Glacial Ridge
National Wildlife Refuge

Erskine, Minnesota
Annual Narrative Fiscal Year 2006

David B. Brunner 4/10/07
Refuge Manager Date

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*Cover photo of Tallgrass Prairie by Juancarlos Giese and Title Page photo of Purple Prairie Clover by Juancarlos Giese

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Refuge Background Information

The Glacial Ridge National Wildlife Refuge was officially established on October 25, 2004. The catalyst for the establishment and the restoration of the Glacial Ridge area was a partnership of 30 non-profit organizations, universities, governments and other agencies. Located approximately 10 miles east of Crookston along U.S. Highway 2 in Polk County, Minnesota, this unique landscape was carved with wind and water over 12,000 years ago from the fluctuating water levels of glacial Lake Agassiz. The variety of prairie grasslands and wetlands that formed provided the ingredients for a very diverse and continentally important biological community- Tallgrass Prairie. The Glacial Ridge NWR will be the center point for the restoration of this fragile ecosystem, as less than one percent of native tallgrass prairie remains in Minnesota.

The approved acquisition boundary of 35,750 acres includes approximately 5,000 acres of non-cultivated native prairie. Future habitat restoration potential includes approximately 18,000 acres of upland prairie and 12,000 acres of wetland. These habitats are important breeding areas for waterfowl, sandhill cranes, shorebirds, greater prairie chickens, many grassland nesting songbirds and a host of mammals. The remnant native prairie area, combined with restored grasslands and wetlands, provides an ideal setting for interpretation of the historical and future importance of this once massive ecosystem.

Among the first flowers to bloom in the spring- the pasque flower shines as a symbol of the tallgrass prairie habitat.
Photo by Christine Reiss

Currently, the Refuge owns 3 parcels of land totaling approximately 2,300 acres. Within the approved boundary there are 1,696 acres of State Wildlife Management Areas, 560 acres of State Land managed as a Scientific and Natural Area, 345 acres owned by the Red Lake Watershed District, 660 acres owned by The Nature Conservancy (hereafter referred to as TNC) managed as a Scientific and Natural Area, 24,000 additional acres owned by TNC, and nearly 7,500 acres in other private ownership. Also present are township, county, state and federal road right-of-ways, Minnesota Northern railroad right-of-way, Burlington Northern-Santa Fe railroad right-of-way, and several gravel easements.

A field of prairie smoke sways in the wind running over the Glacial Ridge NWR.
Photo by Christine Reiss

In January 2001, a draft Environmental Assessment (EA) and an Interim Comprehensive Conservation Plan was developed and approved.

The EA addressed future management of the Refuge and defined the following goals:

- Strive to maintain diversity and increase abundance of waterfowl and other migratory bird species dependent on prairie wetland and grassland habitats.
- Conserve, manage, and restore the diversity and viability of native fish, wildlife and plant populations associated with tallgrass prairie and prairie wetlands.
- Work in partnership with others to restore or enhance native tallgrass prairie, prairie wetlands and unique plant communities.
- Restore, enhance, and protect water quality and quantity that approaches natural hydrologic functions.
- Provide for compatible wildlife-dependent recreational uses by the public, emphasizing increased public understanding of the northern tallgrass prairie ecosystem and the mission of the National Wildlife Refuge System.

The Glacial Ridge National Wildlife Refuge was created under the legal authority of the Migratory Bird Conservation Act (MBCA), Feb. 18, 1929, 16 U.S.C. 715d and the Emergency Wetland Resources Act of 1986, 16 U.S.C. 3901b. The MBCA created the Migratory Bird Conservation Commission and authorized the acquisition of lands from funds appropriated by Congress, and later, from funds generated by the sale of Federal Duck Stamps.

Once brought to the brink of extinction, the greater prairie chicken now thrives on the lands within the Glacial Ridge NWR.
Photo by Christine Reiss

Since 2001, TNC and the Natural Resource Conservation Service have made great strides in the restoration of both wetland and upland acres. Their efforts are the anchor point in the recovery of this imperiled ecosystem. As lands are transferred to the Refuge, management efforts can concentrate on maintenance of these restored habitats. The University of Minnesota – Crookston, University of North Dakota and North Dakota State University are all contributing to the success of the project by gathering baseline data, including wildlife and plant response to restorations, and abiotic conditions such as weather and hydrology. This refuge was established as a partnership and will focus on partnerships with all current and future management.

Highlights

- Through a Challenge Cost Share Grant with Wildlife Biologist Diane Granfors of the HAPET office, a major Marbled Godwit Survey was initiated. On May 9th, a combined survey crew of 21 FWS staff and volunteers were able to complete an 85-mile walking survey route. During the survey, 97 marbled godwits were observed. **See section 1a, p.6**
- Through a Partners for Fish and Wildlife Grant, $38,465.00 was utilized for contracting a Minnesota Conservation Corps crew to clear 40 acres of TNC-Glacial Ridge Project land of European buckthorn and girdle 10 acres of aspen, purchase a rolling herbicide applicator to treat 300 acres of invasive plants, and contract the brush cutting of 319 acres for prairie rejuvenation. ***See section 5a, p.15***
- A multi-year study by USFWS SCEP student Jessica Larson concentrated on amphibian reproductive rates in restored wetlands within the Glacial Ridge NWR approved acquisition boundary. ***See section 1b, p.7***
- Rydell/Glacial Ridge NWR, along with TNC's Glacial Ridge Project, initiated an endeavor to involve the Crookston Chamber of Commerce in a new greater prairie chicken viewing blind program. Due to the coordination of the 3 agencies, 132 people from throughout the United States and Canada were able to get an intense view of the mating display of the greater prairie chicken. ***See section 5a. p14***
- Research by Tyler Janke, University of North Dakota graduate student, compared the vegetative patterns between restored wetlands and natural wetlands within the proposed boundary of the Glacial Ridge NWR. ***See section 1b, p.8***
- Various studies by Paul Kucera and Phil Gerla, from the University of North Dakota, are gathering information on how the precipitation falling within the boundaries of the Glacial Ridge area are effecting groundwater and surface water hydrology, and the water retention abilities of tallgrass prairie habitats. ***See section 1b, p.10***
- Over 30 people participated in the 1st Glacial Ridge Prairie Days Celebration, enjoying a program on the "Such-Muchness of Minnesota Prairies", as well as taking accessible bus/walking tours of the Glacial Ridge Project area. ***See section 8b, p.18***
- Rydell Refuge Staff assisted TNC's Glacial Ridge Project staff and the Detroit Lakes WMD in three burns totaling over 600 acres within the proposed boundary of the Glacial Ridge NWR. **See Section 5a, p.13**

Climate Data

The closest weather station with historical reference is located near the University of Minnesota in Crookston, Minnesota. Weather data has been collected at this station since 1890. Although the collection point is 35 miles west of the Refuge, it provides excellent regional trend data.

The total precipitation for calendar year 2006 was 17.46 inches. The winter of 2005/06 was dramatically warmer with very little moisture, even the 20 ½ inches of snow in February yielded only 0.51 inch of moisture. While July and August appeared somewhat wet, no rain fell from July 9 through mid-August. This resulted in fire crews completing daily patrols in and around Rydell and Glacial Ridge NWRs during this period.

From May 11 through August 11, only 2.58 inches of moisture was received. During this period the largest rain occurred on July 25, with .80 inch. This lack of rain caused a very high Haines index. Tables 1-3 summarize basic weather information, both current and historical.

Table 1. Calendar year 2006 monthly weather totals.

Month	High Temp (F)	Low Temp (F)	06 Precip. (inches)	05 Precip. (inches)	04 Precip. (inches)	03 Precip. (inches)	116 Yr. Avg. Precip. (inches)
January	42	-7	0.42	0.80	0.36	0.15	0.46
February	31	-28	0.51	0.13	0.08	0.24	0.49
March	46	-7	1.50	0.22	0.76	0.86	0.71
April	77	25	1.31	0.41	0.43	0.75	1.30
May	95	31	2.44	3.30	8.02	3.41	2.89
June	92	46	1.06	5.55	1.39	5.05	3.82
July	99	47	1.03	0.89	3.87	2.78	3.26
August	90	44	3.50	5.66	4.82	1.12	3.33
September	86	30	2.66	2.15	4.13	3.67	2.31
October	81	18	1.74	1.95	3.23	1.48	1.72
November	61	-2	0.35	2.03	0.15	0.32	0.89
December	41	-9	0.94	0.82	0.88	0.63	0.59
Totals			17.46 inches	23.91 inches	28.12 inches	20.46 inches	21.77 inches

Table 2. Days of sun.

