



Minnesota Department of Natural Resources
Minnesota Board of Water and Soil Resources

Program Process and Project Evaluations

Appendix A: 2021 Legacy Fund Restoration Evaluation Report

April 2023

Minnesota Department of Natural Resources
Minnesota Board of Soil and Water Resources
Restoration Evaluations
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Legislative Charge

Parks and Trails Fund: M.S. 85.53, Subd. 5.

Outdoor Heritage Fund: M.S. 97A.056, Subd. 10.

Clean Water Fund: M.S. 114D.50, Subd. 6.

As requested by Minnesota Statute 3.197: This report cost \$5,400 to prepare, including staff time, printing and mailing expenses.

Upon request, this material will be made available in an alternative format such as large print, Braille or audio recording. Printed on recycled paper.

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Legislative Charge and Statutory Requirements

Parks and Trails Fund: M.S. 85.53, Subd. 5.

The commissioner of natural resources may convene a technical evaluation panel comprised of five members, including one technical representative from the Board of Water and Soil Resources, one technical representative from the Department of Natural Resources, one technical expert from the University of Minnesota or the Minnesota State Colleges and Universities, and two other representatives with expertise related to the project being evaluated. The commissioner may add a technical representative from a unit of federal or local government. The members of the technical evaluation panel may not be associated with the restoration, may vary depending upon the projects being reviewed, and shall avoid any potential conflicts of interest. Each year, the commissioner may assign a coordinator to identify a sample of up to ten habitat restoration projects completed with parks and trails funding. The coordinator shall secure the restoration plans for the projects specified and direct the technical evaluation panel to evaluate the restorations relative to the law, current science, and the stated goals and standards in the restoration plan and, when applicable, to the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. ***The coordinator shall summarize the findings of the panel and provide a report to the chairs of the respective house of representatives and senate policy and finance committees with jurisdiction over natural resources and spending from the parks and trails fund.*** The report shall determine if the restorations are meeting planned goals, any problems with the implementation of restorations, and, if necessary, recommendations on improving restorations. The report shall be focused on improving future restorations. Up to one-tenth of one percent of forecasted receipts from the parks and trails fund may be used for restoration evaluations under this section.

Outdoor Heritage Fund: M.S. 97A.056, Subd. 10.

The commissioner of natural resources and the Board of Water and Soil Resources must convene a technical evaluation panel comprised of five members, including one technical representative from the Board of Water and Soil Resources, one technical representative from the Department of Natural Resources, one technical expert from the University of Minnesota or the Minnesota State Colleges and Universities, and two representatives with expertise in the project being evaluated. The board and the commissioner may add a technical representative from a unit of federal or local government. The members of the technical evaluation panel may not be associated with the restoration or enhancement, may vary depending upon the projects being reviewed, and shall avoid any potential conflicts of interest. Each year, the board and the commissioner may assign a coordinator to identify habitat restoration or enhancement projects completed with outdoor heritage funding. The coordinator shall secure the plans for the projects specified and direct the technical evaluation panel to evaluate the restorations and enhancements relative to the law, current science, and the stated goals and standards in the project plan and, when applicable, to the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. ***The coordinator shall summarize the findings of the panel and provide a report to the chair of the Lessard-Sams Outdoor Heritage Council and the chairs of the respective house of representatives and senate policy and finance committees with jurisdiction over natural resources and spending from the outdoor heritage fund.*** The report shall determine if the restorations and enhancements are meeting planned goals, any problems with the implementation of restorations and

enhancements, and, if necessary, recommendations on improving restorations and enhancements. The report shall be focused on improving future restorations and enhancements. At least one-tenth of one percent of forecasted receipts from the outdoor heritage fund must be used for restoration and enhancements evaluations under this section.

Clean Water Fund: M.S. 114D.50, Subd. 6.

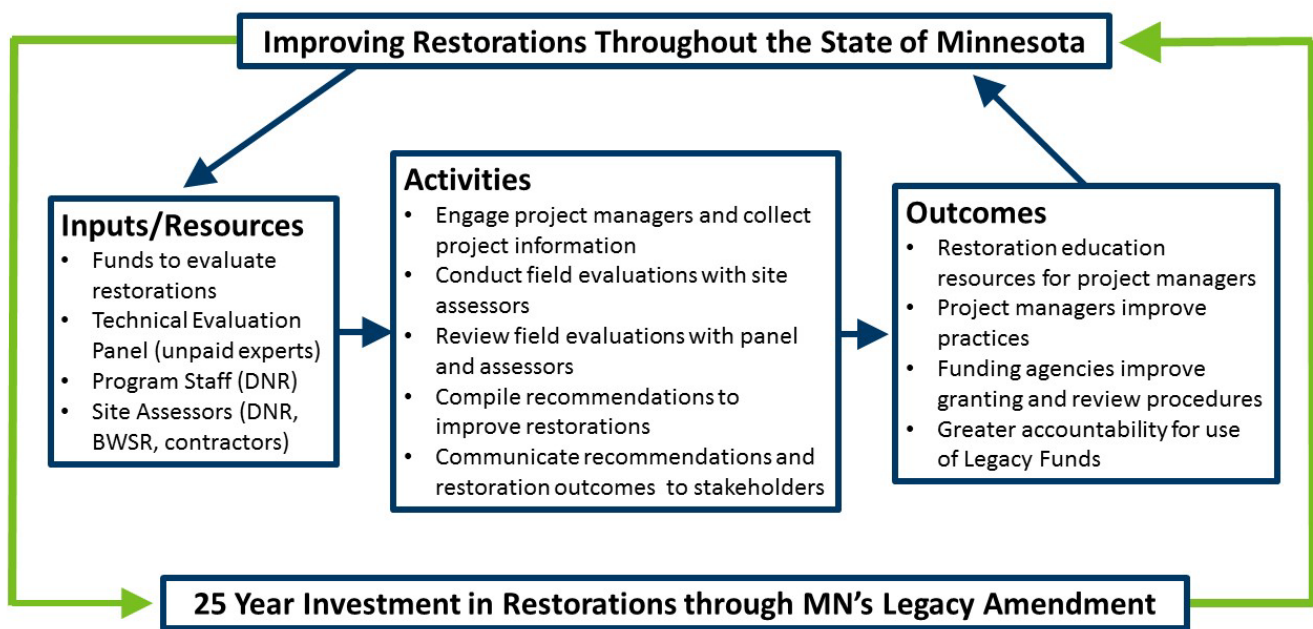
The Board of Water and Soil Resources may convene a technical evaluation panel comprised of five members, including one technical representative from the Board of Water and Soil Resources, one technical representative from the Department of Natural Resources, one technical expert from the University of Minnesota or the Minnesota State Colleges and Universities, and two representatives with expertise related to the project being evaluated. The board may add a technical representative from a unit of federal or local government. The members of the technical evaluation panel may not be associated with the restoration, may vary depending upon the projects being reviewed, and shall avoid any potential conflicts of interest. Each year, the board may assign a coordinator to identify a sample of habitat restoration projects completed with clean water funding. The coordinator shall secure the restoration plans for the projects specified and direct the technical evaluation panel to evaluate the restorations relative to the law, current science, and the stated goals and standards in the restoration plan and, when applicable, to the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. ***The coordinator shall summarize the findings of the panel and provide a report to the chairs of the respective house of representatives and senate policy and finance committees with jurisdiction over natural resources and spending from the clean water fund.*** The report shall determine if the restorations are meeting planned goals, any problems with the implementation of restorations, and, if necessary, recommendations on improving restorations. The report shall be focused on improving future restorations. Up to one-tenth of one percent of forecasted receipts from the clean water fund may be used for restoration evaluations under this section.

Evaluation Process

State law directs the DNR and BWSR to convene an expert panel to evaluate restorations completed with Clean Water Land and Legacy Funds. The evaluations include directly engaging project managers and are completed by third party experts to identify gaps and capture lessons learned from restorations. The agencies use this information to improve restorations throughout the state.

Program Model

The Restoration Evaluation Program was developed with the ultimate goal of improving restorations throughout the state. The diagram below outlines the inputs, activities, and outcomes of the program and our continued investment in improving restorations.



Roles and Responsibilities

Evaluation Panel

Statute directs the evaluation panel to:

- Evaluate restorations relative to the law, current science, and the stated goals and standards in the restoration plan
- Provide findings on the evaluations, determining whether restorations are meeting planned goals, identify problems with implementation of restorations and, provide recommendations on improving restorations

Members of the panel are unpaid experts chosen to fulfill statutory requirements and provide needed expertise in a variety of ecosystems and restoration techniques.

Program Staff

The program staff are responsible for coordinating site assessments, program administration and managing the work of the panel. They are directed in statute to:

- Identify restoration projects completed with Parks and Trails, Outdoor Heritage, and Clean Water Funds
- Secure restoration plans for selected projects
- Summarize the findings of the panel
- Provide reports to the legislature

The staff also promote and document continuous improvement in restorations. Staff work with the panel and agencies to identify and promote actions and provide guidance for implementing improved restorations. DNR and BWSR have assigned staff to ensure consistency in program implementation. The staff are currently housed in DNR's Ecological and Water Resources Division.

Site Assessors

The site assessors are responsible for conducting site assessments. Site assessors are selected based on knowledge of restoration practices and work closely with program staff in assessing project plans, conducting field evaluations, and participating in panel reviews. Site assessors include:

- State agency staff
- Local government staff
- Federal agency staff
- Private contractors

Services provided by assessors are negotiated through the use of contracts, State Interagency Agreements, or work assignments.

Project Managers

Project managers are expected to actively participate in the evaluation process. Project managers provide the necessary project background and attend field evaluations when possible to:

- Identify project work sites
- Provide project context
- Answer assessor questions

It is necessary to acknowledge the diversity of managing organizations and their scope and focus when evaluating projects.

Example project managers for the three Legacy Funds.

Clean Water Fund

- Soil and Water Conservation District manager or technician
- Watershed District staff
- Watershed Management Organization staff
- County Water Resources of Environmental Services staff
- City Water Resource staff

Outdoor Heritage Fund

- State agency staff (DNR, BWSR)
- Federal agency staff (USFWS)
- County conservation and land management staff
- Watershed District staff
- Nongovernmental wildlife organizations

Parks and Trails Fund

- MN DNR Parks and Trails Division, resource management staff
- Metro Regional Parks managers, including county park systems and Three Rivers Park District
- Greater Minnesota park managers

Evaluation Methods

Project Selection

Program staff update the pool of eligible restoration projects on an annual basis. For each fund projects are considered to be eligible if they are complete and contain restoration or enhancement work. Projects evaluated represent a variety of habitat types and geographic distributions of restorations in the state.

Projects are selected in relative proportion to each Fund's appropriation to restoration evaluations. Many grants and appropriations fund restoration activities at multiple project sites. A smaller subsample of project sites is typically evaluated.

Site Assessments

DNR, BWSR and the panel developed a simple and consistent process to facilitate evaluations. To the extent possible the evaluation process engages project managers in conducting site visits and communicating lessons learned. Facilitating an inclusive evaluation process with project managers increases the transfer of knowledge between field practitioners and agencies, ultimately improving restorations.

A site evaluation form was developed to provide project information and address evaluation requirements directed by law. This form describes site assessors' observations of project effectiveness, estimated outcomes based on current conditions and application of current science.

Field visits include inspecting the project's structural components and plant communities. Restored plant communities may take several years or even decades to mature. Evaluations are based on observations of the present and projected conditions relative to the project goals. Assessments of project sites do not represent an overall evaluation of the larger program or Fund.

Restoration science is continually evolving. Best practices are an area of ongoing discussion between practitioners, researchers, agencies and stakeholders. Site assessors and the panel evaluate projects based on methods commonly considered to be within the range of current science.

Legacy Fund Attributes and Requirements

Each of the Legacy Funds has a distinct focus on restoration and specific requirements for projects.

	Clean Water Fund	Outdoor Heritage Fund	Parks and Trails Fund
Fund Purpose	<i>protect, enhance, and restore water quality in lakes, rivers, and streams and protect groundwater from degradation</i>	<i>restore, protect, and enhance wetlands, prairies, forests, and habitat for fish, game, and wildlife</i>	<i>support parks and trails of regional or statewide significance</i>
Primary Restoration Goal	Restore water quality	Restore specific wildlife habitat types	Ecological restoration of specific habitat types
Guidance for project types and locations	Local water management plan, TMDL Implementation plans, or Watershed Restoration and Protection Strategies	Statewide or national wildlife habitat plans	State or Regional Park natural area management plans
Funding source for restoration projects	Competitive grants administered by BWSR	Appropriation to project manager; recommended by Outdoor Heritage Council, or Conservation Partners grants administered by MN DNR	MN DNR appropriation: resource management, or Met Council appropriation: County Regional Park System, Three Rivers Park District
Statutory Requirements	MS 114D.50 Subd. 4. (a) <i>include measurable outcomes, as defined in section 3.303, subdivision 10, and a plan for measuring and evaluating the results. A project must be consistent with current science and incorporate state-of-the-art technology.</i>	Different appropriation years are subject to different requirements but all include: <i>Prepare and retain an ecological restoration and management plan</i> <i>Use current conservation science to achieve the best restoration</i> <i>Establishment of diverse plant species</i> Appropriations in 2009 and 2010 also included. <i>Plant vegetation or sow seed only of ecotypes native to Minnesota.</i>	MS 85.53 Subd. 2 (a) <i>include measurable outcomes, as defined in section 3.303, subdivision 10, and a plan for measuring and evaluating the results. A project or program must be consistent with current science and incorporate state-of-the-art technology</i>

1 Eden Wildlife Management Area Prairie Restoration

Project Background

Project Name: Eden WMA

Project Site: 2016 and 2019 seeding areas, two projects evaluated

Township/Range Section: Township 105N Range 46W Section 24

Project Manager / Affiliated Organization:
Kent Schaap - MNDNR

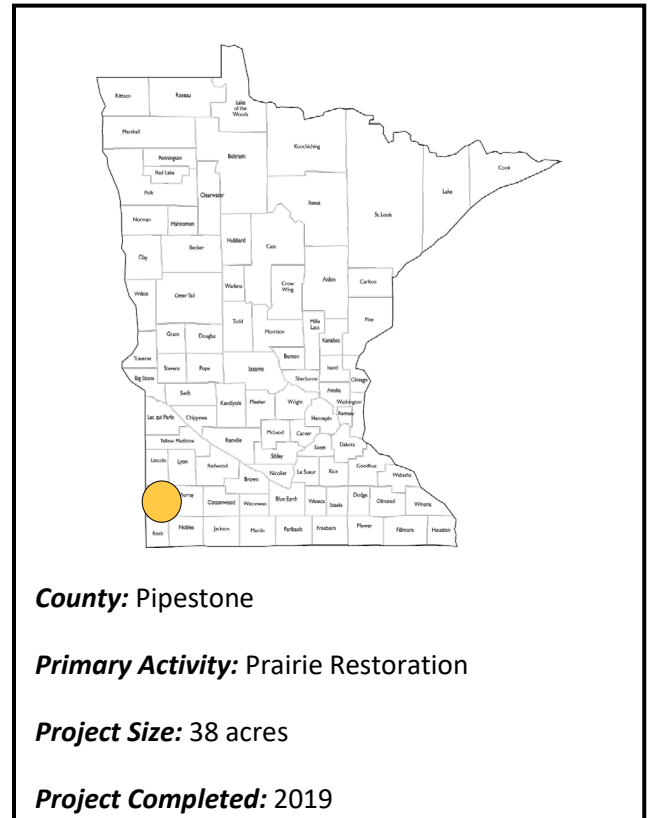
Fund: OHF **Fiscal Year Funds:** 2019

Project Start Date: 2016

Predominant Habitat type: Prairie / Savanna / Grassland

Additional Habitat types:

Project Status: Post Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

This project included a 2014 burn in the southern portion of the WMA. Following the burn seed was hand collected and mixed with purchased seed for two separate prairie seedings north of the unnamed waterway that crosses the site. The north seeding area was seeded in May 2016 using a Truax drill seeder planting into soybean stubble in a former food plot. The 2016 seed mix included 28 forbs (purchased) and hand collected grass species from nearby WMA's. The southern seeding area was planted using the same methods and site preparation, but in June 2019. Only limited spot spraying of Canada thistle has occurred, and neither area has been burned yet. The 2019 seed mix included 34 forb and 10 grass/sedge species. Notably the rate of seeding for Big Bluestem (*Andropogon gerardii*) was lower based on observations of Big Bluestem growing aggressively in previous restorations as well as guidance from the DNR Regional Ecologist.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Site history was communicated by the MNDNR land manager. In addition, the following documentation was provided:

- Figure showing seeding boundaries and management history for the WMA.
- Seed mix information for 2019 planting including species list and seeding rates.
- Hand collected seed list for 2016 planting.
- Shapefiles for planted areas.

3. What are the stated goals of the project?

Install local genotype native prairie seed in a former agricultural food plot and develop a native-dominated prairie community.

4. What are the desired outcomes of achieving the stated goals of the project?

The desired outcome is to have a diverse, native-dominated prairie plant community present on-site, managed by periodic prescribed burns.

5. Were measures of restoration success identified in plans? No

6. Are plan Sets available? No Have project maps been created? Yes

If yes, provide in "site maps" and list maps provided:

A figure was created by the MNDNR in 2019 showing the restoration areas.

7. Provide list of best management practices, standards, guidelines identified in plan set?

None

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

No

The site planting proceeded as planned and on schedule. Minimal management has occurred since except limited herbicide application to Canada thistle in the 2016 seeding area. Project managers identified a prescribed burn as the next management step needed in the unit. .

9. In what ways did alterations change the proposed project outcome?

Alterations have not affected the project outcomes.

Site Assessment

Field Review Date: 7/27/2021

Field Visit Attendees: Kent Schaap - MNDNR, Gina Quiram – MNDNR, and Will Taylor – Cardno

10. Surrounding Landscape Characteristics:

The approximately 40 acre evaluated site falls within the Eden WMA, a 160 acre site that supports prairie restorations and remnants. The landscape beyond the WMA is almost entirely in agricultural use, primarily corn and soybean row crop rotation (77% in Pipestone County), with areas of pasture mixed in including directly west of this site across the highway.

11. Site Characteristics:

a. Soil Series:

Brookings silty clay loam, 0 to 2 percent slopes

Renshaw-Sandberg complex, 2 to 6 percent slopes

Strayhoss loam, 2 to 6 percent slopes

Kranzburg-Brookings silty clay loams, 1 to 6 percent slopes

Hidewood-Badger complex, 0 to 2 percent slopes

b. Topography:

The evaluated areas are on a southwest-facing slope that exhibits good drainage and likely remains dry year round. The elevation at the highest point is in the northeast corner at approximately 1,712 feet and the lowest point in the southwest corner is approximately 1,678 feet.

c. Hydrology:

The site appears well-drained and exhibits a slight, but continuous slope throughout. Three shallow drainage swales focus overland runoff flow south off-site, but do not capture standing water.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Using the MNDNR Native Plant Community Classification, this site would be classified as Southern Mesic Prairie (Ups23), a fire-dependent community dominated by native herbaceous species. The site achieves this classification in both the north and south seeding areas, however they exhibit different dominant species and non-native cover percentages due to their implementation timelines. The north area, seeded in 2015, shows abundant big bluestem, wild bergamot, prairie coneflower, and Indian grass. Here, native areal cover is approximately 90%. The south area, seeded in 2019, is dominated heavily by side-oats grama and prairie coneflower, with blue grama, Maximilian sunflower, and switchgrass also common. Canada thistle is the most common non-native species in the south unit at approximately 20% areal cover. Overall, native cover in the south area is approximately 60-70%, but the majority non-native cover is Canada thistle and this will likely diminish in subsequent years based on current science and similar regional experiences. The newer southern seeding area also contains approximately 10-15% bare ground cover while the northern area has nearly no bare ground cover due to dense vegetation growth and previous years' thatch.

12. Is the plan based on current science? Yes

The site management practices included proper site preparation of drill seeding into soybean stubble and the use of local genotype native seed in addition to supplying from a reputable native seed nursery. Prescribed fire is planned for both units, which is the best management practice for native prairie communities.

13. List indicators of project goals at this stage of project:

Percent native cover and cover composition may be suitable indicators for goal achievement. Each evaluated area exhibits greater than 60% native species coverage, and the southern unit will likely begin to resemble the northern unit if similar management is used. More bare ground may persist in the southern unit benefiting ground nesting pollinator species. As such, the site is meeting the goals of creating a native dry prairie across the majority of the site. Implementation of periodic prescribed burning will likely continue to reduce non-native cover and promote native species proliferation.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, MN DNR staff are managing the site in accordance with the original goals and the site appears to be responding well.

15. Are corrections or modifications needed to achieving proposed goals?

Prescribed fire should be implemented on these parcels as conditions allow. Due to limited burn crew availability and proper burn conditions, prescribed fire can be delayed. It is recommended that project managers prioritize the site for prescribed fire in the next 1-2 years.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Future management plans appear to be reasonable at this time as the site is responding well to initial seeding and light management actions. However, it would be best for prescribed fire to be used within the next few years to solidify the positive initial native seed germination, open up bare ground to support native seed viability and ground-nesting pollinators, and to keep small woody seedlings from encroaching.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

All of the project activities appear to be aligned with the project goals.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Provided the management and periodic monitoring proceeds as planned, there is likely no need for another round of REP assessments due to the site's progress towards site goals. The community is a native dominated dry prairie and the initial implementation appears to be a success.

19. Additional comments on the restoration project.

During the evaluation, Dickcissels were observed singing from perches in the restored areas. This is a grassland specific bird species that has seen significant declines in recent years across much of its breeding range in North America. The MN DNR pollinator coordinator was also on-site during the evaluation and noted an abundance and diversity of pollinator species. Further evaluation of the WMA's pollinator community and resources should be considered if possible.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

The site is dominated by native prairie species across both units, and early adventive non-native cover will likely be diminished over the next two years in the south seeding area. Periodic prescribed fire should further protect the gains made in these units.

23. Site Assessor(s) conducting field review:

Will Taylor - Cardno

Site Maps, Project Plans or Vegetation Tables

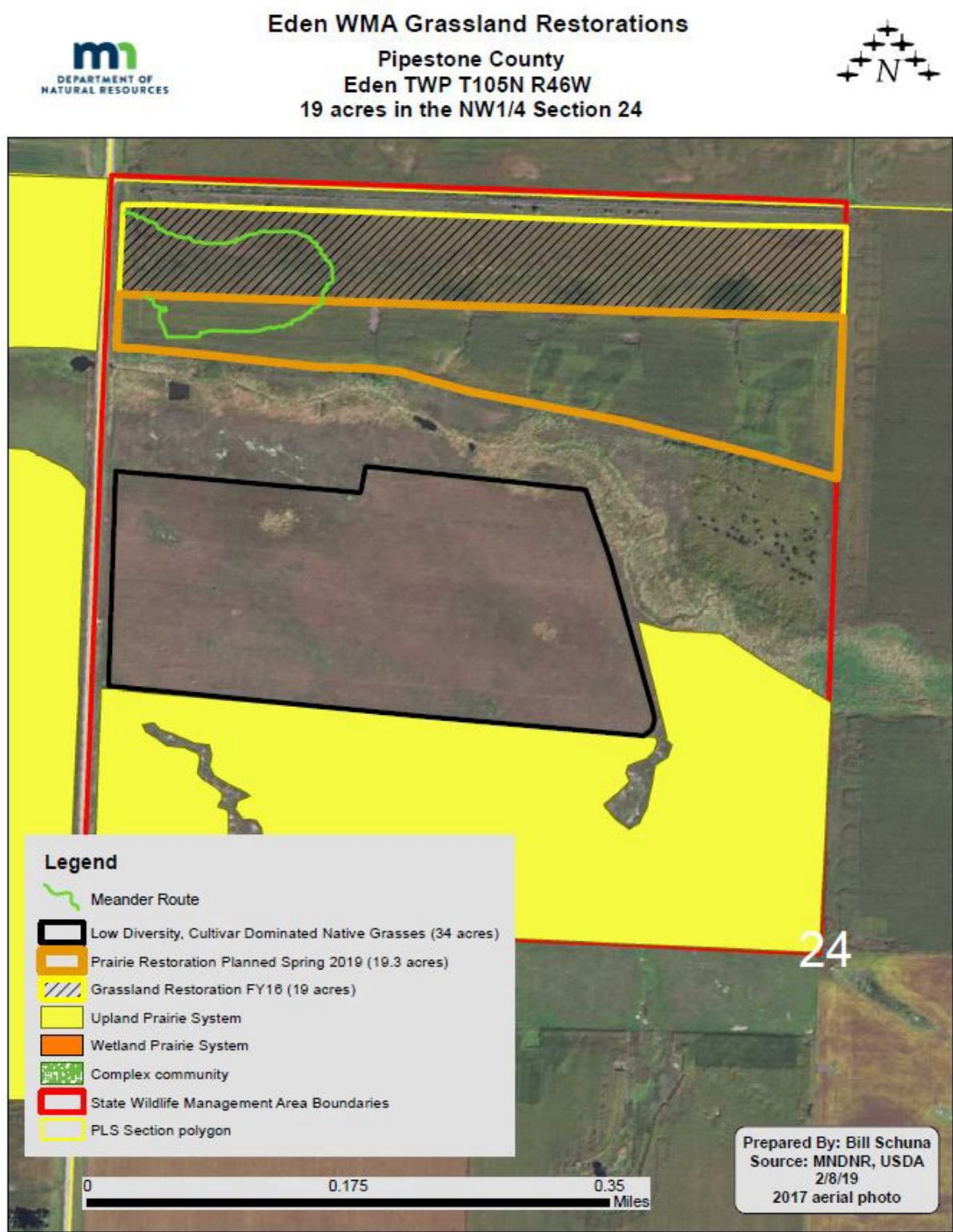


Figure 1-1 2019 Seeding Plan with 2021 evaluation meanders added.

Table 1-1 Eden WMA North unit seed mix list. Seed mix planted in 2016.

Scientific Name	Latin Name	Eden - North Seed Mix 2016	Observed on Site 2020
<i>Acorus americanus</i>	sweet flag	Yes	No
<i>Allium stellatum</i>	prairie onion	Yes	No
<i>Amorpha canescens</i>	leadplant	Yes	No
<i>Asclepias incarnata</i>	swamp milkweed	Yes	No
<i>Asclepias tuberosa</i>	butterfly milkweed	No	No
<i>Astragalus canadensi</i>	Canada milkvetch	Yes	No
<i>Chamaecrista fasciculata</i>	partridge pea	No	Yes
<i>Dalea candida</i>	white prairie clover	Yes	No
<i>Dalea purpurea</i>	purple prairie clover	Yes	Yes
<i>Desmodium candense</i>	showy tick-trefoil	Yes	No
<i>Drymocallis arguta</i>	tall cinquefoil	No	No
<i>Helianthus maximiliani</i>	Maximilian sunflower	No	Yes
<i>Heliopsis helianthoides</i>	false sunflower	Yes	Yes
<i>Heuchera richardsonii</i>	prairie alumroot	Yes	No
<i>Liatris pycnostachya</i>	prairie blazing star	Yes	No
<i>Monarda fistulosa</i>	wild bergamot	Yes	Yes
<i>Penstemon grandiflorus</i>	Large flowered beardtongue	Yes	No
<i>Pycnanthemum virginianum</i>	Virginia mountain mint	Yes	No
<i>Ratibida columnifera</i>	prairie coneflower	Yes	Yes
<i>Ratibida pinnata</i>	gray-headed coneflower	Yes	Yes
<i>Rosa arkansana</i>	prairie wild rose	Yes	No
<i>Rudbeckia hirta</i>	black-eyed Susan	Yes	Yes
<i>Silphium perfoliatum</i>	cup plant	Yes	No
<i>Symphyotrichum laeve</i>	smooth blue aster	Yes	No
<i>Symphyotrichum novae-</i>	New England aster	Yes	No
<i>Thalictrum dasycarpum</i>	tall meadow rue	Yes	No

Scientific Name	Latin Name	Eden - North Seed Mix 2016	Observed on Site 2020
Tradescantia occidentalis	prairie spiderwort	Yes	No
Verbena stricta	hoary vervain	Yes	Yes
Vernonia fasciculata	prairie ironweed	Yes	No
Veronicastrum virginicum	culvers root	Yes	No
Zizia aptera	heart-leaved Alexander	Yes	No
Zizia aurea	golden Alexander	Yes	No
Thistle	Cirsium sp	No	No

Table 1-2 North Planting meander results from 2021.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Amorpha canescens</i>	Leadplant	0-1%	no	native
<i>Andropogon gerardii</i>	Big Bluestem	5-25%	seeded	native
<i>Artemisia frigida</i>	Prairie Sagewort	0-1%	no	native
<i>Asclepias syriaca</i>	Common Milkweed	1-5%	no	native
<i>Astragalus canadensis</i>	Canada Milkvetch	5-25%	no	native
<i>Bouteloua curtipendula</i>	Side-oats Grama	5-25%	no	native
<i>Cirsium arvense</i>	Canada Thistle	1-5%	no	non-native
<i>Dalea candida</i>	White Prairie Clover	0-1%	no	native
<i>Dalea purpurea</i>	Purple Prairie Clover	1-5%	no	native
<i>Echinacea angustifolia</i>	Narrow-leaved Purple Coneflower	0-1%	no	native
<i>Elymus canadensis</i>	Canada Wild Rye	1-5%	no	native
<i>Liatris aspera</i>	Rough Blazing Star	0-1%	no	native
<i>Monarda fistulosa</i>	Wild Bergamot	25-50%	seeded	native
<i>Panicum virgatum</i>	Switchgrass	1-5%	no	native
<i>Poa pratensis</i>	Kentucky Bluegrass	1-5%	no	non-native
<i>Pycnanthemum virginianum</i>	Virginia Mountain Mint	0-1%	no	native
<i>Ratibida columnifera</i>	Prairie Coneflower	5-25%	seeded	native
<i>Rudbeckia hirta</i>	Black-eyed Susan	0-1%	no	native
<i>Rumex crispus</i>	Curly Dock	0-1%	no	native
<i>Solidago missouriensis</i>	Missouri Goldenrod	1-5%	no	native
<i>Sorghastrum nutans</i>	Indian Grass	5-25%	seeded	native
<i>Symphyotrichum leave</i>	Smooth Blue Aster	1-5%	no	native
<i>Symphyotrichum novae-angliae</i>	New England Aster	1-5%	no	native
<i>Zizia aurea</i>	Golden Alexander	0-1%	no	native

Table 1-3 Eden WMA South unit mesic seed mix list. Seed mix planted in 2019.

Species	Scientific Name	PLS seeds per sq ft	% of Mixture PLS	Seeds per PLS lb
Grass				
Sideoats Grama	<i>Bouteloua curtipendula</i>	6.577	12.61%	191,000
Blue Grama	<i>Bouteloua gracilis</i>	7.576	14.52%	825,000
Prairie June Grass	<i>Koeleria macrantha</i>	2.657	5.09%	2,315,000
Switchgrass	<i>Panicum virgatum</i>	0.447	0.86%	389,000
Little Bluestem	<i>Schizachyrium scoparium</i>	4.477	8.58%	260,000
Prairie Dropseed	<i>Sporobolus heterolepis</i>	0.228	0.44%	199,000
Prairie Cordgrass	<i>Spartina pectinata</i>	0.242	0.46%	105,600
Big Bluestem (Placeholder no-bid)	<i>Andropogon gerardii</i>	3.673	7.04%	160,000
Copper-shouldered Oval Sedge	<i>Carex bicknellii</i>	0.312	0.60%	272,000
Plains Oval Sedge	<i>Carex brevoir</i>	0.533	1.02%	464,000
Forbs				
Anise Hyssop/Fragrant Giant Hyssop	<i>Agastache foeniculum</i>	1.446	2.77%	1,440,000
Wild Garlic	<i>Allium canadense</i>	0.010	0.02%	8,960
Prairie Onion	<i>Allium stellatum</i>	0.202	0.39%	176,000
Lead Plant	<i>Amorpha canescens</i>	0.206	0.40%	143,671
Prairie Sage/Cudweed Sagewort	<i>Artemisia ludoviciana</i>	0.581	1.11%	4,048,000
Common Milkweed	<i>Asclepias syriaca</i>	0.177	0.34%	82,174
Butterfly Milkweed	<i>Asclepias tuberosa</i>	0.080	0.15%	70,000
Canada Milkvetch	<i>Astragalus canadensis</i>	1.171	2.24%	272,000
Showy Partridgepea/Partridge Pea	<i>Chamaecrista fasciculata</i>	0.372	0.71%	43,200
White Prairie Clover	<i>Dalea candida</i>	2.204	4.22%	384,000
Purple Prairie Clover	<i>Dalea purpurea</i>	2.729	5.23%	317,000
Showy Tick Trefoil	<i>Desmodium canadense</i>	0.253	0.48%	88,000
Maximillian Sunflower	<i>Helianthus maximiliani</i>	0.423	0.81%	196,360
Common Ox Eye	<i>Heliopsis helianthoides</i>	0.289	0.55%	100,800
Round-Head Bush Clover	<i>Lespedeza capitata</i>	0.241	0.46%	104,960
Rough Blazingstar	<i>Liatris aspera</i>	0.099	0.19%	216,000

Species	Scientific Name	PLS seeds per sq ft	% of Mixture PLS	Seeds per PLS lb
Meadow Blazingstar	<i>Liatris ligulistylis</i>	0.172	0.33%	160,000
Prairie Blazingstar/Thickspike Gayfeather	<i>Liatris pycnostachya</i>	0.172	0.33%	120,000
Wild Bergamot	<i>Monarda fistulosa</i>	1.826	3.50%	1,272,500
Marbleseed	<i>Onosmodium molle</i>	0.034	0.07%	50,000
Large-flowered Beardtongue	<i>Penstemon grandiflorus</i>	0.121	0.23%	263,874
Prairie Cinquefoil	<i>Potentilla arguta</i>	1.896	3.63%	4,403,883
Mountain Mint	<i>Pycnanthemum virginianum</i>	1.515	2.90%	3,520,000
Upright Coneflower/Prairie Coneflower	<i>Ratibida columnifera</i>	1.586	3.04%	737,104
Yellow Coneflower	<i>Ratibida pinnata</i>	1.377	2.64%	480,000
Black-Eyed Susan	<i>Rudbeckia hirta</i>	2.261	4.33%	1,575,760
Stiff Goldenrod	<i>Solidago rigida</i>	1.194	2.29%	1,300,000
Smooth Blue Aster	<i>Symphyotrichum laeve</i>	0.466	0.89%	1,014,000
New England Aster	<i>Symphyotrichum novae-angliae</i>	0.379	0.73%	1,056,000
Purple Meadow Rue	<i>Thalictrum dasycarpum</i>	0.126	0.24%	176,000
Prairie Spiderwort	<i>Tradescantia bracteata</i>	0.115	0.22%	160,000
Hoary vervain	<i>Verbena stricta</i>	0.885	1.70%	685,046
Culver's Root	<i>Veronicastrum virginicum</i>	0.588	1.13%	12,800,000
Golden Alexanders	<i>Zizia aurea</i>	0.253	0.48%	176,000

Table 1-4 South Planting meander results from 2021.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Ambrosia artemisiifolia</i>	Common Ragweed	0-1%		native
<i>Amorpha canescens</i>	Leadplant	0-1%		native
<i>Asclepias syriaca</i>	Common Milkweed	1-5%	seeded	native
<i>Asclepias tuberosa</i>	Butterfly-weed	1-5%	seeded	native
<i>Bouteloua curtipendula</i>	Side-oats Grama	25-50%	seeded	native
<i>Bouteloua gracilis</i>	Blue Grama	5-25%	seeded	native
<i>Carex brevior</i>	Short Sedge	1-5%	seeded	native
<i>Chamaecrista fasciculata</i>	Partridge Pea	5-25%		native
<i>Cirsium arvense</i>	Canada Thistle	5-25%		non-native
<i>Dalea candida</i>	White Prairie Clover	1-5%		native
<i>Dalea purpurea</i>	Purple Prairie Clover	1-5%	seeded	native
<i>Helianthus maximiliani</i>	Maximilian Sunflower	5-25%	seeded	native
<i>Heliopsis helianthoides</i>	False Sunflower	1-5%	seeded	native
<i>Lespedeza capitata</i>	Round-headed Bush Clover	0-1%	seeded	native
<i>Melilotus officinale</i>	Sweet Clover	1-5%		non-native
<i>Onosmodium molle</i>	Marbleseed	0-1%	seeded	native
<i>Panicum virgatum</i>	Switchgrass	5-25%	seeded	native
<i>Poa pratensis</i>	Kentucky Bluegrass	1-5%		non-native
<i>Pycnanthemum virginianum</i>	Virginia Mountain Mint	1-5%	seeded	native
<i>Ratibida columnifera</i>	Prairie Coneflower	25-50%	seeded	native
<i>Schizachyrium scoparium</i>	Little Bluestem	1-5%	seeded	native
<i>Solidago missouriensis</i>	Missouri Goldenrod	1-5%		native
<i>Solidago rigida</i>	Stiff Goldenrod	1-5%	seeded	native
<i>Symphyotrichum laeve</i>	Smooth Blue Aster	0-1%	seeded	native
<i>Symphyotrichum oolentangiense</i>	Sky-blue Aster	0-1%	seeded?	native
<i>Taraxacum officinale</i>	Common Dandelion	1-5%		non-native
<i>Verbena stricta</i>	Hoary Vervain	1-5%	seeded	native

Site Photographs



Photo 1-1 Eden WMA, photo taken during site visit 07/27/2021. 2016 seeding area in north. Native-dominated hillside with wild bergamot, prairie coneflower, and big bluestem.



