducted by Dr. John Downing. These reviewed works lay the background for the BMP's and phosphorus reduction strategies.

The following RMA's will be discussed further in the plan:

RMA	Page	Total Size (acre)	RMA	Page	Total Size (acre)
Lower Gar (Spring Run)	27	11,374	Center Lake	108	612
East Okoboji Beach	39	1,990	Sandbar Slough	118	5,208
Elinor Bedell State Park	48	2,737	Hales Slough	128	719
Garlock Slough	57	1,608	Reed's Run	141	1,574
Lakeside Lab	67	314	Templar Lagoon	149	522
Okoboji View	75	1,797	Hottes/Marble Lake	158	4,292
Lazy Lagoon	83	685	Little Spirit Lake	174	2,060
Welch Lake	91	2,924	Loon Lake	183	19,238
Jemmerson Slough	99	2,348	Other RMA	207	32,783

Table 2 Resource Management Areas of the Iowa Great Lakes

Impaired Waters

Every two years, the Iowa Department of Natural Resources has come out with a list of Impaired Water Bodies that have been tested and shown to consistently have poor water quality due to one or more of a number of reasons. Several of the lakes in the Iowa Great Lakes area have been on the list at one point and some appear consistently. The goal of this plan is to remove and prevent all lakes from being listed by improving the water quality and managing the watershed to the point where the impairments are removed from the given lake. Within the individual RMA plans, it will be discussed how the practices implemented will reduce the excess nutrients reaching the lakes to remove the impaired status. Below is a listing of the lakes as they appeared on the Impaired Waters List and the reason they were impaired.

Lower Gar Lake	2016 — Partially Supporting — Turbidity 2016 — Partially Supporting — Algal Growth Chlorophyll a	Class A1 Class A1
Minnewashta	2016 — Fully Supporting	Class A1
Upper Gar Lake	2016 — Fully Supporting	Class A1
East Okoboji Lake	2016 — Fully Supporting	Class A1
West Okoboji Lake	2016 — Fully Supporting 2016 — Fully Supporting	Class A1 Class HH
West Okoboji Lake	2016 — Partially Supporting — Bacteria: indicator , E. coli	Class A1
Center Lake	2016 — Partially Supporting — Algal Growth, Chorophyll a	Class A1
Big Spirit Lake	2016 — Partially Supporting — Bacteria	Class A1
Little Spirit Lake	2016 — Fully Supporting 2016 — Partially Supporting — Turbidity 2016 — Partially Supporting — Algal Growth: Chlorophyll a	Class B(LW) Class A1 Class A1
East Okoboji Lake	2016 — Fully Supporting	Class A1
Marble Lake	2016 — Not Supporting — Algal Growth: Chlorophyll a	Class B(LW)
Pleasant Lake	2016 — Partially Supporting — Algal Growth: Chlorophyll a	Class B(LW)
Prairie Lake	2016 — Fully Supporting	Class B(LW)

Table 3 Impairments of the Iowa Great Lakes

BEST MANAGEMENT PRACTICES (BMPS)

This WMP is a practice-based approach to show meaningful and measurable progress within the Iowa Great Lakes to removing pollutants causing impairments within the watershed. The plan is voluntary and science based to reduce sediment and Phosphorous impact on waterbodies. The practices discussed in this WMP have been studied and tested extensively and have been proven to improve water quality in many settings. Several are described here with an explanation of how they help but new technology and new thought process may provide for additional practices that are not listed within this plan. This WMP relies on the Nutrient Reduction Strategy and Iowa's Non-point Source Management Plan for its science and planning requirements. Treatment strategies are broken into 6 categories. Those categories include Phosphorus Management, Land Use Change, Edge of Field, Shallow Lake Treatment, Education, and Monitoring. Although many practices have been identified in this plan, it is important to understand the practice is not as important as the reduction in Phosphorus and that is where our concentration should be focused. The NRS will be used as the framework for innovation and verification of new practices and technologies.

Phosphorus Management —

Reduced Tillage (Conservation, strip-, ridge-, no-till): Conservation tillage consisting of Conservation tillage, Strip-tillage, ridge-tillage and no-tillage practices is one of the best tools to keep soil from eroding and becoming sediment in the lakes. These practices allow agricultural crops to be planted with minimal disturbance to the soil and removing little to no residue. The main focus would be on land that is targeted throughout the RMA's as highly erodible or easily erodible.

P Rate Reduction: This practice involves not applying P on fields where soil tests values exceeds the upper boundary of the optimum level for corn and soybeans in Iowa, which is 20 parts per million. This reduction would be continued until the soil test values drop below or equal to the optimal values. This practice would be a cost benefit to landowners and operators as well as reduce the available phosphorus that could enter waterbodies.

Cover Crops: The late summer or early fall planting of cover crops provides a benefit of improved soil quality, improved water retention in the soil, reduction of disease and insect pressure, and reduced erosion and reduced nitrogen and phosphorus loss from the field. This practice can provide a reduction of up to 50% phosphorus loss from a field each year the practice is used.

Land Use Change —

Grassed Waterway: Grassed waterways are placed in areas of significant water flow to reduce soil erosion and prevent ephemeral gulley formation. The roots from the grass hold the soil in place preventing it from running off the field into nearby streams, rivers and lakes.

Sediment Basin: Sediment basins are structures that are used to hold back water carrying sediment and allow the sediment to drop out of the water. Sediment basins will be used where wetlands are not wanted by landowners who don't want to give up land to upland plantings and wetland soils. Basins are an effective alternative which allows the landowner to maintain a farmable row pattern. These basins will be strategically located in small drainage areas where significant loading is occurring to be utilized in the more traditional sense as a catchment to trap pollutants and slow water. A more intense survey of the land and discussion with private landowners is needed to determine the better option regarding wetland restoration or sediment basin.

Grade Stabilization Structures: Grade stabilization structures are built across gullies or grassed waterways and drops flowing water to a lower elevation to protect soil in a gully from eroding into a nearby water way.

Land Retirement: Land Retirement would be used in specific areas with the highest erodible soils (mainly on steep hillsides) to remove this land from production and keep it in permanent tall grass prairie. This might include permanent protection in stopping erosion from highly erodible soils by paying landowner 100% of appraised value for the land plus restoration costs for these tracts of land. In addition, land retirement might be required in wetland restorations to "square fields up" and provide an easy to farm solution to a farmer. Conservation Reserve Program may be part of the land retirement practice as well as conservation easements and acquisition.

Rain Gardens: This practice is a favored one among people living in towns to handle storm water runoff. Soil from a depression or low spot is replaced with an engineered mix of soil, compost and sand to allow for better infiltration of surface water into the ground water system. Native plants are encouraged to be planted because they are tolerant of extreme wet/dry cycles rain gardens typically experience and they help to maintain a high organic content of the engineered soil and keep the soil porous and able to handle the water flow with restored hydrology.

Pervious Pavers: Similar to conventional paver systems, this practice places individual pavers slightly more spaced out over a bed of crushed rock layers instead of sand to allow better percolation of water into the ground beneath the pavers to reduce surface runoff and to catch and trap sediments and excess nutrients preventing them from entering the ground water system. This system is typically used for patios, driveways and parking lots.

Construction Site Management: Urbanization is an ongoing issue in the IGL Watershed and additional incentives are needed to stimulate continued adoption of Low-Impact Development BMP's. Although ordinances have been adopted throughout much of the project area, instances still arise where incentives and cost-share are needed to meet overall project objectives.

Septic System Inspection and Septic System Renovation Demonstration: Rural residence septic systems throughout the watershed, in some instances, have not been adequately maintained and may not be functioning properly. This may be a significant issue due to impermeable soils found throughout the region, which may result in systems being connected directly to field drainage tile. Due to the difficult nature of assessing and detecting these faulty systems, project sponsors intend to launch a voluntary inspection incentive campaign to encourage rural residents to begin to address the issue. Three areas of interest in the Iowa Great Lakes Watershed that do not have sanitary sewer and the human wastes are disposed of via septic tanks. The connection of these three areas to the sanitary district is a key in preventing the listing of two sites in the Iowa Great Lakes onto the States impaired waters list. Emerson Bay on West Okoboji and Marble Beach on Big Spirit Lake are both located near one of these areas with septic tanks and both are proposed to be on the 2010 list of impaired waters list.

Edge of Field —

Wetland Restoration: The land use of the IGL Watershed has undergone dramatic changes post settlement with the bulk of the wetlands that once dominated the landscape now drained and converted to row crop production. These areas that once stored and filtered water are now left with straightened drainage ditches and tile lines leading to the lakes or a small number of over-stressed wetlands. The goal of this practice is to restore wetlands with upland buffers to filter water and assist with restoring historic hydrology where possible. This will be done with native prairie seeding on the upland, surfacing of tile lines, tile line breaks and wetland basin native seeding of a diverse hydrologic plant community. These should be large shallow basins focused only towards water quality and most likely to go nearly dry seasonally. Some of these wetlands may require structures to maximize the wetland restoration to have little to no impact on neighboring properties that don't want to participate with a wetland restoration. Wetlands within the plan have been prioritized by sediment delivery models and wetland to upland ratio. A more intense survey of the land and discussion with private landowners is needed to determine the best option whether it be wetland restoration or to look at other options.

Sediment control practices: This practice includes waterways, sediment basins, and grade stabilization structures and other practices, but these are on the edge of a field rather than part of the field. This practice is flexible and intended to be only in the field margins and the edge of the field as the water moves away from the field.

Filter Strips: Filter strips promoted in critical locations and funded through the CRP program or similar programs. Filter strips are used to slow runoff water and allow it to infiltrate into the soil. Filter strips can be used on streams, lakeshores, tile inlets, storm sewers, and other areas with direct access to surface water.

Underground Outlet: This practice focuses on replacing traditional Hickenbottom intake risers with an underground system to drain excess water from depressions in the field. Traditional riser systems can be tricky to farm around, get stuck in equipment and allow for unfiltered water to drain directly into the field tile without addressing nutrient and sediment concerns. Rock inlets bury the intakes under several feet of pea sized gravel allowing for sediments to naturally settle out before reaching the tile line reducing the chance for impurities to reach the drainage system. This alternative has become popular among farmers as the maintenance is minimal compared with traditional systems. Underground Outlets have the potential to reduce 18 to 30 percent of the sediment loss over conventional intakes.

Shallow Lake Restoration —

Shoreline Restorations: Shoreline work is necessary to address shoreline erosion and to help reduce internal loading of phosphorus within the lakes. The restoration of native prairie buffers around the lakes has reduced shoreline erosion in some areas by up to one foot per year. The deep rooted native vegetation holds the shoreline soils in place better than short rooted turf. Shoreline restoration projects also help reduce internal phosphorus loading by re-establishing plants to use up some of the phosphorus. Native emergent plants like bulrushes, arrowhead plant, bur-reed and sedges help tie down loose sediments on the lake bottoms near the shore where most stirring and re-suspension of sediment takes place. The re-establishment of these plants along with native prairie buffers should eliminate almost all shoreline erosion in areas where they are re-established.

Shallow Lake Restoration Practices: Watershed restorations and reductions in nutrient and sediment loading is not enough to restore water quality in the shallow lakes of some RMA's. Development of a long-term management strategies to improve aquatic plant diversity and density and manage common carp populations are needed to complete a true shallow lake restoration. The feasibility of using water level management (shallow lake management strategies) to positively affect water quality in some shallow lake systems should be explored.

Water-level drawdowns result in consolidation of bottom sediments, germination and growth of emergent aquatic plant species, and management of common carp populations. In shallow lakes, common carp can root up aquatic vegetation and their feeding habits can stir up bottom sediments leading to high turbidity and the release of nutrients into the water. Additionally, installation of fish barriers will help to slow the re-infestation of adult common carp and maximize the period between draw downs. Electric pumping stations and intake lines will most likely be needed to facilitate temporary draw downs in some shallow lake systems. It will be important to maintain some connectivity of these systems to the larger lake system providing spawning and nursery habitat for a number of native fish species.

Carp Exclusion/Reduction: Recent research has indicated that successful common carp reproduction is associated with fish free shallow marshes and sloughs connected to natural lakes. By blocking adult spawning carp from entering these areas, reproduction can be controlled. If reproduction can be controlled, physical removal of adult fish can be used as a viable means of significantly reducing the biomass of common carp and minimizing their impact on water quality and nutrient cycling.

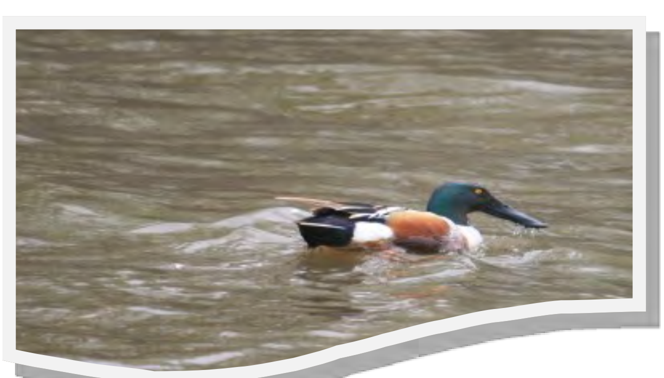

Photo 1: Drake Shoveler on a local restored wetland

WATER MONITORING PLAN

The water monitoring for the Iowa Great Lakes Watershed will focus on the impairments for the individual lakes including specific impairments as well as the system as a whole to determine indirect impacts. Monitoring research will be conducted to get data to determine load reductions in a lake from practices completed on another lake. This is necessary to show load reductions that are required for lakes like Lower Gar that have a large nutrient source coming from the rest of the lakes in the Iowa Great Lakes Watershed.

The sampling within the Iowa Great Lakes will be conducted by local volunteers and staffs from Dickinson Soil and Water Conservation District, the State Hygienic Laboratory (SHL) at the University of Iowa and/or Iowa DNR monitoring and fisheries. The hydrology of the Iowa Great Lakes is unique; therefore sampling frequency will be determined on a site by site basis. Samples will be collected on a regular basis if hydrologic conditions permit as well as after storm events. Sampling locations will be based on BMP installation and hydrologic conditions within each RMA.

The water quality indicators that have been selected for the Iowa Great Lakes Watershed Management Plan are nutrients and sediment. The parameters to be included are total phosphorus, nitrate plus nitrite nitrogen, and total suspended solids. The monitoring in each RMA is designed to capture conditions prior to and after BMP installation at locations where the impacts can be measured. Over the short-term, these monitoring locations will be able to show the effectiveness of the BMP's. Additional long-term, ambient monitoring throughout the watershed will also demonstrate the overall effectiveness of BMPs in the RMA's.

Standard Methods for Collection

Sampling is designed to collect baseline data that will aid in the identification of problems that exist in the watershed. This data will serve as a guideline for future implementation of suggested conservation practices. The sampling design will allow for collection of data during varying flow conditions, including ambient, base flow, and storm conditions. Storm conditions that will be sampled include any storm with over 1.25 inches of rain or a significant amount of rain in a 24 hour period. The samples will be taken using first flush samplers, grab samples, automatic samples, and visual samples.

Depending on the sampling site and conditions, samples will either be collected directly from the stream or lake. Prior to sample collection, each lab sample container is labeled with a permanent waterproof marker. Lab sample container labels include site name, date and time of sample collections, and the collector's name. Equipment cleaning and decontamination and preservation methods as will be instructed by the analyzing laboratory.

Sampling will be conducted in a manner that minimizes the chances of contamination. Lab samples will be collected in sterile, unused sample containers provided by SHL. Sample collection personnel will be instructed not to touch the insides of the sample containers or caps. Lab sample containers will be filled without prerinsing the container. Some lab sample containers contain a preservative. When collecting samples in these containers, a small amount of air space will be left to ensure that the preservative is not lost or diluted.

When grab sampling is suitable, samples should be collected along the sample site cross-section. A sample is taken at a point that best represents the water quality of the total flow at the cross section of the stream. A sampling point should be avoided if it is poorly mixed or if it is affected by local temporary conditions such as ponding across part of the stream width, if there is an obviously disproportionate sediment load or backwater conditions. If a site is poorly mixed across the stream, an integrated sample from across the stream width should be used, or another site should be chosen that is well mixed across the stream width.

If the lab sample is collected directly from the stream, it will be collected in the middle of the channel facing upstream. If the lab sample is taken from a bridge, the sample will be collected on the upstream side of the bridge over the middle of the channel or wherever the flow is the greatest. Regardless of collection method, the grab sample is stored and transported in a clean, labeled container. Samples will be collected directly into the lab sample container, immediately capped, and then stored on ice until packaged for delivery to the lab. Field parameters are then measured for dissolved oxygen, water temperature, chloride, and turbidity. The turbidity sample will be analyzed immediately at the site after calibrating the turbidity meter. To prevent contamination, the glass vial the turbidity sample is measured in will be rinsed with distilled water three times before each use. The remaining water in the water collection container is discarded and "fresh" sample is collected. This water is then used for the chloride test. Chloride is measured using a HACH Quantab test strip. The dissolved oxygen/water temperature probe is lowered into the stream, ensuring that the probe is not making direct contact with the stream bed. Before making the field measurements, the sensors must be allowed to equilibrate with the water being monitored. The sensors have equilibrated adequately when the temperature measurement variance is within ±0.2 ºC and the dissolved oxygen measurement variance is within ±0.5 mg/L. The dissolved oxygen and water temperature measurements will be recorded on the field form.

Grab Samples
Grab samples can be taken at selected sites in the container and volume appropriate for each particular analysis. In-stream samples will be collected at mid-depth range to ensure a representative sample of the stream profile. The method used for any particular sample depends on several factors including flow rate, accessibility and stream depth and width.

The variations of the grab sampling method are described below.

Wading and Hand Collection
If the stream is safe to wade, the person collecting the sample wades with a lab sample bottle to the center of the stream or where the greatest flow exists. The sample collector should face upstream, taking care to ensure that any stream bottom debris disturbed by wading does not contaminate the sample. The lab sample bottle is tipped at a 45° angle, allowing the bottle to fill. If water levels or velocities cause concern for safety, DO NOT WADE!

Reach Pole Collection
When wading conditions are not safe in smaller streams, a grab sample may be collected using a reach pole. In this case, the water sample collection bottle is fitted into a wire cage attached to the end of a long, telescoping reach pole. The water sample collection bottle is tipped at a 45° angle, allowing the bottle to fill. The water sample collection device is filled and rinsed three times before water from it is used to fill the lab sample bottles.

Bridge and Rope Collection
A grab sample may be collected by using a water sample collection container that is made of a non-contaminating material, such as HDPE plastic. The water sample collection bottle should be rinsed at the site a minimum of three times before samples are collected. The rinsing consists of lowering the container into the stream from the bridge deck near the center of the bridge, letting it fill with water, lifting the container back to the bridge, and then pouring the contents of the container out. After completing the rinsing, water is poured from the water sample collection bottle directly into the lab sample bottles; bottles are immediately capped, and then stored on ice until packaged for delivery to the lab.

Grab Sampling Field Equipment
The following is a list of required and optional equipment that is used for collecting grab samples. Equipment will vary due to site differences.

- Chest or Hip Waders
- Personal Flotation Device
- Sterile labeled sample bottles
- Telescoping Reach Pole
- Water sample collection container that is made of a non-contaminating material, such as HDPE plastic

with a 25 foot Nylon rope

- Cooler and Ice
- YSI Dissolved Oxygen/Water Temperature meter
- HACH 2100 Portable Turbidimeter
- HACH Quantab® test strips

Field form, permanent markers, pens/pencils

A reassessment of a lake will either be completed once 25% of the BMP's have been implemented in an RMA or at the end of five years. A reassessment of the lake may be needed if the lake has been found to have enough water quality violations to impair the lake. The reassessment may also be needed if water monitoring finds new water quality violations or if a new problem is found that was not originally evaluated for the current plan.

The public will be educated as part of the monitoring program so they can better understand the improvements being made to the lakes. A workshop to train new IOWATER volunteers and recertify old volunteers is being planned in the area. At these workshops volunteers will sign up for a section within an RMA to monitor and will be able to provide valuable feedback on the management plan as it is implemented.

PUBLIC OUTREACH

Public outreach or information and education is a large part of any community wide project. It is important in the process since it is the land owners, tenants, and citizens who directly manage land and live in the watershed that determines the water quality for the Iowa Great Lakes. During the development of this plan, efforts were made to ensure that local stakeholders were involved in the decision making process regarding goals and required actions for improving water quality in the Iowa Great Lakes Watershed. The following plan will guide public outreach activities in the watershed. In the case of the Iowa Great Lakes, it is crucial and extremely challenging due to the mix of agriculture and urban land as well as the number of visitors and transient people.

TARGET AUDIENCES

The target audience for the Iowa Great Lakes Watershed Management Plan. An effective information and education campaign must establish a connection with a wide cross-section of stakeholders in the effort to influence the targeted audience. Those entities listed below are the immediate target audiences for which the information and education campaign must be directed, but it is important that an adaptive management approach be taken to ensure that the intended audience is receiving the intended message throughout the course of this project. The targeted audience at this venture is as follows:

Target Audience #1: Land Owners

- Agricultural and Urban Land Owners and Private Citizens (Property owners-urban and agricultural; Fishermen, Hunters, Investors, Developers, Boaters, Swimmers, Marinas, Resort Managers, Bankers, Chamber of Commerce, Golf Courses/clubs, Visitors/tourists)

Target Audience #2: Partners

Local Businesses

Beck Engineering

Non-Profit Associations

Bedell Family YMCA
Center Lake Protective and Improvement Association
Conservation Districts of Iowa
Cooperative Lakes Area Monitoring Project (CLAMP)
Corn Growers Association
Dickinson County Beef Producers
Dickinson County Conservation Board Foundation
Dickinson County Farm Bureau
Dickinson County Pheasants Forever
Dickinson County Pork Producers
Dickinson Soil and Water Conservation Foundation
Ducks Unlimited
East Okoboji Lakes Improvement Corporation
Friends of Iowa Lakeside Lab
Historic Arnolds Park Incorporated
Humane Society of Northwest Iowa
Iowa Audubon Society
Iowa Environmental Council
Iowa Great Lakes Association
Iowa Great Lakes Fishing Club
Iowa Great Lakes Corridor
Iowa Great Lakes Maritime Museum
Iowa Great Lakes Water Safety Council
Iowa Lakeside Laboratory
Iowa Native Plant Society
Iowa Natural Heritage Foundation
Iowa Prairie Network
Keep Okoboji Blue
Lakes Art Center
McBride Society
Okoboji Foundation
Okoboji Land Trust
Okoboji Protective Association
Osceola County Pheasants Forever
Silver Lake Park Improvement Association
Soil and Water Conservation Society
Soybean Growers Association
Spirit Lake Protective Association
The Nature Conservancy
Wild Turkey Federation

Local Governments and Commissions

Active Okoboji
Central Water
City of Arnolds Park
City of Lake Park
City of Milford
City of Orleans
City of Okoboji
City of Spirit Lake
City of Spirit Lake
City of Superior
City of Terrill
City of Wahpeton
City of West Okoboji
Dickinson County Board of Supervisors
Dickinson County Water Quality Commission
Iowa Great Lakes Sanitary District
Iowa Great Lakes Chamber of Commerce
Spirit Lake Mainsail
Milford Utilities
Okoboji Community Schools
Okoboji Tourism
Spirit Lake Community Schools
Spirit Lake Utilities

County Boards and Districts

Dickinson County Conservation Board
Dickinson County Board of Health
Dickinson Soil and Water Conservation District
Jackson County Planning & Environmental Services

Jackson County Soil and Water Conservation District

Osceola County Soil and Water Conservation District

State Agencies

Iowa Department of Agriculture and Land Stewardship - DSC
Iowa Department of Natural Resources
Iowa Lakeside Laboratory
Iowa Rural Water Association
Iowa State University Extension Service
Minnesota Department of Natural Resources

Federal Agencies

Iowa Great Lakes RC&D
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Service
USDA Farm Service Agency
USDA Natural Resources Conservation Service

Target Audience #3: Potential Project Funders

- Iowa DNR
- IDALS
- EPA
- Water Quality Commission
- Little Sioux Headwaters Coalition
- Okoboji Foundation
- State and/or Federal Programs and/or Local Legislators

Target Audience #4: Media

- Dickinson County News, Lakes News Shopper
- KUOO Radio, KICD Radio
- KITV Television

Target Audience Outreach Strategy & Tactics

This plan identified a number of barriers and potential strategies which if implemented would engage stakeholders in making water quality improvements. This plan will serve as the framework for connecting with the Storm Lake targeted audiences. The following section outlines potential solutions and/or motivators that could help overcome barriers to the target audiences.

Potential Barriers to Participation

Loss of rental income from production land put into conservation
Cost share to install (conservation) practices
Perception of yield loss when adopting new conservation crop production techniques
Absentee land owner contact and education problems
Loss of crop production land
Selling conservation practices to nonfarm background absentee landowners
Loss of Urban property to install conservation practices
Seasonal or absentee property owners availability
Language barriers amongst the various urban stakeholders

Below is a list of potential solutions, incentives or benefits to encourage participation

Provide and/or increase cost share rates for conservation practices in the watershed
Leverage multi-program funds
Participation recognition and award ceremony
Education and demonstration opportunities

With knowledge of the potential barriers and motivators, public outreach tactics are being developed around the target audiences' preferred means of receiving information, which include: personal contact, press and publicity efforts, and other means such as a watershed specific newsletter.

General Elements

- Project identity – Develop an identity for the project that can be used consistently in all public outreach efforts so it all can be recognized as coming from the same place and tied back to the project.

- Online presence – Create and maintain a basic website to provide information about watershed activities and explore other online communication tools that allow for an ongoing dialogue with all target audiences

- Photography – Capture photos of project activities that can be used to educate target audiences to gain and maintain support by demonstrating project progress.

- Comprehensive communication schedule – Develop an annual outreach plan that takes key dates into account to ensure messaging is relevant and activities for the various audiences are complimentary.

Personal Contact

- Personal meetings and phone calls – Plan for private meetings or phone calls to educate individuals about the project and explain cost sharing options in detail. This will be especially beneficially to those in agricultural production.

- Field days – Arrange an annual field day to increase awareness of watershed activities and practices and show project progress. Demonstrations and tours could be conducted in cooperation with all project partners to demonstrate the level of participation from stakeholders, including rural landowners and/or residents, urban residents, DNR staff, City officials, County officials, etc.

- Other educational events – Any opportunities that allow the watershed coordinator to have a few moments to brief the community and stakeholders on the progress that is occurring in the watershed.

Press & Publicity Efforts

- News releases – Send press releases to media outlets (e.g. newspapers and radio stations) with newsworthy project information and updates, including photographs to visually demonstrate information whenever possible.

- Public recognition/awards – Develop and present "Watershed Warrior" of the year awards to publicly acknowledge project participants and supporters.

- Publicity events – Stage events and educational activities that have a news or "feel good" angle, such as a field day or events that involve other key audiences (e.g. youth involved in the local FFA chapter, 4-H group, or local high school environmental science class).

Other

- Partnerships – Develop strong relationships with local organizations that have forums and tools to help communicate watershed messages to the public.

- Committee & Public Meetings
    - Hold quarterly watershed advisory committee meetings
    - Hold an annual public meeting

Evaluation/Measurement

The ongoing measure of success and plan evaluation will be carried out by the local Lake Associations. The Associations publish newsletters and other alerts throughout each year. There is also an annual meeting held each summer where members and general public can attend. The plan progress and I & E will be evaluated by using both of these activities to measure public perception and knowledge of watershed activities through surveys and also from word of mouth.

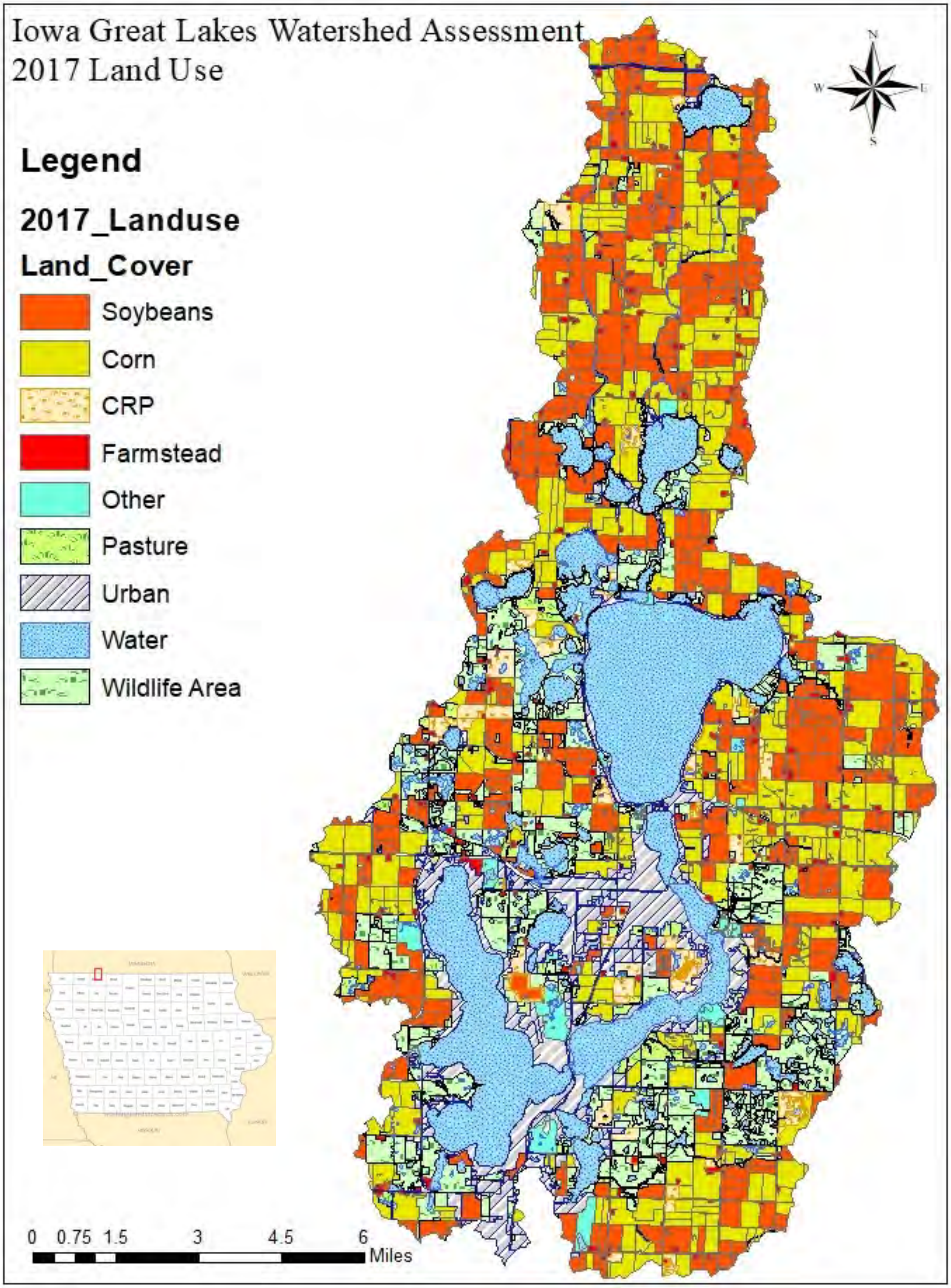

Figure 1 Iowa Great Lakes Land Use Assessment (2017)

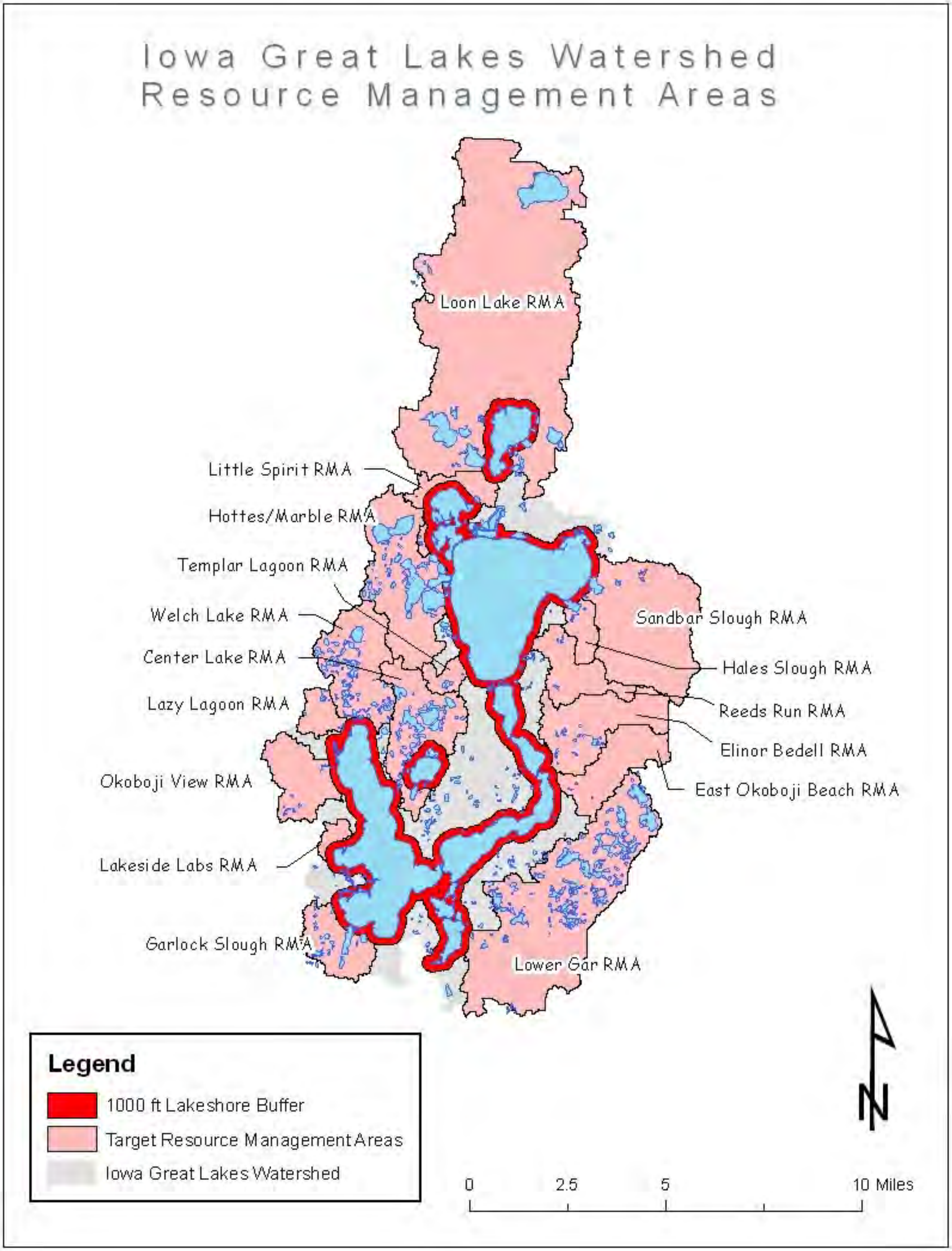

Figure 2 Iowa Great Lakes Resource Management Areas Identification

LOWER GAR LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
242 ac	90,631 ac	11,012 ac	79,619 ac	15	1	15	Yes

Lakes in the watershed of Lower Gar Lake:

Direct

Minnewashta Lake
Upper Gar Lake

Indirect

East Okoboji Lake
Center Lake
Little Spirit Lake
West Hottes
Grovers Lake
Rush Lake
Clear Lake
West Okoboji Lake
Big Spirit Lake
East Hottes
Marble Lake
Loon Lake
Pearl Lake

RMA's that drain to Lower Gar Lake

Direct

Lower Gar Lake RMA

Indirect

East Okoboji Beach RMA
Lakeside Lab RMA
Okoboji View RMA
Welch Lake RMA
Reeds Run RMA
Hales Slough RMA
Sandbar Slough RMA
Loon Lake RMA
Garlock Slough RMA
Elinor Bedell State Park RMA
Lazy Lagoon RMA
Center Lake RMA
Templar Lagoon RMA
Marble/Hottes RMA
Little Spirit Lake RMA

Impairment for Lower Gar Lake: The Class A1 (primary contact recreation) uses are assessed (monitored) as "partially supported" due to aesthetically objectionable conditions caused by poor water transparency due primarily to high levels of non-algal turbidity and aesthetically objectionable conditions caused by algae blooms. The Class B(LW) (aquatic life) uses are assessed (evaluated) as "partially supported" due to high levels of (inorganic) turbidity related primarily to sediment re-suspension at this shallow lake and due to an invasive species introduction (Zebra Mussels). Fish consumption uses are "not assessed" based on a lack of recent data upon which to base an assessment. Sources of data for this assessment include (1) results of the statewide survey of Iowa lakes conducted from 2010 through 2016 by Iowa State University (ISU), and (2) information from the IDNR Fisheries Bureau.

Objective – To remove the turbidity impairment and chlorophyll a impairment from Lower Gar Lake and to improve it to a fully functional condition supporting all its designated uses. The TMDL states phosphorus needs to be reduced by 8,000 pounds per year. A study completed by Dr. John Downing in his study titled "Upper Gar, Minnewashta, Lower Gar Restoration Diagnostic and Feasibility Study" in 2010 states, "the most that can be hoped for in this watershed is to remove half that amount from the lake itself and its watershed. The remaining reduction must come from the lakes that drain into Lower Gar Lake". Therefore, the reduction that will be sought for Lower Gar RMA will be 4,000 pounds of Phosphorus and the remaining 4,000 pounds will be achieved in reduction from the rest of the Iowa Great Lakes Watershed.

Lower Gar (Spring Run) Resource Management Area (RMA)

Objective **–** Prevent sediment and excess nutrients reaching Lower Gar Lake via the outlet stream of the Spring Run Complex. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Lower Gar Lake (8,000 pounds of Phosphorus per year) in accordance with the approved TMDL and a 2010 study showing that only half of the total required amount to remove the impairment from this lake can actually come from within its watershed and the lake itself. The remainder must come from the lakes that drain into Lower Gar Lake. A recent study completed in 2010 by Dr. John Downing, titled Lower Chain Lakes Diagnostic Feasibility Study, states "it would not be possible to realize 45% TP loading reductions without improving the water quality of East Okoboji Lake, the major tributary to the Lower Chain Lakes" because 81% of the Phosphorous loading originates above the Lower Chain Lakes. (Downing, 2010, pg. 3)

Description **–** The Spring Run watershed has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this area degraded in a hydrological sense. This area represents approximately 83% of the watershed directly flowing into Lower Gar Lake, and is vital in the direct input of Phosphorus. Historically, a long series of pothole wetlands and prairie uplands provided important watershed protection to Lower Gar Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both watershed practices and cultural change is needed to reach the project objective of 4,246 pounds of Phosphorus reduction in this RMA.

Restoration Planning Components

<u>Phosphorus Management</u>
A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 875.1 pounds of Phosphorus from entering Lower Gar Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is important to understand that the figure to reach is not an acres or number of a practice but rather the pounds of phosphorus reduced.
<u>Land Use Change</u>
A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 1,391.8 pounds of Phosphorus from entering Lower Gar Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.
<u>Edge of Field</u>
A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 427.1 pounds of Phosphorus from reaching Lower Gar Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.
<u>Shallow Lake Treatment</u>
Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 1,579 pounds of Phosphorus from entering Lower Gar Lake.
<u>Education</u>
An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.
<u>Monitoring</u>
Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Lower Gar (Spring Run) RMA Priority Sub-Watershed														
Clean Water Alliance						Today's Date:		6/26/2018						
	Project Lead:	John H. Wills												
	Start Date:	7/1/2018												
			Annual	Long Term										
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Annual cost per pound of P Removed	Estimated Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				28%	$15,561	$0	416.5	0.0	-$54	$0	$800	56	$14.29
1.1	Conservation Tillage	SWCD	300		0%	-$300		63.03	0.0	-$5	$0	$0	-	$0.00
1.2	No-Till System	SWCD	144		55%	$1,728		107.27	0.0	$16	$0	$800	56	$14.29
1.3	P-Rate Reduction	SWCD	693		0%	-$7,623		44.14	0.0	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	444		0%	$21,756		202.02	0.0	$108	$0	$0	-	$0.00
2	**Land Use Change**				0%	$0	$284,600	556.9	0.0	$0	$1,809	$173,600	190	$913.68
2.1	Grassed Waterway	SWCD		5000	0%		$12,500	94.60	0.0	$0	$132	$0	-	$0.00
2.2	Sediment Basins	SWCD		12	0%		$21,600	189.20	0.0	$0	$114	$0	-	$0.00
2.3	Grade Stabilization Structure	SWCD		2	0%		$36,000	75.10	0.0	$0	$479	$0	-	$0.00
2.4	Land Retirement	SWCD		33	100%		$214,500	198.00	0.0	$0	$1,083	$173,600	190	$913.68
3	**Edge of Field**				29%	$0	$62,609	143.6	1,070.0	$0	$1,242	$225,123	531	$423.96
3.1	Wetland Restoration	SWCD		1	100%		$20,000	50.20	1067.00	$0	$398	$225,123	531	$423.96
3.2	Sediment Control Practice	SWCD		4	0%		$40,000	57.20	0.0	$0	$699	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		4	0%		$809	18.20	0.0	$0	$44	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		6	16%		$1,800	18.00	3.00	$0	$100		-	$0.00
4	**Shallow Lake Treatment**					$15,000	$54,300	358.0	0.0	$15,000	$152	$0	-	$0.00
4.1	Shoreline/bank Restoration	FISH		300	0%		$54,300	357.00	0.0	$0	$152			$0.00
4.2	Carp Exclusion	FISH			0%	$15,000		1.00	0.0	$15,000	$0			$0.00
5	**Education**					$11,000	$0	0.00	0.0	$0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000								
5.2	Print	SWCD				$1,500								
5.3	Landowner Visits	SWCD				$0								
5.4	Landowner Seminar	SWCD				$500								
6	**Monitoring**				0%	$15,800	$0	0.0	0.0	$15,800	$0	$0	-	$0.00
6.1	Lake Monitoring	LSL			0%	$6,000			0.0	$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			0.0	$500	$0			$0.00
6.1.2	CLAMP	LSL			0%	$500			0.0	$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			0.0	$5,000	$0			$0.00
6.2	Wetland	SWCD			0%	$300			0.0	$300	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			0.0	$3,500	$0			$0.00
	Totals					$42,361	$401,509	1,475	1,070			$399,523	777	$514.19

Table 4 Management Plan for Lower Gar RMA Priority Sub-Watershed (Wills J. H., 2012)

Lower Gar (Spring Run) RMA Non-Priority Sub-Watershed														
Clean Water Alliance						Today's Date		2/9/2018						
	Project Lead	John H. Wills												
	Start Date	7/1/2012												
			Annual	Long Term										
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				10%	$29,100	$0	459.6	0.0	-$41	$0	$500	240	$0.00
1.1	Conservation Tillage	SWCD	600		3%	-$600		60.06	0.0	-$10	$0	-$500	80	-$6.25
1.2	No-Till System	SWCD	300		33%	$3,600		106.47	0.0	$34	$0	$1,000	160	$6.25
1.3	P-Rate Reduction	SWCD	300		0%	-$3,300		19.11	0.0	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	600		0%	$29,400		273.00	0.0	$108	$0	$0	-	$0.00
2	**Land Use Change**				25%	$0	$215,000	834.9	0.0	$0	$1,689	$410,100	92	$5,001.22
2.1	Grassed Waterway	SWCD		13000	0%		$32,500	225.80	0.0	$0	$144	$0	-	$0.00
2.2	Sediment Basins	SWCD		20	0%		$36,000	368.20	0.0	$0	$98	$0	-	$0.00
2.3	Grade Stabilization Structure	SWCD		2	0%		$36,000	149.30	0.0	$0	$241	$0	-	$0.00
2.4	Land Retirement	SWCD		17	100%		$110,500	91.60	0.0	$0	$1,206	$410,100	92	$5,001.22
3	**Edge of Field**				0%	$0	$85,855	283.5	0.0	$0	$1,055	$0	-	$0.00
3.1	Wetland Restoration	SWCD		2	0%		$40,000	150.20		$0	$266	$0	-	$0.00
3.2	Sediment Control Practice	SWCD		4	0%		$40,000	62.00		$0	$645	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		5	0%		$1,155	26.34		$0	$44	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		15	0%		$4,500	45.00		$0	$100	$0	-	$0.00
4	**In-Lake Treatment**				0%	$15,000	$181,000	1,194.0	0.0	$15,000	$152	$0	-	$0.00
4.1	Shoreline/bank Restoration	FISH		1000	0%		$181,000	1193.00	0.0	$0	$152			$0.00
4.2	Carp Reduction	FISH			0%	$15,000		1.00	0.0	$15,000	$0			$0.00
5	**Education**					$11,000	$0	0.00	0.0	$0	$0	$0		$0.00
5.1	Radio	SWCD				$9,000								
5.2	Print	SWCD				$1,500								
5.3	Landowner Visits	SWCD				$0								
5.4	Landowner Seminar	SWCD				$500								
6	**Monitoring**				0%	$20,500	$0	0.0	0.0	$20,500	$0	$0	-	$0.00
6.1	Lake Monitoring	LSL			0%	$6,000			0.0	$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			0.0	$500	$0			$0.00
6.1.2	CLAMP	LSL			0%	$500			0.0	$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			0.0	$5,000	$0			$0.00
6.2	Wetland	SWCD			0%	$5,000			0.0	$5,000	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			0.0	$3,500	$0			$0.00
	Totals					$60,600	$481,655	2,771	0			$410,600	322	$1,275.16

Table 5 Management Plan for Lower Gar RMA Non-Priority Sub-Watershed (Wills J. H., 2012)

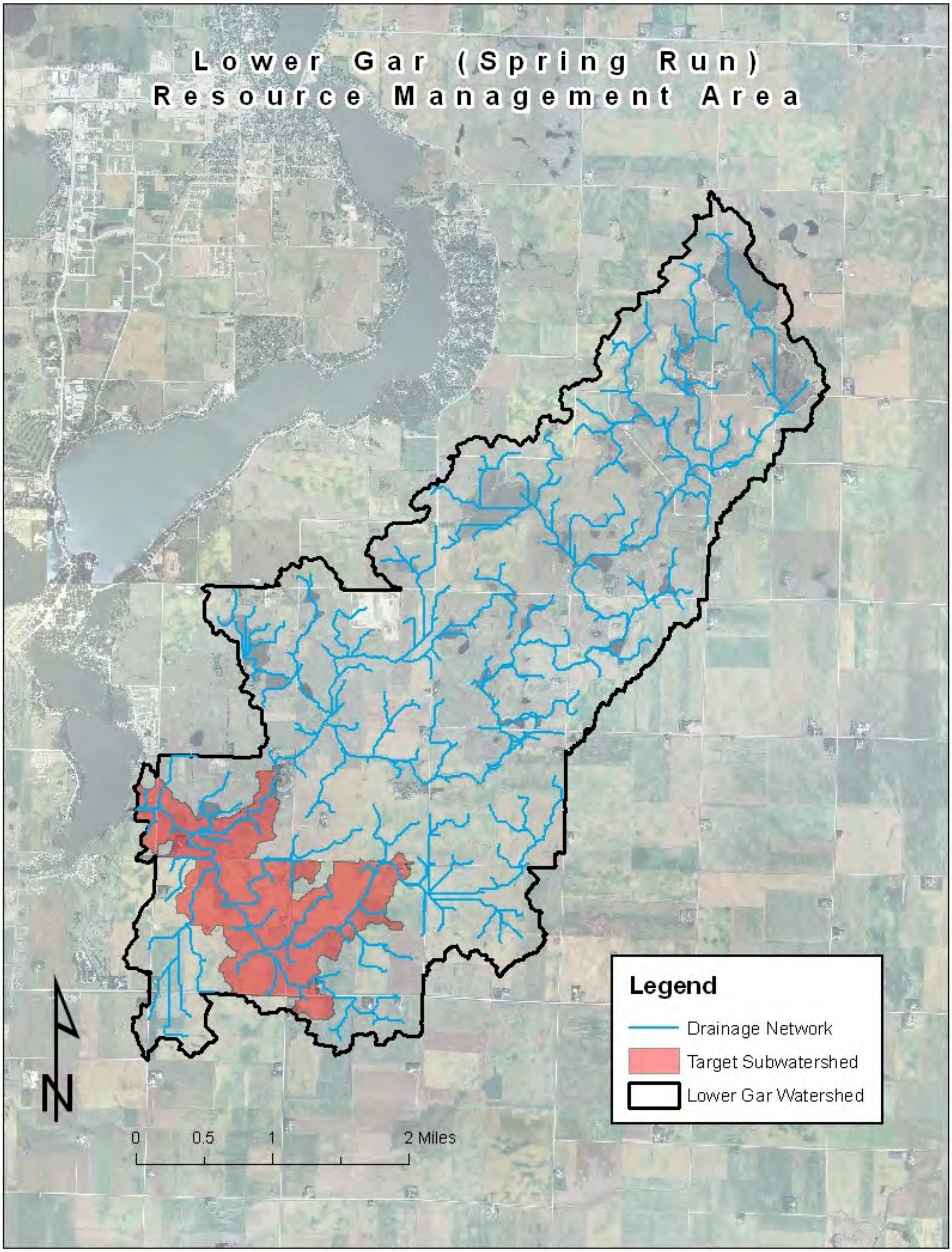

Figure 3 Lower Gar Resource Management Area

Lower Gar (Spring Run) Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Area (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
1788	1748	Lake					108.9	626.0	5.8	1
1848	Lake						90.2	259.7	2.9	2
1726	Lake						6.4	131.4	20.4	3
1552	1563	1565	1630	1637	Lake		31.3	235.8	7.5	4
1851	1840	Lake					9.1	151.1	16.7	5
1805	Lake						8.4	115.6	13.8	6
1734	1788	1748	Lake				5.5	252.1	46.1	7
1728	Lake						2.7	133.7	49.9	8
1692	1630	1637	Lake				6.1	69.3	11.4	9
1601	1630	1637	Lake				1.2	77.2	65.5	10
1727	1726	Lake					1.7	103.1	62.1	11
1716	1734	1788	1748	Lake			3.1	197.3	63.0	12
1730	Lake						0.8	59.6	72.7	13
1593	1601	1630	1637	Lake			2.9	48.9	17.0	14
1808	1848	Lake					3.9	39.9	10.4	15
1604	1630	1637	Lake				3.1	20.4	6.7	16
1731	1788	1748	Lake				3.6	116.5	32.3	17
1523	1552	1563	1565	1630	1637	Lake	0.7	28.0	41.9	18
1617	1630	1637	Lake				7.2	8.9	1.2	19
1449	1630	1637	Lake				1.2	16.6	13.7	20
1303	1630	1637	Lake				1.0	30.7	30.7	21
1757	1730	Lake					2.9	21.7	7.4	22
1853	1848	Lake					1.5	25.8	17.1	23
1854	1848	Lake					0.6	18.1	30.1	24
1790	1788	1748	Lake				4.2	25.4	6.1	25
1388	1389	1630	1637	Lake			1.2	25.8	21.5	26
1859	1851	1840	Lake				5.2	36.3	7.0	27
1852	1851	1840	Lake				4.0	26.2	6.5	28
1699	1728	Lake					7.7	40.7	5.3	29
1711	1699	1728	Lake				4.9	65.0	13.4	30

Table 6 Wetland restoration priorities for the Lower Gar watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

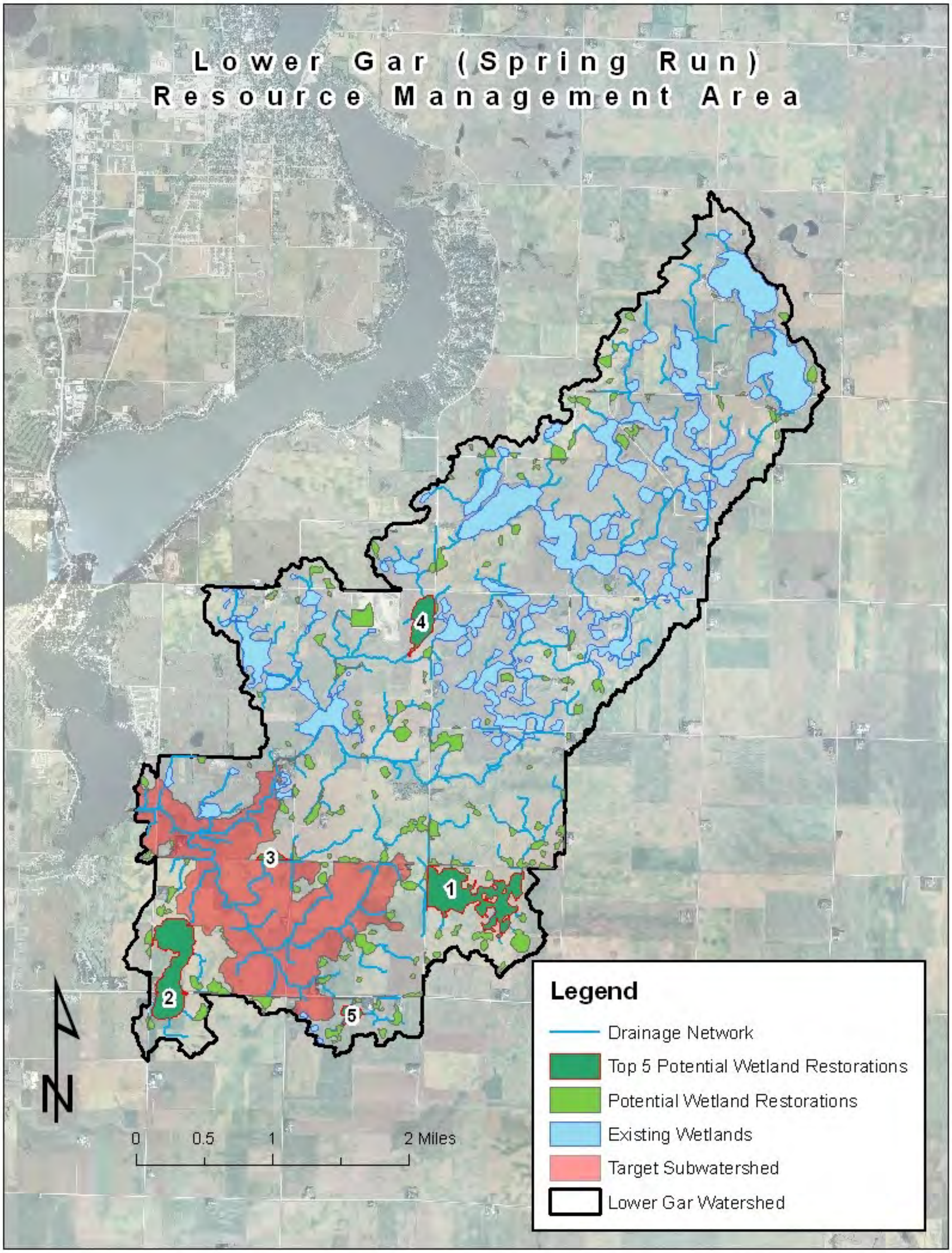

Figure 4 Lower Gar Priority Wetland Restoration Sites

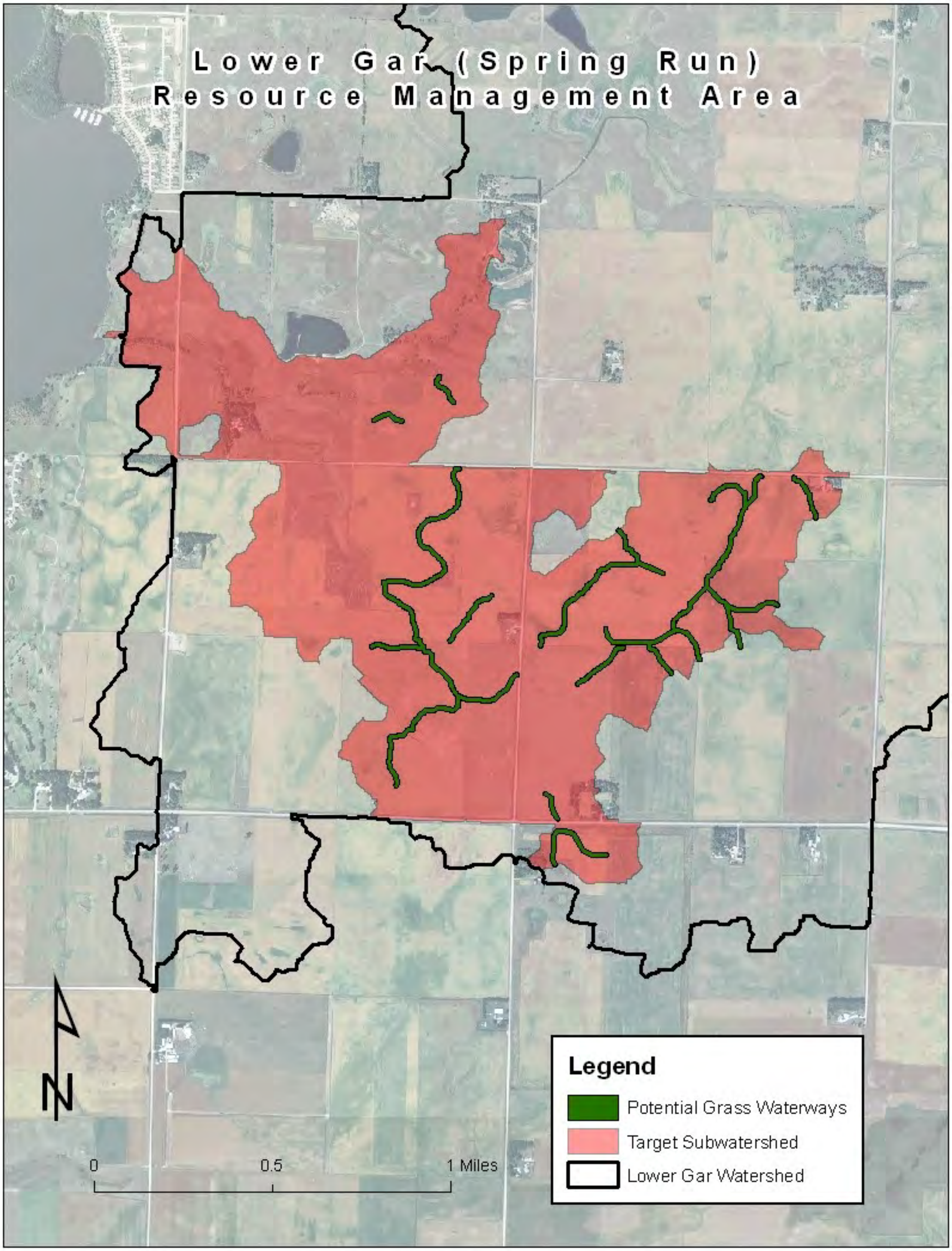

Figure 5 Lower Gar Priority Target Area Ephemeral Gullies

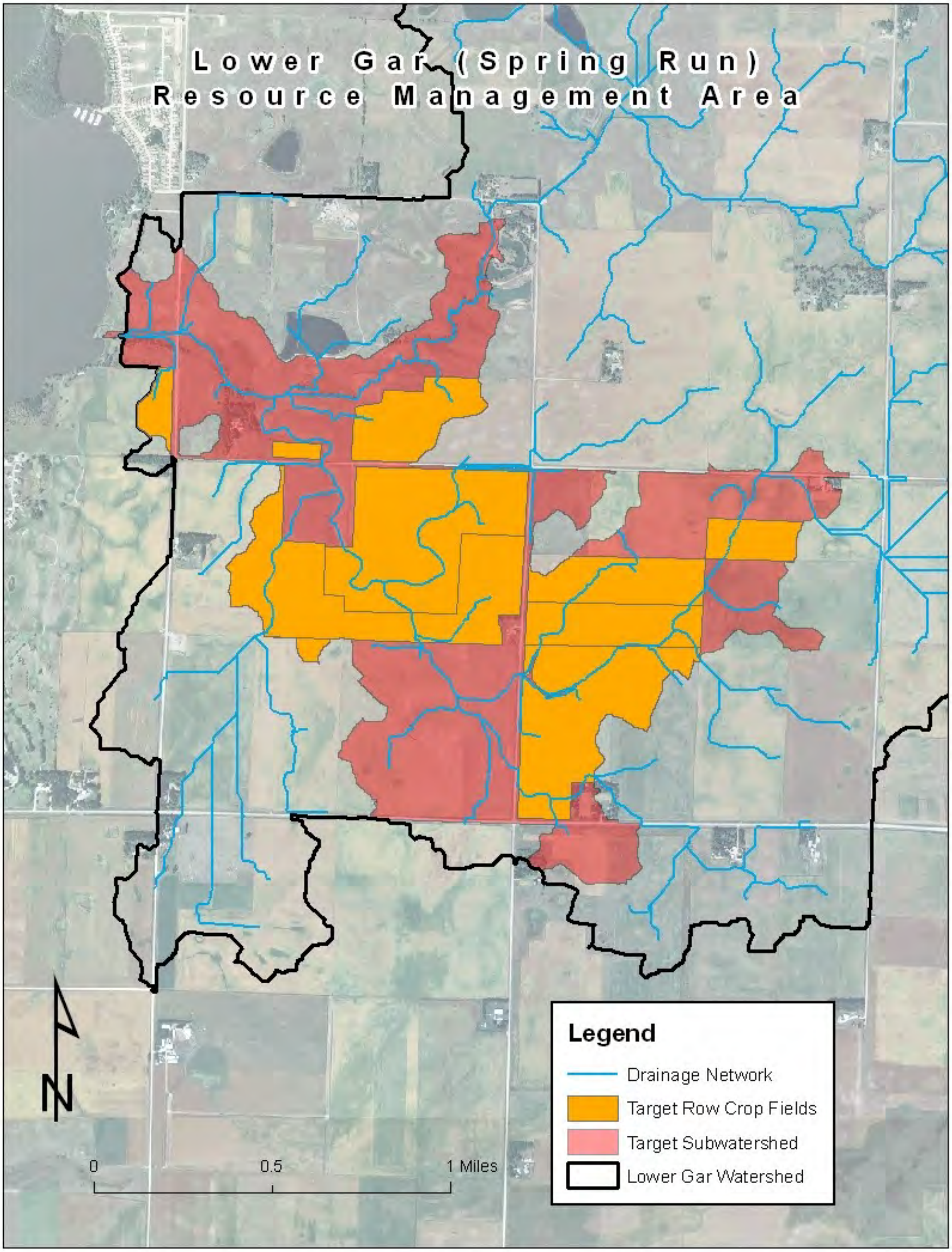

Figure 6 Lower Gar Priority Area Target Row Crop Fields

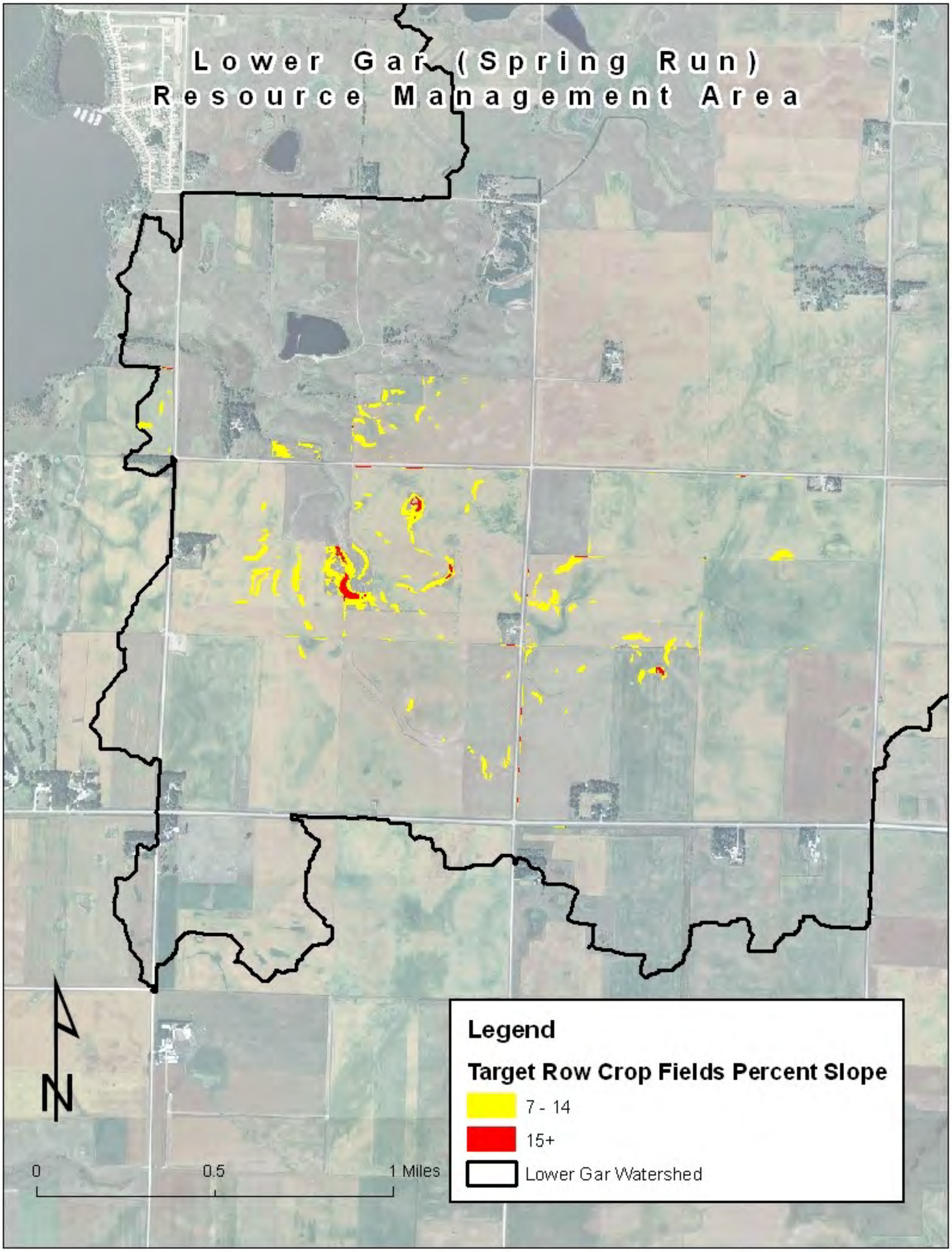

Figure 7 Lower Gar Target Row Crop Slopes

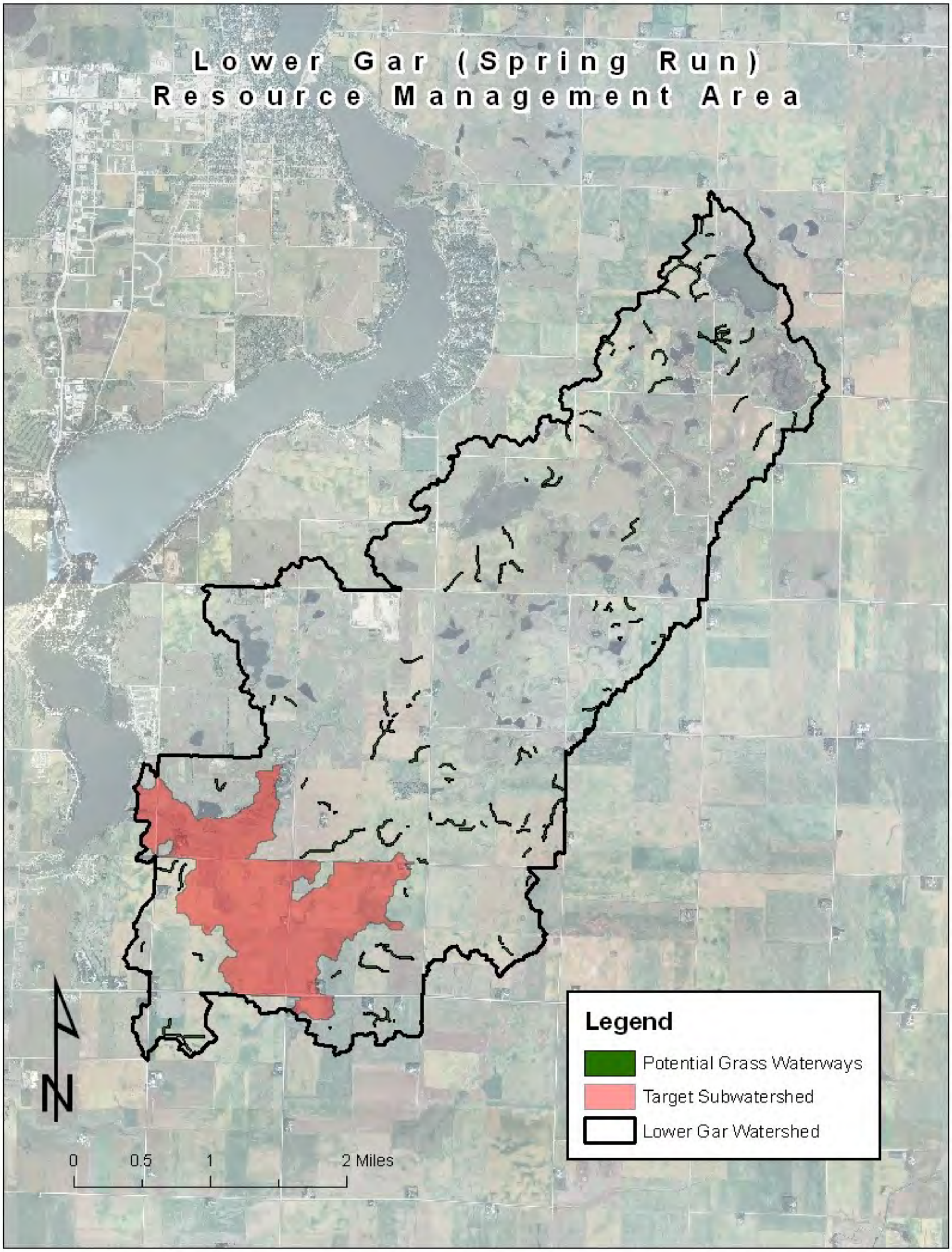

Figure 8 Lower Gar Non-priority Ephemeral Gullies

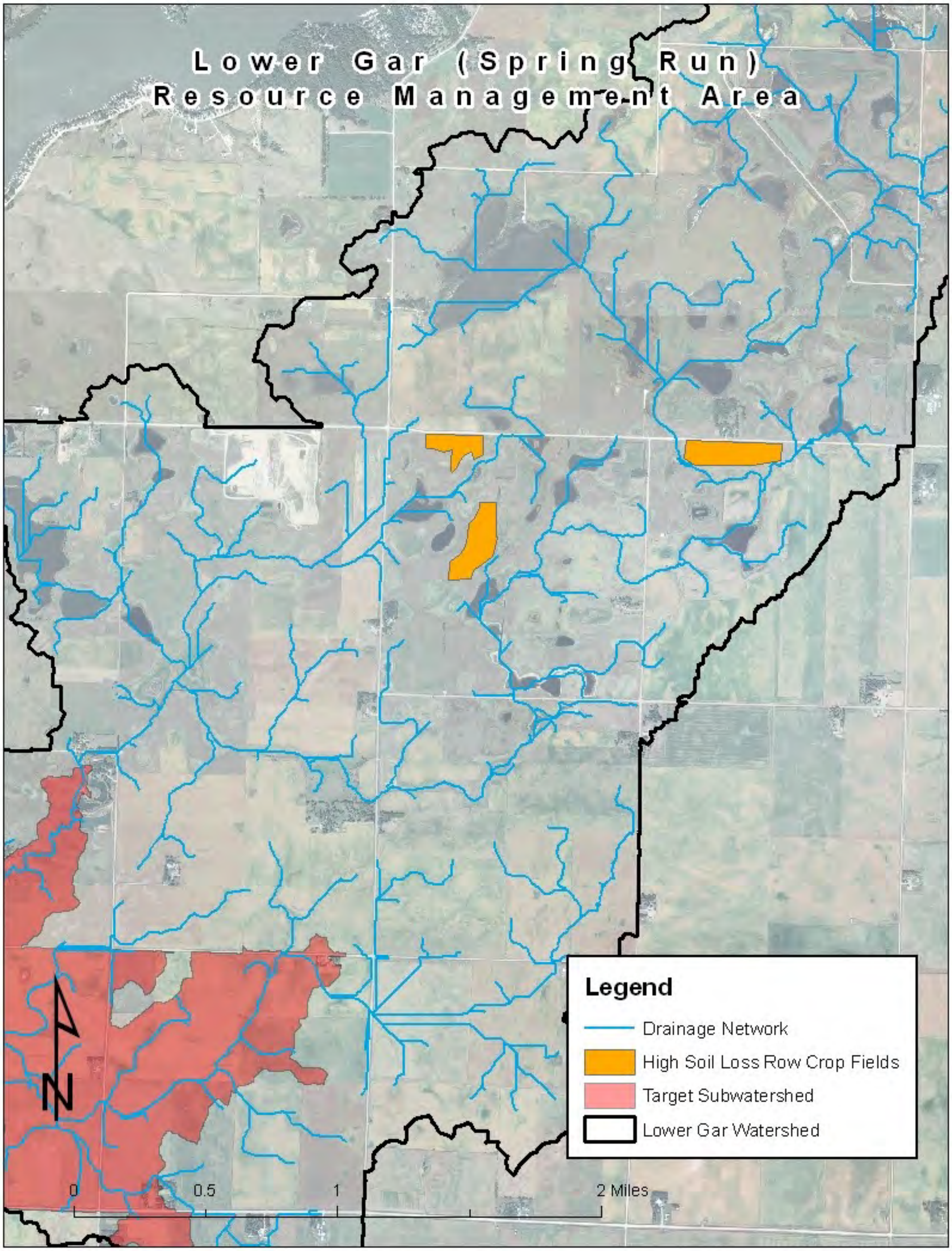

Figure 9 Lower Gar Non-priority High Soil Loss Row Crop Fields

EAST OKOBOJI LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
1843 ac	79,199 ac	11,779 ac	65,577 ac	13	2	13	No

Lakes in the watershed of East Okoboji Lake:

Direct
West Okoboji Lake
Big Spirit Lake

Indirect
Center Lake
East Hottes
Marble Lake
Loon Lake
Pearl Lake
Little Spirit Lake
West Hottes
Grovers Lake
Rush Lake
Clear Lake

RMA's that drain to East Okoboji Lake:

Direct
East Okoboji Beach RMA
Elinor Bedell State Park RMA

Indirect
Garlock Slough RMA
Okoboji View RMA
Welch Lake RMA
Reeds Run RMA
Hales Slough RMA
Sandbar Slough RMA
Loon Lake RMA
Lakeside Lab RMA
Lazy Lagoon RMA
Center Lake RMA
Templar Lagoon RMA
Marble/Hottes RMA
Little Spirit Lake RMA

Impairment for East Okoboji Lake: East Okoboji Lake is not impaired as of 2018 and fully supports is designated uses. The designated use for East Okoboji is Primary contact recreational use: The water's recreation uses involve full body immersion with prolonged and direct contact with the water, such as swimming and water skiing. Work done within the East Okoboji Lake watershed is to protect East Okoboji from becoming impaired for turbidity and nuisance algae blooms. The work within the East Okoboji Lake watershed will also have a impact on sediment and phosphorus reductions in Upper Gar and Lower Gar Lakes that are both impaired.