Sky Condition	Cloudy Days	Partly Cloudy	Sunny Days
2003	136	38	191
2004	140	44	182
2005	187	44	134
2006	130	49	186

Table 3. Snow Fall totals.

Year	Snow Fall
2006	44.4
2005	29.3
2004	42.5
2003	27.6
2002	19.30
2001	18.48

1. Monitoring and Studies

1a. Surveys and Censuses

A refuge monitoring program has not yet been set up. The following studies were conducted as either graduate studies or undergraduate work through the University of Minnesota – Crookston and University of North Dakota, or by other U.S. Fish and Wildlife Service Field Offices.

Marbled Godwit Survey

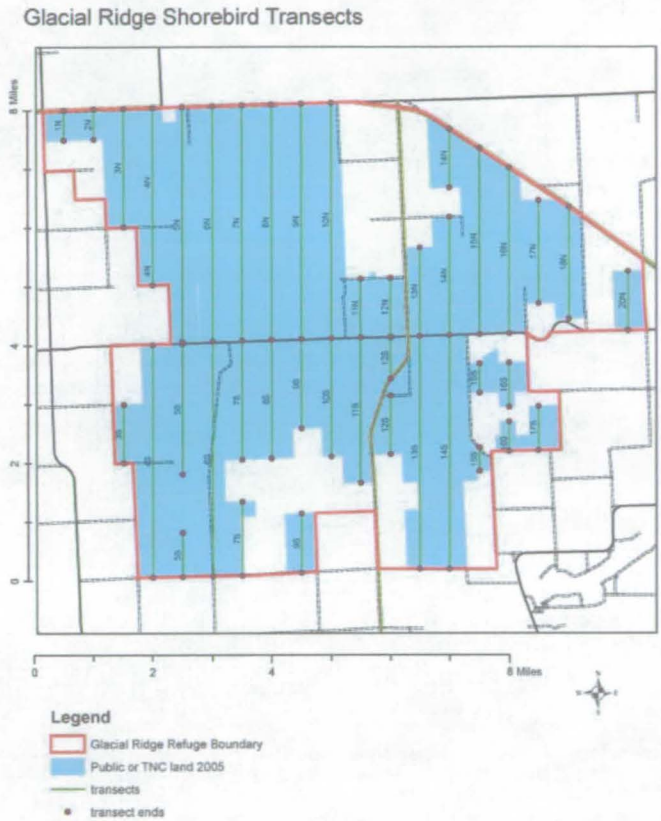
In November 2005, discussion began with Migratory Bird Biologist Bob Russell, HAPET Office Biologist Diana Granfors and Refuge Staff about a proposal for a major survey of marbled godwits on Glacial Ridge. Through the efforts of Biologist Granfors, a Challenge Cost Share Grant was submitted and accepted for the project. The ultimate success, however, would rely on the efforts of the Refuge Staff to find volunteers to complete this monumental survey. As the idea blossomed, a decision was made to also count upland sandpipers and Wilson's phalaropes. With a survey designed by Biologist Granfors and volunteer coordination by Refuge Staff, an 85-mile one day survey was completed on May 9. The 21-person survey crew began at 6:30 a.m.and included 5 F&WS biologists from other stations, 6 refuge staff, 3 TNC personnel and 7 volunteers. While a small portion of the

survey was completed by ATV's, the majority of the routes were completed by walking. The survey ended at 3:30 p.m. Figure 1 depicts the transect locations.

The results included:
Marbled Godwit: 52 location sightings with 97 birds (one flock of 20 birds)
Upland Sandpipers: 38 locations sightings with 49 birds
Wilson's Phalaropes: 8 location sightings with 33 birds

Other highlights included:
Leconte's sparrows, yellow rails, sandhill cranes, 25 Smith's longspurs and one timber wolf.

Figure 1. Map of Glacial Ridge NWR marbled godwit survey transects.



Marbed godwit.
Photo by Greg Thompson

Burrowing Owls

In April, 3 burrowing owls were sighted on a ridge of land owned by TNC on the west side of the Glacial Ridge Project area. The site was being prepared for seeding and was heavily utilized by Richardson's ground squirrels. The owls appeared to be initiating nesting activities in the squirrel's holes. The sighting was confirmed by Regional Biologist Tom Wills, who made the official declaration of the sighting to the bird world. However, after about three weeks the birds disappeared.

1b. Studies and Investigations

Amphibian Research

Amphibian Reproduction in Restored Wetland Habitat in Northwestern Minnesota – Progress Report for Field Season 2006. Prepared by Jessica Larson, Graduate Student,

Univ. of North Dakota.

Loss and fragmentation of the tallgrass prairie region is not only a loss of vegetation, but also a loss of habitat for associated animal species. Amphibians are unique in their need for both aquatic breeding and upland terrestrial habitats. Efforts to restore these prairie wetlands are slowly bringing back the wetland complex needed for amphibian breeding. The 24,142-acre TNC Glacial Ridge Project is located in the tallgrass prairie region of northwestern Minnesota. This Project is being restored back to the native vegetation intermixed with restored wetlands.

USFWS SCEP student Jessica Larson identifies larval stages of prairie amphibian species.

A tree frog metamorph located during a field visit while conducting SCEP student Jessica Larson's amphibian research.

The large extensive restoration of this area brings about the question of what is the impact on the native species. Amphibians are biological indicators of an environment, so looking at their re-colonization abilities and reproductive success in these restored wetlands is one measure of the effectiveness of certain restoration practices.

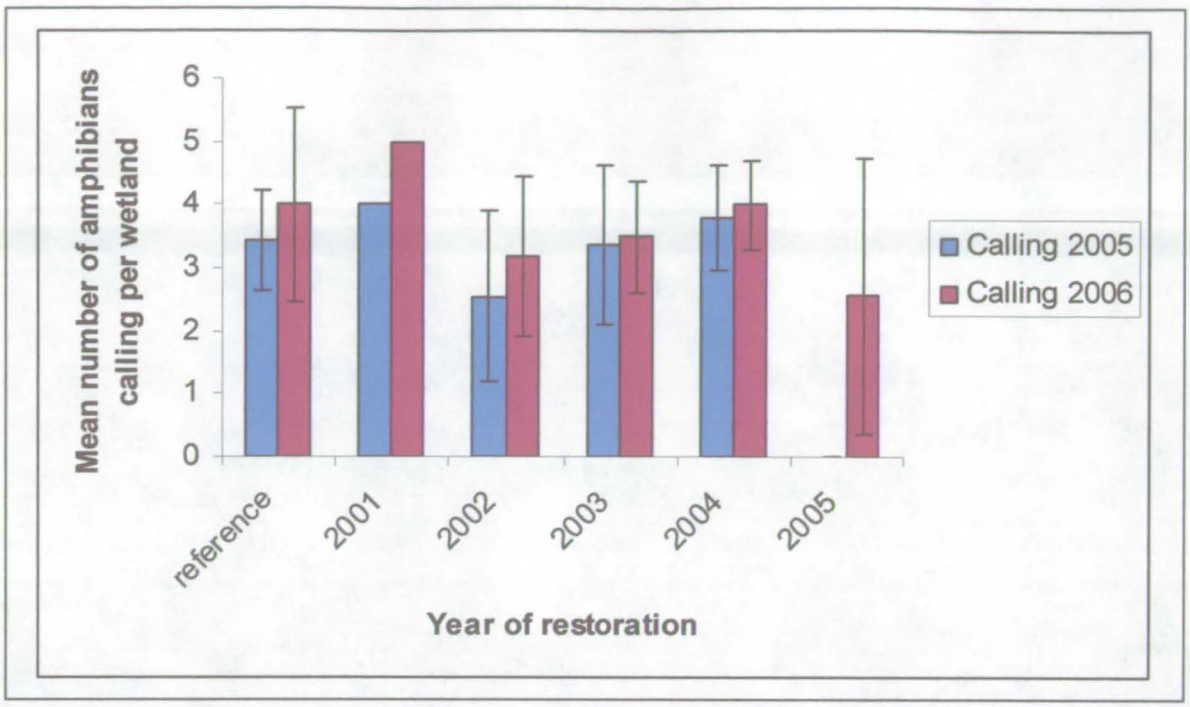
The 2006 field season ran from 9 April 2006 to 18 July 2006, and included 64 wetlands. In total, 7 species used the study area: Wood Frog (*Rana sylvatica*), Western Chorus Frog (*Pseudacris triseriata*), Northern Leopard Frog (*Rana pipiens*), Canadian Toad (*Bufo hemiophrys*), Cope's Gray Tree Frog (*Hyla chrysoscelis*), Gray Tree Frog (*Hyla versicolor*), and Tiger Salamander (*Ambystoma tigrinum*). Figure 2 shows the number of calling amphibians per wetland, based on the year restoration was initiated.