Photo 1-2 Eden WMA, photo taken during site visit 07/27/2021. 2019 seeding southern area. Photo looking north at boundary with 2016 seeding. Line separating two units is evident by change in dominant species and increase in bare soil visible in 2019 seeding.



Photo 1-3 Eden WMA, photo taken during site visit 07/27/2021. 2019 seeding southern area. Photo looking west into recent restoration. Bare soil coverage evident with abundance of prairie coneflower and *Bouteloua* spp. As well as white Canada thistle seed heads to left.



Photo 1-4 Eden WMA, photo taken during site visit 07/27/2021. Prairie Sagewort (*Artemisia frigida*).

2 Rock River Wildlife Management Area Prairie Restoration

Project Background

Project Name: Rock River WMA

Project Site: 2015 and 2016 Prairie Restorations

Township/Range Section: Township 102N Range 45W Section 1

Project Manager / Affiliated Organization:
Kent Schaap - MNDNR

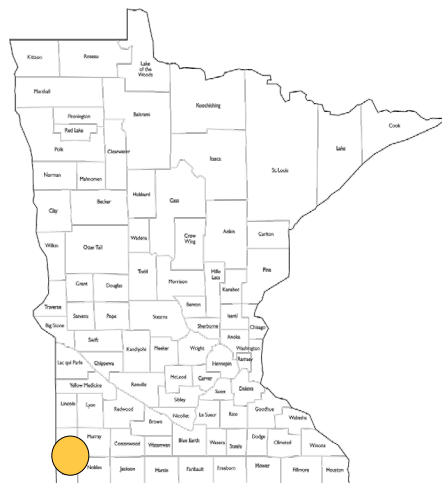
Fund: OHF **Fiscal Year Funds:** 2015

Project Start Date: 2015

Predominant Habitat type: Prairie / Savanna /
Grassland

Additional Habitat types:

Project Status: Post Establishment Phase



County: Rock

Primary Activity: Prairie Restoration

Project Size: 26 acres

Project Completed: 2016

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

This site, which includes two separate parcels in the WMA, was a brome conversion project except for 1.5 acres of food plot that was retired. These areas were broadcast sprayed with Roundup (glyphosate) in fall of 2014 at 2.4 quarts per acre and seeded by Truax drill seeder in the South unit in June of 2015 and in the North unit in May 2016. Following the native seeding, the parcels were again treated with Roundup at 1.5 quarts per acre. The only management since then has been spot spraying of Canada thistle in July of 2016. Prescribed burns have been planned, but wet conditions or lack of available burn crews have hindered implementation. Native and local genotype grass seed was collected from other regional WMAs and SNAs to support forb seed purchased from Shooting Star nursery.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Seed lists from the original implementation are available and the land manager otherwise provided management history for the sites.

3. What are the stated goals of the project?

The goal of the project is to convert brome old field communities into self-supporting native dominated prairie

4. What are the desired outcomes of achieving the stated goals of the project?

The desired outcome is to have a diverse, native-dominated prairie plant community present on-site, managed by periodic prescribed burns.

5. Were measures of restoration success identified in plans? No

6. Are plan Sets available? No Have project maps been created? Yes

If yes, provide in "site maps" and list maps provided:

A figure was created for the restoration project in 2015, which is included below

7. Provide list of best management practices, standards, guidelines identified in plan set?

None

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

Yes

Project implementation proceeded as planned. However, following implementation of herbicide and seeding the south unit, the unit was repeatedly flooded two consecutive years, which potentially both removed native seed and brought in an abundance of upstream non-native seed right when the site was in its fragile early post-restoration phase.

9. In what ways did alterations change the proposed project outcome?

The ultimate effect seems to have allowed for a deposit of upstream non-native seed to coat the site right when it had been recently treated with herbicide and cleared of competition. This is the likely explanation for why the south unit has more non-native cover than the north unit.

Site Assessment

Field Review Date: 7/27/2021

Field Visit Attendees: Kent Schaap – MNDNR, Gina Quiram – MNDNR, and Will Taylor – Cardno

10. Surrounding Landscape Characteristics:

The Rock River WMA is located along the upper terraces of the Rock River, and is otherwise surrounded by row crop agriculture on all sides. The Rock River exhibits flashy hydrology in the spring and following major rain events due to a combination of wetland and natural area conversion into agriculture in the watershed and the effects of abundant field tiling that accelerates water inflow into the river.

11. Site Characteristics:

a. Soil Series:

Spillco silt loam, 0 to 2 percent slopes, frequently flooded

Spillco silt loam, 0 to 2 percent slopes, occasionally flooded

Havelock clay loam, 0 to 2 percent slopes, occasionally flooded

b. Topography:

Both sites are flat terrace prairies with shallow swales present throughout which collect water and exhibit a slightly different species mix when deep enough to affect species growth.

c. Hydrology:

Inputs to WMA include rainfall and high water during Rock River at flood stage. The southern unit tends to flood more frequently than the northern unit, which has mostly stayed dry since planting.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Using the MNDNR Native Plant Community Classification, this site would be classified as Southern Mesic Prairie (UPs13), a fire-dependent community with moderately poorly drained soils dominated by native herbaceous species. The Rock River WMA north unit achieves this classification given its predominantly native cover, while the south unit can be described as heavily invaded mesic prairie due to an abundance of smooth brome, Kentucky bluegrass, and Canada thistle, although native species are present at approximately 40-50%. In the north unit, native species make up approximately 80-90% areal cover with the most abundant species being big bluestem and wild bergamot.

12. Is the plan based on current science? Yes

Site restoration was implemented by following the best practices for site preparation. Each site was boom sprayed with a broad spectrum herbicide multiple times prior to seeding in 2015 and 2016.

Seeding featured both locally collected native grasses and purchased seed from a reputable native plant nursery. Prescribed burns have been planned, but due to crew availability and/or inundated sites, none have been implemented as of 2021.

13. List indicators of project goals at this stage of project:

Percent native cover and cover composition may be suitable indicators for goal achievement. As such, the north unit is meeting the goals of creating a native prairie across the majority of the site. Periodic burning may be enough to maintain this parcel. The south unit currently has more non-native cover and box elder are quickly encroaching east from the river bank. However, woody clearing combined with prescribed burning, if implemented in the next 1-2 years, should substantially improve the prospects for native community establishment.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

A prescribed burn should be prioritized for the south unit if possible within the next 1-2 years. Due to the rapid spread of boxelder saplings from the river bank eastward. These are likely too established to be sufficiently suppressed by a prescribed burn, and may need to be hand cut or forestry mowed during the winter. The north unit is progressing satisfactorily along with the restoration goals and will likely only need periodic fire and oversight to keep woody cover to a minimum and monitor for invasive species growth.

15. Are corrections or modifications needed to achieving proposed goals?

None at this time.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

At this time, the plan is to implement prescribed fire as conditions and burn crew availability allows. At the southern unit, additional measures such as additional seeding and spot spraying combined with boxelder mowing or hand clearing should be considered as the native species do not appear to be on a trajectory for dominance as they do in the north unit.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

All of the project activities appear to be aligned with the project goals.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Further monitoring may be needed for the south unit as it currently is not meeting the site goals.

19. Additional comments on the restoration project.

As with other projects in the region, staff availability for management and prescribed burns is a limiting factor, especially in getting prescribed burns conducted during ideal conditions as the regional demand for crews is higher than their availability. While the north unit is currently meeting the site goals, it should also be targeted for prescribed fire at some point in the next year or two to reduce thatch cover and promote greater native species diversity.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Minimally achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

The north unit is currently meeting the project goals and appears well-situated to remain successful in the near term. The south unit is at risk of reverting to primarily non-native cover and is also experiencing boxelder sapling encroachment that could change the character of the site in the next few years if not addressed. For both these reasons, the site is partially meeting the performance goals, but appears as though applied management techniques can be successful.

23. Site Assessor(s) conducting field review:

Will Taylor – Cardno

Site Maps, Project Plans or Vegetation Tables



Figure 2-1 Rock River WMA North Unit.

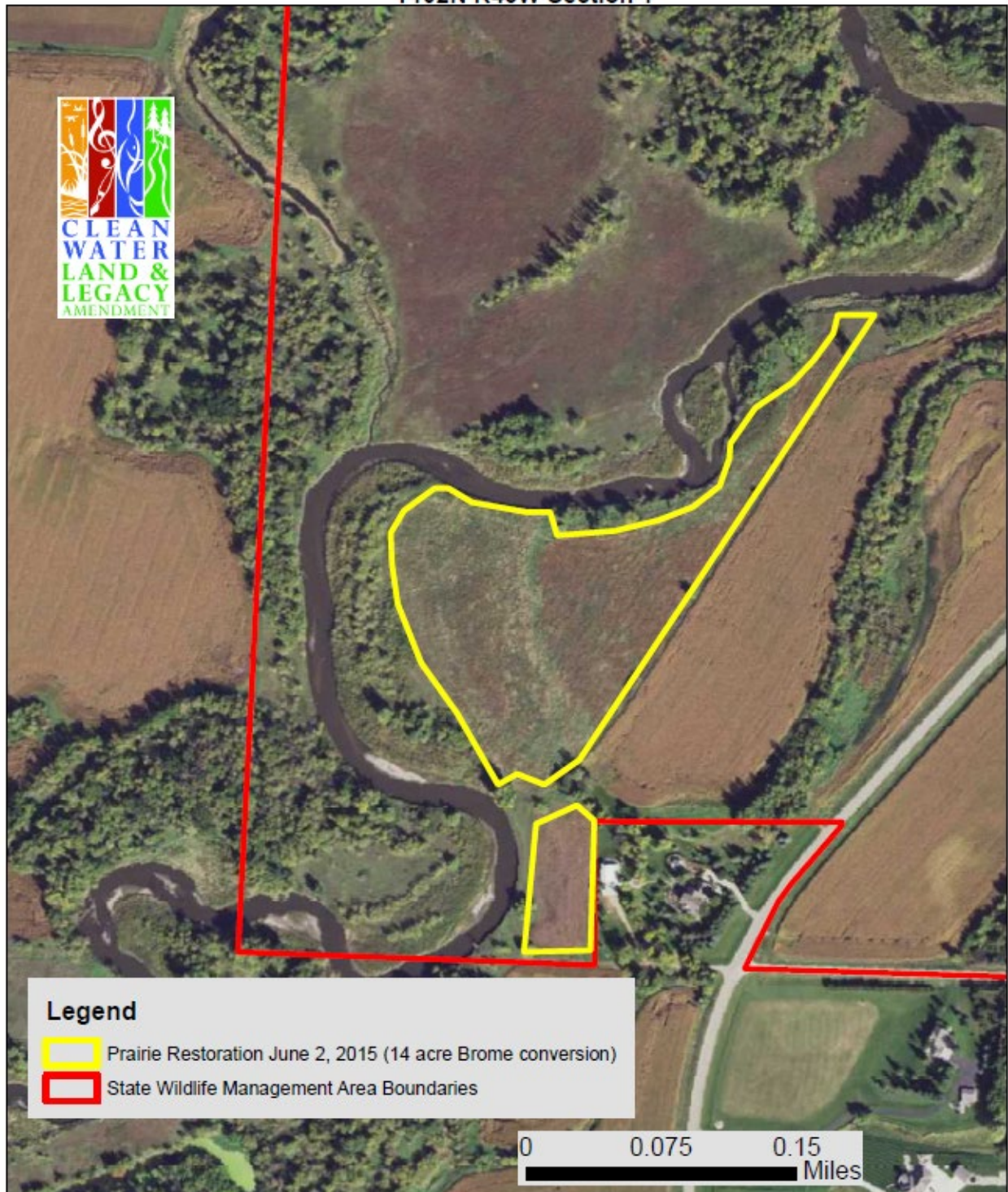


Figure 2-2 Rock River WMA South Unit.



MNDNR1505E
Site 5 - Rock River

5.27 Total lb
5.66 Bulk lb
5.27 PLS lb

Mix %	PLS lb	Bulk lb	Lot Number	Common Name	Scientific Name	Variety	Origin	Mix Purity	Species Purity	Germ	Hard or Dormant	TZ	Total Viable	PLS
4.08%	0.22	0.22	ALLSTE025A	Prairie Onion	Allium stellatum	VNS	MN	3.88%	99.91%				98.00%	97.91%
6.53%	0.34	0.36	AMOCAN025A	Lead Plant	Amorpha canescens	VNS	MN	6.27%	99.79%				97.00%	96.80%
4.08%	0.22	0.23	ASTNOV814A	New England Aster	Aster novae-angliae	VNS	MN	3.96%	98.72%				96.00%	94.77%
6.53%	0.34	0.35	ASTCAN025A	Canada Milk Vetch	Astragalus canadensis	VNS	MN	6.21%	99.91%				98.00%	97.91%
5.17%	0.27	0.28	DALCAN054B	White Prairie Clover	Dalea candidum	VNS	MN	4.96%	99.96%	87.00%	10.00%		97.00%	96.96%
5.17%	0.27	0.29	DALPUR464A	Purple Prairie Clover	Dalea purpurea	VNS	IA	5.12%	99.30%				94.00%	93.34%
2.86%	0.15	0.16	DESCAN464A	Showy Tick Trefoil	Desmodium canadense	VNS	IA	2.72%	98.08%				98.00%	96.12%
6.53%	0.34	0.40	HELHEL025A	Ox-eye Sunflower	Helopsis helianthoides	VNS	MN	6.84%	96.48%				89.00%	85.87%
2.16%	0.12	0.13	HEURIC464A	Prairie Alumroot	Heuchera richardsonii	VNS	IA	2.14%	96.50%				95.00%	91.68%
7.89%	0.42	0.44	MONFIS025A	Wild Bergamot	Monarda fistulosa	VNS	MN	7.66%	98.77%				96.00%	94.82%
6.53%	0.34	0.40	PENGRA024A	Large-flowered Beardtongue	Penstemon grandiflorus	VNS	MN	6.34%	88.59%	8.00%	88.00%		96.00%	85.05%
4.08%	0.22	0.23	POTARG024A	Prairie Cinquefoil	Potentilla arguta	VNS	MN	4.04%	98.17%	54.00%	40.00%		94.00%	92.26%
1.36%	0.07	0.09	PYCVIR464A	Mountain Mint	Pycnanthemum virginianum	VNS	IA	1.37%	90.75%	31.00%	62.00%		93.00%	84.40%
7.89%	0.42	0.44	RATCOL024A	Long-headed Coneflower	Ratibida columnifera	VNS	MN	7.58%	96.55%	97.00%	0.00%		97.00%	93.65%
6.53%	0.34	0.36	RATPIN025A	Yellow Coneflower	Ratibida pinnata	VNS	MN	6.34%	98.79%	98.00%	0.00%		96.00%	95.80%
2.73%	0.14	0.17	ROSARK025A	Prairie Wild Rose	Rosa arkansana	VNS	MN	2.65%	89.62%				96.00%	86.04%
9.24%	0.49	0.49	RUDHIR025A	Black-eyed Susan	Rudbeckia hirta	VNS	MN	8.66%	99.68%	99.50%	0.00%		99.50%	99.18%
1.36%	0.07	0.08	ASTLAE025A	Smooth Blue Aster	Aster laevis	VNS	MN	1.30%	94.33%				98.00%	92.44%
1.36%	0.07	0.08	VERVIR463C	Culver's Root	Veronicastrum virginicum	VNS	IA	1.32%	91.17%				96.00%	87.52%
1.36%	0.07	0.07	ZIZAPT024A	Heartleaf Alexanders	Zizia aptera	VNS	MN	1.30%	98.88%				98.00%	96.88%
6.53%	0.34	0.39	ZIZAUR024A	Golden Alexanders	Zizia aurea	VNS	MN	6.84%	99.04%	9.00%	80.00%		89.00%	88.15%
100.00%	5.27	5.66						Purity 97.46%, Inert Matter 2.34%, Other Crop 0.1%, Weed Seed 0.08%						

Noxious Weeds/lb: None
Test Date: 10/2014

Figure 2-3 Seed mix purchased from shooting Star nursery for seeding at Rock River WMA.

Table 2-1 Southern unit meander results from 2021.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Acer negundo</i>	Boxelder	1-5%	no	native
<i>Andropogon gerardii</i>	Big Bluestem	5-25%	Seeded	native
<i>Asclepias syriaca</i>	Common Milkweed	1-5%	no	native
<i>Bouteloua curtipendula</i>	Side-oats Grama	1-5%	no	native
<i>Bromus inermis</i>	Smooth Brome	25-50%	no	non-native
<i>Carex annectens</i>	Yellow-fruit Sedge	1-5%	no	native
<i>Carex tenera</i>	Quill Sedge	1-5%	no	native
<i>Cirsium arvense</i>	Canada Thistle	5-25%	no	non-native
<i>Elymus trachycaulis</i>	Slender Wheatgrass	1-5%	no	native
<i>Erigeron strigosus</i>	Prairie Fleabane	0-1%	no	native
<i>Fraxinus pennsylvanica</i>	Green Ash	0-1%	no	native
<i>Heliopsis helianthoides</i>	False Sunflower	1-5%	Seeded	native
<i>Melilotus officinalis</i>	Sweet Clover	1-5%	no	non-native
<i>Monarda fistulosa</i>	Wild Bergamot	5-25%	Seeded	native
<i>Panicum virgatum</i>	Switchgrass	5-25%	no	native
<i>Phalaris arundinacea</i>	Reed Canary Grass	5-25%	no	non-native
<i>Poa pratensis</i>	Kentucky Bluegrass	5-25%	no	non-native
<i>Pycnanthemum virginianum</i>	Virginiana Mountain Mint	0-1%	Seeded	native
<i>Ratibida columnifera</i>	Prairie Coneflower	1-5%	Seeded	native
<i>Scrophularia lanceolata</i>	Lance-leaf Figwort	0-1%	no	native
<i>Solidago gigantea</i>	Giant Goldenrod	1-5%	no	native
<i>Solidago missouriensis</i>	Missouri Goldenrod	1-5%	no	native
<i>Sorghastrum nutans</i>	Indian Grass	5-25%	Seeded	native
<i>Spartina pectinata</i>	Prairie Cordgrass	5-25%	no	native
<i>Symphoricarpos occidentalis</i>	Wolfberry	0-1%	no	native
<i>Symphyotrichum novae-angliae</i>	New England Aster	1-5%	Seeded	native
<i>Urtica dioica</i>	Stinging Nettle	1-5%	no	native
<i>Verbascum thapsis</i>	Mullein	0-1%	no	non-native
<i>Zizia aurea</i>	Golden Alexander	0-1%	Seeded	native

Table 2 Northern unit meander results from 2021.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Andropogon gerardii</i>	Big Bluestem	25-50%	Seeded	native
<i>Asclepias syriaca</i>	Common Milkweed	1-5%	no	native
<i>Bouteloua curtipendula</i>	Side-oats Grama	1-5%	no	native
<i>Cannabis sativa</i>	Hemp	0-1%	no	non-native
<i>Carex annectens</i>	Yellow-fruit Sedge	5-25%	no	native
<i>Carex scoparia</i>	Pointed Broom Sedge	5-25%	no	native
<i>Celtis occidentalis</i>	Hackberry	0-1%	no	native
<i>Cirsium arvense</i>	Canada Thistle	1-5%	no	non-native
<i>Echinacea angustifolia</i>	Narrow-leaved Purple Coneflower	1-5%	no	native
<i>Heliopsis helanthoides</i>	False Sunflower	1-5%	Seeded	native
<i>Juniperus virginiana</i>	Eastern Red Cedar	0-1%	no	native
<i>Mimulus ringens</i>	Monkeyflower	0-1%	no	native
<i>Monarda fistulosa</i>	Wild Bergamot	5-25%	Seeded	native
<i>Panicum leibergii</i>	Leiberg's Panic Grass	1-5%	no	native
<i>Panicum virgatum</i>	Switchgrass	1-5%	no	native
<i>Phalaris arundinacea</i>	Reed Canary Grass	1-5%	no	non-native
<i>Plantago major</i>	Common Plantain	1-5%	no	native
<i>Poa pratensis</i>	Kentucky Bluegrass	1-5%	no	non-native
<i>Ratibida columnifera</i>	Prairie Coneflower	1-5%	Seeded	native
<i>Scrophularia lanceolata</i>	Lance-leaved Figwort	0-1%	no	native
<i>Solidago gigantea</i>	Giant Goldenrod	5-25%	no	native
<i>Solidago missouriensis</i>	Missouri Goldenrod	1-5%	no	native
<i>Sorghastrum nutans</i>	Indian Grass	5-25%	Seeded	native
<i>Symphoricarpos occidentalis</i>	Wolfberry	1-5%	no	native
<i>Symphyotrichum ericoides</i>	Heath Aster	1-5%	no	native
<i>Urtica dioica</i>	Stinging Nettle	0-1%	no	native
<i>Verbena stricta</i>	Hoary Vervain	1-5%	no	native
<i>Verbena urticifolia</i>	White Vervain	1-5%	no	native
<i>Veronica virginicum</i>	Culver's Root	0-1%	Seeded	native
<i>Zizia aurea</i>	Golden Alexander	1-5%	Seeded	native

Site Photographs



Photo 2-1 Rock River WMA, photo taken during site visit 07/27/2021. South unit with mix of smooth brome, big bluestem, common milkweed, and Canada thistle.



Photo 2-2 Rock River WMA, photo taken during site visit 07/27/2021. Southern unit showing boxelder encroachment in the prairie in area with lots of wild bergamot and goldenrod.



Photo 2-3 Rock River flowing West of the Southern planting unit at Rock River WMA. Photo taken during site visit 07/27/2021



Photo 2-4 A white tailed deer observed during the site visit of the South unit of Rock River WMA. Photo taken during site visit 07/27/2021



Photo 2-5 Rock River WMA, photo taken during site visit 07/27/2021. Northern unit with abundance of wild bergamot and native prairie grasses.

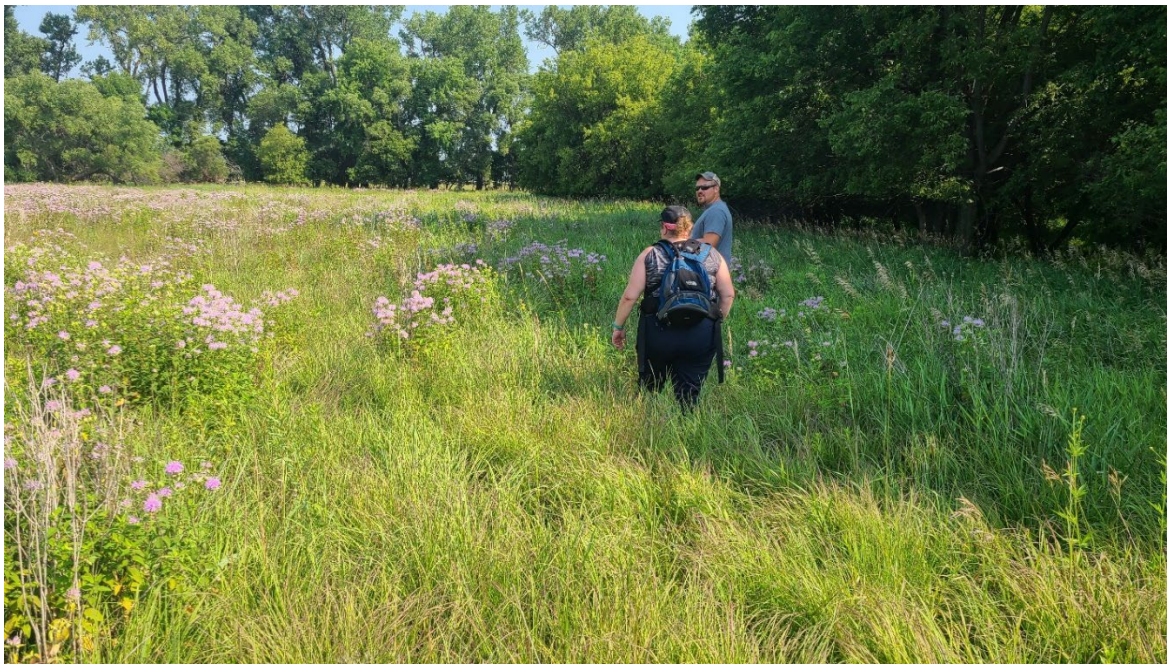


Photo 2-6 Rock River WMA, photo taken during site visit 07/27/2021. Northern unit showing native grass dominance with only brome invasion relegated to shaded border edge.

3 Hole-in-the-Mountain Wildlife Management Area Prairie Enhancement

Project Background

Project Name: Hole-in-the-Mountain WMA

Project Site: East Tract

Township/Range Section: Township 109N Range 45W Section 19,20

Project Manager / Affiliated Organization:
Amber Knutson MNDNR

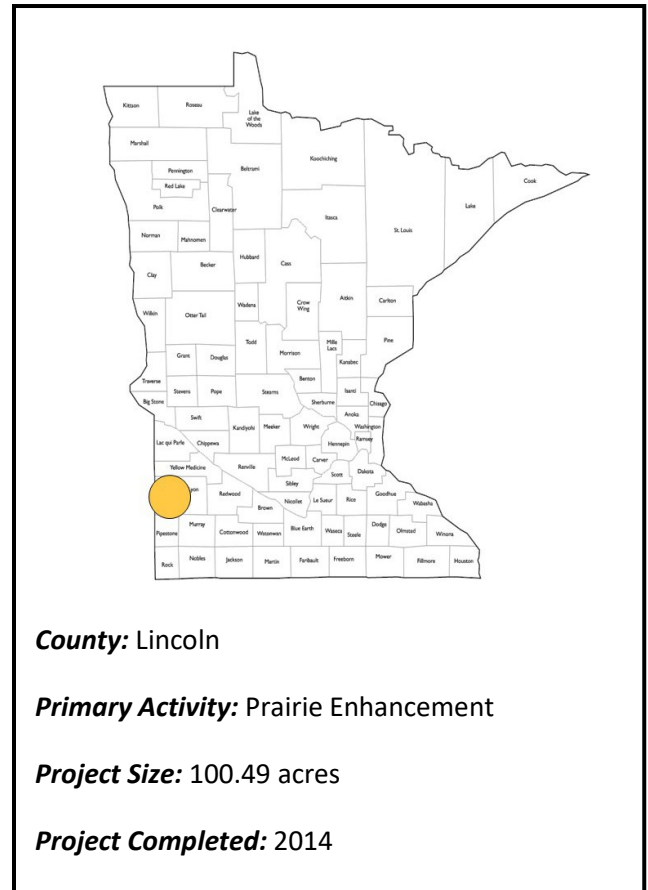
Fund: OHF **Fiscal Year Funds:** 2014

Project Start Date: May 2014

Predominant Habitat type: Prairie / Savanna / Grassland

Additional Habitat types: Wetland

Project Status: Post Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

A prescribed fire was conducted across the entire parcel on May 9, 2014 using OHF funding. Adaptive management grazing has been implemented since June 2019 when approximately 30 head of lightweight cattle were onsite for a 30-day, four unit graze rotation. The density of animals was increased in spring 2021 to approximately 170 lightweight cattle which were moved daily in grazing rotations during a 30 day period. The animals were off the site by late June. Another prescribed burn is desired within the next 1-2 years.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

A grazing approach and research design document was created by MNDNR staff in spring 2021. Notes from an earlier management team were found dating from 2008 and 2009, which summarized early herbicide applications and seeding on-site.

3. What are the stated goals of the project?

- Suppress introduced species – targeting smooth brome and reed canary grass
- Increase native diversity
- Stimulate latent native seed bank
- Increase native biomass
- Improve wildlife habitat quality, with an emphasis on improving patch habitat for Dakota Skipper (*Hesperia dacotae* – State Endangered, Federally Threatened) by expanding habitat zones for prairie dropseed and narrow-leaved purple coneflower.
- Improve and maintain higher level of animal performance (herd weight and nutrition)

4. What are the desired outcomes of achieving the stated goals of the project?

The desired outcome is to have a diverse, native-dominated prairie plant community present on-site, managed by periodic prescribed burns and managed grazing.

5. Were measures of restoration success identified in plans? No

6. Are plan Sets available? Yes Have project maps been created? Yes

If yes, provide in “site maps” and list maps provided:

A figure was created by the MNDNR in 2013 for the 2014 prescribed burn.

7. Provide list of best management practices, standards, guidelines identified in plan set?

The current management plan prescribes a patch-burn-graze methodology, which includes year-round management cycles of burning portions of the site (including other portions of the WMA outside this parcel) followed by intensive managed grazing targeting cool-season grass regrowth, then a period of rest and recovery.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

No

The prescribed burn proceeded as planned and was able to cover most of the site. Adaptive management grazing has been implemented on-site the past two years as prescribed in the planning documents.

9. In what ways did alterations change the proposed project outcome?

NA

Site Assessment

Field Review Date: 7/26/2021

Field Visit Attendees: Amber Knutson – MNDNR, Gina Quiram – MNDNR, and Will Taylor – Cardno

10. Surrounding Landscape Characteristics:

The site is located in a predominantly agricultural setting with row crop agriculture immediately adjacent to the site to the north, east, and south. The western boundary is formed by U.S. Highway 75. Nearby, the site is close to the remaining portions of the Hole-in-Mountain WMA which totals nearly 640 acres. The Nature Conservancy (TNC) also owns 1,364 acres known as Hole-in-the-Mountain Preserve across the highway to the west which is being similarly managed for prairie restoration and rare species habitat.

11. Site Characteristics:

a. Soil Series:

Busc clay loam, 12 to 18 percent slopes, moderately eroded

Busc clay loam, 25 to 40 percent slopes

Vienna-Brookings complex, 1 to 6 percent slopes

Lamoure-La Prairie complex, channeled, 0 to 2 percent slopes, frequently flooded

Vienna silty clay loam, 3 to 6 percent slope

Kranzburg-Brookings silty clay loams, 1 to 6 percent slopes

Darnen loam, stratified substratum, 2 to 6 percent slopes

b. Topography:

The site consists of a stream valley (tributary to Flandreau Creek) that bisects the site from east to west, with steep slopes on both north and south sides and flat plateaus at the hill summits.

c. Hydrology:

The site appears well drained in all plateaus and hillsides. Groundwater and runoff likely flow quickly downhill supporting the tributary to Flandreau Creek. A wet meadow buffers the stream on both sides for much of its course through the site.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Using the MNDNR Native Plant Community Classification, this site would be classified as Southern Dry Prairie (UPs13), a fire-dependent community dominated by native herbaceous species. The site achieves this classification in its current state except for the stream corridor, which is not under the same management goals. Abundant native species include Lead Plant, Big Bluestem, Thimbleweed, Side-oats Grama, Silverleaf Scurfpea, and Canada Goldenrod. Abundant non-native species, which are focused on the hilltops, include Tall Fescue, Smooth Brome, Kentucky Bluegrass, and Canada Thistle in spots. However, total invasive species aerial cover appears to be under approximately 30%.

12. Is the plan based on current science? Yes

The site plan prescribes adaptive management grazing based on current prairie restoration research and principles. The site is also being actively monitored for quantitative plant community response.

13. List indicators of project goals at this stage of project:

Percent native cover and cover composition may be suitable indicators for goal achievement. As such, the site is meeting the goals of creating a native dry prairie across the majority of the site. Burning and grazing management will likely continue to reduce non-native cover and promote native species proliferation.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, MNDNR staff are actively managing the site in accordance with the planning documents and the site appears to be responding well. According to the current land manager, the cattle producer who is

cooperating with the agency and providing cattle for grazing is amenable and willing to work on the timeline the DNR is prescribing. Willing and timely partner cooperation is key to success at this site.