Objective – To keep East Okoboji from becoming impaired and to assist with reducing phosphorus loads and sediment loads to impaired lakes that East Okoboji directly and indirectly drain to within the Iowa Great Lakes Watershed.

East Okoboji Beach Resource Management Area (RMA)

Objective **–** Prevent sediment loaded water reaching East Okoboji Lake. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's .

Description **–** The watersheds draining towards East Okoboji Lake have undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. This watershed represents approximately 15% of the watershed of East Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to East Okoboji Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both erosion control and cultural practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed will be reduced utilizing this plan.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 511.9 pounds of Phosphorus from entering East Okoboji Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 1,714.8 pounds of Phosphorus from entering East Okoboji Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 2,349.41 pounds of Phosphorus from reaching East Okoboji Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 357.9 pounds of Phosphorus from entering East Okoboji Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

East Okoboji Beach Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				15%	$36,600	$0	511.9	-$41	$0	$3,750	414	$18.68
1.1	Conservation Tillage	SWCD	450		11%	-$450		45.05	-$10	$0	-$500	80	-$6.25
1.2	No-Till System	SWCD	300		33%	$3,600		106.47	$34	$0	$1,000	160	$6.25
1.3	P-Rate Reduction	SWCD	300		0%	-$3,300		19.11	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	750		16%	$36,750		341.25	$108	$0	$3,250	174	$18.68
2	**Land Use Change**				5%	$0	$479,000	1,714.8	$0	$1,732	$4,750	174	$27.30
2.1	Grassed Waterway	SWCD		6000	21%		$13,500	425.80	$0	$32	$4,750	174	$27.30
2.2	Sediment Basins	SWCD		20	0%		$36,000	598.20	$0	$60	$0	-	$0.00
2.3	Grade Stabilization Structure	SWCD		4	0%		$72,000	449.30	$0	$160	$0	-	$0.00
2.4	Land Retirement	SWCD		55	0%		$357,500	241.50	$0	$1,480	$0	-	$0.00
3	**Edge of Field**				13%	$0	$393,655	2,349.4	$0	$946	$47,005	12	$3,917.08
3.1	Wetland Restoration	SWCD		2	0%		$348,000	2215.80	$0	$157	$0	-	$0.00
3.2	Sediment Control Practice	SWCD		4	50%		$40,000	62.00	$0	$645	$47,005	12	$3,917.08
3.3	Vegetative Buffer	SWCD		5	0%		$1,155	26.55	$0	$44	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		15	0%		$4,500	45.00	$0	$100	$0	-	$0.00
4	**In-Lake Treatment**				100%	$0	$54,300	357.9	$0	$152	$0	$0	$0
4.1	Shoreline/bank Restoration	FISH		300	100%		$54,300	357.90	$0	$152			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	-	$0.00
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			$0.00
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			$0.00
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$68,100	$926,955	4,934			$55,505	600	$92.51

Table 7 Management Plan for East Okoboji Beach RMA Priority Sub-Watershed (Wills J. H., 2012)

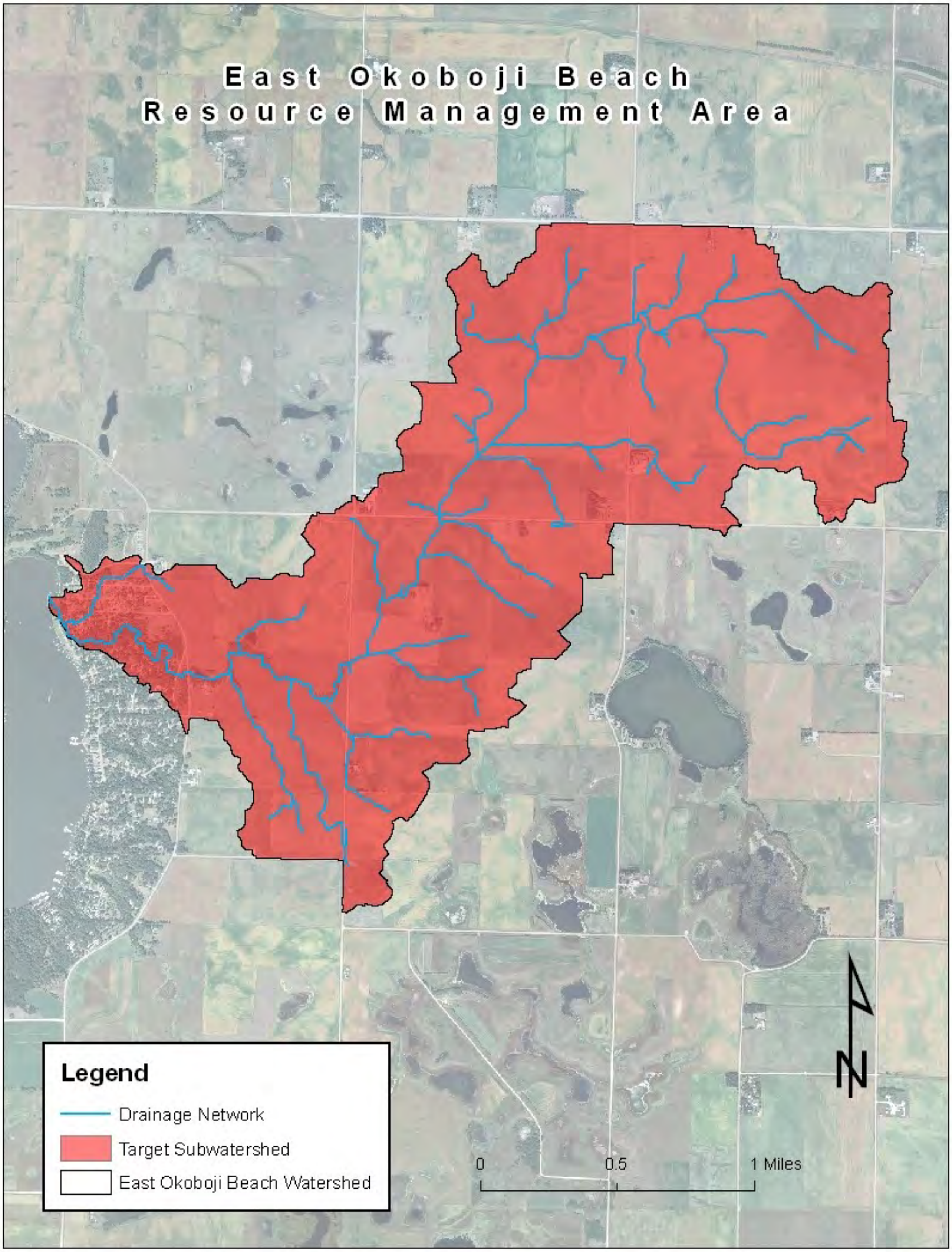

Figure 10 East Okoboji Beach Resource Management Area

East Okoboji Beach Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
1096	1119	1131	Lake				50.2	952.1	19.0	1
1078	1096	1119	1131	Lake			1.8	82.9	45.8	2
1107	1080	1096	1119	1131	Lake		8.4	61.9	7.4	3
1068	1078	1096	1119	1131	Lake		1.5	72.4	47.3	4
1308	Lake						1.1	39.5	35.5	5
990	1096	1119	1131	Lake			4.7	46.2	9.8	6
1102	1068	1078	1096	1119	1131	Lake	16.5	34.3	2.1	7
1084	1096	1119	1131	Lake			15.4	43.8	2.8	8
1310	1308	Lake					3.2	32.5	10.2	9
1020	1096	1119	1131	Lake			15.5	65.1	4.2	10
1281	Lake						1.0	33.2	32.2	11
1264	Lake						0.3	22.3	63.8	12
1341	1310	1308	Lake				3.4	14.0	4.1	13
1233	Lake						3.6	10.8	3.0	14
1094	1107	1080	1096	1119	1131	Lake	6.6	17.8	2.7	15
1132	1096	1119	1131	Lake			2.3	18.2	7.8	16
1121	1107	1080	1096	1119	1131	Lake	1.7	9.6	5.6	17
1053	1096	1119	1131	Lake			1.1	17.2	15.1	18
961	1096	1119	1131	Lake			2.6	7.1	2.7	19
1170	1131	Lake					4.9	20.8	4.3	20
951	990	1096	1119	1131	Lake		0.9	8.1	9.4	21
1311	1281	Lake					2.0	8.5	4.3	22
1060	1068	1078	1096	1119	1131	Lake	1.5	12.3	8.5	23
1297	1281	Lake					2.2	10.9	5.0	24
1161	Lake						0.3	7.0	27.1	25
1148	1153	1160	Lake				0.3	3.8	13.6	26
1101	1119	1131	Lake				1.8	6.4	3.5	27
1194	Lake						1.0	6.9	7.1	28
964	1096	1119	1131	Lake			1.9	9.8	5.0	29
1312	1311	1281	Lake				1.0	2.8	2.8	30

Table 8 Wetland restoration priorities for the East Okoboji Beach watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

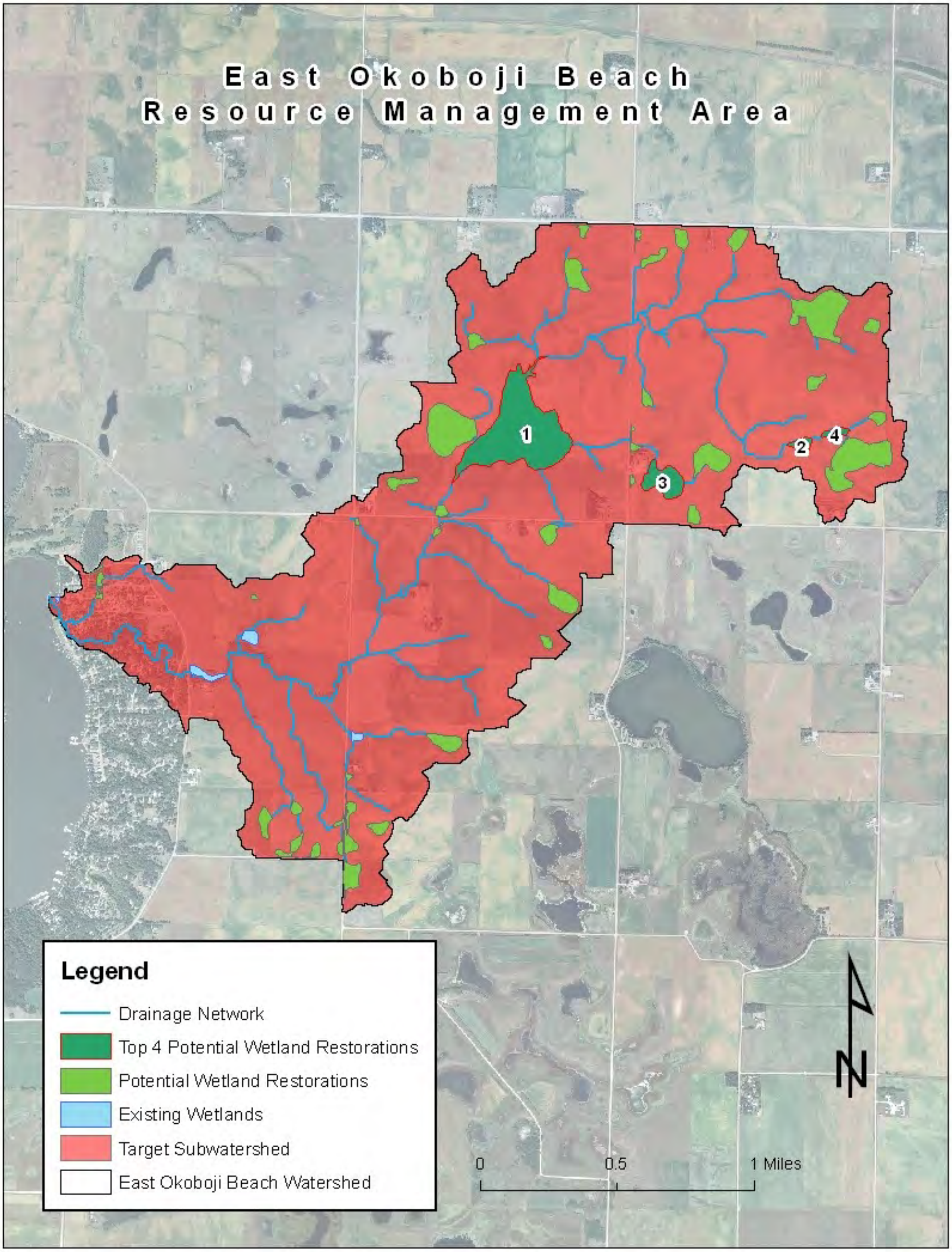

Figure 11 East Okoboji Beach Priority Wetland Restorations

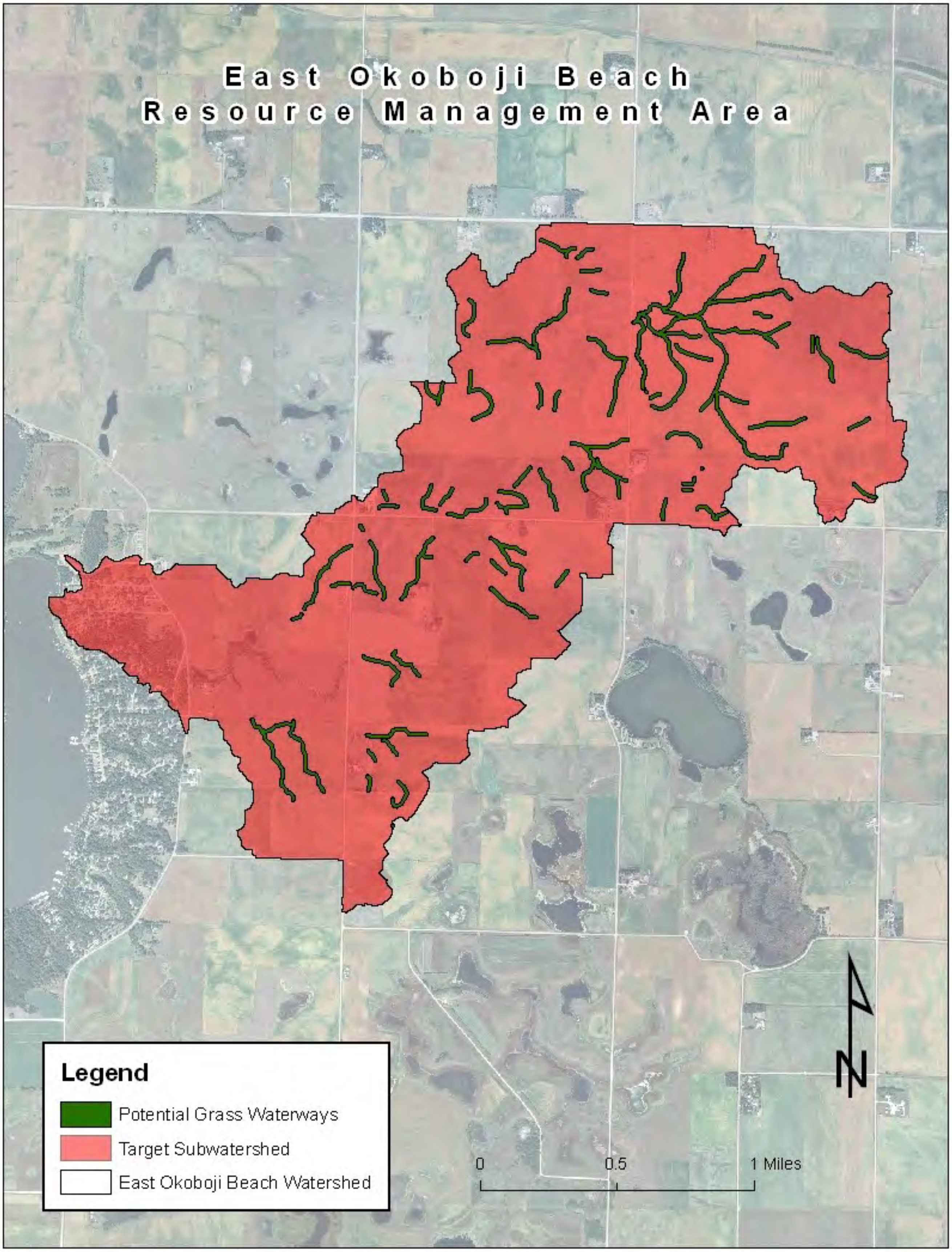

Figure 12 East Okoboji Beach Ephemeral Gullies

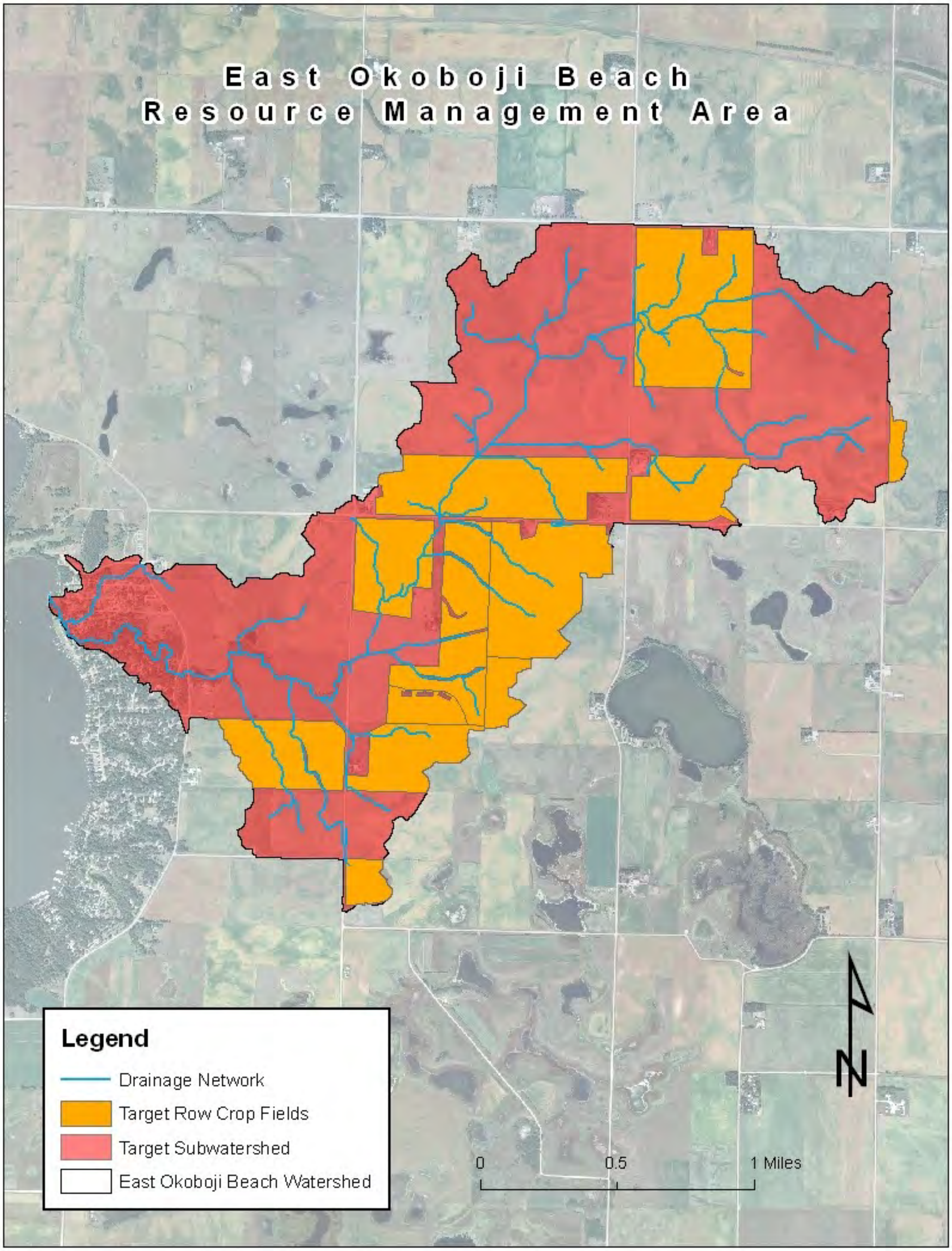

Figure 13 East Okoboji Beach Target Row Crop Fields

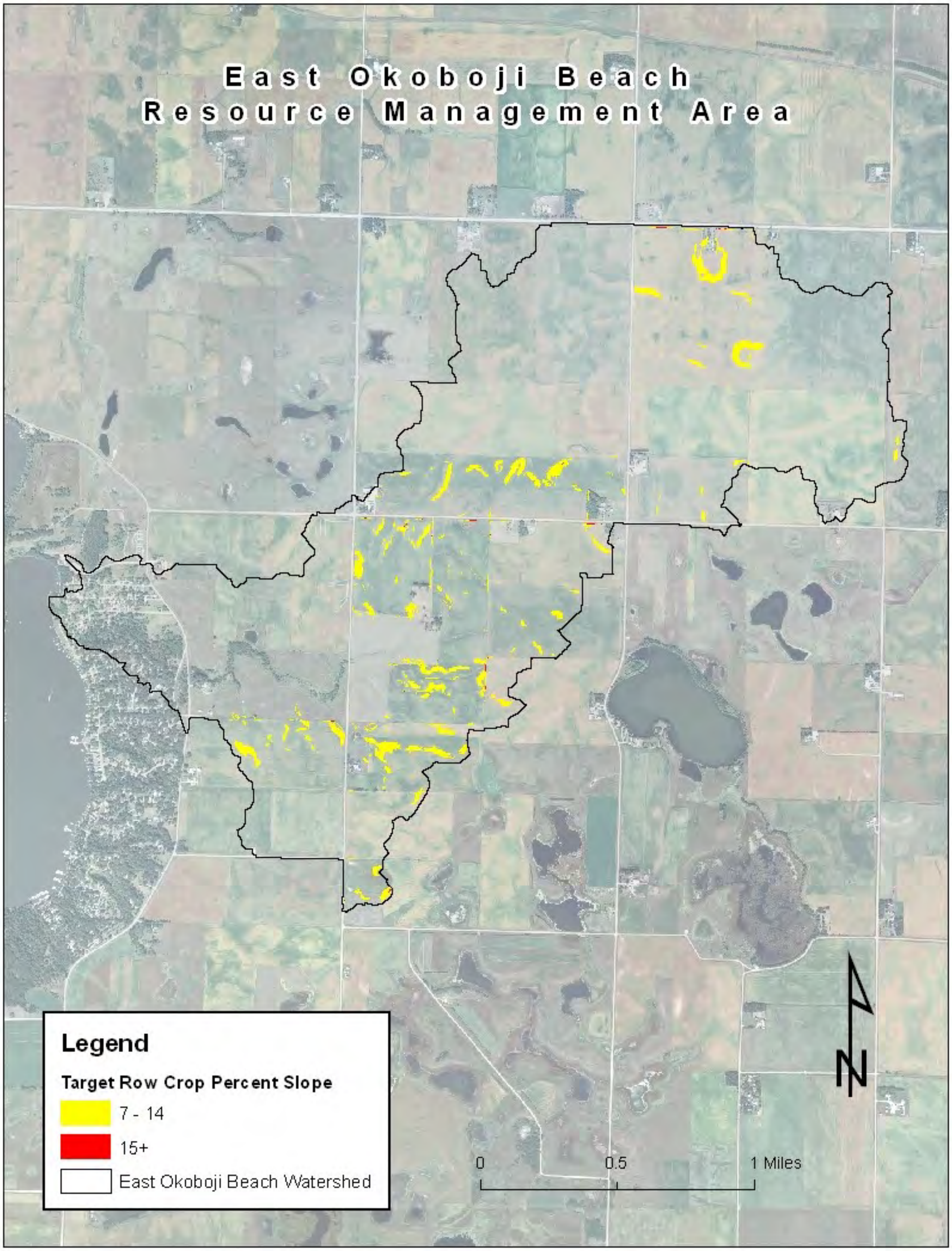

Figure 14 East Okoboji Beach Target Row Crop Slopes

Elinor Bedell State Park Resource Management Area (RMA)

***Objective* –** Prevent sediment loaded water reaching East Okoboji Lake via the stream running through Elinor Bedell State Park. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake in accordance with their specific approved TMDL's .

***Description* –** The watershed draining towards Elinor Bedell State Park has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. This watershed represents approximately 20% of the watershed of East Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to East Okoboji Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both cultural as well as erosion control practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing the following prioritized plan.

Restoration Planning Components

<u>Phosphorus Management</u>

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 494.1 pounds of Phosphorus from entering East Okoboji Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

<u>Land Use Change</u>

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 723.7 pounds of Phosphorus from entering East Okoboji Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

<u>Edge of Field</u>

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 208.9 pounds of Phosphorus from reaching East Okoboji Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

<u>Shallow Lake Treatment</u>

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 117.4 pounds of Phosphorus from entering East Okoboji Lake.

<u>Education</u>

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

<u>Monitoring</u>

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Elinor Bedell State Park RMA													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				14%	$28,875	$0	494.1	-$41	$0	$2,950	180	$22.80
1.1	Conservation Tillage	SWCD	375		16%	-$375		37.54	-$10	$0	-$650	33	-$20.00
1.2	No-Till System	SWCD	300		20%	$3,600		106.47	$34	$0	$600	48	$12.50
1.3	P-Rate Reduction	SWCD	675		0%	-$7,425		43.00	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	675		18%	$33,075		307.13	$108	$0	$3,000	99	$30.30
2	**Land Use Change**				18%	$0	$800,410	723.7	$0	$10,223	$192,800	114	$2,800.39
2.1	Grassed Waterway	SWCD		1960	15%		$4,410	183.20	$0	$24	$800	45	$17.78
2.2	Sediment Basins	SWCD		15	0%		$27,000	242.30	$0	$111	$0	-	$0.00
2.3	Grade Stabilization Structure	SWCD		3	0%		$54,000	225.60	$0	$239	$0	-	$0.00
2.4	Land Retirement	SWCD		110	58%		$715,000	72.60	$0	$9,848	$192,000	69	$2,782.61
3	**Edge of Field**				0%	$0	$46,117	208.9	$0	$908	$0	-	$0.00
3.1	Wetland Restoration	SWCD		1	0%		$20,000	80.50	$0	$248	$0	-	$0.00
3.2	Sediment Control Practice	SWCD		2	0%		$20,000	38.20	$0	$524	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		7	0%		$1,617	45.20	$0	$36	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		15	0%		$4,500	45.00	$0	$100	$0	-	$0.00
4	**In-Lake Treatment**				0%	$0	$54,300	117.4	$0	$463	$0	$0	$0
4.1	Shoreline/bank Restoration	FISH		300	0%		$54,300	117.40	$0	$463			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	-	$0.00
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			$0.00
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			$0.00
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$60,375	$900,827	1,544			$195,750	294	$666.95

Table 9 Management Plan for Elinor Bedell State Park RMA Priority Sub-Watershed (Wills J. H., 2012)

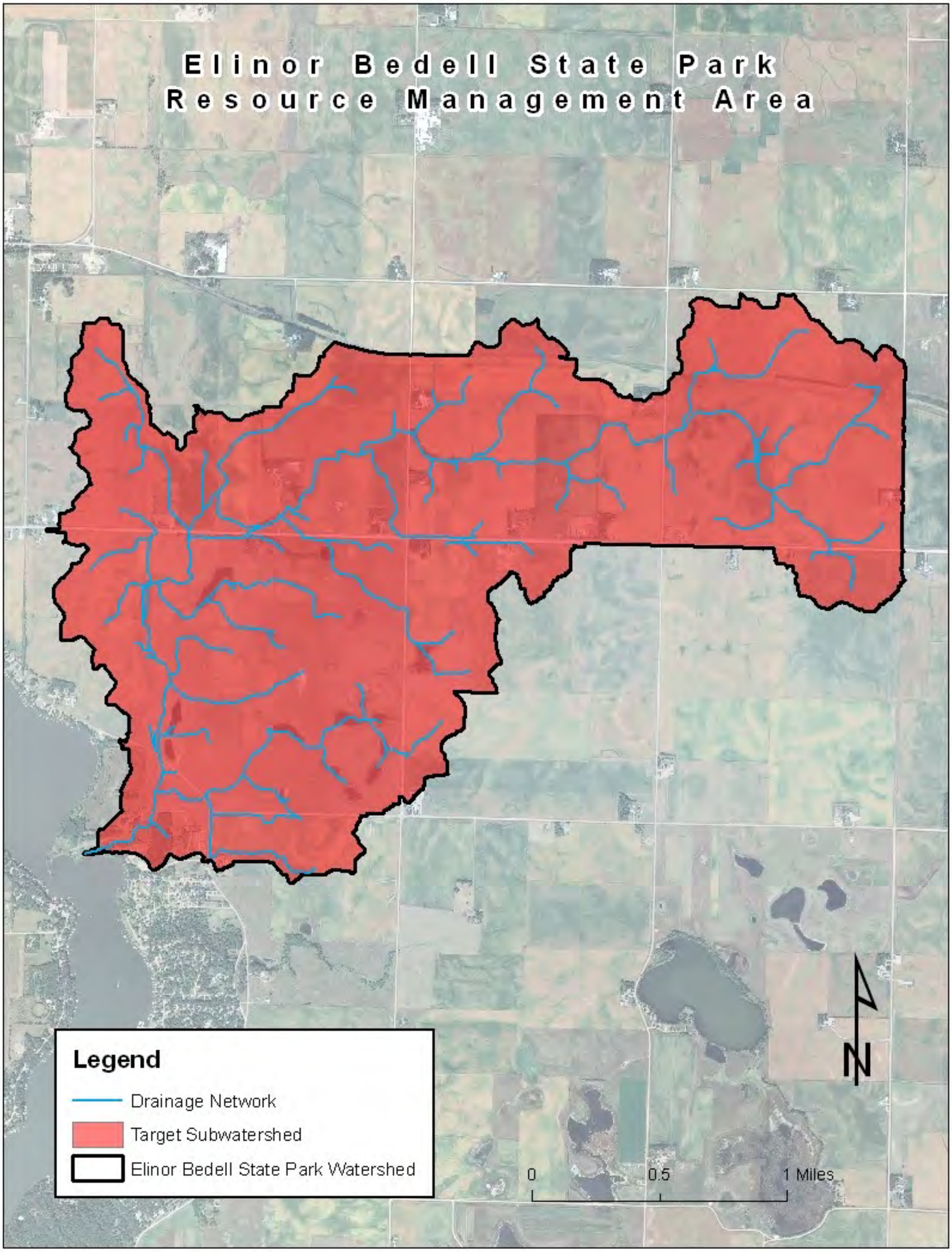

Figure 15 Elinor Bedell State Park Resource Management Area

Elinor Bedell State Park Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
933	Lake				25.1	293.3	11.7	1
935	Lake				3.5	33.1	9.4	2
1146	Lake				6.3	22.5	3.6	3
963	939	938	Lake		10.1	57.4	5.7	4
898	Lake				1.5	36.2	23.5	5
1077	Lake				2.2	19.3	8.7	6
836	Lake				7.3	34.7	4.8	7
930	Lake				1.1	17.1	16.0	8
834	Lake				4.0	13.0	3.3	9
973	Lake				2.0	12.1	6.1	10
862	Lake				0.9	21.3	24.0	11
849	862	Lake			8.1	10.6	1.3	12
969	Lake				0.7	7.2	11.0	13
970	Lake				7.7	9.0	1.2	14
1129	Lake				1.2	18.4	15.3	15
923	898	Lake			6.8	10.7	1.6	16
1128	1146	Lake			0.3	4.8	15.4	17
1079	Lake				1.7	4.4	2.5	18
950	Lake				1.2	6.3	5.3	19
900	Lake				0.6	2.3	4.0	20
943	Lake				1.0	2.5	2.5	21
837	834	Lake			0.9	3.5	4.1	22
909	Lake				1.4	8.0	5.5	23
863	933	Lake			0.7	5.9	8.9	24
881	Lake				1.1	2.8	2.6	25
889	Lake				0.8	7.4	9.2	26
945	953	Lake			0.3	3.2	11.4	27
1115	Lake				0.3	0.7	2.7	28
957	963	939	938	Lake	9.7	16.6	1.7	29
848	Lake				1.2	2.6	2.2	30

Table 10 Wetland restoration priorities for the Elinor Bedell watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

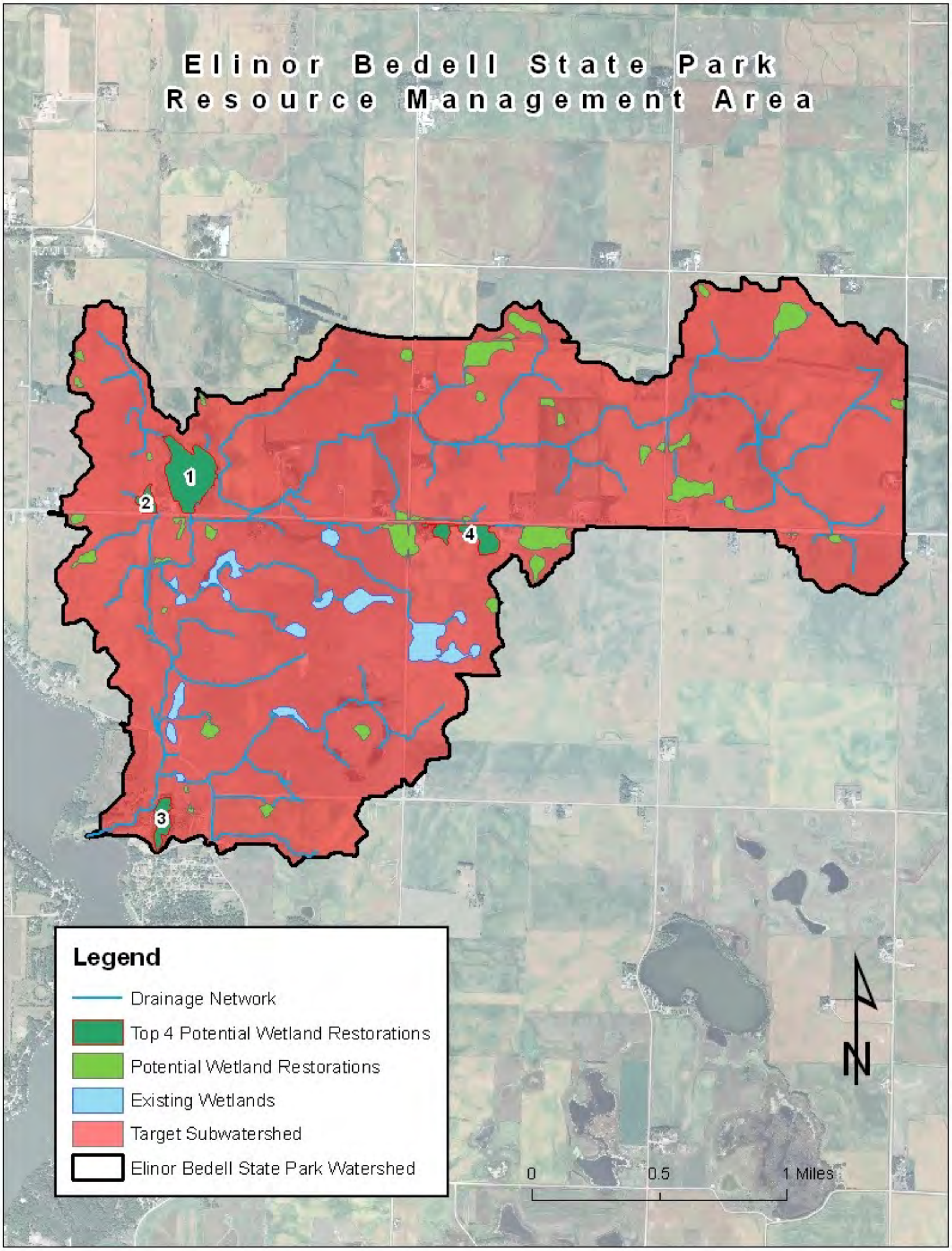

Figure 16 Elinor Bedell Priority Wetland Restoration Sites

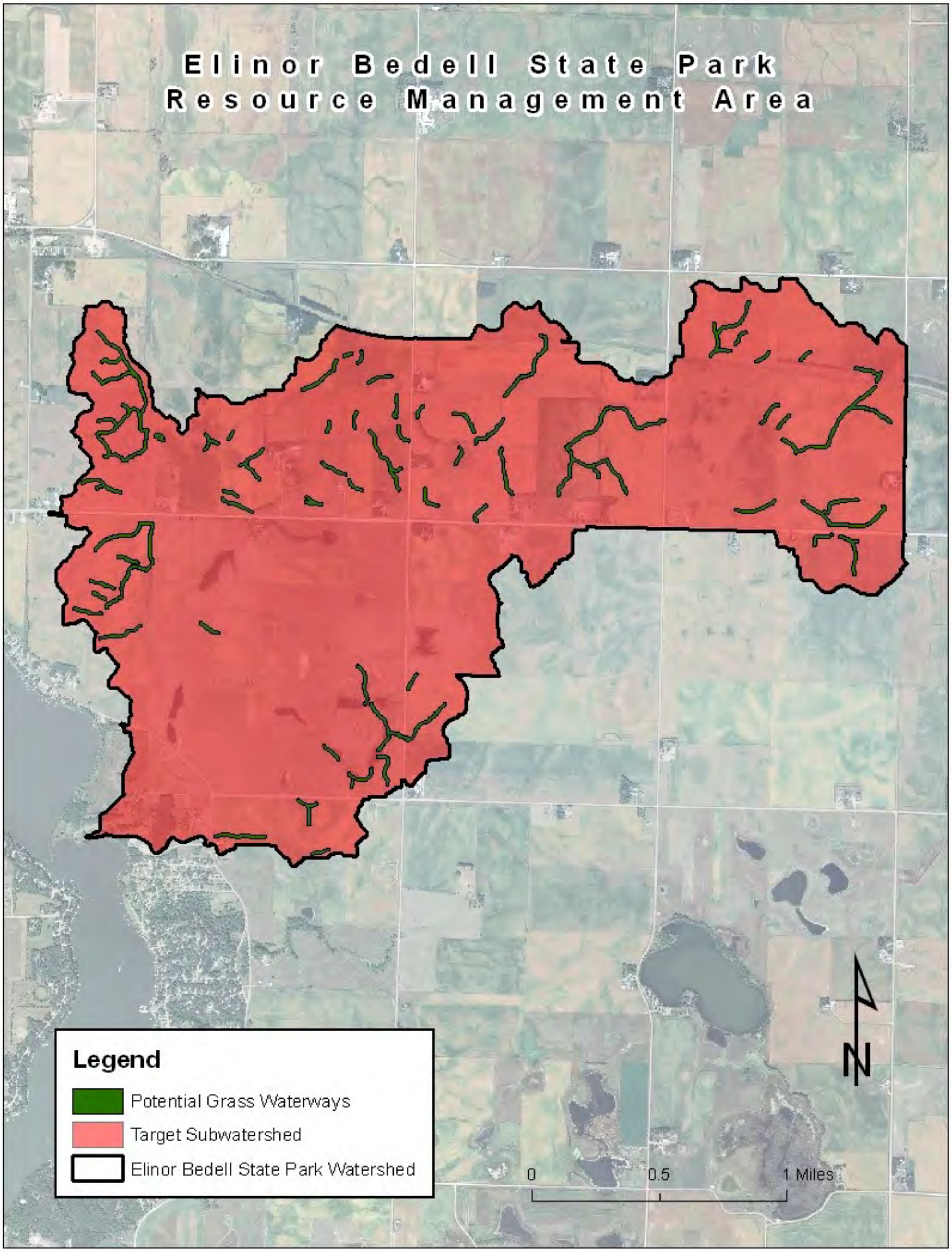

Figure 17 Elinor Bedell Ephemeral Gullies

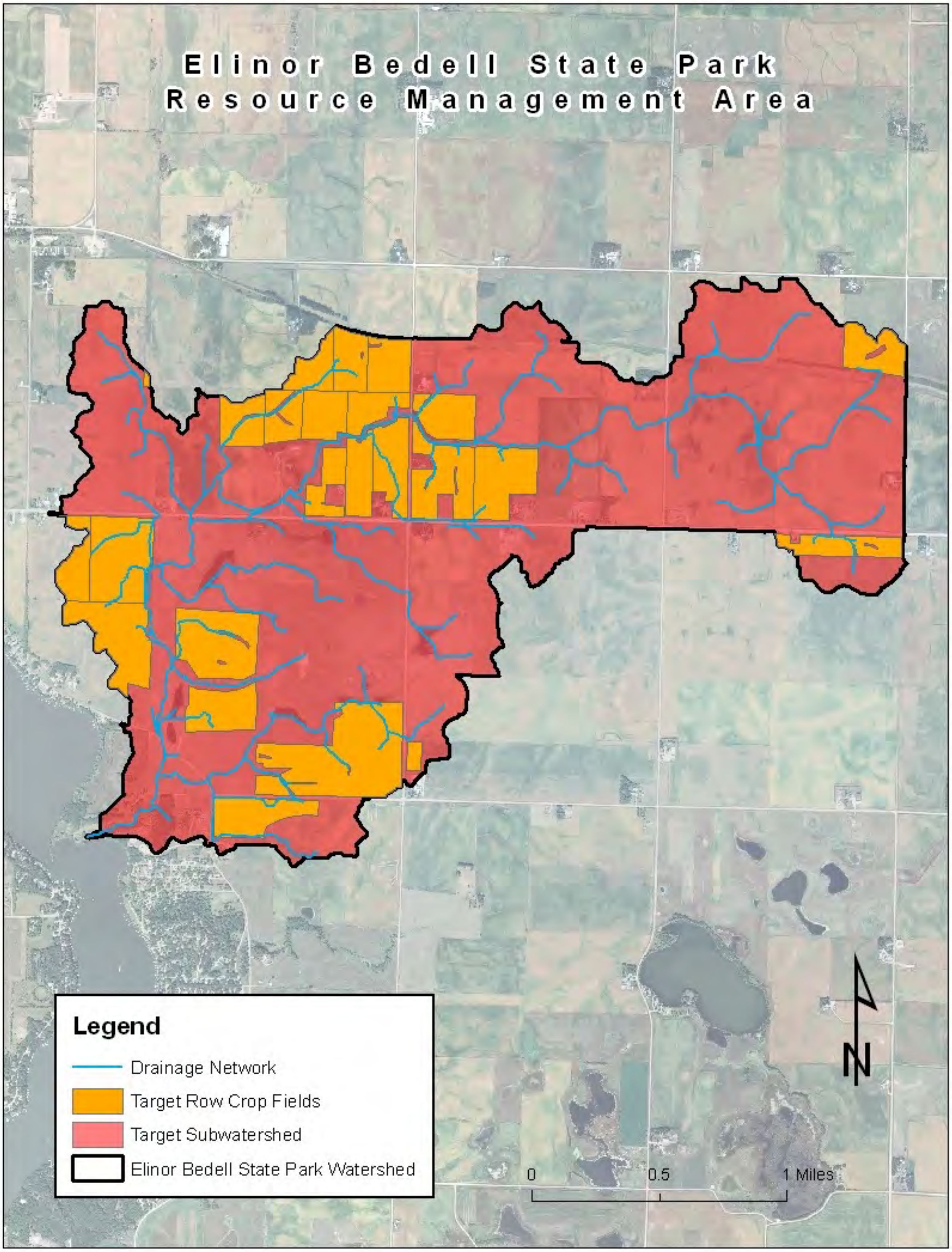

Figure 18 Elinor Bedell Target Row Crop Fields

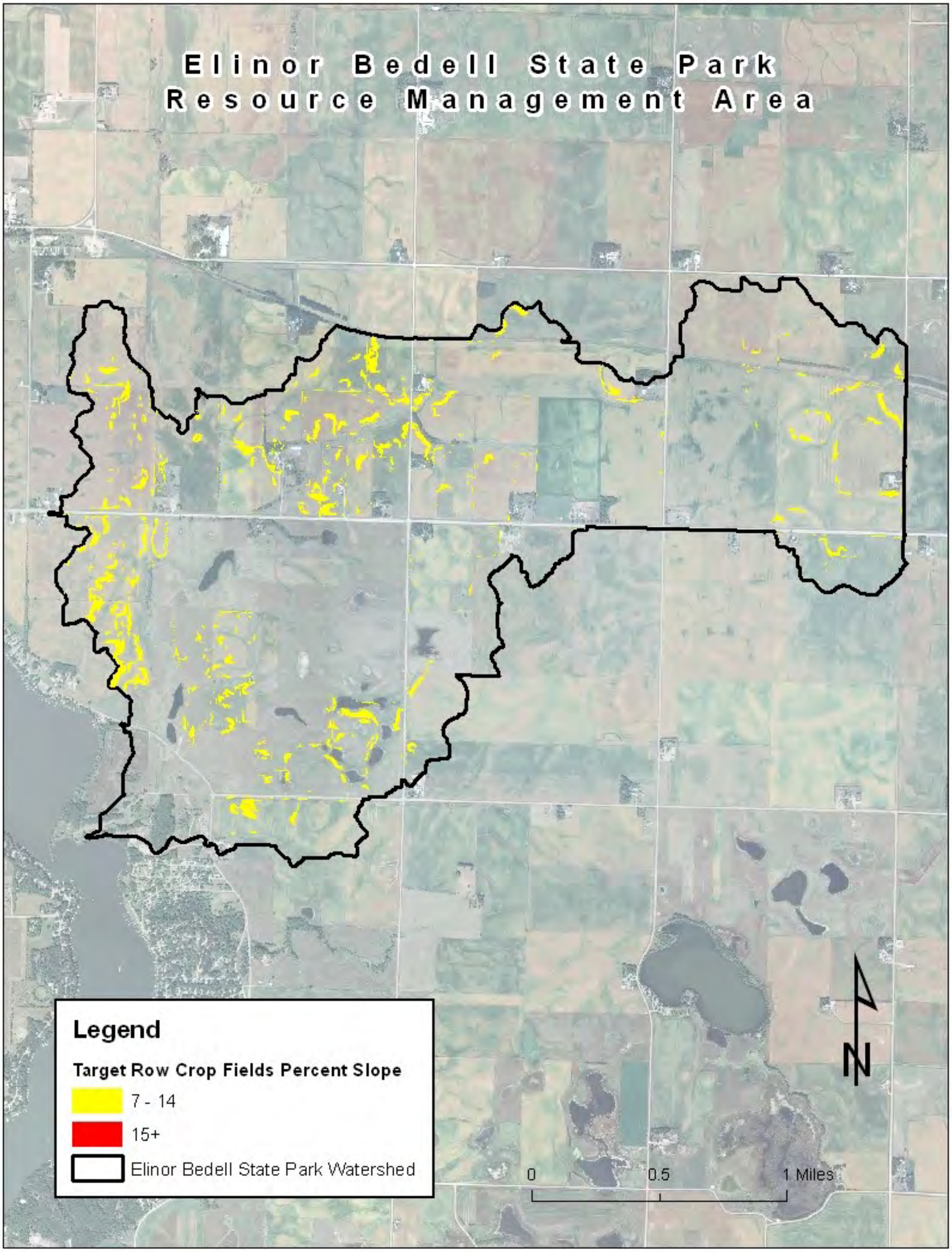

Figure 19 Elinor Bedell Target Row Crop Slopes

WEST OKOBOJI LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
3867 ac	19,916	15,157 ac	892	3	5	1	Yes

Lakes in the watershed of West Okoboji Lake:

Direct
Center Lake

Indirect
Welch Lake
East Okoboji Lake (depending of lake levels)

RMA's that drain to West Okoboji Lake

Direct
Garlock Slough RMA
Lakeside Lab RMA
Okoboji View RMA
Lazy Lagoon
Welch Lake RMA
Jemmerson Slough RMA

Indirect
Center Lake RMA

Impairment for West Okoboji Lake: West Okoboji Lake is not impaired as of 2018 and fully supports is designated uses except on a beaches and a fish kill: Emerson Bay State Park which is impaired due to bacteria and partially supports its due to a fish kill. The designated use for West Okoboji is primary contact recreational use: The water's recreation uses involve full body immersion with prolonged and direct contact with the water, such as swimming and water skiing. Work done within the West Okoboji Lake watershed is to protect West Okoboji from becoming impaired for turbidity and nuisance algae blooms. The work within the West Okoboji Lake watershed will also have a impact on sediment and phosphorus reductions in Upper Gar and Lower Gar Lakes that are both impaired.

Objective **–** To remove the bacteria impairment in Emerson Bay on West Okoboji is the first priority. The second priority objective is to protect and improve West Okoboji from becoming impaired due to turbidity and nuisance algae blooms or increasing the level of blooms or turbidity. As an outstanding waterbody for the State of Iowa, any degradation of this lake is something not to be tolerated. The result of protecting West Okoboji is to prevent nutrients from reaching the lake that would then move down the watershed toward Upper Gar Lake, and Lower Gar Lake. Dr. John Downing has stated Lower Gar cannot be removed from the impaired list unless other lakes that drain towards it are treated to reduce Phosphorus.

Garlock Slough Resource Management Area (RMA)

Objective – Remove bacteria issues from Emerson Bay. Restore and maintain Garlock Slough to a clear water system. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's.

Description – Garlock Slough and its watershed has undergone many hydrological changes since the pioneers first settled the Iowa Great Lakes. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. Active grazing along streams and ephemeral wetlands has further degraded this system.

The Garlock Slough watershed represents approximately 9% of the watershed of West Okoboji Lake. When healthy, a series of shallow wetlands provide important watershed protection to West Okoboji Lake. These areas also provide critical fishery and wildlife habitats. A holistic approach is needed to restore ecological health and water quality to this complex. A combination of both cultural and erosion control practices is needed to reach the project objective.

Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing a prioritized plan through augmentation of existing landowner conservation programs, easements, and public acquisitions. Restoration of the slough to a clear water system can be accomplished through processes designed to mitigate watershed alterations and the introduction of common carp. To simulate natural drought conditions, managed water level draw downs are needed to stimulate growth of emergent aquatic vegetation and reduce or eliminate common carp populations.

Phosphorus Management
A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 435.1 pounds of Phosphorus from entering West Okoboji Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change
A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 690.5 pounds of Phosphorus from entering West Okoboji Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field
A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 293.7 pounds of Phosphorus from reaching West Okoboji Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment
Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 120.3 pounds of Phosphorus from entering West Okoboji Lake.

Education
An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

Monitoring
Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Lake Restoration
Proper wetland management begins by controlling the movement of water and fish in/out of Garlock Slough. A new fish barrier (Figure 25) and water control structure should be constructed to replace the existing barrier between Garlock Slough and West Okoboji Lake which no longer functions to control the movement of common carp into the slough. As Garlock Slough's shoreline is owned entirely by the State of Iowa, an electric water control structure and drain pipe should be placed at the outlet of the slough to allow for periodic draw downs that mimic historic drought conditions that are no longer occurring due to watershed changes. These water level fluctuations will allow managers to control fisheries populations and promote natural and diverse vegetation communities that benefit both fisheries and wildlife interests.

Once water levels are allowed to return, natural fish communities should reintroduce themselves to the system via the outlet to the lake. Proper barrier design will allow natural fish species passage while keeping adult common carp from entering the slough and their preferred spawning areas. Supplemental stocking of advanced northern pike fingerlings right after water levels return would help intercept any young common carp that move into the system immediately after renovation. A long term management plan should be developed between fish and wildlife professionals that outline the criteria and plan for dewatering this basin in order to maintain a balanced ecosystem.

Garlock Slough Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorus Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorus Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				5%	$102,650	$80,000	435.1	-$41	$798	$2,600	21	$2,980.00
1.1	Conservation Tillage	SWCD	350		11%	-$350		35.04	-$10	$0	-$400	20	-$20.00
1.2	No-Till System	SWCD	150		0%	$1,800		53.24	$34	$0	$0	-	$0.00
1.3	P-Rate Reduction	SWCD	300		0%	-$3,300		19.11	-$173	$0			
1.4	Cover Crop	SWCD	500		0%	$24,500		227.50	$108	$0	$0	-	$0.00
1.5	Septic Tank Renovation	SWCD	8		12%		$80,000	100.22	$0	$798	$3,000	1	$3,000.00
2	**Land Use Change**				25%	$0	$365,375	690.5	$0	$1,393	$220,000	25	$8,800.00
2.1	Grassed Waterway	SWCD		1750	0%		$4,375	115.50	$0	$38	$0	-	$0.00
2.2	Sediment Basins	SWCD		10	0%		$18,000	179.50	$0	$100	$0	-	$0.00
2.3	Grade Stabilization Structure	SWCD		1	0%		$18,000	79.50	$0	$226	$0	-	$0.00
2.4	Land Retirement	SWCD		50	100%		$325,000	316.00	$0	$1,028	$220,000	25	$8,800.00
3	**Edge of Field**				25%	$0	$79,962	293.7	$0	$749	$5,000	11	$454.55
3.1	Wetland Restoration	SWCD		2	0%		$65,000	187.20	$0	$347	$0	-	$0.00
3.2	Sediment Control Practice	SWCD		1	0%		$10,000	35.20	$0	$284	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		2	100%		$462	26.34	$0	$18	$5,000	11	$454.55
3.4	Tile Intake Treatment	SWCD		15	0%		$4,500	45.00	$0	$100	$0	-	$0.00
4	**In-Lake Treatment**				0%	$15,000	$18,100	120.3	$15,000	$152	$0	$0	$0
4.1	Shoreline/bank Restoration	FISH		100	0%		$18,100	119.30	$0	$152			$0.00
4.2	Carp Reduction	FISH		1	0%	$15,000		1.00	$15,000	$0			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	-	$0.00
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			$0.00
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			$0.00
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$134,150	$543,437	1,540			$227,600	57	$3,992.98

Table 11 Management Plan for Garlock Slough RMA Priority Sub-Watershed (Wills J. H., 2012)

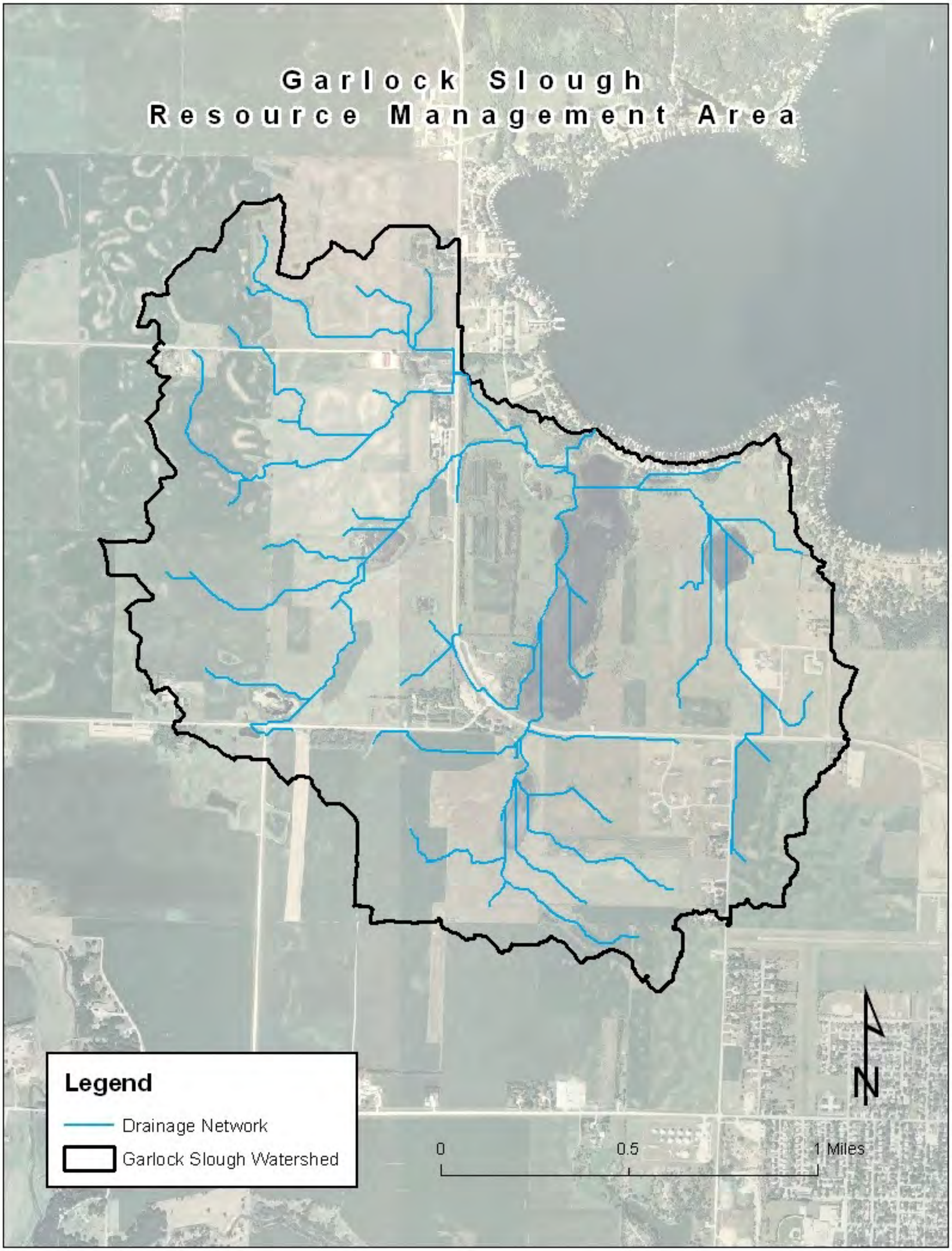

Figure 20 Garlock Slough Resource Management Area

Garlock Slough Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
1624	Lake				7.7	156.6	20.5	Restored
1673	Lake				6.9	35.7	5.2	1
1767	Lake				0.6	30.3	48.1	2
1710	Lake				4.9	105.6	21.7	3
1743	1710	Lake			20.3	50.2	2.5	Restored
1595	1624	Lake			0.5	20.3	44.0	4
1717	1721	Lake			0.8	29.6	37.9	5
1644	1624	Lake			2.3	11.3	4.9	6
1587	1595	1624	Lake		1.5	8.4	5.6	7
1722	1717	1721	Lake		2.6	17.4	6.6	8
1752	1743	1710	Lake		1.1	28.6	25.7	9
1781	1773	1767	Lake		2.5	7.1	2.8	10
1586	1624	Lake			1.1	12.6	11.2	11
1578	1586	1624	Lake		0.9	5.6	6.2	12
1736	Lake				2.0	27.4	13.7	13
1754	1752	1743	1710	Lake	2.2	12.2	5.6	14
1639	Lake				0.7	3.5	5.0	15
1747	1736	Lake			0.6	7.5	11.7	16
1750	Lake				0.5	34.4	71.8	17
1758	1750	Lake			2.6	30.0	11.6	18
1589	Lake				1.5	49.2	33.5	19
1753	1758	1750	Lake		1.0	22.5	21.4	20
1760	Lake				1.1	14.6	13.7	21
1695	Lake				2.3	30.2	13.2	22
1766	1760	Lake			0.8	5.2	6.8	23
1651	Lake				1.5	18.3	12.1	24
1669	Lake				0.3	16.4	53.0	25
1577	Lake				7.8	11.1	1.4	26
1655	1651	Lake			0.3	9.9	32.9	27
1700	1710	Lake			3.5	12.4	3.5	28

Table 12 Wetland restoration priorities for the Garlock Slough Watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

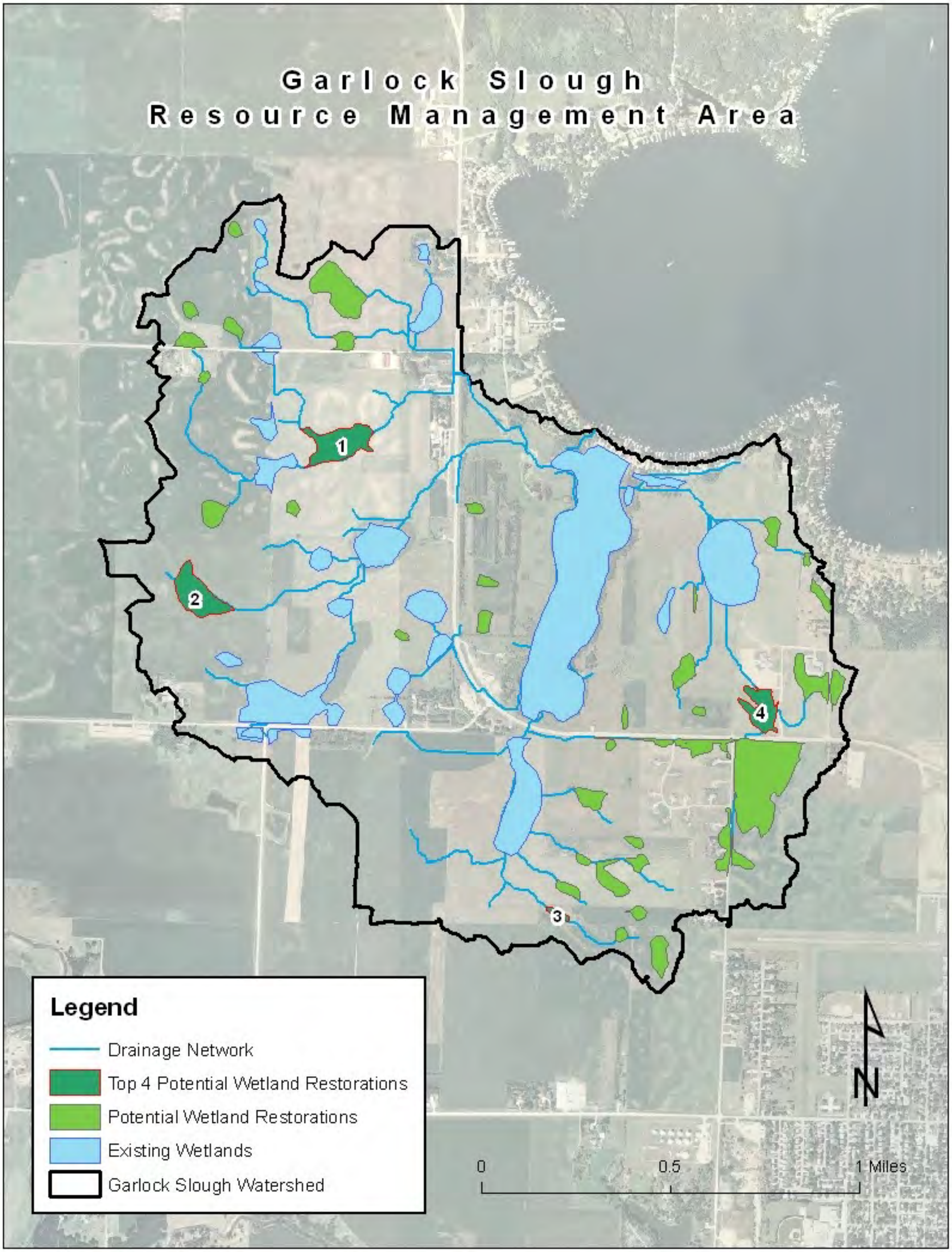

Figure 21 Garlock Slough Priority Wetland Restoration Sites

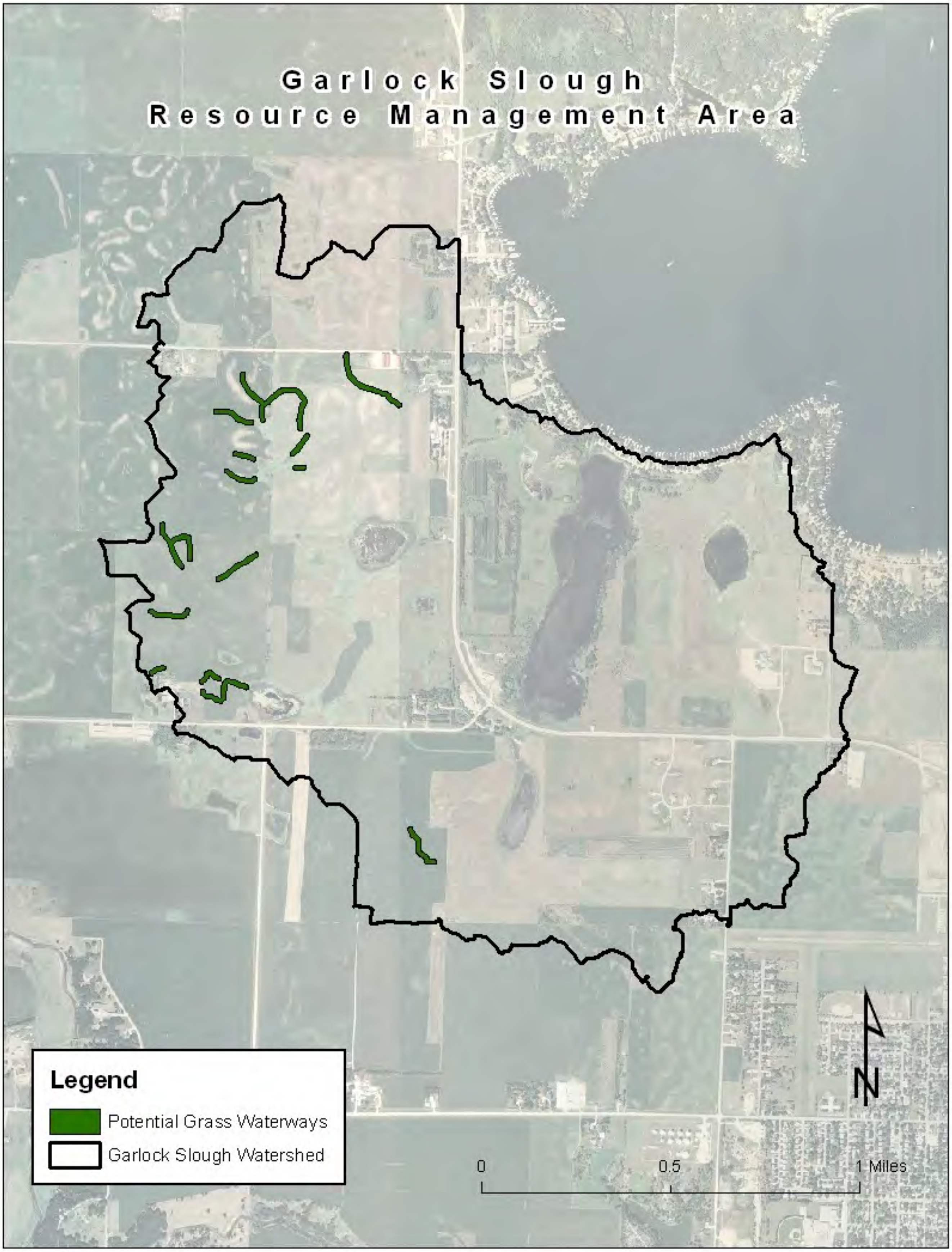

Figure 22 Garlock Slough Ephemeral Gullies

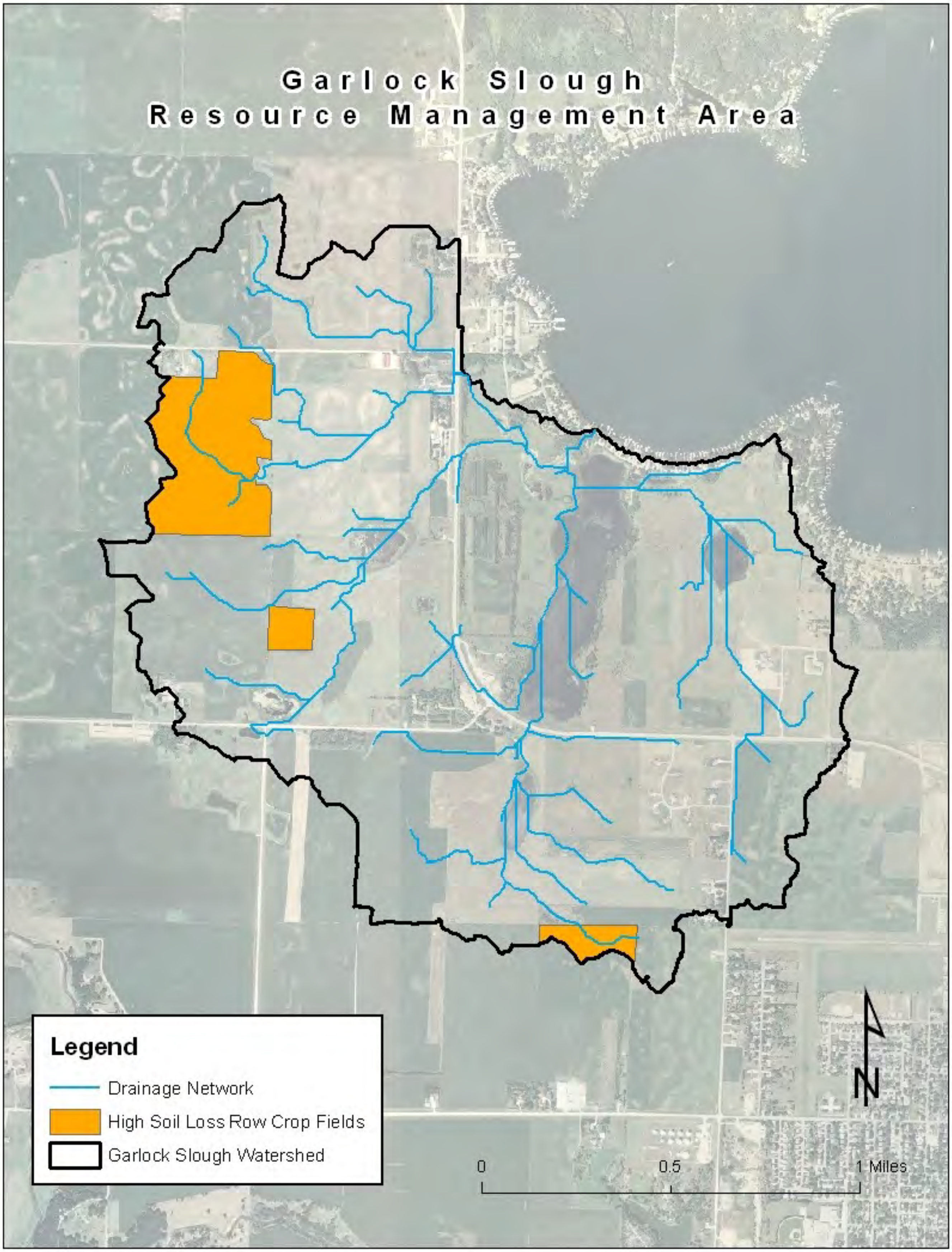

Figure 23 Garlock Slough Target Row Crop Fields

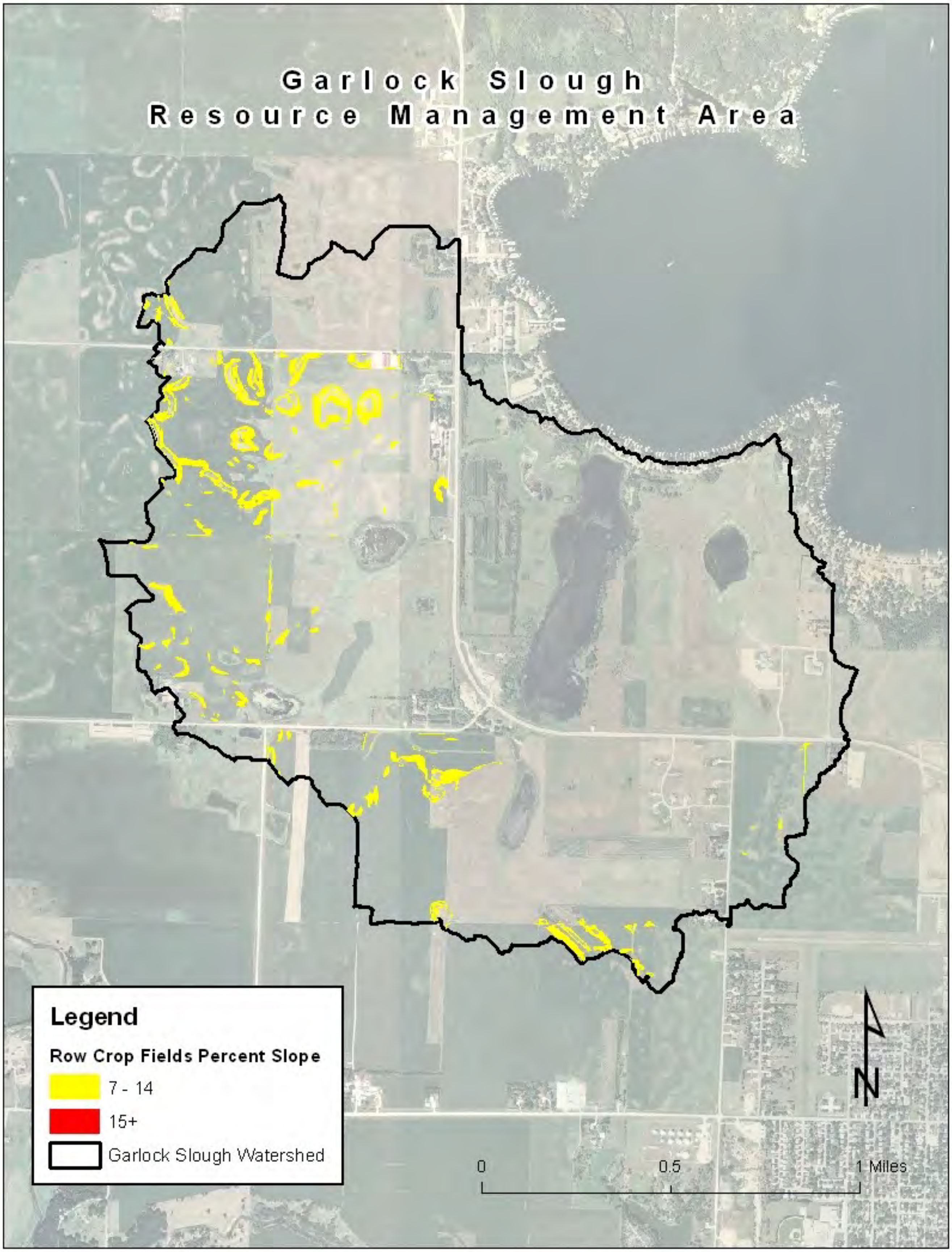

Figure 24 Garlock Slough Target Row Crop Slopes

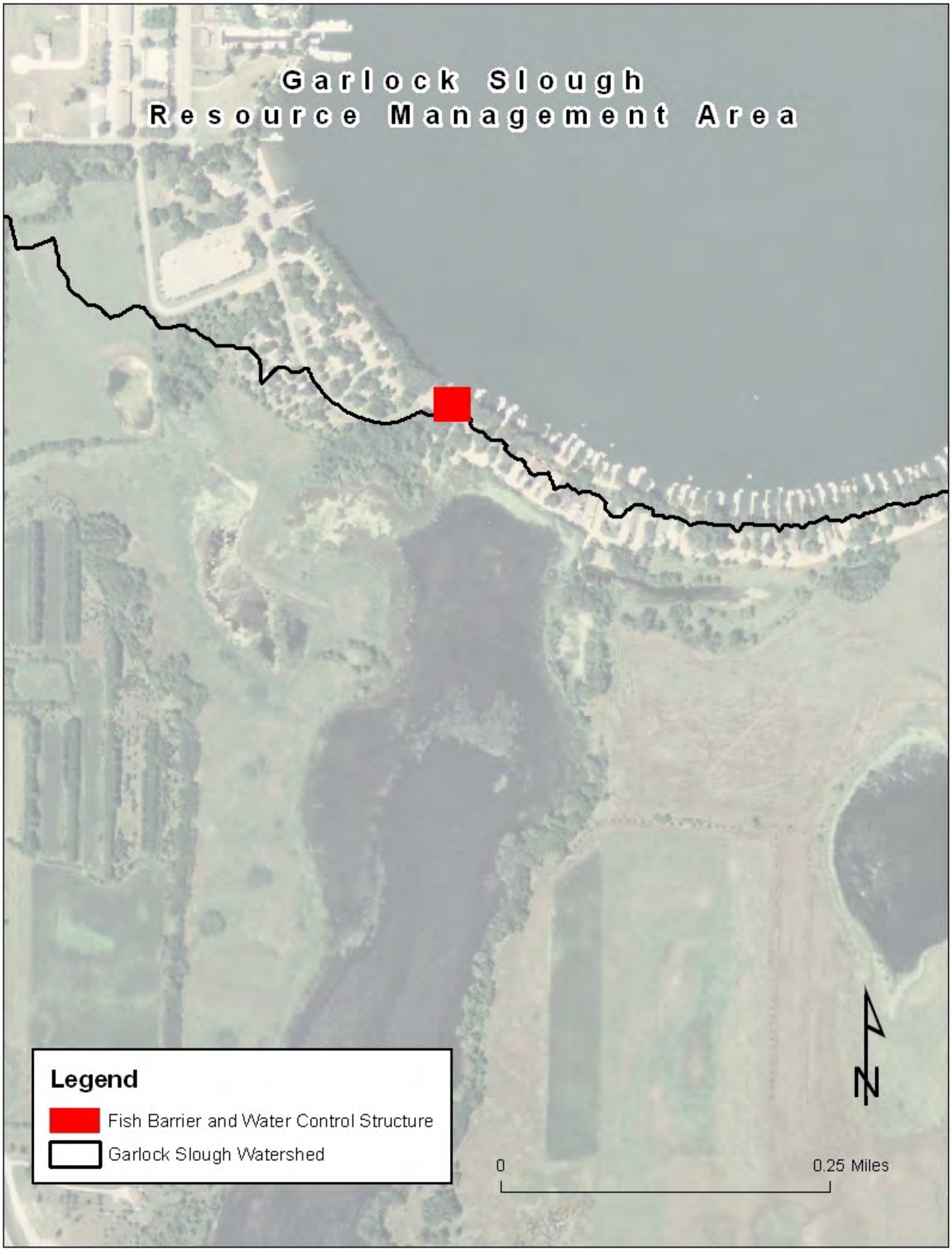

Figure 25 Garlock Slough Fish Barrier Location

Lakeside Labs Resource Management Area (RMA)

***Objective* –** Prevent heavy sediment loaded water reaching West Okoboji Lake via the ephemeral stream adjacent to Lakeside Labs. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved MDL's.