Vegetation Research

Vegetation Re-establishment of Restored Wetlands in Northwestern Minnesota - Progress Report for Field Season 2006. Prepared by Tyler P. Janke, Univ. of North Dakota.

Over the last several decades, the importance of wetlands to ecosystems and society has been increasingly recognized. Due to this recognition, many wetlands have been voluntarily restored. Although wetland restorations have been taking place for more than a decade, detailed scientific study of the vegetation of these habitats has generally been limited. Of the few studies that have examined restored wetland vegetation, most suggest that the vegetation of restorations is different from the vegetation of natural wetlands. One possible limitation to

Figure 2. Mean number of calling amphibians (frogs and toads) per wetland (± standard deviation) based on year of restoration for each field season (2005 and 2006). Year 2001 only has 1 wetland, therefore no standard deviation bars. Field season 2005 did not have wetlands restored in 2005 to be monitored.



past restored wetland vegetation studies is the sole use of reference wetlands as a gauge of vegetative recovery. Since prairie wetlands commonly exhibit cyclic vegetation patterns, information collected from reference wetlands provides only a snapshot of current ecological conditions and cannot account for all relevant ecological dimensions that determine species composition. One approach that would allow spatial and temporal aspects of vegetation dynamics entry into reference data is the use of species pools. A species pool is a set of species which are potentially capable of coexisting in a certain community. By defining the local species pool of a given area, it may be possible to develop a list of reference species that represent the saturated community of that area. In order to test whether or not the use of species pools could allow restoration ecologists a more accurate methodology for evaluating restoration success, a study comparing the

(l-r) Graduate student Tyler Janke, Mike Douglas, and Dan Pazdernic identifying plant species within native prairie vegetation plots on converted agricultural fields within the approved acquisition boundary of the Glacial Ridge NWR.

vegetative similarity of restorations to reference wetlands and restorations to a local species pool is being conducted. For the 2005 field season, the vegetation of 15 wetlands was sampled, including 5 restorations completed in 2004, 5 restorations completed in 2002, and 5 reference wetlands. In total, 208 plant species were identified during the 2005 field season. Specifically, 126 species were recorded from all 2004 restorations, 120 species were recorded from all 2002 restorations, and 148 species were recorded from all reference wetlands. The vegetative similarity between restored wetlands and reference wetlands was calculated using Sörensen's Index of Similarity (SIS). Initial calculations show that 2004 restorations display a SIS of 58.4% while 2002 restorations display a SIS of 60.4%. Once completed, SIS calculations will also be conducted between restored wetlands and the local species pool. Additional data will also be presented detailing the presence of non-native species and floristic quality for all wetlands studied.

Hydrology and soils

Paul Kucera, of the Department of Atmospheric Sciences at the University of North Dakota, has been studying precipitation effects on Glacial Ridge. The ultimate goal of this study is to increase the knowledge of Glacial Ridge's hydrological cycle through long-term monitoring and high-resolution observations of precipitation through both warm and cold seasons. The warm season looks at rainfall on the property, in both a spatial and temporal distribution, with the aid of an on-site weather station. The cold season will monitor snow cover retention abilities of native prairie grass and wetlands with the use of a snow evolution model. Both seasons will be monitored for their input into Glacial Ridge's water budget through snow melt and falling precipitation.

Phil Gerlas, of TNC and the University of North Dakota, has been studying different aspects of hydrology, soil, and vegetation. His study is divided among six different projects. By looking at soil moisture under native prairie plots versus poorer vegetation plots, one portion of his study will show how native grass cover effects soil water storage on beach ridges. The water levels on the Tintah beach ridge are being monitored to investigate the effects of prairie restoration on hydrology of the recharge zones of fens. A third project looks at a water table's response to filling in a cattail dugout using groundwater piezometers. A shallow natural breach in Judicial Ditch #72 was studied to determine the age and origin of the breach, and whether there is any recent evidence of water from the ditch flowing through the natural breach. The fifth project monitors groundwater levels and runoff coming into Judicial Ditch #66 from the Bradshaw Gravel Pit. This water is believed to be cold and mineralized, which has altered the natural system and poses concern for any restorations in the area. The sixth and final project looks at estimating evapotranspiration using Landsat remote sensing imagery.

All of these studies are laying the ground work to better manage Glacial Ridge in the future. These studies also aid the restoration activities presently being conducted. A map showing the placement of water monitoring equipment is included in Appendix 5.

Contaminant Assessment Process (CAP) – Glacial Ridge NWR

In October 2005, discussions began with Ecological Service's Biologist Dave Warburton regarding a CAP review for the Glacial Ridge NWR. This investigation was recommended to identify any contaminate issues early in the establishment of this new refuge. The CAP would further support a full Environmental Contaminant Proposal, if warranted, that could capture biological data on the health of the new Glacial Ridge National Wildlife Refuge. A total budget of $12,000 was approved for the CAP review, with $6,000 being secured for refuge budget requirements. Refuge funding was used to bring SCEP student Jessica Larson back to duty early, with the primary responsibility to enter refuge data directly into the ECOS – CAP database. Jessica began data input on February 16 and completed the refuge portion of the work on March 21.

Environmental Contaminant Proposal (EC) – Glacial Ridge NWR

On January 12, 2006 a conference call with EC Biologist Dave Warburton, TNC Director of Conservation Science Meredith Cornett, UND Professor Phil Gerla and USGS Hydrologist Tim Cowdery was held to coordinate the CAP and develop an on-going TNC/USGS/Red Lake Watershed Hydrology Study into an EC proposal. It was agreed that the EC proposal was important and would need special honing to incorporate the needs of all agencies into the criteria of the EC process. The final proposal was completed and submitted on April 17 as a 4-year project requiring $336,300 to complete three years of field work and one year for analysis and final write up. On September 18, the project was conditionally accepted pending the actual FY-07 contaminant budget.

2. Habitat Restoration

2a. Wetland Restoration: On-Refuge

Restoring the hydrology of land previously drained for agricultural purposes, and providing nesting and feeding habitat for waterfowl, migratory birds, and other species of prairie wildlife is one of the highest priorities of the Glacial Ridge Project. Through TNC, the NRCS Wetland Reserve Program has provided funding and technical support for the restoration of 81 wetlands within the Glacial Ridge NWR approved acquisition boundary. During FY 2006, 3 wetlands, comprising over 35 acres of prairie potholes, were restored to their original state. Wetland restoration projects are delineated in Appendix 3.

2b. Upland Restoration: On-Refuge

All upland restoration and conversion from agricultural land to pre-settlement habitats was completed by TNC prior to transfer to USFWS.

2c. Wetland Restoration: Off-Refuge

Nothing to report.

3. Habitat Management

3a. Manage Water Levels

Nothing to report.

3b. Graze/Mow/Hay

All mowing activities were associated with invasive weed control and are reported under section 3f.

3c. Farming

Nothing to report.

3d. Forest Management

Nothing to report.

3e. Prescribed Burning

The Wildland Fire Management Plan was approved on March 17, 2006. The majority of the plan was completed by Regional Fire Ecologist Tim Hepola. This plan authorized the use of prescribed fire on the Refuge, as well as outlined responsibility of wildfire suppression. Prescribed fire is used to rejuvenate prairie restoration sites, reduce fuels, and recycle nutrients in wetlands. Management of the fire program is directly tied to the fire management team located at the Detroit Lakes Wetland Management District. See section 5a Interagency Coordination for details.

3f. Control Pest Plants

In a cooperative effort with TNC, approximately 320 acres of FWS land on upland restoration sites were mowed to control weedy plants. In addition, approximately 50 acres were chemically treated to control hybrid cattail and reed canarygrass on wetland restoration sites, and a small area of leafy spurge was sprayed.

4. Fish and Wildlife Management

4a. Provide Nest Structures

Nothing to report.

4b. Predator and Exotic Control

Nothing to report.

5. Coordination Activities

5a. Interagency Coordination

The Nature Conservancy (TNC)

Refuge Operations Specialist Juancarlos Giese and Maintenance Worker Jay Ciucci assisted TNC's Glacial Ridge Project staff and the Detroit Lakes Wetland Management District in three burns on Glacial Ridge Refuge and TNC Project land. Over 600 acres were burned within the proposed boundary of the Glacial Ridge NWR. Figure 3 shows the location of prescribed burns, while Table 4 contains information on acres and ownership.

Figure 3. Locations of the prescribed burns conducted within the approved acquisition boundary of the Glacial Ridge NWR in FY 2006.

Table 4. Cooperative efforts of FWS and TNC Staff to burn units within the approved acquisition boundary of the Glacial Ridge NWR.