15. Are corrections or modifications needed to achieving proposed goals?

None at this time.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

At this time, the current plans for the site appear to be sufficient and producing positive results. All project goals are currently being met, at least partly. Dakota Skipper reintroduction success is impossible to evaluate at this time, although host plants and nectar-providing species are present.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

All of the project activities appear to be aligned with the project goals.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Further monitoring and site assessments are recommended. Due to the dominance of non-native cool season grasses in portions of the site, a prolonged pause or disturbance in the management actions could allow these undesirable species to expand their footprint. Also, due to the ongoing active management grazing and Dakota Skipper reintroduction efforts, valuable insight could be gained by following and reviewing site progress after more management cycles are completed.

19. Additional comments on the restoration project.

As with other projects in the region, staff availability for monitoring, grazing oversight, and prescribed burns is a limiting factor, especially in getting prescribed burns conducted during ideal conditions as the regional demand for crews is higher than their availability. As such, sites that are currently meeting objectives are placed behind lower-performing sites. This could lead to successful sites such as Hole-in-Mountain see non-native species and duff continuing to persist and build up in the meantime.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

The site is dominated by native herbaceous species except for hilltop flat areas which remain partially dominated by smooth brome and tall fescue with native species interspersed. However, given the predominance of native species elsewhere on the site, and with prescribed fire and continued grazing management planned, the site will likely continue to progress towards native-dominated prairie.

23. Site Assessor(s) conducting field review: Will Taylor - Cardno

Site Maps, Project Plans or Vegetation Tables

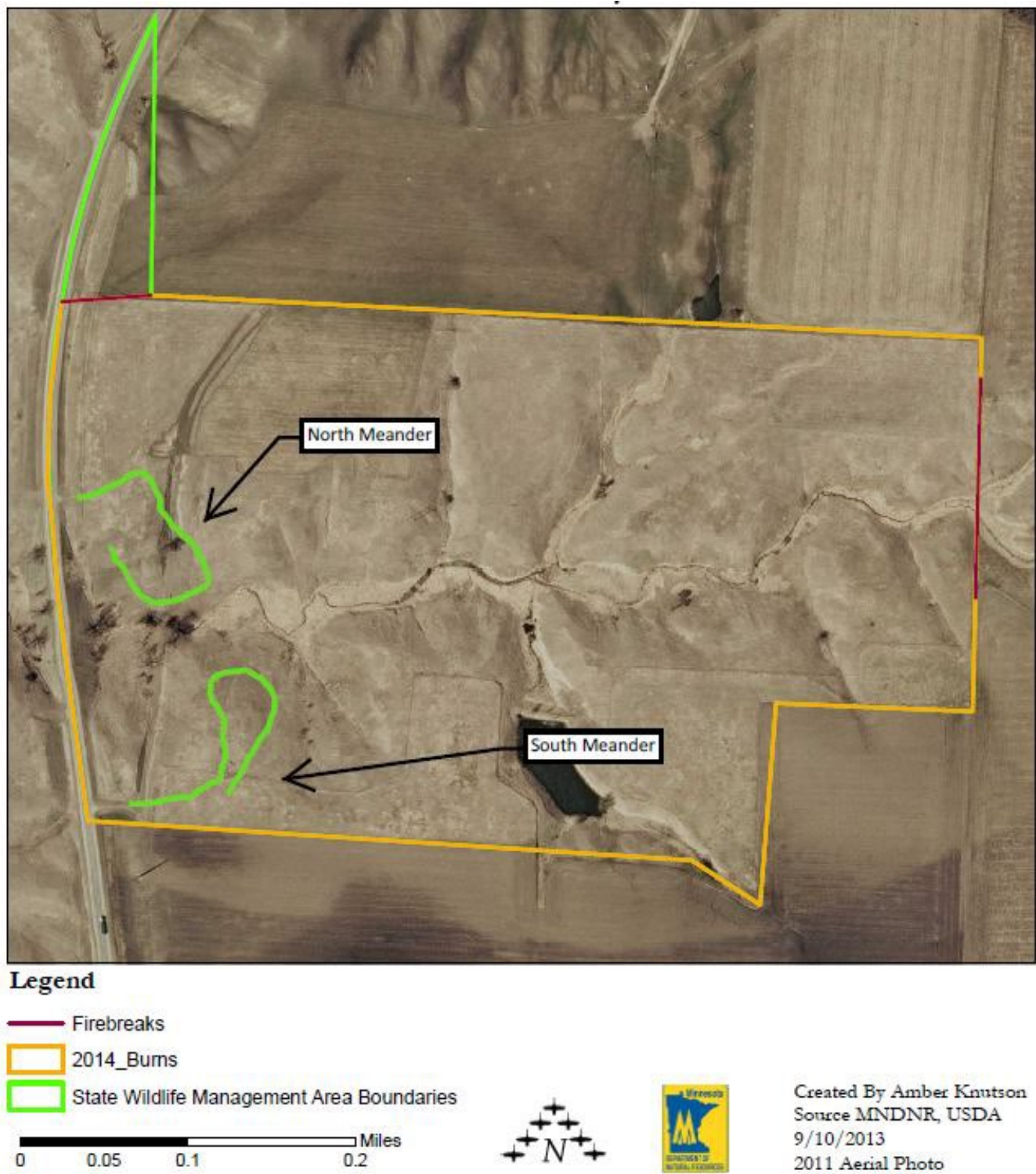


Figure 3-1 2014 Prescribed Burn plan figure with 2021 evaluation meanders added.

Table 3-1 South Entrance Meander Results

Scientific Name	Common Name	Cover Range	Species Status
<i>Achillea millefolium</i>	Common Yarrow	1-5%	native
<i>Ambrosia psilostachya</i>	Western Ragweed	1-5%	native
<i>Amorpha canescens</i>	Lead Plant	5-25%	native
<i>Andropogon gerardii</i>	Big Bluestem	5-25%	native
<i>Anemone cylindrica</i>	Thimbleweed	5-25%	native
<i>Aristida purpurea</i>	Purple Three-awn	5-25%	native
<i>Bouteloua curtipendula</i>	Side-oats Grama	5-25%	native
<i>Brickellia eupatorioides</i>	False Boneset	1-5%	native
<i>Bromus inermis</i>	Smooth Brome	5-25%	non-native
<i>Calylophus serrulatus</i>	Yellow Sundrop	0-1%	native
<i>Carduus acanthoides</i>	Spiny Plumeless Thistle	0-1%	non-native
<i>Cirsium arvense</i>	Canada Thistle	5-25%	non-native
<i>Convolvulus arvensis</i>	Field Bindweed	0-1%	non-native
<i>Dalea purpurea</i>	Purple Prairie Clover	5-25%	native
<i>Echinacea angustifolia</i>	Narrow-leaved Purple Coneflower	1-5%	native
<i>Galium boreale</i>	Northern Bedstraw	0-1%	native
<i>Helianthus grosseserratus</i>	Sawtooth Sunflower	1-5%	native
<i>Hesperstipa spartea</i>	Porcupine Grass	1-5%	native
<i>Koeleria macrantha</i>	Junegrass	1-5%	native
<i>Liatris aspera</i>	Rough Blazing Star	0-1%	native
<i>Lithospermum canescens</i>	Hoary Puccoon	0-1%	native
<i>Lolium arundinaceum</i>	Tall Fescue	5-25%	non-native
<i>Lupinus perennis</i>	Wild Lupine	0-1%	native
<i>Melilotus officinalis</i>	Sweet Clover	1-5%	non-native
<i>Monarda fistulosa</i>	Wild Bergamot	1-5%	native
<i>Pedimelum argophyllum</i>	Silverleaf Scurfpea	5-25%	native
<i>Physalis virginiana</i>	Virginia Ground Cherry	0-1%	native
<i>Poa pratensis</i>	Kentucky Bluegrass	5-25%	non-native
<i>Rosa arkansana</i>	Prairie Rose	1-5%	native
<i>Solidago canadensis</i>	Canada Goldenrod	5-25%	native
<i>Solidago rigida</i>	Stiff Sunflower	1-5%	non-native
<i>Sonchus arvensis</i>	Perennial Sowthistle	0-1%	non-native
<i>Symphoricarpos occidentalis</i>	Wolfberry	1-5%	native
<i>Symphyotrichum ericoides</i>	Heath Aster	1-5%	native
<i>Symphyotrichum laeve</i>	Smooth Blue Aster	1-5%	native
<i>Verbena stricta</i>	Hoary Vervain	1-5%	native
<i>Zizia aurea</i>	Golden Alexander	0-1%	native

Table 3-2 North Entrance Meander Results

Scientific Name	Common Name	Cover Range	Species Status
<i>Amorpha canescens</i>	Lead Plant	1-5%	native
<i>Andropogon gerardii</i>	Big Bluestem	1-5%	native
<i>Anemone cylindrica</i>	Thimbleweed	1-5%	native
<i>Artemisia ludoviciana</i>	White Sage	1-5%	native
<i>Asclepias syriaca</i>	Common Milkweed	1-5%	native
<i>Asclepias viridiflora</i>	Green Milkweed	0-1%	native
<i>Bouteloua curtipendula</i>	Side-oats Grama	5-25%	native
<i>Brickellia eupatorioides</i>	False Boneset	1-5%	native
<i>Bromus inermis</i>	Smooth Brome	5-25%	non-native
<i>Convolvulus arvensis</i>	Field Bindweed	0-1%	non-native
<i>Dalea purpurea</i>	Purple Prairie Clover	1-5%	native
<i>Echinacea angustifolia</i>	Narrow-leaved Purple Coneflower	1-5%	native
<i>Fraxinus pennsylvanica</i>	Green Ash	0-1%	native
<i>Helianthus maximiliani</i>	Maximilian Sunflower	1-5%	native
<i>Hesperostipa spartea</i>	Porcupine Grass	1-5%	native
<i>Juncus dudleyi</i>	Dudley's Rush	1-5%	native
<i>Lolium arundinaceum</i>	Tall Fescue	5-25%	non-native
<i>Melilotus officinalis</i>	Sweet Clover	1-5%	non-native
<i>Panicum virgatum</i>	Switchgrass	5-25%	native
<i>Phleum pratense</i>	Timothy	5-25%	non-native
<i>Poa pratensis</i>	Kentucky Bluegrass	5-25%	non-native
<i>Rosa arkansana</i>	Prairie Rose	0-1%	native
<i>Salix fragilis</i>	Crack Willow	0-1%	non-native
<i>Scirpus pallidus</i>	Pale Bulrush	0-1%	native
<i>Scrophularia lanceolata</i>	Lance-leaf Figwort	0-1%	native
<i>Solidago canadensis</i>	Canada Goldenrod	5-25%	native
<i>Solidago rigida</i>	Stiff Sunflower	1-5%	native
<i>Sonchus arvensis</i>	Common Sowthistle	1-5%	non-native
<i>Spartina pectinata</i>	Prairie Cordgrass	5-25%	native
<i>Symphoricarpos occidentalis</i>	Wolfberry	1-5%	native
<i>Tragopogon dubius</i>	Yellow Goat's Beard	0-1%	non-native
<i>Verbena hastata</i>	Blue Vervain	0-1%	native
<i>Verbena stricta</i>	Hoary Vervain	5-25%	native
<i>Verbena urticifolia</i>	White Vervain	1-5%	native

Site Photographs



Photo 3-1 Hole-in-Mountain WMA, photo taken during site visit 07/26/2021. Native-dominated hillside with Narrow-leaved Purple Coneflower, Side-oats Grama, Leadplant.



Photo 3-2 Hole-in-Mountain WMA, photo taken during site visit 07/26/2021. Showing rolling topography with hilltop plateaus, steep slopes, and wetland stream valley.



Photo 3-3 Hole-in-Mountain WMA, photo taken during site visit 07/26/2021. Hillslope shoulder on north side of site. Typical transition zone where the hilltop was dominated by non-native cool-season grasses and the slope areal cover was almost completely native prairie species.



Photo 3-4 Hole-in-Mountain WMA, photo taken during site visit 07/26/2021. Lower slope transition zone leading into mesic prairie and wet meadow off photo to left. Prairie Cordgrass and Blue Vervain become more common along with various native goldenrod species and Canada Thistle pockets.

Grazing Design Provided by Project Partners

Hole-in-the-Mountain Grazing Approach and Research Design

Report Drafted 3/11/2021 by Megan Benage, Regional Ecologist, Dustin Graham, Plant Ecologist, Fred Harris, Plant Ecologist Supervisor, Amber Knutson, Assistant Area Wildlife Manager; DNR and Kent Solberg, Senior Technical Advisor; Sustainable Farming Association

Overview

Healthy soil is important to farmers and state land managers alike because it is the foundation of our prairie, prairie reconstructions and healthy, productive, and profitable farmlands. “A healthy, functioning prairie, just like an old-growth forest, consists of thousands of different organisms, plants, animals, invertebrates, bacteria and soil fungi. All those organisms rely on complex interactions of nutrients, moisture and energy flow to create and provide them with the food, water and shelter they need to survive. Unlike forests, the abundance of individual prairie plant and animal species changes frequently in response to disturbances such as fire, grazing, and climate extremes. As a result, a particular patch of prairie can look very different from year to year and the prairie landscape as a whole is an intricate shifting mosaic of change.” (Benage and Helzer 2020). This project will monitor the effects of conservation grazing in two different applications: patch-burn-graze and adaptive management grazing on upland prairie and brome-dominated prairie areas at Hole-in-the-Mountain Wildlife Management Area (HIM) in Lincoln County, MN. This is a partnership effort between DNR-Div. of Fish and Wildlife, DNR-Div. of Ecological and Water Resources, DNR-Minnesota Biological Survey, The Sustainable Farming Association of Minnesota, and a local producer.

Hole-in-the-Mountain is also adjacent to The Nature Conservancy’s Hole-in-the-Mountain Preserve where efforts are underway to introduce a rare prairie butterfly, the Dakota Skipper (federally threatened, state endangered), back to the prairie landscape. The Minnesota Zoo and Department of Natural Resources are partnered in these efforts and have worked together to establish a recovery model for the Dakota Skipper. One aspect of this model is the future reintroduction of the Dakota Skipper at HIM. Establishing two different grazing regimes and monitoring their success based on vegetation response is phase 1 of this project. Monitoring the effects on prairie invertebrates like the Dakota Skipper will be phase 2 of the project.

Site

Hole-in-the-Mountain Wildlife Management Area is a 638.56 acre conservation area that is divided into two tracts. Both tracts are near Lake Benton, Minnesota with one tract east of Highway 75 and the other tract to the west. The site is a mix of grassland/open lands mixed with wetlands and some sections of native prairie (Figure 1).

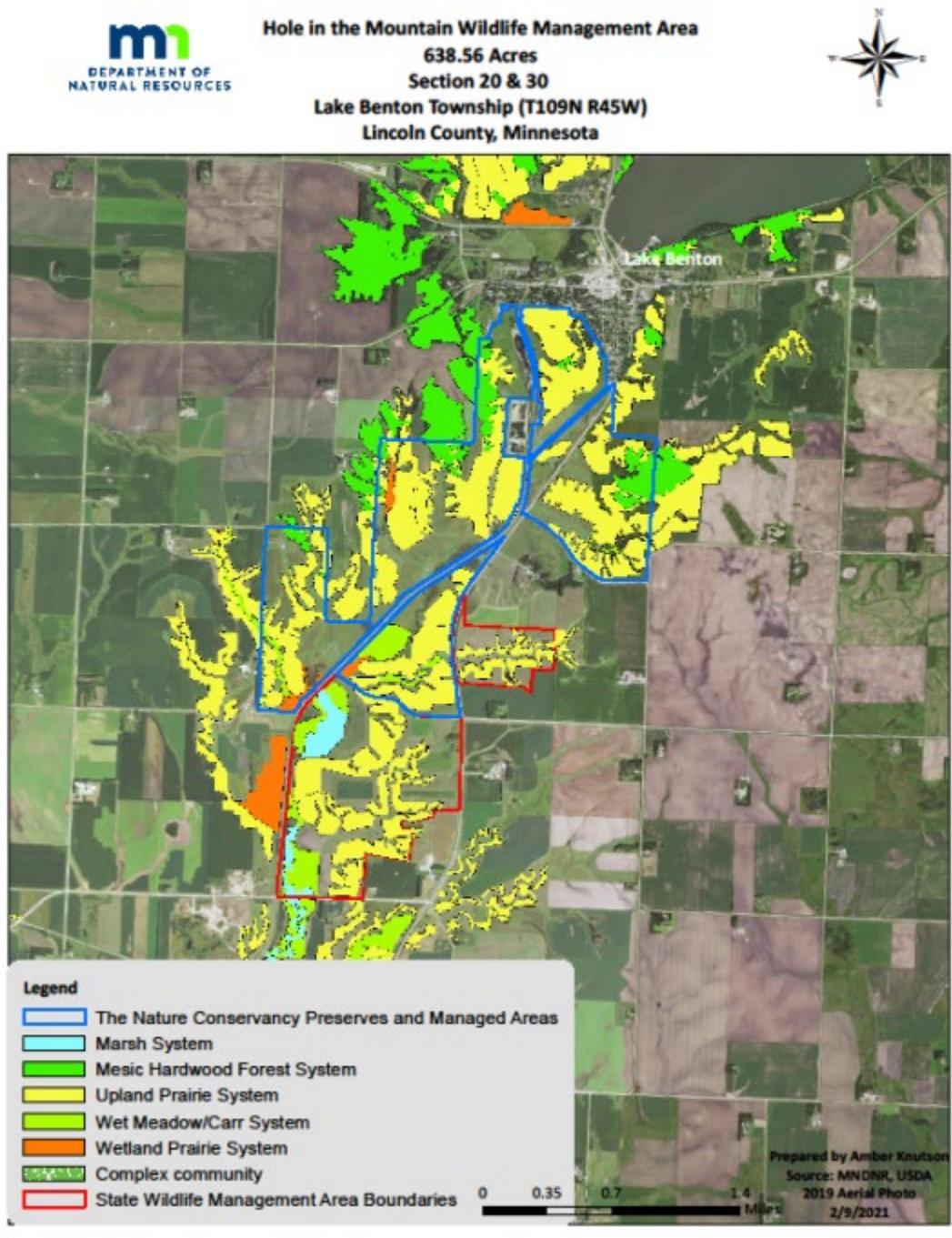


Figure 3-2 Hole-in-the-Mountain Wildlife Management Area (HIM) Location Map with native plant communities identified. Composite Aerial Imagery with HIM outlined in red. HIM is south of Lake Benton city limits in Lincoln County, MN. Site center located at UTM X 419372.8, UTM Y 4896032.5 (NAD 83, UTM Zone 15).

Project Partners

This project is a partnership effort between DNR-Div. of Fish and Wildlife, DNR-Div. of Ecological and Water Resources, DNR-Minnesota Biological Survey, The Sustainable Farming Association of Minnesota, and a local producer. Participants and project roles are outlined below.

Table 3-3 Project partners, roles and contact information for Hole in the Mountain WMA.

Project Role	Name	Phone	Email
Project Coordinator (Regional Ecologist)	Megan Benage	507-233-1256	megan.benage@state.mn.us
Lead Grazing Operation (Producer)	Nick Thooft	605-366-8498	nickthooft@gmail.com
Project Manager (Asst. Area Wildlife Manager)	Amber Knutson	507-537-6464	Amber.knutson@state.mn.us
Researcher (Plant Ecologist/Supervisor)	Fred Harris	651-259-5084	Fred.Harris@state.mn.us
Researcher (Plant Ecologist)	Dustin Graham	651-259-5640	Dustin.Graham@state.mn.us
Lead Grazing Management (Senior Technical Advisor)	Kent Solberg	NA	kent@sfa-mn.org

Patch-Burn-Graze

Patch-Burn Grazing (PBG) is a season-long grazing system in which the grazed area is divided into several burn units that are burned in different years. Because livestock focus grazing on the most recently burned unit, the rotation of burns within the unit results in a rotation of grazing intensity between units over time. The goal is to increase the diversity and structure of the vegetation while also benefitting wildlife and maintaining livestock production.

Goals

- Suppress introduced species—targeting smooth brome and reed canarygrass

- Increase native diversity
- Improve habitat quality for local wildlife populations

The 531-acre west unit of HIM began management with patch-burn grazing in 2018. A perimeter fence was completed in 2017 and then the unit was divided into four burn units (Figure 2). One unit is burned in May each year to target early growth of brome. Within 1 week of burning, cattle are released onto the site to focus their attention on any new brome growth. 100 cow-calf pairs were released initially in 2018 and 2019 with 26 head steers and 70 pair with 3 bulls released in 2020. 70 cow-calf pairs will be released in 2021. Cattle leave burn units freely and can graze across burn units 1-3. The theory behind patch-burn-graze is that the cows are attracted to the flush of new growth post-burn and concentrate their feeding there.

This model of grazing was reduced in 2021 to allow for patch-burn graze and adaptive management grazing. Part of WMA will remain in the original patch-burn-graze research design—units 1, 2, and 3 with unit 3 being subdivided into 3a for patch-burn grazing and 3b for adaptive management grazing along with unit 4 and the east unit. (Figure 6).



Hole-In-Mountain WMA
Lincoln County
Lake Benton TWP
T109N R45W
Parts of Sections 19, 20, 30

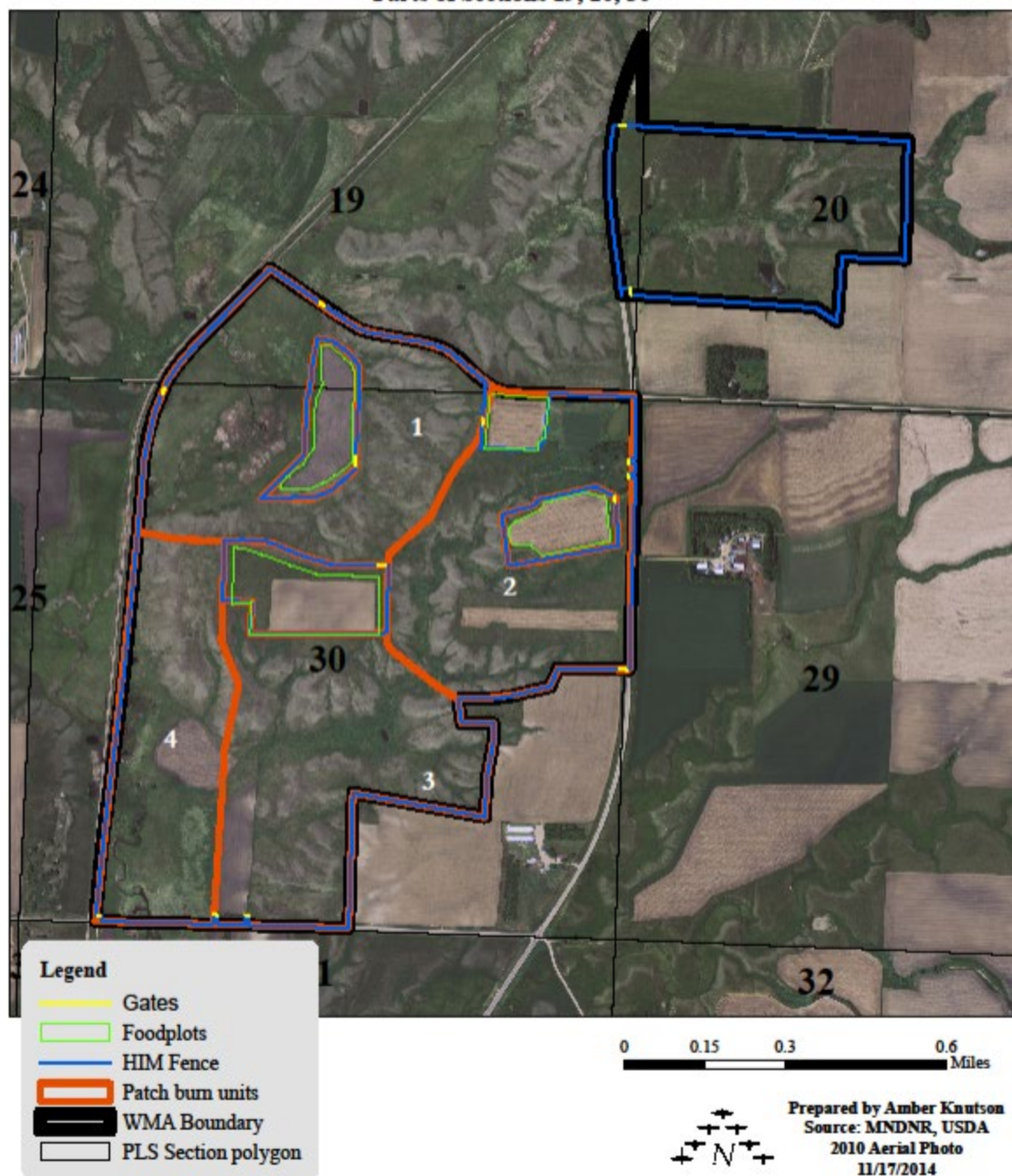


Figure 3-3 Hole-in-the-Mountain Wildlife Management Area (HIM) Patch-Burn Graze unit map.

Prescribed burns rotate annually, counter clockwise, starting with burn unit 1 and then advancing to burn units 4, 3, and 2 (Figure 2). Burn unit 1 was burned on 5/3/18 and unit 4 was burned on 5/7/19. Burn unit 3 was not burned due to safety concerns with the onset of the Covid-19 pandemic. Burn unit 2 will be burned in 2021 and burn unit 1 will be burned again in 2022.

Permanent vegetation plots were established and sampled in 2016. These consist of pairs of plots in which one member of each pair was randomly excluded from grazing with a 20m-diameter exclosure fence. Cattle were first released into the project in May 2018, following a spring burn in burn unit 1. The vegetation of these plot pairs have been sampled twice to date: In 2016 before patch-burn grazing started, and in 2019 after 2 seasons of patch-burn grazing. In order to get a better picture of vegetation change and grazing across the site, numerous additional quadrats were sampled in a systematic grid across the west unit (patch-burn graze project units 1, 2, and 3) and the east unit (east of highway 75). These quadrats were sampled for vegetation structure, brome cover, species diversity, and grazing intensity. The grids were first created in GIS and sampled in 2017 and then sampled a second time in 2019.

In 2020, a prescribed burn did not happen due to the onset of Covid-19 and new restrictions to keep staff safe and physically distant to avoid community spread. As a result, cattle were rotated almost daily around burn unit 3 using temporary poly-wire fence. Once they grazed the burn unit once, they were released to graze freely across the remaining acres of the WMA. In August, they were again restricted and rotated through small temporary paddocks across burn unit 3 until the end of the season on August 31st.

Patch-Burn Graze Monitoring Methods

The objective for monitoring is to document the effects of patch-burn-grazing on plant community composition.

Within each of three burn units identified by DNR Wildlife staff (Knutson 2015), five pairs of permanently marked 10m x 10m vegetation plots were located and established following a stratified random process in 2016 (Figure 3). Pairs of plots were located by assigning random points in GIS to a polygon corresponding to the uplands within each management unit (Harris 2013). The first-generated point was accepted. At that first location, two plots were established in the field that represented similar vegetation and positions in the landscape. One member of the pair of plots then was randomly picked via coin flip to receive an exclosure. The next point in order of random generation was also accepted if it was a minimum of 170m from the first point. Successive pairs of plots were identified that also satisfied the criteria of a minimum distance of 170m from any other pair of plots within the burn unit. The minimum distance between each plot within each pair was 15 meters. Each plot had sides oriented along cardinal directions. Exclosures were allocated randomly within all plot pairs. Each 10m x 10m plot was marked in the field with steel spikes at the corners, and two corners were marked with buried DEEP-1 surveyor magnets. In sampling the vegetation in each 10m x 10m plot, tape measures were positioned on the margins and diagonals of the plot. 12 sets of nested 0.1m² and 1m² quadrats were sampled at pre-determined locations along the tape measures. The 0.1m² quadrat was positioned in the SW corner of each 1m² quadrat (Figure 4).

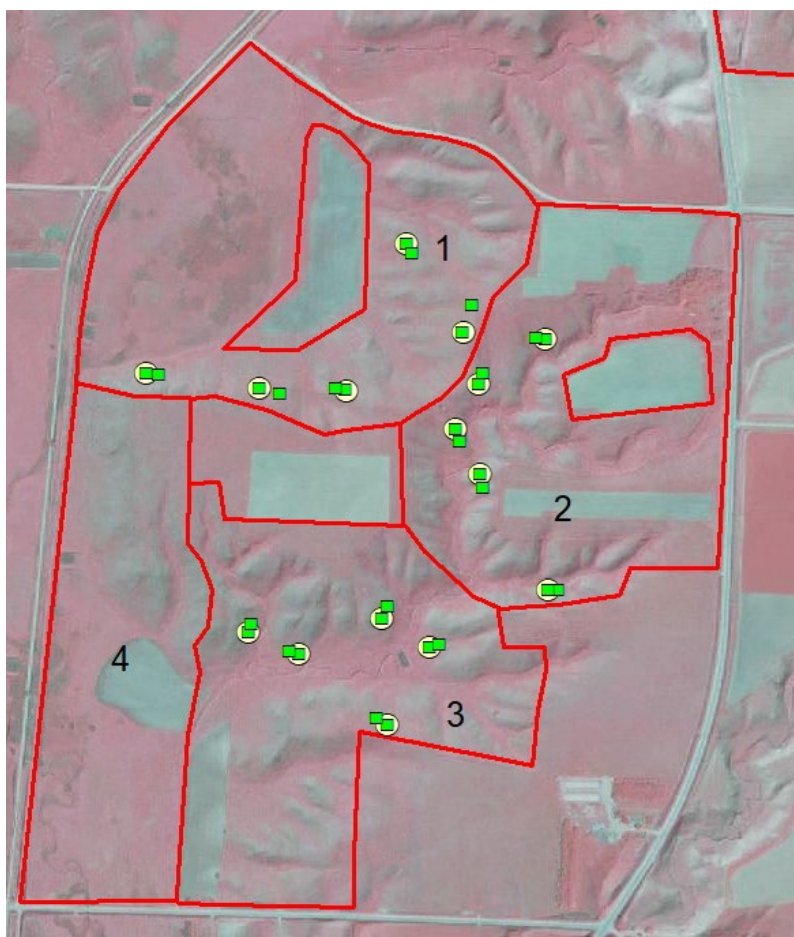


Figure 3-4 Locations of Burn Units 1-4 (Red Polygons), Pairs of Permanent 10m x10m Vegetation Plots (Green Squares), and Exclosures (Yellow Circles)

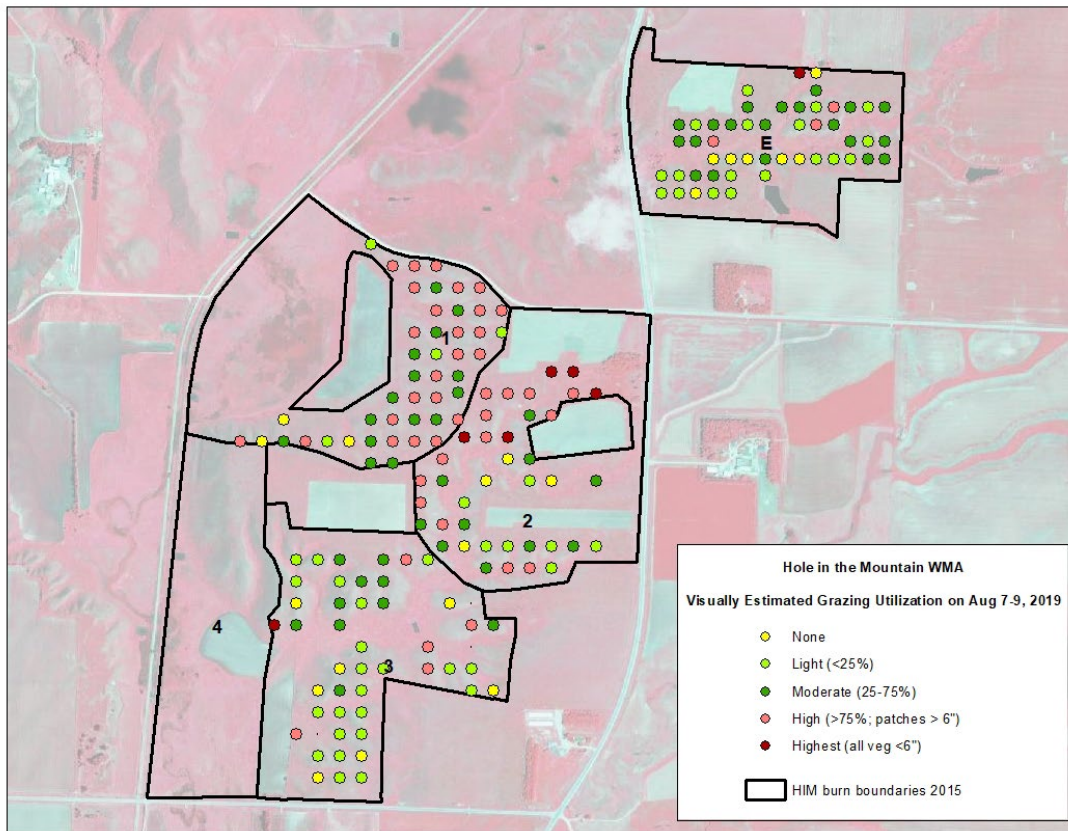


Figure 3-6 Visually Estimated Grazing Utilization in 1m² Quadrats Arranged in Grids in August 2019.

Vegetation sampling schedule

Vegetation in the permanent enclosure plots will be sampled every 3 years in late July/early August. The first year of sampling took place in 2016 before Patch-burn grazing was introduced on the WMA. The grids of quadrats were first established and sampled in 2017, and were then sampled in 2019 and 2020. We plan to sample these quadrats annually in late July/early August.

Adaptive Management Grazing

Adaptive management grazing (AMG) is characterized by short-duration, high density livestock impact followed by rest periods long enough to ensure full plant recovery. Observation and monitoring are key components for success that allow for adjustments in grazing timing, frequency, and intensity. The goals for this type of grazing are included below with the main principle being that increased plant diversity increases or improves:

- Overall biodiversity and functionality for wildlife
- Structural variability (heterogeneity) of vegetation, which in turn supports a variety of grassland bird species and other obligate wildlife
- Revitalizing the soil food web, which is the basis of food chains
- Soil biology, which in turn increases forage nutritional density both for wildlife and for the livestock.
- Nutrient cycling such as carbon, nitrogen, and phosphorus
- Water interception and infiltration
- Resilience in ecological systems e.g., drought tolerance, resistance to plant invasion

DNR's main focus is improving overall biodiversity and functionality for wildlife, which in turn leads to other benefits detailed above. Utilizing this grazing model in addition to patch-burn-graze allows for researchers to evaluate multiple models of grazing and inform future management.