***Description* –** This watershed has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. It represents approximately 2% of the watershed of West Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to West Okoboji Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both watershed cultural and erosion control practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing the plan on the next page.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 299.6 pounds of Phosphorus from entering West Okoboji Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 518.4 pounds of Phosphorus from entering West Okoboji Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 324.3 pounds of Phosphorus from reaching West Okoboji Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Lakeside Laboratory Resource Management Area

Clean Water Alliance — Today's Date: 2/9/2018

Project Lead: John H. Wills

Start Date: 7/1/2012

Goal	Tasks	Task Lead	Annual Acres/feet/number	Long Term Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorus Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorus Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				25%	$12,001	$0	299.6	-$56	$0	$600	48	$12.50
1.1	Conservation Tillage	SWCD	81		0%	-$81		100.00	-$1	$0	$0	-	$0.00
1.2	No-Till System	SWCD	50		100%	$600		60.00	$10	$0	$600	48	$12.50
1.3	P-Rate Reduction	SWCD	199		0%	-$2,189		12.68	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	279		0%	$13,671		126.95	$108	$0	$0	-	$0.00
2	**Land Use Change**				0%	$0	$188,100	518.4	$0	$1,420	$0	-	$0.00
2.1	Grassed Waterway	SWCD		1200	0%		$3,000	138.00	$0	$22	$0	-	$0.00
2.2	Sediment Basins	SWCD		7	0%		$12,600	89.20	$0	$141	$0	-	$0.00
2.3	Grade Stabilization Structure	SWCD		2	0%		$36,000	158.70	$0	$227	$0	-	$0.00
2.4	Land Retirement	SWCD		21	0%		$136,500	132.50	$0	$1,030	$0	-	$0.00
3	**Edge of Field**				6%	$0	$65,193	324.3	$0	$887	$25,190	17	$1,491
3.1	Wetland Restoration	SWCD		1	0%		$20,000	201.00	$0	$100			$0.00
3.2	Sediment Control Practice	SWCD		4	25%		$40,000	62.00	$0	$645			$0.00
3.3	Vegetative Buffer	SWCD		3	0%		$693	16.34	$0	$42			$0.00
3.4	Tile Intake Treatment	SWCD		15	0%		$4,500	45.00	$0	$100			$0.00
3.5	Shoreline Stabilization	SWCD		0	100%						$25,190	17	$1,490.53
4	**Education**					$11,000	$0	0.00	$0	$0	$0	$0	$0
4.1	Radio	SWCD				$9,000							
4.2	Print	SWCD				$1,500							
4.3	Landowner Visits	SWCD				$0							
4.4	Landowner Seminar	SWCD				$500							
5	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	$0	$0
5.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
5.1.1	Vegetation	SWCD			0%	$500			$500	$0			
5.1.2	CLAMP	LSL			0%	$500			$500	$0			
5.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
5.2	Wetland	SWCD			0%	$5,000			$5,000	$0			$0.00
5.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$43,501	$253,293	1,142			$25,790	65	$397.38

Table 13 Management Plan for Lakeside Laboratory RMA Priority Sub-Watershed (Wills J. H., 2012)

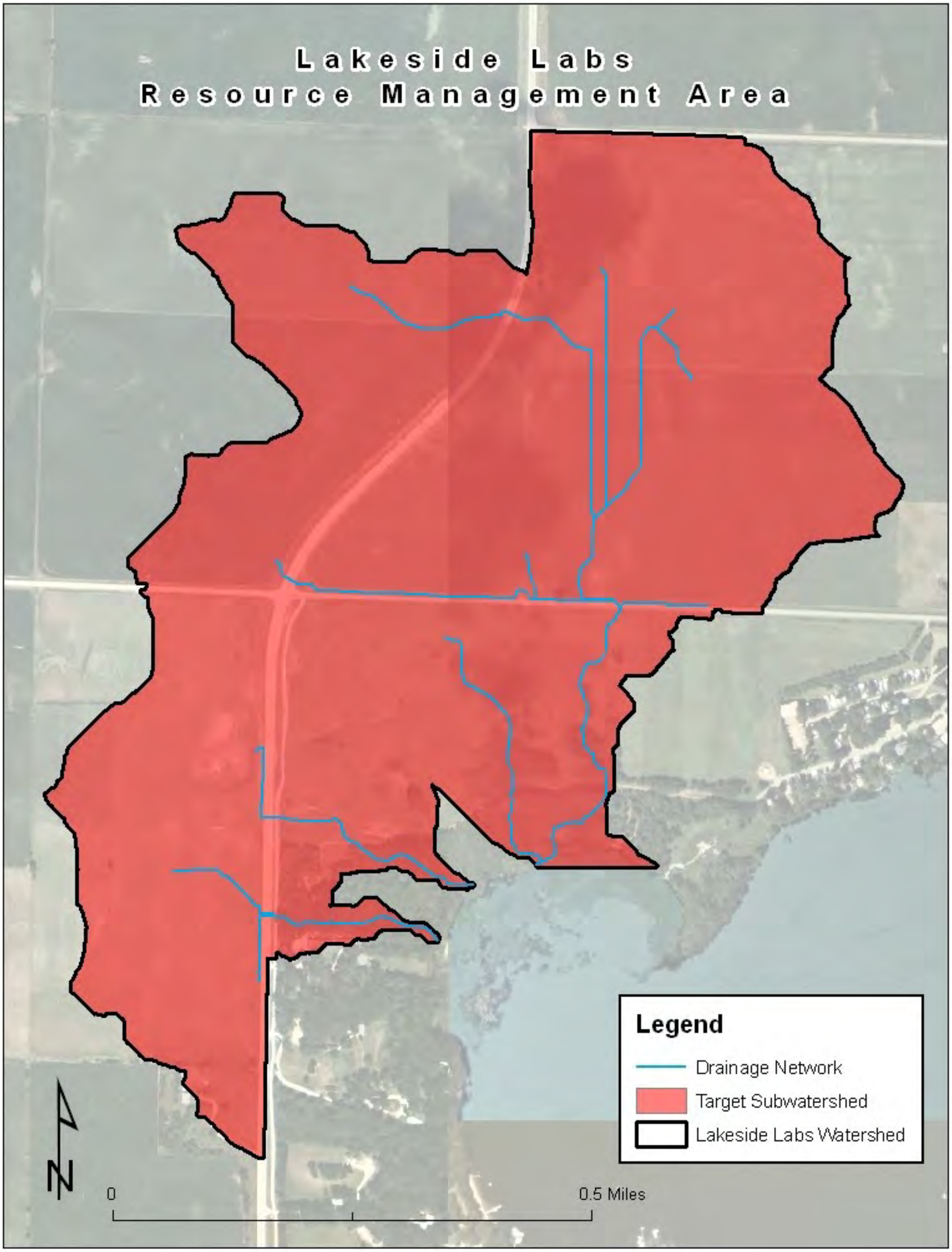

Figure 26 Lakeside Labs Resource Management Area

Lakeside Labs Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
1390	1400	Lake				10.2	108.7	10.7	1
1371	1390	1400	Lake			1.4	41.9	31.0	2
1446	Lake					0.4	12.5	32.9	3
1368	1390	1400	Lake			5.5	18.1	3.3	4
1396	1400	Lake				2.0	16.5	8.1	5
1399	1400	Lake				0.6	9.4	16.8	6
1367	1371	1390	1400	Lake		1.3	8.4	6.7	7
1376	1368	1390	1400	Lake		0.7	3.1	4.3	8
1369	1367	1371	1390	1400	Lake	1.4	3.4	2.5	9
1395	1400	Lake				0.5	2.9	5.6	10

Table 14 Wetland restoration priorities for the Lakeside Labs Watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

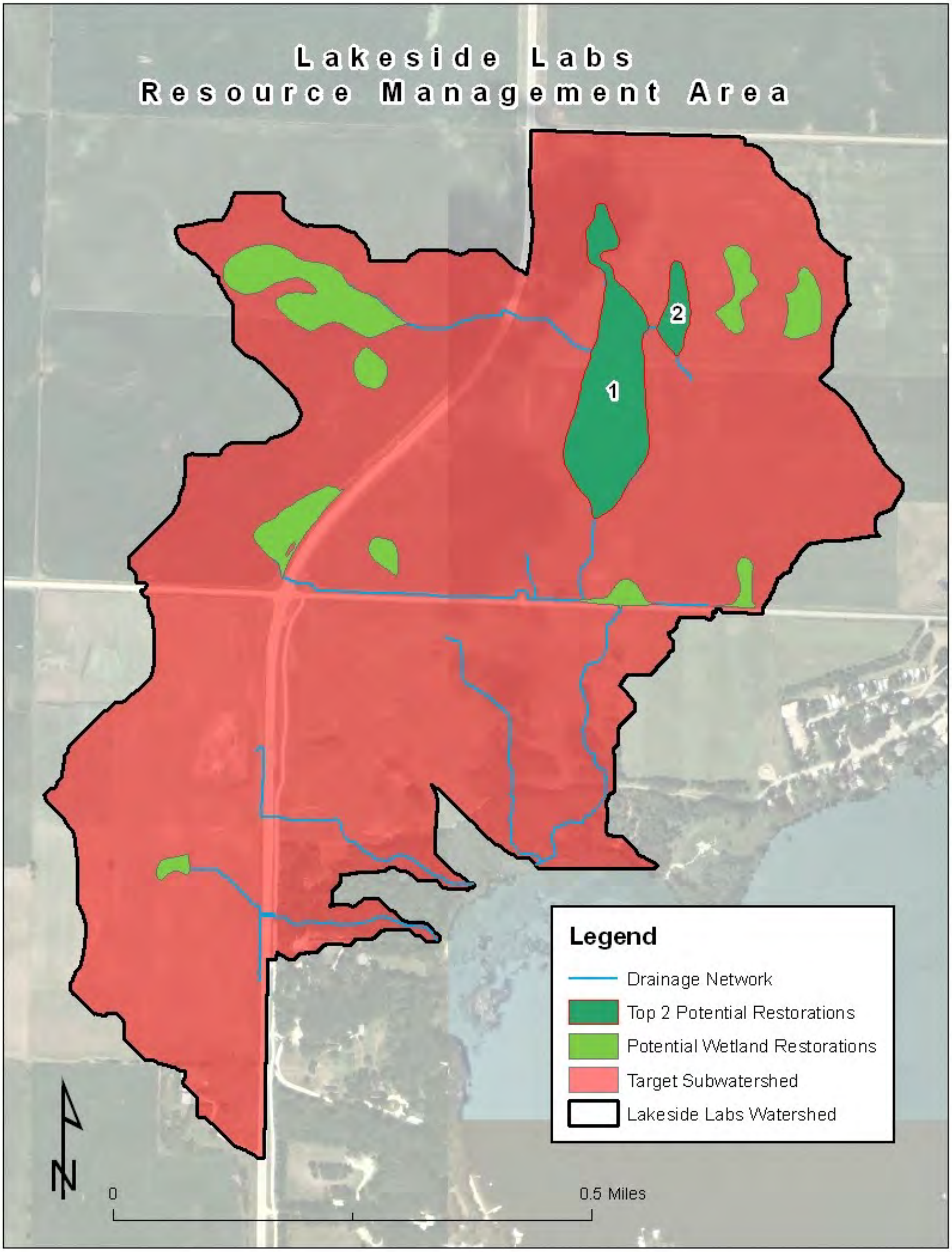

Figure 27 Lakeside Labs Priority Wetland Restoration Sites

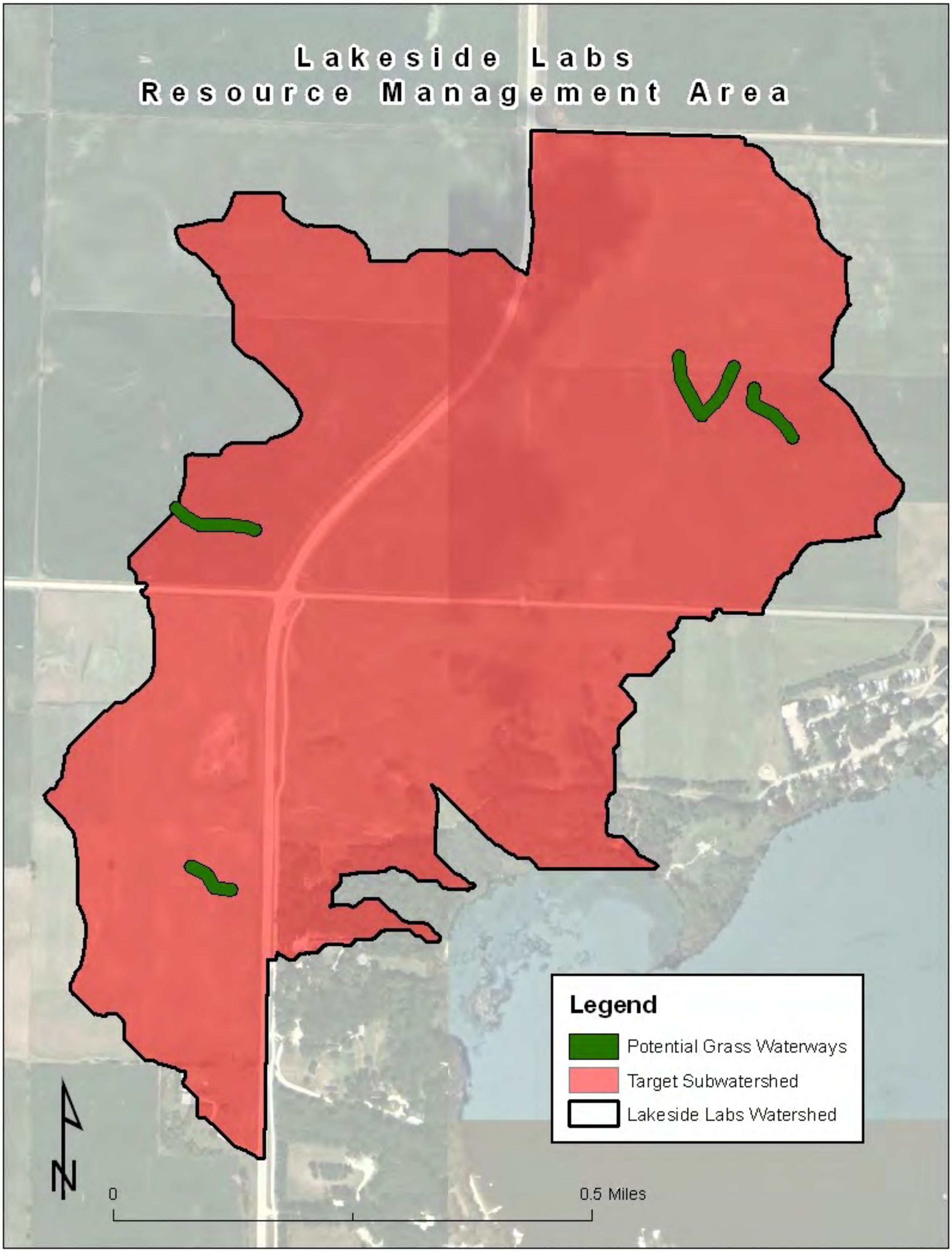

Figure 28 Lakeside Labs Ephemeral Gullies

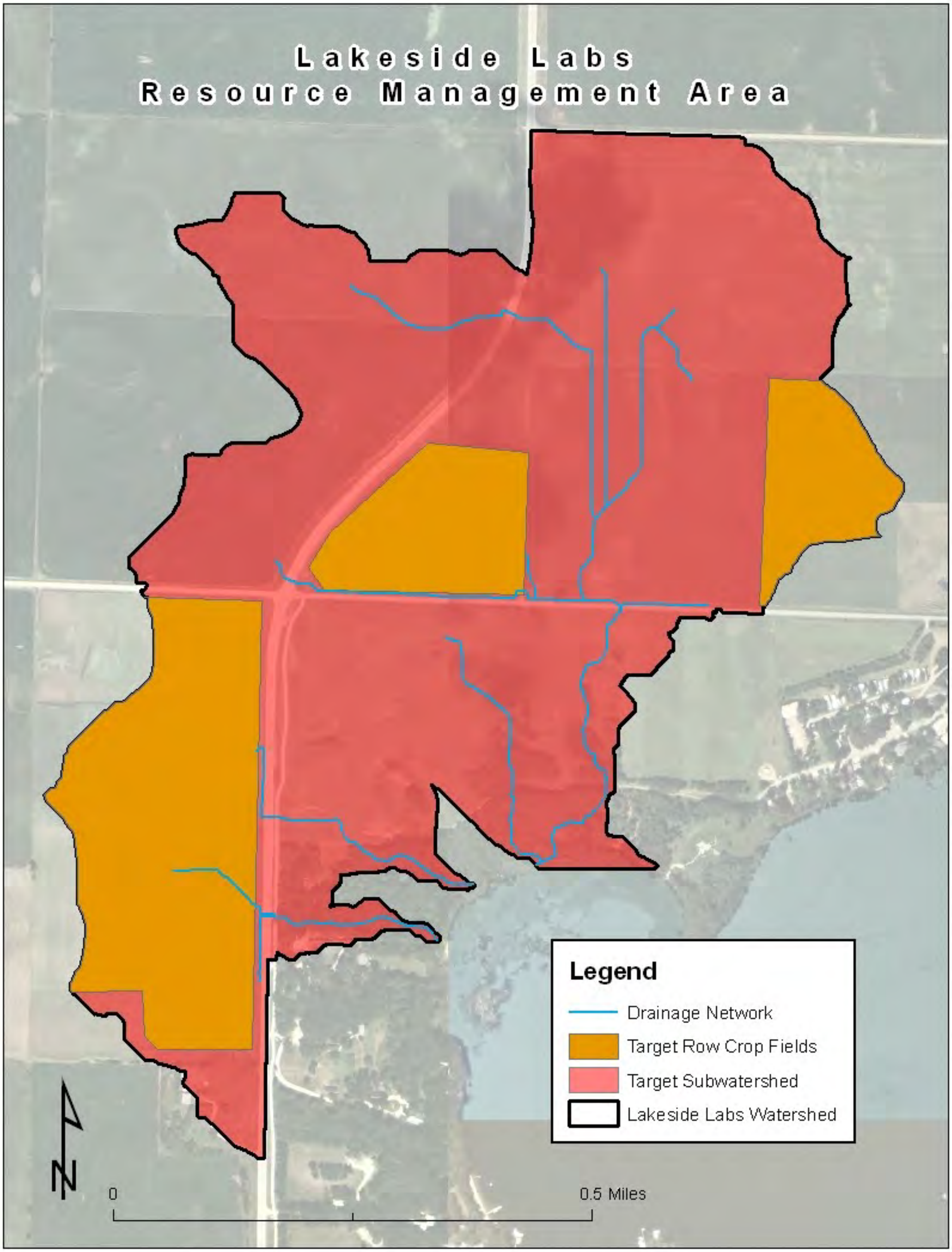

Figure 29 Lakeside Labs Target Row Crop Fields

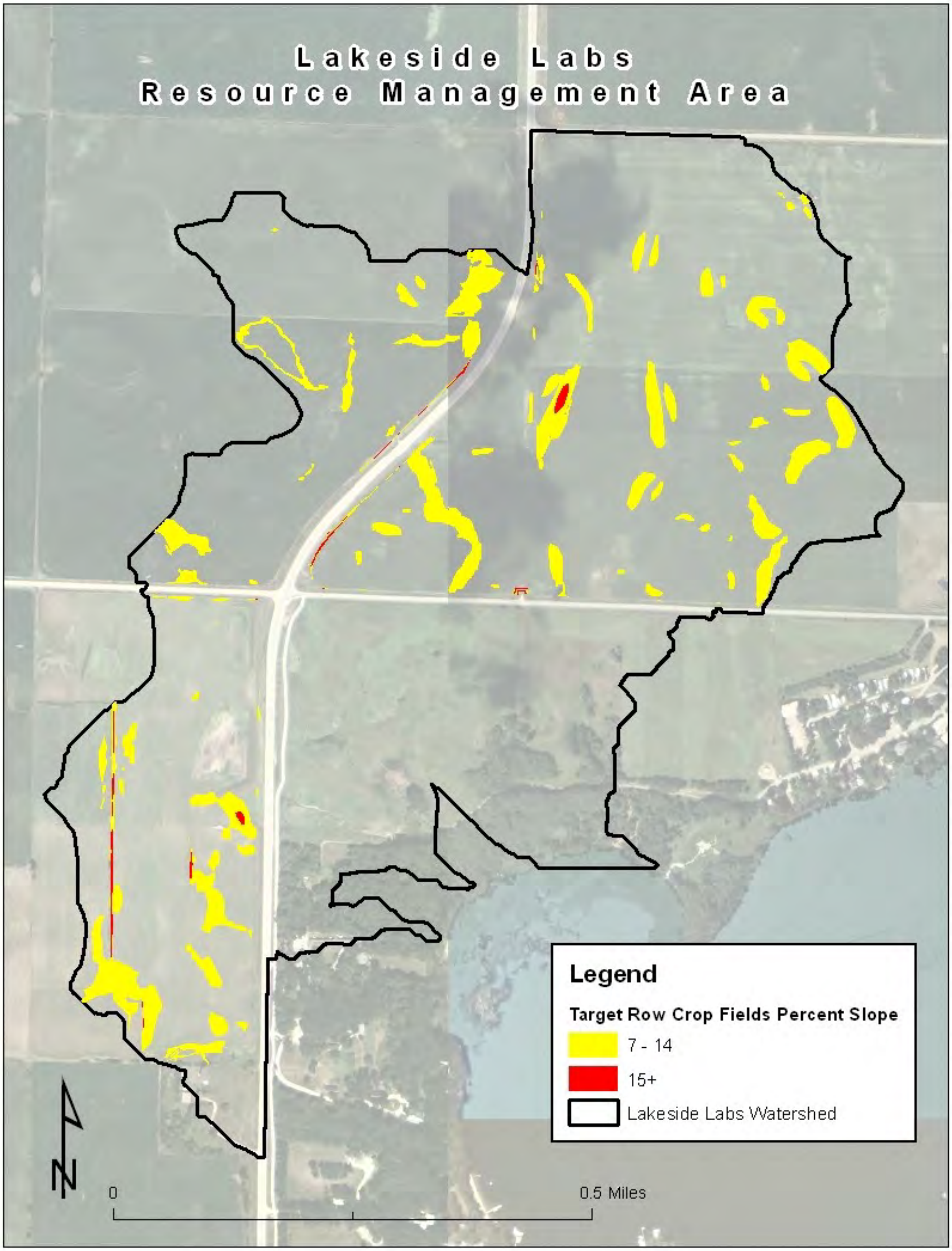

Figure 30 Lakeside Labs Target Row Crop Slopes

Okoboji View Resource Management Area (RMA)

Objective **–** Prevent heavy sediment loaded water reaching West Okoboji Lake via the ephemeral stream adjacent to Okoboji View Golf Course. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's .

Description **–** This watershed has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. It represents approximately 10% of the watershed of West Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to West Okoboji Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both cultural as well as erosion control practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing the following plan.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 320.3 pounds of Phosphorus from entering West Okoboji Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 1,783.8 pounds of Phosphorus from entering West Okoboji Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 887.8 pounds of Phosphorus from reaching West Okoboji Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 358.9 pounds of Phosphorus from entering West Okoboji Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Okoboji View Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				25%	-$160	$0	19.0	0.0	$0	$0	-	$0.00
1.1	Conservation Tillage	SWCD	160		100%	-$160		16.02	0.0	$0	$0	-	$0.00
1.2	No-Till System	SWCD	0		0%	$0		1.00	0.0	$0	$0	-	$0.00
1.3	P-Rate Reduction	SWCD	0		0%	$0		1.00	0.0	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	0		0%	$0		1.00	0.0	$0	$0	-	$0.00
2	**Land Use Change**				25%	$0	$2,243,750	208.0	0.0	$12,189	$2,242,500	630	$3,559.52
2.1	Grassed Waterway	SWCD		500	0%		$1,250	1.00	0.0	$1,250	$0	-	$0.00
2.2	Sediment Basins	SWCD		0	0%		$0	1.00	0.0	$0	$0	-	$0.00
2.3	Grade Stabilization Structure	SWCD		0	0%		$0	1.00	0.0	$0	$0	-	$0.00
2.4	Land Retirement	SWCD		345	100%		$2,242,500	205.00	0.0	$10,939	$2,242,500	630	$3,559.52
3	**Edge of Field**				50%	$0	$424,193	197.0	0.0	$2,876	$150,000	490	$306.12
3.1	Wetland Restoration	SWCD		85	100%		$423,500	194.00		$2,183	$150,000	490	$306.12
3.2	Sediment Control Practice	SWCD		0	0%		$0	1.00		$0	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		3	100%		$693	1.00		$693	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		0	0%		$0	1.00		$0	$0	-	$0.00
4	**In-Lake Treatment**				0%	$15,000	$0	2.0	0.0	$0	$0	$0	$0
4.1	Shoreline/bank Restoration	FISH		0	0%		$0	1.00	0.0	$0			$0.00
4.2	Carp Reduction	FISH			0%	$15,000		1.00	0.0	$0			$0.00
5	**Education**					$11,000	$0	0.00	0.0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	0.0	$0	$0	$0	$0
6.1	Lake Monitoring	LSL			0%	$6,000				$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500				$0			
6.1.2	CLAMP	LSL			0%	$500				$0			
6.1.3	Cyanobacteria	ISU			0%	$5,000			0.0	$0			
6.2	Wetland	SWCD			0%	$5,000			0.0	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			0.0	$0			$0.00
	Totals					$31,340	$2,667,943	426	0		$2,392,500	1,120	$2,136.16

Table 15 Management Plan for Okoboji View RMA Priority Sub-Watershed (Wills J. H., 2012)

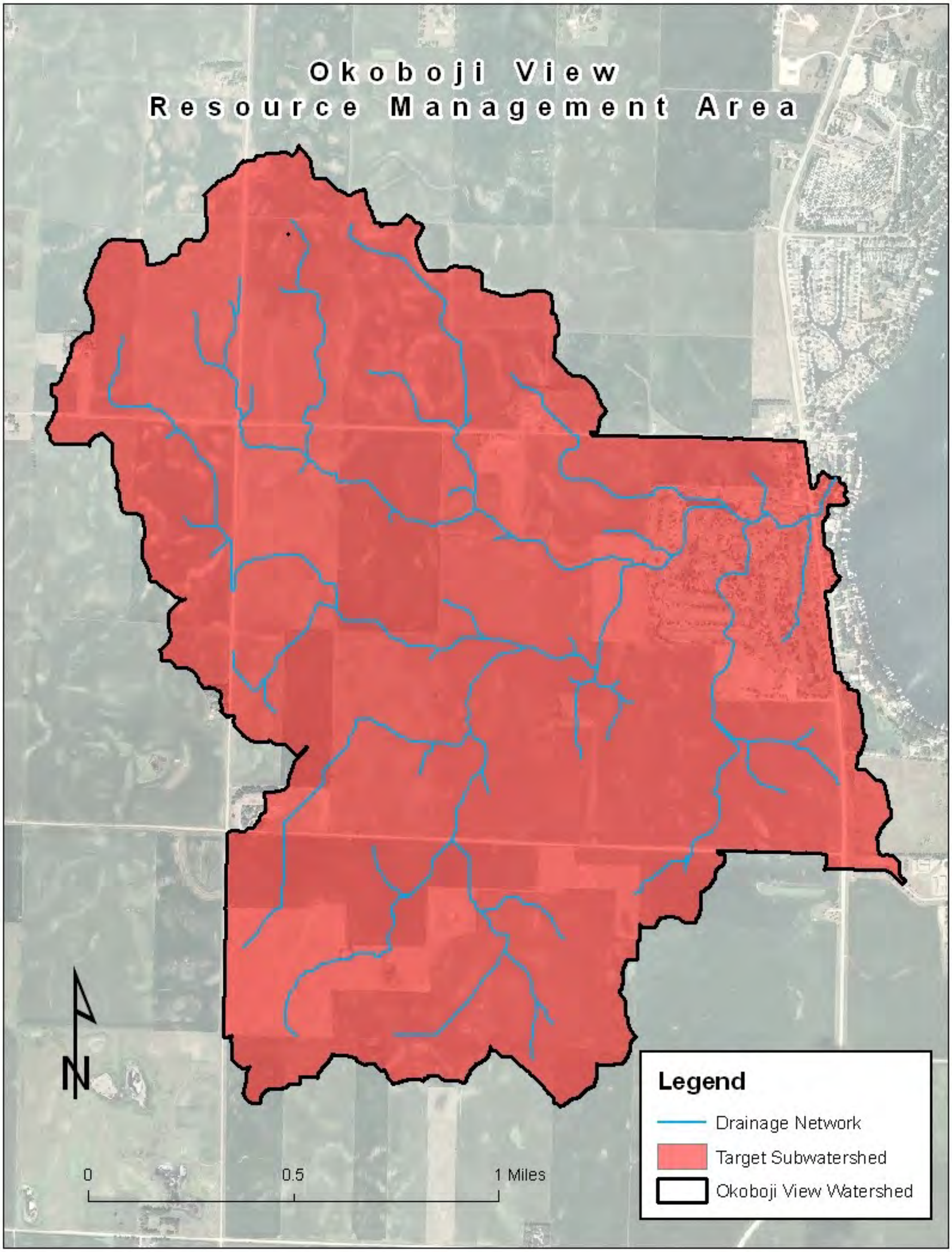

Figure 31 Okoboji View Resource Management Area

Okoboji View Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
1156	1140	1164	1175	Lake				7.2	149.2	20.8	1
1158	1156	1140	1164	1175	Lake			14.5	120.8	8.3	2
1089	Lake							13.4	102.8	7.7	3
1258	Lake							24.2	61.3	2.5	4
1193	1164	1175	Lake					5.5	50.9	9.2	5
1081	1158	1156	1140	1164	1175	Lake		3.7	49.9	13.6	6
1327	Lake							6.0	38.9	6.5	7
1208	1202	Lake						1.8	24.6	14.1	8
1198	Lake							9.3	44.1	4.8	9
1291	1258	Lake						5.3	13.8	2.6	10
1090	Lake							9.6	32.4	3.4	11
1319	Lake							5.0	36.8	7.3	12
1108	Lake							2.1	15.8	7.7	13
1024	1089	Lake						2.2	17.6	7.9	14
1063	1090	Lake						1.8	22.9	12.5	15
1167	Lake							1.4	15.0	10.7	16
1259	Lake							1.3	31.6	24.9	17
1050	1081	1158	1156	1140	1164	1175	Lake	6.4	12.7	2.0	18
1042	1083	Lake						0.9	11.7	12.8	19
1065	1089	Lake						3.1	12.6	4.1	20
1183	1193	1164	1175	Lake				3.3	19.3	5.8	21
1237	Lake							0.6	12.6	21.7	22
1039	1042	1083	Lake					1.1	7.2	6.8	23
1176	1183	1193	1164	1175	Lake			3.1	13.1	4.2	24
1283	1291	1258	Lake					0.5	3.6	7.0	25
1280	1259	Lake						2.9	18.0	6.2	26
1188	1167	Lake						0.5	6.1	11.5	27
1072	1081	1158	1156	1140	1164	1175	Lake	0.6	4.9	7.7	28
1086	1158	1156	1140	1164	1175	Lake		0.3	4.9	17.3	29
1334	1319	Lake						0.8	9.5	11.6	30

Table 16 Wetland restoration priorities for the Okoboji View watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

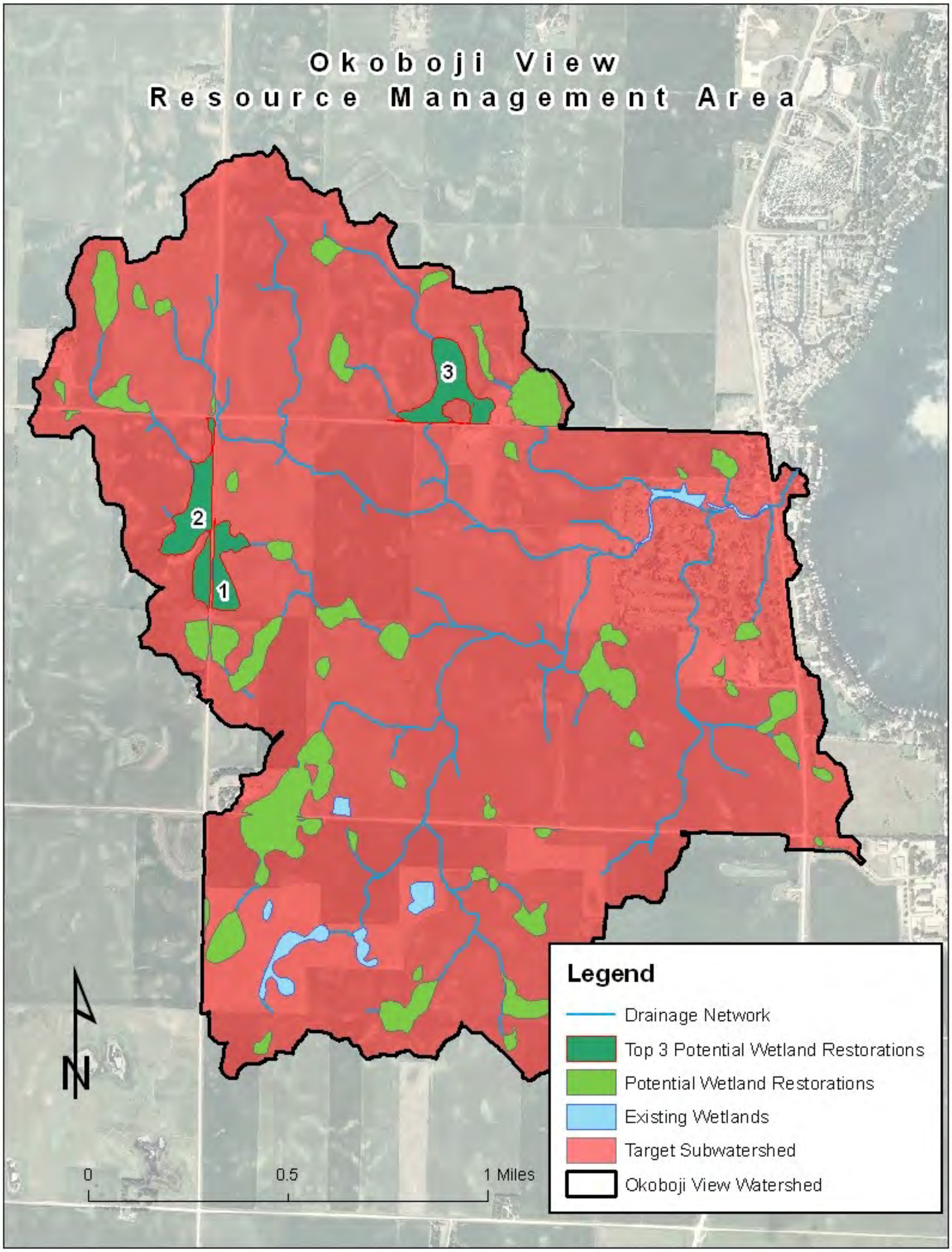

Figure 32 Okoboji View Priority Wetland Restoration Sites

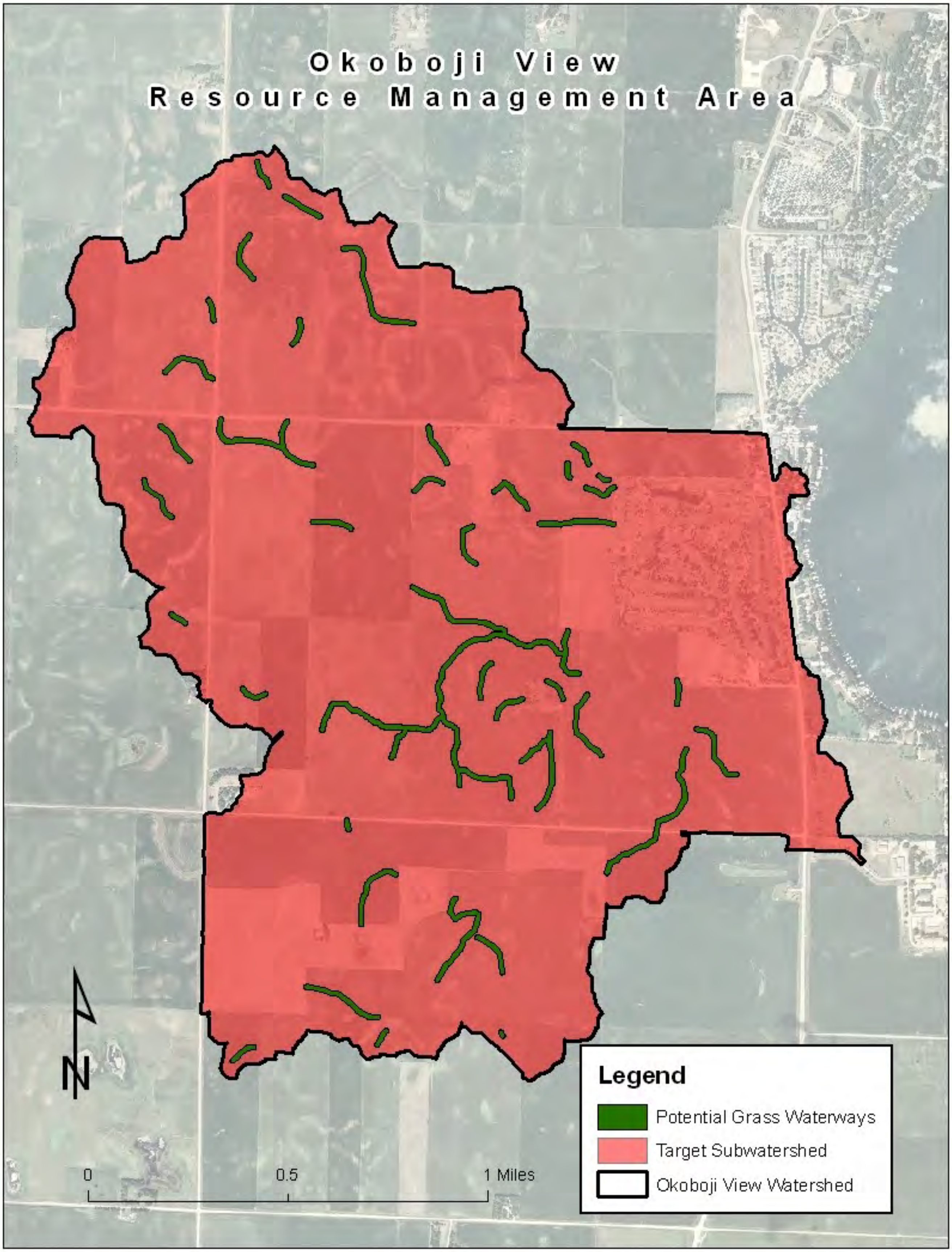

Figure 33 Okoboji View Ephemeral Gullies

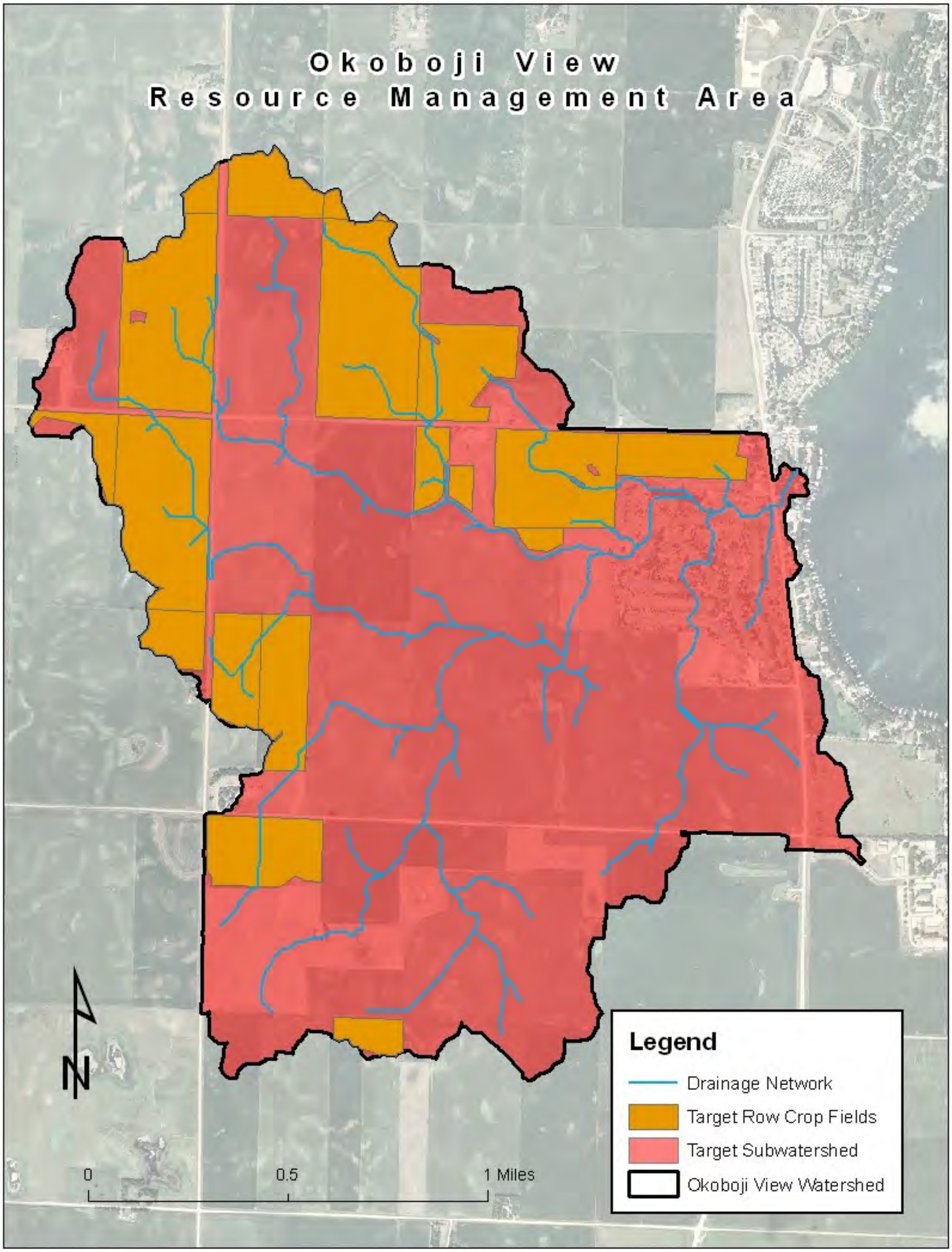

Figure 34 Okoboji View Target Row Crop Fields

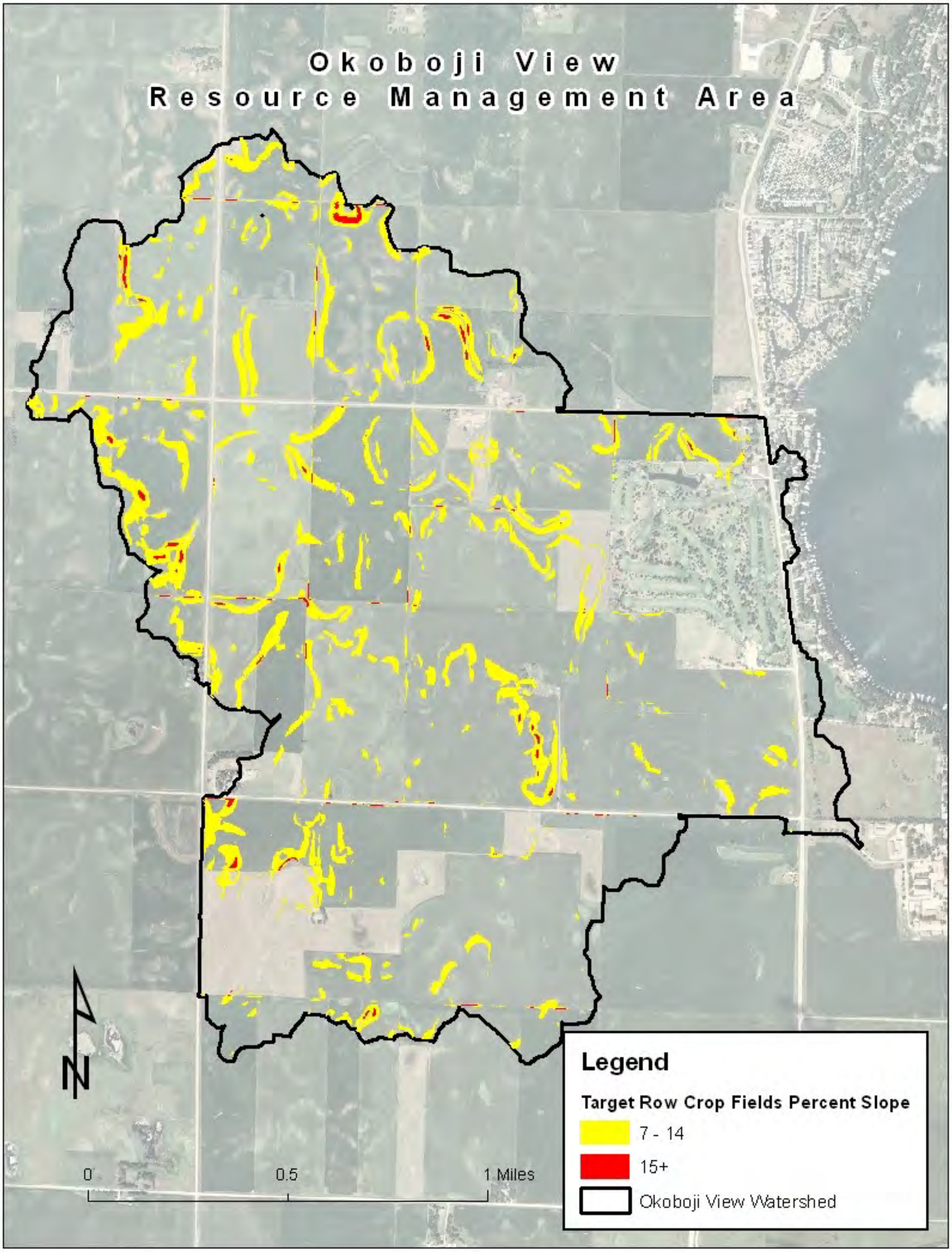

Figure 35 Okoboji View Target Row Slopes

Lazy Lagoon Resource Management Area (RMA)

Objective **–** Prevent heavy sediment loaded water reaching West Okoboji Lake via the ephemeral stream at Triboji. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's.

Description **–** The Triboji watershed has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded.
This watershed represents approximately 4% of the watershed of West Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to West Okoboji Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both cultural and soil erosion control practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing the following plan

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 320.3 pounds of Phosphorus from entering West Okoboji Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 1,783.8 pounds of Phosphorus from entering West Okoboji Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 887.8 pounds of Phosphorus from reaching West Okoboji Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 358.9 pounds of Phosphorus from entering West Okoboji Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Lazy Lagoon Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				33%	$12,751	$0	240.6	-50	$0	-$600	92	-$4.17
1.1	Conservation Tillage	SWCD	201		100%	-$201		20.12	-10	$0	-$1,000	60	-$16.67
1.2	No-Till System	SWCD	133		30%	$1,596		47.20	34	$0	$400	32	$12.50
1.3	P-Rate Reduction	SWCD	334		0%	-$3,674		21.28	-173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	334		0%	$15,030		151.97	99	$0	$0	-	$0.00
2	**Land Use Change**				0%	$0	$221,500	$2,435	0	$254	$0	$0	$0
2.1	Grassed Waterway	SWCD		5000	0%		$12,500	597.10	0	$21	$0	-	$0.00
2.2	Sediment Basins	SWCD		15	0%		$27,000	947.20	0	$29	$0	-	$0.00
2.4	Land Retirement	SWCD		28	0%		$182,000	890.90	0	$204	$0	-	$0.00
3	**Edge of Field**				0%	$0	$63,231	932.5	0	$622	$0	-	$0.00
3.1	Wetland Restoration	SWCD		1	0%		$20,000	797.40	0	$25	$0	-	$0.00
3.2	Sediment Control Practice	SWCD		4	0%		$40,000	82.10	0	$487	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		1	0%		$231	23.00	0	$10	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		10	0%		$3,000	30.00	0	$100	$0	-	$0.00
4	**In-Lake Treatment**				0%	$15,000	$18,100	120.3	15000	$152	$0	$0	$0
4.1	Shoreline/bank Restoration	FISH		100	0%		$18,100	119.30	0	$152			$0.00
4.2	Carp Reduction	FISH		1	0%	$15,000		1.00	15000	$0			$0.00
5	**Education**					$11,000	$0	0.00	0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	20500	$0	$0	$0	$0
6.1	Lake Monitoring	LSL			0%	$6,000			6000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			500	$0			
6.1.2	CLAMP	LSL			0%	$500			500	$0			
6.1.3	Cyanobacteria	ISU			0%	$5,000			5000	$0			
6.2	Wetland	SWCD			0%	$5,000			5000	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			3500	$0			$0.00
	Totals					$44,251	$302,831	3,729			-$600	92	-$6.52

Table 17 Management Plan for Lazy Lagoon RMA Priority Sub-Watershed (Wills J. H., 2012)

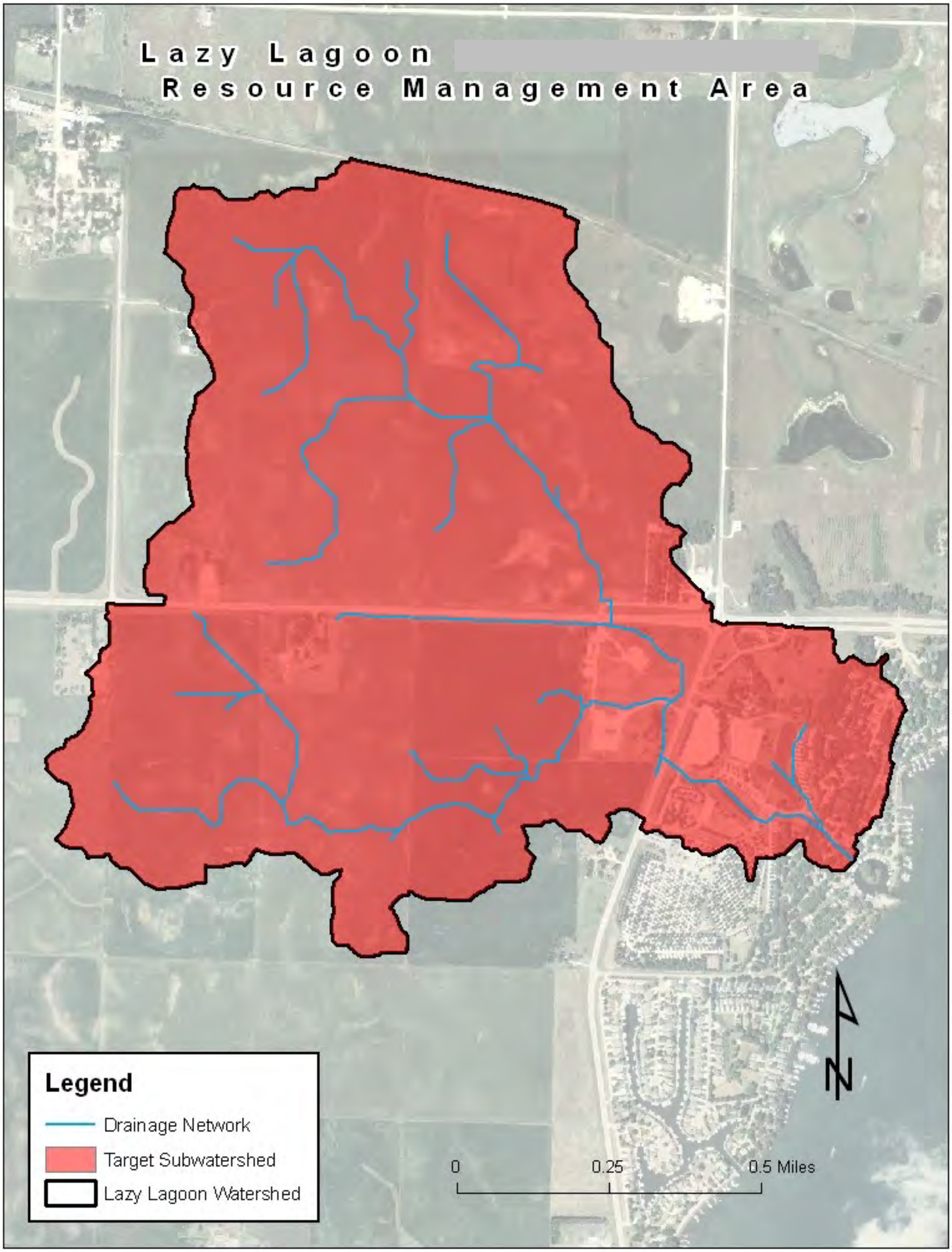

Figure 36 Lazy Lagoon Resource Management Area

Lazy Lagoon Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
941	956	946	Lake		6.9	44.7	6.5	1
850	946	Lake			7.4	47.1	6.4	2
894	946	Lake			2.4	32.8	13.6	3
902	894	946	Lake		1.4	20.4	14.2	4
986	946	Lake			7.8	21.5	2.8	5
921	946	Lake			2.3	13.9	6.2	6
914	902	894	946	Lake	3.2	8.6	2.7	7
901	946	Lake			2.3	19.8	8.5	8
971	Lake				3.2	5.0	1.5	9
954	986	946	Lake		1.0	3.4	3.3	10
1003	946	Lake			1.1	2.1	1.9	11
913	901	946	Lake		1.4	1.7	1.2	12
899	901	946	Lake		0.8	2.4	3.1	13
897	946	Lake			0.4	0.7	1.8	14
925	931	Lake			0.3	2.5	9.5	15

Table 18 Wetland restoration priorities for the Lazy Lagoon watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

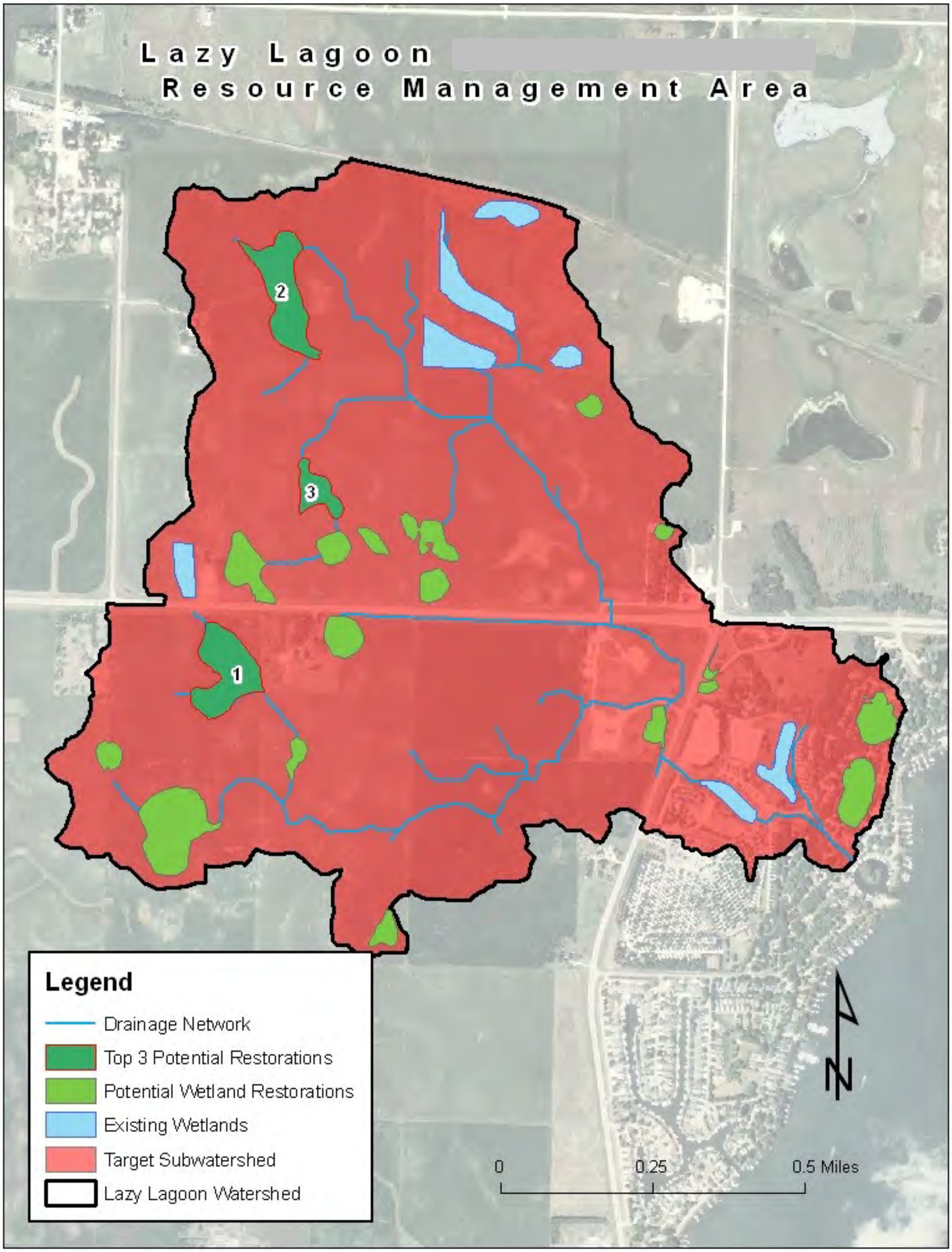

Figure 37 Lazy Lagoon Priority Wetland Restoration Sites

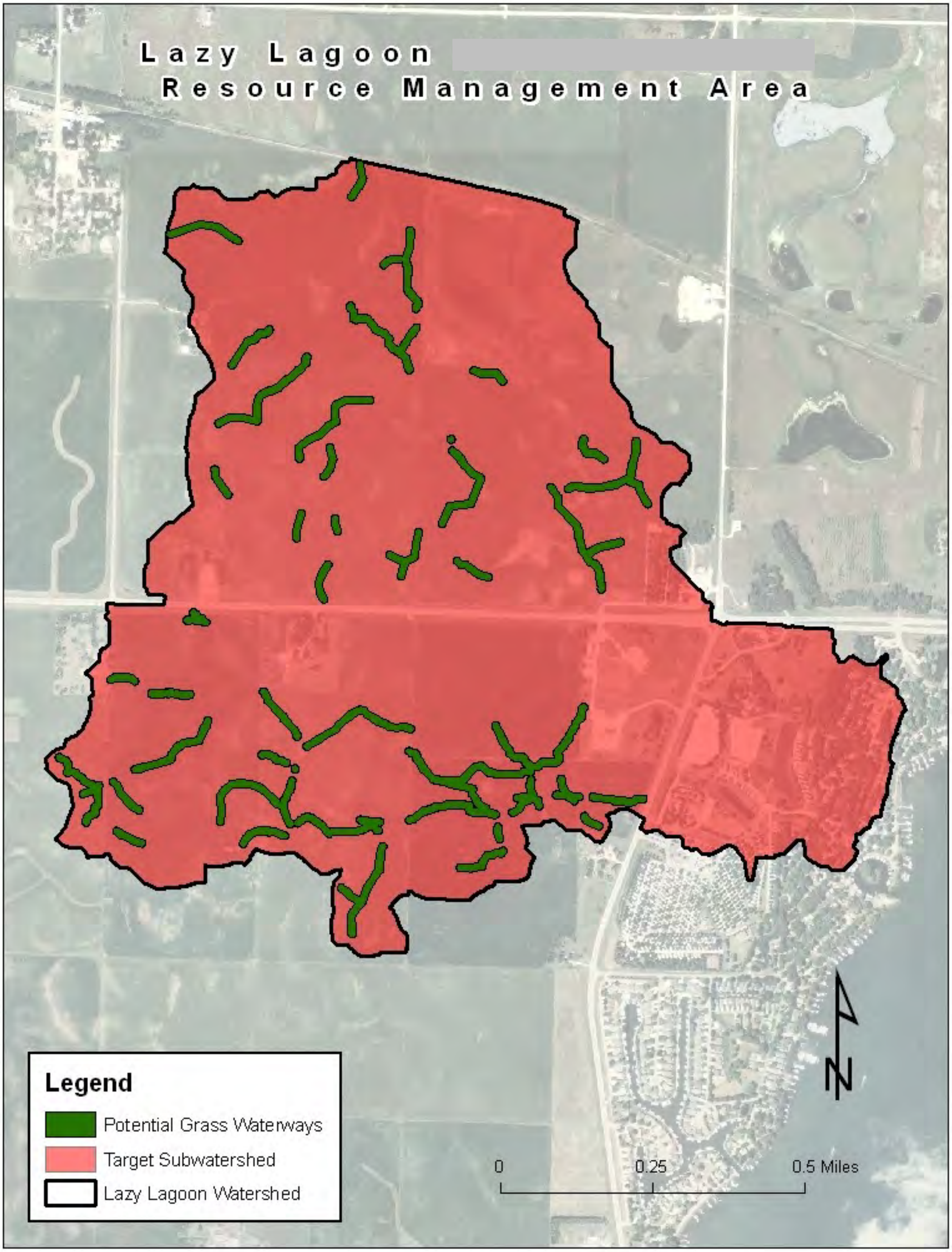

Figure 38 Lazy Lagoon Ephemeral Gullies

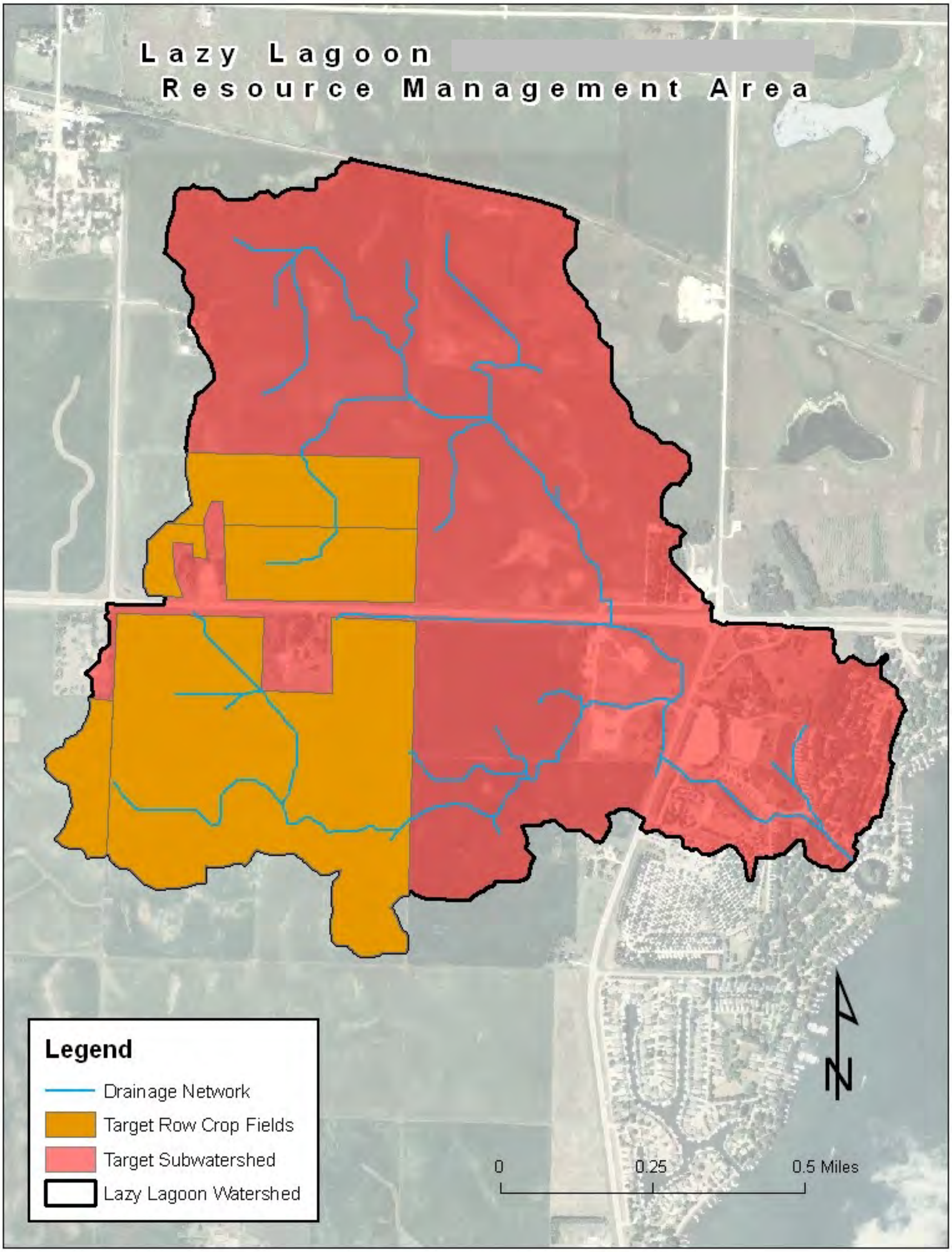

Figure 39 Lazy Lagoon Target Row Crop Fields

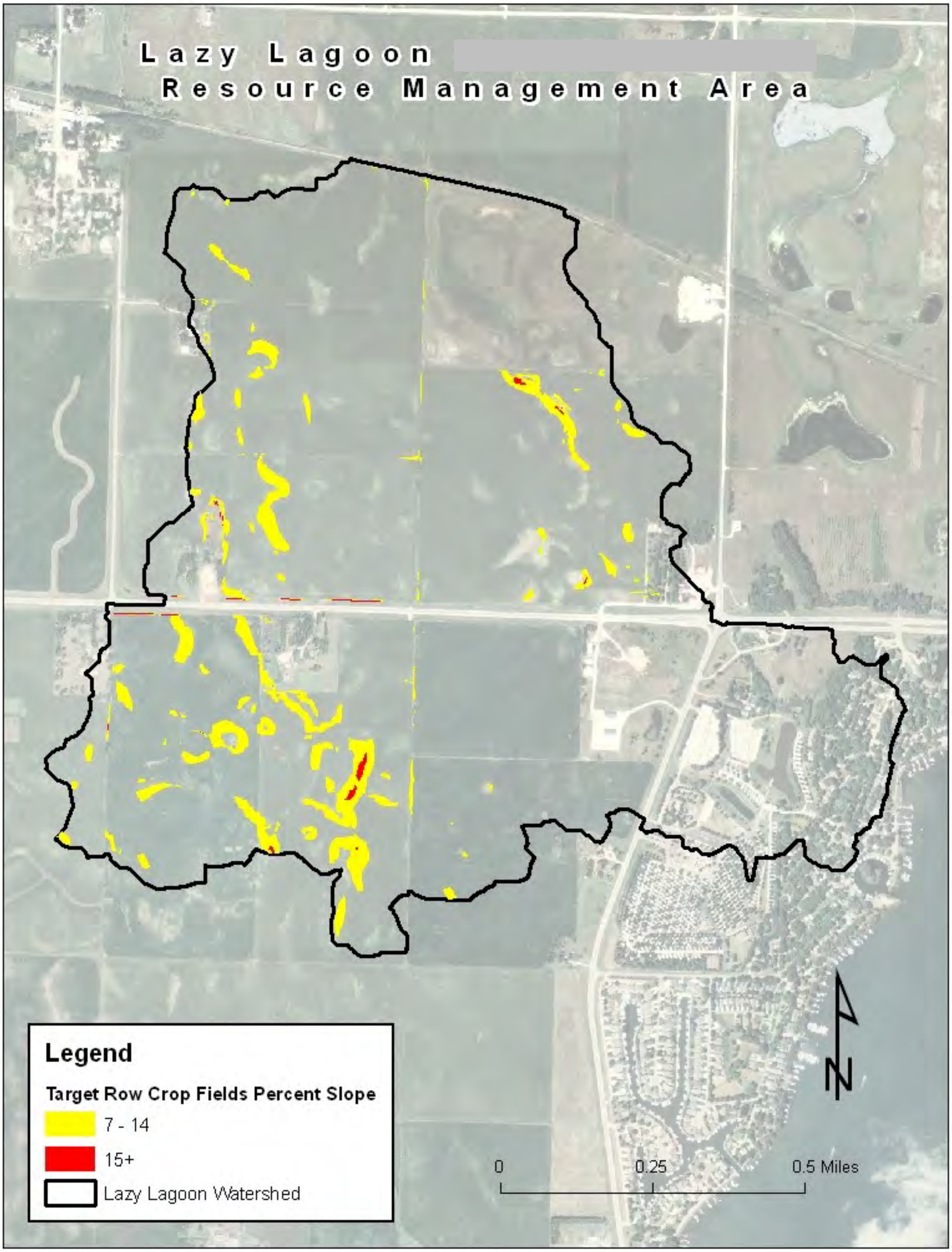

Figure 40 Lazy Lagoon Target Row Crop Slopes

Welch Lake Complex Resource Management Area (RMA)

***Objective* –** Prevent heavy sediment loaded water reaching West Okoboji Lake via the ephemeral stream from the Welch Lake Complex. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's.