FY 2006 Glacial Ridge NWR Prescribed Burns			
Unit	Date	FWS Acres	TNC Acres
Godfrey 9	4/25/2006		572
Onstad 12	4/25/2006	376	341
Tilden 19, 20	4/14/2006	1,581	
Tilden 12	10/27/2005		145
Tilden 30	10/27/2005		366
Tilden 28, 29	10/25/2005		1,506
Tilden 18	9/20/2005		869
Total Acreage		**1,957**	**3,798**

Red Lake Watershed District

The Red Lake Watershed District applied for and received a Challenge Cost Share Grant to continue for one more year a water monitoring project being conducted by the USGS. The Service contributed $24,000 to the project, matched by $14,000 from TNC and $10,000 from the District. The continuation of this project, at least in some aspects, will hopefully be supported in the future utilizing environmental contaminant funds (see section 1b. regarding the Contaminant Assessment Process and Environmental Contaminant Proposal).

Natural Resource Conservation Service

Rydell NWR staff assisted the Natural Resource Conservation Service with an Earth Day event at TNC's Glacial Ridge Project office on April 22. Over 150 people attended, including 132 6th grade students. Rydell staff and volunteers discussed prairie ecosystem dynamics by utilizing a "wildlife calendar" describing native prairie fauna, designed by SCEP Jessica Larson, and provided a live appearance of Puddles.

UM- Crookston students and Refuge volunteers aiding children in identification of prairie wildlife.
Photo by Juancarlos Giese

City of Crookston

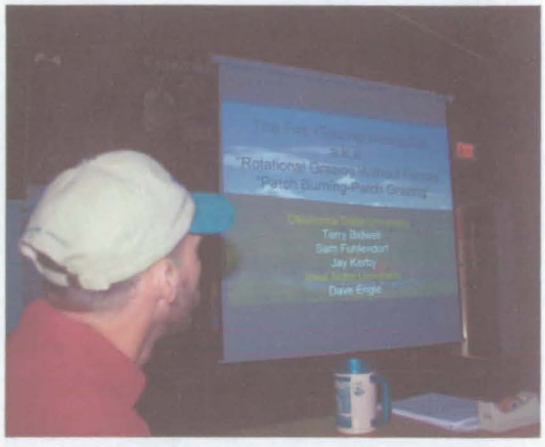
Since the inception of the new Glacial Ridge NWR, there have been substantial efforts undertaken to ensure involvement with local communities and elucidate the benefits that the new Refuge will provide to tourism and commerce. The Rydell and Glacial Ridge NWR staff, along with TNC's Glacial Ridge Project, initiated an endeavor to involve the Crookston Chamber of Commerce in the greater prairie chicken viewing blind program. The Crookston Chamber agreed to be responsible for certain integral aspects of the program, including distributing information to local media outlets, taking reservations for each day of the viewing period, and mailing maps and regulations regarding the viewing blinds. Due to the majority of the visitors to the blinds being from outside of the Crookston area, and traveling to the area specifically for birding, the Chamber was also able to distribute information on area lodging, facilities, and points of interest. Table 5 shows a summary of blind utilization for FY2006.

Refuge volunteer Joe Bailey (r), checking Maintenance Mechanic Bob Hiltner's placement of a prairie chicken blind.
Photo by Juancarlos Giese

Table 5. Summary of prairie chicken blind utilization.

Prairie Chicken Viewing Blind Information	
STATE/ PROVINCE	**VISITORS REPRESENTED**
Minnesota	120
Saskatchewan	6
New Hampshire	2
North Carolina	2
Florida	2
	Total: 132

Think-Tank Meeting - Grazing



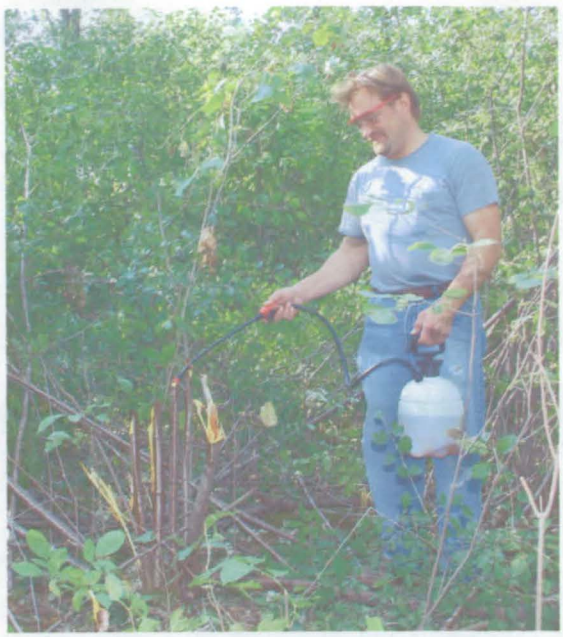
Jason Ekstein, TNC Restoration Ecologist, listening to a "Patch-burn Grazing" presentation at the Rydell NWR.
Photo by Juancarlos Giese

On February 15, a "Think-Tank" meeting to discuss the potential use of grazing as a management tool on Glacial Ridge was held at the Rydell Refuge Visitor Center. This was an effort to be proactive prior to the Refuge managing 20,000+ restored acres of land that will be received from TNC over the next 5 years. Attending the meeting were: Jason Ekstein and Rob Self, TNC; Terry Wolfe and Ross Heir, Minnesota Department of Natural Resources; Greg Hoch, Concordia College, Moorhead, MN.; Dr. Dan Svedarsky, University of Minnesota, Crookston Campus; Gary Huschle, Agassiz NWR; Patricia Heglund, USGS Regional Biologist; and Greg Bengston, Greg Hyack and Howard Moechnig, Natural Resource Conservation Service. A main focus of the day was the discussion of patch burn/grazing and how it might be incorporated into management of native and restored prairies on Glacial Ridge. Dr. Svedarsky, Greg Hoch, Rob Self and Terry Wolfe gave presentations on their experience with patch burn/grazing. The ultimate outcome was a verbal agreement that patch burn/grazing should be tried on Glacial Ridge. Many thought it would be good to try on an experimental basis prior to an overall acceptance of its use on the entire refuge. However, before grazing can be initiated, a Habitat Management Plan must be written and approved. A partial attempt was made to draft a HMP, but was bogged down with other duties and lack of staff time to devote to its completion.

Partners for Fish and Wildlife activities.
The following projects were funded with 1121 dollars, fund targeted via the Rydell NWR.

Buckthorn Brush Control and Aspen Girdling:

In May, a contract was issued to the Minnesota Conservation Corps (MCC) for $2,440 to girdle approximately 10-acres of aspen trees on prairie restoration sites. These sites are an



TNC Glacial Ridge Preserve Management Assistant Brian Kelly applying herbicide to buckthorn stumps.
Photo by Dave Bennett

example of prairie habitat that hadn't seen fire for half a century. It is expected that in following years' fire will be added as a management component to clear young trees and brush and provide adequate sunlight for native prairie grasses and forbs to grow. In August, another contract was issued to MCC to cut and treat buckthorn on 40-acres of TNC land. The buckthorn were scattered throughout a mixed forest area that was mainly a pioneering aspen stand mixed with bur oak. TNC staff followed the MCC crew, spraying buckthorn stumps with herbicide.

Reed canarygrass & other invasive species control:
A rolling drum herbicide applicator was purchased in July with Partners for Fish and Wildlife funds (total cost with shipping was $5,965). This wicking type applicator applies herbicide directly to the leaves of invasive plants at a regulated height interval, avoiding non-target plants growing in the understory. Approximately 300 acres of prairie and wetland restoration sites on TNC land were treated in 2006.

Brush Cutting:
In September, a $27,500 contract was issued through CFM to Thunder Landscaping of Fertile, MN ($10,415 original PFW allocation, supplemented later by $17,000 of additional funding) to brush cut 319 acres on TNC land for prairie rejuvenation. There were 5 areas identified in the contract (Figure 4). Three of the areas were completed by fiscal year end, but a combination of equipment problems (contractor burned up one mower), and complaining by the contractor about the rough terrain, resulted in the last two areas not getting completed until the end of December.

TNC Glacial Ridge Project employee utilizing carpet roller to apply herbicide to a stand of hybrid cattail.
Photo by Jason Ekstein

Figure 4. Areas mowed with contract to Thunder Landscaping.

5b. Tribal Coordination
Nothing to report.

5c. Cooperative/Friends Organizations
Nothing to report.

Thunder Landscaping cutting willow and aspen on TNC land in Glacial Ridge Project area.

6. Resource Protection

6a. Law Enforcement

Detroit Lakes WMD Law Enforcement Officer Brent Taylor handled law enforcement issues for the Refuge in FY-2006. While no citations were issued, off-road driving, deer poaching and general litter issues were documented.