Goals

- Suppress introduced species—targeting smooth brome and reed canarygrass
- Increase native diversity
- Stimulate latent native seed bank
- Increase native biomass
- Improve wildlife habitat quality, with an emphasis on improving patch habitat for Dakota Skipper (*Hesperia dacotae*, *State Endangered*, *Federally Threatened*) by expanding habitat zones for prairie dropseed (*Sporobolus heterolepis*) and narrow-leaved purple coneflower (*Echinacea angustifolia*)
- Improve and maintain higher level of animal performance (herd weight and nutrition)

Part of WMA will remain in the original patch-burn-graze research design—units 1, 2, and 3 with unit 3 being subdivided into 3a for patch-burn grazing and 3b for adaptive management grazing. Paddock 4, unit 3b, and the northeast unit will be used in the adaptive management grazing model where management is changed based on vegetation response (Figure 6).

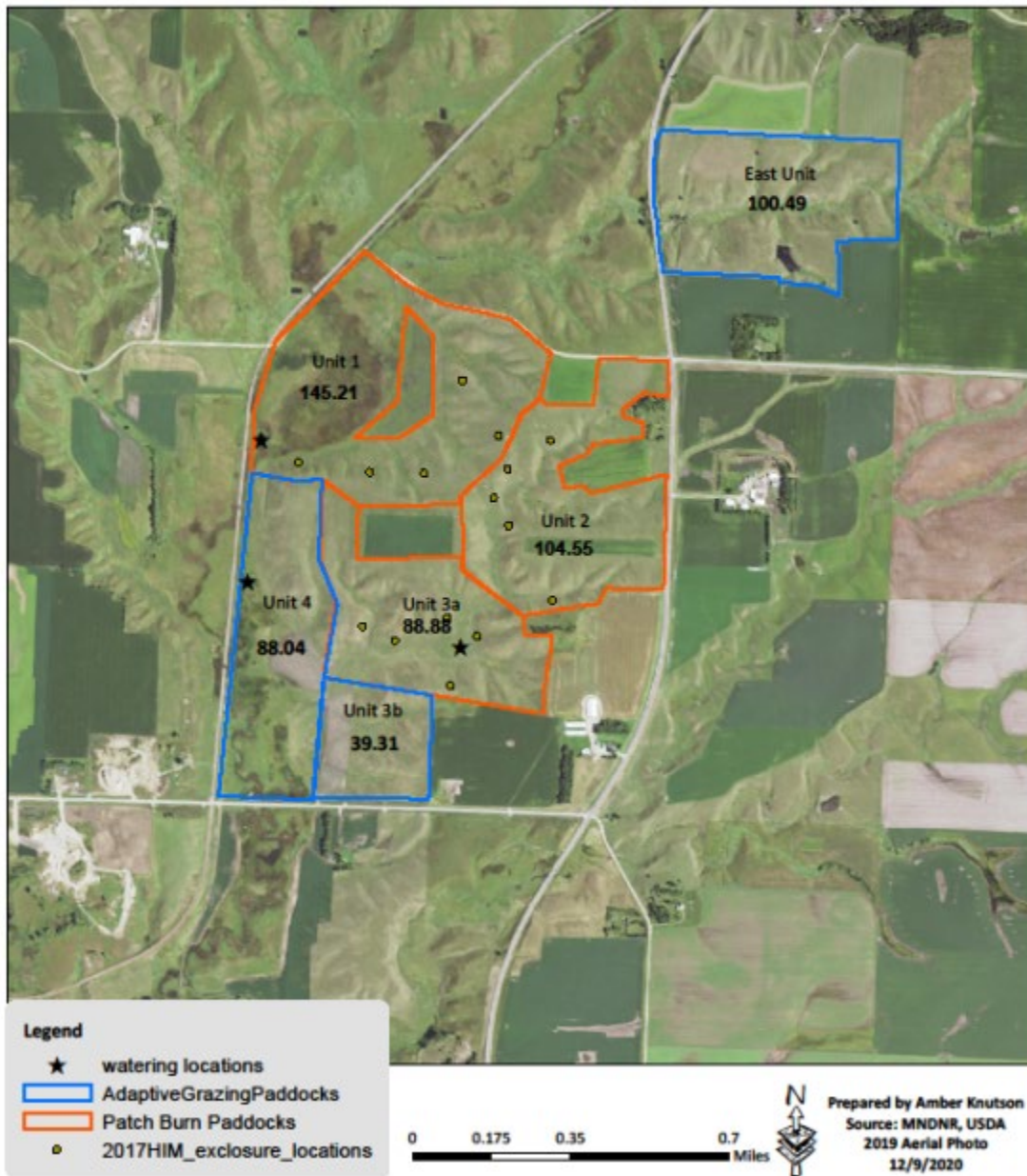


Figure 3-7 Hole-in-the-Mountain Wildlife Management Area (HIM) Adaptive management grazing and Patch-Burn Graze unit map.

Eventually, an invertebrate monitoring component will be added to observation and monitoring in order to determine what impact (if any) this type of grazing is having on the invertebrate community. Unit 3b in Figure 6 has an established grid of quadrats that have already been sampled. A grid of quadrats will be established and sampled in the upland portions of Unit 4 starting in 2021.

Adaptive Management Grazing Monitoring Methods

The objective for monitoring is to document long-term status and trends in plant community composition and smooth brome abundance in prairie undergoing adaptive management grazing. This is an opportunity to collect data and evaluate an innovative approach to management—especially because historically, adaptive management grazing has not been well-documented.

Vegetation sampling methods for this part of the study will only include gridded quadrats with no established exclosures. When gridded quadrats were initially laid out for the patch-burn-graze model, 37 sets of nested 0.1m² and 1m² quadrats were placed in paddock 4 but never sampled (Figure 7), though the unit was included in patch-burn grazing that started in 2018. Plots in the east unit of the WMA (east of Hwy 75) were sampled as part of the 2016 baseline so cattle can be introduced to this area right away in 2021. All plots across both grazing models will be on the same sampling schedule starting in 2021.



Figure 3-8 Locations of quadrats in a grid in the upland portion of Unit 4.

Vegetation sampling schedule

Vegetation in grid plots will be sampled annually in late July/August. Baseline sampling of the expanded plots in paddock 4 will be conducted in July/August 2021 prior to cattle being released to plot areas. The northeast unit had its baseline year of sampling in 2016 and has been sampled post-grazing in 2019 and 2020. Sampling will continue in 2021.

4 Furgamme Wildlife Management Area Prairie Restoration

Project Background

Project Name: Furgamme WMA prairie restoration

Project Site: Furgamme Wildlife Management Area

Township/Range Section: Township 11N Range 43W Section SWSW9 & SWNW16

Project Manager / Affiliated Organization: Alex Nelson, Pheasants Forever (PF)

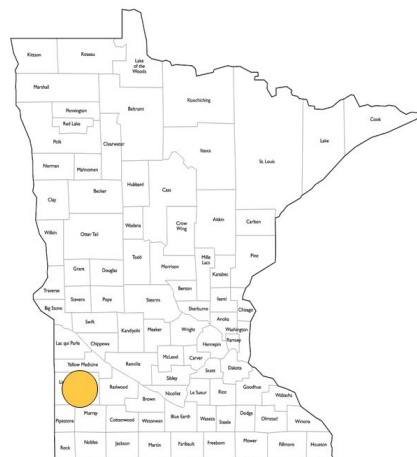
Fund: OHF **Fiscal Year Funds:** 2011

Project Start Date: 2016

Predominant Habitat type: Prairie / Savanna / Grassland

Additional Habitat types:

Project Status: Post Establishment Phase



County: Lyon

Primary Activity: Prairie Restoration

Project Size: 11.8 acres

Project Completed: 2016

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

Both seeding areas at this WMA were dormant season-seeded into soybean stubble in March 2016. Prescribed burn was applied to both units November 20, 2019. No additional grow-in maintenance has occurred.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Records are stored with DNR Wildlife staff at the Marshall office.

3. What are the stated goals of the project?

Restore diverse, native pollinator habitat at both former food plot areas

4. What are the desired outcomes of achieving the stated goals of the project?

Establishment of a diverse set of native grasses and flowers to provide habitat for a wide variety of wildlife, especially pollinators.

5. Were measures of restoration success identified in plans? No

If yes, list specific measurements.

No specific, quantifiable benchmarks were noted during the planning phase of this project.

6. Are plan Sets available? No Have project maps been created? Yes

If yes, provide in "site maps" and list maps provided:

Seed mix lists and maps created for the project are on file with MN DNR.

7. Provide list of best management practices, standards, guidelines identified in plan set?

Project restoration design included late winter dormant season seeding directly over soybean stubble (March 3, 2016).

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

No

No known alterations were made to the plan

9. In what ways did alterations change the proposed project outcome?

No alterations were made to the plan

Site Assessment

Field Review Date: 7/15/2021

Field Visit Attendees: Troy Dale, MN DNR Assistant Area Wildlife Manager; Gina Quiram, MN DNR Restoration Evaluation Specialist, MN DNR EWR; Paul Bockenstedt, Senior Ecologist Stantec.

10. Surrounding Landscape Characteristics:

The north unit is surrounded by native restoration in upland areas on the north side, wetland on the east, roads on the south and west side, as well as rowcrop agricultural land further west. The south unit is bordered by native planting on the north and east sides (with emergent wetland approximately 200 feet the east, row crop land to the south, and road/crop ground to the west.

11. Site Characteristics:

a. Soil Series:

There are four mapped soil types within the 11.8-acre project area:

- Barnes-Buse-Svea complex (loam 8.7 ac.)
- Barnes-Buse complex (loam 2.6 ac.)
- Lakepark-Roliss-Parnell, depressional, complex (loam 0.2 ac.), and
- Vallers clay loam (0.3 ac.)

b. Topography:

Gently sloped to moderately sloped (generally less than approximately 5% slopes)

c. Hydrology:

Both units are comprised primarily of well-drained upland soils with the exception of the Vallers clay loam, which comprises approximately 0.3 ac. across both seeded areas.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Both pollinator sites were previously planted as wildlife food plots each year.

12. Is the plan based on current science? Yes

It is a customary to dormant season broadcast native seed over soybean stubble the fall/winter after the last soybean crop is harvested. In addition to the seed mixes purchased for this project, the seed mix was supplemented with bulk native harvest from other existing prairie reconstruction area(s).

13. List indicators of project goals at this stage of project:

Total cover of native (pollinator) plants

Establishment of species from native pollinator seed mix:

Mesic-Upland Seed Mix

Twenty-five of 36 native species were observed from the seed mix. An additional eight native species were observed, resulting in a total of 34 native plant species observed. Nine nonnative species were observed, bringing the total for native and nonnative species observed to 43.

Mesic-Pollinator Seed Mix

Thirty-one of 40 native species were observed from the seed mix. An additional eight native species were observed, resulting in a total of 39 native plant species observed. Seven nonnative species were observed, bringing the total for native and nonnative plant species observed to 46.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, the project plan was developed based on current science and vegetation establishment indicates project has met goals.

15. Are corrections or modifications needed to achieve proposed goals?

Corrections or modifications do not appear to be needed.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Yes – integration of this area into normal rotation for prescribed burns.

Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

Based on information from MN DNR, PF staff, and field observations, the planned and implemented activities contributed to the overall success of the project.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Follow-up evaluation does not appear to be necessary. The composition of the plant community appears to be established, stable, and at a point where only periodic maintenance will be required.

19. Additional comments on the restoration project.

There was an approximately 12" snowfall the weekend before seeding was conducted in March 2016, which Troy Dale (MN DNR) felt was beneficial for the seeding effort. While it's not typical or customary, the lack of any grow-in maintenance outside of a prescribed burn (late in growing season 2), total obvious invasive, nonnative cover is low.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

Current composition of both of the seeded areas appears to be stable and in good condition, likely only needing periodic maintenance moving forward.

23. Site Assessor(s) conducting field review:

Paul Bockenstedt, Stantec; Gina Quiram, MN DNR

Site Maps, Project Plans or Vegetation Tables

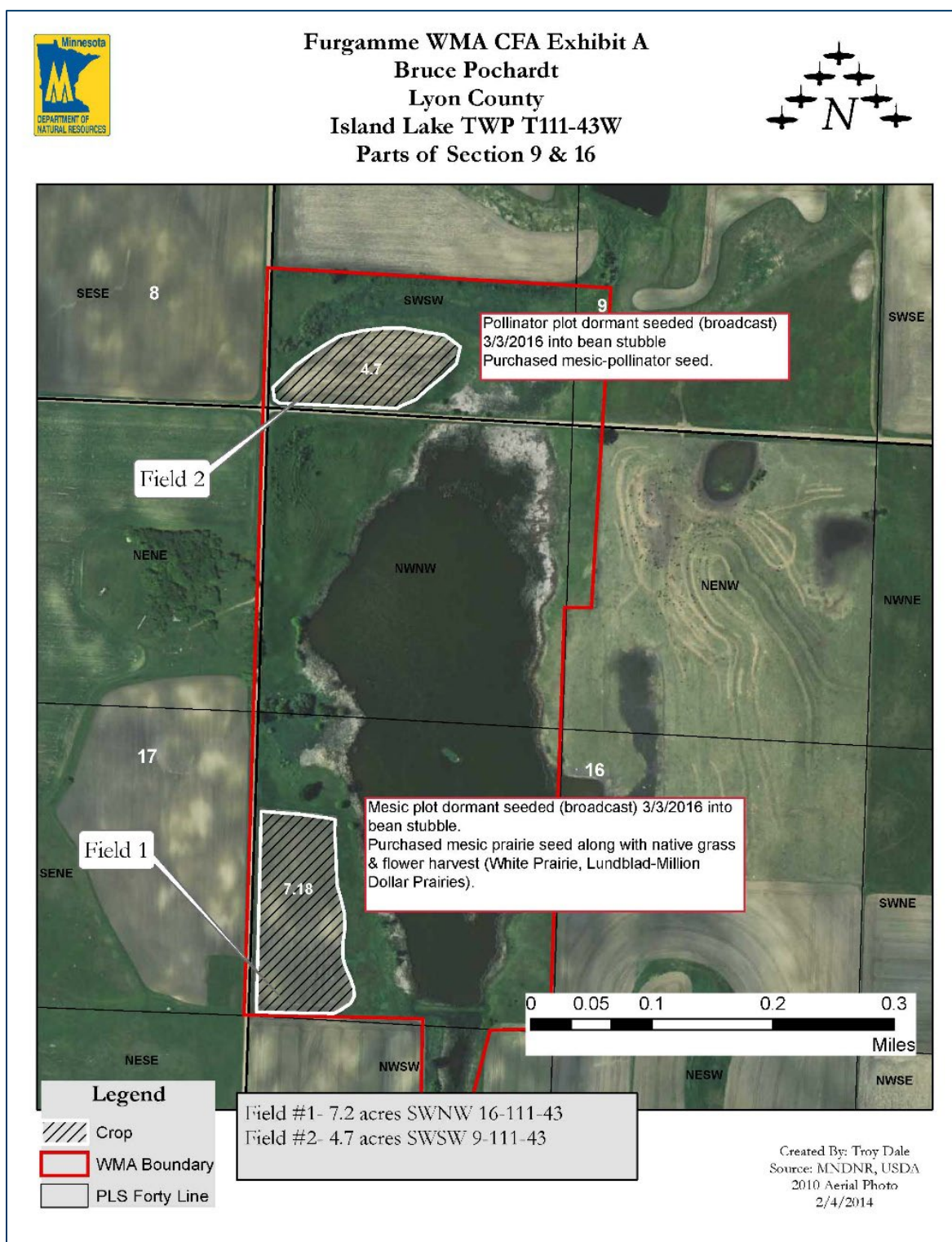


Figure 4-1 Furgamme WMA mesic prairie and pollinator plot seeding areas.

Table 4-1 Furgamme WMA; mesic pollinator field meander vegetation survey.

Scientific Name	Common Name	Cover Range¹	Species Planted/Seeded²	Species Status
Graminoids				
<i>Andropogon gerardii</i>	big bluestem	5-25%	?	Native
<i>Bouteloua curtipendula</i> var. <i>curtipendula</i>	side-oats grama	5-25%	Yes	Native
<i>BROMUS INERMIS</i>	SMOOTH BROME	5-25%	No	Nonnative
<i>Bromus kalmii</i>	Kalm's brome	0-1%	Yes	Native
<i>Elymus canadensis</i> var. <i>canadensis</i>	nodding wild rye	0-1%	?	Native
<i>Elymus trachycaulus</i> subsp. <i>trachycaulus</i>	slender wheatgrass	0-1%	?	Native
<i>Elymus virginicus</i> var. <i>virginicus</i>	Virginia wild rye	1-5%	Yes	Native
<i>Panicum virgatum</i>	switchgrass	5-25%	Yes	Native
<i>POA PRATENSIS</i> SUBSP. <i>PRATENSIS</i>	KENTUCKY BLUEGRASS	1-5%	No	Nonnative
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	little bluestem	5-25%	Yes	Native
<i>Sorghastrum nutans</i>	Indian grass	0-1%	?	Native
<i>Sporobolus compositus</i> var. <i>compositus</i>	rough dropseed	0-1%	?	Native
<i>Sporobolus heterolepis</i>	prairie dropseed	1-5%	Yes	Native
Forbs				
<i>Achillea millefolium</i>	common yarrow	1-5%	Yes	Native
<i>Asclepias syriaca</i>	common milkweed	1-5%	Yes	Native
<i>Astragalus canadensis</i>	Canada milk-vetch	1-5%	Yes	Native
<i>Chamaecrista fasciculata</i>	partridge pea	1-5%	Yes	Native
<i>CIRSIIUM ARVENSE</i>	CANADA THISTLE	5-25%	No	Nonnative
<i>Coreopsis palmata</i>	bird's foot coreopsis	1-5%	Yes	Native
<i>Dalea candida</i>	white prairie clover	1-5%	Yes	Native
<i>Dalea purpurea</i> var. <i>purpurea</i>	purple prairie clover	5-25%	Yes	Native
<i>Desmodium canadense</i>	Canada tick trefoil	5-25%	Yes	Native
<i>Helianthus grosseserratus</i>	sawtooth sunflower	0-1%	?	Native
<i>Helianthus maximiliani</i>	Maximilian's sunflower	5-25%	Yes	Native
<i>Heliopsis helianthoides</i> var. <i>scabra</i>	ox-eye	1-5%	Yes	Native
<i>Lespedeza capitata</i>	round-headed bush clover	1-5%	Yes	Native
<i>MELILOTUS ALBA</i>	WHITE SWEET CLOVER	5-25%	No	Nonnative
<i>Monarda fistulosa</i>	wild bergamot	1-5%	Yes	Native
<i>Potentilla arguta</i> subsp. <i>arguta</i>	tall cinquefoil	0-1%	?	Native
<i>Potentilla arguta</i> subsp. <i>arguta</i>	tall cinquefoil	0-1%	Yes	Native
<i>Ratibida pinnata</i>	gray-headed coneflower	5-25%	Yes	Native
<i>Rudbeckia hirta</i> var. <i>pulcherrima</i>	black-eyed susan	1-5%	Yes	Native
<i>Solidago altissima</i>	late goldenrod	0-1%	No	Native

Scientific Name	Common Name	Cover Range¹	Species Planted/Seeded²	Species Status
<i>Solidago canadensis</i>	Canada goldenrod	1-5%	?	Nonnative
<i>Solidago gigantea</i>	giant goldenrod	1-5%	?	Native
<i>Solidago rigida</i>	stiff goldenrod	1-5%	Yes	Native
<i>Solidago speciosa</i>	showy goldenrod	1-5%	Yes	Native
<i>SONCHUS ARVENSIS</i>	FIELD SOW THISTLE	0-1%	No	Nonnative
<i>Symphyotrichum ericoides</i>	heath aster	0-1%	Yes	Native
<i>Symphyotrichum laeve</i> var. <i>laeve</i>	smooth aster	1-5%	Yes	Native
<i>TARAXACUM OFFICINALE</i>	COMMON DANDELION		No	Nonnative
<i>Zizia aptera</i>	heart-leaved alexanders	0-1%	Yes	Native
<i>Zizia aurea</i>	golden alexanders	1-5%	Yes	Native
<i>Shrubs (and tree seedlings)</i>				
<i>Acer negundo</i>	boxelder	0-1%	No	Native
<i>Amorpha canescens</i>	leadplant	0-1%	Yes	Native

¹ 0-1%, 1-5%, 5-25%, 25-50%, 50-75%, 75-100%

² ? = Species may have been part of bulk harvest seed broadcast seeded at site

Table 4-2 Furgamme WMA; mesic prairie field meander vegetation survey

<i>Scientific Name</i>	<i>Common Name</i>	<i>Cover Range</i> ¹	<i>Species Planted/Seeded</i> ²	<i>Species Status</i>
Graminoids				
<i>Andropogon gerardii</i>	big bluestem	1-5%	?	Native
<i>Bouteloua curtipendula</i> var. <i>curtipendula</i>	side-oats grama	5-25%	Yes	Native
<i>BROMUS INERMIS</i>	SMOOTH BROME	1-5%	No	Nonnative
<i>Bromus kalmii</i>	Kalm's brome	1-5%	Yes	Native
<i>Elymus canadensis</i> var. <i>canadensis</i>	nodding wild rye	0-1%	?	Native
<i>Elymus trachycaulus</i> subsp. <i>trachycaulus</i>	slender wheatgrass	0-1%	?	Native
<i>Elymus virginicus</i> var. <i>virginicus</i>	Virginia wild rye	0-1%	Yes	Native
<i>Panicum virgatum</i>	switchgrass	1-5%	Yes	Native
<i>POA PRATENSIS</i> SUBSP. <i>PRATENSIS</i>	KENTUCKY BLUEGRASS	1-5%	Yes	Native
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	little bluestem	5-25%	Yes	Native
<i>Sorghastrum nutans</i>	Indian grass	0-1%	?	Native
<i>Sporobolus compositus</i> var. <i>compositus</i>	rough dropseed	0-1%	?	Native
<i>Sporobolus heterolepis</i>	prairie dropseed	1-5%	Yes	Native
Forbs				
<i>Achillea millefolium</i>	common yarrow	1-5%	Yes	Native
<i>Asclepias syriaca</i>	common milkweed	1-5%	Yes	Native
<i>Astragalus canadensis</i>	Canada milk-vetch	1-5%	Yes	Native
<i>Chamaecrista fasciculata</i>	partridge pea	0-1%	Yes	Native
<i>CIRSIIUM ARVENSE</i>	CANADA THISTLE	5-25%	No	Nonnative
<i>Coreopsis palmata</i>	bird's foot coreopsis	1-5%	Yes	Native
<i>Dalea candida</i> var. <i>candida</i>	white prairie clover	0-1%	Yes	Native
<i>Dalea purpurea</i> var. <i>purpurea</i>	purple prairie clover	5-25%	Yes	Native
<i>Desmodium canadense</i>	Canada tick trefoil	0-1%	Yes	Native
<i>Helianthus giganteus</i>	giant sunflower	0-1%	?	Native
<i>Helianthus grosseserratus</i>	sawtooth sunflower	0-1%	?	Native
<i>Helianthus maximiliani</i>	Maximilian's sunflower	5-25%	Yes	Native
<i>Heliopsis helianthoides</i> var. <i>scabra</i>	ox-eye	0-1%	Yes	Native
<i>LACTUCA SERRIOLA</i>	PRICKLY LETTUCE	1-5%	No	Nonnative
<i>Lespedeza capitata</i>	round-headed bush clover	0-1%	Yes	Native
<i>MELILOTUS ALBA</i>	WHITE SWEET CLOVER	5-25%	No	Nonnative
<i>Monarda fistulosa</i>	wild bergamot	5-25%	Yes	Native
<i>Potentilla arguta</i> subsp. <i>arguta</i>	tall cinquefoil	0-1%	Yes	Native
<i>Ratibida pinnata</i>	gray-headed coneflower	5-25%	Yes	Native

Scientific Name	Common Name	Cover Range¹	Species Planted/Seeded²	Species Status
<i>Rudbeckia hirta</i> var. <i>pulcherrima</i>	black-eyed susan	5-25%	Yes	Native
<i>Solidago altissima</i>	late goldenrod	0-1%	No	Native
<i>Solidago canadensis</i>	Canada goldenrod	1-5%	No	Native
<i>Solidago gigantea</i>	giant goldenrod	1-5%	No	Native
<i>Solidago rigida</i>	stiff goldenrod	1-5%	Yes	Native
<i>Solidago speciosa</i>	showy goldenrod	0-1%	Yes	Native
<i>SONCHUS ARVENSIS</i>	FIELD SOW THISTLE	0-1%	No	Nonnative
<i>Symphyotrichum laeve</i> var. <i>laeve</i>	smooth aster	1-5%	Yes	Native
<i>Symphyotrichum ericoides</i>	heath aster	0-1%	Yes	Native
<i>TARAXACUM OFFICINALE</i>	COMMON DANDELION	0-1%	No	Nonnative
<i>TRAGOPOGON DUBIUS</i>	YELLOW GOATSBEARD	0-1%	No	Nonnative
<i>Zizia aptera</i>	heart-leaved alexanders	0-1%	Yes	Native
<i>Zizia aurea</i>	golden alexanders	1-5%	Yes	Native
Shrubs (and tree seedlings)				
<i>Amorpha canescens</i>	leadplant	0-1%	Yes	Native
<i>Acer negundo</i>	boxelder	0-1%	No	Native
<i>LONICERA TATARICA</i>	TARTARIAN HONEYSUCKLE	0-1%	No	Nonnative

¹ 0-1%, 1-5%, 5-25%, 25-50%, 50-75%, 75-100%

² ? = Species may have been part of bulk harvest seed broadcast seeded at site

Site Photographs



Photo 4-1 Mesic pollinator prairie seeding area, looking northeast.



Photo 4-2 Mesic pollinator prairie seeding area, illustrating exceptional expression of purple prairie clover in this area.



Photo 4-3 Drier, hilltop area south mesic prairie restoration area with abundant cover by purple prairie clover.



Photo 4-4 Overhead view of ground cover in area shown in previous photo.



Photo 4-5 View of restored mesic prairie on south side of mesic prairie seeding at Furgamme WMA.



Photo 4-6 DNR Regional Ecologist examining grasses in the restored mesic prairie on south side of mesic prairie seeding at Furgamme WMA.

5 Amiret Wildlife Management Area Prairie Restoration

Project Background

Project Name: Amiret WMA Prairie Restoration

Project Site: Amiret WMA

Township/Range Section: Township 111N Range 40W Section 32

Project Manager / Affiliated Organization: Alex Nelson, Pheasants Forever (PF)

Fund: OHF **Fiscal Year Funds:** 2016

Project Start Date: 2017

Predominant Habitat type: Prairie / Savanna / Grassland

Additional Habitat types:

Project Status: Post Establishment Phase



County: Lyon

Primary Activity: Prairie Restoration

Project Size: 118.17 acres

Project Completed: 2017

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

The project consists of three different seeding areas totaling 118.17 acres, including:

- 53.83 acres drilled into soybean stubble (plus broadcast seeding of some amount of bulk native harvest from nearby sites)
 - Dry prairie (19.08 ac.)
 - Mesic prairie (34.75 ac.)
- 64.34 ac. broadcast seeding of purchased and native bulk harvest

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Information regarding project planning and execution is housed with Pheasants Forever (PF) and MN DNR Wildlife. Plans primarily consist of:

- seed mixes for purchased seed,
- areas where native bulk harvest was conducted at other MN DNR sites,
- maps,
- summary of activities/dates, and

- photos
- 3. What are the stated goals of the project?**
Create diverse habitat for pollinators, non-game wildlife, game, and other wildlife
- 4. What are the desired outcomes of achieving the stated goals of the project?**
Diverse and stable populations of pollinators, non-game wildlife, and game
- 5. Were measures of restoration success identified in plans? No**
If yes, list specific measurements.
NA
- 6. Are plan Sets available? No Have project maps been created? Yes**
If yes, provide in "site maps" and list maps provided:
Seeding zone map with restoration timing/methods notes
- 7. Provide list of best management practices, standards, guidelines identified in plan set?**
Project restoration design included late winter dormant season seeding directly over soybean stubble (March 15, 2017), as well as drill and broadcast seed over soybean stubble (May 30, 2017)

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

- 8. Were alterations made to the plan during project implementation?**
No
Implementation of restoration occurred as planned.
- 9. In what ways did alterations change the proposed project outcome?**
Not applicable

Site Assessment

Field Review Date: 7/15/2021

Field Visit Attendees: Wendy Krueger, MN DNR Area Wildlife Manager; Troy Dale, MN DNR Assistant Area Wildlife Manager; Alex Nelson, Pheasants Forever; Gina Quiram, MN DNR EWR Restoration Evaluation Specialist; Paul Bockenstedt, Ecologist Stantec.

10. Surrounding Landscape Characteristics:

Surrounding land use at Amiret WMA includes public land (WMA) to the west, southeast and northeast. The Redwood River Sportsmen's Club adjoins the project area to the east. Row crop agriculture is common in other land area, with a smaller amount of pasture and unmaintained vegetation.

11. Site Characteristics:

a. Soil Series:

There are seven different soil series mapped within the restoration area at Amiret. Soil texture varies widely across the site from silty clay loam to loam, to sandy loam with mapped sand and gravel deposits at the surface. Mapped soil series (and approximate acreages) include:

- Canisteo clay loam (4.1 ac.)
- Arvilla sandy loam (2.4 ac.)

- Amiret-Swanlake loams (73.9 ac.)
- Rauville silty clay loam (<0.1 ac.)
- Storden-Ves complex (23.5 ac.)
- Normania loam (10.4)
- Calco silty clay loam (3.7 ac.)

b. Topography:

Topography of the restoration site at Amiret WMA is moderately rolling with irregular hills. The south side of the restoration area slopes down to an emergent (cattail) marsh on the south project area border.

c. Hydrology:

The restoration area is characterized by stark contrast in soil drainage class with well-drained to excessively drained soils adjacent to poor to very poorly drained soils (some of which are rated as whole-unit hydric soils).

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Vegetation within the project area is characterized largely by the native species in the restoration seed mixes.

12. Is the plan based on current science? Yes

Restoration techniques utilized follow current customary practice for native seeding

13. List indicators of project goals at this stage of project:

Dormant season broadcast seeding was conducted over soybean stubble the winter after the last soybean crop was harvested. In addition to the seed mixes purchased for this project, the seed mix was supplemented with bulk native harvest from other existing prairie reconstruction areas. Total native cover is generally good across this site, irrespective of the timing/method of seeding. A summary of each seed mix by installation method is listed below:

Mesic Prairie, Drill Seeded

A total of five of seven native grass and 14 of 28 native forbs seeded were observed, for a total of 19 of 35 species seeded being observed. A total of 42 plant species were observed (33 native and nine nonnative).

Mesic Prairie, Broadcast Seeded

A total of three of eight native grass and two of nine native forbs seeded were observed. 26 total plant species were observed, including seven nonnative species (four of which are invasive).

Dry Prairie, Drill Seeded

A total of six of seven native grasses and 10 of 27 forbs from the seed mix were observed (16 of 34 total species observed from seed mix). A total of 43 plant species were observed, including four nonnative and 13 native species that were not seeded.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes – observations lead evaluators to conclude goals have been achieved

15. Are corrections or modifications needed to achieve proposed goals?

Based on observations in the field, corrections/modifications are not necessary.

16. Do proposed or planned future steps, including long-term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Yes, the restoration area will be incorporated into regular maintenance schedule by MN DNR.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

Based on information from MN DNR, PF staff, and field observations, the planned and implemented activities contributed to the overall success of the project.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Follow-up evaluation does not appear to be necessary. The composition of the plant community appears to be established, stable, and at a point where only periodic maintenance will be required.

19. Additional comments on the restoration project.

There was little to no active grow-in maintenance conducted at this site. Despite this, the outcome has been good. Canada thistle is a particularly challenging issue with most prairie reconstruction projects. While Canada thistle was broadly present across this site, there were very few patches that were robust, obvious, and producing seed. Overtime the density of Canada thistle is expected to decline in the well-established diverse native planting.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

The restoration area was walked extensively, and the current composition of the overall restoration is good. As noted above, there are a few small pockets of invasives that are present in dense stands.

23. Site Assessor(s) conducting field review:

Paul Bockenstedt, Stantec; Gina Quiram, MN DNR

Site Maps, Project Plans or Vegetation Tables

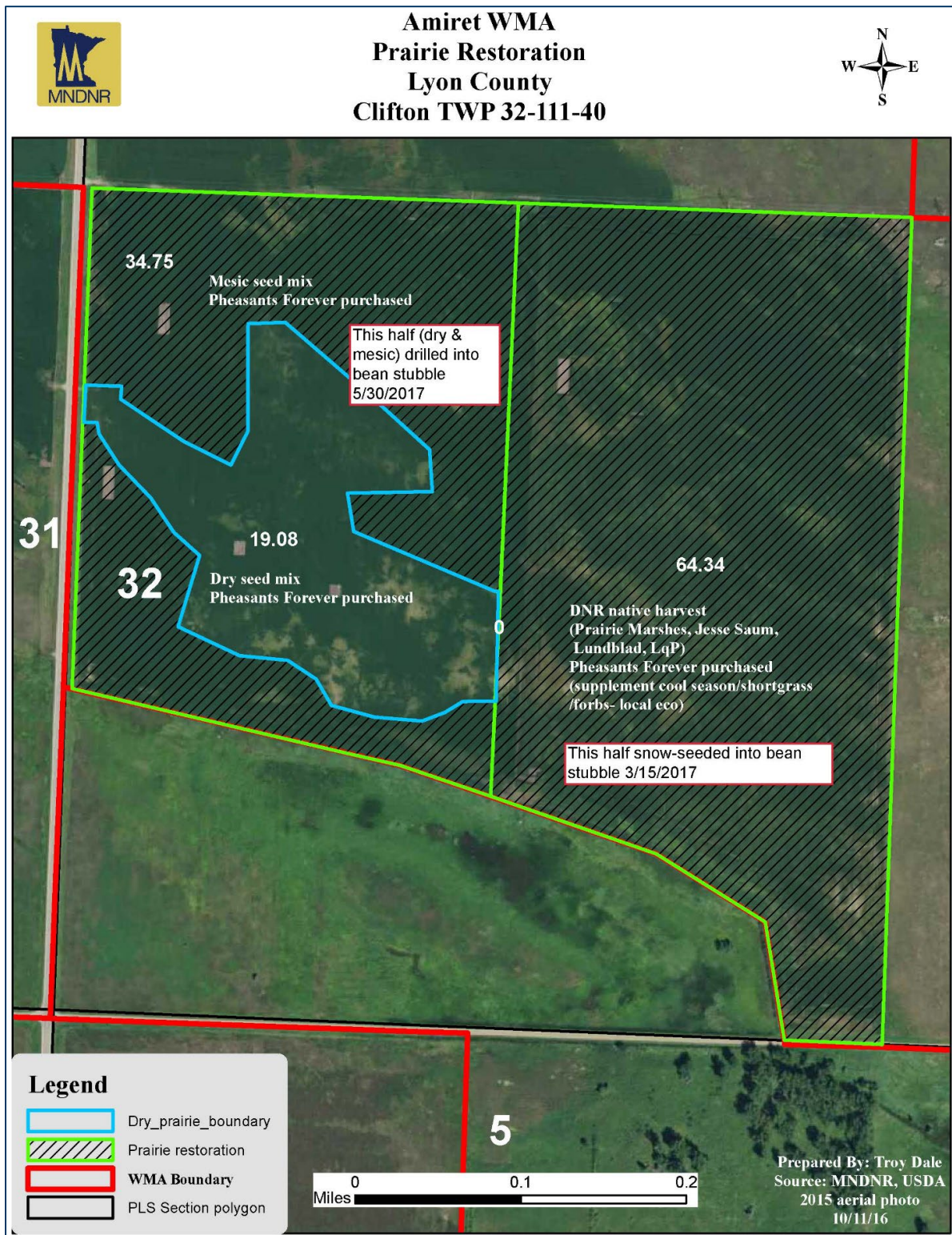


Figure 5-1 Amiret WMA map of prairie restoration types and seeding zones.