***Description* –** This watershed has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. It represents approximately 16% of the watershed of West Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to West Okoboji Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both cultural practices and soil erosion control practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing the following plan.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 333.3 pounds of Phosphorus from entering West Okoboji Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 1,976.2 pounds of Phosphorus from entering West Okoboji Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 1,150.1 pounds of Phosphorus from reaching West Okoboji Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 363.3 pounds of Phosphorus from entering West Okoboji Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Welch Lake Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				0%	$17,644	$0	333.3	-$50	$0	$0	-	$0.00
1.1	Conservation Tillage	SWCD	228		0%	-$228		22.82	-$10	$0	$0	-	$0.00
1.2	No-Till System	SWCD	220		0%	$2,640		78.08	$34	$0	$0	-	$0.00
1.3	P-Rate Reduction	SWCD	448		0%	-$4,928		28.54	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	448		0%	$20,160		203.84	$99	$0	$0	-	$0.00
2	**Land Use Change**				15%	$0	$1,348,350	1,976.2	$0	$3,867	$231,490	$155	$1,493
2.1	Grassed Waterway	SWCD		3500	0%		$8,750	990.20	$0	$9	$0	-	$0.00
2.2	Sediment Basins	SWCD		12	0%		$21,600	547.60	$0	$39			
2.3	Grade Stabilization Structure	SWCD		1	0%		$18,000	75.20	$0	$239	$0	-	$0.00
2.4	Land Retirement	SWCD		200	59%		$1,300,000	363.20	$0	$3,579	$231,490	155	$1,493.48
3	**Edge of Field**				25%	$0	$65,448	1,150.1	$0	$401	$109,125	46	$2,372.28
3.1	Wetland Restoration	SWCD		2	100%		$40,000	934.20	$0	$43	$109,125	46	$2,372.28
3.2	Sediment Control Practice	SWCD		2	0%		$20,000	83.60	$0	$239	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		8	0%		$1,848	96.30	$0	$19	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		12	0%		$3,600	36.00	$0	$100	$0	-	$0.00
4	**In-Lake Treatment**				0%	$15,000	$54,300	363.3	$15,000	$150	$0	$0	$0
4.1	Shoreline/bank Restoration	FISH		300	0%		$54,300	362.30	$0	$150			$0.00
4.2	Carp Reduction	FISH		1	0%	$15,000		1.00	$15,000	$0			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	$0	$0
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			
6.1.2	CLAMP	LSL			0%	$500			$500	$0			
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$49,144	$1,468,098	3,823			$340,615	201	$1,694.60

Table 19 Management Plan for Welch Lake RMA Priority Sub-Watershed (Wills J. H., 2012)

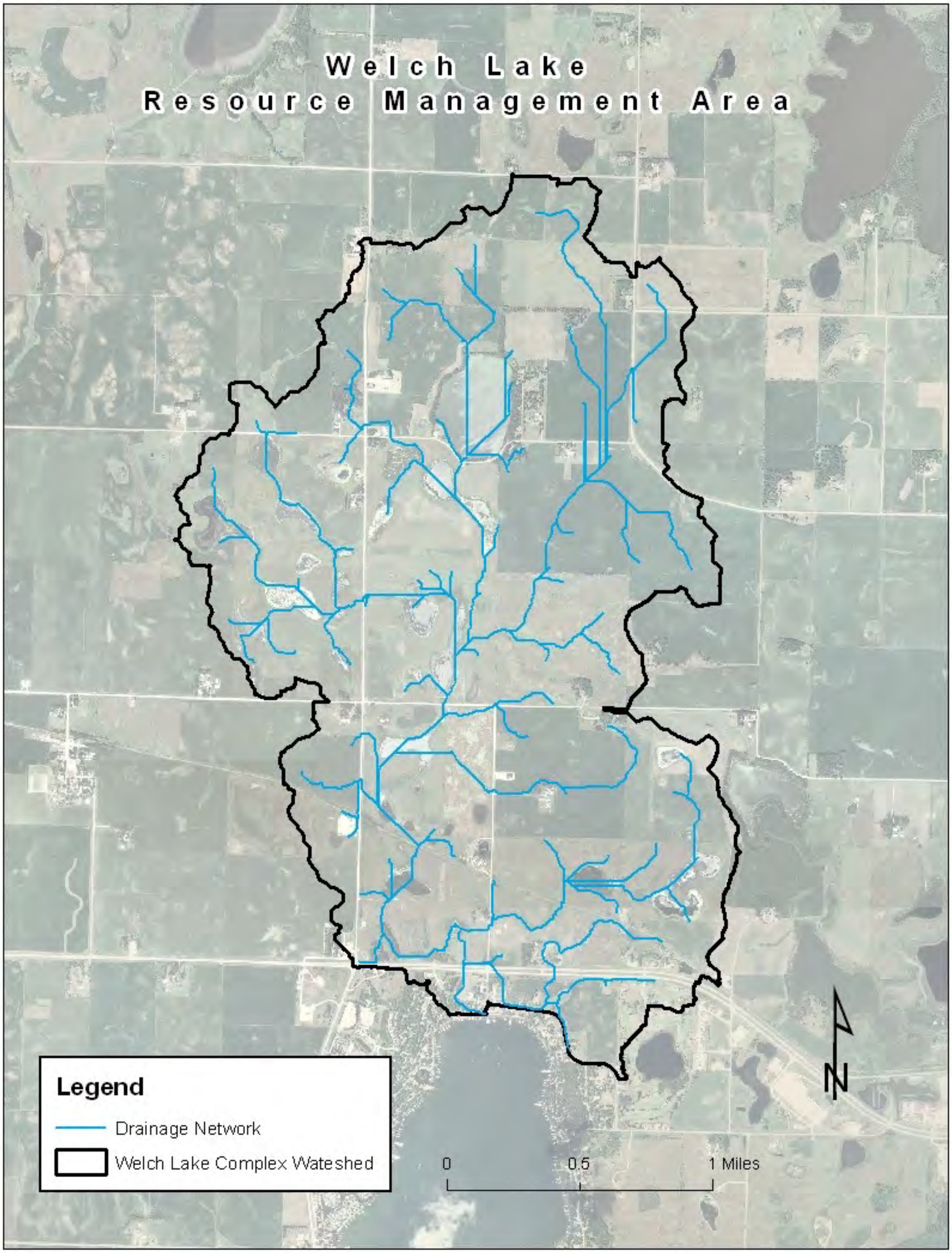

Figure 41 Welch Lake Resource Management Area

Welch Lake Complex Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
718	737	Lake				12.1	484.1	40.1	1
705	718	737	Lake			82.5	336.9	4.1	2
827	Lake					4.9	131.4	27.0	Restored
580	705	718	737	Lake		1.6	34.5	21.7	3
662	705	718	737	Lake		8.7	71.1	8.2	4
783	Lake					2.3	63.5	27.6	5
777	783	Lake				3.3	54.0	16.2	6
838	824	827	Lake			11.6	62.0	5.3	7
709	705	718	737	Lake		1.9	28.3	14.6	8
646	Lake					16.1	40.1	2.5	9
616	Lake					6.1	74.4	12.3	10
690	Lake					3.3	38.6	11.5	11
715	709	705	718	737	Lake	4.5	13.6	3.0	12
823	838	824	827	Lake		4.8	37.1	7.8	13
644	Lake					7.2	19.3	2.7	14
826	Lake					1.1	65.4	61.1	15
764	777	783	Lake			1.6	16.7	10.6	16
679	662	705	718	737	Lake	1.7	10.7	6.3	17
924	942	Lake				1.0	45.8	45.8	18
740	737	Lake				3.1	58.6	18.9	19
829	826	Lake				2.3	20.3	8.8	20
833	824	827	Lake			0.3	10.1	32.5	21
842	829	826	Lake			0.5	35.4	72.2	22
871	Lake					0.4	8.1	20.7	23
801	827	Lake				0.9	6.9	7.7	24
804	801	827	Lake			0.6	4.1	6.4	25
893	Lake					1.5	8.5	5.5	26
678	690	Lake				0.4	3.9	9.4	27
675	Lake					1.0	33.8	32.8	28
892	Lake					0.3	1.7	6.6	29

Table 20 Wetland restoration priorities for the Welch Lake watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

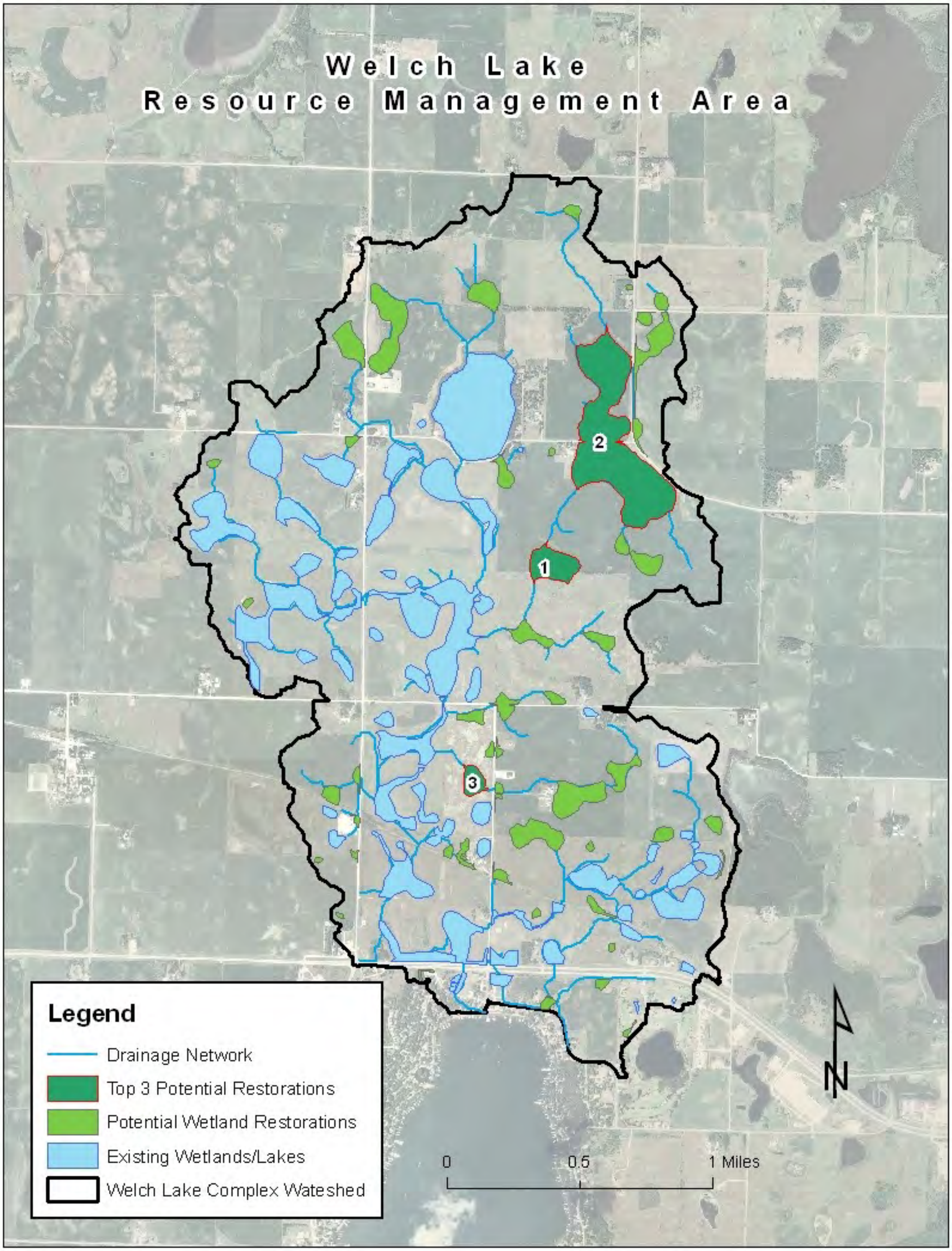

Figure 42 Welch Lake Priority Wetland Restoration Sites

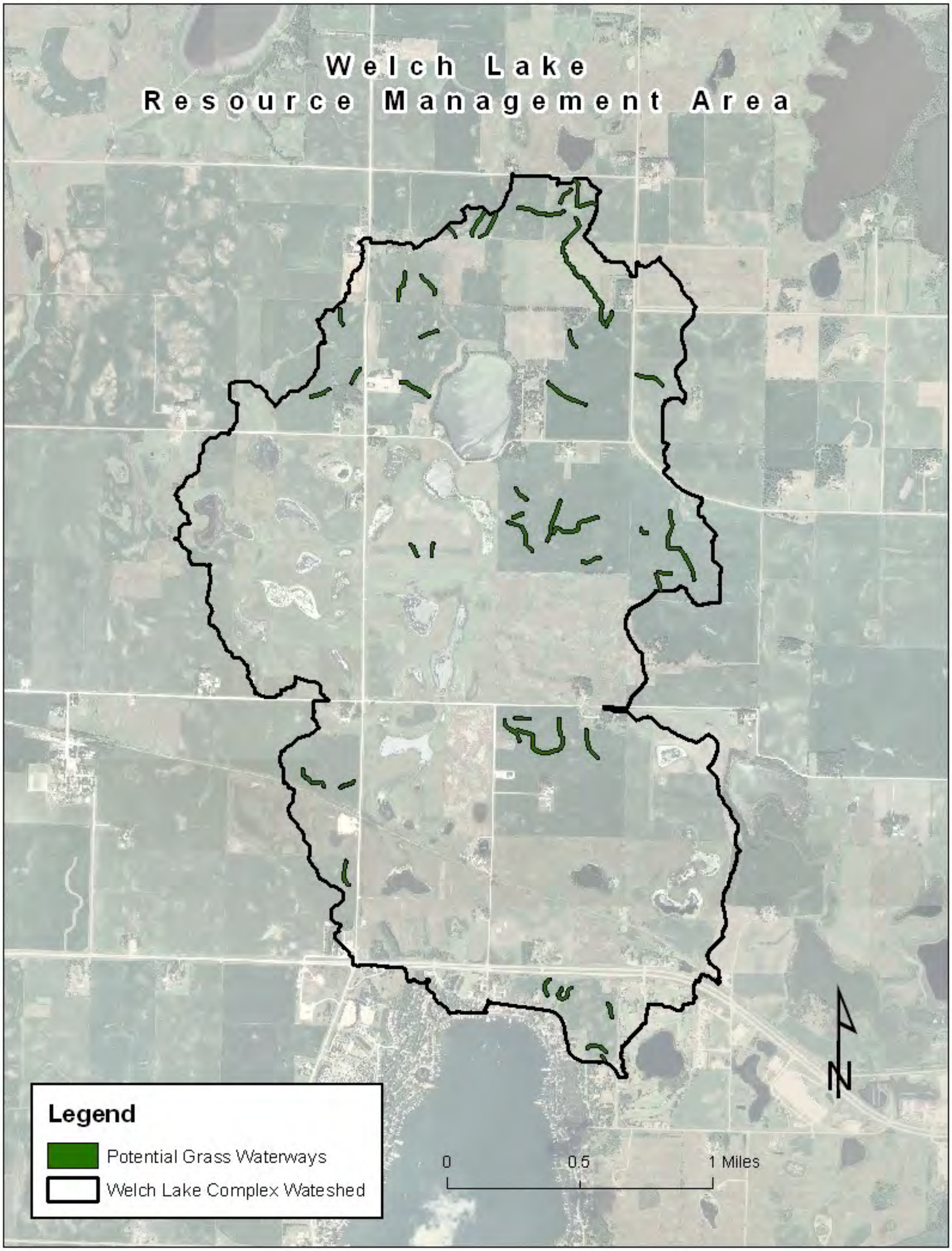

Figure 43 Welch Lake Ephemeral Gullies

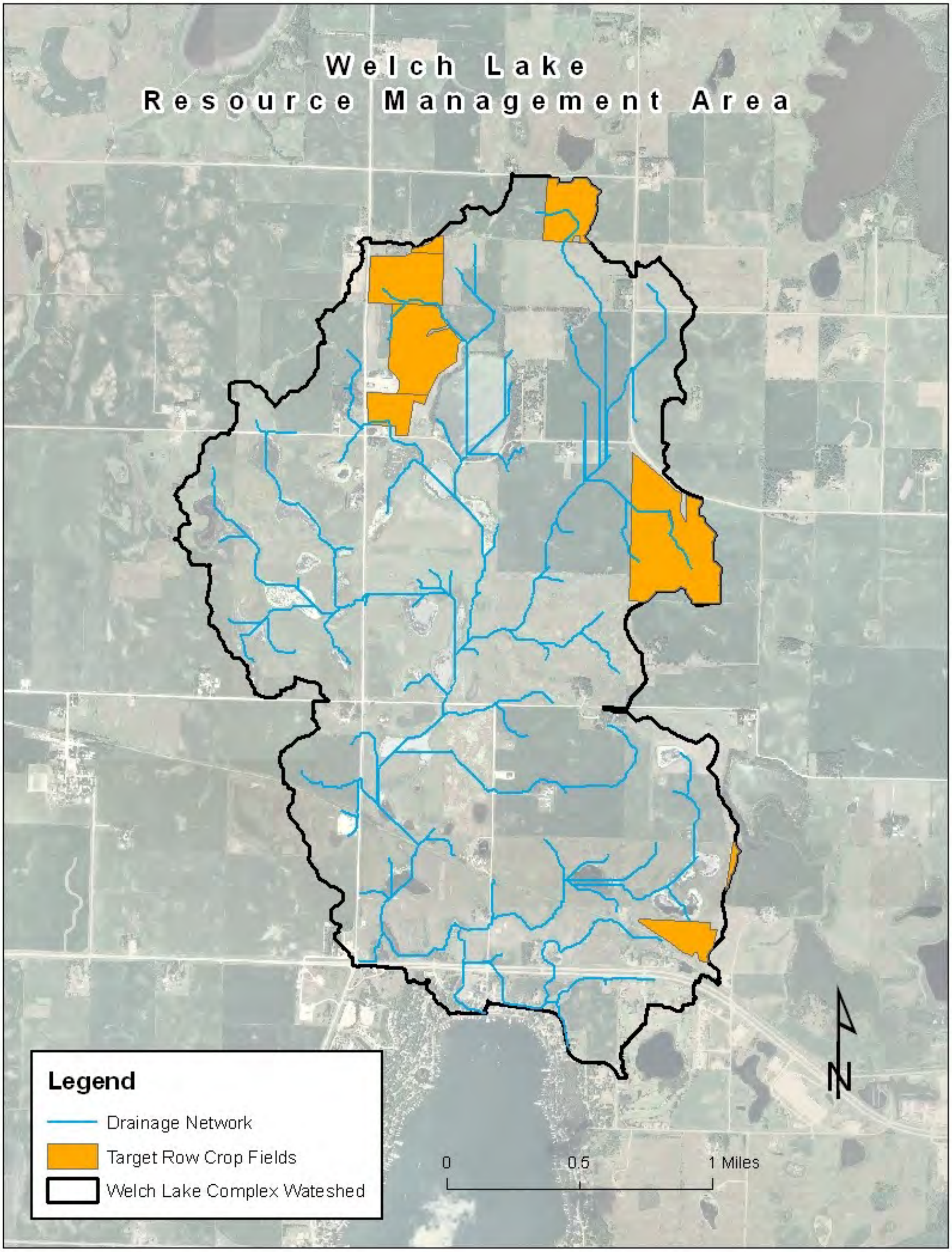

Figure 44 Welch Lake Target Row Crop Fields

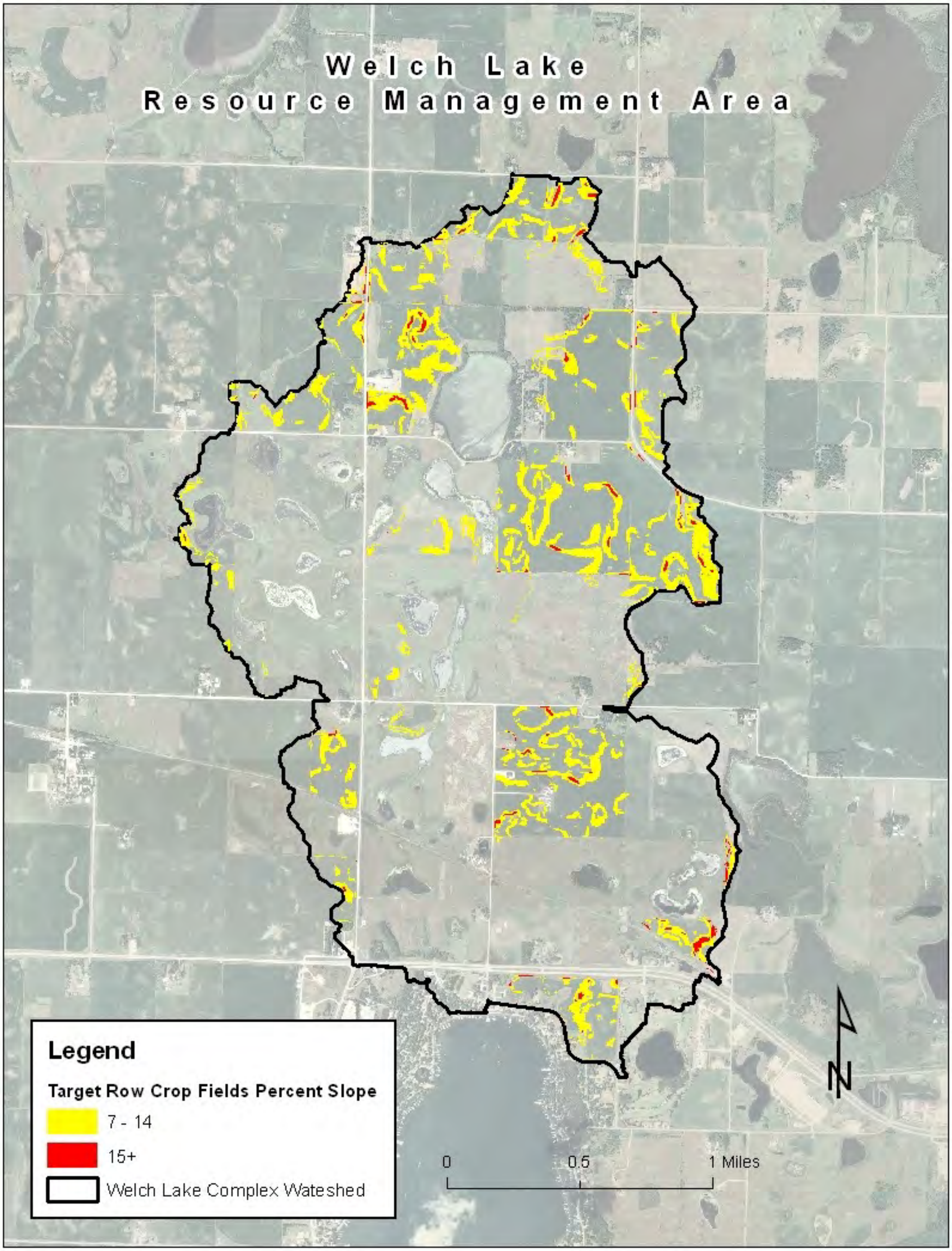

Figure 45 Welch Lake Target Row Crop Slopes

Jemmerson Slough Resource Management Area (RMA)

Objective **–** Prevent heavy sediment loaded water reaching West Okoboji Lake via the ephemeral stream from the Jemmerson Slough Wildlife Complex. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's.

Description **–** This watershed has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. It represents approximately 16% of the watershed of West Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to West Okoboji Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both cultural practices and soil erosion control practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing the following plan.

Restoration Planning Components

<u>Phosphorus Management</u>
A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 223.5 pounds of Phosphorus from entering West Okoboji Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

<u>Land Use Change</u>
A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 1,614.4 pounds of Phosphorus from entering West Okoboji Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

<u>Edge of Field</u>
A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 872.8 pounds of Phosphorus from reaching West Okoboji Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

<u>Shallow Lake Treatment</u>
Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 358.9 pounds of Phosphorus from entering West Okoboji Lake.

<u>Education</u>
An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

<u>Monitoring</u>
Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Jemmerson Slough Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				9%	$11,860	$0	223.5	-$50	$0	-$800	24	-$33.33
1.1	Conservation Tillage	SWCD	220		36%	-$220		22.02	-$10	$0	-$800	24	-$33.33
1.2	No-Till System	SWCD	100		0%	$1,200		35.49	$34	$0	$0	-	$0.00
1.3	P-Rate Reduction	SWCD	320		0%	-$3,520		20.38	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	320		0%	$14,400		145.60	$99	$0	$0	-	$0.00
2	**Land Use Change**				11%	$0	$209,900	1,614.4	$0	$665	$67,200	$13	$5,169
2.1	Grassed Waterway	SWCD		800	0%		$2,000	461.30	$0	$4	$0	-	$0.00
2.2	Sediment Basins	SWCD		8	0%		$14,400	647.50	$0	$22			
2.3	Grade Stabilization Structure	SWCD		1	0%		$18,000	79.30	$0	$227	$0	-	$0.00
2.4	Land Retirement	SWCD		27	44%		$175,500	426.30	$0	$412	$67,200	13	$5,169.23
3	**Edge of Field**				0%	$0	$44,155	872.8	$0	$475	$0	-	$0.00
3.1	Wetland Restoration	SWCD		1	0%		$20,000	734.40	$0	$27	$0	-	$0.00
3.2	Sediment Control Practice	SWCD		2	0%		$20,000	62.00	$0	$323	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		5	0%		$1,155	46.35	$0	$25	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		10	0%		$3,000	30.00	$0	$100	$0	-	$0.00
4	**In-Lake Treatment**				0%	$15,000	$54,300	358.9	$15,000	$152	$0	$0	$0
4.1	Shoreline/bank Restoration	FISH		300	0%		$54,300	357.90	$0	$152			$0.00
4.2	Carp Reduction	FISH		1	0%	$15,000		1.00	$15,000	$0			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	$0	$0
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			
6.1.2	CLAMP	LSL			0%	$500			$500	$0			
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$43,360	$308,355	3,070			$66,400	37	$1,794.59

Table 21 Management Plan for Jemmerson Slough RMA Priority Sub-Watershed (Wills J. H., 2012)

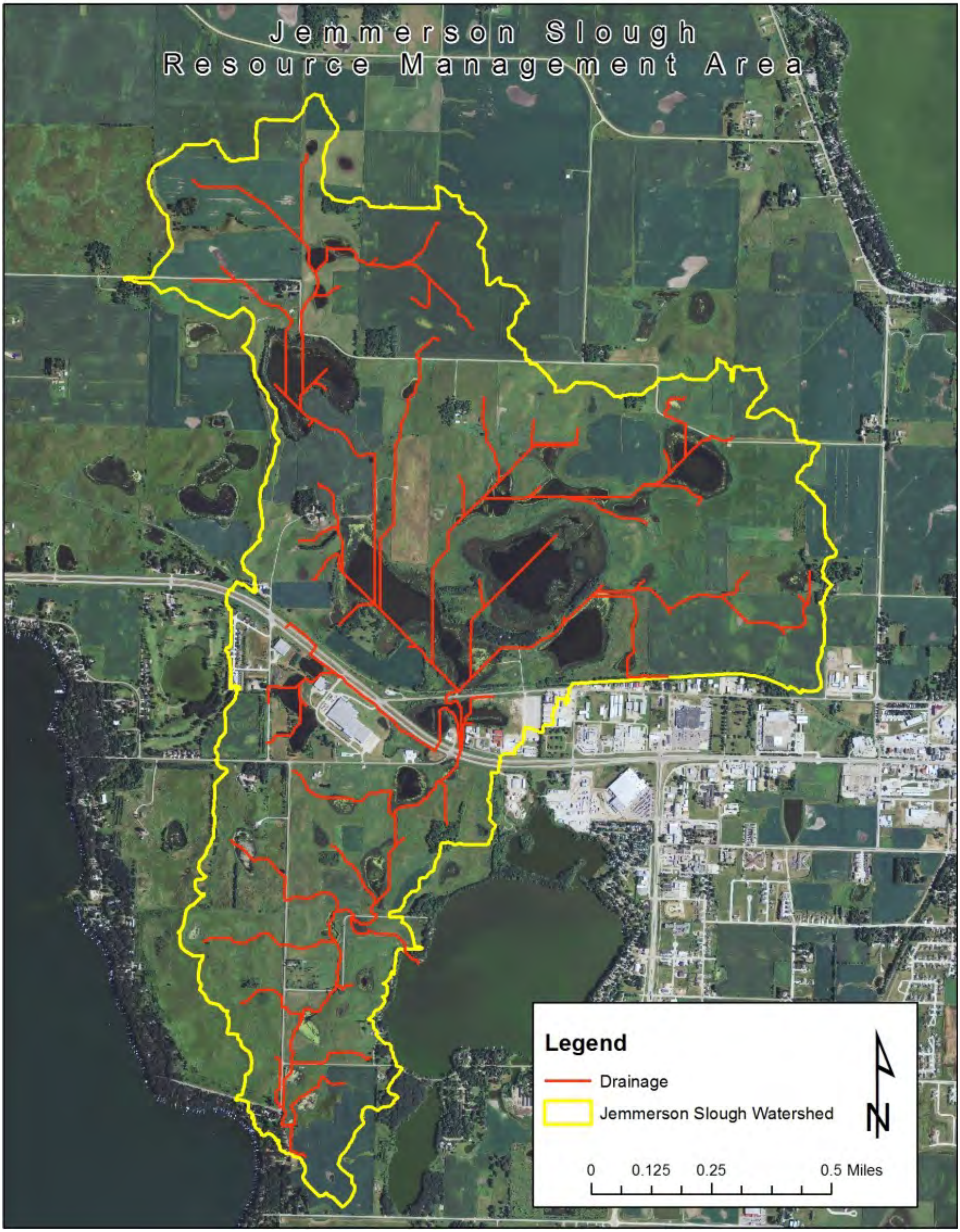

Figure 46: Jemmerson Slough Resource Management Area

Jemmerson Slough Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Area (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
762	985	Lake						58.3	210.7	3.6	1
1069	Lake							0.6	42.3	71.7	2
784	985	Lake						1.5	49.3	31.8	3
797	762	985	Lake					11.7	81.3	7.0	4
966	985	Lake						15.4	103.6	6.7	5
1124	Lake							3.5	31.7	9.0	6
983	Lake							0.6	30.2	54.9	7
903	985	Lake						2.5	17.6	7.0	8
968	Lake							1.2	18.3	15.1	9
769	784	985	Lake					8.5	22.3	2.6	10
959	966	985	Lake					2.3	66.0	28.2	11
1118	1124	Lake						1.7	15.1	9.1	12
1048	Lake							0.9	15.9	17.1	13
781	784	985	Lake					0.8	10.3	13.2	14
1172	Lake							0.6	10.7	17.8	15
883	985	Lake						6.0	17.3	2.9	16
1179	1172	Lake						1.9	5.5	3.0	17
932	968	Lake						0.9	3.7	4.4	18
879	985	Lake						0.9	4.3	4.8	19

Table 22 Wetland restoration priorities for the Welch Lake watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

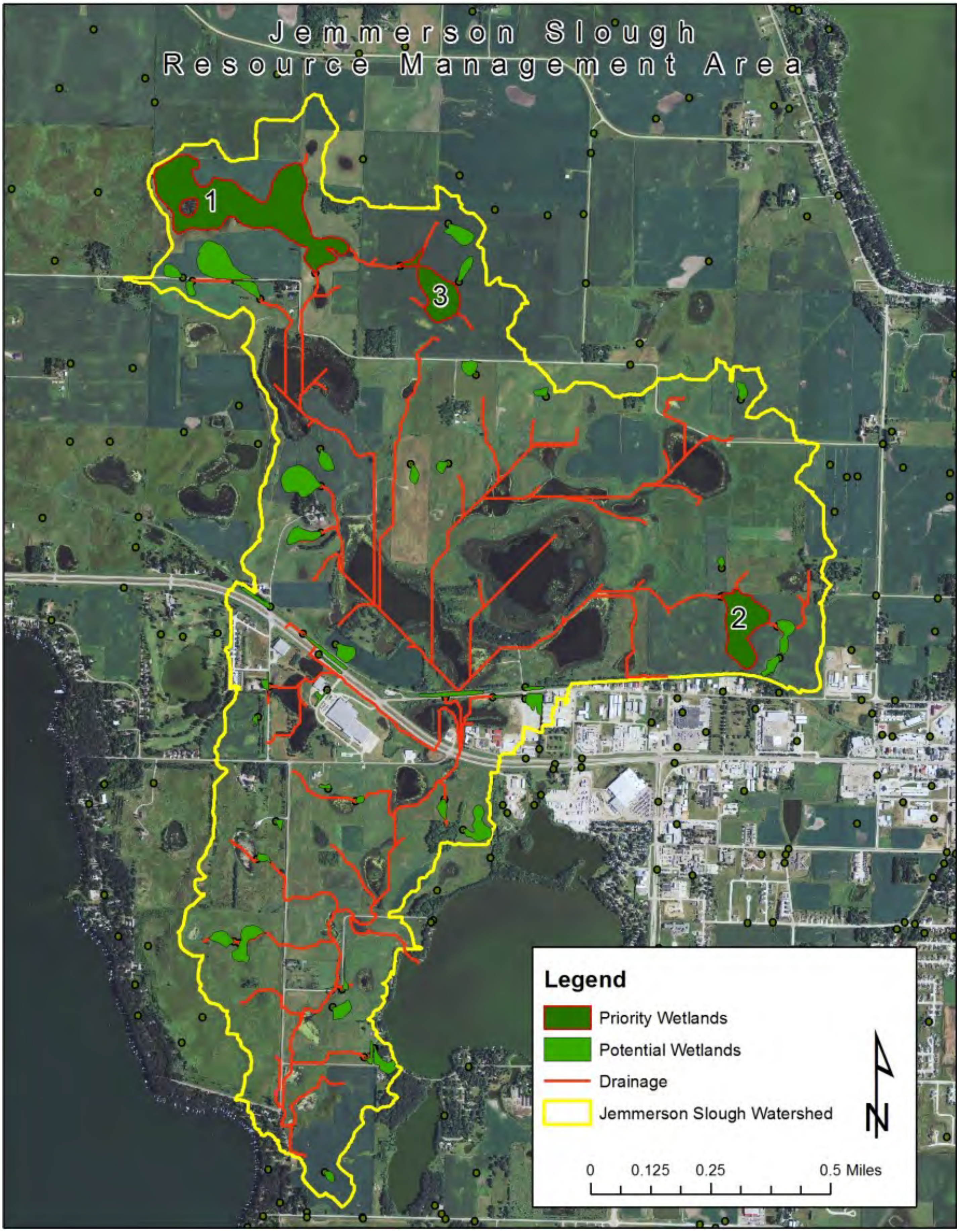

Figure 47: Jemmerson Slough Priority Wetland Areas

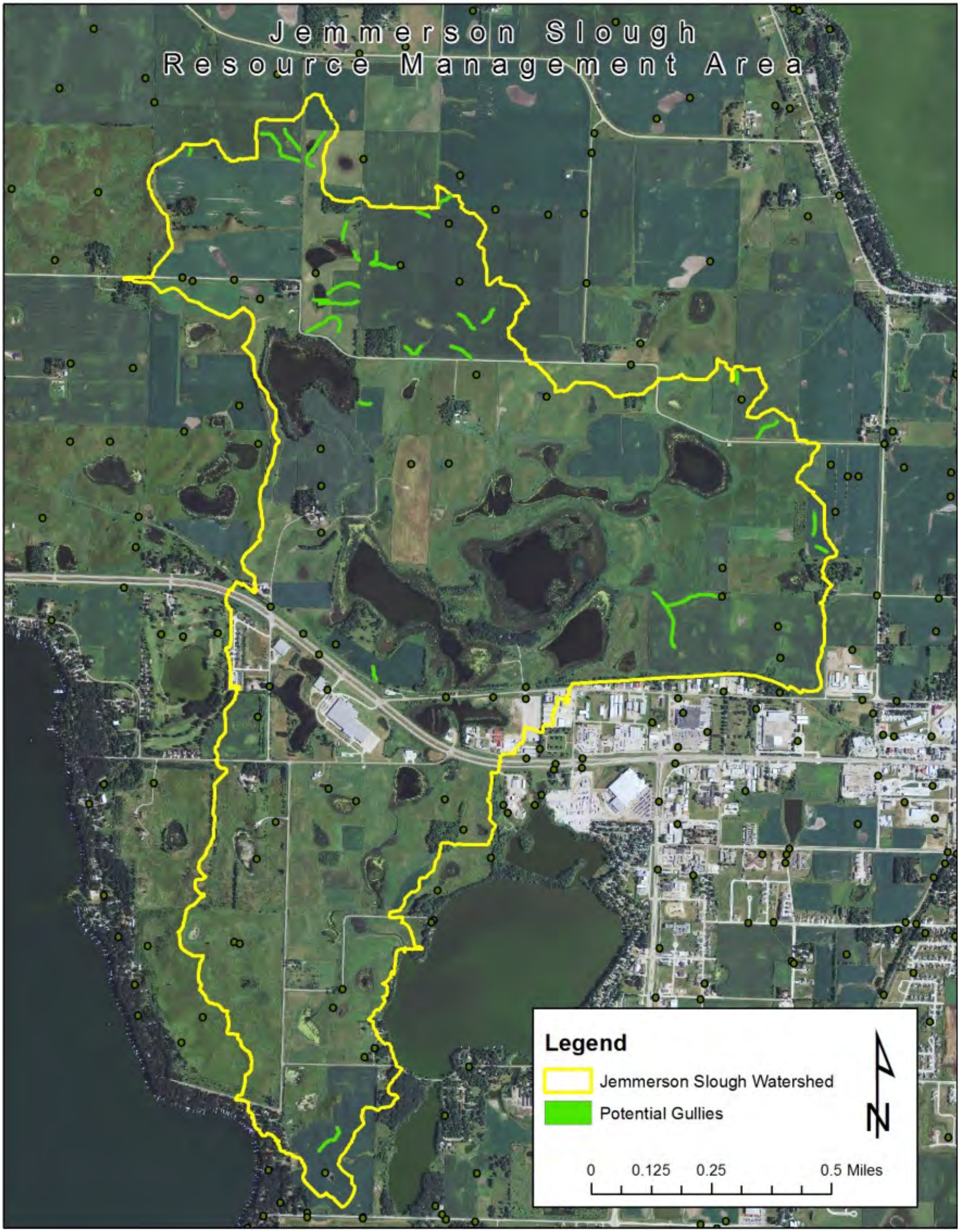

Figure 48: Jemmerson Slough Priority Gully Areas

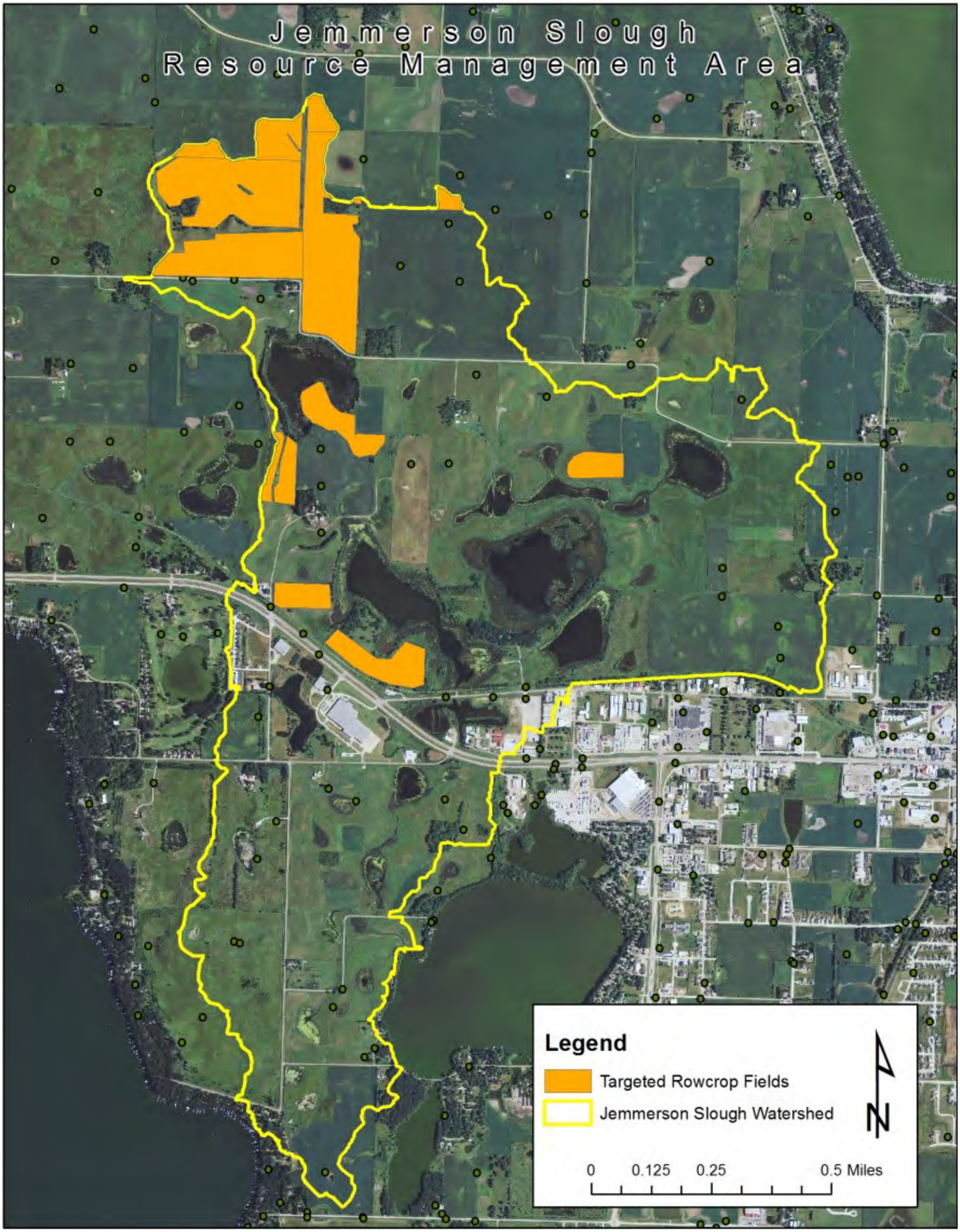

Figure 49: Jemmerson Slough RMA Priority Row Crop Areas

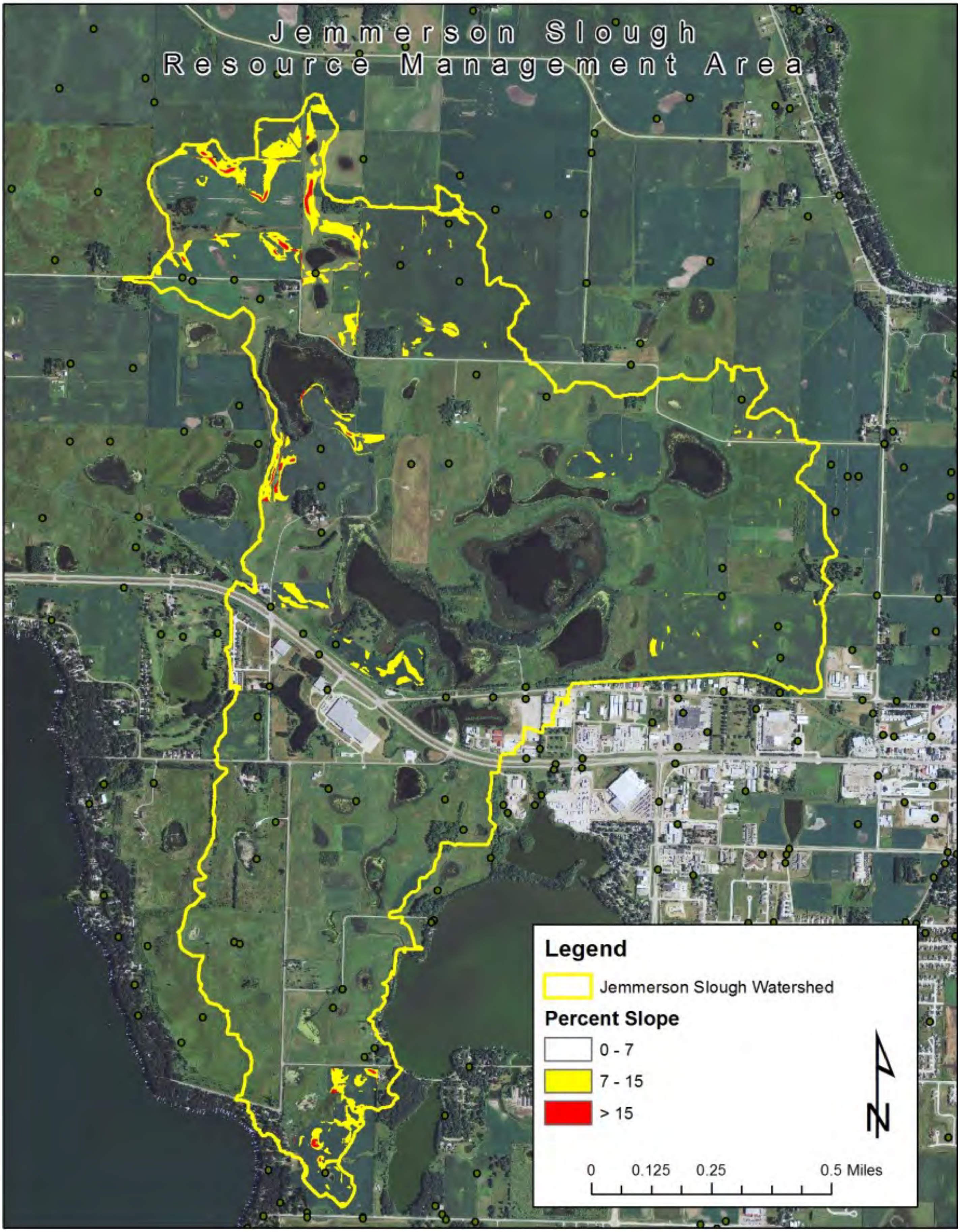

Figure 50: Jemmerson Slough RMA Priority Slope Areas

CENTER LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
280 ac	892 ac	612 ac	n/a	15	1	n/a	Yes

Lakes in the watershed of Center Lake: None

RMA's that drain to Lower Gar Lake

Direct

Center Lake RMA

Impairment for Center Lake: Center Lake was impaired on the 2016 303 (d) list approved by EPA. Center Lake is impaired due to Algal growth and Chlorophyll a for both recreational primary contact and aquatic life. A TMDL has not been written for Center Lake's impairments.

Objective – To remove the impairments for recreational primary contact and aquatic life designations. To protect the lakes Center Lake drains into directly and indirectly from getting a similar impairment caused by nutrients. Any work done in the Center Lake Watershed will assist with other lakes that Center Lake drains to indirectly. As an outstanding Iowa Waterbody, West Okoboji holds the most clean water in the state and any degradation to West Okoboji is unacceptable. Any reduction of phosphorus to Center Lake will help to remove the impairment from Lower Gar and protect and improve the lakes which Center Lake drains into.

Center Lake Resource Management Area (RMA)

***Objective* –** Restore and maintain Center Lake to a clear water system. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's. In addition, Center Lake has an impairment that will be assisted by the practices and plan that follows.

***Description* –** Center Lake has undergone many hydrological changes since the pioneers first settled the Iowa Great Lakes. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. The shift from natural drainage to a mostly urban sprawl has drastically increased the volume of water entering Center Lake via storm sewers. This huge influx of unfiltered water has a dramatic and negative impact on the water quality of the system.

Center Lake and its watershed represent nearly 18% of the watershed of West Okoboji Lake. When healthy, the shallow wetland complex and lake making up this watershed provide important protection to West Okoboji Lake. These areas also provide critical fishery and wildlife habitats. A holistic approach is needed to restore ecological health and water quality to this complex. A combination of both watershed and lake management practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing the following prioritized plan.

Restoration of the lake to a clear water system can be accomplished through processes designed to mitigate watershed alterations and the introduction of common carp. A fish barrier system should be installed at the new outlet to prevent fish migrating up to Center Lake from West Okoboji, and options should be discussed for the removal of existing carp populations in Center Lake.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 48.4 pounds of Phosphorus from entering Center Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 220.3 pounds of Phosphorus from entering Center Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 149.3 pounds of Phosphorus from reaching Center Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 358.9 pounds of Phosphorus from entering Center Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

Monitoring
Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Lake Restoration
Proper in lake management begins by controlling the movement of water and fish in/out of Center Lake. A new fish barrier (Figure 1.36) should be installed at the newly constructed outlet and water control structure. Because extensive shoreline development exists, a long term drawdown is unlikely. However, the water level should be lowered and maintained to around 6-inches below the ordinary high water level. If the lake home-owners association agrees, the lake should be lowered an additional 6-inches for a brief period of time during and/or after a large scale rough fish removal. This time when the lake is low will stimulate shoreline vegetation and firm up near shore bottom sediments. This time of lower maintained water level could occur after a natural drought time to minimize the impact on lakeshore owners.

Photo 2: No sanitary sewer Areas in the Iowa Great Lakes

Pollution Reduction
Center Lake does not have a TMDL assigned to it, but it is listed on the State's List of Impaired Waters (303 (d) list. In order to ensure the Lake and its watershed are sustainable for future years this plan requires a 273 pound reduction of phosphorous per year to be removed. This Management Plan will help meet that 273 pound goal with a reduction in phosphorous coming from the restored priority wetlands, stopping the ephemeral gullies using grassed waterways and sediment basins, conservation tillage, vegetative cover, and nutrient and pest management. In addition, rock tile intakes and vegetation around the intakes will ensure an adequate reduction of phosphorous and associated sediment. In lake vegetation will also use nutrients that are currently in the water table and prevent them from being released back into the water column and reused for algae production.

Center Lake Resource Management Area														
Clean Water Alliance						Today's Date:		2/9/2018						
	Project Lead:	John H. Wills												
	Start Date:	7/1/2012												
			Annual	Long Term										
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	Phosphorus Management				25%	$2,570	$0	48.4	0.0	-$50	$0	-$500	15	-$33.33
1.1	Conservation Tillage	SWCD	50		100%	-$50		5.01	0.0	-$10	$0	-$500	15	-$33.33
1.2	No-Till System	SWCD	20		0%	$240		7.10	0.0	$34	$0	$0	-	$0.00
1.3	P-Rate Reduction	SWCD	70		0%	-$770		4.46	0.0	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	70		0%	$3,150		31.85	0.0	$99	$0	$0	-	$0.00
2	Land Use Change				25%	$0	$100,850	220.3	0.0	$0	$2,056	$178,882	119	$1,503
2.1	Grassed Waterway	SWCD		500	0%		$1,250	32.00	0.0	$0	$39	$0	-	$0.00
2.2	Sediment Basins	SWCD		2	0%		$3,600	64.00	0.0	$0	$56			
2.3	Grade Stabilization Structure	SWCD		1	0%		$18,000	79.30		$0	$227	$0	-	$0.00
2.4	Land Retirement	SWCD		12	100%		$78,000	45.00	0.0	$0	$1,733	$178,882	119	$1,503.21
3	Edge of Field				50%	$0	$41,593	149.3	0.0	$0	$956	$85,000	244	$348.36
3.1	Wetland Restoration	SWCD		1	100%		$20,000	85.00		$0	$235	$85,000	244	$348.36
3.2	Sediment Control Practice	SWCD		2	0%		$20,000	34.00		$0	$588	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		3	100%		$693	21.30		$0	$33	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		3	0%		$900	9.00		$0	$100	$0	-	$0.00
4	In-Lake Treatment				84%	$45,000	$271,500	358.9	0.0	$45,000	$759	$382,567	$1,139	$336
4.1	Shoreline/bank Restoration	FISH		1500	100%		$271,500	357.90	0.0	$0	$759	$382,567	1,139	$335.88
4.2	Carp Reduction	FISH		3	67%	$45,000		1.00	0.0	$45,000	$0			$0.00
5	Septic Tank Renovation				0%	$150,000	$900,000	173	0.0	$150,000	$5,233	$0	-	$0.00
5.1	Plan to connect to IGLSD	SSD	1		0%	$150,000		1	0.0	$150,000	$0			
5.2	Connect to IGLSD	SSD		42	0%		$900,000	172		$0	$5,233			$0.00
5	Education					$11,000	$0	0.00	0.0	$0	$0	$0	-	$0
5.1	Radio	SWCD				$9,000								
5.2	Print	SWCD				$1,500								
5.3	Landowner Visits	SWCD				$0								
5.4	Landowner Seminar	SWCD				$500								
6	Monitoring				0%	$20,500	$0	0.0	0.0	$20,500	$0	$0	-	$0
6.1	Lake Monitoring	LSL			0%	$6,000				$6,000	$0			
6.1.1	Vegetation	SWCD			0%	$500				$500	$0			
6.1.2	CLAMP	LSL			0%	$500				$500	$0			
6.1.3	Cyanobacteria	ISU			0%	$5,000			0.0	$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			0.0	$5,000	$0			$0.00
6.3	LID Practice Samples	SWCD			0%	$3,500			0.0	$3,500	$0			$0.00
	Totals					$34,070	$1,313,943	950	0			$645,949	1,517	$425.81

Table 23 Management Plan for Center Lake RMA Priority Sub-Watershed (Wills J. H., 2012)

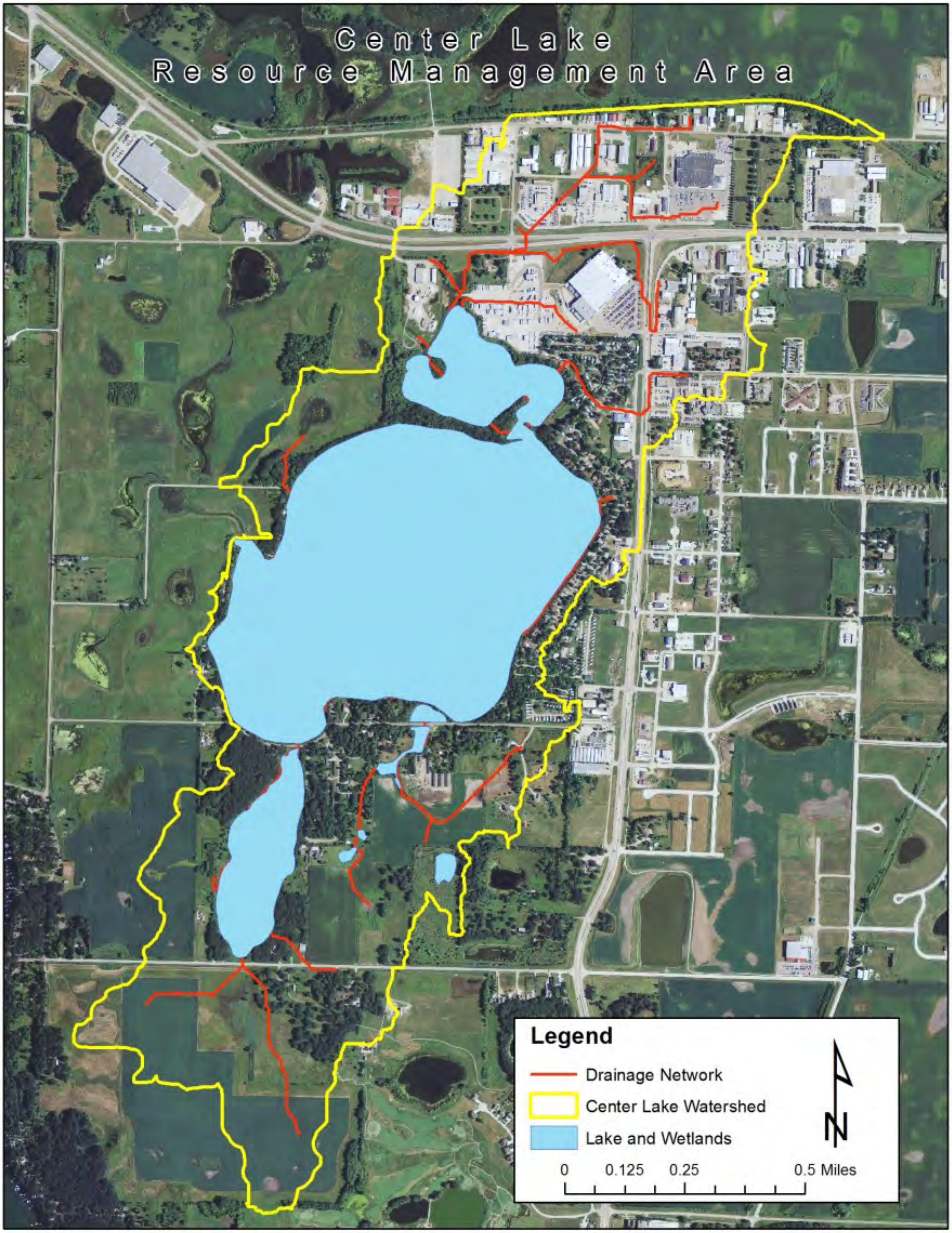

Figure 51 Center Lake Resource Management Area

Center Lake Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Area (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
1018	1031	1025	1035	1043	Lake			21.5	89.2	4.1	1
1298	Lake							20.2	77.9	3.9	2
1240	Lake							0.4	24.8	65.2	3
1254	1240	Lake						1.7	19.3	11.2	4
1201	Lake							4.0	23.6	6.0	5
1052	1031	1025	1035	1043	Lake			0.3	24.7	72.7	6
1099	Lake							0.6	25.1	39.8	7
996	1018	1031	1025	1035	1043	Lake		1.2	12.4	10.4	8
1015	1018	1031	1025	1035	1043	Lake		1.1	15.8	14.9	9
1186	1201	Lake						0.6	9.5	14.9	10
1082	Lake							0.3	18.0	53.0	11
1023	Lake							0.6	8.9	16.1	12
1249	1254	1240	Lake					0.8	8.2	10.7	13
991	996	1018	1031	1025	1035	1043	Lake	0.6	5.2	9.4	14
1268	1249	1254	1240	Lake				0.9	4.5	4.8	15
1047	1046	Lake						1.0	3.3	3.3	16

Table 24 Wetland restoration priorities for the Center Lake watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

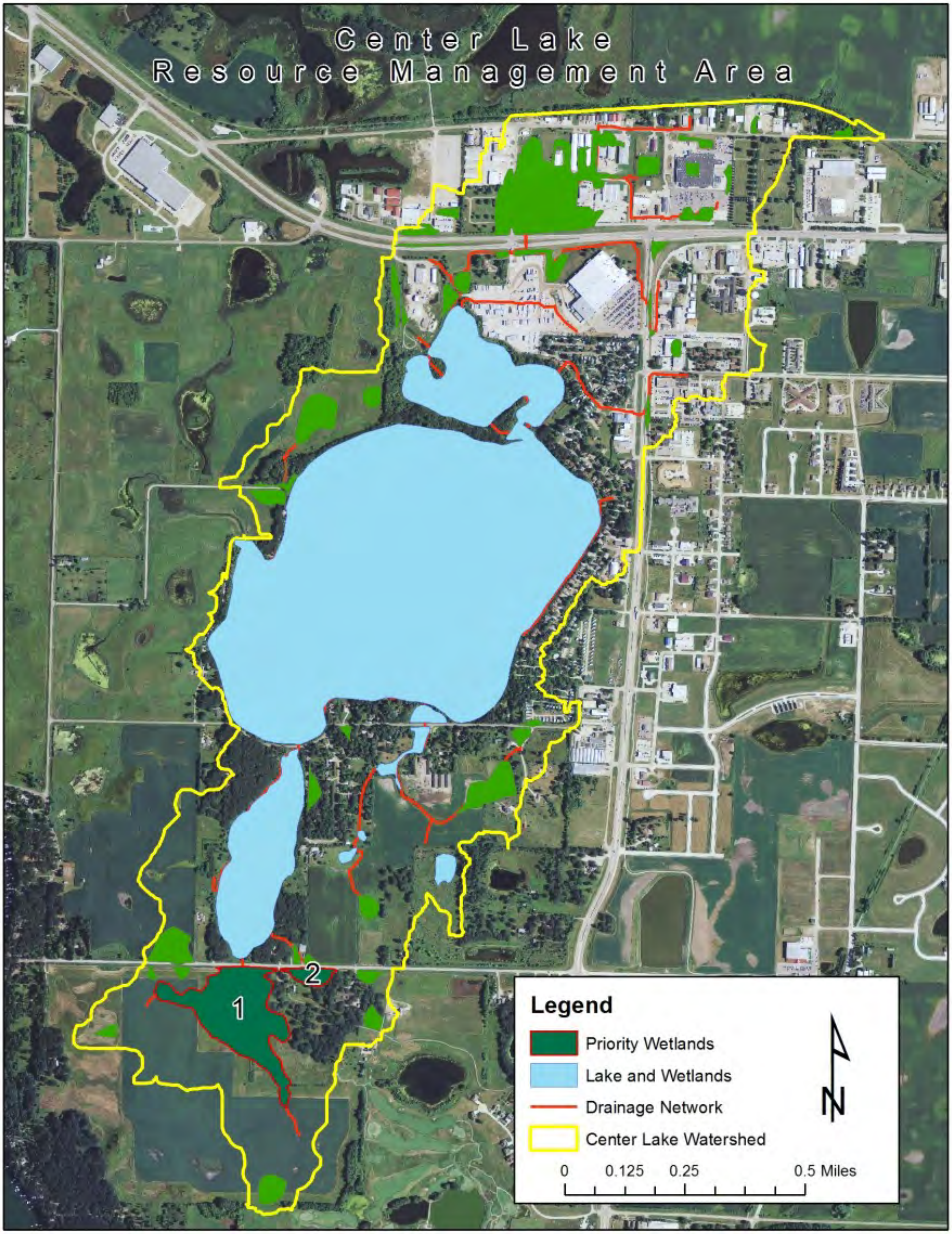

Figure 52 Center Lake Priority Wetland Restoration Sites

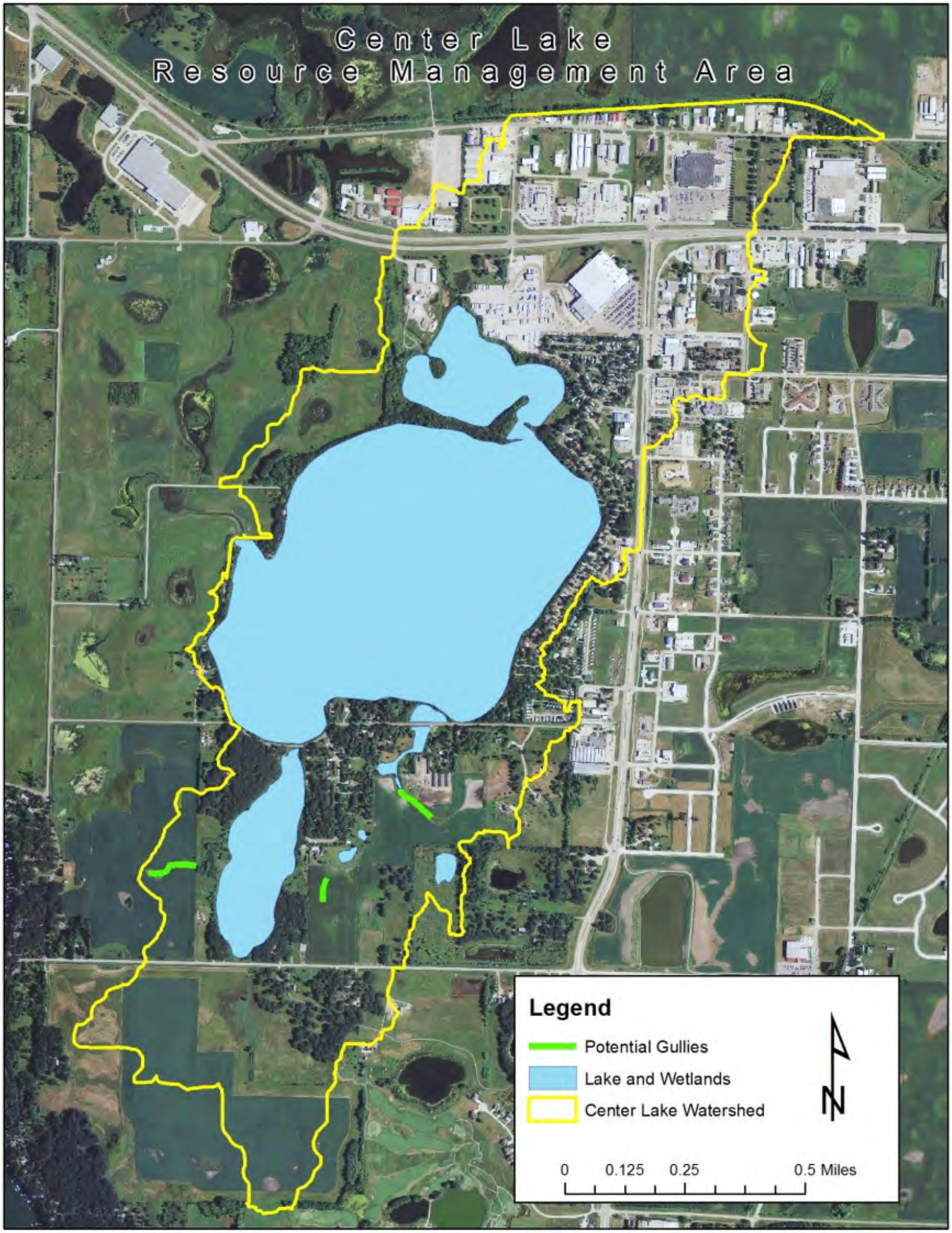

Figure 53 Center Lake Ephemeral Gullies

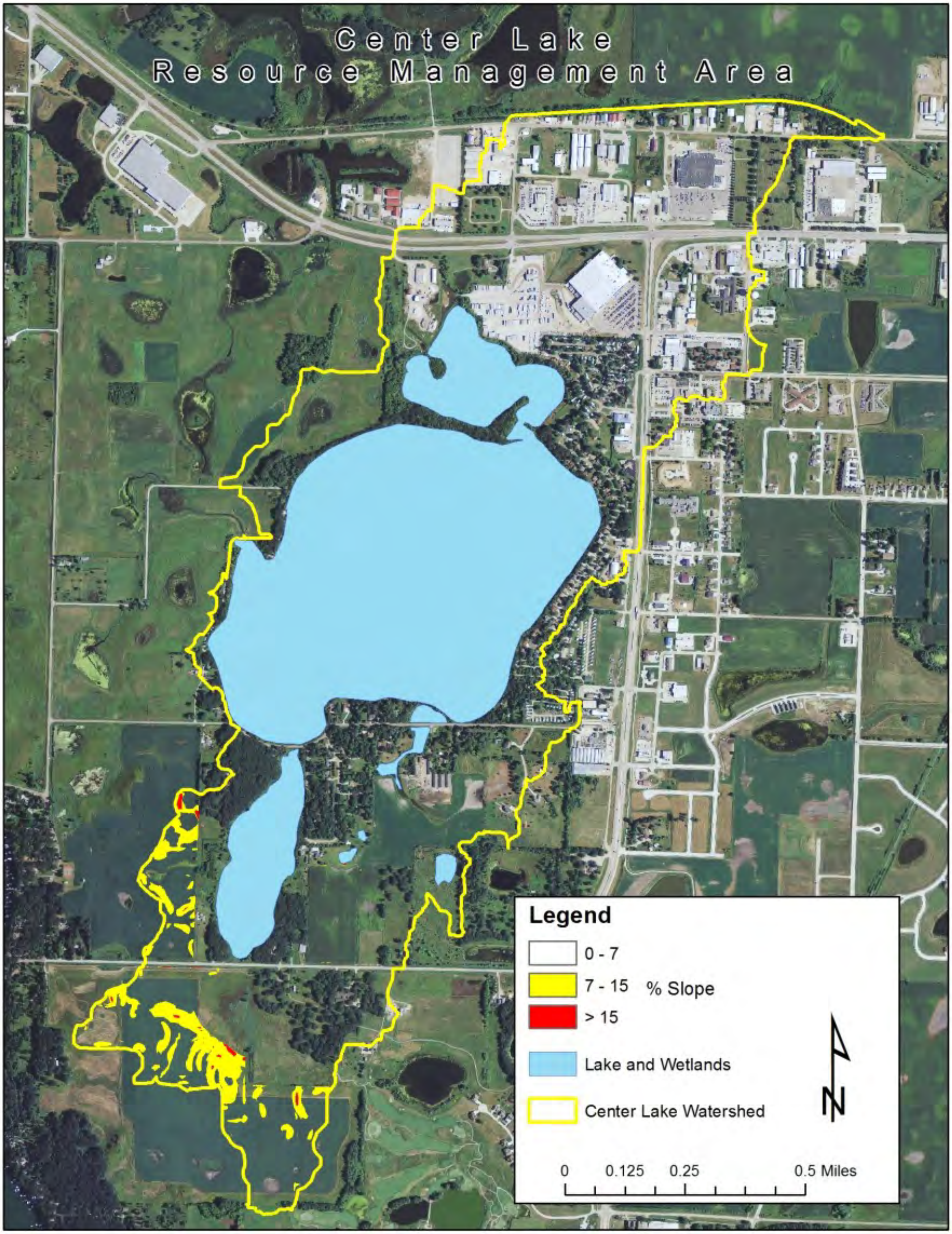

Figure 54 Center Lake Row Crop Slopes

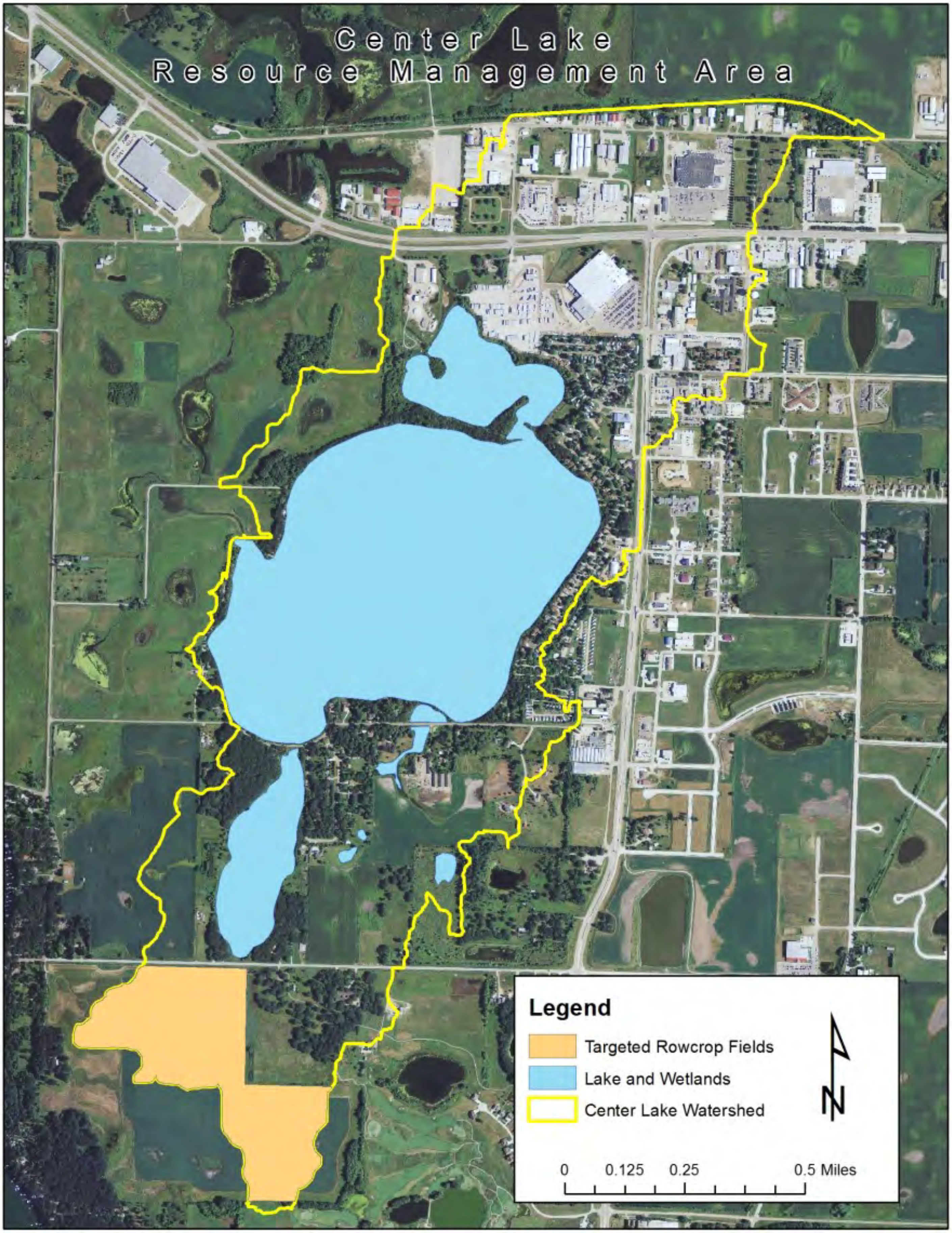

Figure 55 Center Lake Target Row Crop Fields

BIG SPIRIT LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
5,684 ac	45,661 ac	14,399 ac	25,578 ac	9	4	3	Yes

Lakes that Drain to Big Spirit Lake:

Direct
Loon Lake
Little Spirit Lake
East Hottes Lake

Indirect
Clear Lake
West Hottes Lake
Pearl Lake
Grovers Lake

RMA's to Big Spirit Lake:

Direct
Sandbar Slough RMA
Hales Slough RMA
Reeds Run RMA
Templar Lagoon RMA

Indirect
Loon Lake RMA
Little Spirit RMA
Hottes/ Marble RMA

Impairment for Big Spirit Lake: Big Spirit Lake was impaired as part of the 2016 303 (d) Impaired Waterways list by the Iowa DNR. The impairment is due to bacteria determined by beach monitoring activities. The bacteria readings that caused the impairment are specific to the monitoring done at Marble Beach Camp ground on the west shore of Big Spirit Lake.