6b. Wildfire Preparedness
See section 3e.

8. Public Education and Recreation

8a. Provide Visitor Services

Managed Deer Hunts

During FY 2005 the Glacial Ridge NWR hunting plan was finalized and approved. The hunt plan opened a portion of the 2,300 acres currently owned by FWS, with future plans for the approved 35,750 acres, to hunting of deer, greater prairie chicken, sharp-tailed grouse, and migratory birds. Migratory birds include waterfowl, mourning doves, common snipe, woodcock, and rails. Approximately 25% of the Refuge will be utilized for non-consumptive public use and the facilitation of special hunts for youth and people with disabilities. Goals for the hunts include: provide the public with safe and enjoyable hunts that are compatible with the Refuge purpose, provide quality hunts that minimize conflicts with other public use, provide opportunities for people with disabilities, and ensure hunts are consistent with State of Minnesota rules and regulations, and the 1997 Refuge Improvement Act.

Hunting opportunities are open to all members of the general public following state and federal regulations and seasons. Maps designating appropriate hunting zones for specific species, as well as approved access points, were available at the Rydell NWR headquarters and were posted at TNC's Glacial Ridge project office and designated parking areas throughout the Refuge.

8b. Outreach

Environmental Education

Rydell and Glacial Ridge NWR staff joined forces with TNC in conducting the first annual Glacial Ridge Prairie Days Celebration on August 13th at TNC's Glacial Ridge Project office. Dr. Dan Svedarsky, dean of Natural Resources at the UM-Crookston, presented a program on the "such-muchness" of the prairies of northwest Minnesota. Through photographic journey, Dr. Svedarsky was able to elaborate on the unique traits of prairies, and the benefits that current and future habitat restoration will have on the incredible diversity of flora and fauna within the approved acquisition boundary of the Glacial Ridge NWR.

The afternoon's activities concluded with a tour of a tract of native tallgrass prairie on TNC land. A wheelchair accessible bus was rented for the occasion to provide accessibility to the tour sites for all members of the visiting public. Rydell and Glacial Ridge NWR staff were joined by UMC faculty members, DNR Area Manager Terry Wolfe, TNC Restoration Ecologist Jason Ekstein, and Agassiz NWR ROS Gary Tischer, all of whom facilitated an authoritative and entertaining tour. Once at the site, the various tour guides led visitors into the prairie for an up close and personal look at native prairie plants, many of which were in full bloom.

Wildlife Viewing

As mentioned earlier, this year the Refuge began a collaborative effort with TNC and the Crookston Chamber of Commerce to allow visitors an opportunity to sit in one of four blinds and observe the mating rituals of greater prairie chickens and sharp-tailed grouse. By all accounts, the program was a success. Callers were directed to the Chamber of Commerce, who handled reservations of blinds and mailed out maps to the blinds and information about the local area. Most time slots were filled, with weekend and morning slots being the most popular. See section 5a for more information about the program.

9. Planning and Administration

9a. Comprehensive Conservation Planning

The Glacial Ridge NWR Interim CCP was approved by the Regional Office September 28, 2001.

9b. General Administration

Staffing

The Glacial Ridge National Wildlife Refuge is currently administered by funding and staff from the Rydell National Wildlife Refuge.

Land Acquisition

On July 1, 2005, a general introduction letter was sent to private landowners within the approved acquisition boundary for the Glacial Ridge NWR. The letter also indicated that the Service would be willing to provide an appraisal for any and all willing sellers. Table 6 shows a summary of land acquisition activities in FY2006.

Table 6, Land Acquisition Actions

Landowner	Acres	Acquisition Request Submitted	Action as of 12/31/06	Comment
Broden R.	141	2/24/05	Pending	Lack of Funds
Olson A.	110	2/24/06	Pending	Lack of Funds
Christianson	118	2/24/05	Pending	Lack of Funds
Broden R.	240	6/15/05	Purchase Agreement	5/06/06
Neuman	51	7/07/05	Purchased	3/16/06
Engelstad	160	7/08/05	Purchase Agreement	5/17/06
Proulx	41	7/26/05	Purchased	10/18/06
Olson R.	139	8/16/05	Pending	Lack of Funds
Longtin	80	10/13/05	Pending	Lack of Funds
Chapman	160	12/16/05	Pending	TNC Potential Purchase
Pederson	320	1/20/06	Pending	Lack of Funds
Christian	160	4/06/06	Pending	Lack of Funds
Abrahamson	6	4/06/06	Pending	Lack of Funds
Bradford	10	5/22/06	Rejected by RO	Major building site

On September 13, 2006, Refuge Manager attended and provided support to the Regional and Washington Office Reality Division at the Migratory Bird Conservation Commission (MBCC) Meeting at the Department of Interior in Washington D.C. The meeting was a success as the Commission approved both the acceptance of the Glacial Ridge NWR as a MBCC funded project, and also specifically approved the Engelstad and R. Broden tracts. Although this didn't allocate funds for the purchase of these tracts, it did authorize the spending of MBCC funds should there be any available.

Equipment and Facilities

Repairs Wetland 12-1

In the spring of 2006, water erosion began washing soil out from around the control structure for Wetland 12-1 in Tract 10a. This structure, which includes a fixed height overflow box with a concrete culvert going under a township road, restores a 40-acre wetland. A contract for $1,950 was issued to Erickson Construction of Erskine for excavator work, and $1,376 was issued to

Washout of culvert in wetland 12-1. Notice no rip rap on slope.

Fertile Sand and Gravel for purchase and delivery of clay and rock for rip rap. All repairs were completed on June 29. The entire pipe was exposed, and clay was used to replace the sand that was originally used for bedding the pipe. Rip rap was then placed around the structure and up onto the road slope, where originally it had only been around the structure and offered no protection to the slope and pipe. The YCC students assisted with the project by hand tamping the clay bedding.

Complete embedding of pipe with clay was needed to replace sand.

Repair included clay and rip rap being totally placed around box riser.

Budget

Glacial Ridge NWR received $41,250 from the Partners for Fish and Wildlife program and $24,000 from a Challenge Cost Share grant. The PFW funds were used to pay salaries, purchase herbicide and a rolling drum herbicide applicator, issue one brush cutting contract and two contracts to Minnesota Conservation Corps to hand cut/girdle trees. The $24,000 in CCS grant money was used to continue a USGS water monitoring study being conducted on the Refuge and in the surrounding area. Cooperators on the CCS grant included the Red Lake Watershed District and TNC.

APPENDIX 1

Glacial Ridge Project

The Nature Conservancy®
Saving the Last Great Places

The Nature Conservancy

The Nature Conservancy is a private, international, nonprofit organization with the mission of preserving the plants, animals, and natural communities that represent the diversity of life on Earth. Since its founding in 1951 the Conservancy has protected more than 12 million acres in the United States. The Minnesota chapter, with a membership of 22,000, has protected 400,000 acres, and today owns 56 preserves, totaling approximately 60,000 acres.

MONARCH BUTTERFLY ON A BLAZING STAR

The Nature Conservancy of Minnesota
1313 Fifth Street SE, Suite 320
Minneapolis, MN 55414
(612) 331-0750

The Nature Conservancy®
Saving the Last Great Places
www.nature.org

The Nature Conservancy of Minnesota
Glacial Ridge Project
Rural Route 1, Box 27
Mentor, MN 56736
(218) 637-2146

In August 2000 when The Nature Conservancy purchased 24,270 acres 10 miles east of Crookston, the stage was set for the largest prairie restoration project in history.

Agassiz Beach Ridges

As the last glacier receded, its melting ice fed Glacial Lake Agassiz, which stretched far into Canada. A set of beach ridges that developed along the lakeshore forms the underlying skeleton of the current Glacial Ridge ecosystem.

The variable soils—from sand to silt to clay—result in a patchwork of moist and dry prairies, dotted with wetlands. Zones of groundwater seepage give rise to more specialized plant communities: calcareous fens and seepage prairies. These wet prairies and fens are among the largest, least-damaged examples in the region.

Countless species find habitat here, including such rarities as prairie chicken, marbled godwit, Dakota skipper butterfly, and western prairie fringed orchid.

© DOMINIQUE BRAUD

GREATER PRAIRIE CHICKEN

FIELD OF WHEAT © COLDSNAP PHOTOGRAPHY/JOHN GREGOR

The Protection of a Landscape

The purchase of Glacial Ridge, the Conservancy's largest in Minnesota to date, has linked the pre-existing Pembina Trail preserve with two Scientific and Natural Areas, three Waterfowl Production Areas, and about a dozen Wildlife Management Areas. Much of it may eventually become the Glacial Ridge National Wildlife Refuge, administered by the U.S. Fish and Wildlife Service.