Table 5-1 Amiret WMA field meander survey results

Scientific Name	Common Name	Mesic Broadcast		Mesic Drill		Dry Drill		
		Cover Range ¹	Species Planted/ Seeded ²	Cover Range ¹	Species Planted/ Seeded ²	Cover Range ¹	Species Planted/ Seeded ²	Species Status
Graminoids								
Andropogon gerardii	big bluestem	1-5%	?			1-5%	?	Native
Bouteloua curtipendula var. curtipendula	side-oats grama			5-25%	Yes	5-25%	Yes	Native
Bouteloua gracilis	blue grama					1-5%	Yes	Native
BROMUS INERMIS	SMOOTH BROME			5-25%	No	1-5%	No	Nonnative
Bromus kalmii	Kalm's brome			1-5%	Yes	1-5%	Yes	Native
Carex brevior	short sedge	0-1%	?					Native
Dichanthelium leibergii	Leiberg's panic grass	0-1%	Yes					Native
Elymus canadensis var. canadensis	nodding wild rye	0-1%	?	1-5%	?			Native
Elymus trachycaulus	slender wheatgrass					1-5%	Yes	Native
Elymus virginicus var. virginicus	Virginia wild rye			1-5%	Yes	0-1%	?	Native
Koeleria macrantha	junegrass	0-1%	Yes					Native
Panicum virgatum	switchgrass					1-5%	Yes	Native
POA PRATENSIS SUBSP. PRATENSIS	KENTUCKY BLUEGRASS	1-5%	No	1-5%	No	1-5%	No	Nonnative
Schizachyrium scoparium var. scoparium	little bluestem	5-25%	Yes	5-25%	Yes	5-25%	Yes	Native
Sorghastrum nutans	Indian grass			1-5%	Yes	1-5%	?	Native
Forbs								
Agastache foeniculum	blue giant hyssop			0-1%	Yes			Native
Apocynum cannabinum	American hemp					0-1%	?	
ARTEMISIA ABSINTHIUM	ABSINTHE WORMWOOD	0-1%	No					Nonnative
Artemisia ludoviciana subsp. ludoviciana	white sage	0-1%	?	0-1%	?	1-5%	Yes	Native
Asclepias syriaca	common milkweed	1-5%	?	1-5%	?	1-5%	Yes	Native
Astragalus canadensis	Canada milk-vetch			5-25%	Yes	1-5%	?	Native
CIRSIIUM ARVENSE	CANADA THISTLE	5-25%	No	5-25%	No	5-25%	No	Nonnative
Coreopsis palmata	bird's foot coreopsis			0-1%	?	0-1%	?	Native
Dalea candida var. candida	white prairie clover	0-1%	Yes	5-25%	Yes	0-1%	Yes	Native
Dalea purpurea var. purpurea	purple prairie clover	0-1%	Yes	5-25%	Yes	5-25%	Yes	Native
Desmodium canadense	Canada tick trefoil			1-5%	Yes	1-5%	Yes	Native
Eryngium yuccifolium	rattlesnake master			0-1%	?			Native
Helianthus grosseserratus	sawtooth sunflower			1-5%	?			Native
Helianthus maximiliani	Maximilian's sunflower	1-5%	?	1-5%	Yes	1-5%	?	Native
Helianthus pauciflorus	stiff sunflower	0-1%	?					Native
Heliopsis helianthoides var. scabra	ox-eye			1-5%	Yes			Native
LACTUCA SERRIOLA	PRICKLY LETTUCE			0-1%	No			Nonnative
LOTUS CORNICULATUS	BIRD'S FOOT TREFOIL			0-1%	No			Nonnative
MEDICAGO LUPULINA	BLACK MEDICK	0-1%	No					Nonnative
MEDICAGO SATIVA	ALFALFA			0-1%	No			Nonnative
MELILOTUS ALBA	WHITE SWEET CLOVER			0-1%	No			Nonnative
Monarda fistulosa	wild bergamot	5-25%	?	5-25%	Yes			Native
Packera aurea	golden ragwort	0-1%	?	0-1%	?			Native
Penstemon gracilis	slender beard tongue					0-1%	?	Native
Ratibida columnifera	prairie coneflower	0-1%	?	0-1%	Yes			Native
Ratibida pinnata	gray-headed coneflower	1-5%	?	5-25%	Yes	1-5%	Yes	Native
Rudbeckia hirta var. pulcherrima	black-eyed susan			1-5%	No	0-1%	Yes	Native
Silphium perfoliatum var. perfoliatum	cup plant			0-1%	Yes			Native
Solidago altissima	late goldenrod			1-5%	No	0-1%	Yes	Native
Solidago canadensis	Canada goldenrod	1-5%	No	1-5%	No			Native
Solidago gigantea	giant goldenrod	1-5%	No					Native
Solidago nemoralis	gray goldenrod			0-1%	Yes			Native
Solidago rigida	stiff goldenrod	1-5%	?					Native
Symphyotrichum ericoides	heath aster	1-5%	?	0-1%	?	0-1%	Yes	Native
Symphyotrichum lanceolatum var. lanceolatum	eastern panicled aster			0-1%	?			Native
Symphyotrichum novae-angliae	New England aster			0-1%	Yes	0-1%	?	Native
TARAXACUM OFFICINALE	COMMON DANDELION	0-1%	No	0-1%	No	0-1%	No	Nonnative
TRAGOPOGON DUBIUS	YELLOW GOAT'S BEARD			0-1%	No			Nonnative
Verbena hastata	blue vervain			0-1%	Yes			Native
Zizia aurea	golden alexanders			0-1%	Yes	0-1%	Yes	Native
Shrubs (and tree seedlings)								
Amorpha canescens	leadplant					0-1%	Yes	Native
LONICERA TATARICA	TARTARIAN HONEYSUCKLE	0-1%	No					Nonnative

¹ 0-1%, 1-5%, 5-25%, 25-50%, 50-75%, 75-100%

² ? = Species may have been part of bulk harvest seed broadcast seeded at site

Site Photographs



Photo 5-1 Photo of snow seeding taken March 15, 2017.



Photo 5-2 Drilled vs. snow-seeded field on June 29, 2017. Snow-seeding occurred on March 15, 2017 and seed drilling occurred on May 30, 2017.



Photo 5-3 Project implementation team members and MN DNR evaluation staff in successful prairie restoration area at Amiret WMA.



Photo 5-4 Native establishment, total cover, and overall forb cover are generally good throughout the project area.



Photo 5-5 Hilltop areas showed good establishment of dry prairie species from the seed mix, including purple prairie clover.



Photo 5-6 View from southeast corner of project area, looking north-northwest illustrating uniform habitat cover including forbs from the native seed mix.

6 Swessinger Wildlife Management Area Wetland and Prairie Restoration

Project Background

Project Name: Swessinger WMA Wetland and Prairie Restoration

Project Site: Swessinger WMA

Township/Range Section: Township 104N Range 14W Section 17

Project Manager / Affiliated Organization: Jon Schneider, Ducks Unlimited

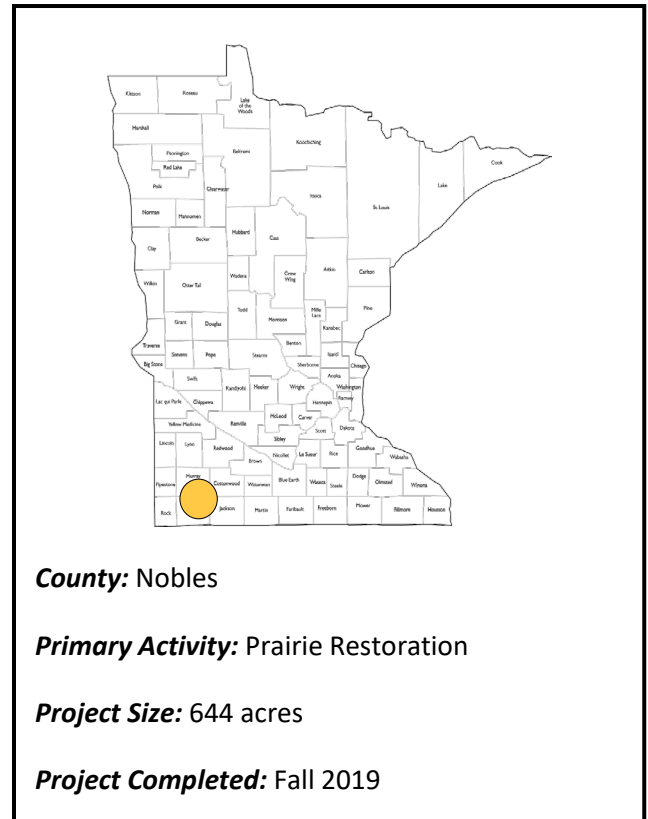
Fund: OHF **Fiscal Year Funds:** 2015

Project Start Date: July 2015

Predominant Habitat type: Prairie / Savanna / Grassland

Additional Habitat types: Wetland

Project Status: Post Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

The project included the following components:

- Wetland hydrologic modifications (site survey, engineering, construction)
- Stream re-meandering (site survey, engineering, construction)
- Native seeding (dry-mesic prairie, mesic prairie, wet meadow, emergent marsh)
- Grow-in management of native seeding areas (prescribed burn)

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Project records, survey and design documents (including as-built engineering design plan set) information is filed with Ducks Unlimited and MN DNR Area Wildlife office.

Additionally, DU included the following summary in their final grant project report:

“On the 644-acre Jones Tract at Swessinger WMA in Nobles County, restoration work began with Minnesota DNR field staff seeding 52 acres of the tract back to native grass and forbs in December

2015. DU then purchased a large quantity of additional native seed (100 different species) to restore over 500 additional upland and wetland acres of the tract in fall 2016 (based on expert guidance from Minnesota DNR prairie ecologists and wildlife biologists), which Minnesota DNR Wildlife staff broadcast seeded onto the site in fall 2016. At the same time, a private contractor hired by DU began wetland restorations in November 2016 and work continued until the ground froze in December 2016. Most wetlands were restored on the site by end of December 2016 except three larger wetland basins affecting county and township roads, which were later restored in 2018 and 2019 after DU and DNR negotiated with Nobles County and Bloom Township to develop mutually-acceptable restoration plans for each basin that maximized wetland hydrology restoration while meeting road safety and integrity concerns of the local units of government. All wetland work was eventually completed in fall 2019.”

3. What are the stated goals of the project?

Protect (through fee title purchase) and restore wetlands and prairie on the 644-acre Jones Tract of Swessinger WMA.

4. What are the desired outcomes of achieving the stated goals of the project?

Provide diverse wetland and upland habitat that supports diverse wildlife, for both resident and migratory wildlife.

5. Were measures of restoration success identified in plans? No

If yes, list specific measurements.

NA

6. Are plan Sets available? Yes Have project maps been created? Yes

If yes, provide in “site maps” and list maps provided:

- Engineering plan set (DU), including as-built mark ups
- Site restoration map (MN DNR)
- Seed mix tables, native seed vendor seed lists

7. Provide list of best management practices, standards, guidelines identified in plan set?

Engineering design plan set specifically identified MN DNR Operational Order 113 (Invasive Species BMPs).

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

Yes

Modifications were made to engineers estimated quantities for items such as cubic yards of excavation, rock, erosion control blanket and similar, as recorded through plan set mark ups (as-builts). The project manager (DU) and MN DNR staff did not indicate that there were any significant modifications made to restoration of native vegetation (seeding) from original plans.

9. In what ways did alterations change the proposed project outcome?

Not applicable

Site Assessment

Field Review Date: 7/16/2021

Field Visit Attendees: Jon Schneider, Ducks Unlimited; Bill Schuna, MN DNR Area Wildlife Manager; John Lindstrom, Ducks Unlimited; Megan Benage, MN DNR Regional Ecologist; Kent Schaap, MN DNR Assistant Area Wildlife Manager; Gina Quiram, MN DNR Restoration Evaluation Specialist; Scott Rall, Nobles County Chapter Pheasants Forever; Paul Bockenstedt, Senior Ecologist Stantec; Will Gallman, Pheasants Forever; Jesse Walker, Pheasants Forever Member.

10. Surrounding Landscape Characteristics:

The land surrounding Swessinger WMA is gently rolling and includes a mix of private, agricultural land (primarily corn/bean row cropping), and public land (Boom Waterfowl Production Area immediately to the south, as well as eight MN DNR WMAs within three miles of Swessinger WMA.

11. Site Characteristics:

a. Soil Series:

There are 23 mapped soil types within the approximately one-square mile of Swessinger WMA. Soil textures range from clay loams to silty clay loams, mucky silty clay loam, and sandy loam.

b. Topography:

Topography at Swessinger WMA is gently to moderately rolling

c. Hydrology:

The site supports seven or more depressional wetlands ranging from saturated to temporarily flooded, to semi-permanently flooded. Surficial flows traverse the site from west to east, through two wetlands. A portion of the stream connecting the two largest wetlands was historically ditched/straightened and was re-meandered as part of this project. In swales and convex side slopes, the water table is generally expected to be within 24 inches of the surface, per soil survey data.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Vegetation within the project area is characterized largely by the native species in the restoration seed mixes.

12. Is the plan based on current science? Yes

Survey, engineering design and construction techniques all appear consistent with current industry best practices. Native seed mixes were designed in a collaborative process between DU staff and MN DNR Wildlife/Ecological and Water Resources staff.

13. List indicators of project goals at this stage of project:

Wetland hydrology earthwork and structures all are reported by project partners to be functioning as intended/designed. During the site visit most wetlands were dry due to ongoing drought conditions. Native seeding has established well, with limited amounts of invasive plant species occurring as obvious patches (e.g., Canada thistle is present but not as thick robust clones with lots of seed heads).

Basic summary of each seed mix/seed type area includes:

Dry-mesic seed mix

Seed mix design included five grasses and 41 forbs (plus an unknown number of species from bulk harvest) Actual observed species from purchased seed includes three (of five) grasses and 17 (of 41) forbs. Total species noted is 39, of which 12 were grasses and 22 forbs. There was a total of seven invasive/nonnative species noted, most prominent was Canada thistle.

Mesic seed mix

Purchased seed included four grasses and 30 forbs. Actual observed includes four (of four) grass species and 22 (of 30) forb species. A total of 53 plant species were observed, 6 of which are invasive/nonnative. Natives that originated from the bulk harvest (or colonized the site on their own) totaled 19 species.

Wetland/Wet Meadow seeding

By virtue of naming of seed mixes from native vendors, it was difficult to ascertain which lists went to wetland or wet meadow. For the purposes of this summary, they were combined. A total of 11 of 17 graminoids (grasses, sedges, rushes) and seven or 32 forbs from the purchased seed list were observed. A total of 41 species were observed, of which three were invasive/nonnative (reed canary grass, Canada thistle and hybrid cattail).

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, based on observations and communications from project partners present, the site currently and will continue to achieve the desired outcomes.

15. Are corrections or modifications needed to achieve proposed goals?

None that were observed by field evaluation team, or known by DU or MN DNR staff

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Yes. Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

A small portion of the total amount of seed included in the wet meadow and wetland seed mixes curiously included a few dry prairie species. For instance, silky aster (a dry prairie plant species) was included in the wet meadow seed mix.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? No Explain.

Activities all appear to have contributed to the positive outcomes at this site.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Follow-up assessment does not appear to be necessary at this time.

19. Additional comments on the restoration project.

Overall native plant species richness across different seeding areas is good. The project included seeding of both purchased seed, as well as bulk harvest seed from other nearby WMAs and other donor sites.

While it was clear that there was some contribution to the overall native cover and higher species richness from the bulk harvest seed, there were no records of the amount of seed or species harvested, and no seed lab testing so it was not possible to determine the level of contribution that extra seed made. The bulk harvest seed was broadcast seeded in a different step/pass than drill seeding.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

Native vegetation establishment has been good, and consistent across the project site, resulting in quality wildlife habitat

23. Site Assessor(s) conducting field review:

Paul Bockenstedt, Senior Ecologist Stantec

Site Maps, Project Plans or Vegetation Tables

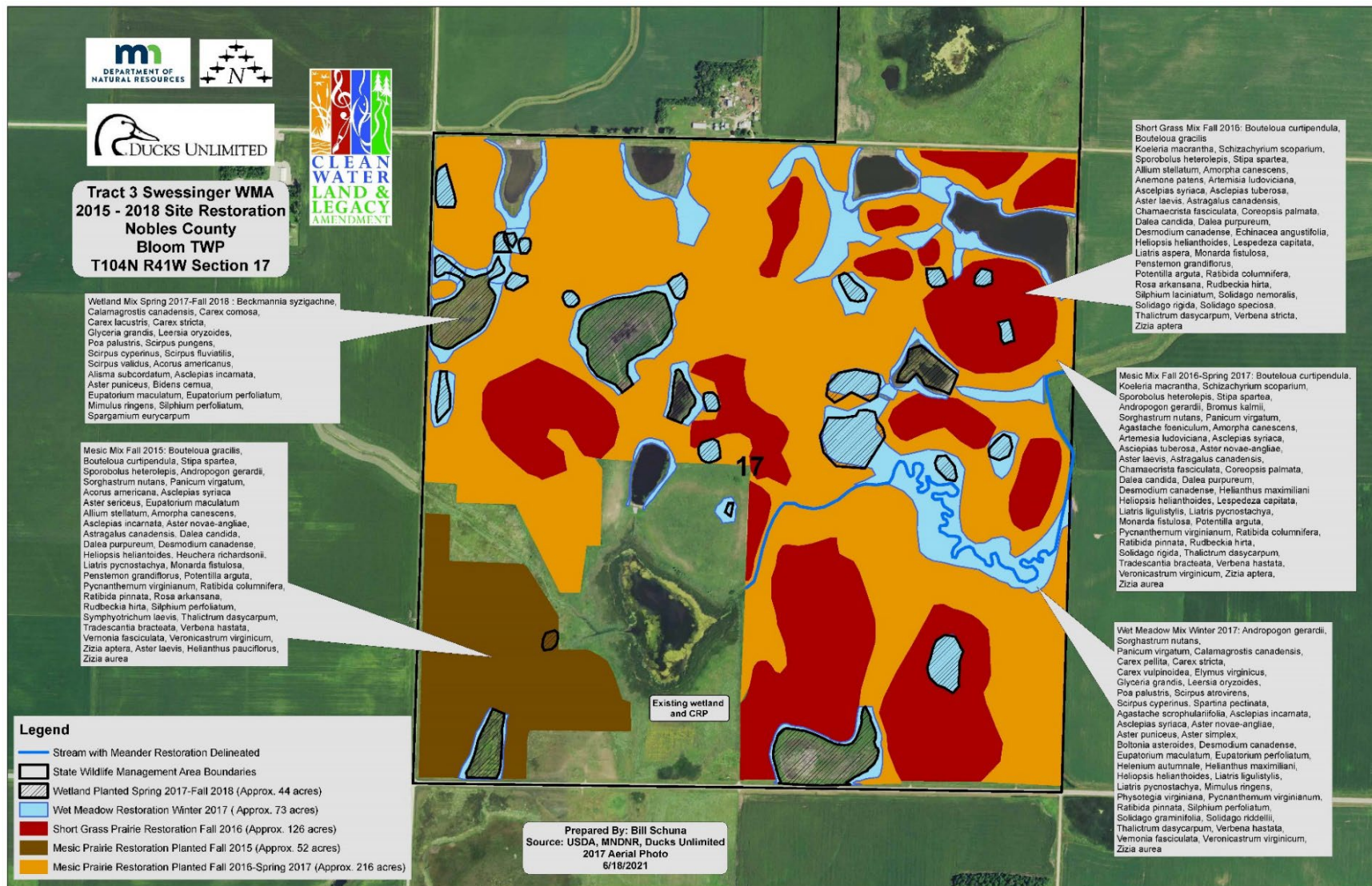


Figure 6-1 Summary native seeding map for Swessinger WMA restoration project.



Figure 6-2 Aerial photo of the Jones Tract in 1938 with signatures of multiple wetlands on the property.



Figure 6-3 Aerial photo of the Jones Tract in 2003 showing primarily row crop agriculture with one permanently flooded wetland.

Table 6-1 Swessinger WMA vegetation meander survey results

Scientific Name	Common Name	Dry-mesic Prairie		Mesic Prairie		Wetland ³		
		Cover Range ¹	Species Planted/Seeded ²	Cover Range ¹	Species Planted/Seeded ²	Cover Range ¹	Species Planted/Seeded ²	Species Status
Graminoids								
<i>Andropogon gerardii</i>	big bluestem			0-1%	?			Native
<i>Beckmannia syzigachne</i>	American slough grass					1-5%	Yes	Native
<i>Bolboschoenus fluviatilis</i>	river bulrush					1-5%	Yes	Native
<i>Bouteloua curtipendula</i> var. <i>curtipendula</i>	side-oats grama	5-25%	Yes	5-25%	Yes			Native
<i>BROMUS INERMIS</i>	SMOOTH BROME	1-5%	No	0-1%	No			Nonnative
<i>Bromus kalmii</i>	Kalm's brome	1-5%	?	0-1%	Yes			Native
<i>BROMUS TECTORUM</i>	CHEATGRASS	1-5%	No					Nonnative
<i>Carex comosa</i>	bristly sedge					1-5%	Yes	Native
<i>Carex hystericina</i>	porcupine sedge					0-1%	No	Native
<i>Carex vulpinoidea</i>	fox sedge					0-1%	Yes	Native
<i>Echinochloa crus-galli</i>	cockspur barnyard grass					0-1%	No	Native
<i>Eleocharis acicularis</i>	least spikerush					1-5%	No	Native
<i>Eleocharis erythropoda</i>	bald spikerush					1-5%	No	Native
<i>Elymus canadensis</i> var. <i>canadensis</i>	nodding wild rye	0-1%	?	1-5%	?			Native
<i>Elymus trachycaulus</i> subsp. <i>trachycaulus</i>	slender wheatgrass	1-5%	?					Native
<i>Elymus virginicus</i> var. <i>virginicus</i>	Virginia wild rye	1-5%	?	1-5%	?	5-25%	Yes	Native
<i>Glyceria grandis</i> var. <i>grandis</i>	tall manna grass					5-25%	Yes	Native
<i>Hesperostipa spartea</i>	porcupine grass			0-1%	?			Native
<i>Hordeum jubatum</i> subsp. <i>jubatum</i>	foxtail barley	1-5%	No			0-1%	No	Native
<i>Juncus dudleyi</i>	Dudley's rush					1-5%	No	Native
<i>Juncus nodosus</i>	knotty rush					0-1%	No	Native
<i>Juncus torreyi</i>	Torrey's rush					1-5%	No	Native
<i>Koeleria macrantha</i>	junegrass	1-5%	Yes	1-5%	Yes			Native
<i>Leersia oryzoides</i>	rice cut grass					1-5%	Yes	Native
<i>Panicum virgatum</i>	switchgrass			1-5%	?			Native
<i>PHALARIS ARUNDINACEA</i>	REED CANARY GRASS					1-5%	No	
<i>Phragmites australis</i> subsp. <i>americanus</i>	common reedgrass			0-1%	No			Native
<i>Poa palustris</i>	fowl bluegrass	0-1%	No	0-1%	?	5-25%	Yes	Native
<i>POA PRATENSIS</i> SUBSP. <i>PRATENSIS</i>	KENTUCKY BLUEGRASS	1-5%	No	1-5%	No			Nonnative
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	little bluestem	5-25%	Yes	5-25%	Yes			Native
<i>Schoenoplectus tabernaemontani</i>	soft stem bulrush					1-5%	Yes	Native
<i>Scirpus atrovirens</i>	dark green bulrush					1-5%	Yes	Native
<i>Spartina pectinata</i>	prairie cordgrass					0-1%	Yes	Native
<i>Sporobolus heterolepis</i>	prairie dropseed			1-5%	?			Native
Forbs								
<i>Achillea millefolium</i>	Yarrow			0-1%	?			Native
<i>Agastache foeniculum</i>	blue giant hyssop			0-1%	Yes			Native

Scientific Name	Common Name	Dry-mesic Prairie		Mesic Prairie		Wetland ³		
		Cover Range ¹	Species Planted/Seeded ²	Cover Range ¹	Species Planted/Seeded ²	Cover Range ¹	Species Planted/Seeded ²	Species Status
<i>Agastache scrophulariaefolia</i>	purple giant hyssop	0-1%	?					Native
<i>Alisma subcordatum</i>	heart-leaved water plantain					1-5%	Yes	
<i>Amaranthus retroflexus</i>	redroot amaranth					0-1%	No	
<i>Ambrosia artemisiifolia</i>	common ragweed	1-5%	No					Native
<i>Antennaria neglecta</i>	field pussytoes			0-1%	No			Native
<i>Artemisia ludoviciana subsp. ludoviciana</i>	white sage	1-5%	Yes	1-5%	Yes			Native
<i>Asclepias incarnata</i> var. <i>incarnata</i>	swamp milkweed					1-5%	No	
<i>Asclepias syriaca</i>	common milkweed	1-5%	Yes	1-5%	Yes			Native
<i>Asclepias tuberosa</i> var. <i>interior</i>	butterflyweed			0-1%	Yes			Native
<i>Bidens cernua</i>	nodding bur marigold					1-5%	Yes	
<i>Boltonia asteroides</i>	false aster					1-5%	Yes	
<i>CARDUUS ACANTHOIDES SUBSP. ACANTHOIDES</i>	PLUMELESS THISTLE	0-1%	No					Nonnative
<i>Chamaecrista fasciculata</i>	partridge pea	0-1%	Yes	0-1%	Yes			Native
<i>CIRSIUM ARVENSE</i>	CANADA THISTLE	5-25%	No	5-25%	No	1-5%	No	Nonnative
<i>Coreopsis palmata</i>	bird's foot coreopsis	1-5%	Yes	1-5%	Yes			Native
<i>Dalea candida</i>	white prairie clover	1-5%	Yes					Native
<i>Dalea purpurea</i> var. <i>purpurea</i>	purple prairie clover			1-5%	Yes			Native
<i>DAUCUS CAROTA</i>	QUEEN ANN'S LACE			0-1%	No			Nonnative
<i>Desmodium canadense</i>	Canada tick trefoil	5-25%	Yes	1-5%	Yes			Native
<i>Echinacea angustifolia</i>	narrow-leaved purple coneflower	0-1%	?					Native
<i>Erechtites hieraciifolius</i> var. <i>hieraciifolius</i>	pilewort					0-1%	No	
<i>Euthamia graminifolia</i>	grass-leaved goldenrod			1-5%	?			Native
<i>Helianthus giganteus</i>	giant sunflower	1-5%	?					Native
<i>Helianthus grosseserratus</i>	sawtooth sunflower	1-5%	?	0-1%	?			Native
<i>Helianthus maximiliani</i>	Maximilian's sunflower			1-5%	Yes			Native
<i>Heliopsis helianthoides</i> var. <i>scabra</i>	ox-eye			1-5%	Yes			Native
<i>Hypericum majus</i>	large St. John's-wort					0-1%	No	
<i>Lactuca canadensis</i>	Canada wild lettuce			0-1%	No			Native
<i>Lespedeza capitata</i>	round-headed bush clover			0-1%	Yes			Native
<i>Liatris aspera</i>	rough blazing star			0-1%	?			Native
<i>Liatris pycnostachya</i> var. <i>pycnostachya</i>	great blazing star			0-1%	Yes			Native
<i>Lysimachia ciliata</i>	fringed loosestrife			0-1%	?	0-1%	No	Native
<i>MELILOTUS ALBA</i>	WHITE SWEET CLOVER	1-5%	No					Nonnative
<i>Monarda fistulosa</i>	wild bergamot	5-25%	Yes	5-25%	Yes			Native
<i>Oenothera biennis</i>	common evening primrose			0-1%	?			Native
<i>Penstemon grandiflorus</i>	large-flowered beard tongue	0-1%	Yes					Native
<i>Penthorum sedoides</i>	ditch stonecrop					1-5%	No	
<i>Persicaria pensylvanica</i>	Pennsylvania smartweed					1-5%	No	
<i>Persicaria punctata</i>	dotted smartweed					0-1%	No	
<i>Potamogeton natans</i>	floating pondweed	Blank	Blank			0-1%	No	
<i>Potentilla arguta</i> subsp. <i>arguta</i>	tall cinquefoil	Blank	Blank	1-5%	Yes			Native

Scientific Name	Common Name	Dry-mesic Prairie		Mesic Prairie		Wetland ³		
		Cover Range ¹	Species Planted/Seeded ²	Cover Range ¹	Species Planted/Seeded ²	Cover Range ¹	Species Planted/Seeded ²	Species Status
<i>Pycnanthemum virginianum</i>	Virginia mountain mint	0-1%	Yes					Native
<i>Ratibida columnifera</i>	prairie coneflower	0-1%	Yes					Native
<i>Ratibida pinnata</i>	gray-headed coneflower	5-25%	Yes	1-5%	Yes			Native
<i>Rudbeckia hirta</i> var. <i>pulcherrima</i>	black-eyed susan	1-5%	Yes					Native
<i>RUMEX CRISPUS</i>	CURLY DOCK			0-1%	No			Nonnative
<i>Silphium laciniatum</i>	compass plant	1-5%	Yes	1-5%	?			Native
<i>Silphium perfoliatum</i> var. <i>perfoliatum</i>	cup plant					0-1%	Yes	
<i>Solidago canadensis</i>	Canada goldenrod	5-25%	?	1-5%	?			Native
<i>Solidago gigantea</i>	giant goldenrod	1-5%	?	0-1%	?			Native
<i>Solidago nemoralis</i>	gray goldenrod			0-1%	?			Native
<i>Solidago rigida</i>	stiff goldenrod	5-25%	Yes	1-5%	Yes			Native
<i>Sparganium eurycarpum</i>	giant bur-reed					1-5%	Yes	
<i>Stuckenia pectinata</i>	sago pondweed					0-1%	No	
<i>Symphyotrichum ericoides</i>	heath aster			0-1%	?			Native
<i>Symphyotrichum laeve</i>	smooth blue aster	1-5%	Yes	1-5%	Yes			Native
<i>Symphyotrichum novae-angliae</i>	New England aster			1-5%	Yes	1-5%	Yes	Native
<i>TARAXACUM OFFICINALE</i>	COMMON DANDELION	0-1%	No	1-5%	No			Nonnative
<i>Thalictrum dasycarpum</i>	tall meadow-rue	0-1%	Yes					Native
<i>TYPHA</i> × <i>GLAUCA</i>	HYBRID CATTAIL					5-25%	No	Nonnative
<i>Verbena hastata</i>	blue vervain					0-1%	No	
<i>Verbena stricta</i>	hoary vervain			0-1%	?			Native
<i>Vernonia fasciculata</i>	bunched ironweed					0-1%	Yes	
<i>Veronicastrum virginicum</i>	Culver's root			0-1%	Yes			Native
<i>Zizia aptera</i>	heart-leaved alexanders	1-5%	Yes	0-1%	Yes			Native
<i>Zizia aurea</i>	golden alexanders			0-1%	Yes			Native
Shrubs (and tree seedlings)								
<i>Amorpha canescens</i>	leadplant			0-1%	Yes			
<i>Populus deltoides</i> subsp. <i>monilifera</i>	cottonwood					0-1%	No	

¹ 0-1%, 1-5%, 5-25%, 25-50%, 50-75%, 75-100%

² ? = Species may have been part of bulk harvest seed broadcast seeded at site

³ Includes both wetland and wet meadow seeding areas

Site Photographs



Photo 6-1 View of mesic prairie seeded area on southeast side of WMA illustrating overall dominance by native cover from seeded native species. Blooming bergamot was prominent at the site, despite the unusually dry growing season.



Photo 6-2 View of dry-mesic prairie seeding area on northwest side of project site, looking southeast across WMA.



Photo 6-3 Evaluation group reviewing vegetation establishment in the bottom of a dry emergent wetland area on the southeast side of Swessinger WMA. Vegetation in this area includes a mix of seeded native, volunteer native and colonizing nonnative (hybrid cattail) plant species.



Photo 6-4 View of overflow channel for wetland shown in Photo 3 that is characterized by a mix of native and nonnative (hybrid cattail) vegetation.



Photo 6-5 View of a wet meadow seeding area on the southeast side of Swessinger WMA that includes mostly native plant species, as well as nonnative hybrid cattail in the background.



Photo 6-6 View looking south across a restored wetland on the northeast side of Swessinger WMA. Hybrid cattail comprise the majority of plant cover in the emergent fringe, with native, seeded plant species also present.



Photo 6-7 View of emergent wetland mud flat of the wetland shown in Photo 6 with native pond weed and softstem bulrush colonizing.



Photo 6-8 View of dry-mesic prairie hilltop on northeast side of Swessinger WMA looking southeast toward hydrologically restored wetland area. The dry-mesic prairie restoration in this area included several species that were not specifically identified in the restoration seed mix and presumably were part of the bulk native harvest seed that was broadcast at the site.