Objective – To remove Big Spirit Lake bacteria impairments and keep the lake from becoming impaired from turbidity due to sediment loading or algae. Work done within the Big Spirit Lake Watershed to keep the lake from becoming impaired for turbidity or nuisance algae blooms will assist with impairments on Upper and Lower Gar Lakes. As an outstanding Iowa Waterbody any degradation of this lake is unacceptable. Finally any reduction of Phosphorus entering Big Spirit Lake will help to remove the impairment from Lower Gar Lake and improve the other lakes which Big Spirit Lake flows into such as East Okoboji, West Okoboji, Upper Gar Lake, and Minnewashta Lake.

Sandbar Slough Resource Management Area (RMA)

Objective – Restore and maintain Sandbar Slough to a functional wetland system with the capability to remove sediment and nutrients. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's.

Description – Sandbar Slough has undergone many hydrological changes since the pioneers first settled the Iowa Great Lakes. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. Active grazing along the shoreline and direct access of cattle to the slough has further degraded this system. The Sandbar Slough watershed represents nearly 23% of the watershed of Big Spirit Lake. When healthy, the shallow wetland complex making up the Sandbar watershed provides important watershed protection to Big Spirit Lake. These areas also provide critical fishery and wildlife habitats. A holistic approach is needed to restore ecological health and water quality to this complex. A combination of both cultural and soil erosion practices is needed to reach the project objective.

Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing a prioritized plan through augmentation of existing landowner conservation programs, easements, and public acquisitions. Restoration of the lake to a clear water system can be accomplished through processes designed to mitigate watershed alterations and the introduction of common carp. To simulate natural drought conditions, managed water level draw downs are needed to stimulate growth of emergent aquatic vegetation and reduce or eliminate common carp populations.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 223.5 pounds of Phosphorus from entering Big Spirit Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, grazing management, and land retirement will prevent approximately 1,614.4 pounds of Phosphorus from entering Big Spirit Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 872.8 pounds of Phosphorus from reaching Big Spirit Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 358.9 pounds of Phosphorus from entering Big Spirit Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this RMA but will be done in a way that anyone can use the information.

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Lake Restoration

Proper in lake management begins by controlling the movement of water and fish in/out of Sandbar Slough. A new fish barrier (Figure 1.53) and water control structure should be constructed between Sandbar Slough and Big Spirit Lake to help control the movement of common carp into the slough. An electric water control structure and drain pipe should be placed at the outlet of the slough to allow for periodic draw downs that mimic historic drought conditions that are no longer occurring due to watershed changes. These water level fluctuations will allow managers to control fisheries populations and promote natural and diverse vegetation communities that benefit both fisheries and wildlife interests.

Once control structures are in place, an initial extended drawdown should occur in order to firm up near shore bottom sediments and promote extensive plant growth before water levels are allowed to return. This drawdown will also allow managers to apply chemical treatments to completely eliminate any existing fishery. Once water levels are allowed to return, natural fish communities should reintroduce themselves to the system via the outlet to the lake. Supplemental stocking of advanced northern pike fingerlings right after water levels return would help intercept any young common carp that move into the system immediately after renovation. A long term management plan should be developed between fish and wildlife professionals that outline the criteria and plan for dewatering this basin in order to maintain a balanced ecosystem.

Sandbar Slough Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				10%	$77,100	$0	1,452.4	-$50	$0	-$3,800	246	-$20.83
1.1	Conservation Tillage	SWCD	1500		20%	-$1,500		150.15	-$10	$0	-$5,000	150	-$33.33
1.2	No-Till System	SWCD	600		20%	$7,200		212.94	$34	$0	$1,200	96	$12.50
1.3	P-Rate Reduction	SWCD	2100		0%	-$23,100		133.77	-$173	$0	$0	0	$0.00
1.4	Cover Crop	SWCD	2100		0%	$94,500		955.50	$99	$0	$0	0	$0.00
2	**Land Use Change**				6%	$0	$1,401,550	6,987.8	$0	$613	$33,124	117	$283
2.1	Grassed Waterway	SWCD		7500	0%		$18,750	1557.00	$0	$12	$0	0	$0.00
2.2	Sediment Basins	SWCD		26	23%		$46,800	1875.00	$0	$25	$33,124	117	$283.11
2.3	Grade Stabilization Structure	SWCD		2	0%		$36,000	189.30	$0	$190	$0	0	$0.00
2.4	Land Retirement	SWCD		200	0%		$1,300,000	3366.50	$0	$386	$0	0	$0.00
3	**Edge of Field**				0%	$0	$110,248	3,163.9	$0	$555	$0	0	$0.00
3.1	Wetland Restoration	SWCD		3	0%		$60,000	2856.00	$0	$21	$0	0	$0.00
3.2	Sediment Control Practice	SWCD		4	0%		$40,000	95.30	$0	$420	$0	0	$0.00
3.3	Vegetative Buffer	SWCD		8	0%		$1,848	128.60	$0	$14	$0	0	$0.00
3.4	Tile Intake Treatment	SWCD		28	0%		$8,400	84.00	$0	$100	$0	0	$0.00
4	**In-Lake Treatment**				0%	$0	$159,800	257.3	$0	$15,565	$0	0	$0
4.1	Shoreline/bank Restoration	FISH		800	0%		$144,800	256.30	$0	$565			$0.00
4.2	Carp Reduction	FISH		1	0%	$0	$15,000	1.00	$0	$15,000			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	0	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	0	$0
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$108,600	$1,671,598	11,861			$29,324	363	$81

Table 25 Management Plan for Sandbar Slough RMA Priority Sub-Watershed (Wills J. H., 2012)

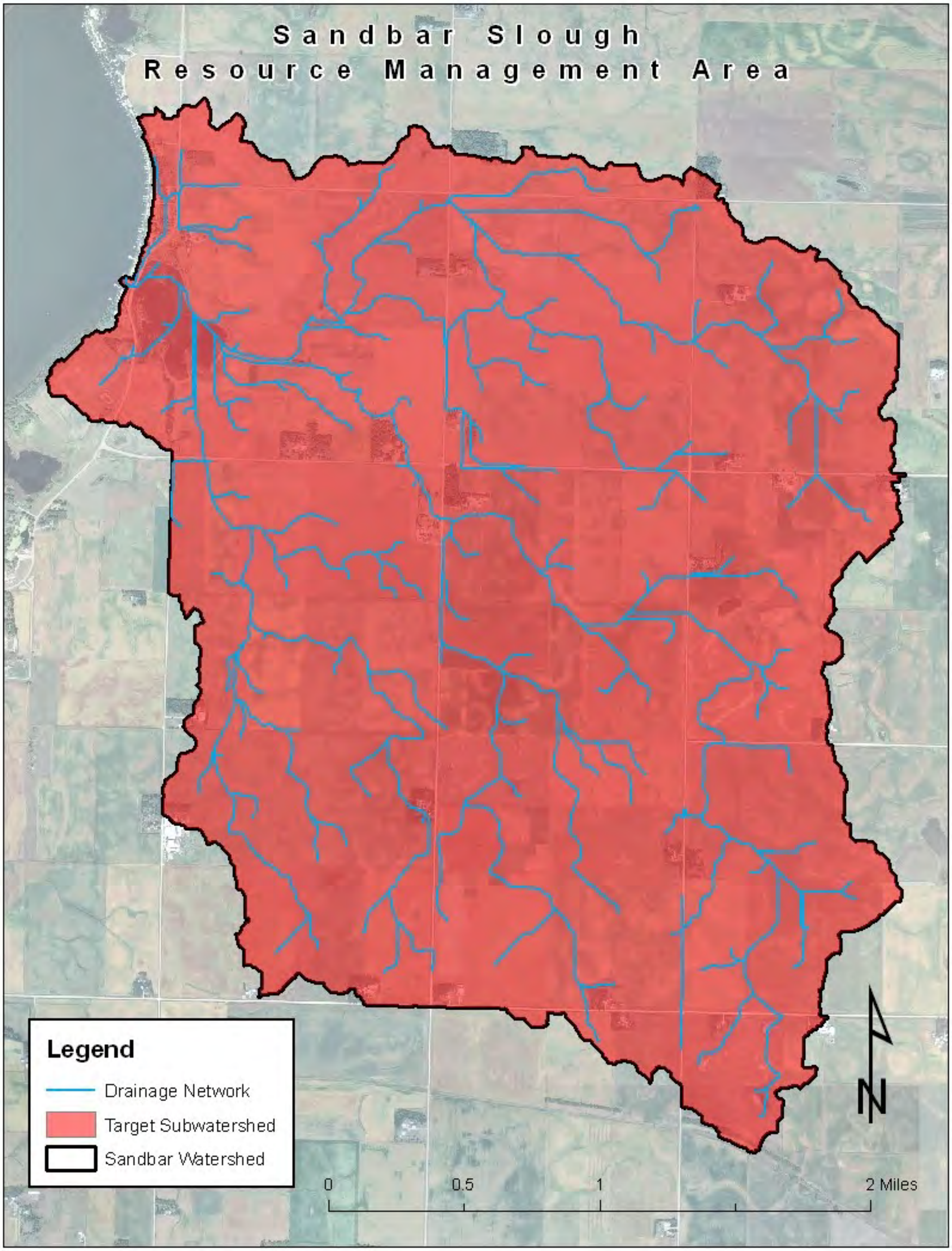

Figure 56 Sandbar Slough Resource Management Area

Sandbar Slough Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
665	596	Lake						120.6	947.9	7.9	1
532	528	549	Lake					75.1	1,221.9	16.3	2
749	713	698	665	596	Lake			32.2	354.8	11.0	3
559	550	532	528	549	Lake			20.5	346.3	16.9	4
582	559	550	532	528	549	Lake		36.6	184.4	5.0	5
702	689	Lake						4.5	222.3	49.4	6
547	539	532	528	528	549	Lake		7.1	196.5	27.8	7
604	582	559	550	532	528	549	Lake	34.3	69.0	2.0	8
785	642	612	596	Lake				18.4	138.9	7.5	9
600	543	545	532	528	549	Lake		46.0	81.8	1.8	10
600	543	545	532	528	549	Lake		46.0	81.8	1.8	10
574	547	539	532	528	549	Lake		9.4	97.4	10.4	12
760	724	702	689	Lake				18.8	76.8	4.1	13
800	749	713	698	665	596	Lake		3.8	85.2	22.1	14
819	800	749	713	698	665	596	Lake	6.9	74.8	10.8	15
531	549	Lake						3.6	76.2	21.3	16
533	532	528	549	Lake				4.9	73.4	14.9	17
523	531	549	Lake					2.3	55.4	24.4	18
585	574	547	539	532	528	549	Lake	1.8	64.2	34.9	19
527	Lake							6.4	157.9	24.7	20
513	527	Lake						7.9	145.4	18.4	21
518	523	531	549	Lake				9.1	39.4	4.3	22
739	749	713	698	665	596	Lake		6.8	24.3	3.6	23
556	547	539	532	528	549	Lake		1.6	65.8	40.9	24
735	642	612	596	Lake				7.2	47.1	6.5	25
688	Lake							1.1	41.6	38.2	26
703	688	Lake						9.8	29.8	3.1	27
772	760	724	702	689	Lake			0.4	25.5	70.9	28
763	719	Lake						13.8	56.8	4.1	29
778	785	642	612	596	Lake			11.5	28.9	2.5	30

Table 26 Wetland restoration priorities for the Sandbar Slough watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

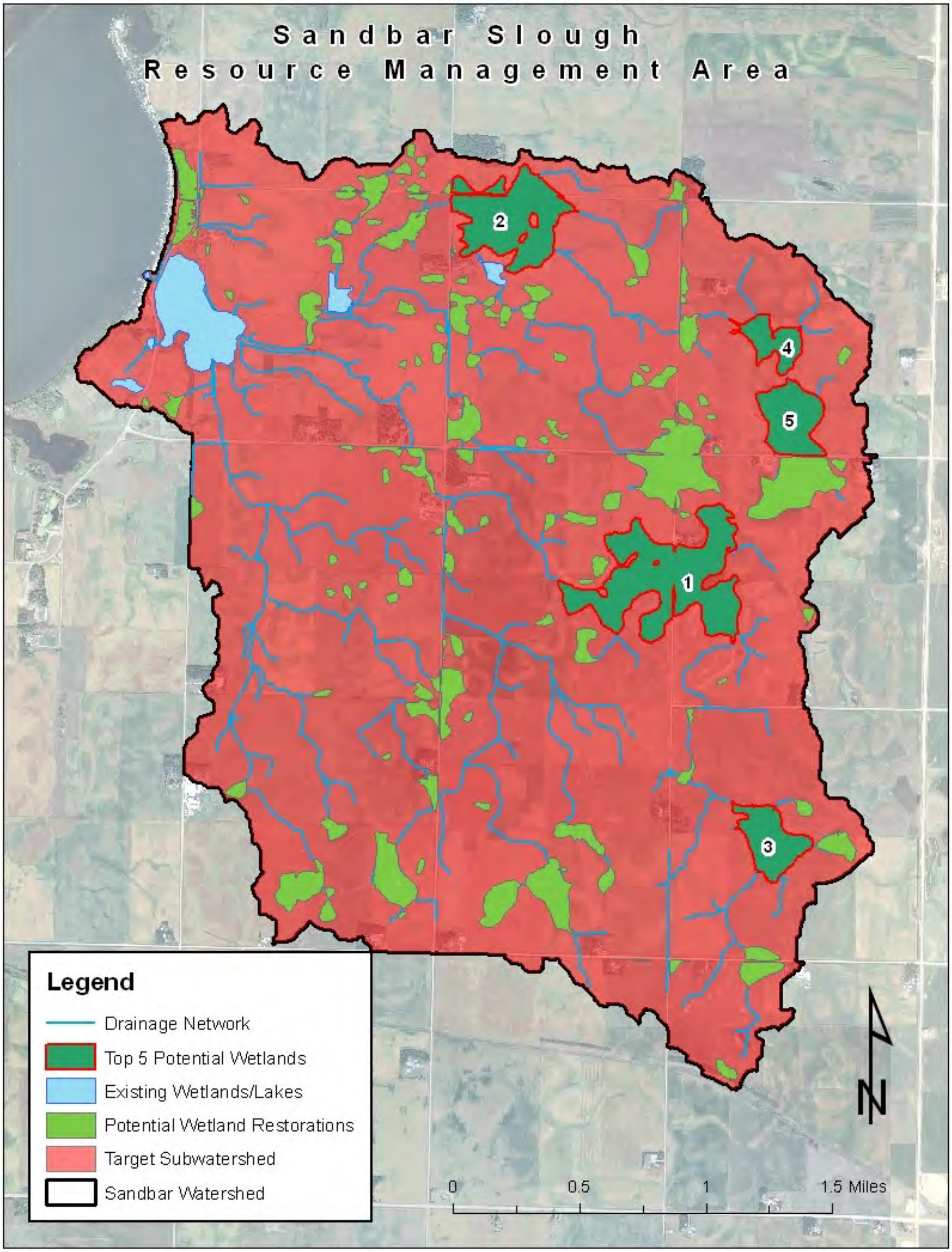

Figure 57 Sandbar Slough Priority Wetland Restorations

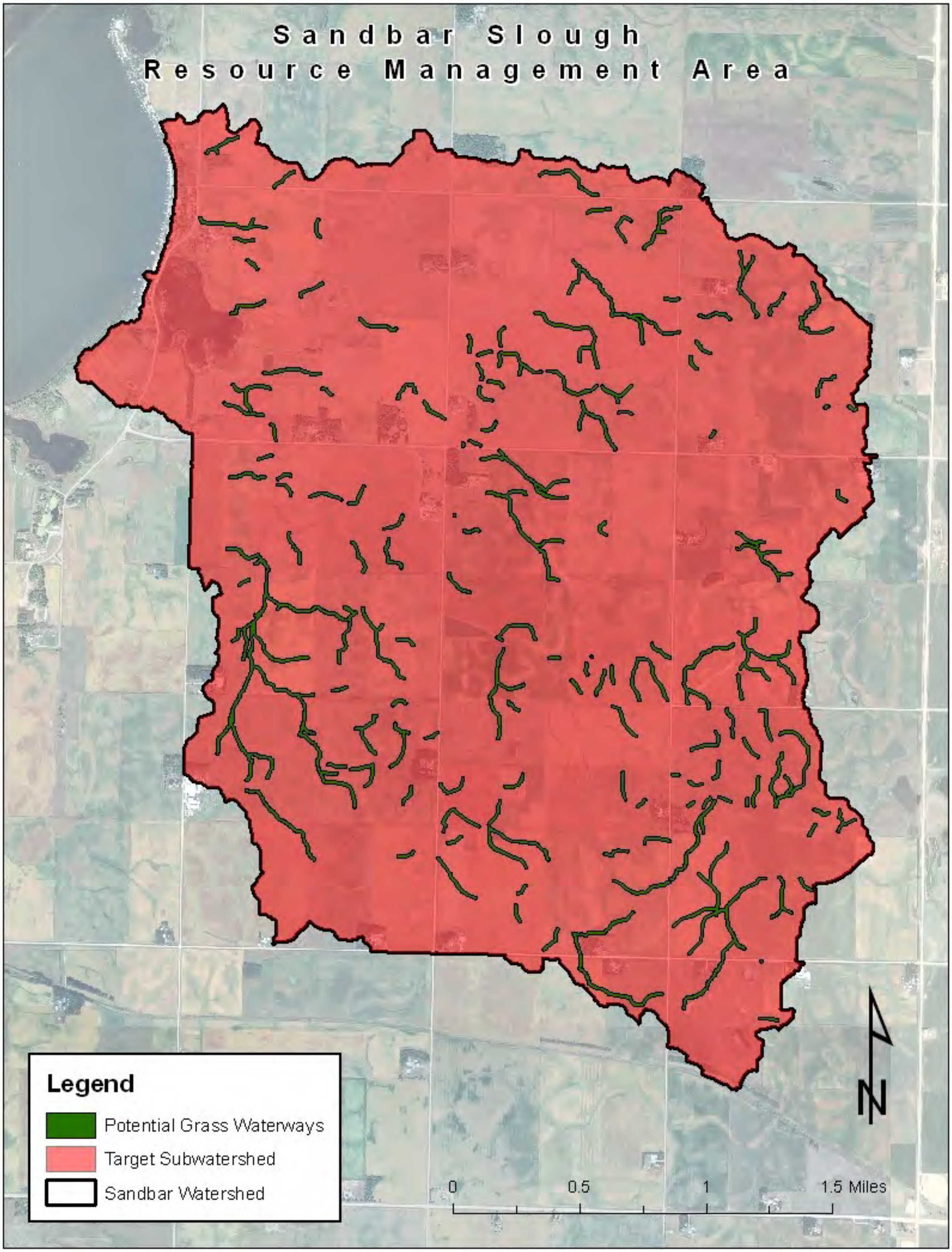

Figure 58 Sandbar Slough Ephemeral Gullies

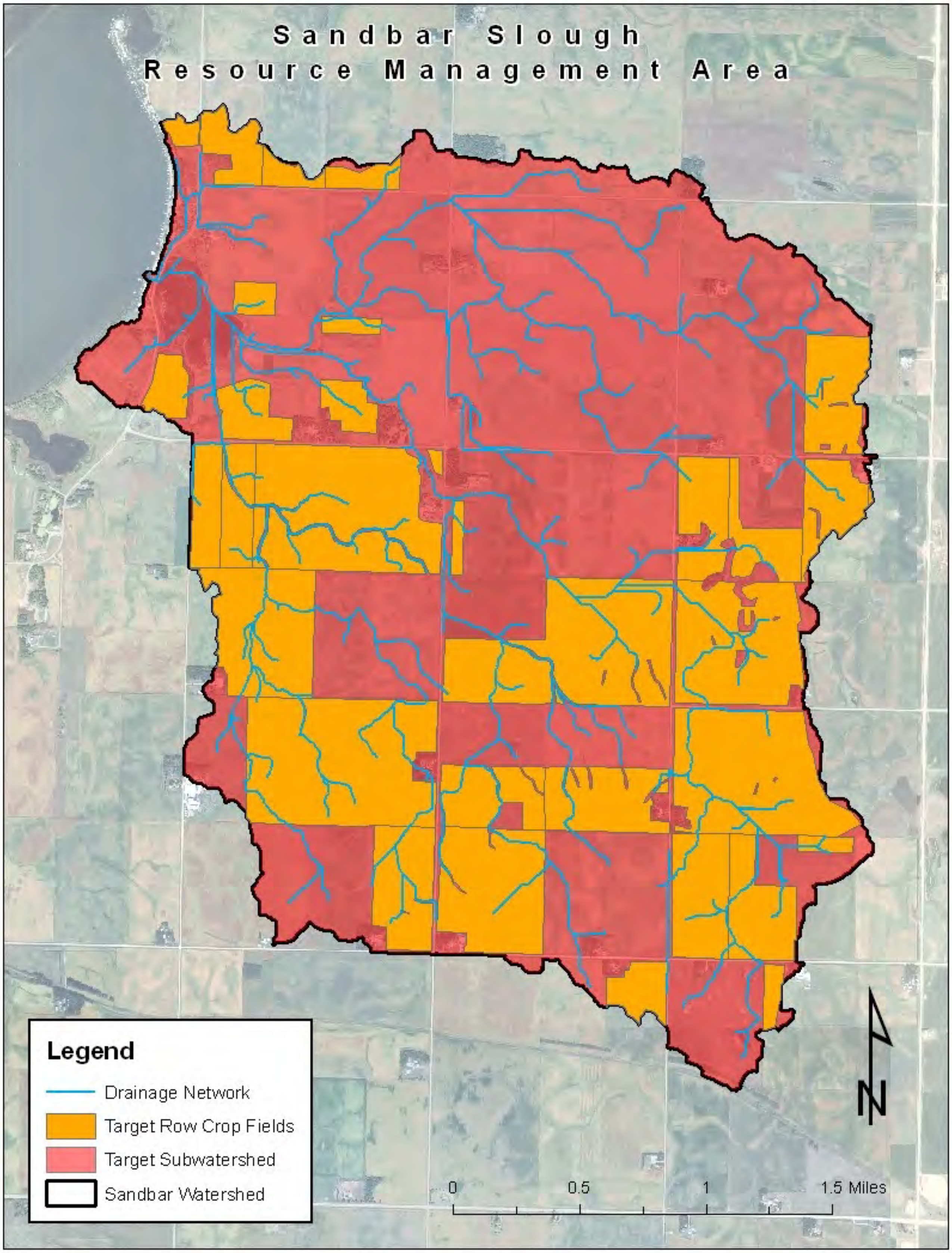

Figure 59 Sandbar Slough Target Row Crop Areas

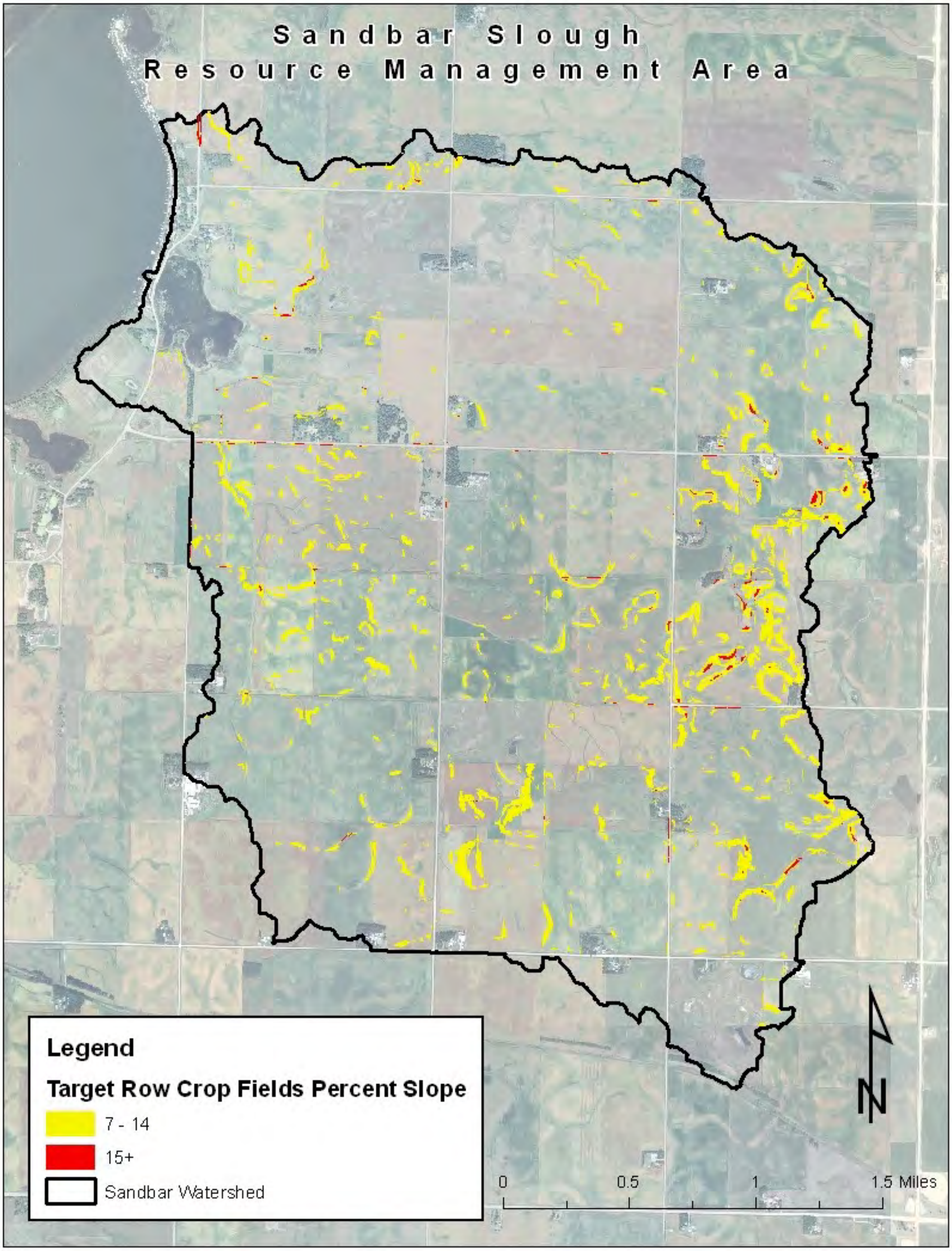

Figure 60 Sandbar Slough Target Row Crop Slopes

Figure 61 Sandbar Slough Fish Barrier Location

Hales Slough Resource Management Area (RMA)

Objective – Restore and maintain Hales Slough to a clear water system. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake (3,300 pounds per year) and Lower Gar Lake (6,100 per year) in accordance with their specific approved TMDL's.

Description – Major changes in hydrology within the watershed of this complex along with the introduction of common carp have led to slow degradation of water. Submersed aquatic vegetation has nearly disappeared within Hales Slough.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 223.5 pounds of Phosphorus from entering Big Spirit Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 1,614.4 pounds of Phosphorus from entering Big Spirit Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 872.8 pounds of Phosphorus from reaching Big Spirit Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 358.9 pounds of Phosphorus from entering Big Spirit Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this

RMA but will be done in a way that anyone can use the information.

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Hales Slough and its associated watershed represent approximately 3% of the watershed of Big Spirit Lake. When healthy, this wetland complex provides important watershed protection to Big Spirit Lake. These areas also provide critical fishery and wildlife habitats. A holistic approach is needed to restore ecological health and water quality to this complex. A combination of both watershed and lake management practices is needed to reach the project objective.

Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing a prioritized plan through augmentation of existing landowner conservation programs, easements, and public acquisitions. Restoration of the lake to a clear water system can be accomplished through processes designed to mitigate watershed alterations and the introduction of common carp.

Lake Restoration

Proper in lake management begins by controlling the movement of water and fish in/out of Hales Slough. A new fish barrier should be constructed at the outlet of Hales Slough in order to prevent the movement of common carp into the slough (Figure 1.62).

Once the fish barrier is in place, a chemical treatment should be applied during late fall in order to eliminate any adult carp still remaining in the slough. The following spring, natural fish communities will return to spawn via the natural connection to Big Spirit Lake. A long term management plan should be developed between fish and wildlife professionals that outline the criteria and plan for chemically controlling the fishery in order to maintain a balanced ecosystem.

Hales Slough Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				19%	$17,285	$0	326.3	-$50	$0	$400	30	$50.00
1.1	Conservation Tillage	SWCD	245		24%	-$245		24.52	-$10	$0	-$600	18	-$33.33
1.2	No-Till System	SWCD	200		50%	$2,400		70.98	$34	$0	$1,000	12	$83.33
1.3	P-Rate Reduction	SWCD	445		0%	-$4,895		28.35	-$173	$0	$0	0	$0.00
1.4	Cover Crop	SWCD	445		0%	$20,025		202.48	$99	$0	$0	0	$0.00
2	**Land Use Change**				25%	$0	$267,800	4,264.6	$0	$336	$151,200	148	$1,022
2.1	Grassed Waterway	SWCD		3800	0%		$9,500	1135.80	$0	$8	$0	0	$0.00
2.2	Sediment Basins	SWCD		26	0%		$46,800	1074.20	$0	$44			
2.3	Grade Stabilization Structure	SWCD		2	0%		$36,000	189.30	$0	$190	$0	0	$0.00
2.4	Land Retirement	SWCD		27	100%		$175,500	1865.30	$0	$94	$151,200	148	$1,021.62
3	**Edge of Field**				0%	$0	$90,248	1,287.1	$0	$565	$0	0	$0.00
3.1	Wetland Restoration	SWCD		2	0%		$40,000	976.30	$0	$41	$0	0	$0.00
3.2	Sediment Control Practice	SWCD		4	0%		$40,000	97.30	$0	$411	$0	0	$0.00
3.3	Vegetative Buffer	SWCD		8	0%		$1,848	128.60	$0	$14	$0	0	$0.00
3.4	Tile Intake Treatment	SWCD		28	0%		$8,400	84.90	$0	$99	$0	0	$0.00
4	**In-Lake Treatment**				0%	$0	$159,800	257.3	$0	$15,565	$0	0	$0
4.1	Shoreline/bank Restoration	FISH		800	0%		$144,800	256.30	$0	$565			$0.00
4.2	Carp Reduction	FISH		1	0%	$0	$15,000	1.00	$0	$15,000			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	0	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	0	$0
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$48,785	$517,848	6,135			$151,600	178	$852

Table 27 Management Plan for Hales Slough RMA Priority Sub-Watershed (Wills J. H., 2012)

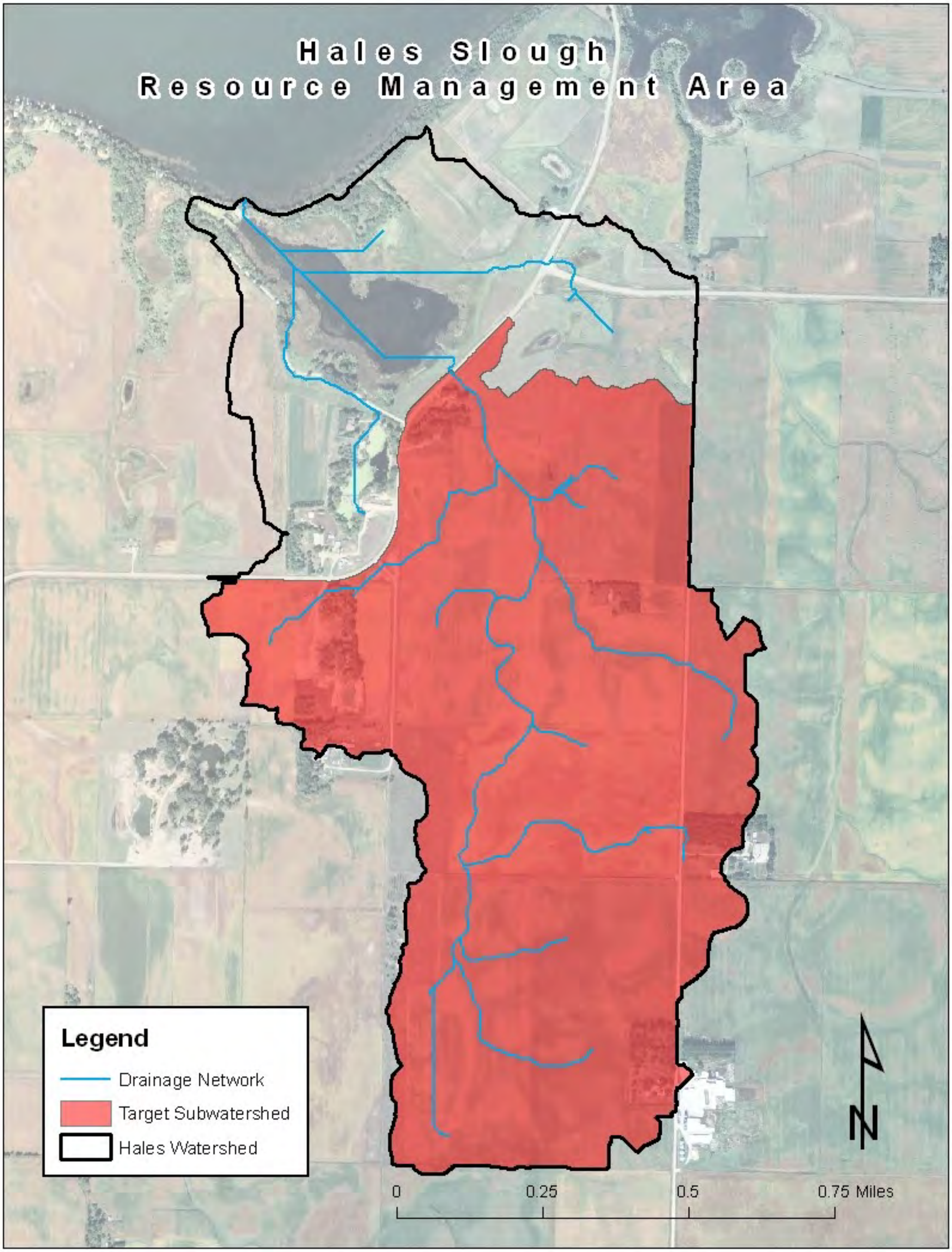

Figure 62 Hales Slough Resource Management Area

Hales Slough Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
721	615	Lake					11.5	28.4	2.5	1
592	Lake						0.9	58.7	63.8	2
625	615	Lake					1.1	49.5	45.9	3
650	625	615	Lake				8.8	39.6	4.5	4
666	615	Lake					4.3	21.9	5.1	5
710	615	Lake					1.1	21.1	18.7	6
636	650	625	615	Lake			2.1	22.0	10.3	7
627	592	Lake					2.9	7.5	2.6	8
680	663	666	615	Lake			0.3	15.5	51.7	9
590	Lake						1.3	4.6	3.6	10
605	615	Lake					1.2	6.4	5.4	11
656	636	650	625	615	Lake		1.5	4.3	2.9	12
595	615	Lake					0.7	3.4	4.6	13
659	615	Lake					1.9	5.3	2.8	14
653	650	625	615	Lake			2.2	5.0	2.3	15
663	666	615	Lake				0.3	1.6	5.3	16
626	627	592	Lake				0.6	4.3	7.2	17
661	656	636	650	625	615	Lake	0.4	1.2	3.1	18
664	659	615	Lake				0.7	2.5	3.6	19

Table 28 Wetland restoration priorities for the Hales Slough Lake watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

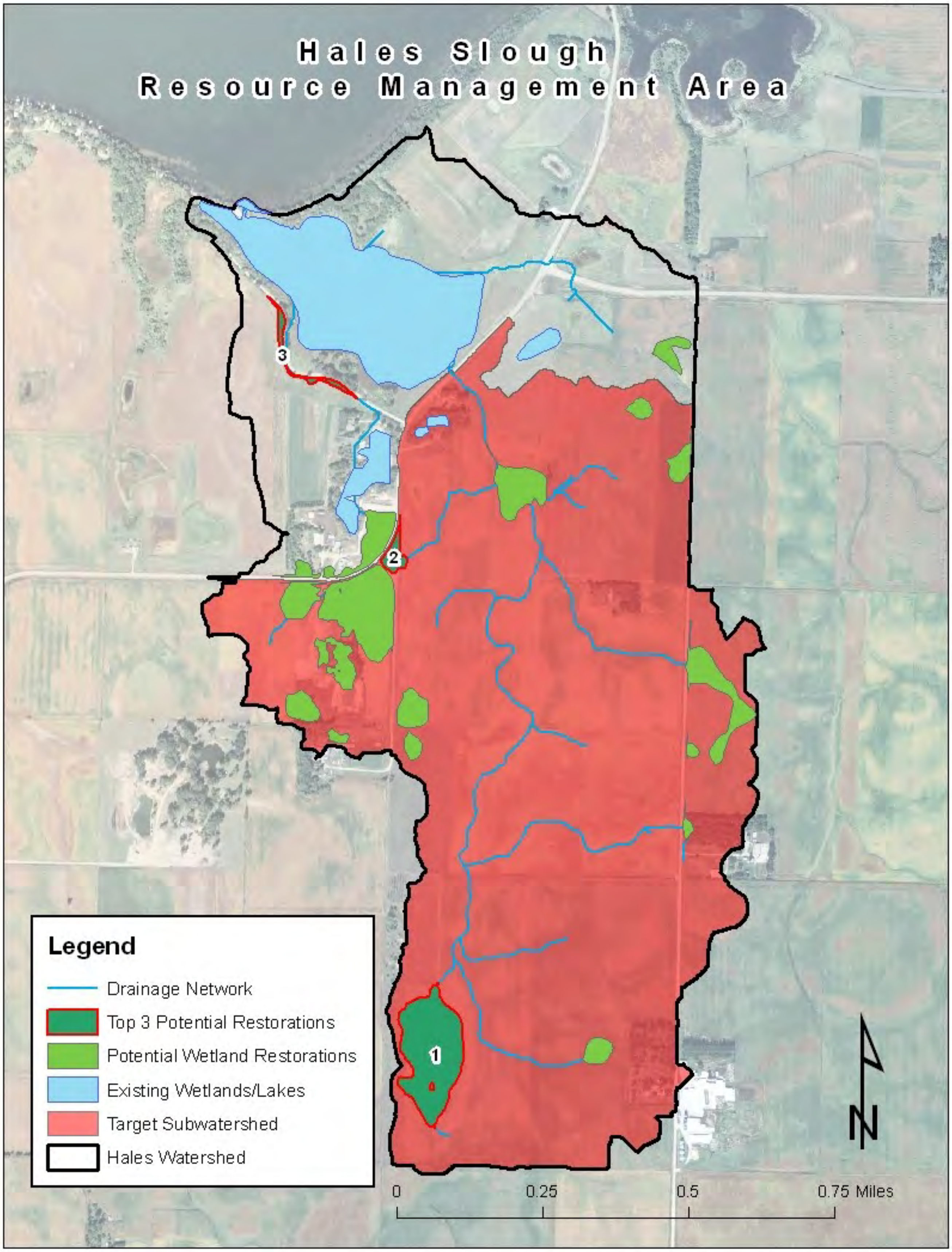

Figure 63 Hales Slough Priority Wetland Restorations

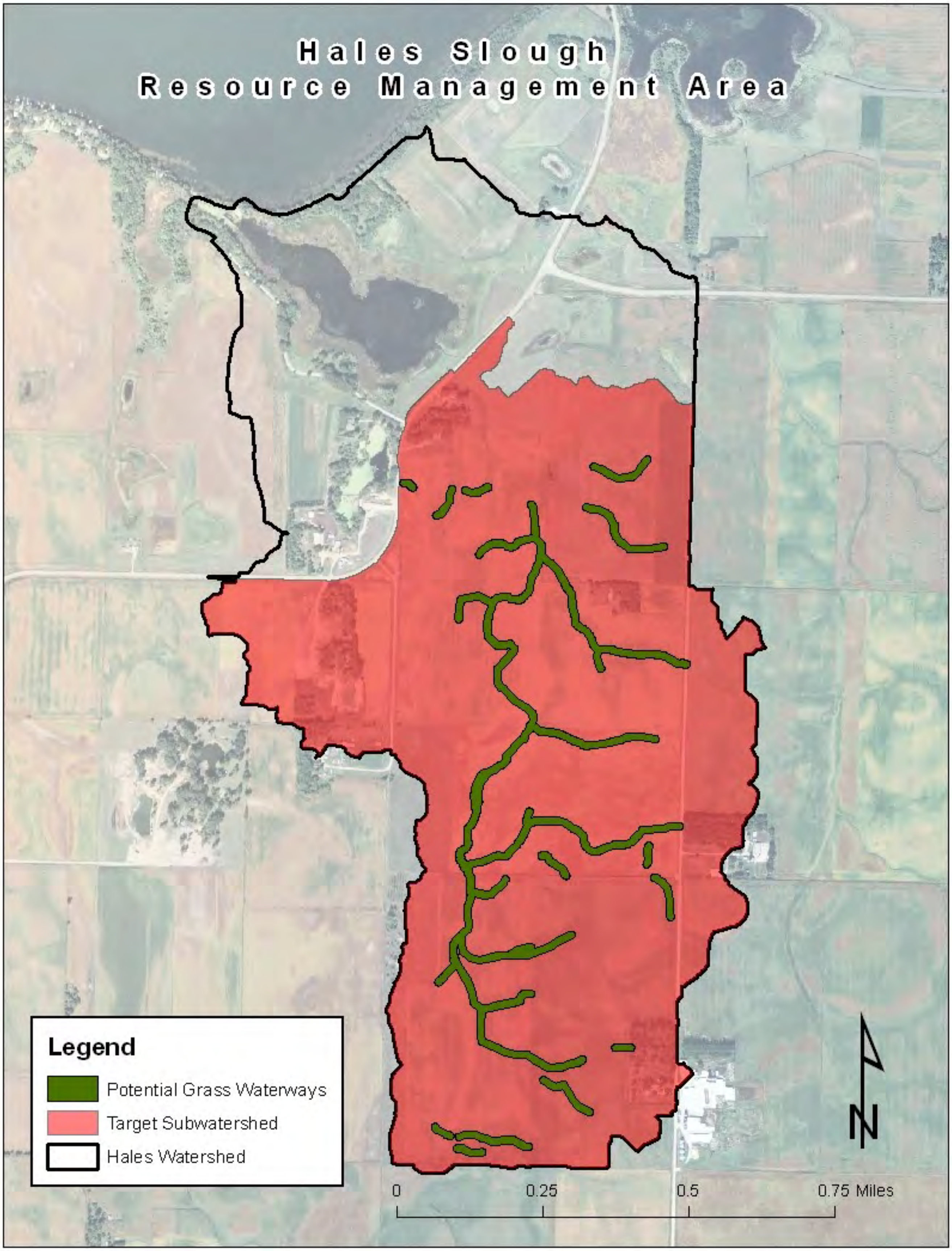

Figure 64 Hales Slough Ephemeral Gullies

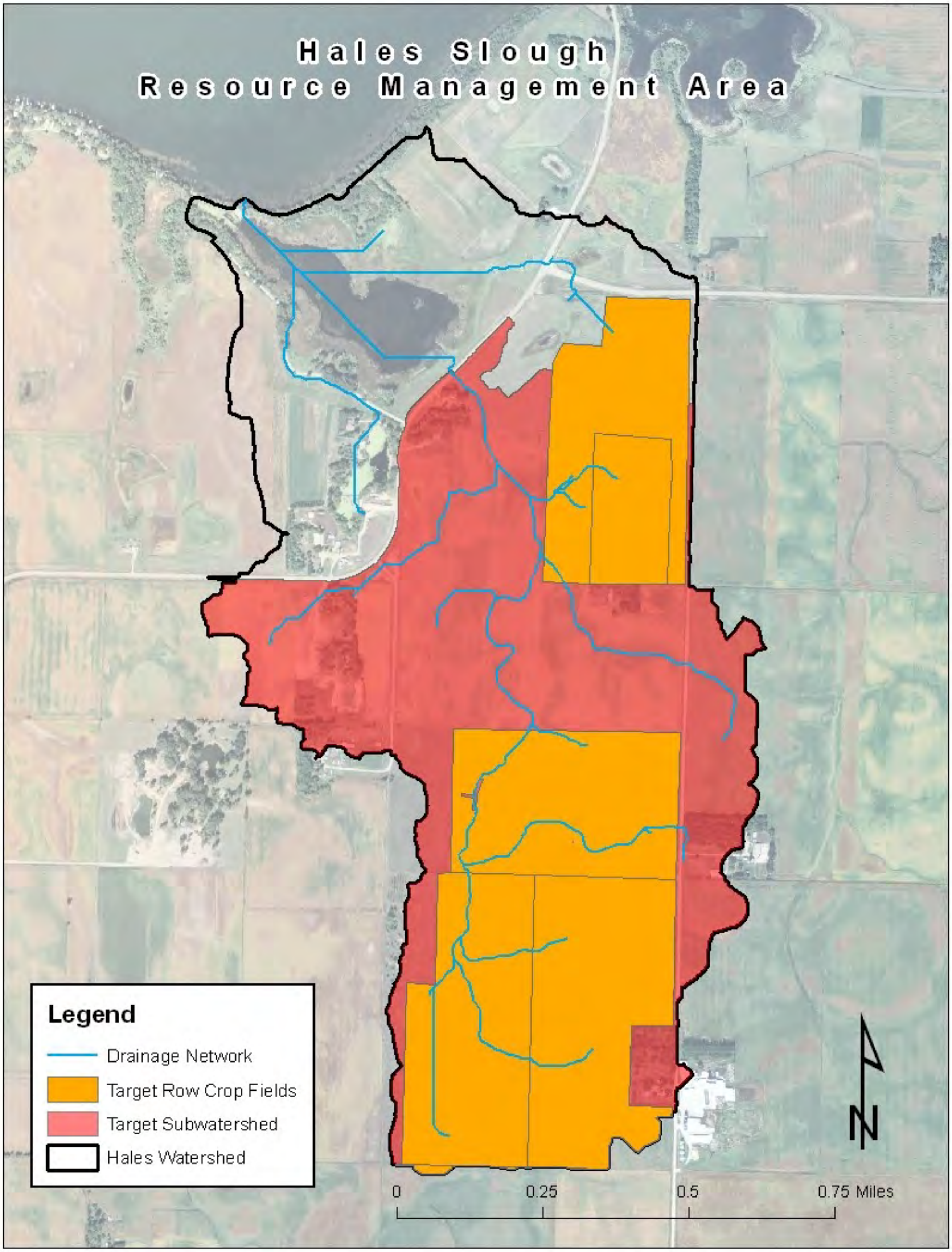

Figure 65 Hales Slough Target Row Crop Fields

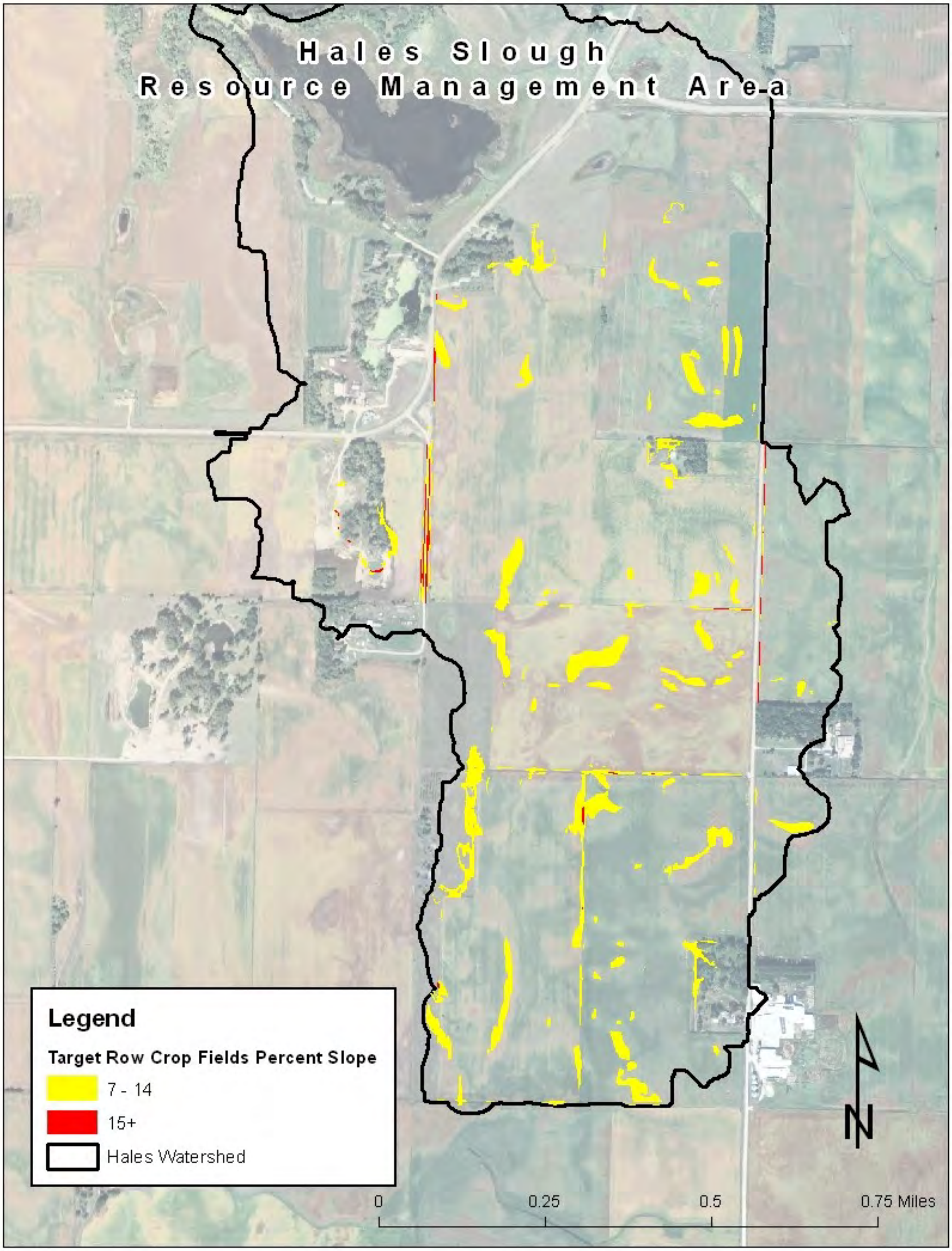

Figure 66 Hales Slough Target Row Crop Slopes

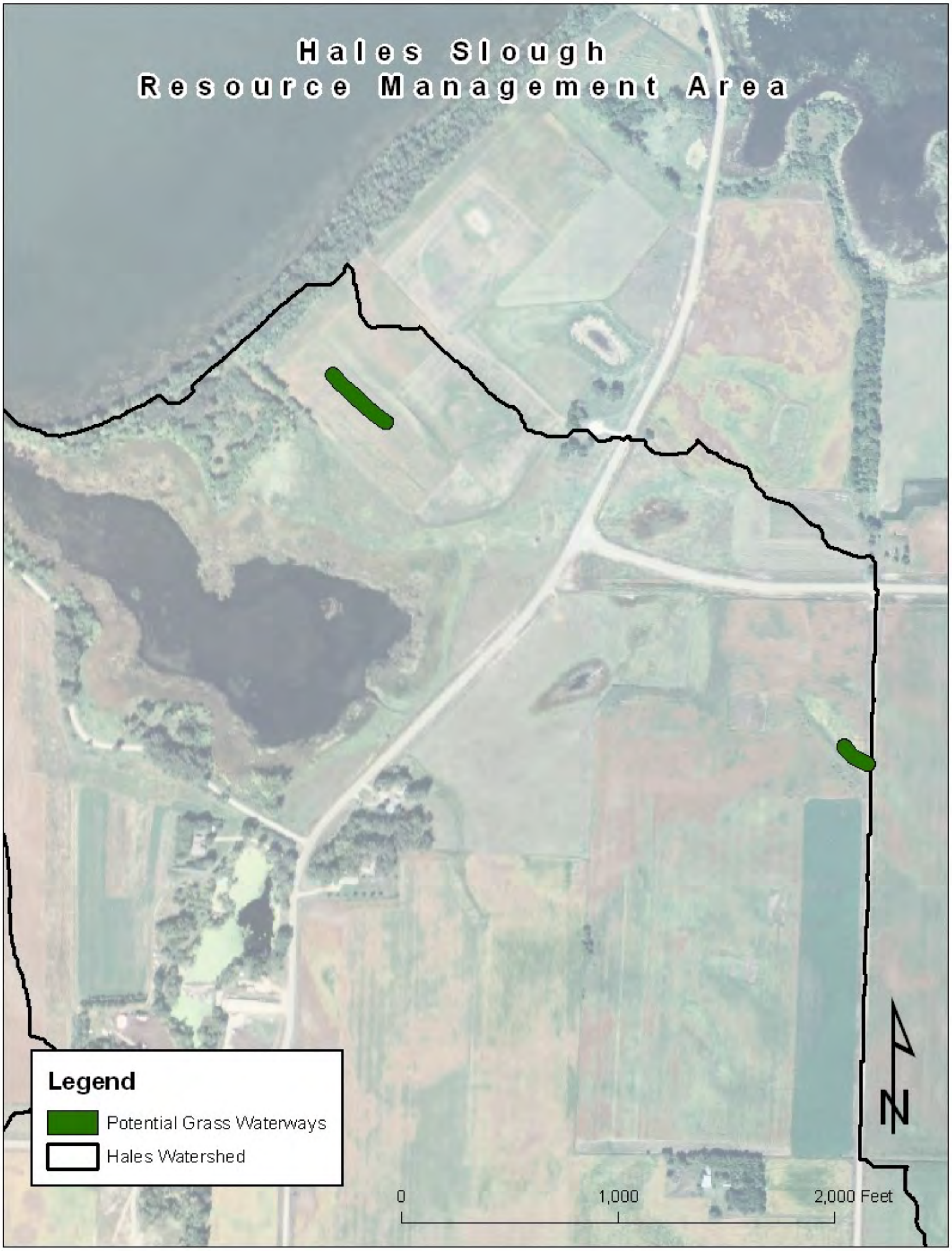

Figure 67 Hales Slough Ephemeral Gullies

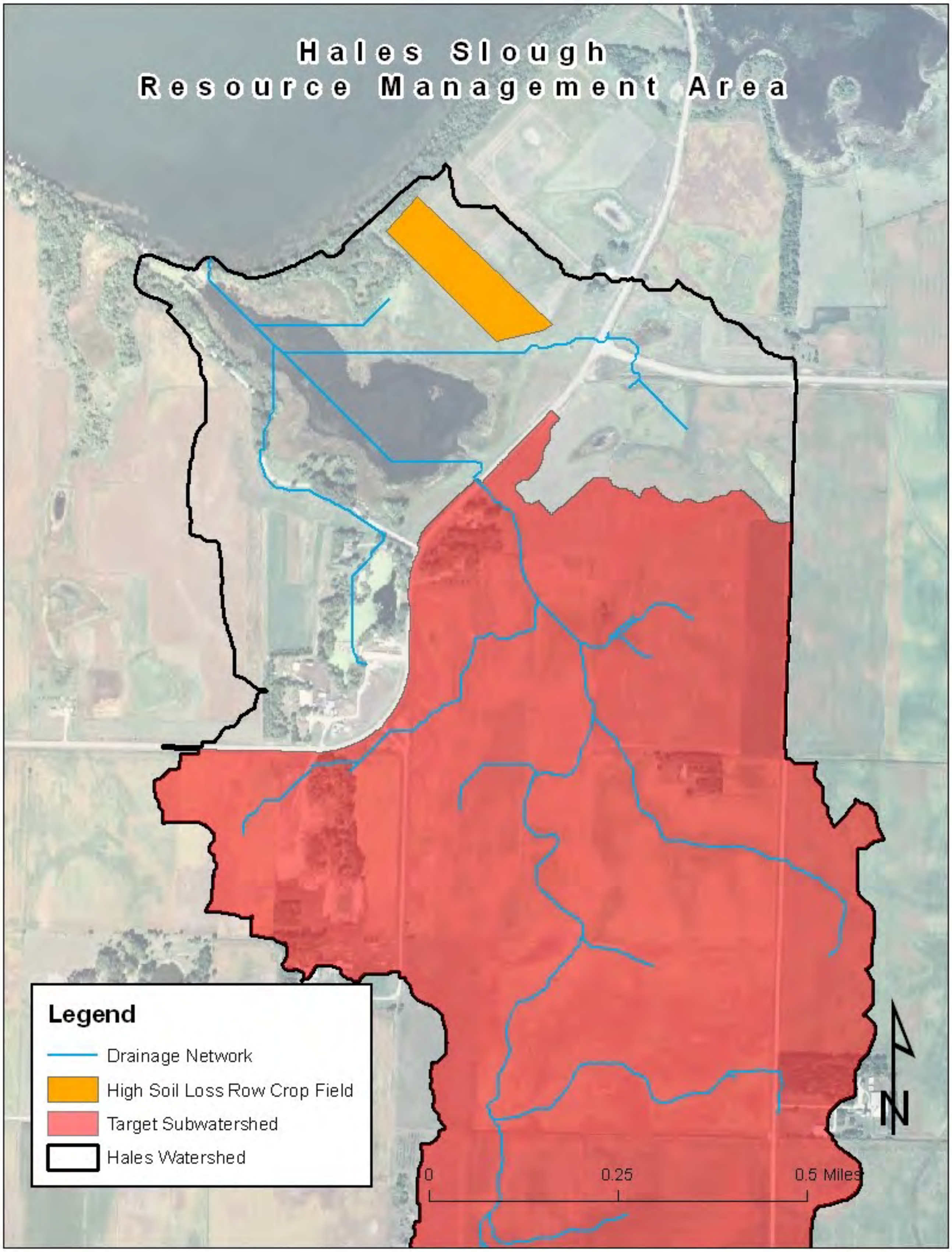

Figure 68 Hales Slough Target Row Crop Fields

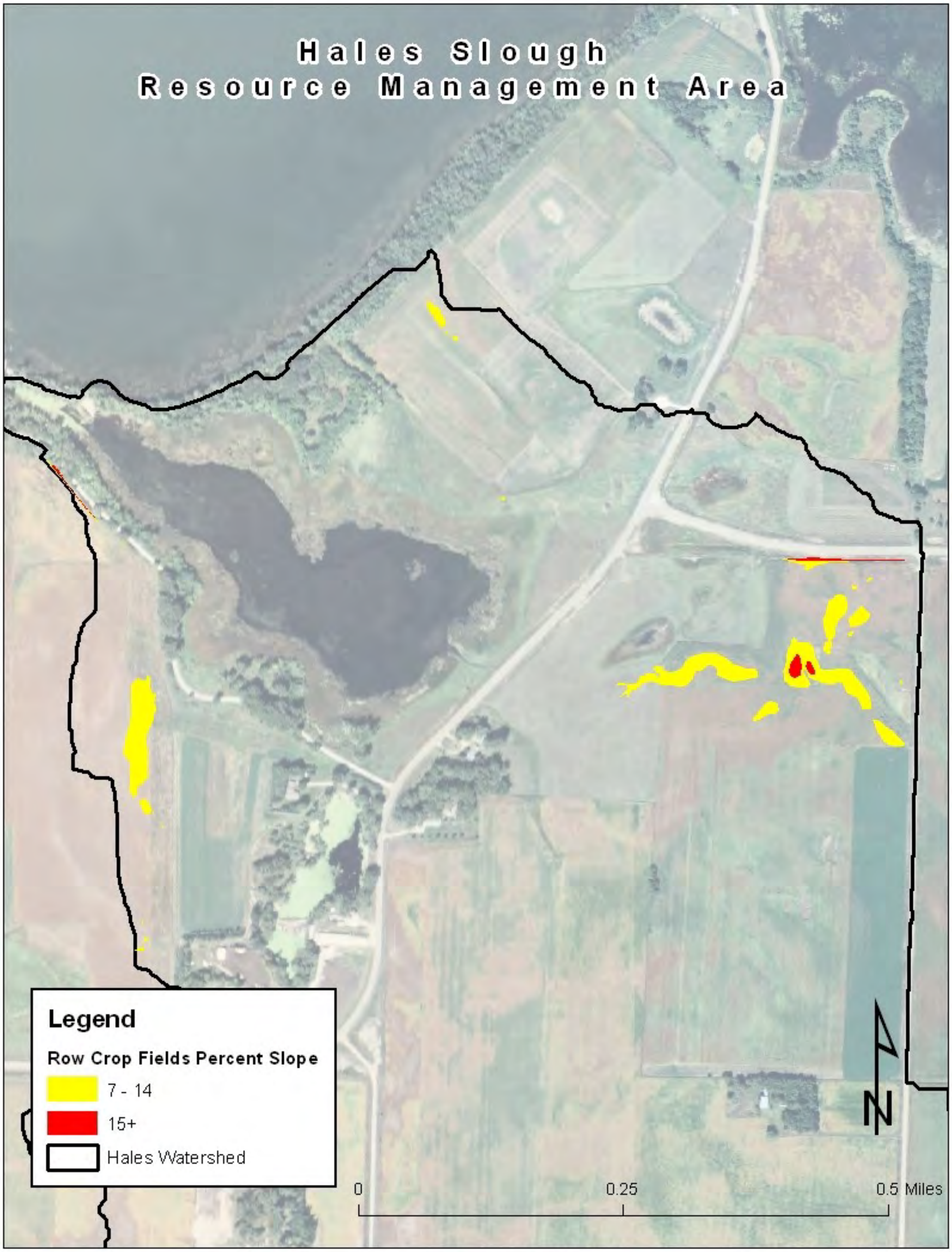

Figure 69 Hales Slough Target Row Crop Slopes

Figure 70 Hales Slough Fish Barrier Location

Reeds Run Resource Management Area (RMA)

Objective – Prevent sediment loaded water reaching Big Spirit Lake via the Reeds Run sub-watershed. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's.