©RICHARD HAMILTON SMITH

BULL MOOSE

But purchasing the land is not enough. Less than 1% of Minnesota's native prairie remains unplowed, and even though the beach ridges landscape is not highly productive for agriculture, 15,000 acres of Glacial Ridge were converted to row crops. The size of the area, with small patches of native prairie, makes Glacial Ridge a superb restoration opportunity.

© BRIAN MINTER

The Restoration of an Ecosystem

The Conservancy hopes to have approximately 11,700 acres enrolled in the Wetland Reserve Program (WRP) of the USDA Natural Resources Conservation Service by the fall of 2003. Local contractors are restoring natural water levels and vegetation to drained wetlands on WRP land. Eventually 8,000 acres of wetlands will be re-created. The contractors seed the surrounding uplands with native prairie grasses and wildflowers collected within 65 miles.

Restoration doesn't replace what's gone—restored prairies are usually far less diverse than natural ones—but it connects the isolated remnants, permitting populations of plants and small animals to interact. Starting with these isolated prairies, restoration at Glacial Ridge will set an entire ecosystem on the road to recovery.

The tremendous scale of the restoration project allows tests for all sorts of landscape level responses. The U.S. Geological Survey is conducting a five-year hydrological study to measure any reduction of sedimentation in ditches, improvements in water quality, increases in groundwater recharge, or reduction of downstream flooding potential.

Community Cooperation

The Glacial Ridge project benefits the local community beyond ecological and hydrological improvements. The City of Crookston plans to install new municipal wells on Conservancy land. Local farmers are growing prairie seed for the project, and some gravel pits will remain in operation. All the restoration activities will pump hundreds of thousands of dollars into the local economy annually.

© R. DANA

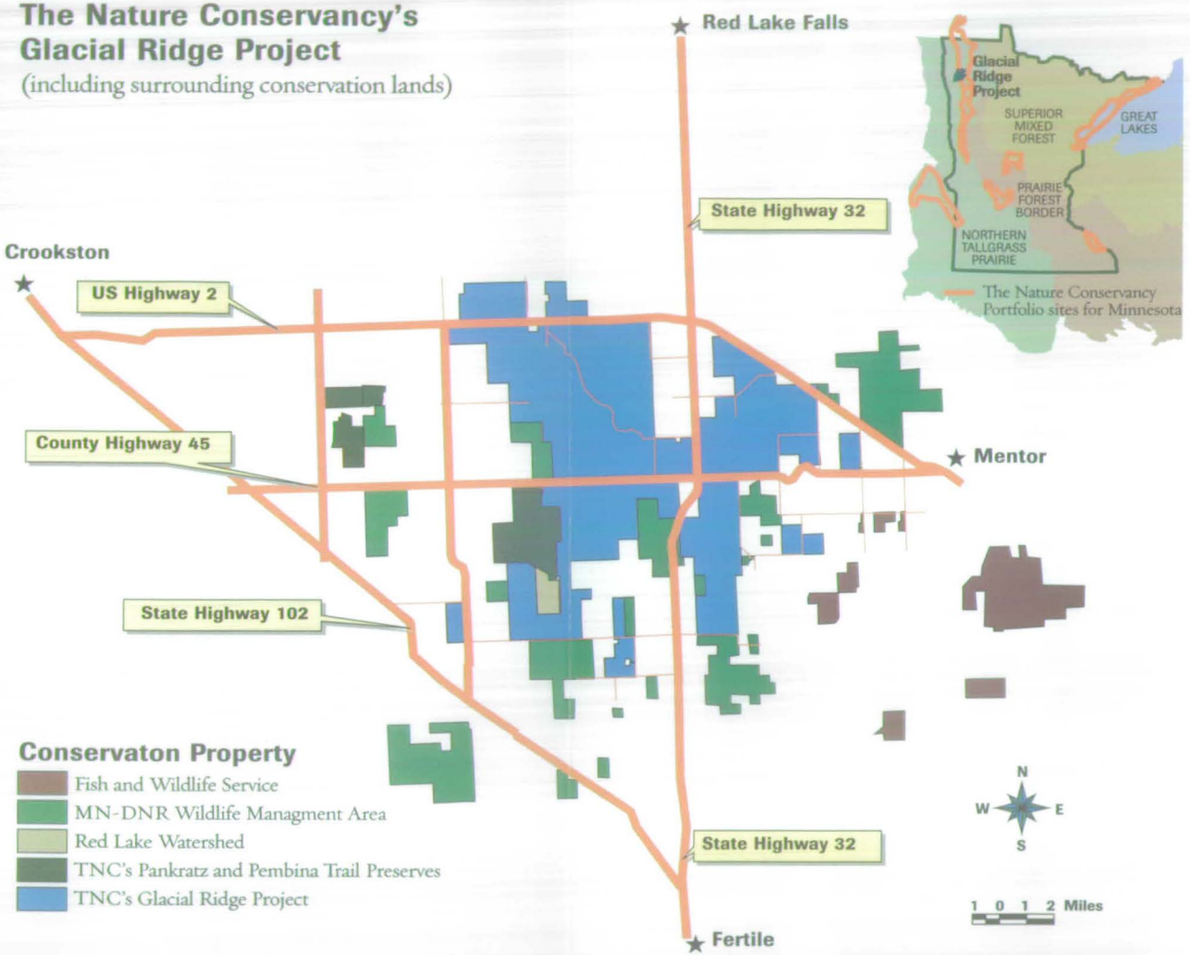
REGAL FRITILLARY ON FLODMAN'S THISTLE

© NEBRASKA GAME & PARKS COMMISSION

SANDHILL CRANES

The Nature Conservancy's Glacial Ridge Project

(including surrounding conservation lands)



Partners

Twenty-six public and private partners are cooperating in this historic restoration project. One day Glacial Ridge will be the crown jewel of the northern tallgrass prairie.

STATE AND FEDERAL GOVERNMENT
- USDA Natural Resources Conservation Service
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- Environmental Protection Agency
- Minnesota Pollution Control Agency
- Minnesota Department of Natural Resources

LOCAL GOVERNMENT
- City of Crookston
- Polk County
- Red Lake County
- Red Lake River Watershed District
- Sandhill River Watershed District
- West Polk Soil and Water Conservation District
- East Polk Soil and Water Conservation District
- Red River Flood Damage Reduction Work Group
- Pembina Trail Resource Conservation and Development

UNIVERSITIES AND RESEARCH INSTITUTES
- University of Minnesota, Crookston
- University of North Dakota
- North Dakota State University
- Moorhead State University
- Concordia College of Moorhead
- South Dakota State University
- Nature Northwest

NON-GOVERNMENTAL ORGANIZATIONS AND FOUNDATIONS
- Ducks Unlimited, Inc.
- Bush Foundation
- Minnesota Waterfowl Association
- The Audubon Society

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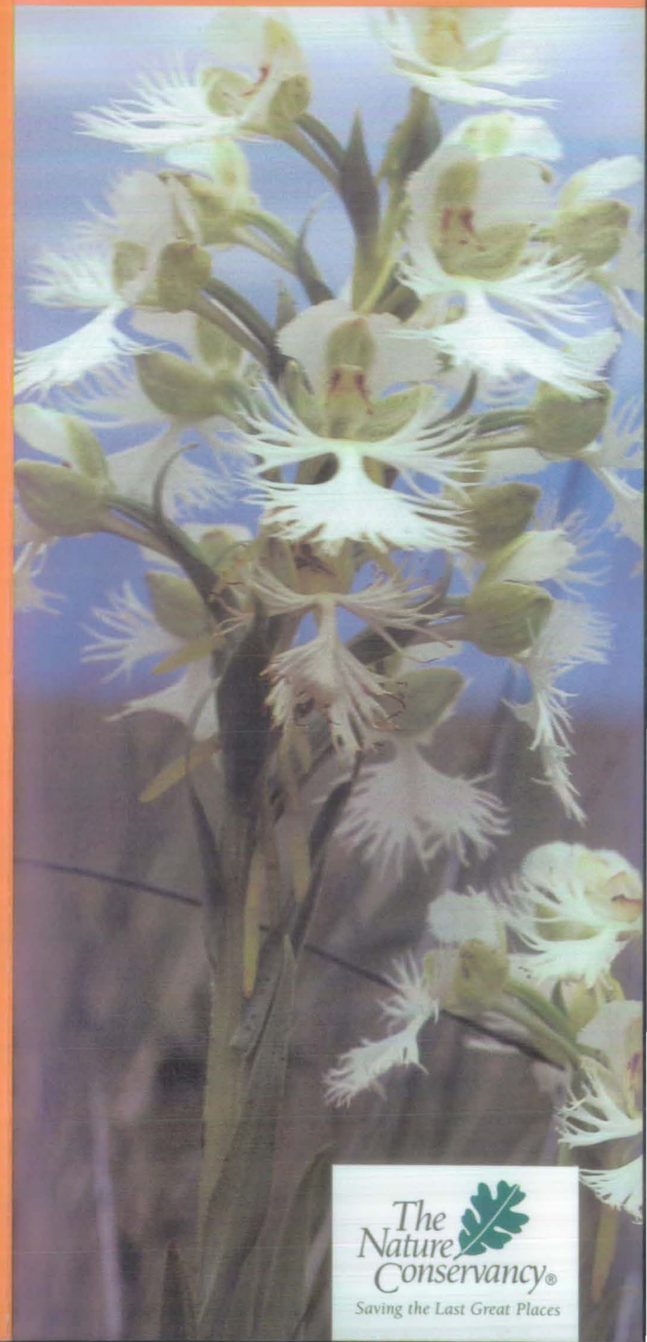
Glacial Ridge Project