7 Cannon River Turtle Preserve SNA Prairie Enhancement

Project Background

Project Name: Accelerated Forest Wildlife Habitat Program, Phase I – Cannon River Turtle Preserve SNA

Project Site: Cannon River

Township/Range Section: Township 113N Range 16W Section 25

Project Manager / Affiliated Organization: Bob Welsh, MN DNR – Fish & Wildlife

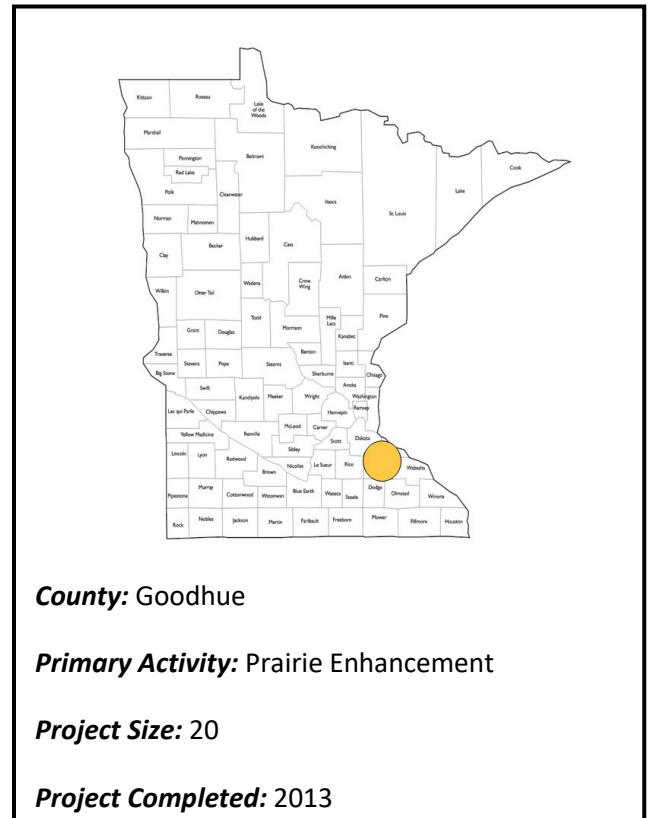
Fund: OHF **Fiscal Year Funds:** 2010

Project Start Date: 2012

Predominant Habitat type: Forest

Additional Habitat types: Prairie / Savana / Grassland

Project Status: Post Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

The key components of this project included 1.) hand cut/treat of invasive trees and shrubs in former crop field fence line as well as two remnant bedrock bluff prairies overlooking the Cannon River, and 2.) conduct prescribed fire of two reconstructed prairie areas (former crop ground) and two remnant bedrock bluff prairie areas where invasive brush cut/treat work was conducted.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

MN DNR SNA program staff have records for tools, timing and methods for work that occurred at this site. Records include forms/written narratives of work as well as GIS-based mapping.

3. What are the stated goals of the project?

Decrease levels of invasive brush in remnant bluff prairie areas, remove trees and other woody growth in fence line bordering prairie reconstruction (former crop ground), and implement prescribed burn to stimulate native prairie vegetation and suppress invasive woody vegetation.

4. What are the desired outcomes of achieving the stated goals of the project?

Increased total cover and condition of native prairie

5. **Were measures of restoration success identified in plans? No**
If yes, list specific measurements.
NA - no plans were developed
6. **Are plan Sets available? No Have project maps been created? Yes**
If yes, provide in "site maps" and list maps provided:
Cannon River Turtle Preserve SNA – Enhancement ML2010
7. **Provide list of best management practices, standards, guidelines identified in plan set?**
No engineering/design plan set was developed for this project. Work was executed in accordance with a site management plan (1997) as well as relevant MN DNR Operational Orders and resource management practices.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. **Were alterations made to the plan during project implementation?**
No
No alterations were reported
9. **In what ways did alterations change the proposed project outcome?**
Not applicable, no significant alterations were made to planned management activities

Site Assessment

Field Review Date: 9/21/2021

Field Visit Attendees: Russ Smith – MN DNR SNA Central Region Site Manager, Wade Johnson – MNDNR, Paul Bockenstedt – Senior Ecologist Stantec

10. Surrounding Landscape Characteristics:

The site occurs within Cannon River Turtle Preserve SNA. The project area prairie units occur on moderate to steep south-facing slopes characterized by somewhat open to dense, brushy oak woodland on the slopes. The Cannon River floodplain lies at the base of the slope, south of the management area and is characterized by floodplain and terrace forest, with intermittent open meadows and sand/gravel bars. The area to the north of the project area includes crop ground common to southeast Minnesota where hilltops and shoulder slopes are accessible by farm equipment for cultivation and row crop production.

11. Site Characteristics:

a. Soil Series:

Remnant dry bluff prairie openings are comprised of Brodale-Bellechester complex soils (flaggy fine sandy loam and flaggy to very flaggy loam) on 30-60% slopes. The bluff prairie slopes have a plate-like flagstone at the surface in amounts that vary from nearly absent to moderately dense at this site. The north unit of the project area (prairie reconstruction) is largely comprised of Timula-Mt. Carroll complex soils (silt loam) with 6-18% slopes and a small area of Brodale-Bellechester complex soils (flaggy fine sandy loam and flaggy to very flaggy loam) on 30-60% slopes.

b. Topography:

The bluff prairies are characterized by moderately steep to very steep slopes. The north prairie reconstruction area has slopes that are moderate to moderately steep.

c. Hydrology:

The steep slopes, thin soils and bedrock at or near the surface result in well drained to excessively drained.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Dry, bedrock bluff prairie areas are characterized by a mix of native remnant prairie species with moderately good species richness (estimated quality rank of BC to C). The prairies appear to have been historically grazed and in recent decades increasingly colonized by shrubs and trees, including the invasive, nonnative Oriental bittersweet (encountered occasionally here). Vegetation was comprised more of grasses and sedges than forbs. Graminoids observed on the bluff prairie include 10 native grasses (e.g., panic grass, Indian grass, sideoats grama grass) and two native sedges, as well as the occasionally observed nonnative Canada bluegrass. A total of 32 native forbs were observed in lesser amounts compared to native grasses. Commonly observed forbs on the bluff prairie include bergamot, flowering spurge, tall anemone, purple prairie clover, false boneset and others. The north prairie reconstruction is dominated largely by a mix of tall native grasses (Indian grass) and scattered native forbs (bergamot, yellow coneflower, several species of goldenrod).

12. Is the plan based on current science? Yes

The approach and methods for controlling invasive woody growth of cut/treat and follow-up foliar treatment of resprouts, along with the periodic application of prescribed fire, is consistent with current best practices for treating woody growth in remnant and reconstructed prairie.

13. List indicators of project goals at this stage of project:

Based on past conditions reported by MN DNR SNA staff as well as evidence of recolonization of native herbaceous cover into areas where brush clearing has occurred indicates progress in has been made in maintaining the prairie reconstruction area and restoring the dry bluff prairie remnant areas.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes. The woody cut/treat and prescribed burn resource management activities that were implemented under the grant funding have: 1.) reversed the trend in the remnant bluff prairie of invasive woody species displacing native prairie plants, and 2.) reduced the risk of woody invasion into the reconstructed prairie by removing invasive trees and brush in a former fence line.

15. Are corrections or modifications needed to achieve proposed goals?

No corrections or modifications are needed.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

This grant-funded project activities concluded in 2013. Since that time, MN DNR staff have endeavored to maintain or expand the gains made through the 2012-13 OHF Grant-funded efforts. Since 2013, efforts have been challenging to implement consistently due to challenges associated with funding, staffing, and, most recently, restrictions on conducting work due to COVID-19.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No. Work conducted since 2013 has been supportive of maintaining or improving the quality of the two prairie areas (remnant and reconstructed) at this site.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No, for several reasons. The work completed with OHF funds accomplished intended goals and MN DNR conducts regular site visits and monitoring as part of normal operations.

19. Additional comments on the restoration project.

Initial work conducted with OHF grant dollars provided improvement during the project period. Restrictions to staff time and funding since 2013 has meant that the remnant prairie has not continued on the upward trajectory of improvement but has largely stayed at about the same stage of recovery. More substantial progress could have potentially been made on the remnant prairie through 1.) more intense work during the 2012-13 grant-funded time period, 2.) longer grant-funded project time frame, and/or 3.) subsequent restoration implementation phases to enable building on the gains made during the 2012-13 OHF project.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

OHF Grant-funded effort clearly helped arrest woody invasives expansion, particularly on the remnant bluff prairie.

23. Site Assessor(s) conducting field review:

Wade Johnson, MN DNR Legacy Evaluation Team; Paul Bockenstedt, Senior Ecologist - Stantec

Site Maps, Project Plans or Vegetation Tables

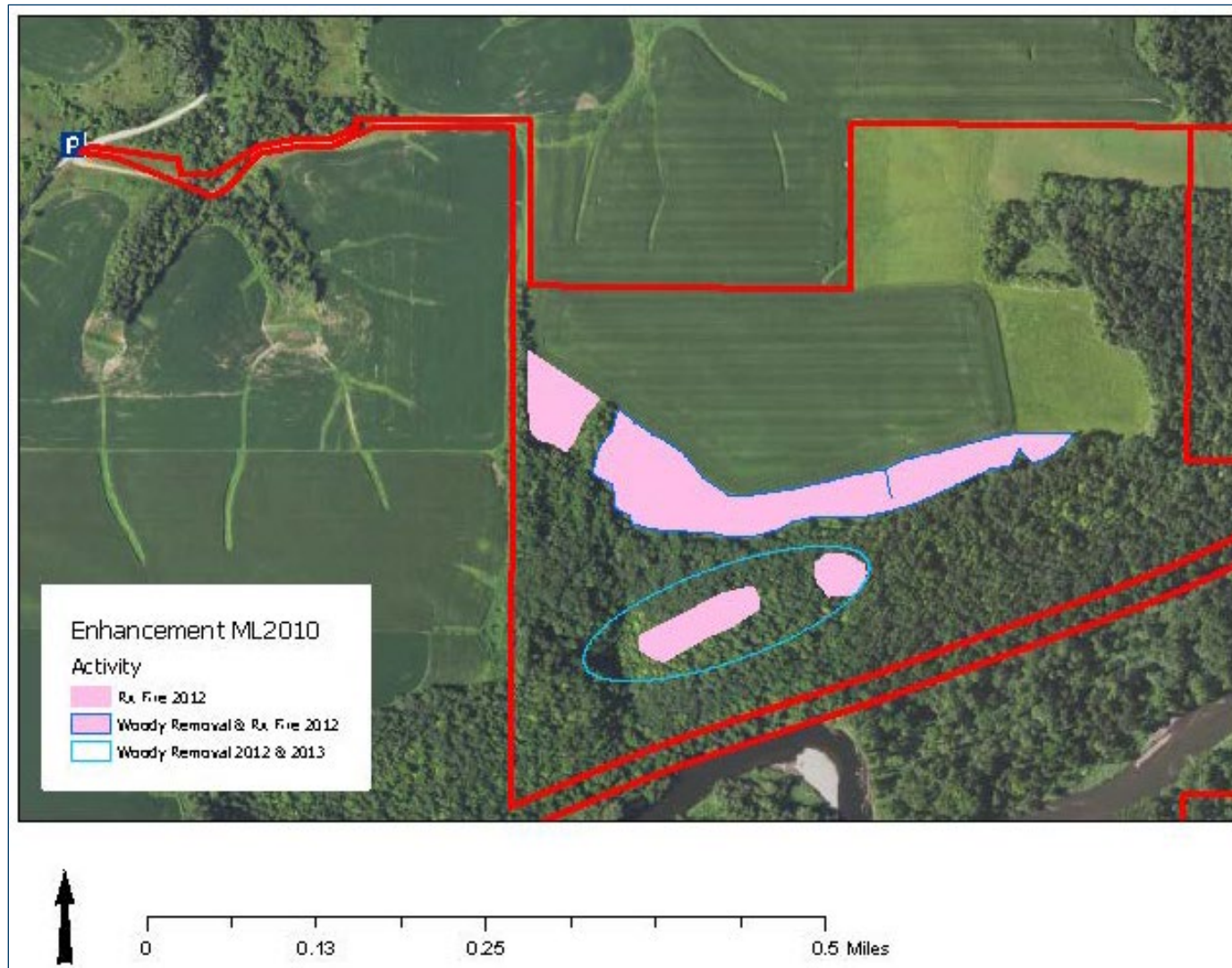


Figure 4 Location map of 2012-13 OHF Grant-funded restoration invasive woody management and prescribed burning work at Cannon River Turtle Preserve SNA, Goodhue County (source: MN DNR SNA program).

Table 2 Meander survey results for Cannon River Turtle Preserve SNA 2012-13 OHF Grant-funded restoration effort. Meander survey data September 21, 2021.

Scientific Name	Common Name	Cover Range¹	Species Planted/ Seeded²	Species Status
Graminoids				
<i>Bouteloua curtipendula</i> var. <i>curtipendula</i>	side-oats grama	5-25%	NA	Native
<i>Carex blanda</i>	charming sedge	0-1%	NA	Native
<i>Carex inops</i> subsp. <i>heliophila</i>	sun-loving sedge	1-5%	NA	Native
<i>Dichanthelium oligosanthes</i>	Scribner's panic grass	1-5%	NA	Native
<i>Elymus canadensis</i> var. <i>canadensis</i>	nodding wild rye	0-1%	NA	Native
<i>Hesperostipa spartea</i>	porcupine grass	1-5%	NA	Native
<i>Muhlenbergia cuspidata</i>	Plains muhly	1-5%	NA	Native
<i>Muhlenbergia frondosa</i>	swamp muhly grass	0-1%	NA	Native
POA COMPRESSA	CANADA BLUEGRASS	1-5%	NA	NONNATIVE
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	little bluestem	1-5%	NA	Native
<i>Sorghastrum nutans</i>	Indian grass	5-25%	NA	Native
<i>Sporobolus heterolepis</i>	prairie dropseed	0-1%	NA	Native
Forbs				
<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot	0-1%	NA	Native
<i>Anemone cylindrica</i>	long-headed thimbleweed	0-1%	NA	Native
<i>Anemone virginiana</i>	tall thimbleweed	0-1%	NA	Native
<i>Antennaria plantaginifolia</i>	plantain-leaved pussytoes	0-1%	NA	Native
<i>Aquilegia canadensis</i>	columbine	0-1%	NA	Native
<i>Asclepias verticillata</i>	whorled milkweed	0-1%	NA	Native
ASPARAGUS OFFICINALIS	ASPARAGUS	0-1%	NA	Native
<i>Brickellia eupatorioides</i> var. <i>corymbulosa</i>	false boneset	1-5%	NA	Native
<i>Cirsium altissimum</i>	tall thistle	0-1%	NA	Native
<i>Dalea candida</i> var. <i>candida</i>	white prairie clover	0-1%	NA	Native
<i>Dalea purpurea</i> var. <i>purpurea</i>	purple prairie clover	1-5%	NA	Native
<i>Euphorbia corollata</i> var. <i>corollata</i>	flowering spurge	1-5%	NA	Native
<i>Galium concinnum</i>	shining bedstraw	0-1%	NA	Native
<i>Gentianella quinquefolia</i> var. <i>occidentalis</i>	stiff gentian	0-1%	NA	Native
<i>Geum triflorum</i>	prairie smoke	0-1%	NA	Native
<i>Helianthus pauciflorus</i>	stiff sunflower	0-1%	NA	Native
<i>Lactuca canadensis</i>	Canada wild lettuce	0-1%	NA	Native
<i>Monarda fistulosa</i>	wild bergamot	1-5%	NA	Native

Scientific Name	Common Name	Cover Range¹	Species Planted/ Seeded²	Species Status
<i>Oenothera biennis</i>	common evening primrose	0-1%	NA	Native
<i>Potentilla arguta</i> subsp. <i>arguta</i>	tall cinquefoil	0-1%	NA	Native
<i>Prenanthes racemosa</i>	smooth rattlesnakeroot	0-1%	NA	Native
<i>Ratibida pinnata</i>	gray-headed coneflower	1-5%	NA	Native
<i>Solidago gigantea</i>	giant goldenrod	1-5%	NA	Native
<i>Solidago rigida</i> subsp. <i>rigida</i>	stiff goldenrod	0-1%	NA	Native
<i>Solidago ulmifolia</i> var. <i>ulmifolia</i>	elm-leaved goldenrod	0-1%	NA	Native
<i>Symphyotrichum ericoides</i>	heath aster	1-5%	NA	Native
<i>Symphyotrichum oblongifolium</i>	aromatic aster	0-1%	NA	Native
<i>Symphyotrichum oolentangiense</i>	skyblue aster	1-5%	NA	Native
VERBASCUM THAPSUS	COMMON MULLEIN	0-1%	NA	NONNATIVE
<i>Viola palmata</i> var. <i>pedatifida</i>	bearded birdfoot violet	0-1%	NA	Native
<i>Viola sororia</i>	common blue violet	0-1%	NA	Native
Shrubs (and tree seedlings)				
<i>Cornus racemosa</i>	gray dogwood	5-25%	NA	Native
<i>Ulmus americana</i>	American elm	0-1%	NA	Native
<i>Juglans nigra</i>	black walnut	0-1%	NA	Native
<i>Rhus glabra</i>	smooth sumac	5-25%	NA	Native
<i>Populus tremuloides</i>	quaking aspen	1-5%	NA	Native
RHAMNUS CATHARTICA	COMMON BUCKTHORN	1-5%	NA	NONNATIVE
<i>Amorpha canescens</i>	leadplant	0-1%	NA	Native
<i>Rubus occidentalis</i>	black raspberry	5-25%	NA	Native
<i>Toxicodendron radicans</i> subsp. <i>Negundo</i>	common poison ivy	0-1%	NA	Native
<i>Fraxinus pennsylvanica</i>	green ash	0-1%	NA	Native
<i>Prunus serotina</i>	black cherry	0-1%	NA	Native
<i>Celtis occidentalis</i>	hackberry	0-1%	NA	Native
<i>Quercus ellipsoidalis</i>	northern pin oak	0-1%	NA	Native
<i>Prunus pumila</i>	sand cherry	0-1%	NA	Native
Vines				
CELASTRUS ORBICULATUS	ASIAN BITTERSWEET	0-1%	NA	NONNATIVE
<i>Smilax tamnoides</i>	greenbrier	1-5%	NA	Native
<i>Vitis riparia</i>	wild grape	0-1%	NA	Native
<i>Clematis virginiana</i>	virgin's bower	0-1%	NA	Native

¹ 0-1%, 1-5%, 5-25%, 25-50%, 50-75%, 75-100%

² Please note that the column heading is part of standard reporting format – this project did not include seeding

Site Photographs



Photo 9 View of former crop field fence line, looking southeast from northwest corner. Prior to the 2012-13 OHF Grant-funded project, the border between crop field and reconstructed prairie was characterized by trees and brush. (Cannon River Turtle Preserve SNA, photo taken during site visit 9/21/2021). All figures and tables will require alt text. Right click on the figure or image, click format picture, go to the layout and properties icon and open the alt text field. Then you can add a title and alt text. For guidance and examples of alt text you can visit the [Minnesota IT Services guidance](#).



Photo 10 View of former crop field fence line, looking south from edge of crop field. Brown vegetation is invasive woody growth that was spot foliar treated with herbicide in late summer 2021 as part of ongoing follow-up treatments to sustain gains made during work associated with 2012-13 OHF Grant-funded work. (Cannon River Turtle Preserve SNA, photo taken during site visit 9/21/2021).



Photo 11 View of remnant bedrock bluff prairie where invasive tree and brush removal work was conducted during 2012-13 OHF Grant-funded work. (Cannon River Turtle Preserve SNA, photo taken during site visit 9/21/2021).



Photo 12 View of remnant bedrock bluff prairie looking west, where invasive tree and brush removal work was conducted during 2012-13 OHF Grant-funded work. (Cannon River Turtle Preserve SNA, photo taken during site visit 9/21/2021).



Photo 13 View of remnant bedrock bluff prairie where buckthorn colonized areas that were formerly under the drip line of eastern red cedar trees that were removed during 2012-13 OHF Grant-funded work. Work continues to follow-up treat these areas as agency resources allow (Cannon River Turtle Preserve SNA, photo taken during site visit 9/21/2021).

8 Blue Mounds State Park Prairie & Stream Restoration

Project Background

Project Name: Blue Mounds State Park

Project Site: Embankment and Wet Meadow

Township/Range Section: Township 103N Range 45W Section 24

Project Manager / Affiliated Organization:
Molly Tranel - MNDNR, Becky Thompson - MNDNR

Fund: PTF **Fiscal Year Funds:** 2019

Project Start Date: 2019

Predominant Habitat type: Wetland

Additional Habitat types: Aquatic , Prairie / Savana
/ Grassland

Project Status: Post Establishment Phase



County: Rock

Primary Activity: Prairie Restoration

Project Size: 14 acres

Project Completed: October 2019

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

In 2016, the dam along Mound Creek at the South Mound Creek Pool failed and drained the pool and some adjacent wetlands leading to an unstable stream system and adventive non-native vegetation dominating the floodplain. Beginning in 2017, local genotype seed was collected in preparation for post-restoration seeding. In 2020, following channel reconstruction and berm placement, the mesic prairie embankment was seeded by MNDNR staff and the while the contractor used a similar but separate mix to seed the floodplain terrace as shown in Figure 1. Invasive species were spot-treated with broad-spectrum herbicides in these areas in 2021.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

An original restoration work plan was created in January 2017 which outlined schedules, methods, and a long-term management outline for the project. Changes to the plan were described by MNDNR land managers and an updated figure was created to reflect actual seeding locations that differed from the 2017 plan figure.

3. What are the stated goals of the project?

- Restore hydrology to conditions similar to those prior to dam installation.

- Restore native prairie and wetland vegetation to the disturbed portions of the project area.
- Immediately revegetate construction areas to diverse native vegetation or temporary cover crop to comply with Stormwater Pollution Prevention Plan (SWPPP).

4. *What are the desired outcomes of achieving the stated goals of the project?*

The desired outcome is to have an open, native-dominated riparian and wetland system along the new Mound Creek channel that provides habitat support for native species, especially rare and important species such as the Topeka Shiner (MN SC, Federally Endangered) and Blanding's Turtle (MN THR), both of which are known to occur near the project area and depend upon healthy functioning stream ecosystems.

5. *Were measures of restoration success identified in plans? Yes*

If yes, list specific measurements.

A successful vegetation restoration would:

- Be dominated by native species and compete with invasives,
- Cover and stabilize soils, and
- Contain a diverse mix of grass, forbs, sedge, and shrubs, but minimal tree species.

6. *Are plan Sets available? Yes Have project maps been created? Yes*

If yes, provide in "site maps" and list maps provided:

A restoration work plan and associated figure was created in 2017 to support annual work plans and goals. A revised seeding figure was created during restoration to more accurately show seed mix installation ones. See included Figure 1 below.

7. *Provide list of best management practices, standards, guidelines identified in plan set?*

The project is following current best management practices common in stream and native prairie community restoration. Seed was collected from local communities to protect local genotype dominance, grassland mowing was conducted after August 1 to protect early season ground nesting birds, a combination of prescribed fire and spot herbicide applications will be used, and seed application is being managed for success including delaying spring drought seeding for later frost seeding under more favorable conditions.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. *Were alterations made to the plan during project implementation?*

Yes

The area designated for the High Diversity Mix was planned for a native seeding in spring 2021, however due to persistent drought conditions, the seeding has been rescheduled for fall 2021. The mix will be frost seeded in late fall instead. During the final earthen dam removal, it was discovered that the embankment had been used by snakes as a hibernaculum. The project team adjusted plans and worked to create a new hibernaculum structure and rock pile entrance immediately south of the previous dam structure. A wildlife crossing was also installed parallel with the water under the footpath on the embankment and a replacement snake hibernaculum was created adjacent to the site. Monitoring is ongoing to determine species use. The north terrace area that was originally planned for an upland seed mix has been found to be wetland with variable hydrology and will be allowed to revert to wetland.

Additionally following construction and seeding, corrections to site hydrology required installing four berms parallel to mound creek.

9. *In what ways did alterations change the proposed project outcome?*

The High Diversity seed area east of the embankment was not evaluated in 2021 due to the delayed seeding during unfavorable drought conditions in spring 2021. This area is still targeted for restoration to a native prairie community following a 2021 fall seeding. Berm construction following seeding provided opportunity for non-native and invasive species to establish. The other alterations in the restoration plan have not likely significantly altered the outcome or long-term success of the project.

Site Assessment

Field Review Date: 7/26/2021

Field Visit Attendees: Molly Tranel - MNDNR, Becky Thompson - MNDNR, Gina Quiram – MNDNR, and Will Taylor – Cardno

10. *Surrounding Landscape Characteristics:*

The site is located within Blue Mounds State Park which primarily supports a biologically significant shallow topsoil prairie community and is ranked by the Minnesota Biological Survey as having outstanding biological significance. Beyond the park boundaries, the region is heavily dominated by row crop agriculture and the Rock River is less than a mile to the east.

11. *Site Characteristics:*

a. *Soil Series:*

Colo silty clay loam, deep loess, 0 to 2 percent slopes, occasionally flooded

Ihlen-Rock outcrop complex, 4 to 35 percent slopes

Alcester silty clay loam, cool, 0 to 2 percent slopes

b. *Topography:*

The site features low rolling topography varying by approximately 30 feet within the project area. The Mound Creek stream valley dominates the topography, with remnant shoreline and dam features still evident along the corridor running west to east.

c. *Hydrology:*

Groundwater and runoff flows into Mound Creek, which flows east beyond the park where it contributes to the Rock River. Springs are evident in the floodplain terraces as the ground remains spongy and saturated during much of the year. The borrow pits, where material was excavated to create the berms, are typically saturated or ponded during portions of the year.

d. *Vegetation: Plant Communities, Dominant Species & Invasives % Cover:*

Areas that were previously flooded by the Mound Creek Pool, are now recovering floodplain terraces planted with mesic prairie seed mixes. They are being restored to reflect Southern Mesic Prairie (Ups23a) communities dominated by native tallgrass prairie species such as Big Bluestem, Indian Grass, Switchgrass, and various asters and other forbs. Shorelines and wetter areas were seeded with wet meadow/riparian mixes combining wetland sedges and rushes with sandbar willow live stakes. Invasive and early adventive species are currently common on the site such as sweet clover, Canada thistle, and common and giant ragweed. Non-native invasive cover is currently greater than 50% across the evaluation area.

12. *Is the plan based on current science?* Yes

The project combined modern stream restoration guidelines, recreating a meandering channel and floodplain terrace and used native local genotype seeds according to the presumed hydrological regime in all areas.

13. *List indicators of project goals at this stage of project:*

The observed areas can be considered suitably stabilized and covered by a mix of annual and perennial vegetation, which satisfies one of the project goals. However, over half of this vegetative cover is comprised of non-native invasive species or species such as giant and common ragweeds which will likely persist during the early post-establishment phase.

14. *Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?*

Due to project alterations described elsewhere, the timeline may need to be extended and alternatives to prescribed fire may need to be used as lack of certified crews or suitable weather/hydrology often delay or postpone fires for years. Additional time and management visits will likely be needed during the early implementation phase.

15. *Are corrections or modifications needed to achieving proposed goals?*

Due to the high invasive species cover, the site may need additional restoration attention, such as prioritizing the site for prescribed burning, spring mowing, and additional monitoring or a rapid response approach to invasive species recurrences.

16. *Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?*

The long-term management plan includes relying primarily on fire as the main tool to promote native prairie development. Due to the hydrology causing wetter than predicted conditions, except for the 2021 drought season, fire may be difficult to deploy if conditions aren't suitable or fire crews are occupied during burn windows. Management may need to rely on mechanical measures such as mowing or hand clearing non-native vegetation and additional spot spraying with persistent non-native perennials such as reed canary grass.

17. *Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.*

The project activities and methods as proposed in the restoration plan are aligned with the restoration goals and should not be a detriment to success, but may need to be intensified or prolonged.

18. *Are follow-up assessments by the Restoration Evaluation Program needed? Explain.*

Additional monitoring is recommended. First, the area identified in the figure as High Diversity Seed Mix will be seeded this fall and the seeding success should be assessed either in 2022 or 2023. Second, due to the high invasive species cover and early stage of the restoration, another assessment following a year or two of management actions will be useful in tracking efficacy and providing feedback for similar difficult restoration scenarios.

19. *Additional comments on the restoration project.*

Although there are many confounding factors for this project, it remains a visible and informative project. With continued restoration actions and the upcoming frost seeding east of the embankment, the site will likely change significantly in the next few years and should be followed closely so that management can be adaptive and gains aren't lost.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Minimally achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

The project area that was previously disturbed and graded is now well vegetated with total aerial vegetation cover exceeding 80%. It can be considered stabilized. However, at this time the vegetation cover is predominantly non-native invasive species or adventives such as sweet clover, Canada thistle, and common and giant ragweed. There is a diverse assemblage of native species present, but despite some aggressive native species such as rice cutgrass, sawtooth sunflower, and Canada goldenrod that are boosting native species cover numbers in the seeded areas, overall seeding success is still limited at this time.

There are multiple challenges present in the system that have contributed to this mid-restoration outcome. Since much of the project area was inundated for decades, sediment built up and much of the native seed bank may have been lost. In the last few years, the restoration planning and seeding has been hampered by the discovery of multiple springs in the floodplain early on and then significant drought conditions in 2021. Following final grading activities in the fall of 2020, the Stormwater Pollution Prevention Plan (SWPPP) associated with the project required stabilization within a few weeks of the final ground disturbance. This is typical for construction projects, but requires the use of heavy cover crop seed use to achieve soil stabilization in the short term. This, combined with heavy invasive species pressure from the newly exposed and constructed soils, likely contributed to the difficulties of establishing native vegetative cover in the first two years post-restoration.

However, due to the ongoing management including spot spraying and potentially a future prescribed burn, the site will likely show progression towards a native-dominated community.