Description – The Reeds Run watershed has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. This watershed represents approximately 7% of the watershed of Big Spirit Lake. Originally a long series of pothole wetlands provided important watershed protection to Big Spirit Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both cultural as well as soil erosion control practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced using the following plan.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 450.8 pounds of Phosphorus from entering Big Spirit Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 679.5 pounds of Phosphorus from entering Big Spirit Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 647.7 pounds of Phosphorus from reaching Big Spirit Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 95.6 pounds of Phosphorus from entering Big Spirit Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Reeds Run Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				12%	$19,736	$0	460.8	-$50	$0	-$1,125	96	-$9.03
1.1	Conservation Tillage	SWCD	500		40%	-$500		50.05	-$10	$0	-$2,000	60	-$33.33
1.2	No-Till System	SWCD	266		0%	$3,192		94.40	$34	$0	$0	-	$0.00
1.3	P-Rate Reduction	SWCD	766		0%	-$8,426		48.79	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	566		6%	$25,470		257.53	$99	$0	$875	36	$24.31
2	**Land Use Change**				25%	$0	$195,100	679.5	$0	$1,036	$76,256	56	$1,362
2.1	Grassed Waterway	SWCD		5000	0%		$12,500	175.60	$0	$71	$0	-	$0.00
2.2	Sediment Basins	SWCD		12	0%		$21,600	196.30	$0	$110			
2.3	Grade Stabilization Structure	SWCD		1	0%		$18,000	72.30	$0	$249	$0	-	$0.00
2.4	Land Retirement	SWCD		22	100%		$143,000	235.30	$0	$608	$76,256	56	$1,361.71
3	**Edge of Field**				15%	$0	$110,248	647.7	$0	$703	$58,900	64	$920.31
3.1	Wetland Restoration	SWCD		3	0%		$60,000	336.90	$0	$178			$0.00
3.2	Sediment Control Practice	SWCD		4	0%		$40,000	97.30	$0	$411			$0.00
3.3	Vegetative Buffer	SWCD		8	38%		$1,848	128.60	$0	$14			$0.00
3.4	Tile Intake Treatment	SWCD		28	21%		$8,400	84.90	$0	$99	$58,900	64	$920.31
4	**In-Lake Treatment**				0%	$0	$36,200	95.6	$0	$379	$0	-	$0
4.1	Shoreline/bank Restoration	FISH		200	0%		$36,200	95.60	$0	$379			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	-	$0
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$51,236	$341,548	1,874			$134,031	216	$621

Table 29 Management Plan for Reeds Run RMA Priority Sub-Watershed (Wills J. H., 2012)

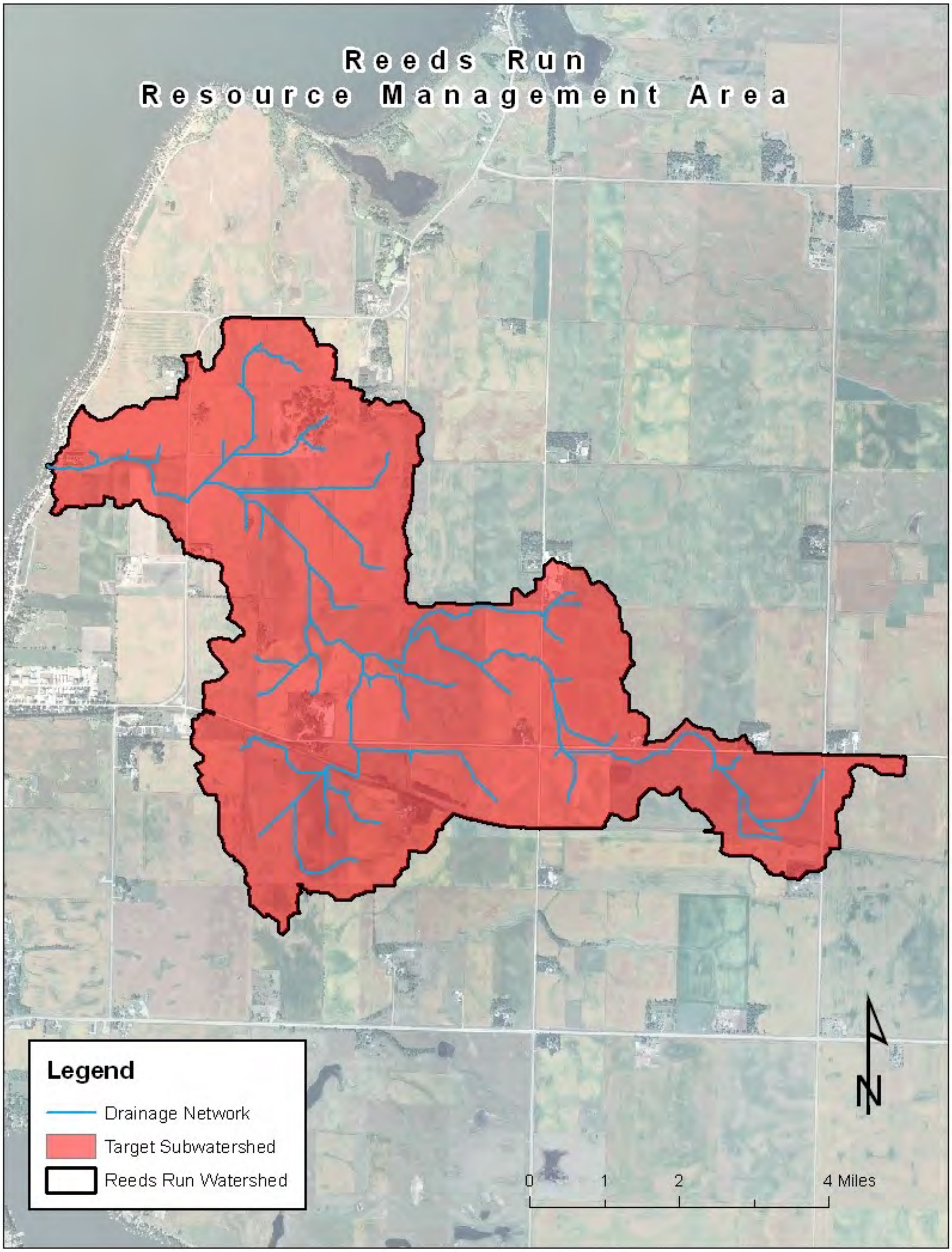

Figure 71 Reeds Run Resource Management Area

Reeds Run Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
733	Lake							200.6	1,262.3	6.3	1
787	733	Lake						11.2	386.6	34.6	2
808	787	733	Lake					8.3	316.9	38.4	3
809	759	733	Lake					6.9	219.7	31.8	4
884	808	787	733	Lake				73.6	155.7	2.1	5
839	790	802	809	759	733	Lake		27.9	105.4	3.8	6
757	733	Lake						6.9	54.3	7.9	7
730	733	Lake						7.1	51.4	7.2	8
843	839	790	802	809	759	733	Lake	3.1	21.8	7.0	9
830	808	787	733	Lake				4.2	22.7	5.4	10
818	839	790	802	809	759	733	Lake	1.1	17.1	15.4	11
682	Lake							1.2	9.0	7.7	12
677	Lake							0.7	5.3	7.2	13
693	Lake							1.9	7.0	3.6	14
660	733	Lake						2.2	8.4	3.8	15
815	809	759	733	Lake				0.6	7.6	12.3	16
711	733	Lake						0.6	6.8	10.6	17
676	Lake							0.9	4.0	4.5	18
814	830	808	787	733	Lake			1.4	2.1	1.5	19
789	757	733	Lake					1.0	6.5	6.7	20
805	809	759	733	Lake				0.6	1.6	2.6	21
774	765	733	Lake					0.6	6.3	9.7	22
765	733	Lake						0.5	9.5	19.7	23
796	789	757	733	Lake				1.2	3.4	2.9	24
695	733	Lake						0.4	2.1	4.7	25
704	695	733	Lake					0.7	0.8	1.0	26
791	787	733	Lake					1.9	4.4	2.3	27
793	791	787	733	Lake				0.4	1.3	3.6	27

Table 30 Wetland restoration priorities for the Reeds Run watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

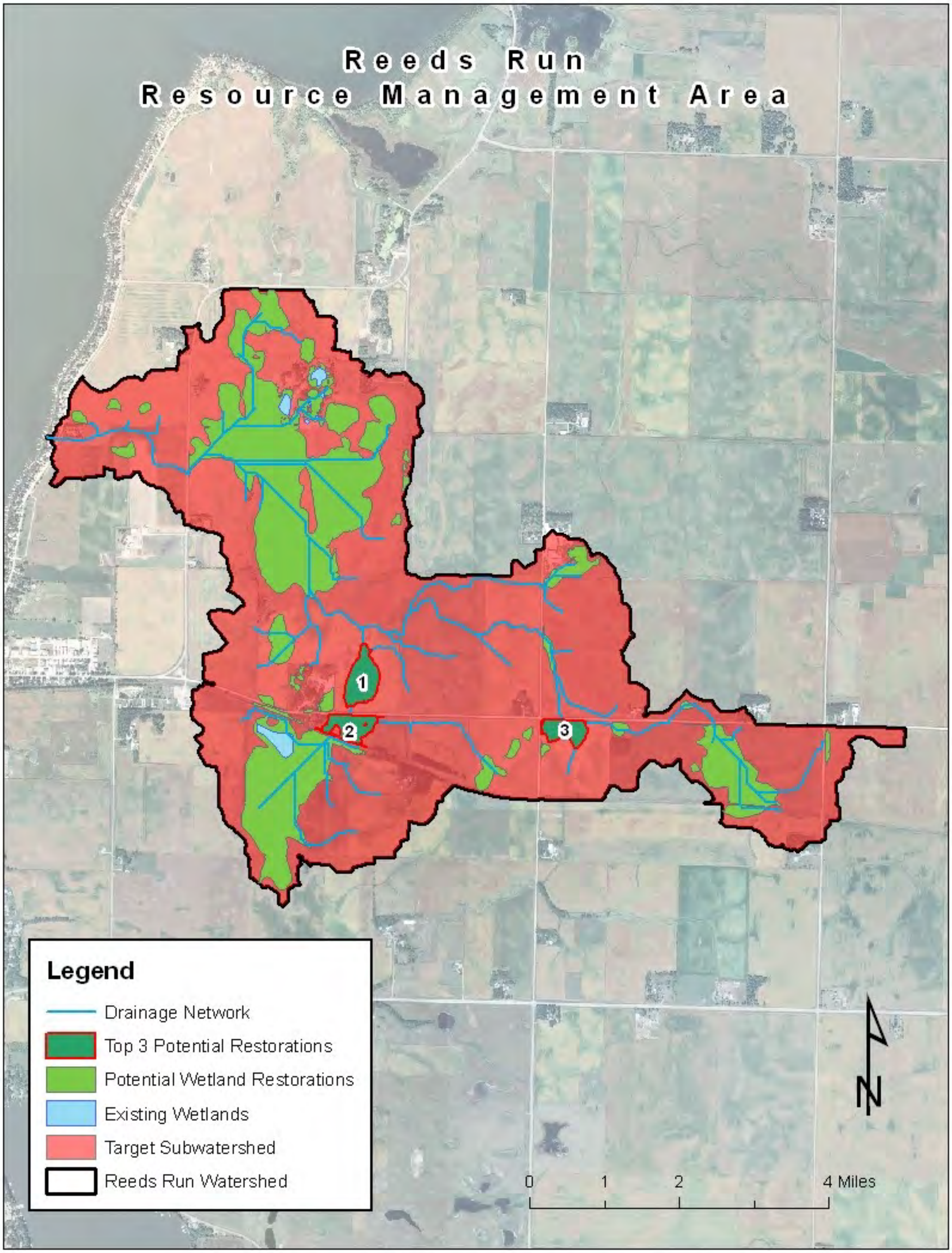

Figure 72 Reeds Run Priority Wetland Restorations

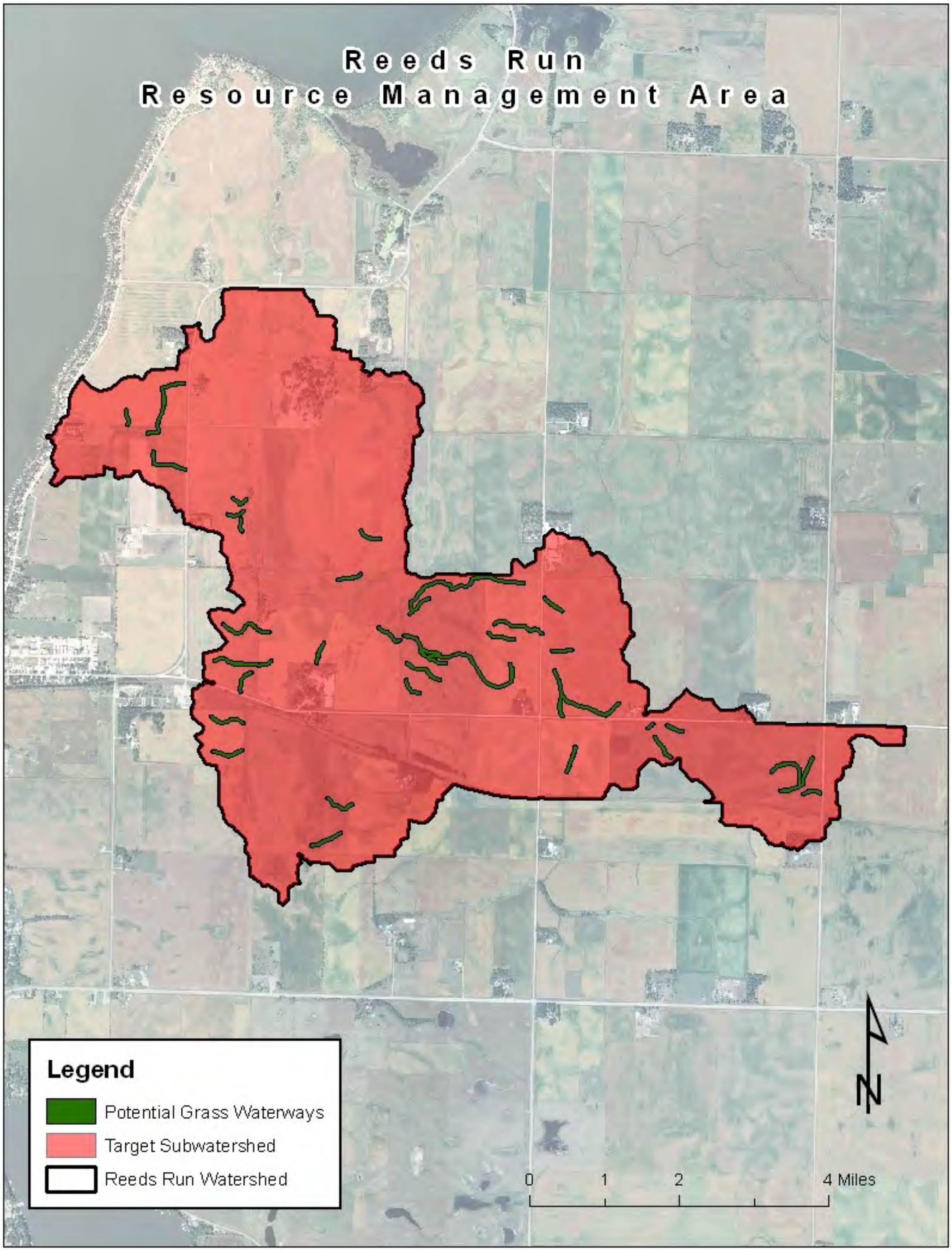

Figure 73 Reeds Run Ephemeral Gullies

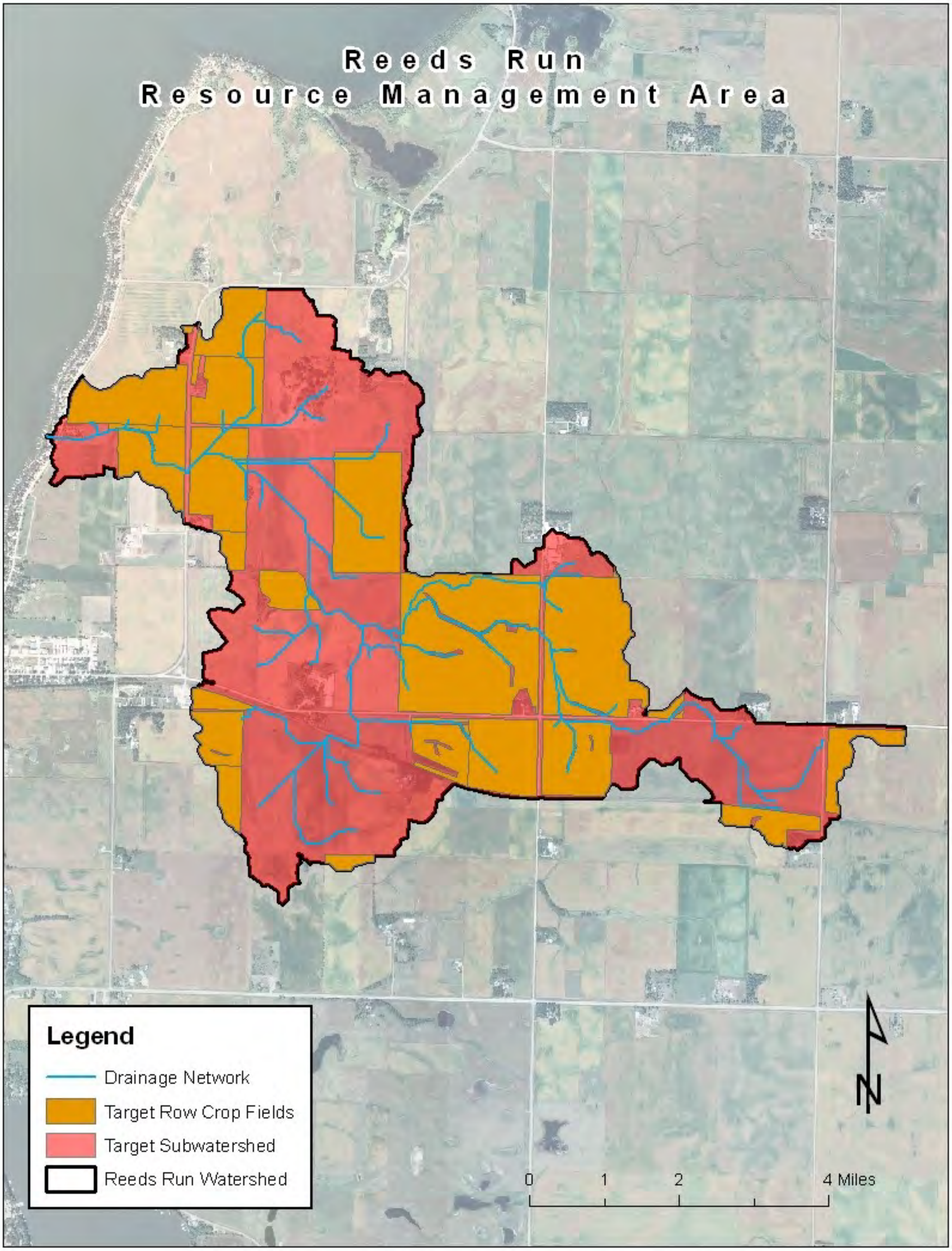

Figure 74 Reeds Run Target Row Crop Fields

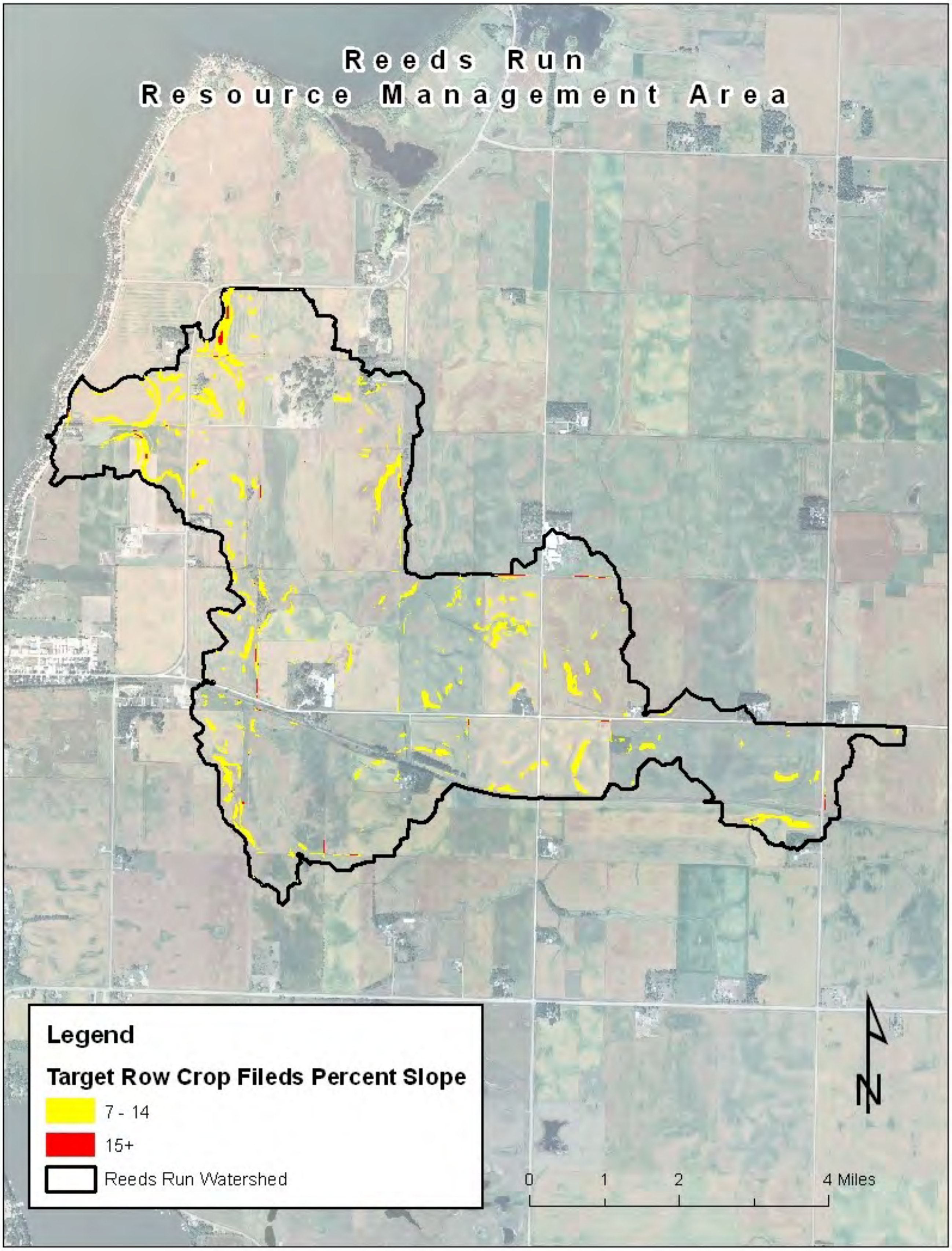

Figure 75 Reeds Run Target Row Crop Slopes

Templar Park Resource Management Area (RMA)

***Objective* –** Prevent sediment loaded water reaching Big Spirit Lake via Templar Park Lagoon. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's.

***Description* –** The watershed draining towards Templar Park has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. This watershed represents approximately 2% of the watershed of Big Spirit Lake. Originally a long series of pothole wetlands provided important watershed protection to Big Spirit Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both cultural and soil erosion control practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing the following plan.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 172.2 pounds of Phosphorus from entering Big Spirit Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 1066.8 pounds of Phosphorus from entering Big Spirit Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 594.8 pounds of Phosphorus from reaching Big Spirit Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 65.3 pounds of Phosphorus from entering Big Spirit Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Templar Park Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				5%	$9,355	$0	172.2	-$50	$0	-$200	6	-$33.33
1.1	Conservation Tillage	SWCD	193		21%	-$193		19.32	-$10	$0	-$200	6	-$33.33
1.2	No-Till System	SWCD	42		0%	$504		14.91	$34	$0	$0	-	$0.00
1.3	P-Rate Reduction	SWCD	266		0%	-$2,926		16.94	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	266		0%	$11,970		121.03	$99	$0	$0	-	$0.00
2	**Land Use Change**				6%	$0	$180,875	1,066.8	$0	$652	$12,500	$15	$833
2.1	Grassed Waterway	SWCD		750	0%		$1,875	295.40	$0	$6	$0	-	$0.00
2.2	Sediment Basins	SWCD		10	0%		$18,000	263.50	$0	$68			
2.3	Grade Stabilization Structure	SWCD		1	0%		$18,000	72.30	$0	$249	$0	-	$0.00
2.4	Land Retirement	SWCD		22	22%		$143,000	435.60	$0	$328	$12,500	15	$833.33
3	**Edge of Field**				0%	$0	$84,962	594.7	$0	$583	$0	-	$0.00
3.1	Wetland Restoration	SWCD		2	0%		$40,000	366.90	$0	$109	$0	-	$0.00
3.2	Sediment Control Practice	SWCD		4	0%		$40,000	97.30	$0	$411	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		2	0%		$462	45.60	$0	$10	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		15	0%		$4,500	84.90	$0	$53	$0	-	$0.00
4	**In-Lake Treatment**				100%	$0	$9,050	65.3	$0	$139	$3,925	$69	$57
4.1	Shoreline/bank Restoration	FISH		50	100%		$9,050	65.30	$0	$139	$3,925	69	$56.64
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	$0	$0
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$40,855	$274,887	1,899			$16,225	$90	$180

Table 31 Management Plan for Templar Park RMA Priority Sub-Watershed (Wills J. H., 2012)

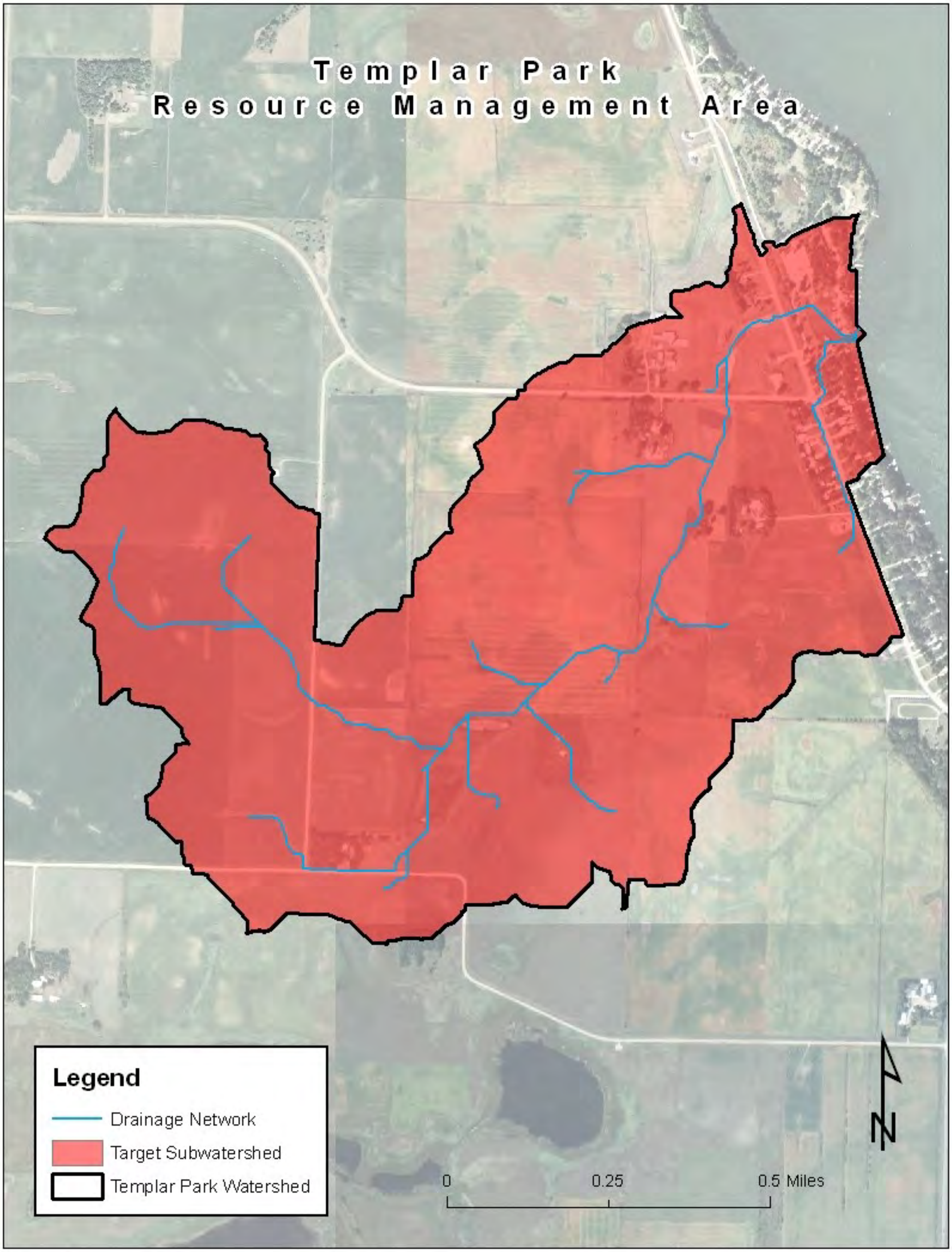

Figure 76 Templar Park Resource Management Area

Templar Lagoon Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
776	720	714	Lake			5.0	285.0	57.2	1
780	776	720	714	Lake		11.8	90.3	7.6	2
817	776	720	714	Lake		2.5	54.2	21.9	3
741	780	776	720	714	Lake	1.4	18.7	13.4	4
736	780	776	720	714	Lake	3.6	12.7	3.6	5
747	Lake					3.3	21.5	6.5	6
743	747	Lake				0.4	7.2	17.6	7
746	780	776	720	714	Lake	0.3	2.7	9.9	8
714	Lake					1.1	6.9	6.5	9
820	817	776	720	714	Lake	0.5	19.8	43.0	10

Table 32 Wetland restoration priorities for the Templar Park watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

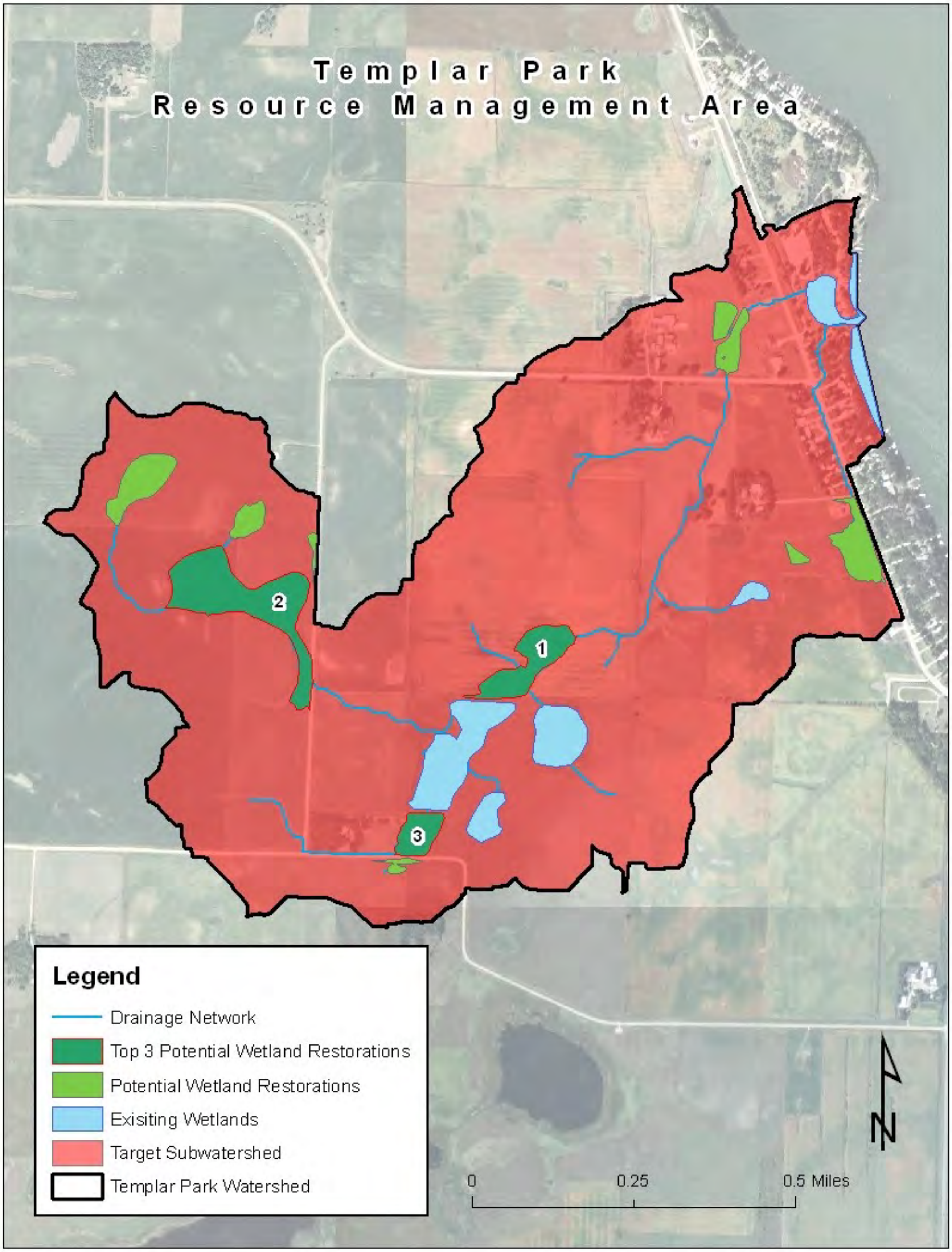

Figure 77 Templar Park Priority Wetland Restorations

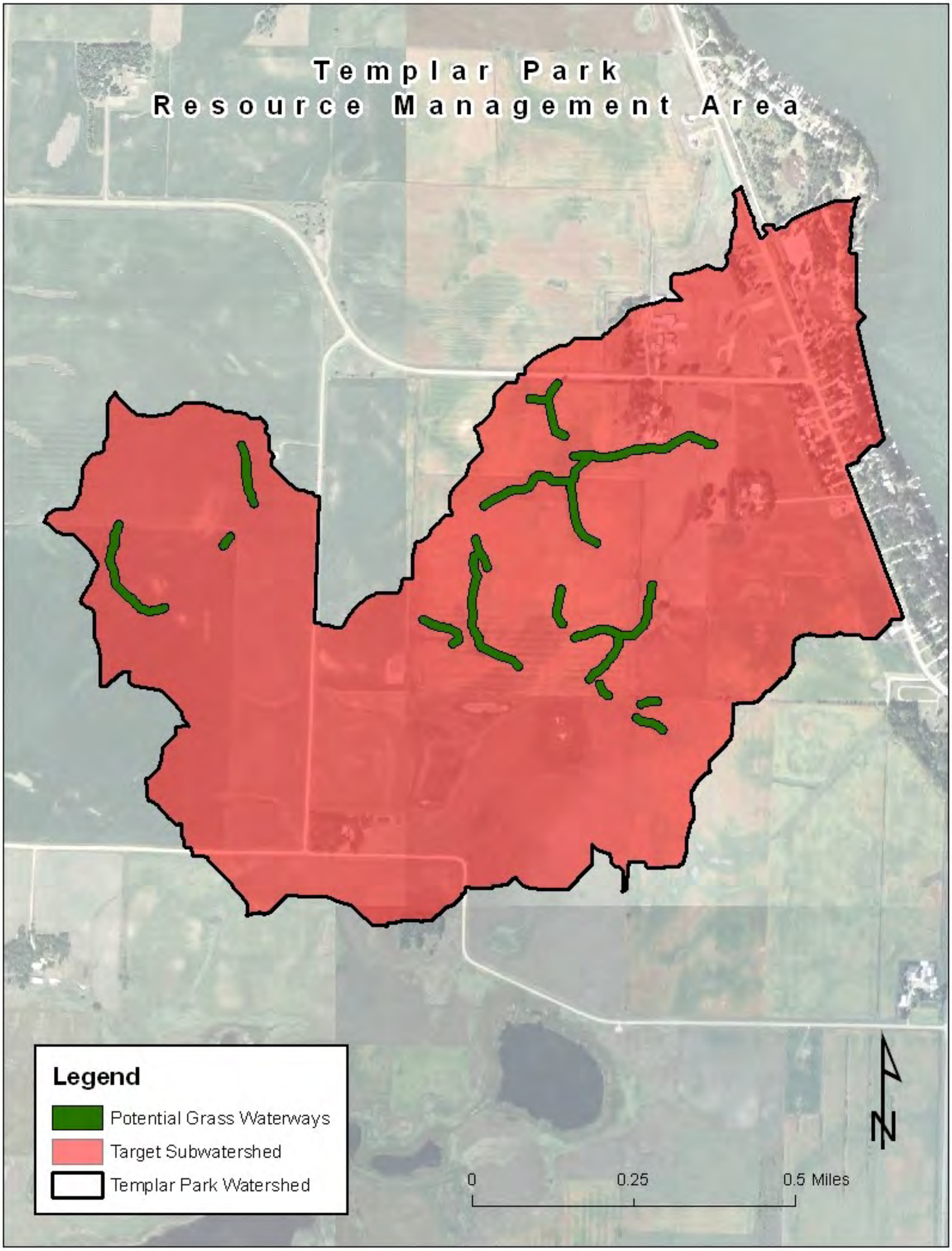

Figure 77 Templar Park Ephemeral Gullies

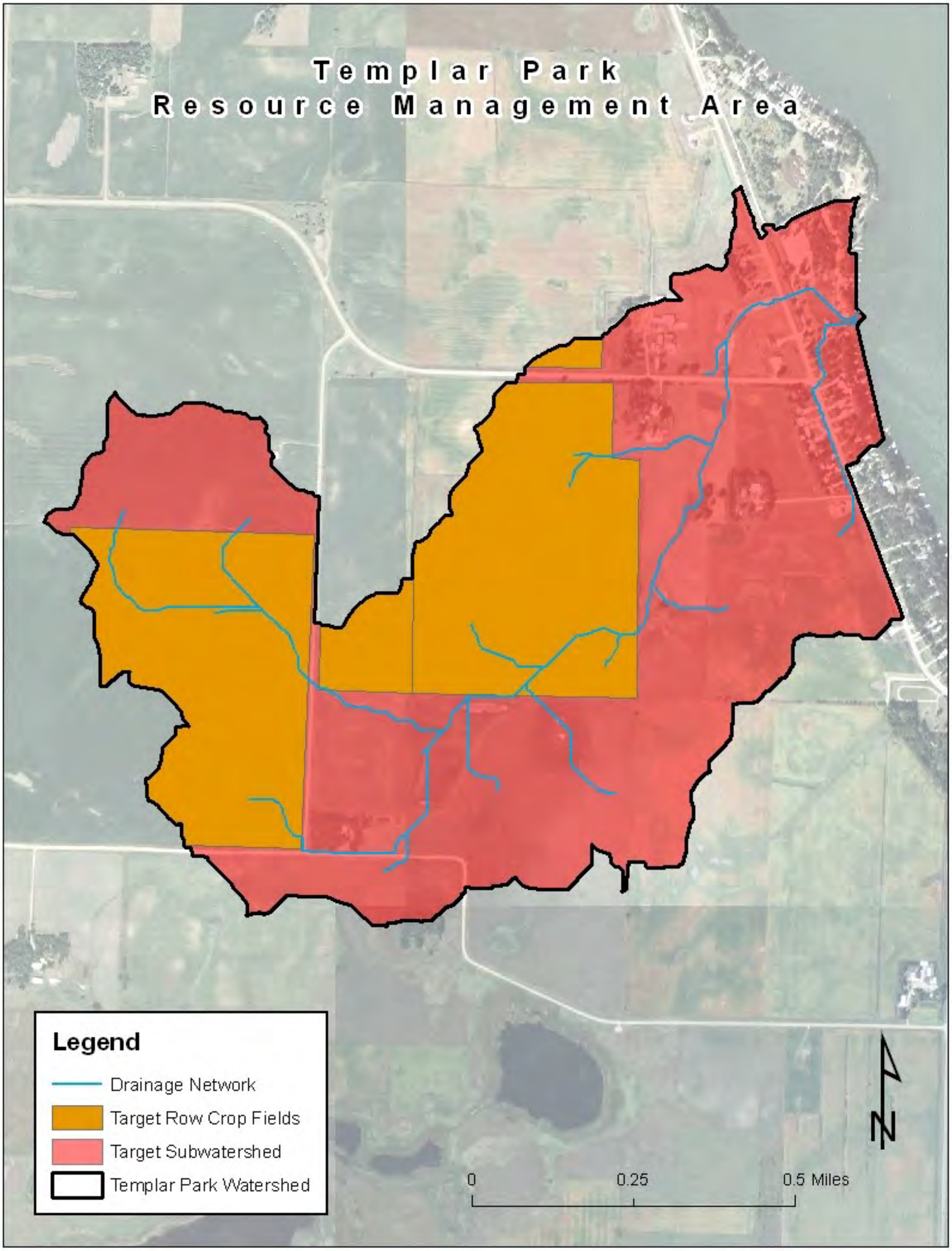

Figure 78 Templar Park Target Row Crop Fields

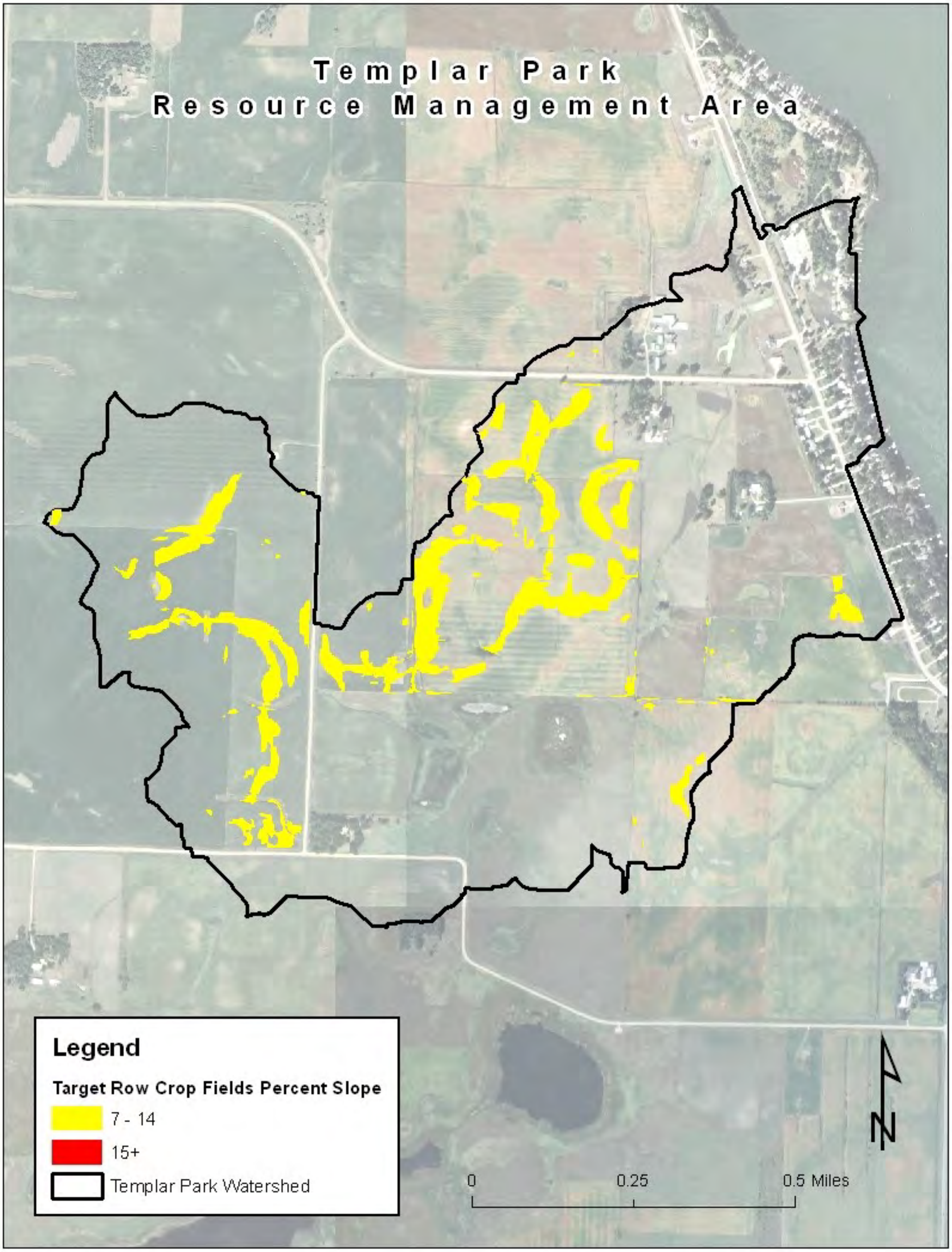

Figure 79 Templar Park Row Crop Target Slopes

MARBLE/ HOTTES LAKES WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
67 ac	4292 ac	4225 ac	n/a	5	1	n/a	No

Lakes in the watershed of East Hottes Lake:

Direct
Marble Lake
West Hottes
North Hottes

Indirect
Grovers Lake

RMA's that drain to East Hottes Lake:

Direct
Hottes & Marble Lake RMA

Impairment for East Hottes Lake: East Hottes lake is not impaired.

Objective – East Hottes Lake is a fully functional lake and is protecting Big Spirit Lake from large sediment deposits and nutrients. The West Hottes and Marble Lakes were restored in 2016 and now the goal is to maintain the lakes within the Marble/Hottes Lake watershed to a fully functional state protecting Big Spirit Lake and indirectly reducing sediment and phosphorus loads to Lower Gar and Upper Gar Lakes which are impaired.

Hottes and Marble Lakes Resource Management Area (RMA)

Objective – Restore and maintain the Hottes Lakes and Marble Lake to clear water systems. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's.

Description – Major changes in hydrology in the watersheds of this complex, along with the introduction of common carp have led to slow degradation of water quality in these shallow lakes. Aquatic vegetation has nearly disappeared in Marble Lake and has receded dramatically in West Hottes Lake. As the 1939 and 2002 aerial photos show a considerable amount of vegetation has disappeared on the Hottes/Marble Lake Complex (Photo 4 & 5) The Hottes/Marble Lake Resource Management Area is shown in Figure 81.

The Hottes/Marble Lake Complex and associated watershed represents nearly 19% of the watershed of Big Spirit Lake. When healthy, the shallow lakes making up the Hottes/Marble Lake Complex provide important watershed protection to Big Spirit Lake. These areas also provide critical fishery and wildlife habitats.
A holistic approach is needed to restore ecological health and water quality to this complex. A combination of both cultural and soil erosion control practices is needed to reach the project objective.

Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing a prioritized plan through augmentation of existing landowner conservation programs, easements, and public acquisitions. Restoration of the lake to a clear water system can be accomplished through processes designed to mitigate watershed alterations and the introduction of common carp. To simulate natural drought conditions, managed water level draw downs are needed to stimulate growth of emergent aquatic vegetation and reduce or eliminate common carp populations.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 775.8 pounds of Phosphorus from entering Big Spirit Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 3,070.8 pounds of Phosphorus from entering Big Spirit Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 2,461.8 pounds of Phosphorus from reaching Big Spirit Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

This project was completed in 2016 and will continue to be evaluated Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 115.3 pounds of Phosphorus from entering Big Spirit Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this

Monitoring
Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Lake Restoration
Proper in-lake management begins by controlling the movement of water and fish in/out of Marble Lake and the Hottes lakes. Electric water control devices including drain tiles will allow for periodic draw downs that mimic historic drought conditions that are no longer occurring due to watershed changes. These water level fluctuations will allow managers to control fisheries populations and promote natural and diverse vegetation communities that benefit both fisheries and wildlife interests. At the same time and location the water control structures are placed; mechanical fish barriers should be installed to control the movement of fish in/out of these systems.

A long term management plan should be developed between fish and wildlife professionals that outline the criteria and plan for dewatering these basins in order to maintain a balanced ecosystem.

Marble Lake and Hottes Lake Resource Management Area

Clean Water Alliance — Today's Date: 2/9/2018

Project Lead: John H. Wills

Start Date: 7/1/2012

Goal	Tasks	Task Lead	Annual Acres/feet/number	Long Term Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				38%	$41,763	$0	775.8	-$50	$0	$5,367	595	$11.15
1.1	Conservation Tillage	SWCD	693		38%	-$693		69.37	-$10	$0	-$2,633	79	-$33.33
1.2	No-Till System	SWCD	342		100%	$4,104		121.38	$34	$0	$4,000	400	$10.00
1.3	P-Rate Reduction	SWCD	1128		0%	-$12,408		71.85	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	1128		14%	$50,760		513.24	$99	$0	$4,000	116	$34.48
2	**Land Use Change**				31%	$0	$285,500	3,070.7	$0	$803	$631,428	452	$1,998
2.1	Grassed Waterway	SWCD		5200	25%		$13,000	1299.60	$0	$10	$4,169	133	$31.34
2.2	Sediment Basins	SWCD		15	0%		$27,000	1263.20	$0	$21			
2.3	Grade Stabilization Structure	SWCD		1	0%		$18,000	72.30	$0	$249	$0	-	$0.00
2.4	Land Retirement	SWCD		35	100%		$227,500	435.60	$0	$522	$627,259	319	$1,966.33
3	**Edge of Field**				38%	$0	$84,962	2,461.4	$0	$492	$8,522	30	$284.07
3.1	Wetland Restoration	SWCD		2	50%		$40,000	2233.60	$0	$18	$8,522	30	$284.07
3.2	Sediment Control Practice	SWCD		4	0%		$40,000	97.30	$0	$411	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		2	100%		$462	45.60	$0	$10	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		15	0%		$4,500	84.90	$0	$53	$0	-	$0.00
4	**In-Lake Treatment**				100%	$0	$309,050	115.3	$0	$6,139	$0	-	$0
4.1	Shoreline/bank Restoration	FISH		50	100%		$9,050	65.30	$0	$139			
4.2	Fish Barrier and Lake	FISH		2	100%		$300,000	50.00	$0	$6,000			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0.00
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	-	$0
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$73,263	$679,512	6,423			$645,317	1,077	$599

Table 33 Management Plan for Marble Lake and Hottes Lake RMA Priority Sub-Watershed (Wills J. H., 2012)

Photo 3 and 4 MARBLE AND HOTTES LAKE Aerial Photography from 2002 (top) and 2015 (bottom) demonstrating the change in extent of emergent vegetation. The 2002 photo shows almost no vegetation in the water and the 2015 photo shows a tremendous growth after the restoration.

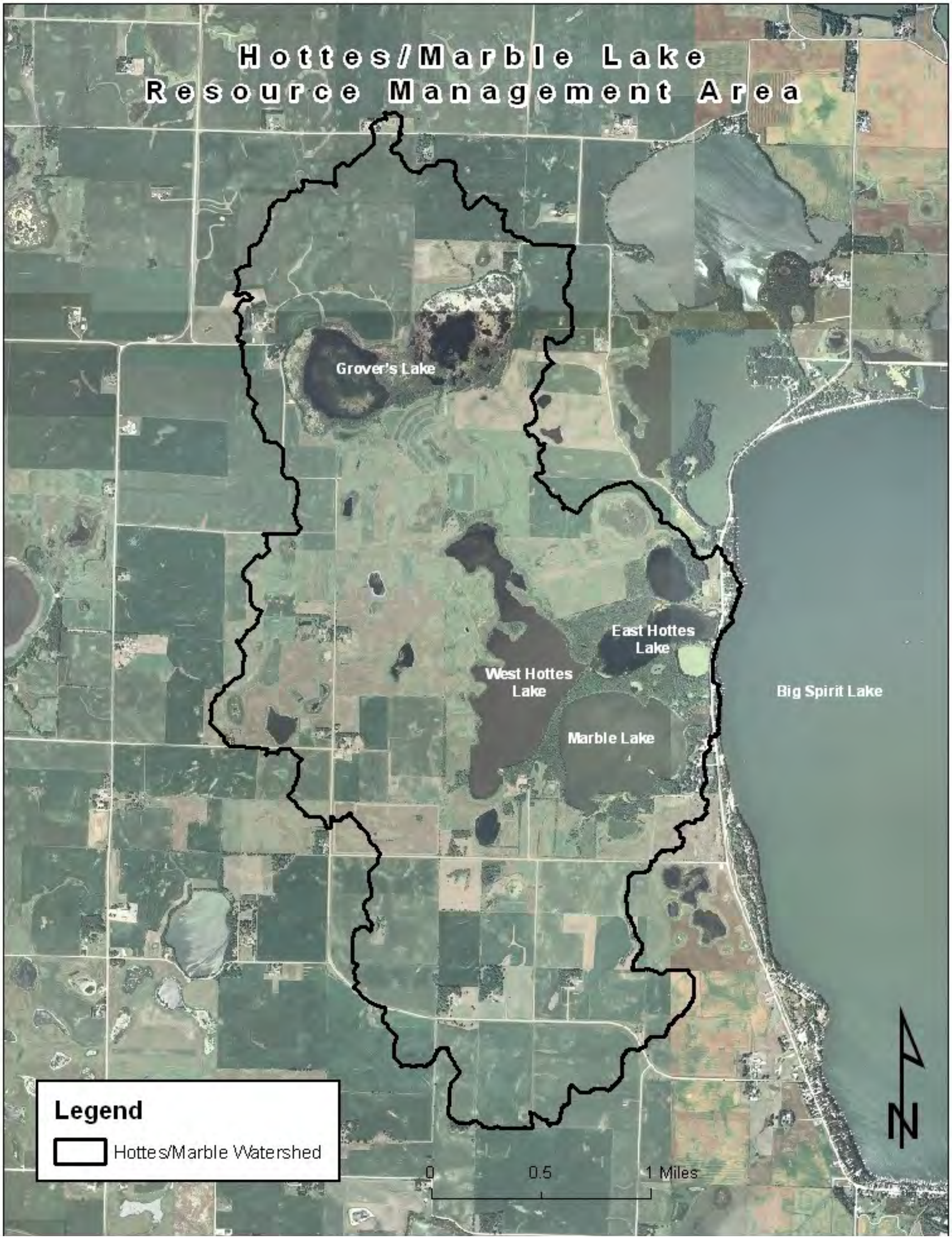

Figure 80 Hottes/Marble Lake Resource Management Area

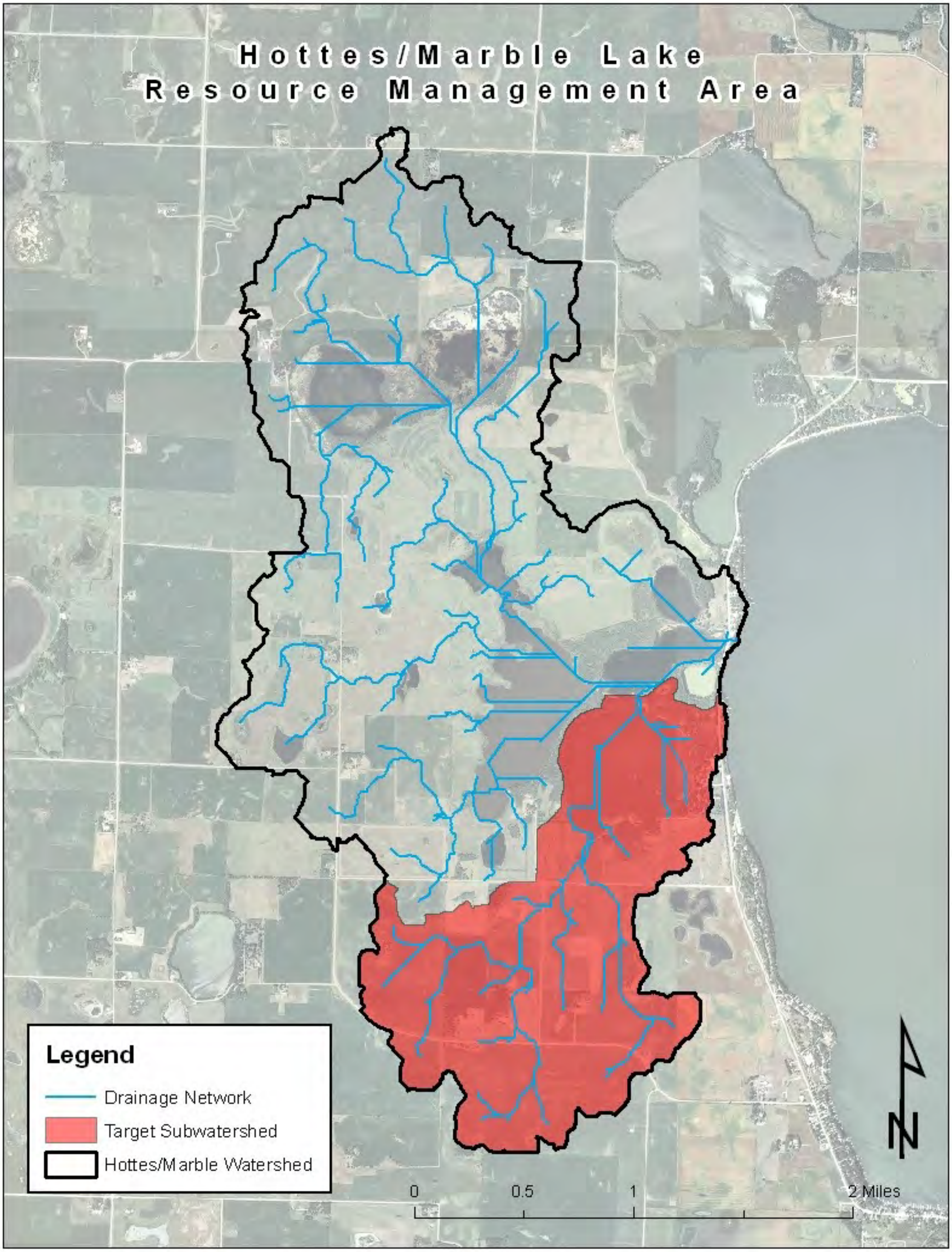

Figure 81 Priority sub-watershed (red) within the Hottes/Marble Lake watershed.

Hottes Lake Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
674	633	Lake				25.5	518.9	20.3	Restored
681	647	620	Lake			22.2	161.0	7.3	2
691	681	647	620	Lake		5.6	112.7	20.3	3
498	Lake					3.2	130.8	40.6	4
453	Lake					4.6	249.3	54.2	5
668	674	633	Lake			10.1	67.4	6.7	6
571	Lake					5.8	135.0	23.4	7
589	571	Lake				0.8	41.2	50.2	8
586	589	571	Lake			6.2	29.8	4.8	9
505	498	Lake				1.8	84.8	48.5	10
622	Lake					1.1	29.5	27.1	11
489	Lake					47.4	61.6	1.3	12
707	674	633	Lake			3.0	14.7	4.9	13
440	Lake					1.3	73.2	55.8	14
448	440	Lake				14.8	38.5	2.6	15
701	674	633	Lake			4.4	38.7	8.8	16
694	691	681	647	620	Lake	6.2	20.1	3.2	17
416	434	453	Lake			5.6	30.0	5.4	18
442	453	Lake				0.5	31.3	68.1	19
441	442	453	Lake			1.3	25.6	20.0	20
435	441	442	453	Lake		3.4	17.9	5.3	21
634	622	Lake				2.3	9.5	4.1	22
631	633	Lake				3.2	7.2	2.3	23
728	674	633	Lake			5.1	10.1	2.0	24
671	674	633	Lake			1.0	6.9	6.5	25
640	668	674	633	Lake		1.6	8.3	5.0	26
697	633	Lake				4.5	7.0	1.5	27
503	Lake					3.7	8.2	2.2	28
422	453	Lake				1.2	13.6	11.7	29
470	Lake					0.4	6.1	16.0	30

Table 34 Wetland restoration priorities for the Hottes/Marble Lake watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

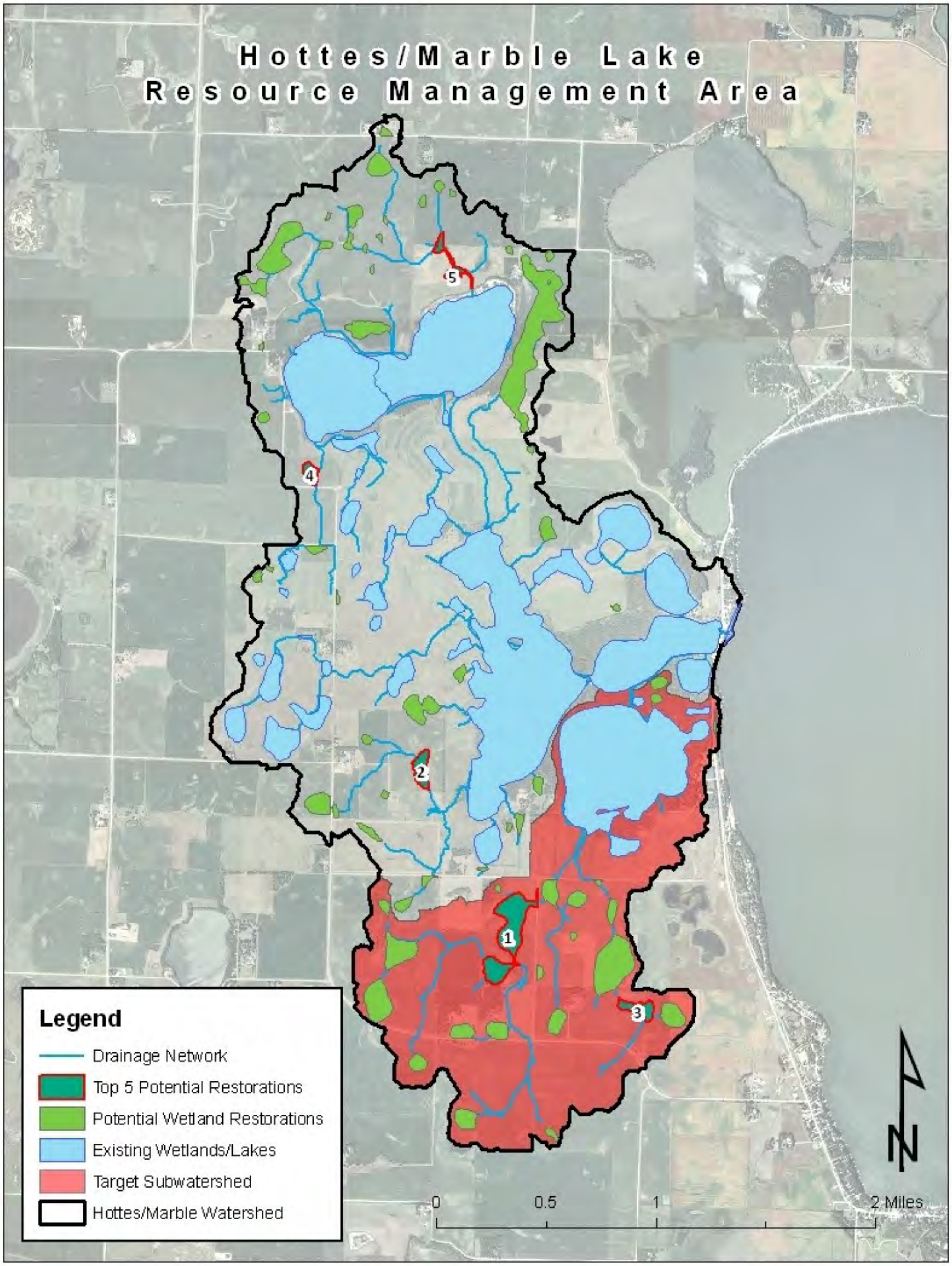

Figure 82 Wetland restoration priorities within the Hottes/Marble Lake watershed.