The Nature Conservancy®
Saving the Last Great Places

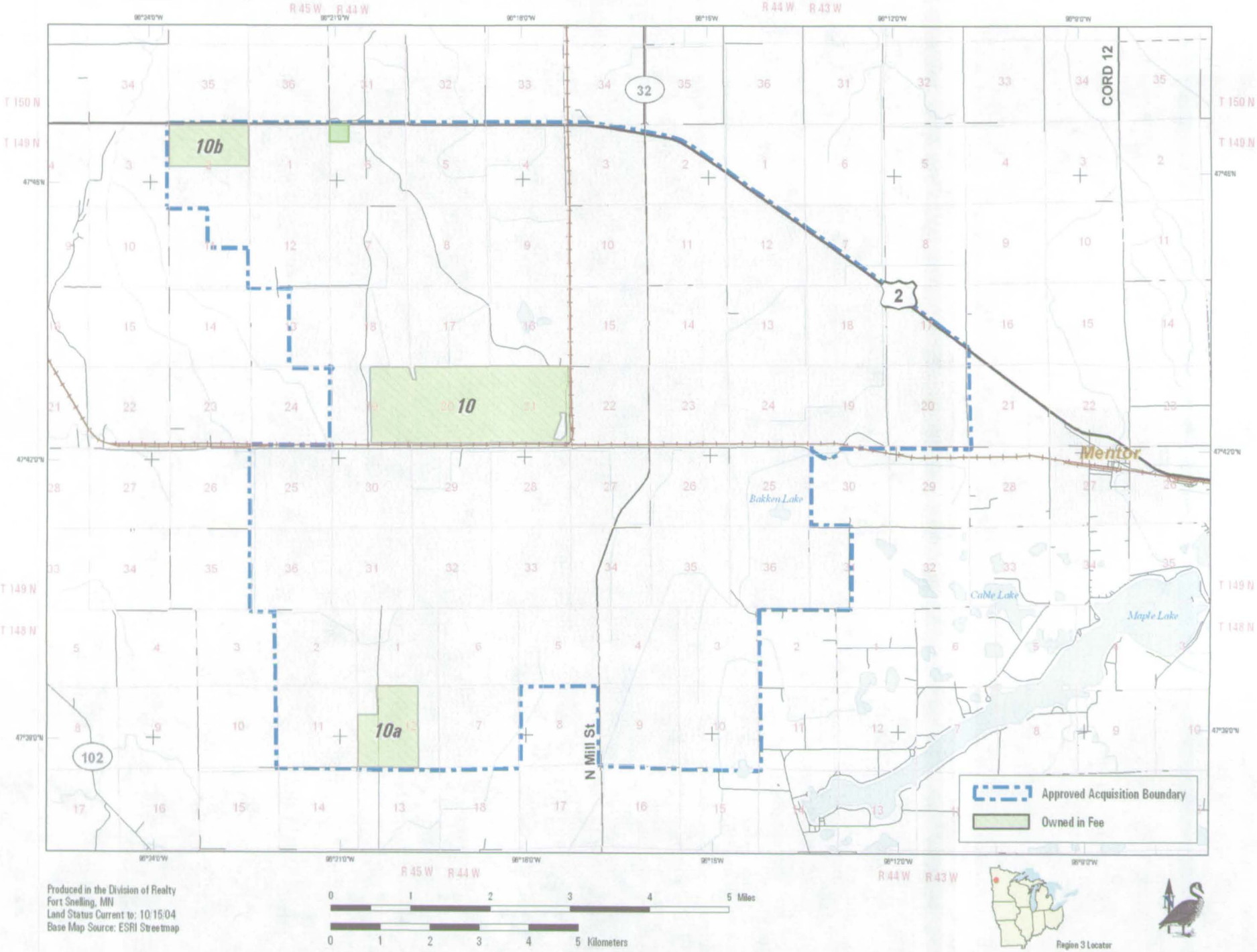
APPENDIX 2

U.S. Fish & Wildlife Service

Glacial Ridge National Wildlife Refuge

Polk County, Minnesota

The Nature Conservancy - T[illegible]a,b



Produced in the Division of Realty
Fort Snelling, MN
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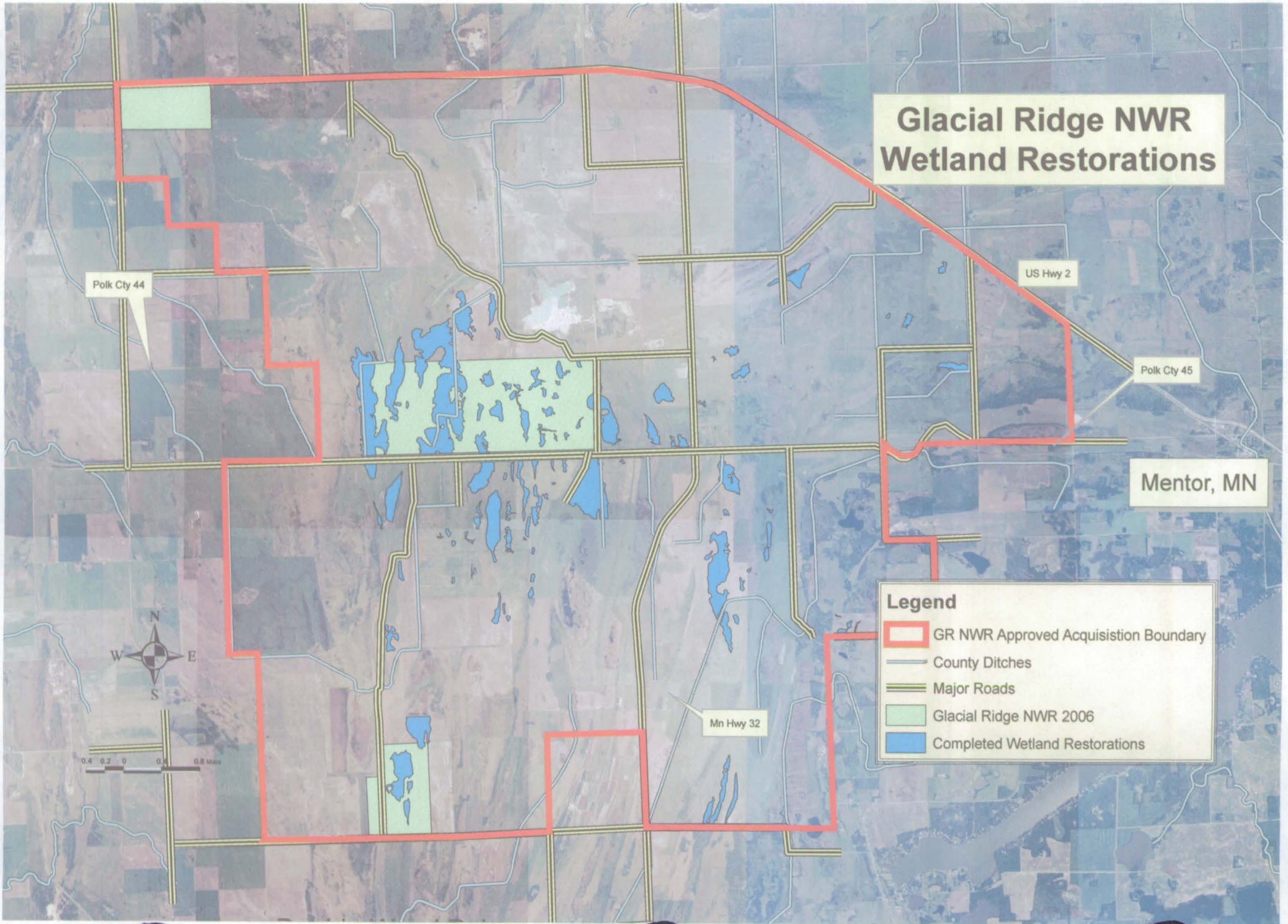
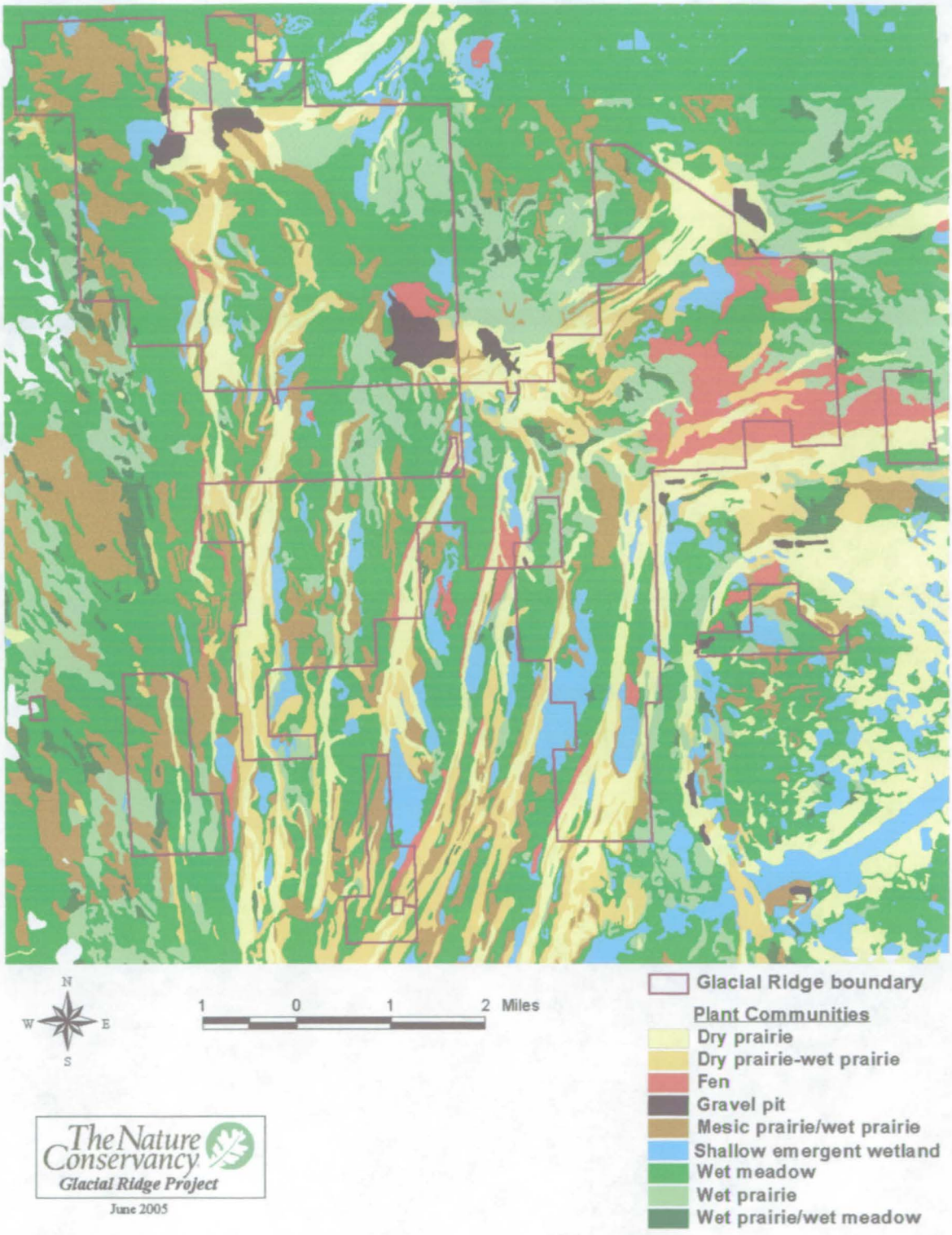
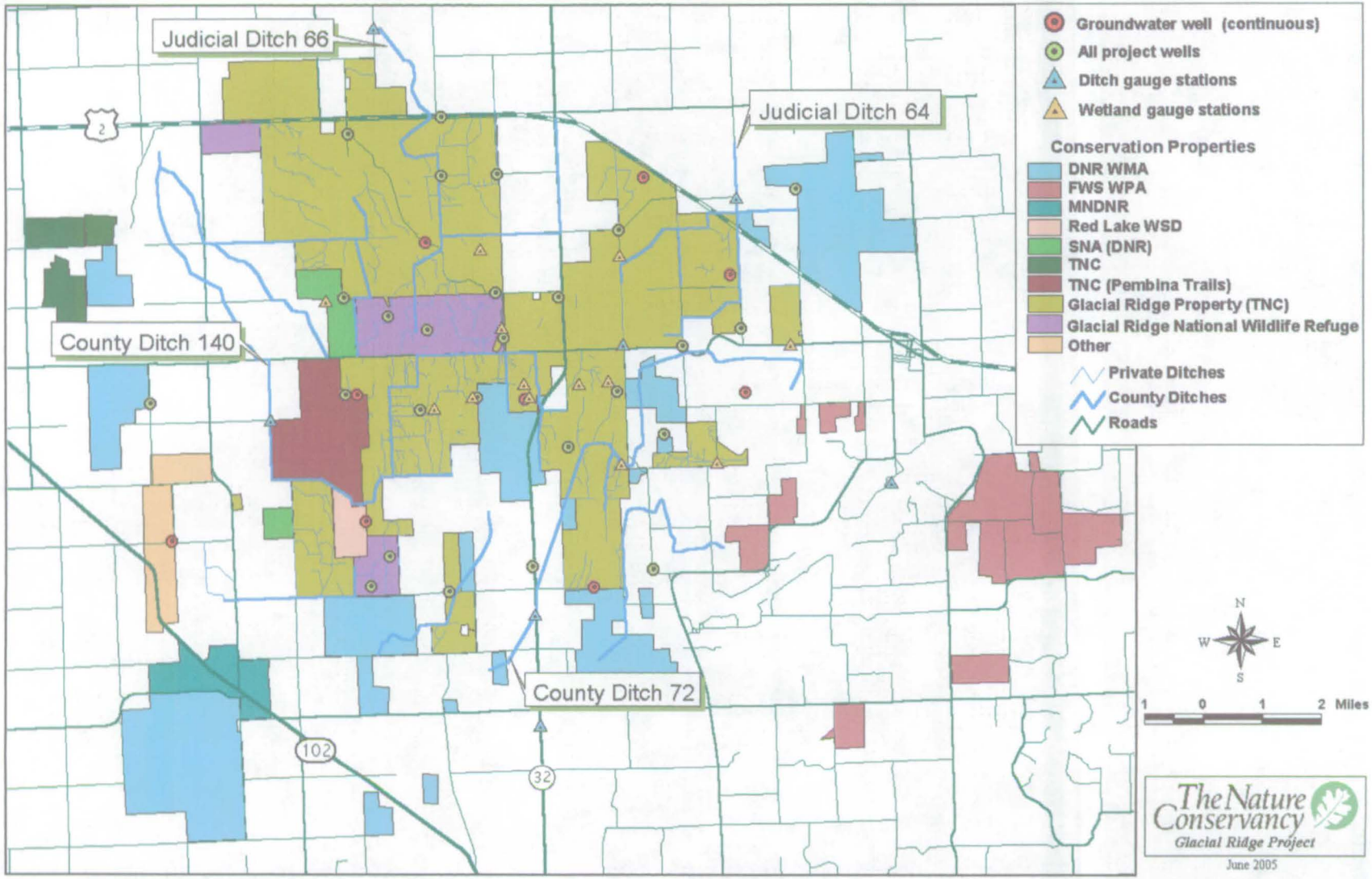
Base Map Source: ESRI Streetmap


Glacial Ridge NWR
Wetland Restorations
Polk Cty 44
US Hwy 2
Polk Cty 45
Mentor, MN
Mn Hwy 32
N
W
E
S
0.4 0.2 0 0.4 0.8 Miles
Legend
GR NWR Approved Acquisistion Boundary
County Ditches
Major Roads
Glacial Ridge NWR 2006
Completed Wetland Restorations



Appendix 4- Expected distribution of plant communities as a result of restoration activities within the vicinity of the Nature Conservancy's Glacial Ridge Project, including the lands within the Glacial Ridge NWR approved Acquisition Boundary.



Appendix 5- Location of surface water (triangular) and groundwater (circles) monitoring stations at Glacial Ridge (data courtesy of USGS, Mounds View, Minnesota)