23. Site Assessor(s) conducting field review:

Will Taylor - Cardno

Site Maps, Project Plans or Vegetation Tables

Blue Mounds SP Basin Native Seeding

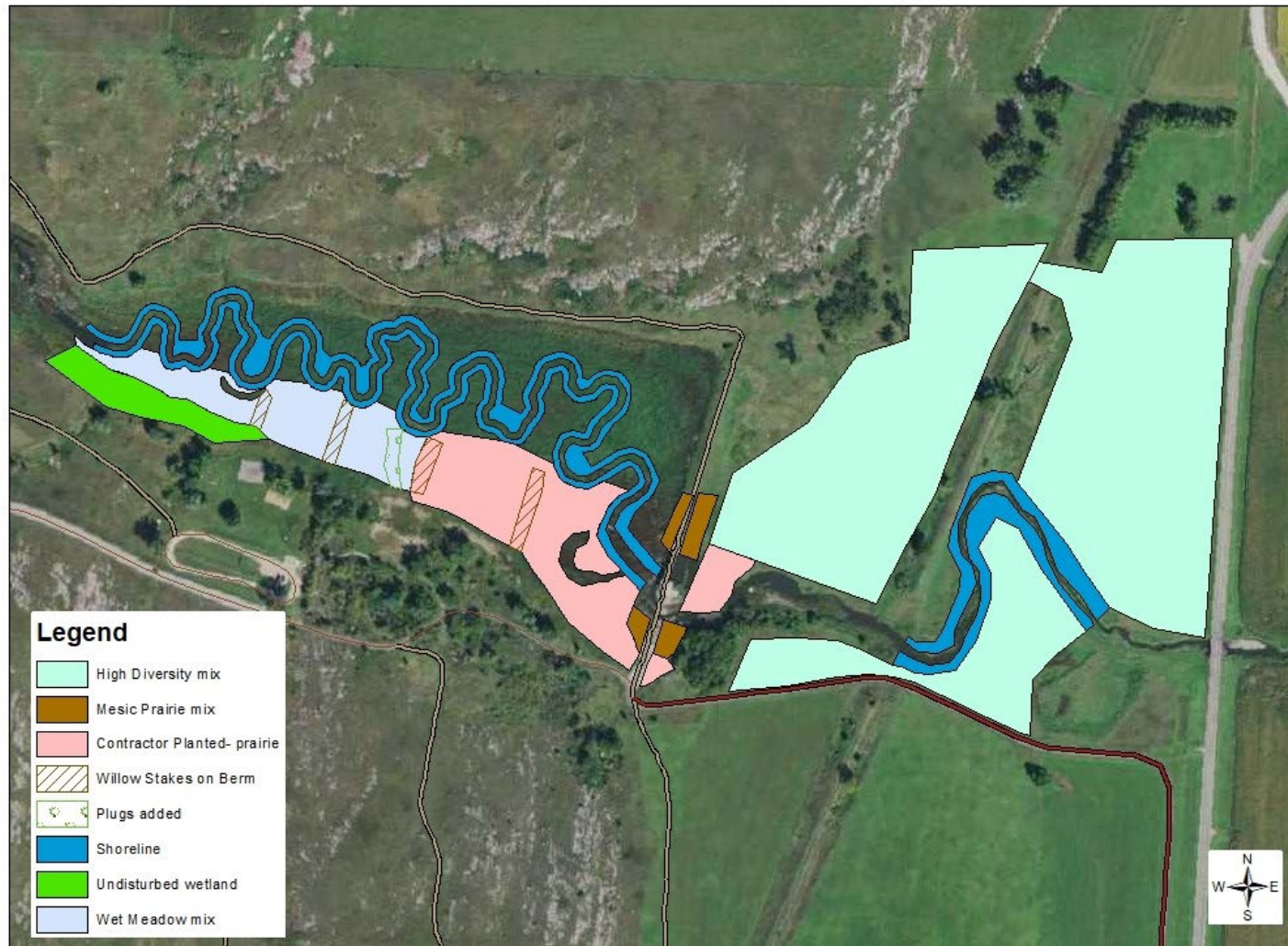


Figure 7-1 2019 Seeding Plan Update

Table 7-1 Mesic Embankment (Brown in Figure) Meander Results

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Agrostis gigantea</i>	Redtop	1-5%		non-native
<i>Ambrosia artemisiifolia</i>	Common Ragweed	5-25%		native
<i>Ambrosia trifida</i>	Giant Ragweed	5-25%		native
<i>Asclepias syriaca</i>	Common Milkweed	1-5%		native
<i>Bromus inermis</i>	Smooth Brome	1-5%		non-native
<i>Carduus acanthoides</i>	Spiny Plumeless Thistle	1-5%		non-native
<i>Cirsium arvense</i>	Canada Thistle	1-5%		non-native
<i>Daucus carota</i>	Wild Carrot	5-25%		non-native
<i>Elymus canadensis</i>	Canada Wild Rye	1-5%	seeded	native
<i>Erigeron annuus</i>	Annual Fleabane	1-5%		native
<i>Hackelia virginiana</i>	Virginia Stickseed	1-5%		native
<i>Helianthus grosseserratus</i>	Sawtooth Sunflower	5-25%		native
<i>Helianthus maximiliani</i>	Maximilian Sunflower	1-5%		native
<i>Heliopsis helianthoides</i>	False Sunflower	1-5%	seeded	native
<i>Lactuca canadensis</i>	Wild Lettuce	0-1%		native
<i>Leersia oryzoides</i>	Rice cutgrass	1-5%		native
<i>Lolium arundinaceum</i>	Tall Fescue	1-5%		non-native
<i>Melilotus officinalis</i>	Sweet Clover	50-75%		non-native
<i>Nepeta cataria</i>	Catnip	1-5%		non-native
<i>Oenothera biennis</i>	Common Evening Primrose	1-5%		native
<i>Panicum virgatum</i>	Switchgrass	1-5%		native
<i>Phalaris arundinacea</i>	Reed Canary Grass	5-25%		non-native
<i>Phleum pratense</i>	Timothy	1-5%		non-native
<i>Poa palustris</i>	Fowl Meadow Grass	1-5%		native
<i>Potentilla norvegica</i>	Rough Cinquefoil	1-5%		native
<i>Ratibida pinnata</i>	Gray-headed Coneflower	1-5%	seeded	native
<i>Rumex stenophyllus</i>	Narrowleaf Dock	1-5%		non-native
<i>Scirpus pallidus</i>	Pale Bulrush	0-1%		native
<i>Scrophularia lanceolata</i>	Lance-leaf Figwort	0-1%		native
<i>Solidago canadensis</i>	Canada Goldenrod	5-25%		native
<i>Solidago gigantea</i>	Giant Goldenrod	1-5%	seeded	native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Sonchus arvensis</i>	Common Sow Thistle	1-5%		non-native
<i>Verbascum thapsis</i>	Mullein	1-5%		non-native
<i>Verbena hastata</i>	Blue Vervain	1-5%		native
<i>Verbena urticifolia</i>	White Vervain	1-5%		native
<i>Zizia aurea</i>	Golden Alexander	0-1%	seeded	native

Table 7-2 Contractor Planting Area (Pink in Figure) Meander Results

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Acer negundo</i>	Boxelder	1-5%		native
<i>Agrostis gigantea</i>	Redtop	1-5%		non-native
<i>Amaranthus retroflexus</i>	Redroot Pigweed	1-5%		non-native
<i>Ambrosia artemisiifolia</i>	Common Ragweed	25-50%		native
<i>Ambrosia psilostachya</i>	Western Ragweed	1-5%		native
<i>Ambrosia trifida</i>	Giant Ragweed	5-25%		native
<i>Andropogon gerardii</i>	Big Bluestem	1-5%	seeded	native
<i>Artemisia campestris</i>	Field Sagewort	1-5%		non-native
<i>Asclepias incarnata</i>	Swamp Milkweed	1-5%		native
<i>Bidens cernuum</i>	Nodding Bur-Marigold	1-5%		native
<i>Bidens frondosa</i>	Devil's Beggarticks	1-5%		native
<i>Bolboschoenus fluviatilis</i>	River Bulrush	5-25%		native
<i>Carex cristatella</i>	Crested Sedge	1-5%		native
<i>Carex molesta</i>	Troublesome Sedge	1-5%		native
<i>Cerastium nutans</i>	Nodding Chickweed	1-5%		native
<i>Chenopodium album</i>	Lamb's-quarters	0-1%		non-native
<i>Cicuta maculata</i>	Water Hemlock	0-1%		native
<i>Cirsium arvense</i>	Canada Thistle	1-5%		non-native
<i>Cirsium flodmanii</i>	Flodman's Thistle	0-1%		native
<i>Conyza canadensis</i>	Canadian Horseweed	1-5%		native
<i>Dichanthelium leibergii</i>	Leiberg's Panic Grass	1-5%		native
<i>Elymus trachycaulus</i>	Slender Wheatgrass	1-5%		native
<i>Eupatorium perfoliatum</i>	Common Boneset	1-5%		native
<i>Fallopia convolvulus</i>	Black-bindweed	0-1%		non-native
<i>Geum aleppicum</i>	Yellow Avens	1-5%		native
<i>Hackelia virginiana</i>	Virginia Stickseed	1-5%		native
<i>Hordeum jubatum</i>	Foxtail Barley	1-5%		native
<i>Leersia oryzoides</i>	Rice Cutgrass	5-25%		native
<i>Lycopus uniflorus</i>	Northern Bugleweed	1-5%		native
<i>Melilotus officinalis</i>	Sweet Clover	5-25%		non-native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
Mimulus ringens	Monkeyflower	1-5%		native
Persicaria lapathifolia	Nodding Smartweed	1-5%		native
Phalaris arundinacea	Reed Canary Grass	5-25%		non-native
Populus deltoides	Cottonwood	0-1%		native
Ratibida columnifera	Prairie Coneflower	1-5%	seeded	native
Ratibida pinnata	Gray-headed Coneflower	0-1%		native
Rumex crispus	Curly Dock	1-5%		non-native
Salix interior	Sandbar Willow	1-5%		native
Setaria pumila	Yellow Foxtail	1-5%		non-native
Solidago gigantea	Giant Goldenrod	1-5%		native
Sonchus arvensis	Perennial Sowthistle	0-1%		non-native
Tragopogon dubius	Yellow Goat's-beard	0-1%		native
Triosteum aurantiacum	Early Horse-gentian	0-1%		native
Urtica dioica	Stinging Nettle	1-5%		native
Verbena hastata	Blue Vervain	5-25%		native

Site Photographs



Photo 7-1 Blue Mounds State Park, photo taken during site visit 07/26/2021. Looking upstream at Mound Creek reconstructed channel and floodplain with contractor seeding to left (south bank).



Photo 7-2 Blue Mounds State Park, photo taken during site visit 07/26/2021. Looking at mesic prairie planted embankment currently dominated by sweet clover and wild carrot, with some hardy native species interspersed.



Photo 7-3 Blue Mounds State Park, photo taken during site visit 07/26/2021. Near southern end of mesic prairie planted embankment, looking northwest. Area is dominated by adventive and primarily non-native species with evidence of recent herbicide application.



Photo 7-4 Blue Mounds State Park, photo taken during site visit 07/26/2021. In the contractor planting areas, early restoration species growth includes heavy cover by ragweed species, which should dissipate in the next growing season or two, however sweet clover and reed canary grass will persist unless intensely managed.



Photo 7-5 Blue Mounds State Park, photo taken during site visit 07/26/2021. The berms in the contractor planted area especially are dominated by invasive species such as sweet clover. The mesic basins have a higher component of native species such as blue vervain and river bulrush, however ragweeds, yellow foxtail, and curly dock are also abundant.



Photo 7-6 Snake hibernaculum at Blue Mounds State Park, photo taken during site visit 07/26/2021.

Project Review from Project Manager

Blue Mounds State Park- Mound Creek Basin Restoration - Audit

Project goals or objectives:

1. To restore hydrology to conditions similar to those prior to dam installation.
2. To restore native prairie and wetland vegetation to the disturbed portions of the project area.
3. To immediately revegetate construction areas to diverse native vegetation or temporary cover crop and comply with Stormwater Pollution Prevention Plan (SWPPP).

A successful vegetation restoration would:

- Be dominated by native species and compete with invasives.
- Cover and stabilize soils
- Contain a diverse mix of grass, forbs, sedge, and shrubs but minimal tree species.

Project location and setting:

The project is located at Mound Creek within Blue Mounds State Park, 5 miles north of Luverne, MN, Rock County. Elevations range from 1477 to 1502 feet within the project area.

Blue Mounds state park is considered an important area of biodiversity in an agriculturally dominated landscape due to the intact native plant communities and high number of rare features. The entire park is ranked as a MCBS site with outstanding biodiversity significance.

The geology of Blue Mounds State Park is dominated by rock outcrops that rise above the shallow prairie soils as part of the Sioux Quartzite formation and lie within the Pipestone basin. These outcrops form “long, narrow ridges that project a few feet to several tens of feet about the surrounding prairie.” (Jirsa, et al. 2015)

Existing site conditions:

- The project area is highly disturbed, due to the severe flood event, which resulted in the failure of the lower dam. In this event, Mound creek washed out below the dam and sustained extreme damage and scouring of the channel. The historic reservoir above the dam was drained and large areas scoured. In the time since the dam failure, Mound creek had remained unstable and continued to head cut in the channel and slump on the banks, causing sedimentation downstream. The previous footprint of the reservoir now consisted of mudflats dominated by non-native vegetation like reed canary grass and undesirable woody species like cottonwoods. Some desirable sandbar willow was providing stabilization of the soils in this area.
- Mound Creek is a prairie stream classified as an E4 stream type with riffle/pool sequences on a meandering channel. The watershed is 16.9 square miles with 83% of that in row crops. Considerable watershed health and water quality issues are present. The bedrock at the surface of the basin, the braided channel, and the 0.9 acre natural pool below the Upper Dam are unique features to Mound Creek.
- The land cover surrounding the project area is classified as Ups23a (Southern Mesic Prairie). It is S2-Imperiled. A small section of habitat through the project area is also MHs38b (Southern Mesic Oak-Basswood Forest). It is ranked as S3-Vulnerable to extirpation. Just upstream of the Upper dam is classified as a marsh system.
- A snake hibernacula was constructed just outside the project area to mitigate loss of the historic dam structure that provided overwintering habitat for local snakes.
- The soils within Blue Mounds State Park generally tend to be well-drained, silty-clay-loams with very fine textures. They lie in thin layers over the bedrock. Following construction of the dam in 1937, sediment has gathered within the project area behind the dam. It has never been dredged. Soil borings determined the bedrock depth to be 60 feet. The topsoil fill was described as silty sand. In the existing embankments, the fill consisted of silty sand and lean clay with some organic clays. Below the fill, silty sand, poorly graded sands with silts, and sandy clays were discovered on top of lean clays and then bedrock (Table 1).

Table 7-3 **NRCS Map Units within Project Area, Lower Mound Basin Restoration.** Source: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at <http://websoilsurvey.nrcs.usda.gov/>. Accessed [10/11/2016].

Map Unit	Description	Slopes	Depth to restrictive feature	Limitations – Picnic Areas	Limitations – Paths and Trails
P06A	Colo silty clay loam, occasionally flooded	0 to 2 percent	Very deep	Very Limited	Very Limited
P11A	Dempster silt loam	0 to 2 percent	Very deep	Not limited	Not limited
P16A	Graceville silty clay loam	0 to 2 percent	Very deep	Not limited	Not limited
P17A	Ihlen silty clay loam	0 to 2 percent	20 - 40 inches	Not limited	Not limited
P17B	Ihlen silty clay loam	2 to 6 percent	20 - 40	Not limited	Not limited
P18B	Ihlen-Rock outcrop complex	0 to 4 percent	20 - 40	Not limited	Not limited
P18C	Ihlen-Rock outcrop complex	4 to 38 percent	20 - 40	Somewhat limited	Not limited
P19A	Judson silty clay loam	1 to 3 percent	Very deep	Not limited	Somewhat limited
P24B	Moody silty clay loam	2 to 5 percent	Very deep	Not limited	Not limited
P33A	Spillco silt loam, Occasionally flooded	0 to 2 percent	Very deep	Somewhat limited	Somewhat limited
P40A	Bluemound silt loam	0 to 3 percent	10 - 20 inches	Very limited	Not limited
W	Water	-	-	Not rated	Not rated

Original restoration work plan (Written Jan 2017) (Figure 2):

Due to the complexity of the construction activities on this project, the vegetation restoration will be completed in phases that are dependent on the timing of the construction activities. Below is the anticipated construction plan:

- 1) Installation of erosion control measures as identified on the SWPPP
- 2) Creation of the staging area
- 3) Removal of the main spillway and creation of a diversion channel for the stream through the location of the main spillway. This diversion channel is necessary to create the restored natural stream channel in the emergency spillway washout area that the stream is currently flowing through.
- 4) Construction of the restored natural stream channel northerly of the current stream location through the basin and through the washout area.
- 5) Establishing vegetation along the newly constructed stream channel.
- 6) Plugging the existing stream channel so the stream is directed into the newly constructed channel.
- 7) Filling the current stream channel with the spoils of the new channel and completing construction of the pedestrian bridge

- 8) Seeding of all disturbed areas with native species.*
- 9) Restoration of native plants within the former reservoir.

*Temporary cover crops will be used in accordance with established erosion prevention BMP's throughout the project.

It is expected that restoration of the vegetation would take several years of management effort. Seed collection to obtain local ecotype native seed and mowing of the existing vegetation will begin in the summer of 2017, prior to construction. Mowing will occur in after August 1st to protect grassland nesting birds. Seeding of a temporary cover crop and/or native seed will occur as portions of the construction activities are complete to achieve revegetation as soon as possible. Final seeding will occur once the construction activities are completed and ground is thawed, likely spring 2019. The first growing season following construction will consist of maintenance mowing of weedy vegetation and possible spot spraying of invasive species. Inventories of the site will be conducted to determine if additional species need to be added in the form of plugs or bare root stock. In years 2-5 mowing and prescribed burning will be used to reduce invasive species and trees. Once the vegetation is established a burn regime appropriate to the prairie ecosystem will be maintained.

Seed collection, seed mix, and the restoration plan will be designed and conducted by MDNR Parks and Trails Resource Program staff. Actual seeding on site will be completed either by Resource staff or will be contracted out as part of the construction bid.

Vegetation best management practices will be used to establish native plant species throughout the former reservoir. The vegetation restoration plan includes seed collection, site preparation, seeding, establishment, and maintenance.

Some desirable sandbar willow is providing stabilization of the soils in this area. Seed and/or vegetative material from native vegetation on site will be collected prior to construction. Seed will be collected on site as much as possible, but additional seed will need to be collected elsewhere in the park, at other natural areas in the vicinity, or purchased from a seed vendor. Final seed mix and origin will depend on availability of seed.

Seed mixes will be created for four approximate zones as follows:

- River shore zone – 3 acres
- Wet meadow zone – 13 acres
- Upland prairie zone – 5 acres
- Embankments and trails zone – 1 acre

The site will be prepared by mowing the project area prior to construction. Invasive species may be spot sprayed to prevent their spread during construction.

Seeding will be broadcast by hand or ATV mounted Viccon seeder. Use of cover crop will help to revegetate and stabilize the site quickly. As much existing native vegetation will be utilized as possible, including willow whips to anchor down erosion blankets. Since the seed bed already contains many of these species, supplementing what has naturally established is our goal.

A use of a local genotype diverse seed mix will benefit local species like pollinators, and will help to restore ecosystem functions like sediment filtering. A diverse seed mix will also better compete with the invasive species like reed canary grass, which are currently at the site. The seed mixes will include a diverse mix of grasses, forbs, and shrubs to provide for pollinator food sources throughout the season. The embankment and trails zone mix will be a low diversity mix of native grasses since these areas will be routinely mowed.

Long-term management plan:

The first growing season after seeding will include establishment activities such as mowing and spot spraying weeds. The planting will be monitored to determine germination success and if additional species are needed. Years 2 and 3 following planting will include prescribed burning when conditions allow, cutting and stump treating of woody species, and addition of native plugs or seeds where diversity seems low.

The long-term management of this site is to maintain it as a prairie community through a variety of grassland management tools. Fire will be the main tool to maintain the site. This site is particularly challenging in that most years it is extremely wet. If smoke concerns or weather prevent fire in some years, additional methods may be needed.

In areas where seeding was unsuccessful, interseeding or spraying and reseeding may be needed. Currently we have purchased 3 additional lbs, pure live seed (PLS), of high diversity seed to place out on some of the areas that didn't take. It will be used after a disturbance... like spraying reed canary grass, mowing, or burning.

The need for additional work will be determined by the resource specialist and park manager walking the site periodically and visually inspecting if the plant community is moving toward more natives or more invasives. No formal monitoring is planned at this time, other than the high diversity planting area, which will be monitored as part of a larger pollinator project.

Tree encroachment could be an issue in the wet areas that will not carry fire. Forestry mowers may be used in very dry years or in winter to combat invasion of tree species. Additionally, hand crews may be necessary to control volunteer trees by stump cutting and treating with Garlon.

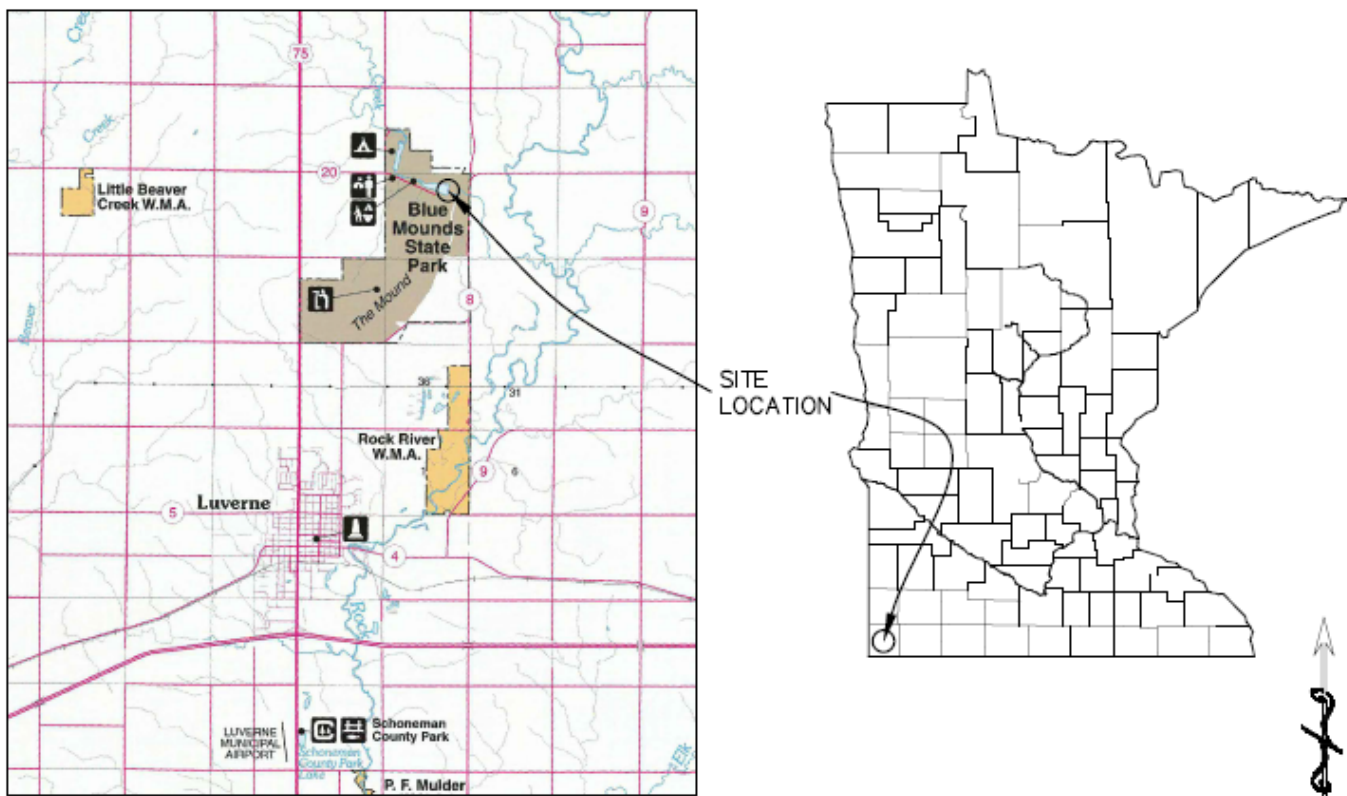


Figure 7-2. Project location in Rock County, MN.

Blue Mounds SP Basin Native Seeding

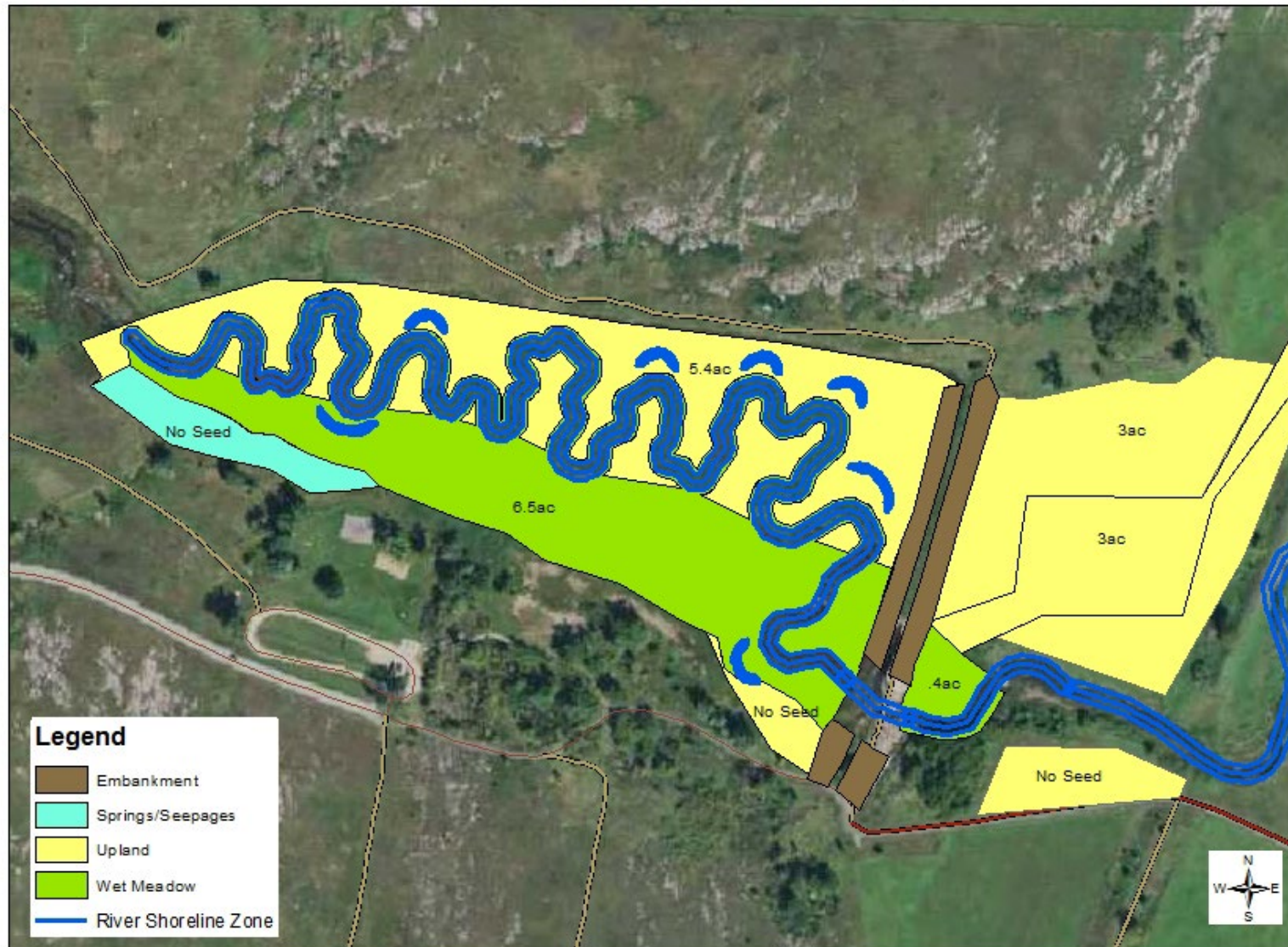


Figure 7-3. Original seeding plan for the basin restoration project. Created January 2017.

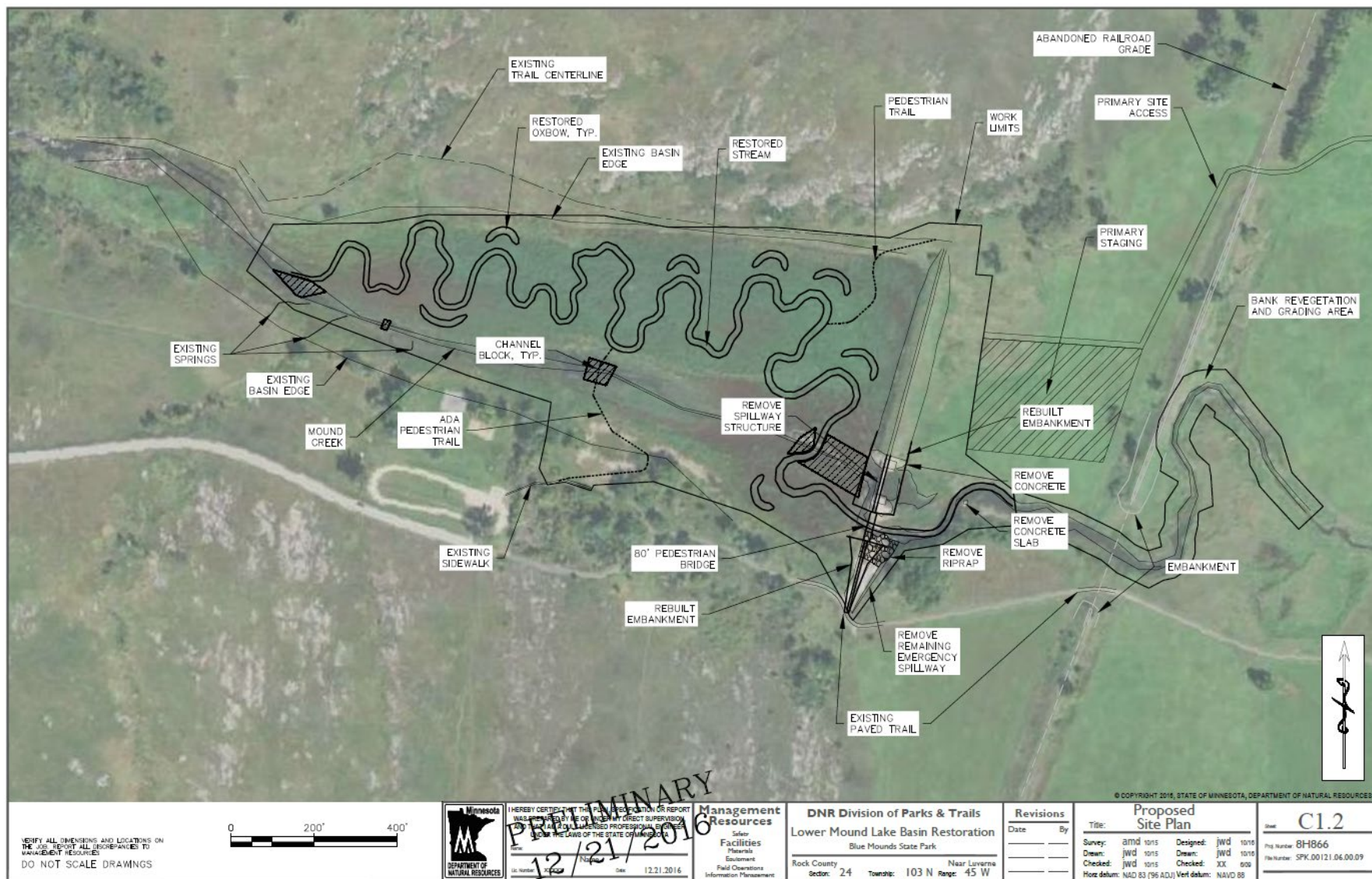


Figure 7-4. Planned construction activities in the basin area.



Photo 7-7. Project area post flood but prior to restoration.



Photo 7-8. Willow staking of riparian shoreline.



Photo 7-9. Aerial view of the project area just before moving water into the new channel.

Blue Mounds SP Basin Native Seeding

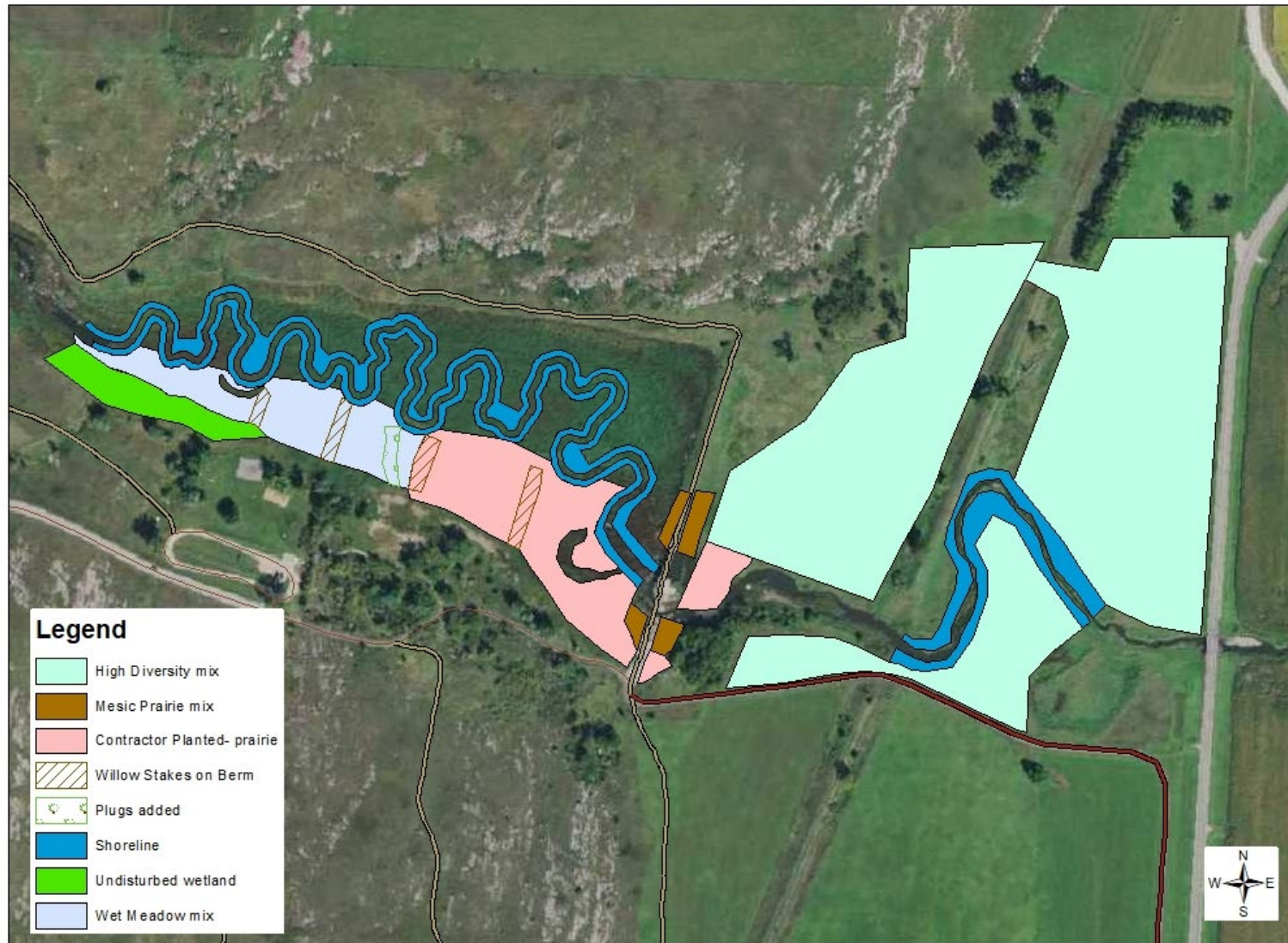


Figure 7-5. Actual seeding of the Blue Mounds basin.

Riparian Shoreline and Wet Meadow Mix-

Riparian Shoreline- Seeded Spring 2019, 3 acres. The vegetation in this part of the basin naturally regenerated in the years after the basin drained. The channel was cut into this area with minimal disturbance to the vegetation. The areas that were disturbed were hand seeded with the mix found in Table 2, below. The areas in blue on the map were hand seeded and allowed to stabilize for a year before water was moved into this channel. Not all sedges in this mix were identified to species. Most were collected in the *Undisturbed wetland* area on the map as well as another wetland in the park. Common arrowhead was also salvaged from disturbed areas and placed along the edges of some of the newly created oxbows on the north side (not shown on map). Wet meadow and the riparian shoreline were roughly the same mix but seeded at different times. Oats were seeded as a cover crop. There was pretty significant flooding after the basin was seeded, so some of the seed was likely lost.

Wet Meadow Mix- Seeded by hand on 9/27/2019, 2.2 acres.

Willow stakes- Planted 11.6.2019. 512 freshly cut willow stakes were added to the 5 berms that were constructed to prevent the creek from washing back into the old channel. These berms were not part of the original design, but added at a later date when it was determined that that part of the project was not at a high enough elevation. The construction of the berms also resulted in some additional open water wetlands in between them that were not part of the original design. An additional 250-300 willow stakes were added along some of the riparian shorelines of the channel and the oxbows where the engineers were concerned about stability.

Plugs Added- 48 plugs of allegheny monkeyflower (*mimulus rigens*) were planted in a wet area just along the hiking trail into the basin. Additional plugs will likely be added in summer/fall of 2021.

Table 7-4 Riparian shoreline and wet meadow mix.