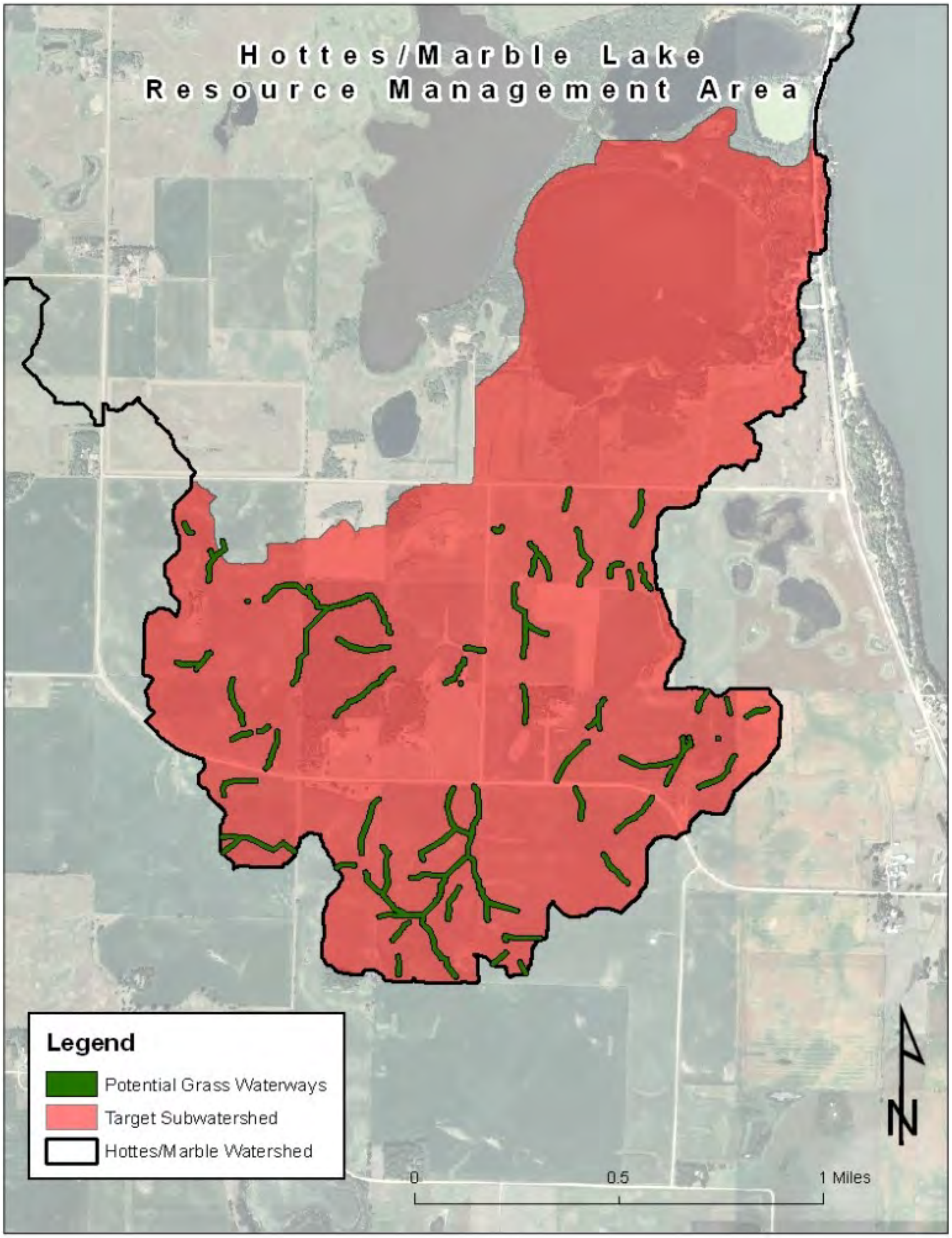

Figure 83 Hottes/Marble Lake Priority Area Ephemeral Gullies

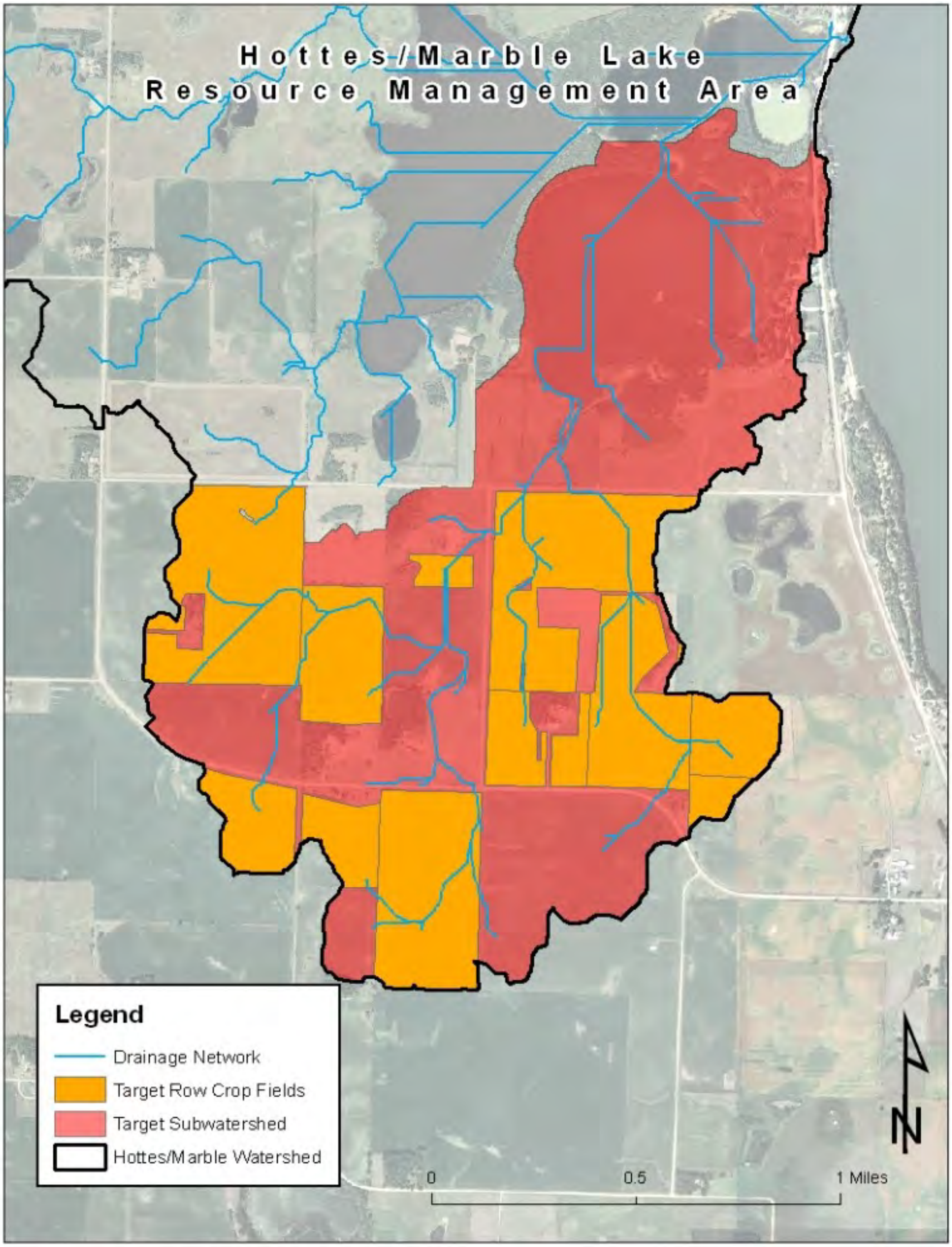

Figure 84 Marble/Hottes Lake Priority Area Targeted Row Cropped Fields

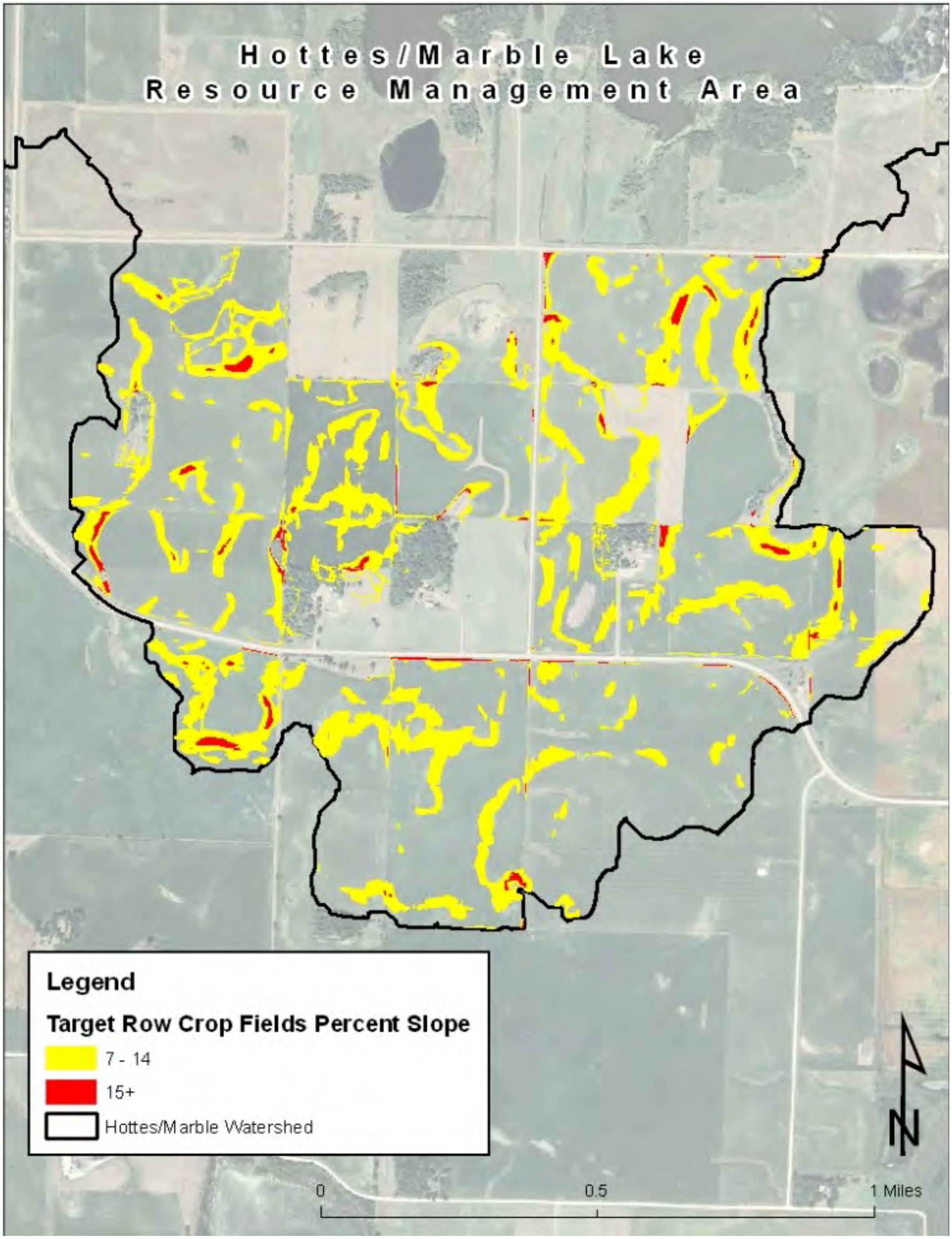

Figure 85 Hottes/Marble Lake Priority Sub-Watershed Row Crop Targeted Slopes

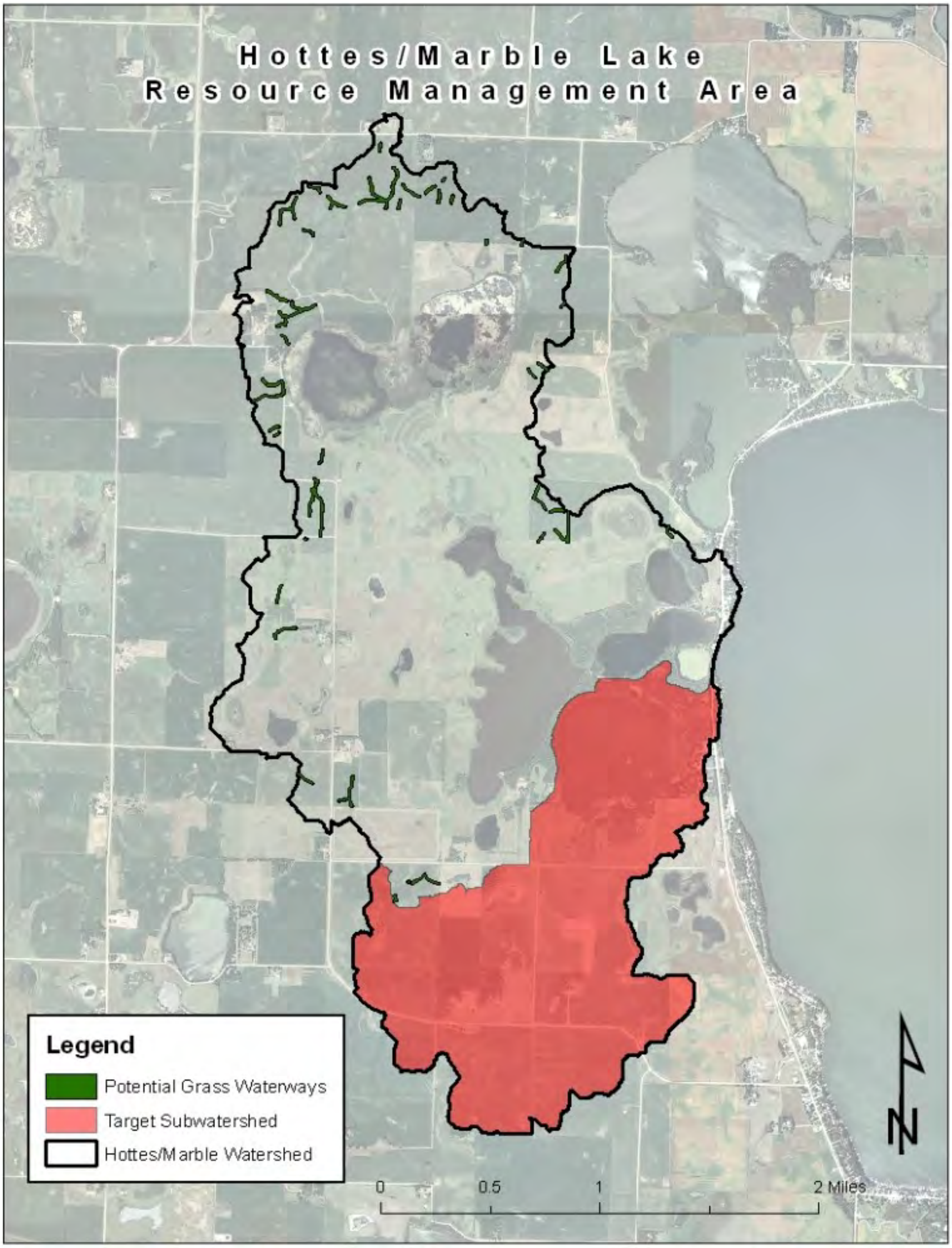

Figure 86 Hottes/Marble Lake Watershed Non-Priority Ephemeral Gullies

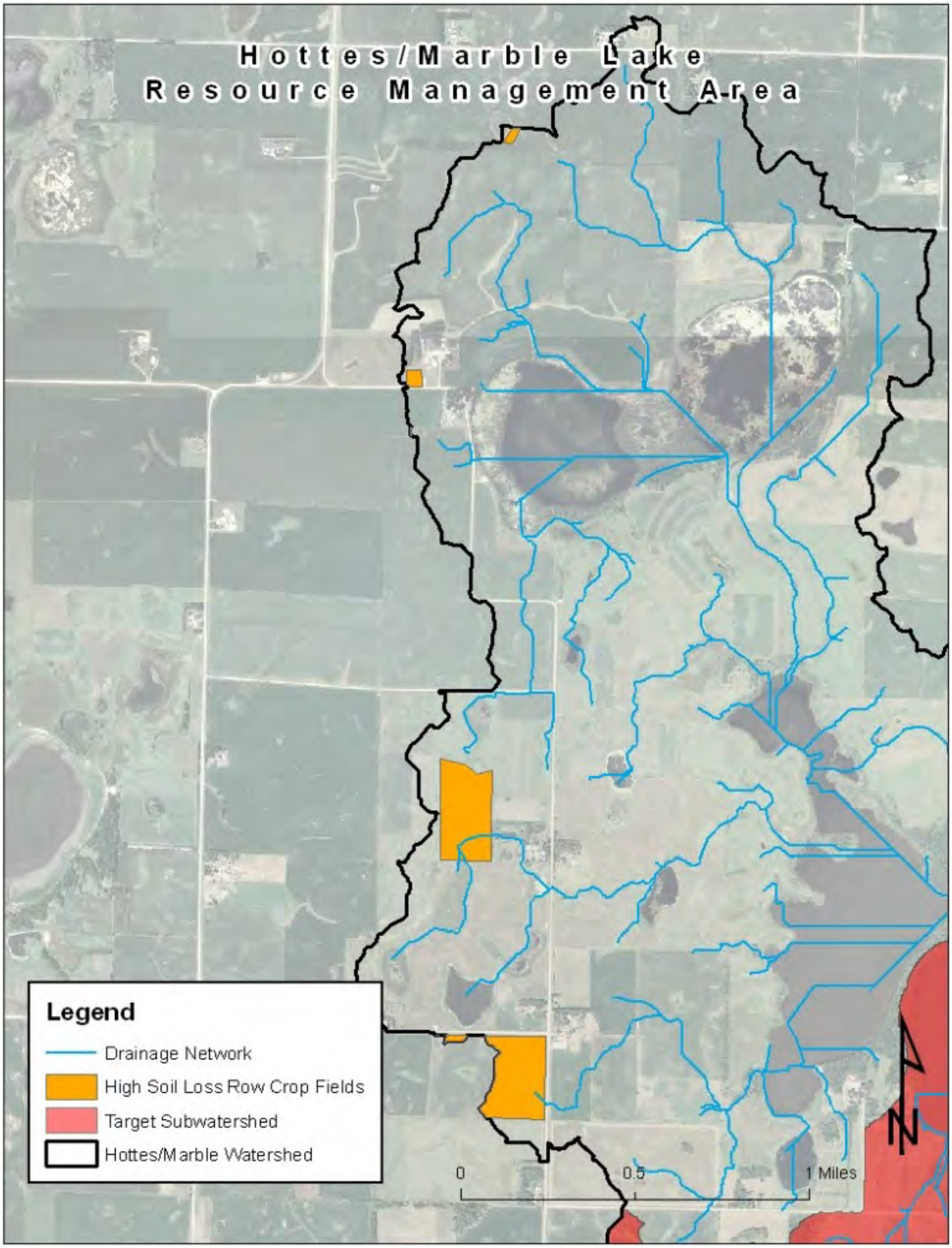

Figure 87 Hottes/Marble Lake Non-Priority Targeted Row Crop Fields

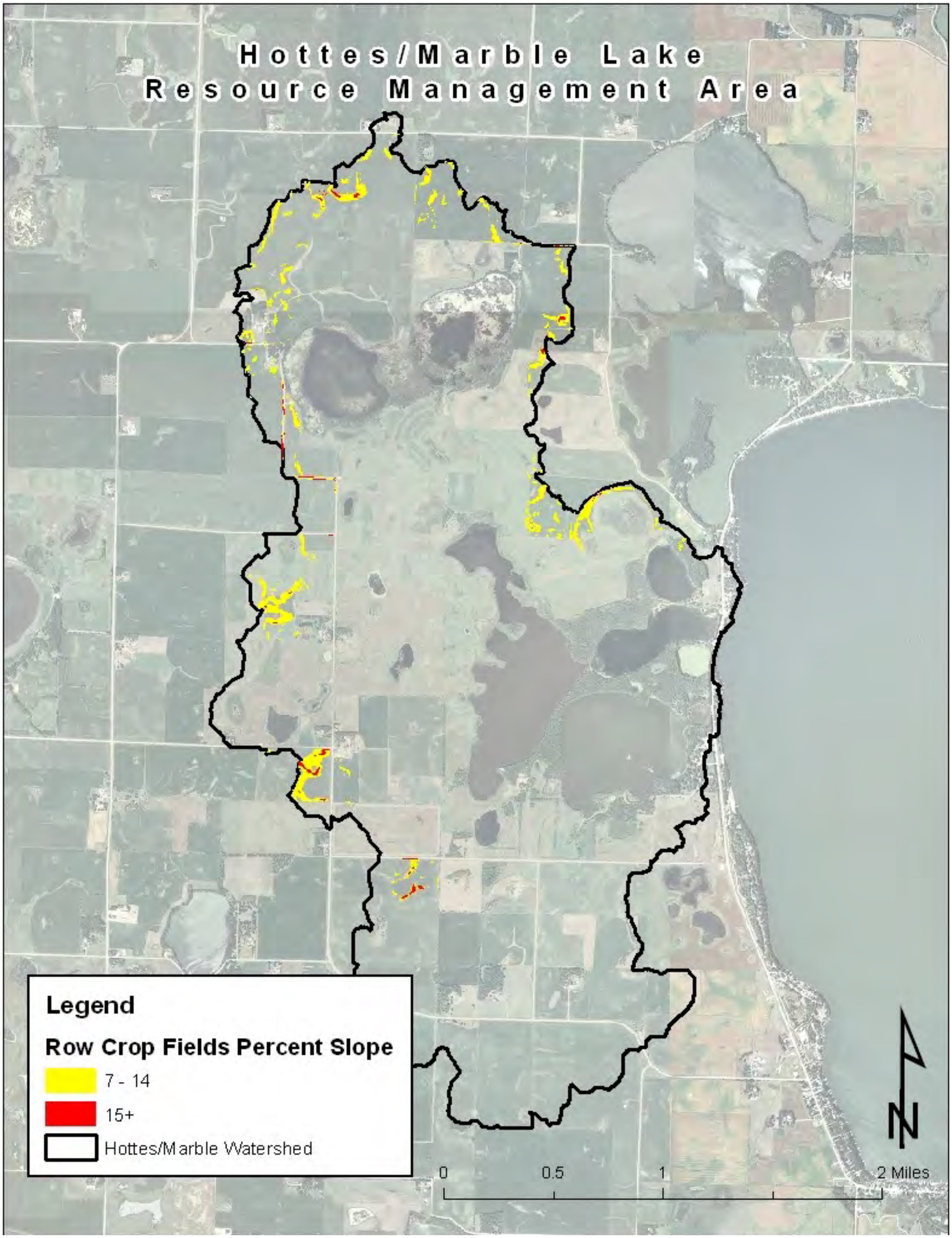

Figure 88 Hottes/Marble Lake Non-Priority Row Crop Targeted Slopes

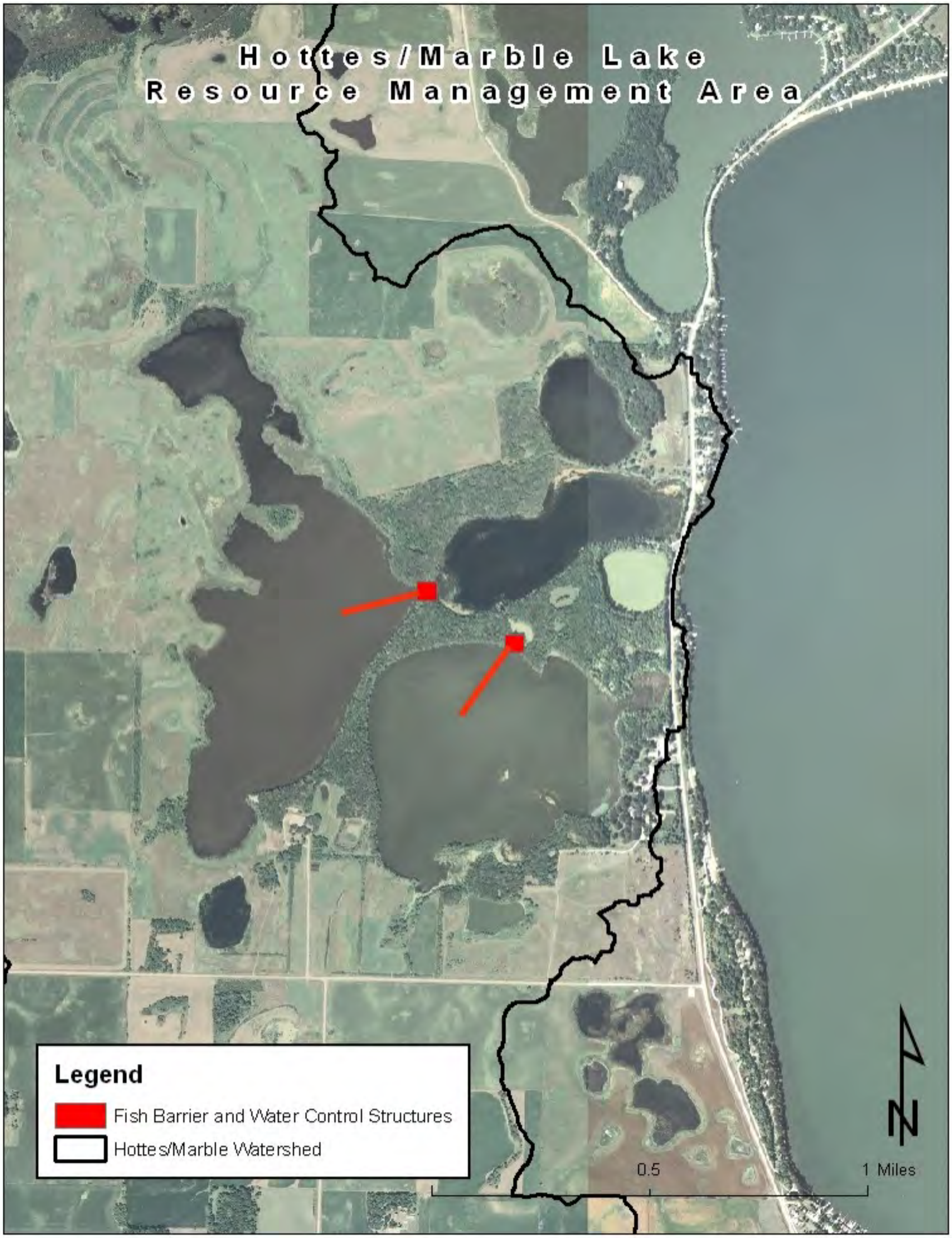

Figure 89 Hottes/Marble Lake RMA Fish Barrier and Water Control Structure Locations

LITTLE SPIRIT LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
604 ac	2048 ac	1,444 ac	n/a	15	1	n/a	Yes

Lakes in the watershed of Little Spirit Lake: None

RMA's that drain to Little Spirit Lake:

Direct

Little Spirit Lake RMA

Impairment for Little Spirit Lake: Little Spirit Lake, according to the 2016 Assessment Summary, is full supporting its designated uses. Designated uses for Little Spirit Lake are Primary Contact Recreation and Aquatic Life.

Objective: Little Spirit Lake is a fully functional lake and is protecting Big Spirit Lake from large sediment deposits and nutrients. The goal is to maintain Little Spirit Lake as a fully functional lake that protects Big Spirit Lake and indirectly reducing sediment and phosphorus loads to Lower Gar and Upper Gar Lakes which are impaired.

Little Spirit Resource Management Area (RMA)

Objective – Restore and maintain Little Spirit Lake to a clear water system. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake and Lower Gar Lake in accordance with their specific approved TMDL's.

Description – Major changes in hydrology in the watersheds of this complex along with the introduction of common carp have led to slow degradation of water quality in this shallow lake. Aquatic vegetation has nearly disappeared within Little Spirit Lake. The Little Spirit Lake watershed represents nearly 9% of the watershed of Big Spirit Lake. When healthy, the shallow lake and wetland complex making up Little Spirit Lake watershed provide important watershed protection to Big Spirit Lake. These areas also provide critical fishery and wildlife habitats. A holistic approach is needed to restore ecological health and water quality to this complex. A combination of both cultural and soil erosion control practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing the following plan to simulate natural drought conditions, managed water level draw downs are needed to stimulate growth of emergent aquatic vegetation and reduce or eliminate common carp populations.

Restoration Planning Components

<u>Phosphorus Management</u>
A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 359 pounds of Phosphorus from entering Little Spirit Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

<u>Land Use Change</u>
A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 1,638.7 pounds of Phosphorus from entering Little Spirit Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

<u>Edge of Field</u>
A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 465.3 pounds of Phosphorus from reaching Little Spirit Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

<u>Shallow Lake Treatment</u>
Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 306.6 pounds of Phosphorus from entering Little Spirit Lake.

<u>Education</u>
An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this

<u>Monitoring</u>
Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Little Spirit Lake Resource Management Area

Clean Water Alliance						Today's Date:		2/9/2018						
	Project Lead:	John H. Wills												
	Start Date:	7/1/2012												
			Annual	Long Term										
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				13%	$18,402	$0	359.0	0.0	-$50	$0	$380	74	-$20.83
1.1	Conservation Tillage	SWCD	400		10%	-$400		40.04	0.0	-$10	$0	-$400	12	-$33.33
1.2	No-Till System	SWCD	187		42%	$2,244		66.37	0.0	$34	$0	$780	62	$12.50
1.3	P-Rate Reduction	SWCD	487		0%	-$5,357		31.02	0.0	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	467		0%	$21,915		221.59	0.0	$99	$0	$0	-	$0.00
2	**Land Use Change**				0%	$0	$113,805	1,638.7	0.0	$0	$382	$0	$0	$0
2.1	Grassed Waterway	SWCD		5122	0%		$12,805	432.50	0.0	$0	$30	$0	-	$0.00
2.2	Sediment Basins	SWCD		10	0%		$18,000	668.30	0.0	$0	$27			
2.3	Grade Stabilization Structure	SWCD		1	0%		$18,000	102.30		$0	$176	$0	-	$0.00
2.4	Land Retirement	SWCD		10	0%		$65,000	435.60	0.0	$0	$149	$0	-	$0.00
3	**Edge of Field**				2%	$0	$54,962	465.3	0.0	$0	$643	$4,700	3	$1,566.67
3.1	Wetland Restoration	SWCD		2	0%		$40,000	237.50		$0	$168	$0	-	$0.00
3.2	Sediment Control Practice	SWCD		4	0%		$40,000	97.30		$0	$411	$0	-	$0.00
3.3	Vegetative Buffer	SWCD		2	0%		$462	45.60		$0	$10	$0	-	$0.00
3.4	Tile Intake Treatment	SWCD		15	8%		$4,500	64.90		$0	$53	$4,700	3	$1,566.67
4	**In-Lake Treatment**				13%	$0	$340,800	306.6	0.0	$0	$16,066	$0	$0	$0
4.1	Shoreline/bank Restoration	FISH		1800	0%		$325,800	305.60		$0	$1,066			
4.2	Fish Barrier and Lake	FISH		1	25%		$15,000	1.00	0.0	$0	$15,000			$0.00
5	**Education**					$11,000	$0	0.00	0.0	$0	$0	$0	$0	$0
5.1	Radio	SWCD				$9,000								
5.2	Print	SWCD				$1,500								
5.3	Landowner Visits	SWCD				$0								
5.4	Landowner Seminar	SWCD				$500								
6	**Monitoring**				0%	$20,500	$0	0.0	0.0	$20,500	$0	$0	$0	$0
6.1	Lake Monitoring	LSL			0%	$6,000				$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500				$500	$0			
6.1.2	CLAMP	LSL			0%	$500				$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			0.0	$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			0.0	$5,000	$0			
6.3	LID Practice Samples	SWCD			0%	$3,500			0.0	$3,500	$0			$0.00
	Totals					$49,902	$539,567	2,770	0			$5,080	$77	$66

Table 35 Management Plan for Little Spirit Lake RMA Priority Sub-Watershed (Wills J. H., 2012)

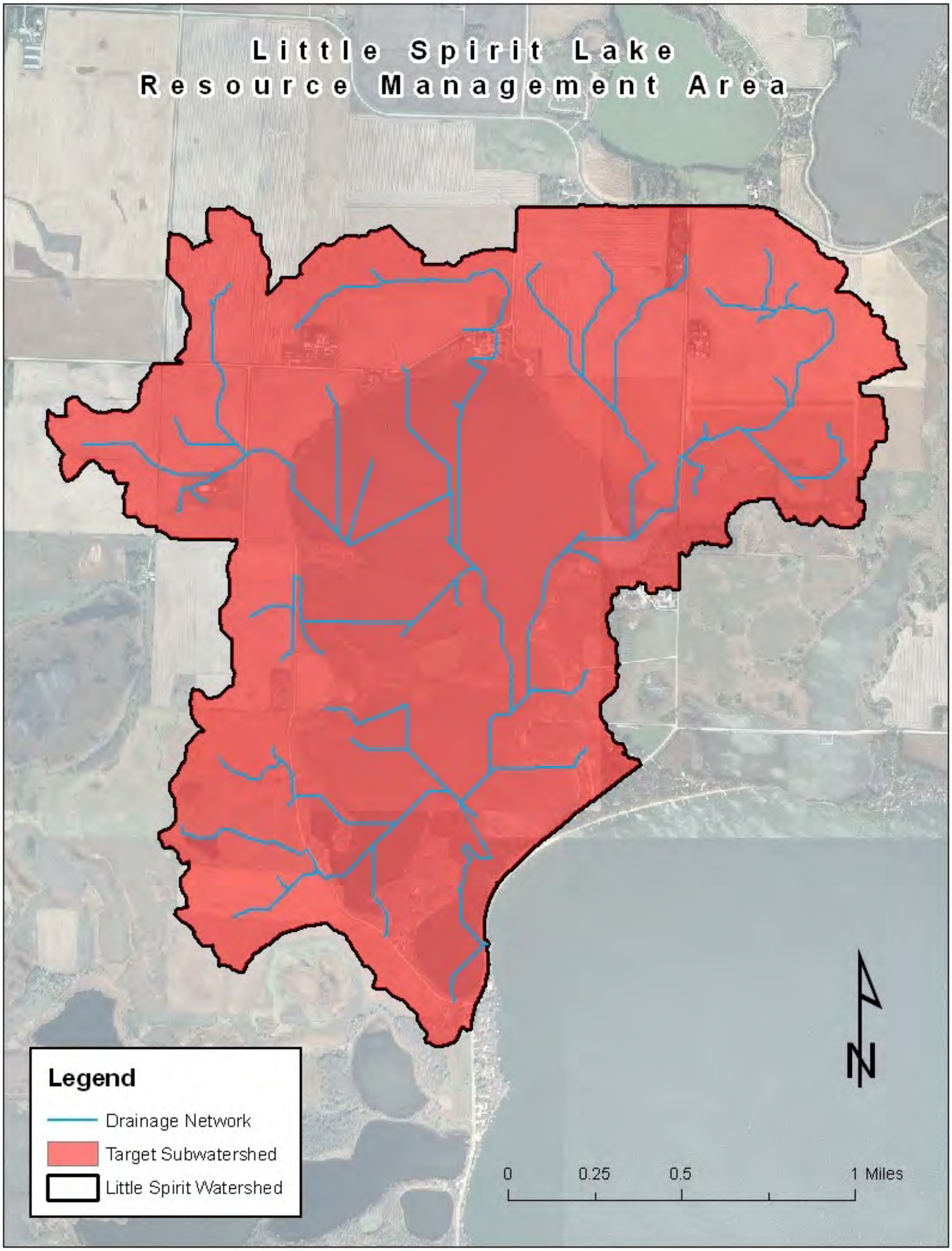

Figure 90 Little Spirit Lake Resource Management Area

Little Spirit Lake Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
430	Lake						17.2	168.7	9.8	1
428	Lake						34.9	161.2	4.6	2
436	Lake						20.0	212.7	10.6	3
401	Lake						1.6	121.3	74.0	4
464	Lake						1.5	54.4	35.8	5
500	Lake						8.4	46.4	5.5	6
486	Lake						0.9	48.8	52.5	7
406	430	Lake					4.6	52.3	11.5	8
400	408	414	436	Lake			1.4	90.4	66.5	9
395	401	Lake					2.0	79.9	39.7	10
402	400	408	414	436	Lake		14.6	52.2	3.6	11
425	430	Lake					2.9	29.3	10.2	12
414	436	Lake					6.1	146.9	24.2	13
408	414	436	Lake				6.9	117.8	17.0	14
398	428	Lake					4.1	28.7	6.9	15
473	Lake						1.6	31.1	19.2	16
407	397	395	401	Lake			7.0	18.7	2.7	17
397	395	401	Lake				9.4	54.7	5.8	18
506	Lake						2.8	8.9	3.2	19
499	500	Lake					2.3	13.5	5.9	20
396	406	430	Lake				4.9	17.9	3.6	21
399	428	Lake					2.7	23.0	8.6	22
472	Lake						0.4	5.4	13.9	23
389	402	400	408	414	436	Lake	2.7	14.3	5.2	24
429	436	Lake					2.3	33.9	14.4	25
390	402	400	408	414	436	Lake	0.8	6.4	8.3	26
377	388	428	Lake				1.6	5.4	3.3	27
438	Lake						3.3	7.2	2.2	28
502	Lake						7.3	11.1	1.5	29
412	Lake						1.8	4.4	2.5	30
494	500	Lake					1.4	4.5	3.2	31
439	430	Lake					0.5	3.7	7.1	32
418	429	436	Lake				2.6	10.0	3.9	33
393	406	430	Lake				0.7	3.0	4.3	34
383	398	428	Lake				3.3	5.5	1.7	35

Table 36 Wetland restoration priorities for the Little Spirit Lake watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

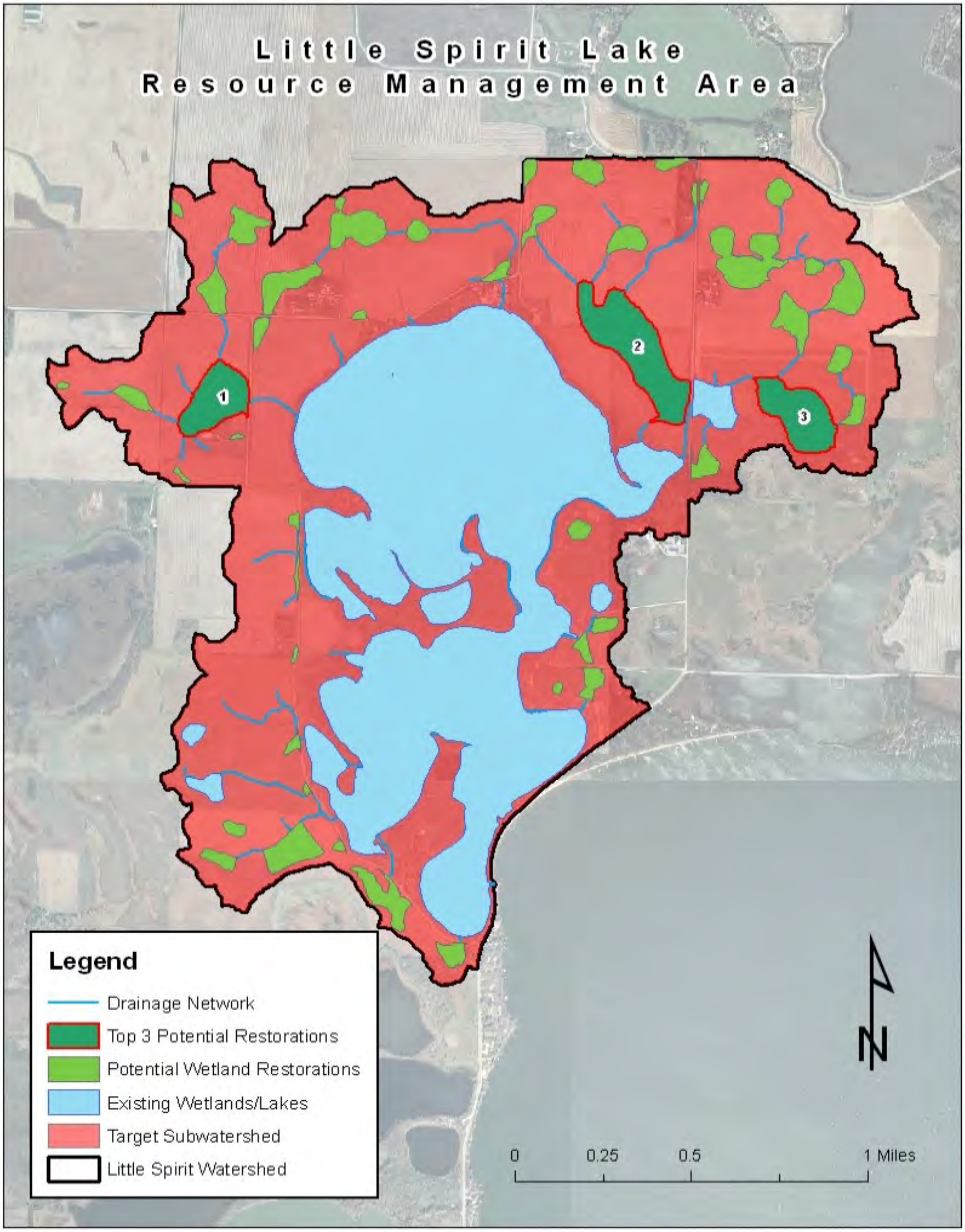

Figure 91 Little Spirit Lake Prioritized Wetland Restorations

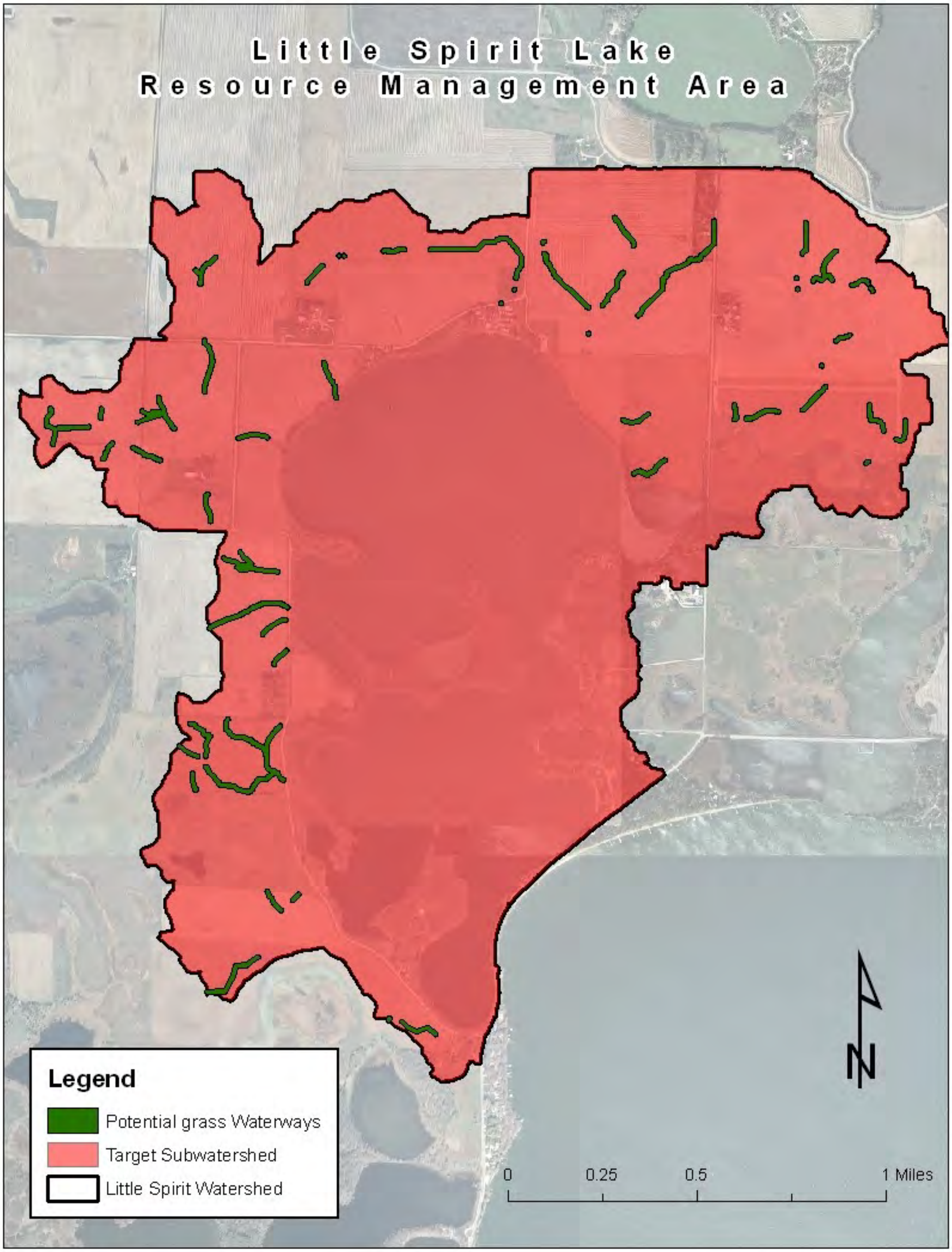

Figure 92 Little Spirit Lake Ephemeral Gullies

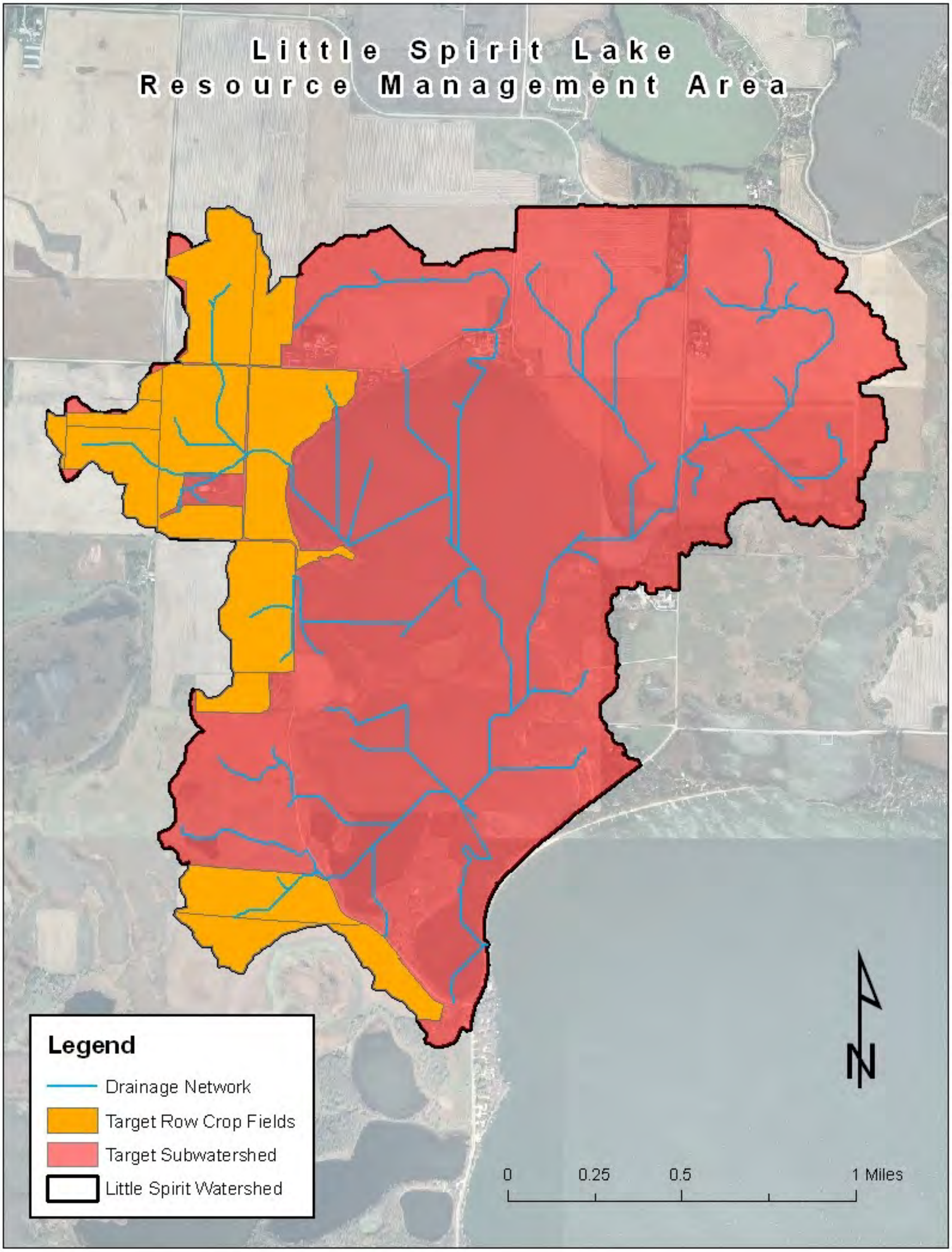

Figure 93 Little Spirit Lake Target Row Crop Fields

Figure 94 Little Spirit Lake Fish Barrier Location

LOON LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
679 ac	19,238 ac	18,559 ac	n/a	3	1	0	Yes

Lakes in the watershed of Loon Lake:

Direct
Rush Lake
Clear Lake

Indirect
Pearl Lake

RMA's that drain to Loon Lake:

Direct
Loon Lake RMA

Impairment for Loon Lake: Loon Lake was impaired in 2018 for nutrient/eutrophication biological indicators. There is no approved TMDL for this Loon Lake as of 2010. The Minnesota Pollution Control Agency show that work on the TMDL will be complete in 2018. Within the Loon Lake watershed Clear Lake is impaired for nutrient/eutrophication biological indicators and a TMDL was written by the State of Minnesota in 2010.

Objective **–** To remove excessive nutrient impairment from Clear and Loon Lake. This work will be done by reducing sediment loading into Clear and Loon Lake from agricultural landscape, minimal urban areas and improvement of septic systems. Improvements to Loon Lake are necessary to protect Big Spirit Lake from being impaired for excess nutrients and nuisance algae blooms. The work done within the Loon Lake watershed will also have an impact on the impairments on Upper Gar and Lower Gar Lakes.

Loon Lake Resource Management Area (RMA)

Objective – Restore and maintain Loon Lake to a clear water state. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake (3,300 pounds per year) and Lower Gar Lake (6,100 per year) in accordance with their specific approved TMDL's.

Description – Major changes in hydrology in the watersheds of this complex along with the introduction of common carp have led to slow degradation of water quality in this shallow lake. Aquatic vegetation has nearly disappeared within Loon Lake Watershed.

Restoration Planning Components

Phosphorus Management

A combination of Conservation Tillage, No-till systems, Phosphorous Rate Reduction, and Cover Crops will reduce approximately 5,535.5 pounds of Phosphorus from entering Big Spirit Lake each year. The Spreadsheet that follows details the number of acres and level of treatment. However, it is significant to understand that the important figure to reach is not an acres of a practice but rather the pounds of phosphorus reduction.

Land Use Change

A combination of Grassed Waterways, Sediment Basins, Grade Stabilization, Structures, and land retirement will prevent approximately 14,453.3 pounds of Phosphorus from entering Big Spirit Lake. The spreadsheet that follows will detail the number of acres and the level of treatment necessary to get the required level of reduction. However, it is significant to point out that the pounds of Phosphorus is the important factor in the reduction.

Edge of Field

A combination of wetland restorations, sediment control practices, vegetative buffers, and tile intake treatments will be used to prevent approximately 10,421.5 pounds of Phosphorus from reaching Big Spirit Lake. It is significant to note that the acres and number of practices is not as important as is the pounds of Phosphorus reduced.

Shallow Lake Treatment

Shoreline restoration and carp exclusion and reduction are used in this category to reduce the in-lake contribution of sediment and Phosphorus from being re-suspended into the lake and a continual problem. It is estimated that these practices will eliminate 306.6 pounds of Phosphorus from entering Big Spirit Lake.

Education

An intensive education campaign to change attitudes and the culture that has been formed over time will be implemented. The education campaign will closely follow the Public Outreach program that is outlined on page 13 of this Management Plan. The campaign will specifically target the landowners and operators of this

Monitoring

Water monitoring of this RMA will be vital in providing a baseline and documentation of any improvements that are realized by the cultural practices and the erosion control practices that are installed as part of the plan. The water monitoring will be inclusive and follow the QUAPP that has been developed specifically for this RMA.

Loon Lake Resource Management Area														
Clean Water Alliance						Today's Date:		2/9/2018						
	Project Lead:	John H. Wills												
	Start Date:	7/1/2012												
			Annual	Long Term										
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				8%	$294,186	$0	5,539.5	-$50	$0	$0	340	$4.17
1.1	Conservation Tillage	SWCD	6000		10%	-$6,000		600.60	-$10	$0	-$6,000	180	-$33.33
1.2	No-Till System	SWCD	2091		20%	$25,092		742.10	$34	$0	$6,000	160	$37.50
1.3	P-Rate Reduction	SWCD	8091		0%	-$89,001		515.40	-$173	$0	$0	0	$0.00
1.4	Cover Crop	SWCD	8091		0%	$364,095		3681.41	$99	$0	$0	0	$0.00
2	**Land Use Change**				1%	$0	$1,097,583	14,453.5	$0	$246	$2,455	67	$37
2.1	Grassed Waterway	SWCD		25633	2%		$64,083	2205.40	$0	$29	$2,455	67	$36.64
2.2	Sediment Basins	SWCD		35	0%		$63,000	3125.60	$0	$20			
2.3	Grade Stabilization Structure	SWCD		3	0%		$54,000	602.30	$0	$90	$0	0	$0.00
2.4	Land Retirement	SWCD		141	0%		$916,500	8520.20	$0	$108	$0	0	$0.00
3	**Edge of Field**				0%	$0	$272,199	10,421.5	$0	$240	$12,544	12	$1,045.33
3.1	Wetland Restoration	SWCD		5	0%		$100,000	8236.20	$0	$12	$0	0	$0.00
3.2	Sediment Control Practice	SWCD		14	0%		$140,000	1173.50	$0	$119	$0	0	$0.00
3.3	Vegetative Buffer	SWCD		29	0%		$6,699	756.80	$0	$9	$0	0	$0.00
3.4	Tile Intake Treatment	SWCD		85	1%		$25,500	255.00	$0	$100	$12,544	12	$1,045.33
4	**In-Lake Treatment**				13%	$0	$340,800	306.6	$0	$16,066	$0	0	$0
4.1	Shoreline/bank Restoration	FISH		1800	0%		$325,800	305.60	$0	$1,066			
4.2	Fish Barrier and Lake	FISH		1	25%		$15,000	1.00	$0	$15,000			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	0	$0
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	0	$0
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$325,686	$1,710,582	30,721			$14,999	419	$35.80

Table 37 Management Plan for Loon Lake RMA Priority Sub-Watershed (Wills J. H., 2012)

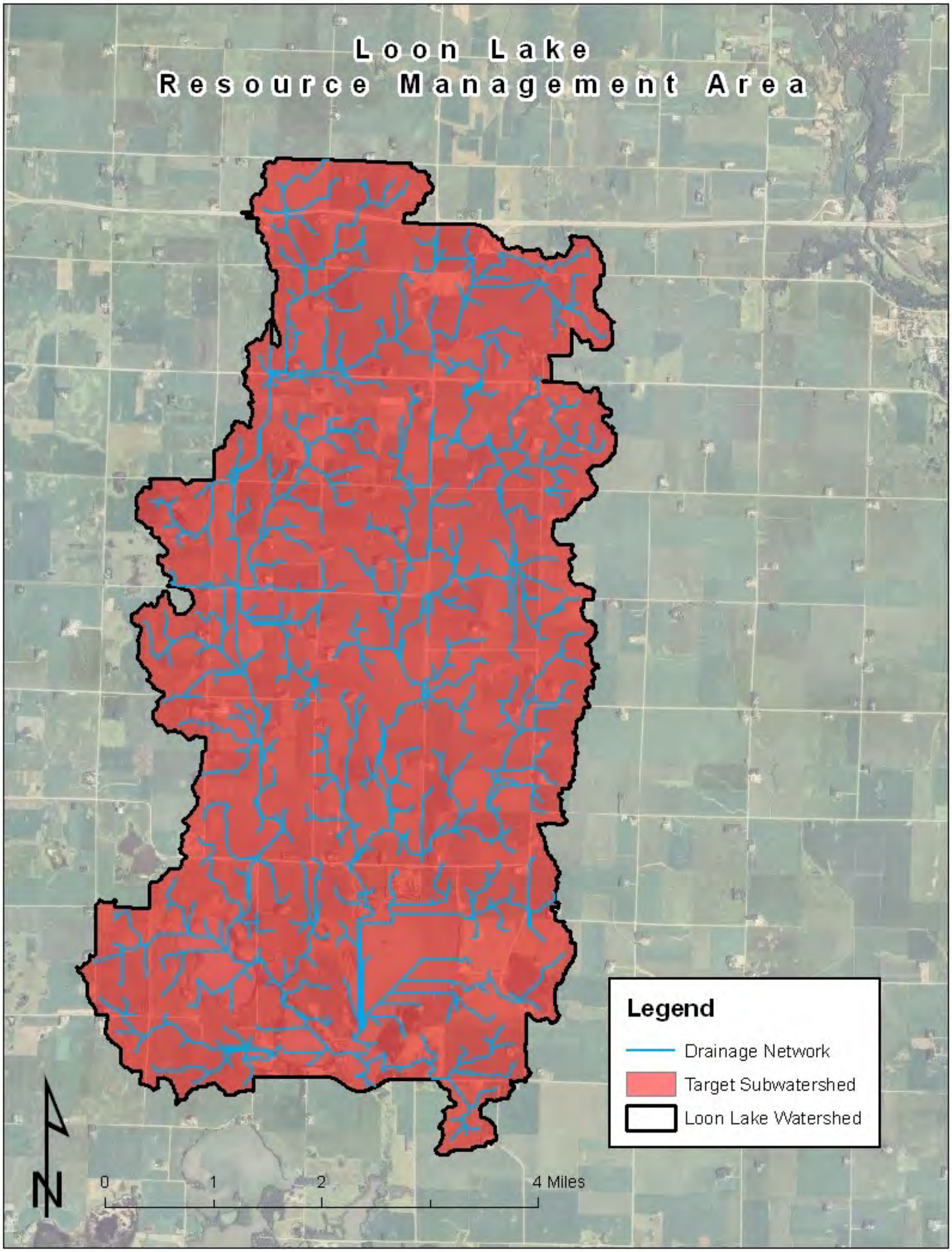

Figure 95 Loon Lake Resource Management Area

Loon Lake Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
155	162	255	Lake				14.6	973.5	66.8	1
271	280	Lake					94.1	391.3	4.2	2
166	Lake						17.6	701.9	39.9	3
203	255	Lake					49.8	533.1	10.7	4
191	175	255	Lake				73.3	435.1	5.9	5
186	Lake						74.0	424.2	5.7	6
101	Lake						13.1	413.5	31.5	7
237	255	Lake					11.2	300.5	26.7	8
318	Lake						7.7	270.6	35.2	9
114	255	Lake					5.8	291.5	50.6	10
117	114	255	Lake				5.0	272.2	54.1	11
324	Lake						12.0	275.0	23.0	12
349	363	358	Lake				8.6	204.8	23.9	13
207	191	175	255	Lake			28.3	209.8	7.4	14
315	317	324	Lake				39.2	185.0	4.7	15
370	374	Lake					11.3	225.4	19.9	16
200	203	255	Lake				7.6	243.3	32.0	17
108	136	145	166	Lake			13.3	258.3	19.4	18
35	89	255	Lake				5.3	171.4	32.1	19
84	86	155	162	255	Lake		9.5	181.7	19.2	20
319	311	Lake					39.1	158.4	4.0	21
150	154	Lake					16.4	222.2	13.5	22
363	358	Lake					33.7	254.0	7.5	23
53	47	50	52	89	255	Lake	95.8	211.2	2.2	24
106	155	162	255	Lake			5.2	151.3	29.4	25
238	237	255	Lake				3.3	120.2	37.0	26
21	Lake						3.3	123.3	37.6	27
279	Lake						3.3	92.2	27.5	28
229	271	280	Lake				14.9	91.7	6.2	29
381	Lake						14.2	99.8	7.0	30

Table 38 Wetland restoration priorities for the Loon Lake watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

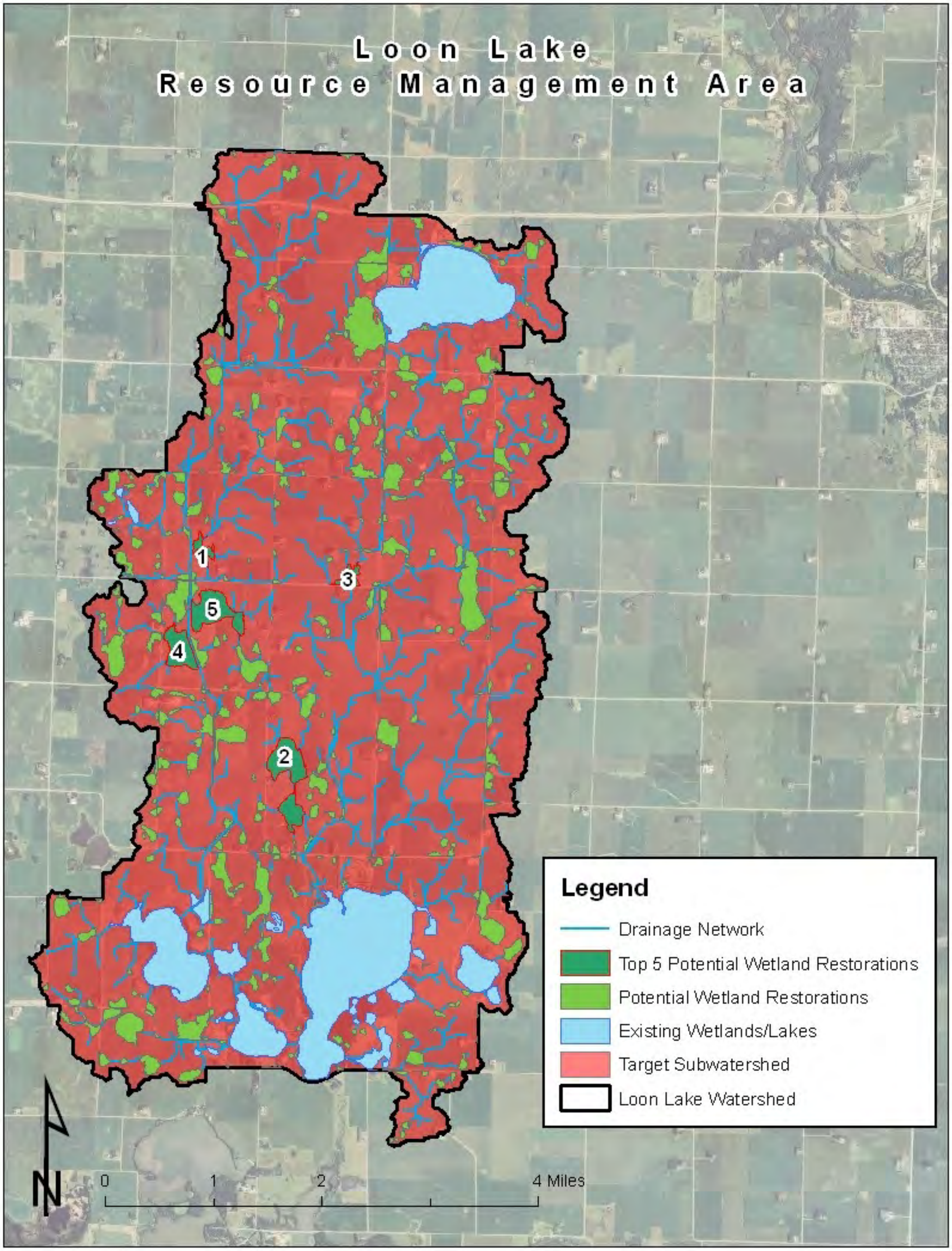

Figure 96 Loon Lake Priority Wetland Restoration

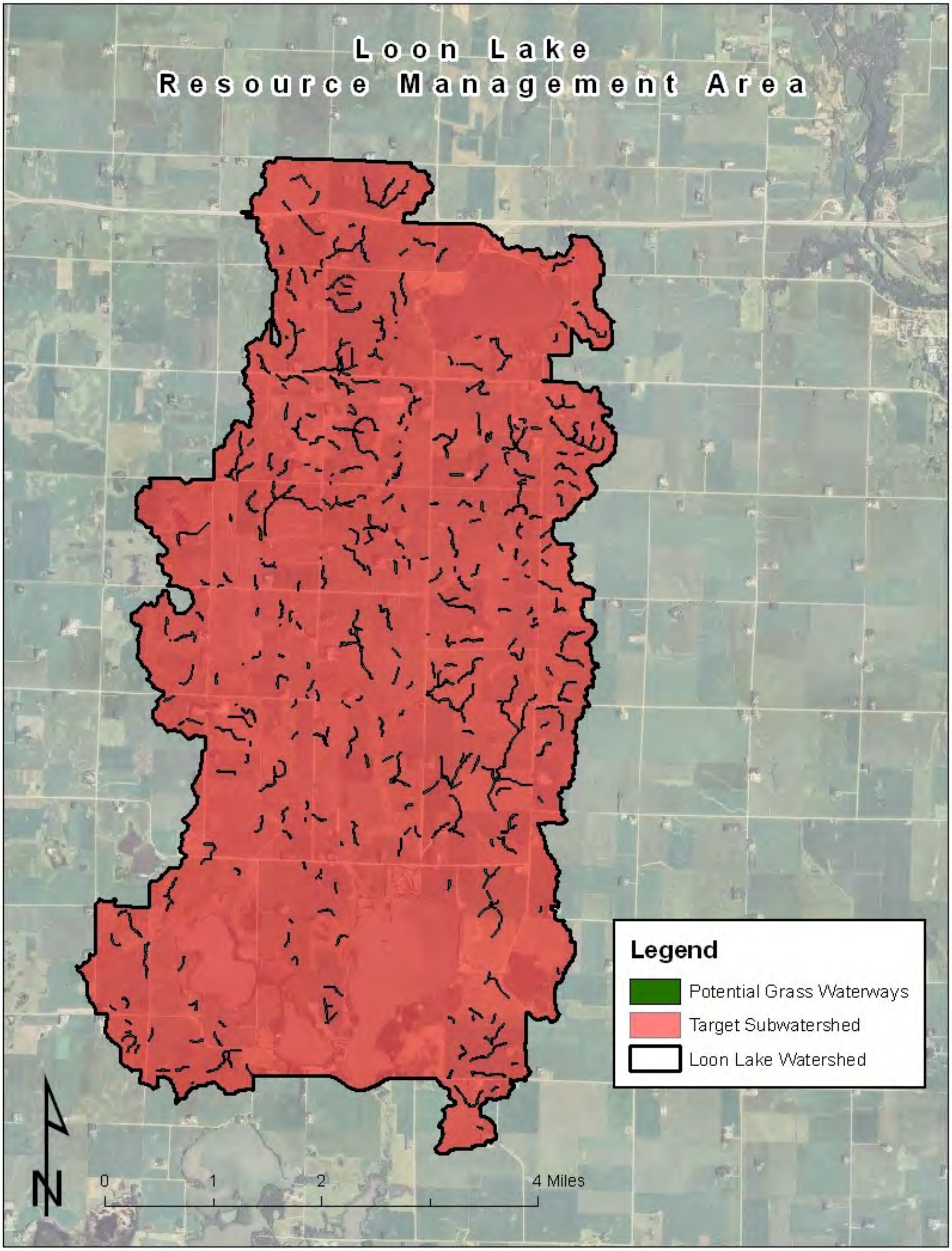

Figure 97 Loon Lake Priority Ephemeral Gullies

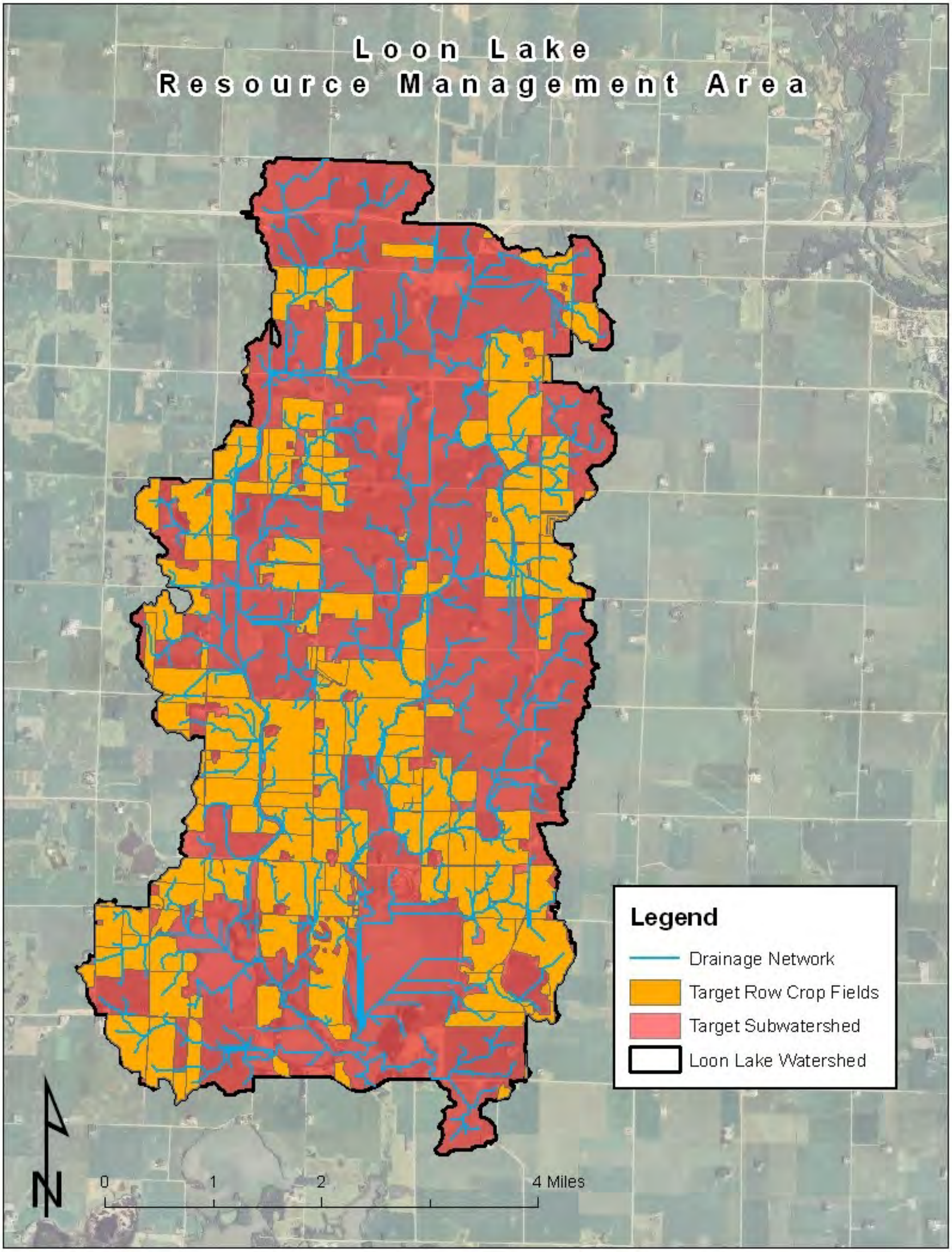

Figure 98 Loon Lake Target Row Crop Fields

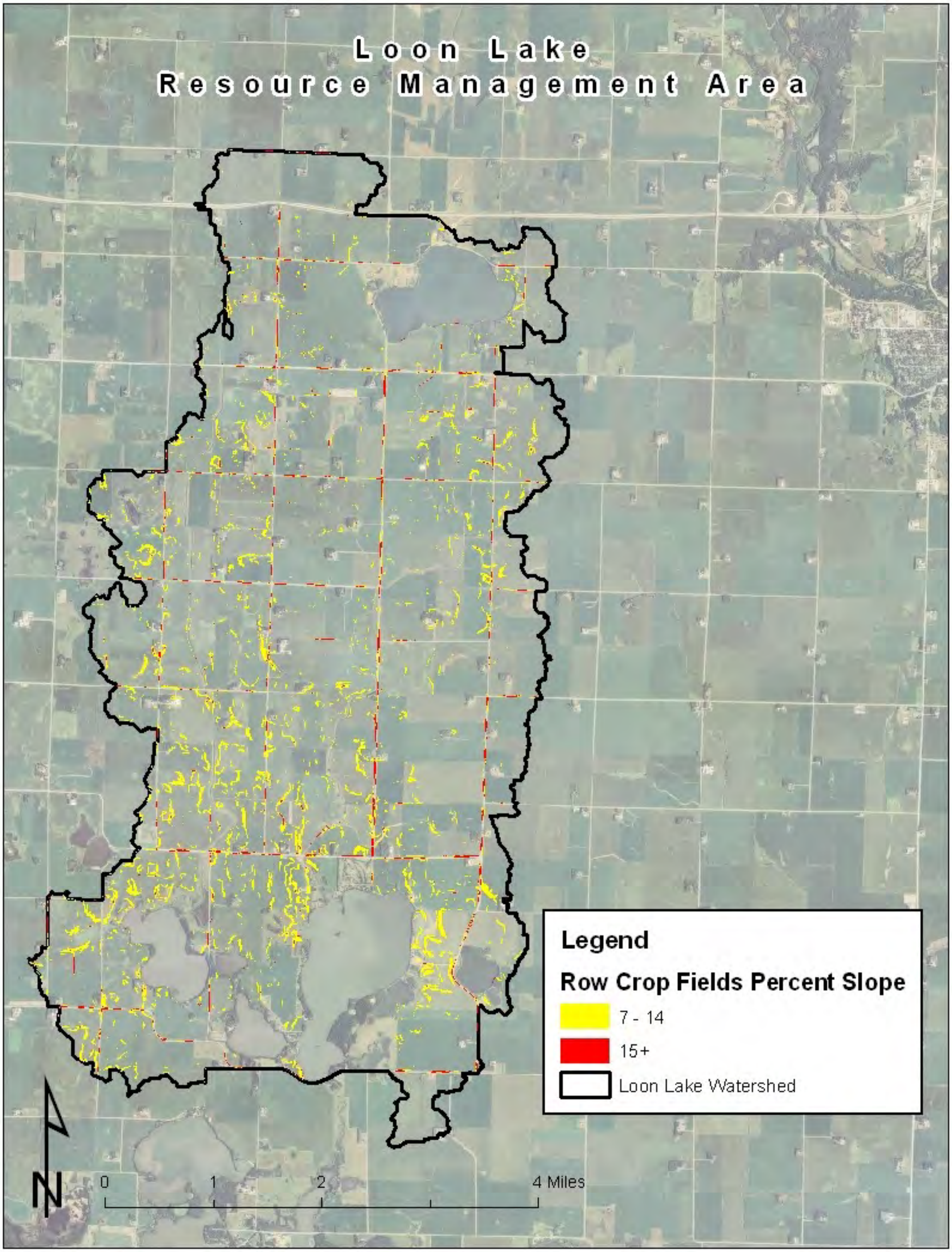

Figure 99 Loon Lake Target Row Crop Slopes

URBAN RMA'S

Objective – Reduce the amount of pollutant and runoff coming from Urban Resource Management Areas.

Description – The Urban Areas of the Iowa Great Lakes have undergone many hydrological changes since the pioneers first settled the Iowa Great Lakes. The reduction of wetlands and the switch from prairies to impervious surfaces left these areas of the watershed very degraded.

When healthy, a series of shallow wetlands provide important watershed protection to the lakes of the Watershed. These areas also provided critical fishery and wildlife habitats. A holistic approach is needed to restore ecological health and water quality within the areas identified as urban resource management areas. A combination of both watershed and lake management practices is needed to reach the project objective.

Sediment, nutrients, and water volume loadings from the urban areas should be reduced utilizing Low Impact Development and other conservation practices. Low Impact Development practices help to reduce runoff, filter pollutants, and cool the water before it reaches the lake. The figures to follow show where the majority of runoff comes from in the Urban RMA's as well as storm sewer intakes. In addition, there are figures that show storm sewer intakes that are easily retrofitted to rain garden/bio-retention cells. The Low Impact Development practices to be used include, but are not limited to, rain gardens, bio-retention cells, infiltration trenches, grassy swales, soil amendments/improvements, deep tillage, deep aeration, and others.

Pollution Reduction

The Iowa Great Lakes has a significant area of urban or urbanizing land. The density of urban area is proportional to the amount of runoff from a site. When runoff comes from an urban area it is nearly all unfiltered and contains a high level of pollutants to include phosphorous, nitrates, zinc, copper, antifreeze, and motor oil. Areas where more than 50% of a rain event runs off into the storm sewer system should be treated with Low Impact Development (LID) Practices to reduce the overall runoff from a high level to a moderate or low level. Using assigned LID to treat these areas will reduce the pollutant level as well as the "flashy" rise and fall of the lakes water level. This flashy water level is a cause of shoreline erosion and poor emergent vegetation growth.

Using a variety of practices recommended in the Statewide Urban Design and Specifications in the locations with the highest runoff value will give the greatest benefit for the dollars spent. In addition, a culture of ordinances and regulations which favor low impact development on existing and new construction sites should be encouraged. The goal is to reduce the reduce the runoff value from more than 60% runoff to 30% runoff or less on those sites with high runoff values. Using LID practices, the runoff will be slower, less in volume, and carry fewer pollutants with it. According to the Iowa Storm water Management Manual the practices identified in its pages reduce pollution by around 30% to as much as 85% by using these criteria. The pollution caused by urban runoff will be reduced proportionately with the runoff volume creating a pollution reduction in all urban areas from 30% to 60%.

Great Lakes Mall Urban Resource Management Area													
Clean Water Alliance					Today's Date:		2/9/2018						
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				39%	$15,090	$0	160.9	$286	$0	$3,100	120	$47
1.1	Use No P Fertilizer	SWCD	30		0%	$0		80.00	$0	$0	$0	0	$0.00
1.2	Use silt fence/erosion control	SWCD	3		66%	$15,000		80.00	$188	$0	$2,500	75	$33.33
1.3	Cover Crop	SWCD	2		50%	$90		0.91	$99	$0	$600	45	$13.33
2	**Land Use Change**			38	7%	$0	$1,153,000	294.0	$0	$15,810	$12,267	8	$5,073
2.1	LID Practices (general)	SWCD		15	12%		$343,000	67.00	$0	$5,119	$6,057	2	$4,038.00
2.2	Mall Parking Lot (LID)	SWCD		6	0%		$350,000	85.00	$0	$4,118			
2.3	HyVee Parking Lot (LID)	SWCD		5	0%		$210,000	77.00	$0	$2,727			
2.4	Pure Fishing (LID)	SWCD		8	25%		$250,000	65.00	$0	$3,846	$6,210	6	$1,035.00
2.5	County Expo (LID)	SWCD		4	0%		$100,000	56.00	$0	$1,786	$0	0	$0.00
3	**Edge of Watershed**			5	0%	$0	$25,000	300.0	$0	$167	$0	0	$0
3.1	Wetland Restoration	SWCD		1	0%		$20,000	150.00	$0	$133			$0.00
3.2	Silt Fence/Erosion Control	SWCD		5	0%		$5,000	150.00	$0	$33			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	0	$0
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$3,500	$0	$0	$3,500	$0	$0	0	$0
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$29,590	$1,178,000	755			$15,367	128	$120.53

Table 39 Management Plan for Great Lakes Mall Urban RMA Priority Sub-Watershed (Wills J. H., 2012)

HWY 71 Urban Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				22%	$15,090	$0	165.9	$286	$0	$1,800	45	$40
1.1	Use No P Fertilizer	SWCD	45		0%	$0		85.00	$0	$0	$0	-	$0.00
1.2	Use silt fence/erosion control	SWCD	3		66%	$15,000		80.00	$188	$0	$1,800	45	$40.00
1.3	Cover Crop	SWCD	2		0%	$90		0.91	$99	$0	$0	-	$0.00
2	**Land Use Change**			59	27%	$0	$1,343,655	325.0	$0	$16,331	$809,032	40	$42,655
2.1	LID Practices (general)	SWCD		25	72%		$532,000	87.00	$0	$6,115	$459,032	26	$17,655.08
2.2	Stables/Caseys	SWCD		10	0%		$362,000	95.00	$0	$3,811			$0.00
2.3	Mau Marine Area	SWCD		10	0%		$199,655	78.00	$0	$2,560	$65,000	12	$5,416.67
2.4	Preservation Plaza	SWCD		8	63%		$250,000	65.00	$0	$3,846	$350,000	14	$25,000.00
2.5	Taco House Area	SWCD		6	0%		$100,000	56.00	$0	$1,786	$0	-	$0.00
3	**Edge of Watershed**			6	0%	$0	$25,000	300.0	$0	$0	$0	-	$0
3.1	Wetland Restoration	SWCD		1	0%		$20,000	150.00	$0				$0.00
3.2	Silt Fence/Erosion Control	SWCD		5	0%		$5,000	150.00	$0				$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$3,500	$0	$0	$3,500	$0	$0	-	$0
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$29,590	$1,368,655	791			$810,832	85	$9,539

Table 40 Management Plan for HWY 71 Corridor Urban RMA Priority Sub-Watershed (Wills J. H., 2012)

Walmart/Polaris Urban Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				7%	$15,090	$0	160.9	$286	$0	$500	20	$25
1.1	Use No P Fertilizer	SWCD	35		0%	$0		80.00	$0	$0	$0	-	$0.00
1.2	Use silt fence/erosion control	SWCD	5		20%	$15,000		80.00	$188	$0	$500	20	$25.00
1.3	Cover Crop	SWCD	2		0%	$90		0.91	$99	$0	$0	-	$0.00
2	**Land Use Change**			40	45%	$0	$1 271,111	315.0	$0	$16,052	$507,778	27	$65,502
2.1	LID Practices (general)	SWCD		15	93%		$432,111	78.00	$0	$5,540	$29,401	2	$14,700.68
2.2	Polaris Grounds	SWCD		12	100%		$350,000	85.00	$0	$4,118	$412,658	23	$17,941.65
2.3	Walmart Grounds	SWCD		14	0%		$290,000	87.00	$0	$3,333			
2.4	Great Lakes GM Toyota	SWCD		8	0%		$199,000	65.00	$0	$3,062	$0	-	$0.00
2.5	Bowling Alley	SWCD		6	33%		$90,000	46.00	$0	$1,957	$65,719	2	$32,859.50
3	**Edge of Watershed**			6	50%	$0	$25,000	450.0	$0	$100	$114,078	16	$7,130
3.1	Wetland Restoration	SWCD		1	100%		$20,000	300.00	$0	$67	$114,078	16	$7,129.86
3.2	Silt Fence/Erosion Control	SWCD		5	0%		$5,000	150.00	$0	$33			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$3,500	$0	$0	$3,500	$0	$0	-	$0
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$29,590	$1,296,111	926			$622,356	63	$9,879

Table 41 Management Plan for Polaris/WalMart Urban RMA Priority Sub-Watershed (Wills J. H., 2012)

Figure 100 Arnolds Park Storm Sewer locations

Figure 101 Arnolds Park Easily Retrofitted Storm Sewers

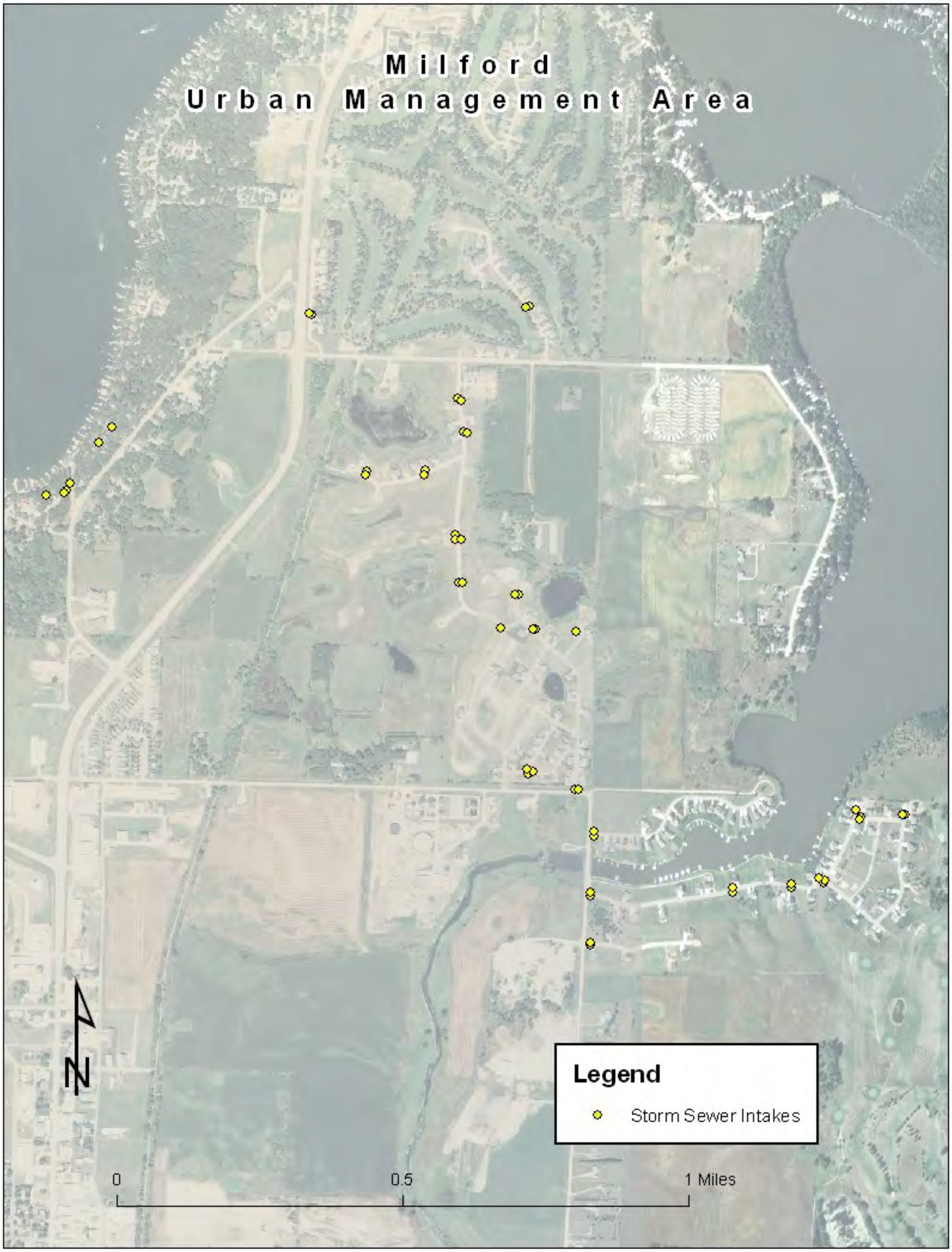

Figure 102 Milford Storm Sewer Intakes

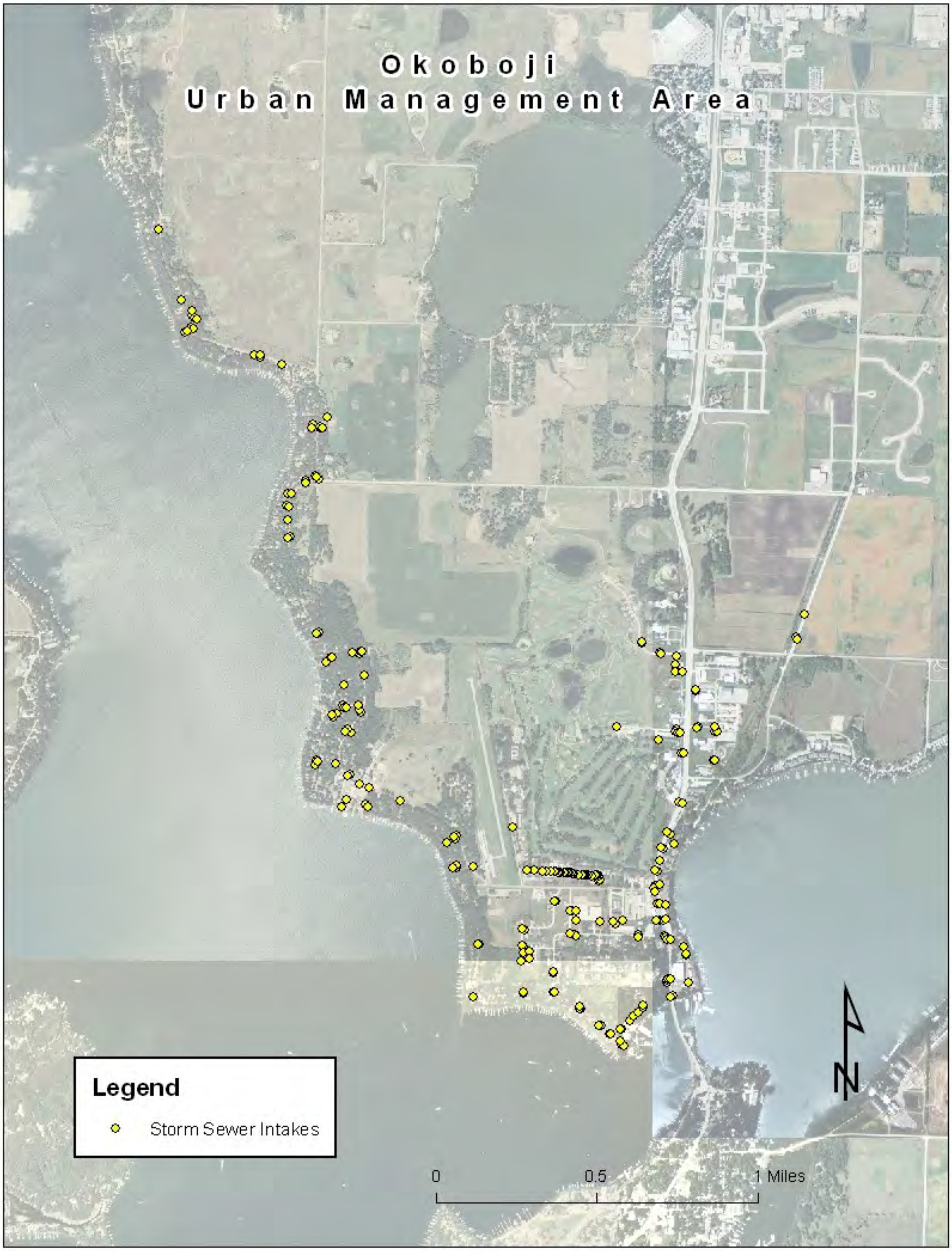

Figure 103 Okoboji Storm Sewer Locations

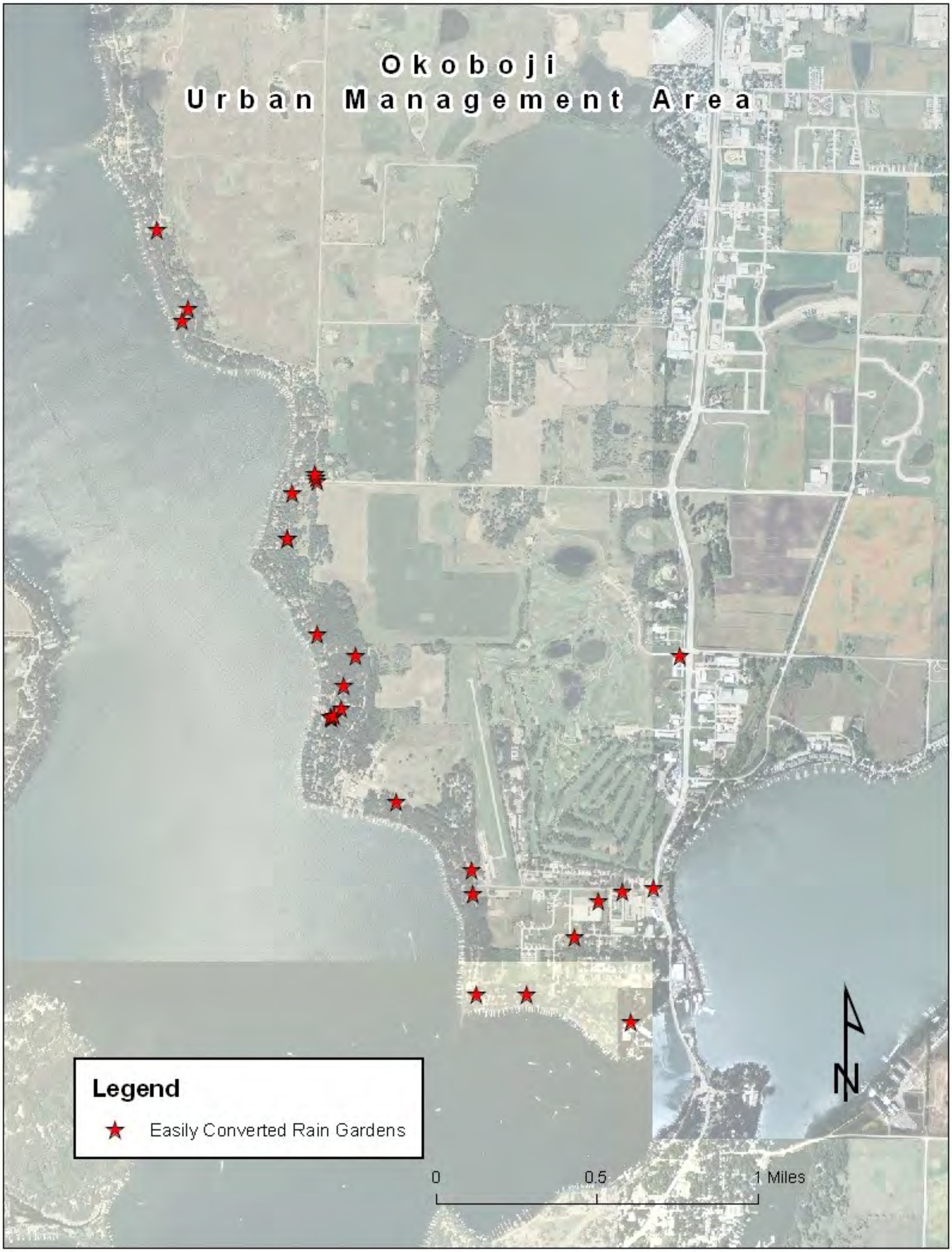

Figure 104 Okoboji Easily Retrofitted Storm Sewers

Figure 105 Orleans Storm Sewer Locations

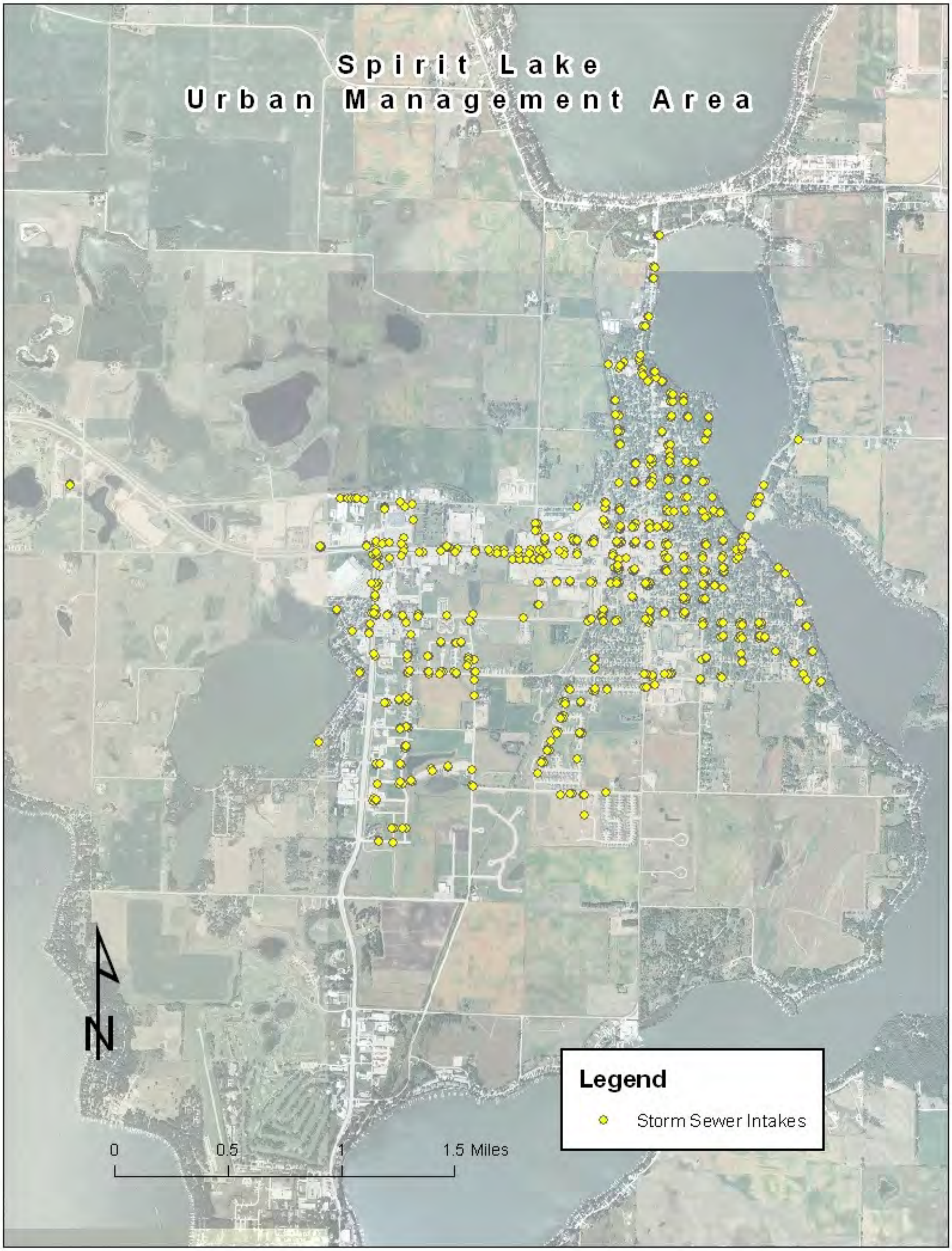

Figure 106 Spirit Lake Storm Sewer Locations

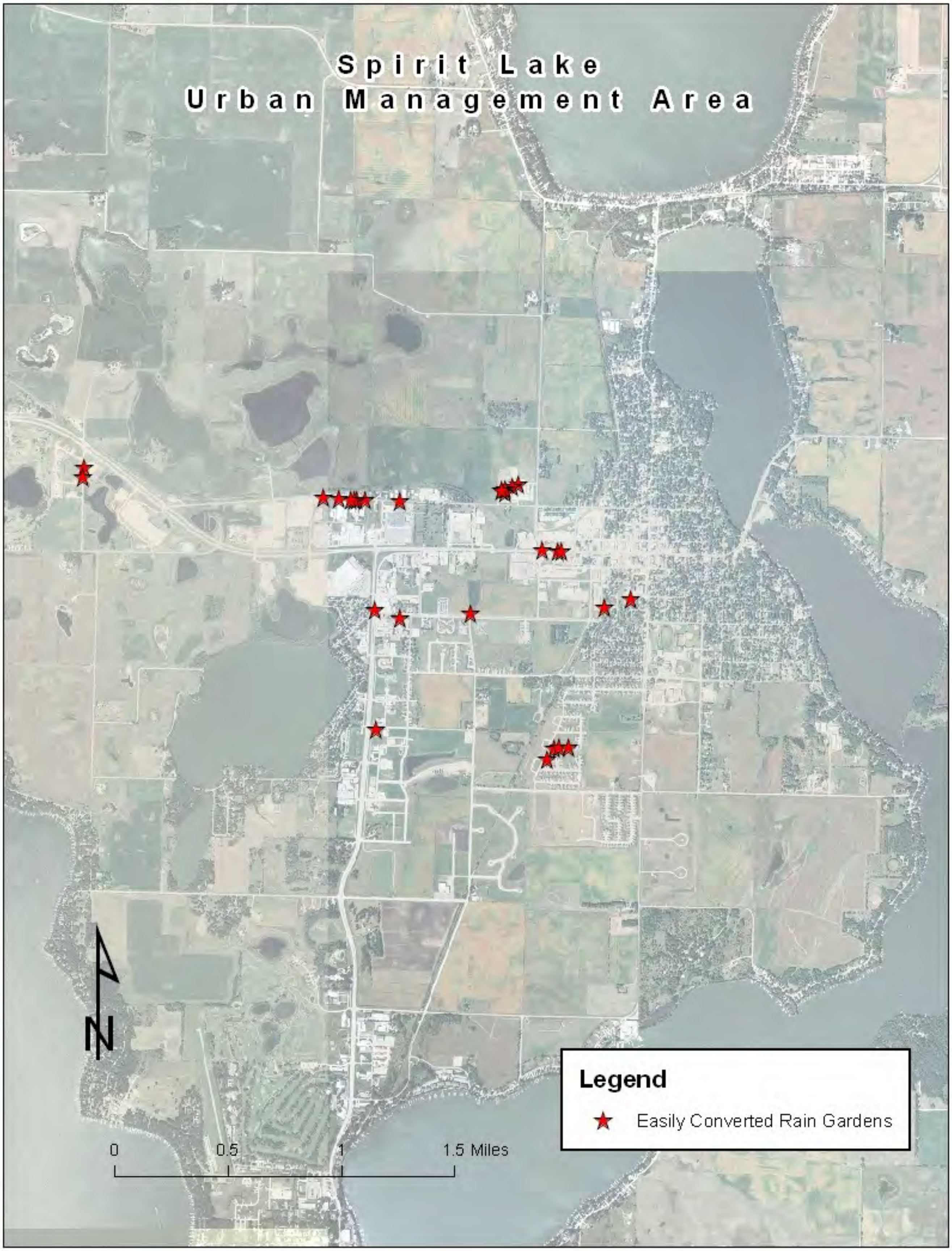

Figure 107 Spirit Lake Easily Retrofitted Storm Sewers

Figure 108 West Okoboji Storm Sewer Locations

Figure 109 West Okoboji Easily Retrofitted Storm Sewers

Figure 110 Wahpeton Storm Sewer Locations

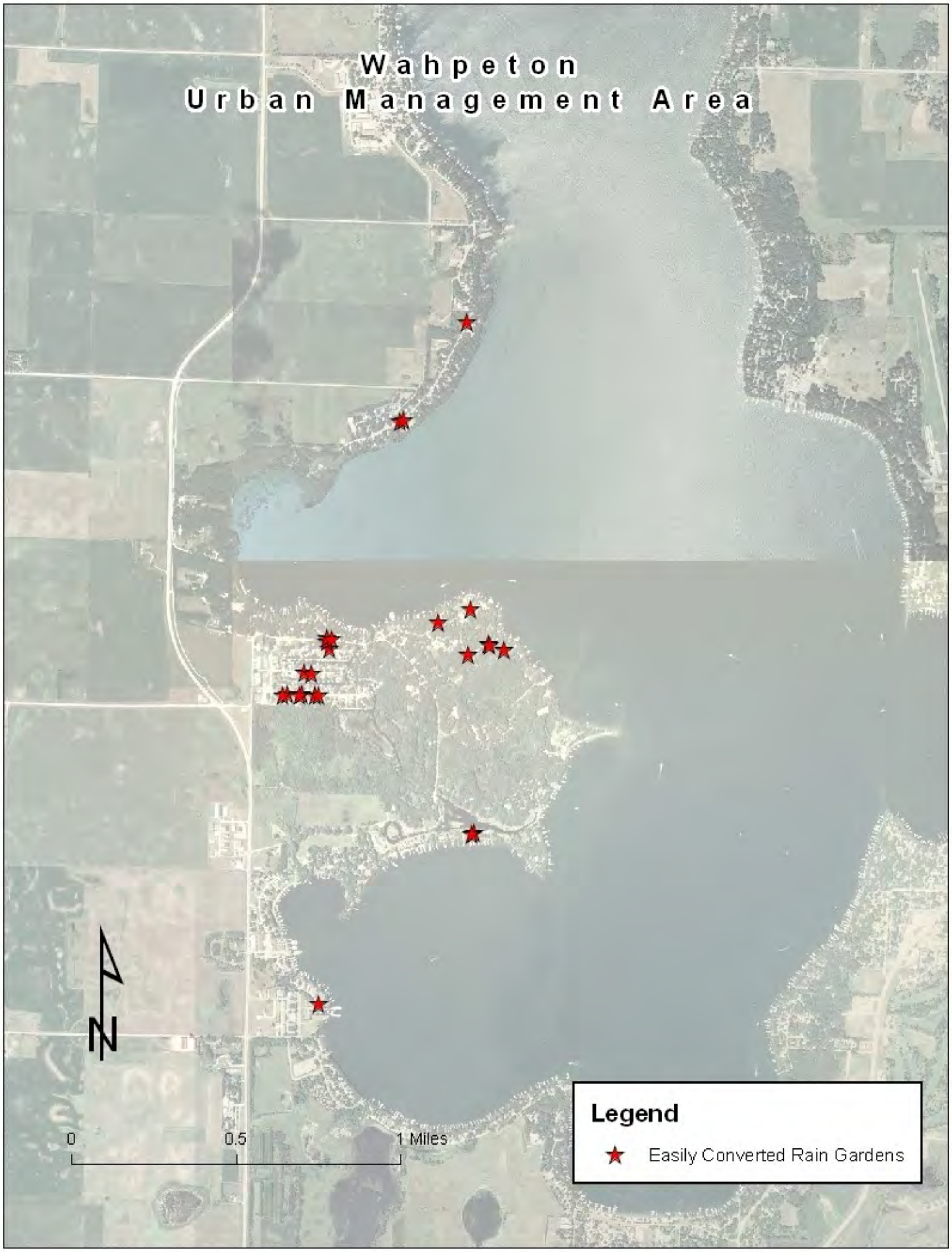

Figure 111 Wahpeton Storm Easily Retrofitted Storm Sewers

1000-FOOT LAKESHORE BUFFER ZONE

Objective – Reduce the amount of pollutant and runoff coming from the area closest and most detrimental to the lakeshore.

Description – Within 1,000 feet of lakeshore of the Iowa Great Lakes, there are areas of urban development, rural farmland, golf courses, recreation areas and timber land. In these areas, there are practices that can be put in place to reduce runoff, sediment delivery and contaminants that are flowing into the IGL. Once implemented, we are hopeful that the quality of the water flowing into the lakes from this buffer will be greatly improved. This zone is critical to the ecosystem as the water from this area has almost instant access to the lakes in a storm and will have the least amount of time to filter out contaminants.

Urban Development: Currently, the residents of this area are accepting of Low Impact Development (LID) practices, but more can be done to implement them on a wider scale. There are projects currently in the planning and early development phase utilizing LID in whole residential developments that will be used as models for years to come for the entire State of Iowa. Practices that will be commonplace in the IGL include:

- Rain Gardens: Naturally filter runoff through the soil as opposed to running off the surface directly into the lake or storm drain
- Pervious Pavers: Paving systems that allow the runoff to naturally filtrate into the soil
- Shoreline Restoration: re-introduce naturally occurring vegetation to the shoreline ecosystem to reduce shoreline erosion due to wind, waves, and humans
- Bio-retention Cells: slows the flow of water to reduce erosion on a larger scale than a rain garden (for commercial scale projects)

Recreation Areas &Timberlands: There are many acres of timber in the Iowa Great Lakes region. Most is located on public land and some is in private residential areas. The public may use the land for hunting, camping, hiking and nature walking. The main problem caused by these areas is soil erosion. Since the trees are so dense, the sunlight does not reach the ground to promote new vegetation growth. Without the root system of the small plants on the floor of the forest, the soil is at risk for washing away in a small storm. The larger storms are capable of degrading the forest to such an extent of washing away soil around tree roots making them vulnerable to falling over in strong winds. Some of the following practices would help reduce the soil erosion making the areas safer and more desirable for recreational uses.

- Rock lined gulley: reduce soil erosion due to flowing water
- Shade loving grasses & ground covers: reduce soil erosion in areas where vegetation is sparse due to low sunlight
- Controlled burns: reduce debris and get rid of dead trees, branches, leaves and any other natural hindrance for new, young growth
- Reduce the number of trees so a savannah type landscape is achieved.

Rural Farmland: There are a few farm fields that exist within the 1000 foot zone of the Lakes. Most of the operators of the farms are concerned with the runoff factors associated with normal maintenance of the land. Incentives could make some conservation practices a more attractive option for farmers who might be interested in improving their operation above what is required.

- CRP: reduce the amount of surface soil area that could end up as flowing sediment (erosion) into the water system
- Conservation tillage & Nutrient and Pest Management: reduce erosion & the amount of natural & synthetic chemicals that could become suspended in the water system
- Grassed waterways: reduce soil erosion, slows the flow of storm water to reduce the chance of gulley formation

Golf Courses: Currently there are 4 golf courses that have land within the buffer area. A golf course has to improve the quality of the course in order to draw in golfers. Because of this courses may use a large amount of fertilizers and pesticides to enhance the vegetation. In addition irrigation is used a great deal on golf courses which causes greater runoff during rain events.

- Fertilizers: more stringent requirements on types and amounts of chemicals put on fairways, greens & roughs within 1000' of the lakeshore
- Buffers around water features: give an additional safeguard against runoff contaminants flowing into the water features
- Additional water features (wetland areas) or any other urban conservation practice: helps to slow and clean the water eventually flowing in to the lakes system

"Other" Non-named Resource Management Area													
Clean Water Alliance						Today's Date:		2/9/2018					
	Project Lead:	John H. Wills											
	Start Date:	7/1/2012											
			Annual	Long Term									
Goal	Tasks	Task Lead	Acres/feet/number	Acres/feet/number	% Complete	Estimated Annual Cost of Practice	Estimated Cost of Practice	Estimated Phosphorous Removal (lbs)	Annual cost per pound of P Removed	Cost per pound of P removed	Actual Cost of Practice	Actual Phosphorous Removed (based on Iowa Pollutant Reduction Calculator)	Actual Cost per Pounds of P removed
1	**Phosphorus Management**				7%	$330,000	$0	8,053.5	-$50	$0	$6,000	144	$177.52
1.1	Conservation Tillage	SWCD	15000		17%	-$15,000		1501.50	-$10	$0	-$2,500	75	-$33.33
1.2	No-Till System	SWCD	7500		10%	$90,000		2661.75	$34	$0	$7,500	56	$133.93
1.3	P-Rate Reduction	SWCD	7500		0%	-$82,500		477.75	-$173	$0	$0	-	$0.00
1.4	Cover Crop	SWCD	7500		1%	$337,500		3412.50	$99	$0	$1,000	13	$76.92
2	**Land Use Change**				31%	$0	$2,420,500	9,389.8	$0	$602	$985,600	452	$2,181
2.1	Grassed Waterway	SWCD		15000	2%		$37,500	1805.40	$0	$21	$0	-	$0.00
2.2	Sediment Basins	SWCD		40	23%		$72,000	1925.70	$0	$37			
2.3	Grade Stabilization Structure	SWCD		2	0%		$36,000	302.20	$0	$119	$0	-	$0.00
2.4	Land Retirement	SWCD		350	100%		$2,275,000	5356.50	$0	$425	$985,600	452	$2,180.53
3	**Edge of Field**				6%	$0	$233,965	3,713.2	$0	$299	$124,178	7	$17,739.71
3.1	Wetland Restoration	SWCD		5	0%		$100,000	2463.50	$0	$41			$0.00
3.2	Sediment Control Practice	SWCD		12	25%		$120,000	808.20	$0	$148	$124,178	7	$17,739.71
3.3	Vegetative Buffer	SWCD		15	0%		$3,465	336.50	$0	$10			$0.00
3.4	Tile Intake Treatment	SWCD		35	0%		$10,500	105.00	$0	$100			$0.00
4	**In-Lake Treatment**				33%	$0	$521,800	290.6	$0	$16,750	$26,562.00	231	$115.04
4.1	Shoreline/bank Restoration	FISH		2800	41%		$506,800	289.60	$0	$1,750	$26,562	231	$115.04
4.2	Fish Barrier and Lake	FISH		1	25%		$15,000	1.00	$0	$15,000			$0.00
5	**Education**					$11,000	$0	0.00	$0	$0	$0	-	$0
5.1	Radio	SWCD				$9,000							
5.2	Print	SWCD				$1,500							
5.3	Landowner Visits	SWCD				$0							
5.4	Landowner Seminar	SWCD				$500							
6	**Monitoring**				0%	$20,500	$0	0.0	$20,500	$0	$0	-	$0
6.1	Lake Monitoring	LSL			0%	$6,000			$6,000	$0			$0.00
6.1.1	Vegetation	SWCD			0%	$500			$500	$0			
6.1.2	CLAMP	LSL			0%	$500			$500	$0			$0.00
6.1.3	Cyanobacteria	ISU			0%	$5,000			$5,000	$0			
6.2	Wetland	SWCD			0%	$5,000			$5,000	$0			
6.3	LID Practice Samples	SWCD			0%	$3,500			$3,500	$0			$0.00
	Totals					$361,500	$3,176,265	21,447			$1,142,340	834	$1,370

Table 42 Management Plan for Other RMA Priority Sub-Watershed (Wills J. H., 2012)

IMPLEMENTATION SCHEDULE

"You can always amend a big plan, but you can never expand a little plan. I don't believe in little plans. I believe in plans big enough to meet a situation which we can't possibly foresee now."

Harry S. Truman

It is not likely that the water quality of the Iowa Great Lakes will ever equal or exceed that of pre-settlement. However, as in the picture below, from 1910, the water quality of our lakes has great potential to become sustainable and desirable for its highest and best use, which in many instances is contact.

Photo 6: Swimmers near Arnolds Park in the 1930's

The difficulty in assigning an implementation schedule for a watershed the size of the Iowa Great Lakes is trying to foresee any delays, human caused or weather related, and how to understand the relationship of how fast a water body can react to treatment conditions. In some instances a 10% reduction of sediment may boost the water quality to a sustainable and desirable level but in another it may actually create a different problem than was being experienced prior to the treatment. In the second example, a new treatment schedule would need to be planned.

What can be done is create an implementation schedule that has an "order of importance" to it. For instance, Figure 113 shows the agricultural areas in the IGL which produce 30% of the sediment that reaches a water body or basin. Those are the areas that need to be treated adequately, first, prior to moving onto new management areas. In addition to agricultural areas, urban areas are a significant source of pollutants to the Iowa Great Lakes. The areas that produce at least 60% runoff from those urban areas are shown in Figure 114.

The Iowa Great Lakes Watershed plan has a organized and detailed schedule but many factors can influence that schedule. Those factors can be human caused, weather caused, or even just timing. The schedule outlined in Table 43 is an aggressive one which pursues the implementation of plans previously described in this plan for each of the RMA's. Since we recognize situations will occur that could influence water quality of the Iowa Great Lakes as a whole, this plan should be considered adjustable in that those areas that produce the greatest pollution should be aggressively pursued in reducing pollution to the lakes. In the end, the important factor to consider is the reduction of phosphorus and other nutrients in the Iowa Great Lakes that improves the condition of these lakes and keeps them sustainable far into the future.

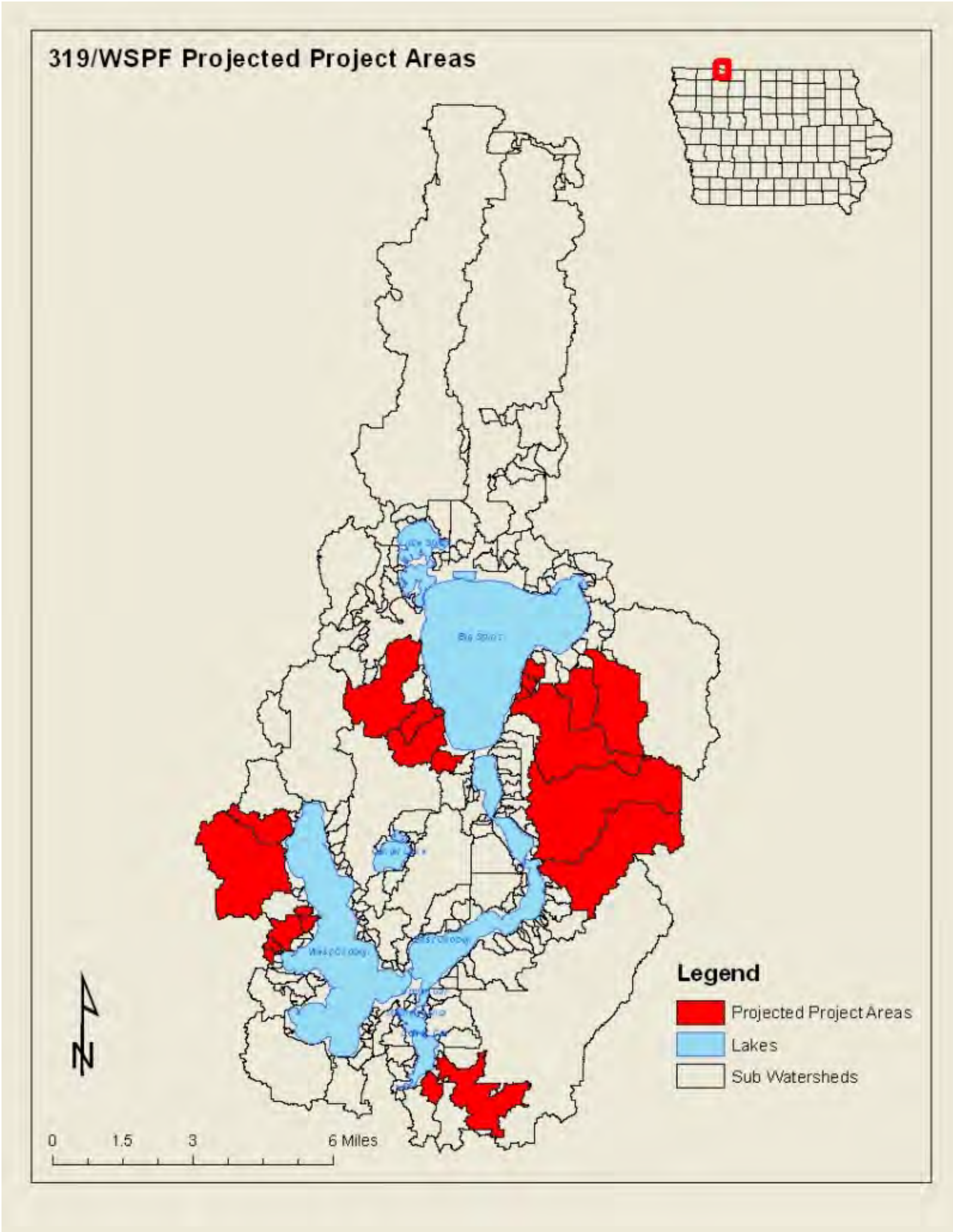

Figure 112 Sub-watersheds that produce 30% of sediment delivered to the Iowa Great Lakes each year.

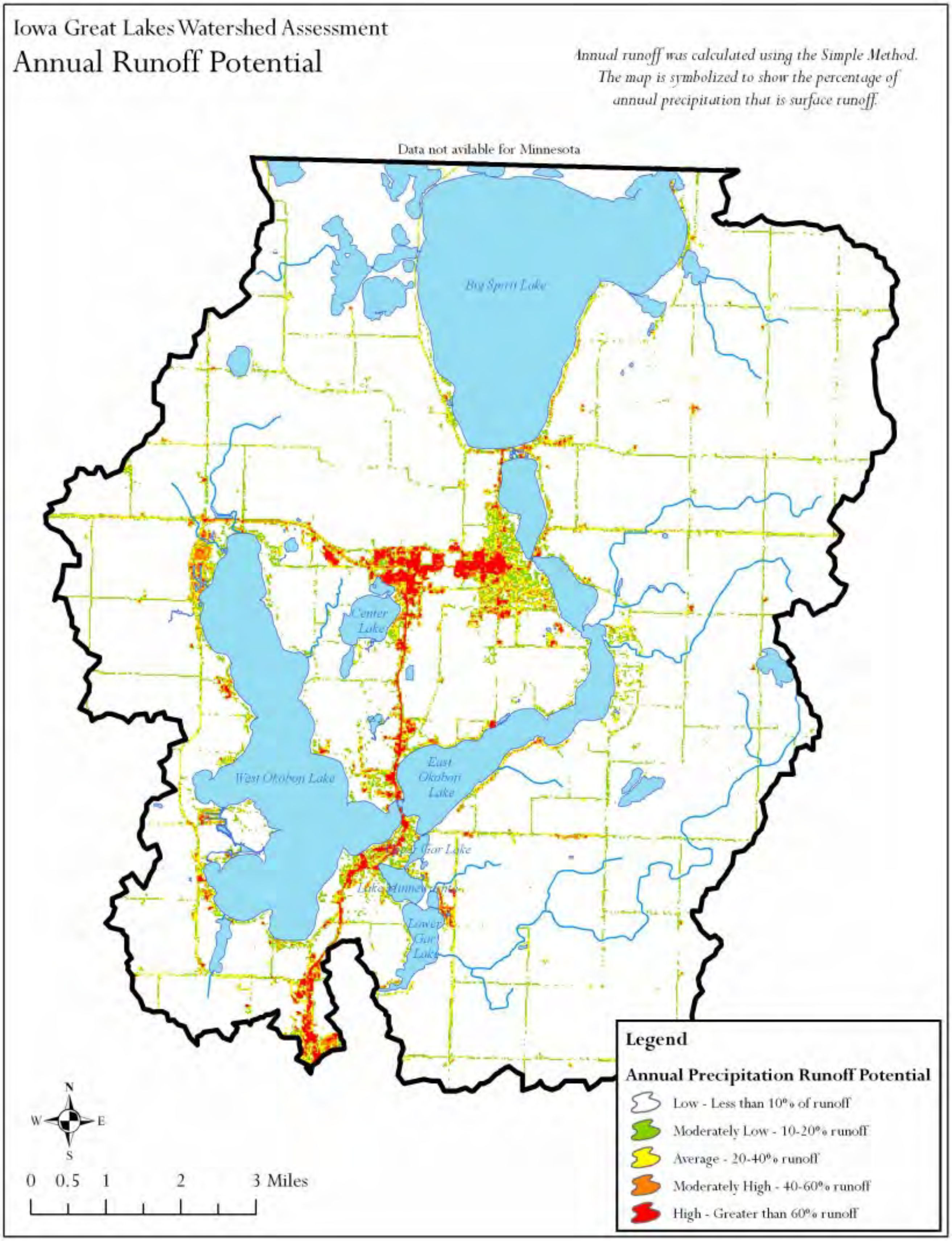

Figure 113 Annual Urban Runoff Potential

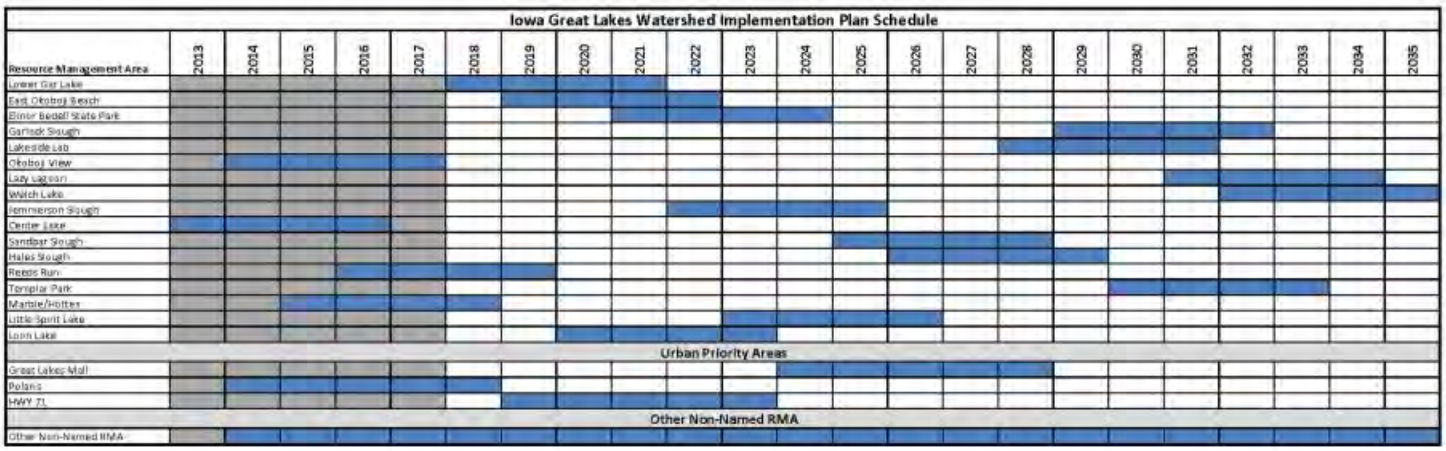

Table 43 Iowa Great Lakes Plan of Work (Wills J. H., 2012)

RESOURCE NEEDS

Conservation is a state of harmony between men and land.
Aldo Leopold

The Iowa Great Lakes has been degrading for over 100 years. The Iowa Great Lakes is a complicated system of lakes, wetlands, streams, and urban development. The Watershed is separated by state boundaries, two counties, and city governments. These challenges make restoring the Iowa Great Lakes water quality to acceptable levels a problem.

The costs associated with implantation of the protection measures in the Iowa Great Lakes Watershed are illustrated in Table 44, based on current estimates and the amount of BMP's necessary as cited in Table 44. Likely funding sources are predicted and are assured to come from multiple sources in a variety of denominations.

Possible Funding Sources for IGL Improvements

Priority Wetland Restoration
- Watershed Improvement Fund (WIRB)
- Wetlands Reserve Program (WRP)
- Section 319 Clean Water Act (319)
- North American Wetland Conservation Act (NAWCA)
- Conservation Reserve Enhancement Program (CREP)

Sediment Retention Basins
- Iowa Watershed Protection Program (WSPF)
- Section 319 Clean Water Act (319)
- Iowa Financial Incentives Program (IFIP)
- Watershed Improvement Fund (WIRB)

Grassed Waterways
- Continuous Conservation Reserve Program (CCRP)
- Iowa Watershed Protection Program (WSPF)

Tillage Incentive
- Environmental Quality Incentives Program (EQIP)
- Iowa Financial Incentives Program (IFIP)
- Conservation Security Program (CSP)

Conservation Cover
- General Signup Conservation Reserve Program (CRP)

Nutrient and Pest Management
- Environmental Quality Incentives Program (EQIP)
- Conservation Security Program (CSP)

Lake Management
- Section 319 Clean Water Act (319)
- Iowa Great Lakes Water Quality Commission
- Lake Restoration Fund

Urban Practices
- Lake Restoration Fund
- Section 319 Clean Water Act (319)
- Watershed Improvement Fund (WIRB)
- Resource Enhancement and Protection Program (REAP)
- Iowa Watershed Protection Program (WSPF)
- Iowa Great Lakes Water Quality Commission
- Water Protection Fund (WPF)

Total Cost and Estimated Phosphorus Removal						
Resource Management Area (RMA)	Estimated Cost	Estimated Pounds of P Removed (measure of success)	Cost per pound of P Removed	Total Actual Cost	Total Actual Pollutant Removed	Total Actual Cost of P Removed Per Pound
Lower Gar Priority RMA	$443,870	1,475	$301	$ 399,523	777	$ 514.19
Lower Gar Non-Priority RMA	$542,255	2,771	$196	$ 410,600	322	$ 1,275.16
East Okoboji Beach RMA	$995,055	4,934	$202	$ 55,505	600	$ 92.51
Elinor Bedell State Park RMA	$961,202	1,544	$622	$ 195,750	294	$ 666.95
Garlock Slough RMA	$677,587	1,540	$440	$ 227,600	57	$ 3,992.98
Lakeside Lab RMA	$296,794	1,142	$260	$ 25,790	65	$ 397.38
Okoboji View RMA	$2,699,283	426	$6,336	$ 2,392,500	1,120	$ 2,136.16
Lazy Lagoon RMA	$347,082	3,729	$93	$ (600)	92	$ (6.52)
Welch Lake RMA	$1,517,242	3,823	$397	$ 340,615	201	$ 1,694.60
Jemmerson Slough RMA	$351,715	3,070	$115	$ 66,400	37	$ 1,794.59
Center Lake RMA	$1,348,013	950	$1,419	$ 645,949	1,517	$ 425.81
Sandbar Slough RMA	$1,780,198	11,861	$150	$ 29,324	363	$ 80.78
Hales Slough RMA	$566,633	6,135	$92	$ 151,600	178	$ 851.69
Reeds Run RMA	$392,784	1,874	$210	$ 134,031	216	$ 620.51
Templar Park RMA	$315,742	1,899	$166	$ 16,225	90	$ 179.68
Marble/Hottes RMA	$752,775	6,423	$117	$ 645,317	1,077	$ 599.18
Little Spirit Lake RMA	$589,469	2,770	$213	$ 5,080	77	$ 65.63
Loon Lake RMA	$2,036,268	30,721	$66	$ 14,999	419	$ 35.80
Great Lakes Mall Priority Area	$1,207,590	755	$1,600	$ 15,367	128	$ 120.53
Polaris Priority Area	$1,325,701	926	$1,432	$ 622,356	63	$ 9,878.67
HWY 71 Priority Area	$1,398,245	791	$1,768	$ 810,832	85	$ 9,539.20
Other RMA	$3,537,765	21,447	$165	$ 1,142,340	834	$ 1,369.88
Totals	$24,083,267	111,005	$217	$ 8,347,103	8,612	$ 969.30
* dollar amounts are estimated at 2012 values						
** The RMA's, above, are arranged starting at the outlet, on Lower Gar,						
of the Iowa Great Lakes and are not in order of importance or treatment.						

Table 44 Total Cost and Estimated Phosphorus Removal and Actual Cost and Estimated Removal (Wills J. H., 2012)

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APPENDIX A: SOCIAL DYNAMICS ASSESSMENT

Excerpt from SOCIAL DYNAMICS ASSESSMENT: UPPER GAR, MINNEWASHTA, LOWER GAR RESTORATION, December 2009.

Research Design and Methods

This social dynamics assessment was conducted in 2009 and structured to compare assumptions and understanding about the Lower Chain of Lakes and related issues among watershed residents. The diagnostics and feasibility study team considered this comparison critical in order to formulate implementation plans and communicate restoration alternatives to the public. A questionnaire survey was designed and conducted using adaptations of the Dillman Tailored Design Method with 24 questions including closed-ended, multiple response, and scaled response options. All research protocols and techniques complied with Iowa State University Institutional Review Board requirements. Residents were invited to participate in several ways. Internet links to the questionnaire were provided to four lake protective associations (Three Lakes, West, East and Spirit Lakes), six non-profit organizations (Okoboji Foundation, Cooperative Lakes Area Monitoring Project, Friends of Lakeside Lab, Iowa Great Lakes Chamber of Commerce, Iowa Lakes Corridor Development Corporation, Iowa Great Lakes Water Safety Council). Invitations to participate were also conveyed through two local list serves and through a Dickinson County newspaper and its blog.

The survey sample size is statistically representative of the study area population. Population for the study area was a total of 2814. This included the communities of Arnolds Park, Okoboji, West Okoboji, and the portion of Milford incorporated limits associated with Lower Gar Lake (U.S. Census Bureau 2000). The total sample included 332 participants.

Results and Discussion

Who Participated in the Research

Men represented 69.5% of the sample. Reported respondent age response rates were similar to county rates, with 58% of the sample between the ages of 50 and 69. Twenty-eight percent of research participants were less than fifty years old and 13.6% were older than 69. Seventy-five percent of research participants indicated having no children under the age of 18 residing with them. Lastly, a significant number of respondents have been associated with the Iowa Great Lakes Area for more than twenty years (Figure 1).

Slightly less than 25% of respondents reported participation in one or more local non-profit organization association with the Iowa Great Lakes region (Figure 2).

Most respondents (97%) reported owning or renting residential property. Fifteen percent own or rent commercial property, nine percent own or rent agricultural property, and one percent own "other" types of property such as storage.

Seventy-nine percent of respondents indicated they were property owners on or near a lake. Respondents reporting ownership of property on or near the Lower Chain of Lakes represented 45% of the sample.

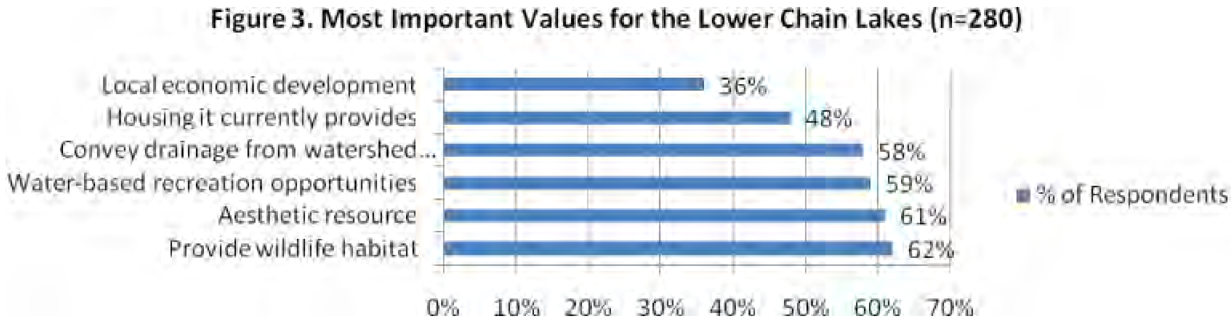
The top five water-based recreational activities respondents indicated participating in include pleasure boating (77%), fishing (58%), using adjacent parks and water skiing (both 43%), and swimming (23%).

Lawn Fertilization Rates

More than half of respondents, 56%, indicated they fertilize their lawns. An additional 12% are unsure if their lawn is fertilized. Sixty-eight percent of those fertilizing reported using a P-Free fertilizer product.

Why Lakes Are Valuable

The most frequently reported values for the Lower Chain Lakes include providing wildlife habitat, aesthetics, water-based recreation opportunities, and conveying water downstream. Each was reported by a majority of respondents. Additionally, 62% of respondents indicated both water-based recreation and providing wildlife habitat was very important (Figure 3).

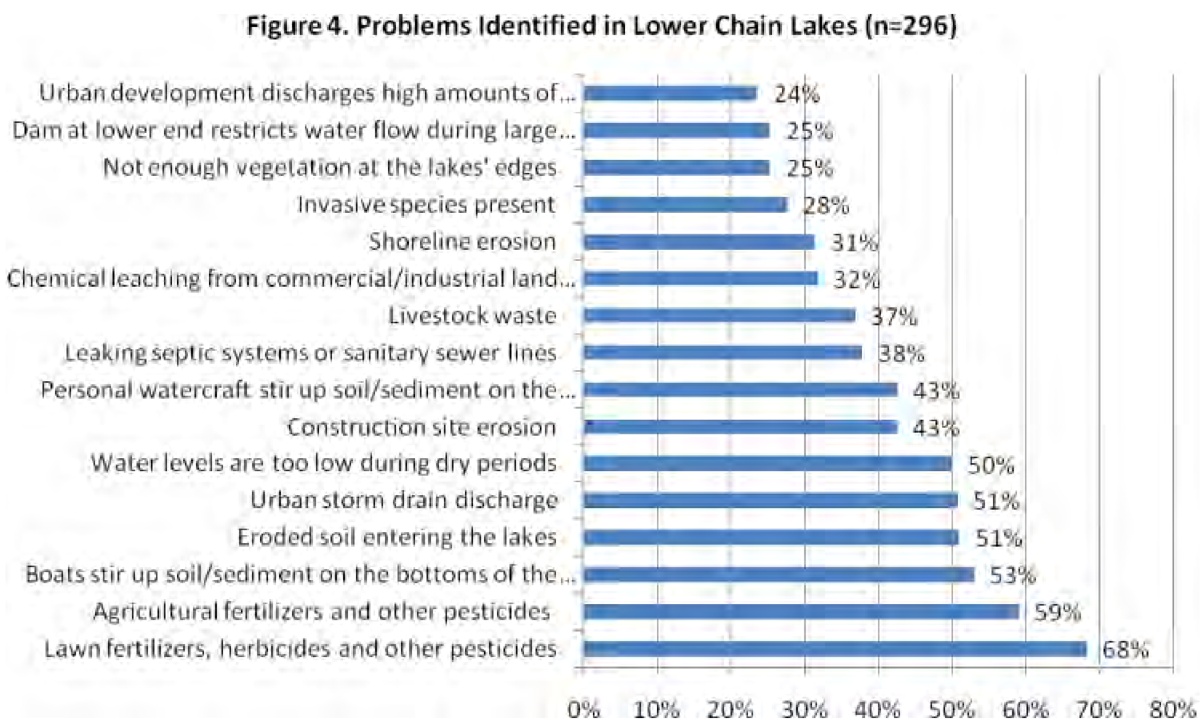


Water Quality and Pollution in the Lower Chain of Lakes

Survey respondents reported they defined water quality primarily by human senses and quality of use. More than 80% of the total sample indicated they use water appearance and smell to judge water quality. The quality of swimming, nutrient, and chemical quality were identified by more than 60% of the sample. The ability to use docks and ramps, enjoyment of boating and skiing, quality of fishing, quality of habitat the lake provides, and lake depth were criteria reported by between 50-60% of respondents.

Beliefs about Problems in Lower Chain Lakes

Fertilizers and pesticides were the most frequently identified pollution problem warranting attention in the Lower Chain (Figure 4). Urban sources were identified at a slightly higher rate than agricultural sources. Two problems associated specifically with soil were also indicated by more than half the sample: eroded soil entering the lakes and boats stirring up sediment on the bottom of the lakes. Urban storm drain discharge, as a concept, was also indicated as a potential impact to lake water quality by a majority of respondents.



Expectations for Future Lake Condition

The need for enhancement of Lower Chain lakes as a broad concept was well supported by respondents. Only 3% of respondents indicated they believed it was appropriate for Lower Chain lakes to remain as is among options for future outcomes.

Less turbidity and less frequent algae blooms were supported by the highest number of respondents (73%) (Table 1). Of those supporting dredging, nearly twice as many support dredging in specific places to enhance habitat than support lake deepening to allow larger boat access and recreation. Deeper dredging to allow larger boat access and recreation on the Lower Chain was supported by only 35% of respondents.

Table 1. More Than 50% of Participants Support These Five Potential Restoration Outcomes for the Lower Chain of Lakes (n=297).

Potential Outcomes	% of Respondents
Water is less cloudy with sediment (less turbid)	73%
Lake bottom is more solid	51%
Lake(s) are deepened in places that enhance fisheries and other habitat	61%
Water leaving Lower Gar Lake is less polluted	54%
Algae blooms are less frequent	73%

Beliefs About Improving Lake Condition

Water quality enhancement practices such as wetland restoration in agricultural areas and bioretention in urban areas are considered effective in the region. A majority of survey participants indicated their belief that construction of additional agricultural practices (75%) and urban practices (75%) may improve water quality. The majority (57%) also indicated they believe limiting development would improve lake conditions.

Full Citation of this report:

Wagner, Mimi. 2009. Upper Gar, Minnewashta, Lower Gar Restoration Diagnostic and Feasibility Study: Social Dynamics Assessment. Iowa State University Department of Landscape Architecture for Iowa Department of Natural Resources, Des Moines Iowa.

APPENDIX B: POTENTIAL FUNDING SOURCES

Watershed Improvement Funding Sources

Iowa Department of Agriculture and Land Stewardship - Division of Soil Conservation

Programs	Web address (some may break on to two lines)	Program Description	Application Due
Iowa Financial Incentives Program (IFIP)	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	50 percent cost-share available to landowners through 100 SWCDs for permanent soil conservation practices	continuous
No-Interest Loans	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	State administered loans to landowners for permanent soil conservation practices	Feb. 1
District Buffer Initiatives	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	Funds for SWCDs to initiate, stimulate and incentivise signup of USDA programs, specifically buffers	continuous
Mining Reclamation	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	$2 million state and federal program (16:1 match) to reclaim abandoned surface coal mines at no cost to landowner	varies
Agricultural Drainage Well Closure Assistance Fund	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	Provides 75 percent cost-share to landowners for alternative drainage in order to close ag drainage wells and protect groundwater quality	varies
Iowa Watershed Protection Program (WSPF)	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	Funds for SWCDs to provide water quality protection, flood control, and soil erosion protection in priority watersheds; 50-75 percent cost-share; Used as state match for EPA 319 funding	April 15
Conservation Reserve Enhancement Program (CREP)	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	Levering USDA funds (4:1) to establish nitrate removal wetlands in north central Iowa with no cost to landowner	continuous
Soil and Water Enhancement Account - REAP Water Quality Improvement Projects	www.iowaagriculture.gov/FieldServices/waterQualityProtectionProjects.asp	REAP funds for water quality improvement projects (sediment, nutrient and livestock waste) and wildlife habitat and forestry practices; 50-75 percent cost-share, Used as state match for EPA 319 funding	April 15
Soil and Water Enhancement Account - REAP Water Quality Improvement Practices	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	Tree planting, native grasses, forestry, buffers, streambank stabilization, traditional erosion control practices, livestock waste management, ag drainage well closure, urban stormwater	continuous
Integrated Farm and Livestock Management Demonstration Program (IFLM)	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	Statewide farm demonstrations of BMPs for nutrient and pesticide management, air quality, and soil and water conservation	
State Revolving Loans (SRF)	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	Low interest loans provided by SWCDs to landowners for permanent water quality improvement practices; subset of DNR program	continuous

* Dates are approximate. Check with funding agency to determine exact due date.

Iowa Department of Agriculture and Land Stewardship

Programs	Web address	Program Description	Application Due*
Watershed Improvement Fund	www.iowaagriculture.gov/FieldServices/waterQualityProtectionPractices.asp	Local watershed improvement grants to enhance water quality for beneficial uses, including economic development	August 2

U.S. Department of Agriculture - Farm Services Agency

Programs	Web address	Program Description	Application Due*
General Signup Conservation Reserve Program (CRP)	www.fsa.usda.gov Click on "Conservation Programs."	Encourages farmers to convert highly erodible land or other environmentally sensitive land to vegetative cover; Farmers receive annual rental payments	determined from time-to-time
Continuous Conservation Reserve Program (CCRP)	www.fsa.usda.gov Click on "Conservation Programs."	Encourages farmers to convert highly erodible land or other environmentally ensitive land to vegetative cover, filter strips, or riparian buffers; Farmers receive annual rental payments	continuous
Farmable Wetland Program (FWP)	www.fsa.usda.gov/pas/publications/facts/html/farmwetland04.htm	Voluntary program to restore farmable wetlands and associated buffers by improving hydrology, vegetation	continuous

U.S. Department of Agriculture - Farm Services Agency and Natural Resources Conservation Service

Programs	Web address	Program Description	Application Due*
Grassland Reserve Program (GRP)	www.nrcs.usda.gov/programs/GRP/	Provides funds to grassland owners to maintain, improve, establish grass. Contracts of easements up to 30 years	No additional signup at this time

U.S. Department of Agriculture - Natural Resources Conservation Service

Programs	Web address	Program Description	Application Due*
Environmental Quality Incentives Program (EQIP)	www.nrcs.usda.gov/programs/eqip/	Provides technical and financial assistance for natural resource conservation in environmentally beneficial and cost-effective manner; program is generally 50 percent cost-share	continuous
Wetlands Reserve Program (WRP)	www.nrcs.usda.gov/programs/wrp/	Provides restoration of wetlands through permanent and 30 year easements and 10 year restoration agreements	continuous
Emergency Watershed Protection Program (EWP)	www.nrcs.usda.gov/programs/ewp/	Flood plain easements acquired via USDA designated disasters due to flooding	determined by need
Wildlife Habitat Incentives Program (WHIP)	www.nrcs.usda.gov/programs/whip/	Cost-share contracts to develop wildlife habitat	continuous
Farm & Ranchlands Protection Program (FRPP)	www.nrcs.usda.gov/programs/frpp/	Purchase of easements to limit conversion of ag land to no-ag uses. Requires 50 percent match	

* Dates are approximate. Check with funding agency to determine exact due date.

U.S. Department of Agriculture - Natural Resources Conservation Service

Programs	Web address	Program Description	Application Due*
Cooperative Conservation Partnership Initiative (CCPI)	www.nrcs.usda.gov/programs/cpi/	Conservation partnerships that focus technical and financial resources on conservation priorities in watersheds and airsheds of special significance	April 15
Iowa Conservation and Partnerships: "Supersheds" Program		Cooperative effort among conservation agencies and organizations to combine resources to implement resource improvement projects	
Conservation Security Program (CSP)	www.nrcs.usda.gov/programs/csp/	Green payment approach for maintaining and increasing conservation practices	variable
Public Law 83-566	www.nrcs.usda.gov/programs/watershed/index.html	Contains authority to improve water quality as well as control flooding, reduce soil erosion, provide recreation, and provide a water supply	
Public Law 78-534	www.nrcs.usda.gov/programs/watershed/pl534.html	Permanent practices built for the purpose of erosion and flood control in Little Sioux River basin.	
Conservation Innovation Grants (CIG)	www.nrcs.usda.gov/programs/cig/	National and state grants for innovative solutions to a variety of environmental challenges	variable

U.S. Army Corps of Engineers

Programs	Web address	Program Description	Application Due*
Aquatic Ecosystem Restoration - Section 206	www.mvp.usace.army.mil/environment/ Click on "Aquatic Ecosystem Restoration - Section 206."	Restoration projects in aquatic ecosystems such as rivers, lakes and wetlands	
Habitat Restoration of Fish and Wildlife Resources - Section 1135	www.mvp.usace.army.mil/environment/ Click on "Habitat Restoration - Section 1135."	Must involve modification of the structures or operations of a project constructed by the Corps of Engineers	April 15

U.S. Forest Service

Programs	Web address	Program Description	Application Due*
Forest Land Enhancement Program (FLEP)	www.fs.fed.us/spf/coop/programs/loa/flep.shtml	Encourages the long-term sustainability of non-industrial private forest lands by establishing, restoring, protecting, managing, maintaining and enhancing	

* Dates are approximate. Check with funding agency to determine exact due date

U.S. Environmental Protection Agency

Programs	Web address	Program Description	Application Due*
Targeted Watershed Grants	www.iowadnr.gov/water/nonpoint/watershed.html	Nationwide grants for implementation of activities and BMPs specifically designed to improve water quality	
Water Quality Cooperative Agreements [Section 104(b)(3)]	www.epa.gov/owm/cwfinance/waterquality.htm	Developing, implement, and demonstrate innovative approaches relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution	varies

U.S. Environmental Protection Agency and Iowa Department of Natural Resources

Programs	Web address	Program Description	Application Due*
Section 319 Clean Water Act	www.iowadnr.gov/water/nonpoint/index.html	Grants to implement NPS pollution control programs and projects; requires 40 percent state match	April 15
Iowa Water Quality Loan Fund (SRF)	www.iowadnr.gov/water/srf/index2.html	Source of low-cost financing for farmers and landowners, livestock producers, community groups, developers, watershed organizations, and others	continuous

Iowa Department of Natural Resources

Programs	Web address	Program Description	Application Due*
Water Monitoring and Assessment Program	http://wqm.igsb.uiowa.edu/	Provides funding for restoration of Iowa's publicly owned lakes, in combination with watershed improvement to improve water quality. New in 2006.	
IOWATER	www.iowater.net/	Training, supplies, and technical support for citizen water quality monitoring network; subset of ambient program	
Lake Restoration Fund	www.iowadnr.gov/water/lakerestoration/index.html	Flood plain easements acquired via USDA designated disasters due to flooding	
Resource Enhancement and Protection Program (REAP)	www.iowadnr.gov/reap/index.html	Provides funding for enhancement and protection of State's natural and cultural resources	varies
GIS mapping data for watershed managers	www.iowadnr.gov/other/mapping.html	Watershed Atlas provides a variety of interactive GIS data layers for watershed planning on all watersheds in Iowa	

* Dates are approximate. Check with funding agency to determine exact due date.

Iowa Department of Natural Resources

Programs	Web address	Program Description	Application Due*
Ambient Water Quality Monitoring Network	http://wqm.igsb.uiowa.edu/	Delivers consistent, unbiased information about the condition of Iowa's surface and groundwater resources	
Other Water Programs	www.iowadnr.gov/water/index.html		

Iowa Department of Natural Resources and Iowa Department of Agriculture and Land Stewardship - Soil Conservation

Programs	Web address	Program Description	Application Due*
Stream bank Stabilization and Habitat Improvement		Penalties from fish kills used for environmental improvement on streams impacted by the kill	

Iowa Department of Natural Resources and Iowa Finance Authority

Programs	Web address	Program Description	Application Due*
State Revolving Fund (SRF)	www.iowadnr.gov/water/srf/index.html	Provides low interest loans to municipalities for waste water and water supply; expanding to private septics, livestock, stromwater, and NPS pollutants	continuous

Federal Agencies

Programs	Web address	Program Description	Application Due*
Other grant and loan programs	http://cfpub.epa.gov/fedfund/	Searchable database for federal funding programs	varies

* Dates are approximate. Check with funding agency to determine exact due date

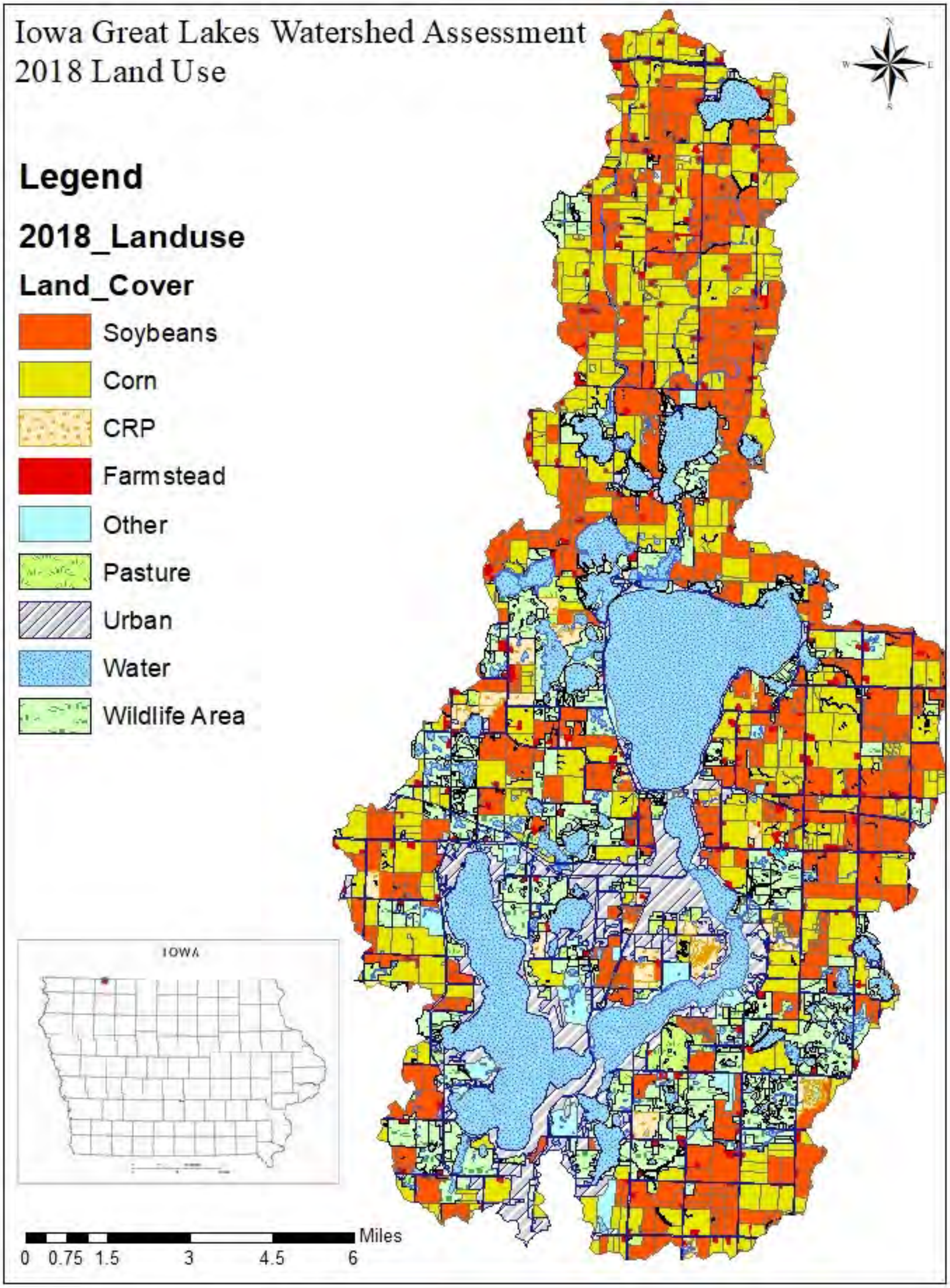


Figure 114 2018 Land use and tillage survey