Grasses	Scientific Name	Common Name	Lbs
1	Carex spp.	Sedge species	5
2	Carex hystericina	Bottlebrush Sedge	0.85
3	Carex vulpinoidea	Fox Sedge	0.75
4	Carex pellita	Woolly Sedge	0.85
5	Leersia oryzoides	Rice Cutgrass	2.11
6	Juncus dudleyi	Dudley's Rush	0.03
7	Juncus torreyi	Torrey's Rush	0.03
8	Unknown juncus	unkown rushes	0.03
9	Schoenoplectus	Softstem Bulrush	0.04
10	Schoenoplectus fluviatilis	Bulrush species	0.08
11	Spartina pectinata	Prairie Cordgrass	0.06
		SUBTOTAL GRASS/SEDGE	9.83

Forbs	Scientific Name	Common Name	Lbs
1	Agalinis tenuifolia	Slenderleaf False Foxglove	0.21
2	Amorpha fruticosa	False Indigo	0.12
3	Anemone canadensis	Canadian Anemone	0.1
4	Asclepias incarnata	Swamp Milkweed	0.09
5	Bidens cernua	Nodding Beggartick	0.81
6	Cicuta maculata	Water hemlock	0.25
7	Epilobium coloratum	Purpleleaf Willowherb	0.37
8	Eupatorium perfoliatum	Boneset	0.15
9	Eupatorium purpureum	Sweetscented Joe pye weed	0.01
10	Helenium autumnale	Sneezeweed	0.05
11	Helianthus grosseserratus	Saw-tooth Sunflower	1.25
12	Lobelia siphilitica	Great Lobelia	0.03
13	Oenothera biennis	Com. Evening Primrose	0.01
14	Pedicularis lanceolata	Swamp Lousewort	0.4
15	Pycnanthemum virginianum	Common mountain mint	0.15
16	Sparganium eurycarpum	Common Bur Reed	0.2
17	Symphyotrichum spp.	Asters, wet spp.	unknown
18	Sambucus	Black berried Elder	.072
19	Thalictrum dasycarpum	Purple Meadow-rue	0.2
20	Verbena hastata	Blue Vervain	1.37
21	Vernonia fasciculata	Ironweed	unknown
		SUBTOTAL FORBS	2.55
	Total Riparian/ Wet Meadow Mix		12.4 lbs

Mesic Prairie and High Diversity Mixes-

Mesic Prairie Mix- Seeded by hand on 10.22.2019. Half an acre. Flail vac seed from Camden SP (See Table 2 for species), plus part ~5 lbs of the hand collected seed (Table 3, below).

High Diversity Mix- not planted yet. Due to extremely dry conditions this summer, it was determined to hold off on planting this mix until fall. This mix includes the remainder of the hand collected seed in the species below (Table 1.) as well as seed purchased for an LCCMR pollinator grant to supplement additional forbs for pollinators.

Table 7-5. Hand collected seed to supplement Mesic prairie and High diversity mixes. Weights were of fairly clean seed but not PLS because germination was not tested. Seed was not cleaned to the level of a seed vendor, but estimates were made to determine how much of the weight was actual seed versus chaff, so these are estimates only.

Grasses	Scientific Name	Common Name	Lbs
1	Andropogon gerardii	Big Bluestem	4
2	Schizachyrium scoparium	Little Bluestem	0.6
3	Sorghastrum nutans	Indiangrass	3.76
4	Elymus canadensis	Canada Wildrye	0.88
5	Sporobolus heterolepis	Prairie Dropseed	0.41
6	Bouteloua gracilis	Blue grama	0.311
7	Hesperostipa spartea	Porcupinegrass	0.46
8	Carex spp.	Sedge mix	1.2
9	Bouteloua curtipendula	Sideoats grama	1.81
10		Tall grass mix	11
		SUBTOTAL GRASS	24.43
Forbs	Scientific Name	Common Name	Lbs
1	Anemone virginiana	Tall thimbleweed	0.32
2	Achillea millefolium	Western Yarrow	1.46
3	Allium canadense	Meadow garlic	0.03
4	Allium stellatum	Prairie onion	0.52
5	Artemesia sp.	Sage	0.075
6	Asclepias syriaca	Common Milkweed	12
7	Asclepias verticillata	Whorled milkweed	0.75
8	Astragalus canadensis	Canada milkvetch	trace
9	Amorpha canescens	Lead Plant	2.5
10	Brickellia e.	False boneset	0.063
11	Cirsium sp.	native thistle	0.038
12	Dalea purpurea	Purple Prairie Clover	0.33

Forbs	Scientific Name	Common Name	Lbs
13	Eupatorium perfoliatum	Boneset	0.39
14	Gallium boreale	Northern bedstraw	trace
16	Gentiana spp.	Gentian species	0.025
17	Onosmodium bejariense	False gromwell	trace
18	Heliopsis helianthoides	Ox-eye	0.04
19	Helenium autumnale	Sneezeweed	0.06
20	helianthus spp.	Sunflower species	0.03
21	Lespedeza capitata	Round hd bushclover	1
22	Liatris spp. (ligulistylis)	Blazingstar species	0.3
23	Monarda fistulosa	Wild bergamot	0.1
24	Oenothera biennis	Com. Ev. Primrose	1.14
25	Oligoneuron rigidum	Stiff goldenrod	0.18
26	Rosa arkansana	Prairie Wild Rose	2.5
27	Ratibida pinnata	Gray Coneflower	5
28	Solidago spp.	Goldenrod species	1.22
29	Solidago speciosa	Showy goldenrod	0.18
30	Symphyotrichum ericoides	White heath aster	1
31	Symphyotrichum lanceolatum	White Panicle Aster	0.2
32	Symphyotrichum novae-angliae	New England Aster	
33	Potentilla arguta	Prairie Cinquefoil	0.23
34	Pycnanthemum virginianum	Com. mountain mint	0.04
35	Verbena stricta	Hoary Vervain	0.43
36	Zizia aurea	Golden Alexander's	0.25
37		Upland mix	4.5
		SUBTOTAL FORBS	36.90
	TOTAL Hand Collected Mix		61.34

Contractor Planted Prairie-

3 acres- 120 lbs of uncleaned seed harvested with a flail vac seed stripper from a seed plot at Camden State Park. Seed tests (Table 4) indicate that it was about 55% pure seed, so it was closer to 66 lbs of actual seed that was planted. They had planned to use a broadcast seeder behind an ATV, but some of the areas were too wet for equipment due to fall flooding of the project area. Some of the areas may have been hand seeded by the contractor.

Table 7-6 Seed Purity results of Camden North Field mix planted in the Contractor Planted areas.

Pure Seed	% of Sample	Seeds Per lb in Sample
Total Pure Seed	54.0	
Bluestem, big (Andropogon gerardii)	31.85	
Aster (Aster spp.)	3.24	
Indiangrass (Sorghastrum nutans)	8.00	
Switchgrass (Panicum virgatum)	5.941	
Bluestem, little (Schizachyrium scoparium)	4.44	
Calamagrostis spp.	.59	
Other Crop Seed	1.2	
Wild sunflower (Helianthus annuus)		19.3
Dodder (Cuscuta spp.)		12.9
Hoary vervain (Verbena stricta)		64.8
Maximilian sunflower (Helianthus maximiliani)		194.3
Milkweed, common (Asclepias syriaca)		453.5
Prairie coneflower (Ratibida columnifera)		129.6
Scirpus spp.		323.9
Sideoats grama (Bouteloua curtipendula)		583
Sunflower (Helianthus spp.)		647.8
Tall dropseed (Sporobolus compositus)		2008.2
TOTAL NATIVE SEED	55.2%	
Inert matter	44.3	
Weed Seed (foxtail, ragweed, curly dock, quackgrass, brome)	.5	

9 McCarthy Beach State Park Forest Restoration (Log Landing)

Project Background

Project Name: McCarthy Beach State Park landing site planting

Project Site: Log landing site

Township/Range Section: Township 60N Range 21W Section 16

Project Manager / Affiliated Organization: Tony Lenocho – MNDNR Parks and Trails Division

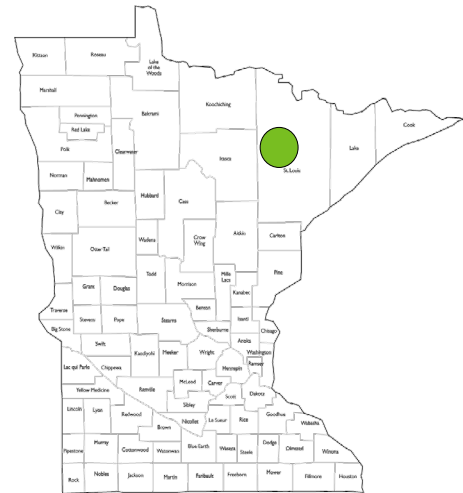
Fund: PTF **Fiscal Year Funds:** 2014

Project Start Date: 2010

Predominant Habitat type: Forest

Additional Habitat types:

Project Status: Post Establishment Phase



County: St. Louis

Primary Activity: Forest Restoration

Project Size: 0.5 acres (estimated)

Project Completed: 2013

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

Plant degraded landing site from post commercial timber harvest that removed all spruce species and harvested other species only as needed for the removal of the spruce. Harvest was completed in November 2011 targeting non-native Norway spruce in the FDn33 Northern Dry-Mesic Mixed Woodland in the park. Landing site was located north of Ski Trail Road and was degraded after being used to store slash prior to removal for biofuel. Landing was hand planted with a white pine and red pine mix in spring 2012. Follow-up regeneration check occurred in 2013.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

- Timber appraisal form
- Permit supervision record

- Biomass pricing worksheet auction
 - Project overview including map completed 6/18/2010
 - Stand Silvicultural prescription worksheet
- 3. What are the stated goals of the project?**
The goal was to re-plant disturbed landing site with native white and red pine after removal of Norway spruce.
- 4. What are the desired outcomes of achieving the stated goals of the project?**
The desired outcome was to restore the native plant community (FDn33) and for the artificially regenerated plantings and naturally regenerated white and red pine seedlings and saplings to establish and form a reproducing cohort of seed trees in the future. Secondly, the restoration aimed to minimize the presence of weedy invasive species (e.g., Canada thistle, Siberian peashrub).
- 5. Were measures of restoration success identified in plans? Yes**
If yes, list specific measurements.
Success was based on a qualitative regeneration check in the years following planting of pine species. However no quantitative value (e.g., # pine saplings per acre) was given.
- 6. Are plan Sets available? Yes Have project maps been created? Yes**
If yes, provide in "site maps" and list maps provided:
- Locations of sale boundary and landing sites
- 7. Provide list of best management practices, standards, guidelines identified in plan set?**
Best management plans were specified for safe harvest with minimal ecological harm including:
- Cutting and felling
 - Season of operation
 - Slash disposal
 - Site, soil and water protection
 - Landings, roads and trails

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

- 8. Were alterations made to the plan during project implementation?**
Yes
Changed from summer harvest to fall harvest in November. Changed planting of white pine/jack pine mix to white pine/red pine mix.
- 9. In what ways did alterations change the proposed project outcome?**
Red pine became the dominant pine species, and jack pine was not present. Season of harvest did not affect the outcome of pine regeneration success.

Site Assessment

Field Review Date: 9/15/2021

Field Visit Attendees: Tony Leno – MNDNR Parks and Trails Division, Cathy Handrick – MNDNR Parks and Trails Division, Tami Rahkola – MNDNR Parks and Trails Division, Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

10. Surrounding Landscape Characteristics:

The project area is within McCarthy Beach State Park, east of Sturgeon Lake and north of Side Lake. The park is located within the Nashwauk Uplands Ecological Subsection but near the southern boundary of the Littlefork-Vermilion Uplands Subsection. At the finer Land Type Association level, it is within the Nashwauk Moraine LTA. However, the project area falls within an outwash landform that is pitted with ice block depressions.

11. Site Characteristics:

a. Soil Series:

A1B—Eagleview and Menahga soils, 1 to 8 percent slopes

b. Topography:

Mostly flat outwash with ice block pitting.

c. Hydrology:

Somewhat excessively drained loamy sand with high infiltration. Water drains to the southwest to a small unnamed lake and its associated wetlands.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Native Plant Community mapping indicates FDn33: Northern Dry-Mesic Mixed Woodland (mapping by Rebecca Holmstrom, EWR). More intact areas just outside of landing area are FDn33a1: Red Pine-White Pine Woodland Balsam Fir Subtype. Within the project area, non-native species had less than 5% cover: orange hawkweed, Canada thistle, common dandelion, and ox-eye daisy.

12. Is the plan based on current science? Yes

Planting of white and red pine follows the guidelines set forth in the *NPC silviculture strategies for forest stand prescriptions* for [FDn33](#). These guidelines were developed by the ECS program in the Division of Forestry. Both white and red pine have an “Excellent” tree suitability index for FDn33.

13. List indicators of project goals at this stage of project:

All Norway spruce have been removed and the white and red pine plantings have been completed.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes. At the time of site assessment, there was no indication of Norway spruce re-colonization and the red and white pine saplings have successfully established in the landing site.

15. Are corrections or modifications needed to achieve proposed goals?

Generally no. Would recommend future monitoring of the weedy invasive species common in the landing. These species likely do not have a detrimental effect on the regeneration success of the pine species. Many will naturally die off as the canopy becomes more closed, but it is important to ensure that they do not increase in abundance and cover.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

- The success of the pine planting is largely due to controlling the deer browse impact on pine shoots. With a combination of bud capping and hosting annual deer hunts, there was no evidence of significant deer browse in the landing area or surrounding woodland. Though bud capping may no longer be required because the planted pine saplings will soon grow to beyond browse height, it would be beneficial to continue the annual deer hunts. There is a healthy population of naturally seeded pine seedlings, and they will still need to be protected from browse.
- Introduction of prescribed fire is not currently recommended because of the vulnerability of the young pine seedlings and saplings. However, as these pine trees mature and become more fire resistant, prescribed fire may be considered to control undesirable deciduous woody species and weedy invasive species. The use of prescribed fire is logistically challenging as there are considerations for smoke, safety of nearby private properties, and engagement of the public. Oftentimes, there is a narrow temporal window at which to burn, but aligning the ecologically ideal burn time with that which is socially acceptable may be difficult.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No. All activities have been and are in support of restoring an open landing site to the FDn33 native plant community. Some *Diplodia*-infected nursery stock of planted red pine needed to be removed. There was no indication of *Diplodia* shoot blight and canker during time of assessment.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No. The removal of Norway spruce was successful and the plantings of white and red pine are establishing well. The trajectory portends a mixed pine overstory in the future.

19. Additional comments on the restoration project.

The removal of Norway spruce and planting to native conifers are consistent with the park management plan's goal to maintain a natural forest for park patrons. Other resource ideals include:

1. Use of prescribed fire, where appropriate, to maintain fire-dependent native plant communities.
2. Shoreline restoration and stabilization with removal of invasive Siberian peashrub.
3. More mammal survey work.
4. Continuing multi-day deer hunts.
5. Re-evaluating potential old growth forest stands.
6. Preserving cultural resources.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

The project goal was to remove the non-native Norway spruce and plant the disturbed landing with native white and red pine in order to restore to an FDn33 native plant community. Removal of the spruce was complete and there was no evidence of re-colonization of spruce seedlings. Both artificially regenerated pine through planting and naturally regenerated pine through natural seeding are establishing well with no signs of deer browse. The stand will most likely succeed to a semi-closed canopy, mixed pine woodland that is characteristic of FDn33.

23. Site Assessor(s) conducting field review:

Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

Site Maps, Project Plans or Vegetation Tables

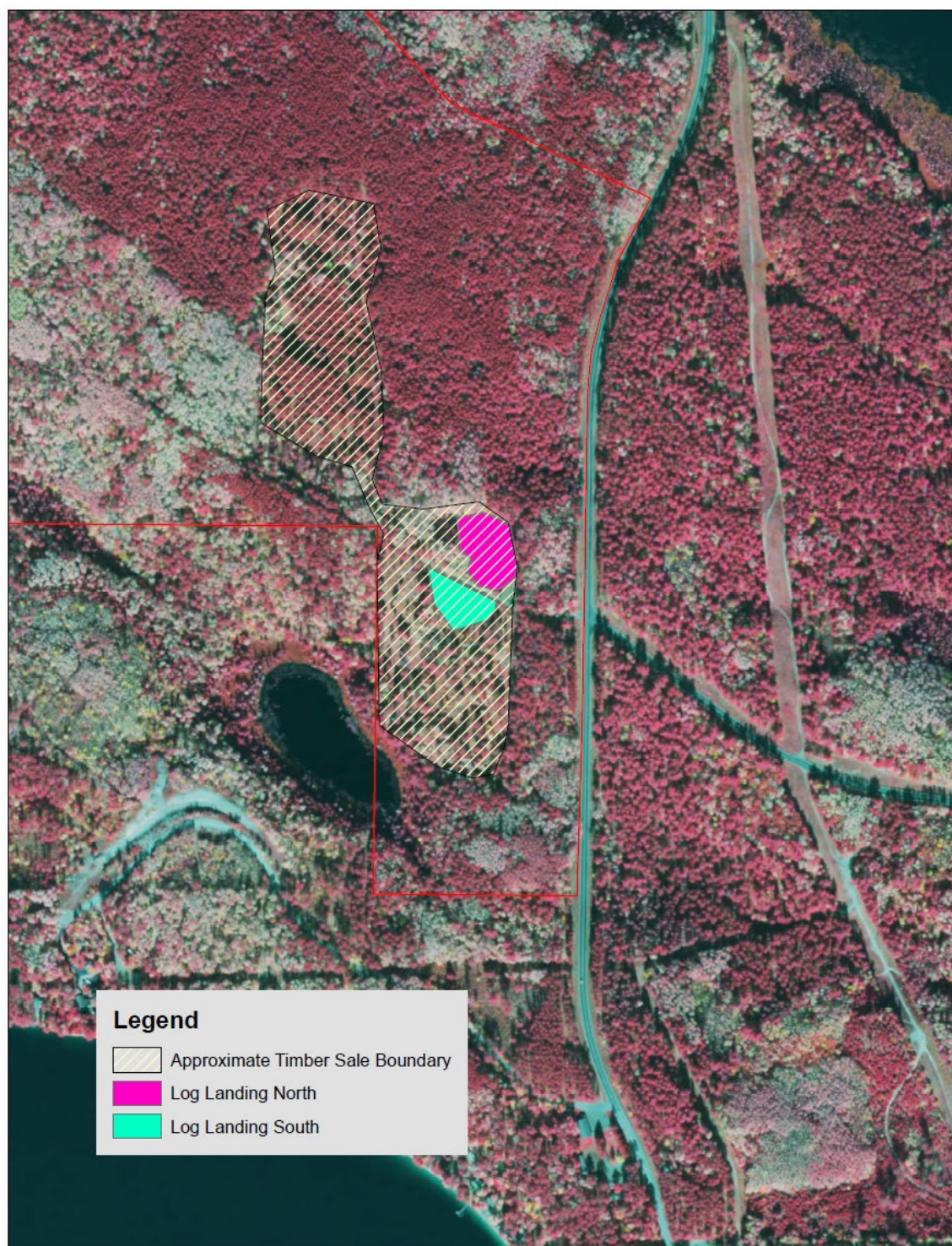


Figure 8-1 Map showing the location of Norway spruce removal in the timber sale boundary and location of landing sites.

Table 8-1 Meander survey for McCarthy Beach State Park in log landing area for Norway spruce removal commercial thinning. Species are listed by physiognomy and height strata.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<u>Evergreen 2-5 m</u>				
<i>Pinus resinosa</i>	Red pine	25-50%	Yes - planted	Native
<i>Pinus strobus</i>	Eastern white pine	1-5%	Yes - planted	Native
<u>Evergreen 0-2 m</u>				
<i>Pinus resinosa</i>	Red pine	5-25%	No – natural regen	Native
<i>Pinus strobus</i>	Eastern white pine	1-5%	No – natural regen	Native
<u>Deciduous 0-2 m</u>				
<i>Quercus rubra</i>	Northern red oak	0-1%	No	Native
<i>Cornus rugosa</i>	Round-leaved dogwood	0-1%	No	Native
<i>Populus tremuloides</i>	Trembling aspen	0-1%	No	Native
<i>Rubus allegheniensis</i>	Allegheny blackberry	1-5%	No	Native
<i>Vaccinium angustifolium</i>	Lowbush blueberry	1-5%	No	Native
<i>Rubus idaeus subsp. strigosus</i>	Wild red raspberry	75-100%	No	Native
<i>Amelanchier cf. spicata</i>	Creeping juneberry	0-1%	No	Native
<u>Forbs 0-2 m</u>				
<i>Calystegia spithamea</i>	Upright bindweed	0-1%	No	Native
<i>Symphyotrichum ciliolatum</i>	Lindley's aster	0-1%	No	Native
<i>Solidago hispida</i>	Hairy goldenrod	0-1%	No	Native
<i>Viola adunca</i>	Sand violet	0-1%	No	Native
<i>Trientalis borealis</i>	Starflower	0-1%	No	Native
<i>Hieracium aurantiacum</i>	Orange hawkweed	0-1%	No	Invasive
<i>Aralia nudicaulis</i>	Wild sarsaparilla	0-1%	No	Native
<i>Athyrium filix-femina</i>	Lady fern	0-1%	No	Native
<i>Galium triflorum</i>	Sweet-scented bedstraw	0-1%	No	Native
<i>Achillea millefolium</i>	Common yarrow	0-1%	No	Native
<i>Cirsium arvense</i>	Canada thistle	1-5%	No	Invasive
<i>Maianthemum canadense</i>	Canada mayflower	1-5%	No	Native
<i>Eurybia macrophylla</i>	Large-leaved aster	1-5%	No	Native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Taraxacum officinale</i>	Common dandelion	0-1%	No	Invasive
<i>Fragaria virginiana</i>	Common strawberry	1-5%	No	Native
<i>Pteridium aquilinum</i>	Bracken fern	25-50%	No	Native
<i>Leucanthemum vulgare</i>	Ox-eye daisy	0-1%	No	Invasive
<u>Graminoids 0-0.5 m</u>				
<i>Muhlenbergia mexicana</i>	Mexican muhly grass	0-1%	No	Native
<i>Danthonia spicata</i>	Poverty grass	5-25%	No	Native
<i>Poa palustris</i>	Fowl bluegrass	5-25%	No	Native
<i>Carex arctata</i>	Drooping wood sedge	1-5%	No	Native
<i>Oryzopsis asperifolia</i>	Mountain rice grass	1-5%	No	Native
<i>Schizachne purpurascens</i>	False melic grass	1-5%	No	Native
<i>Bromus ciliatus</i>	Fringed brome	1-5%	No	Native

Site Photographs



Photo 8-1 Active landing site at McCarthy Beach State Park during timber harvest in November 2011.



Photo 8-2 Landing site at McCarthy Beach State Park in December 2011 following timber harvest but prior to restoration.



Photo 8-3 Landing site at McCarthy Beach State Park in 2021 with well-established planted pines.



Photo 8-4 Naturally regenerating white pine in a landing site at McCarthy Beach State Park.



Photo 8-5 Bud capping from previous growing seasons successfully protected many trees from browse.

10 McCarthy Beach State Park Forest Enhancement (Township 60N)

Project Background

Project Name: McCarthy Beach State Park Forest Enhancement

Project Site: Norway spruce removal site

Township/Range Section: Township 60N Range 21W Section 16

Project Manager / Affiliated Organization: Tony Lenocho – MNDNR Parks and Trails Division

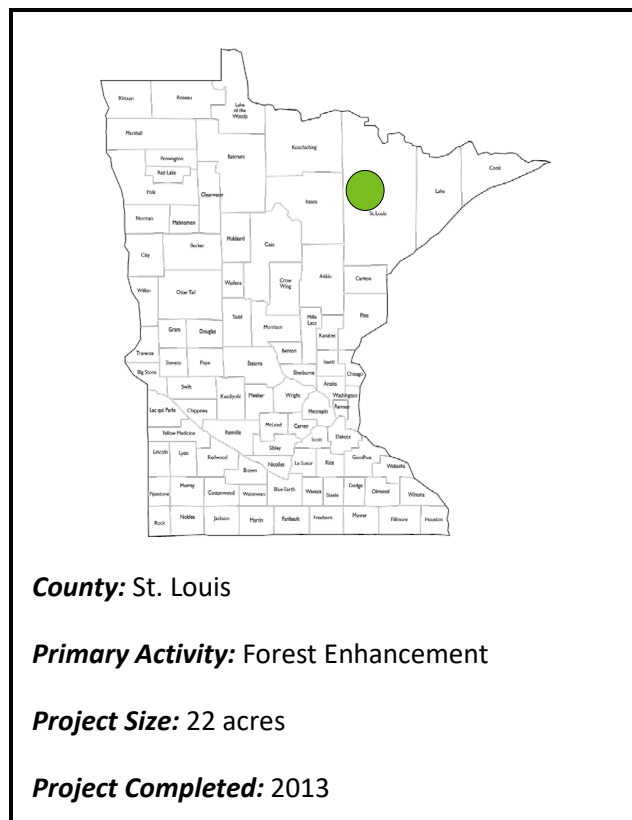
Fund: PTF **Fiscal Year Funds:** 2014

Project Start Date: 2010

Predominant Habitat type: Forest

Additional Habitat types:

Project Status: Post Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

Project objective was to remove non-native Norway spruce through commercial thinning of approximately 22 acres north and south of Perch Lake Road to restore the natural native plant community makeup of FDn33, Northern Dry-Mesic Mixed Woodland. Other species were harvested only as needed for the removal of spruce. Harvest was completed in November 2011. CCM crews also did chainsaw removal of residual Norway spruce trees that had established beyond the plantation area. Follow-up regeneration check occurred in 2013.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

- Timber appraisal form
- Permit supervision record
- Biomass pricing worksheet auction

- Project overview including map completed 6/18/2010
 - Stand Silvicultural prescription worksheet
- 3. What are the stated goals of the project?**
The goal was to remove non-native Norway spruce so that only native tree species represent the FDn33a1 native plant community.
- 4. What are the desired outcomes of achieving the stated goals of the project?**
The desired outcome was to restore the native plant community (FDn33a1) and for the naturally regenerated white and red pine seedlings and saplings to establish and form a reproducing cohort of seed trees in the future.
- 5. Were measures of restoration success identified in plans? Yes**
If yes, list specific measurements.
Success was based on a qualitative pine regeneration check in the years following spruce removal. However no quantitative value (e.g., # pine saplings per acre) was given.
- 6. Are plan Sets available? Yes Have project maps been created? Yes**
If yes, provide in "site maps" and list maps provided:
- Locations of sale boundary and landing sites
- 7. Provide list of best management practices, standards, guidelines identified in plan set?**
Best management plans were specified for safe harvest with minimal ecological harm including:
- Cutting and felling
 - Season of operation
 - Slash disposal
 - Site, soil and water protection
 - Landings, roads and trails

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

- 8. Were alterations made to the plan during project implementation?**
Yes
Changed from summer harvest to fall harvest in November.
- 9. In what ways did alterations change the proposed project outcome?**
Season of harvest did not affect the outcome of pine regeneration success.

Site Assessment

Field Review Date: 9/15/2021

Field Visit Attendees: Tony Lenocho – MNDNR Parks and Trails Division, Cathy Handrick – MNDNR Parks and Trails Division, Tami Rahkola – MNDNR Parks and Trails Division, Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

- 10. Surrounding Landscape Characteristics:**

The project area is within McCarthy Beach State Park, east of Sturgeon Lake and north of Side Lake. The park is located within the Nashwauk Uplands Ecological Subsection but near the southern boundary of the Littlefork-Vermilion Uplands Subsection. At the finer Land Type Association level, it is within the Nashwauk Moraine LTA. However, the project area falls within an outwash landform that is pitted with ice block depressions.

11. Site Characteristics:

a. Soil Series:

A1B—Eagleview and Menahga soils, 1 to 8 percent slopes

A2D—Graycalm-Grayling-Leander complex, pitted, 0 to 18 percent slopes

A2E—Graycalm-Grayling-Leander complex, pitted, 0 to 45 percent slopes

b. Topography:

Mostly flat to gently sloping outwash with ice block pitting.

c. Hydrology:

Somewhat excessively drained loamy sand with high infiltration. Water drains to the southwest to a small unnamed lake and its associated wetlands.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Native Plant Community mapping indicates FDn33a1: Red Pine- White Pine Woodland Balsam Fir Subtype (mapping by Rebecca Holmstrom, EWR). Within the project area, non-native species had less than 1% cover: Siberian peashrub, white campion, orange hawkweed, and Canada thistle.

12. Is the plan based on current science? Yes

Norway spruce is a non-native species and did not characterize the *ca.* 1800 vegetation of FDn33a1.

Tree species suitable for [FDn33](#) are set forth in the *NPC silviculture strategies for forest stand prescriptions* published by the ECS program in the Division of Forestry, MNDNR.

13. List indicators of project goals at this stage of project:

All canopy Norway spruce have been removed. Remaining conifers are native white and red pine and sparse white spruce.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes. At the time of site assessment, there was no indication of Norway spruce re-colonization. Natural regeneration of red and white pine was abundant and healthy.

15. Are corrections or modifications needed to achieving proposed goals?

No. Goals were met successfully.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

- The success of the naturally regenerating pine is largely due to controlling the deer browse impact on pine shoots. With a combination of bud capping and hosting annual deer hunts, there was no evidence of significant deer browse in the woodland. Though bud capping may no longer be required, it would be beneficial to continue the annual deer hunts. There is a healthy population of naturally seeded pine seedlings, and they will still need to be protected from browse.
- Introduction of prescribed fire is not currently recommended because of the vulnerability of the young pine seedlings and saplings. However, as these pine trees mature and become more fire resistant, prescribed fire may be considered to control undesirable deciduous woody species

and weedy invasive species. The use of prescribed fire is logistically challenging as there are considerations for smoke, safety of nearby private properties, and engagement of the public. Oftentimes, there is a narrow temporal window at which to burn, but aligning the ecologically ideal burn time with that which is socially acceptable may be difficult.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No. All activities have been and are in support of restoring an open landing site to the FDn33 native plant community.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No. The removal of Norway spruce was successful and naturally regenerating pine seedlings are abundant. A new cohort of red and white pine will eventually recruit into the overstory and form a reproducing tree population to maintain the FDn33a1 native plant community. However, park staff should monitor the status of this regenerating pine over time to ensure their recruitment into the overstory is not impeded by competing deciduous shrubs and trees, invasive species, or elevated deer browse and disease.

19. Additional comments on the restoration project.

The removal of Norway spruce is consistent with the park management plan's goal to maintain a natural forest for park patrons. Other resource ideals include:

7. Use of prescribed fire, where appropriate, to maintain fire-dependent native plant communities.
8. Shoreline restoration and stabilization with removal of invasive Siberian peashrub.
9. More mammal survey work.
10. Continuing multi-day deer hunts.
11. Re-evaluating potential old growth forest stands.
12. Preserving cultural resources.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

The project goal was to remove the non-native Norway spruce and rely on naturally seeded native white and red pine regeneration in order to maintain an FDn33a1 native plant community. Removal of the spruce was complete and there was no evidence of re-colonization of spruce seedlings. Pine seedling density is abundant, and the stand will most likely succeed to a semi-closed canopy, mixed pine woodland that is characteristic of FDn33a1. Depending on annual variation of deer browse pressure,

park staff may choose to continue bud capping vulnerable pine seedlings or forego this activity entirely. This regenerating population of white and red pine is exceptional when compared to other northern MN pine-dominated native plant communities across different landforms and soil parent material.

23. *Site Assessor(s) conducting field review:*

Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

Site Maps, Project Plans or Vegetation Tables

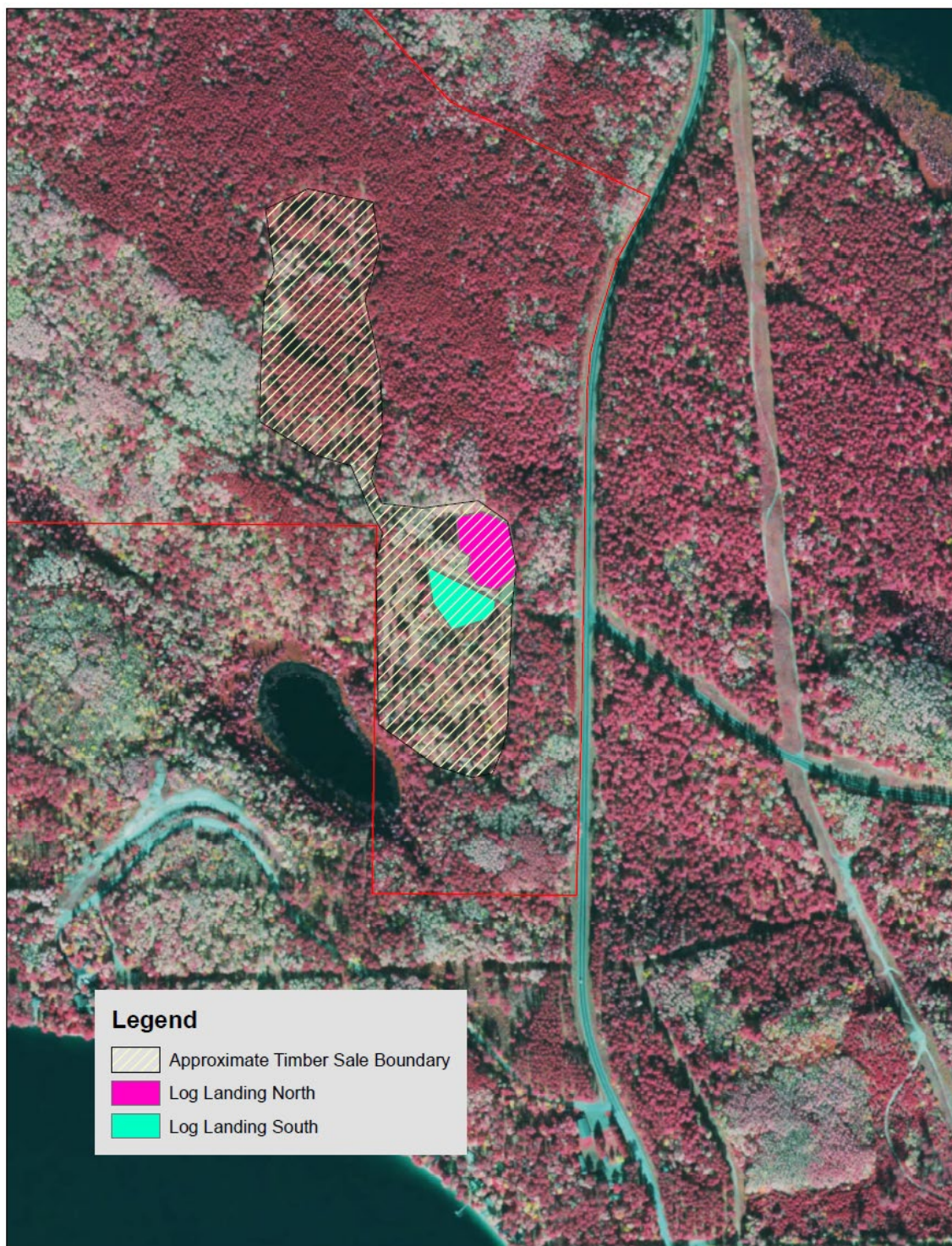


Figure 9-1 Map showing the location of Norway spruce removal in the timber sale boundary and location of landing sites.

Table 9-1 Meander survey for McCarthy Beach State Park in area of Norway spruce removal commercial thinning. Species are listed by physiognomy and height strata.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<u>Evergreen 10-20 m</u>				
<i>Pinus resinosa</i>	Red pine	50-75%	No	Native
<i>Pinus banksiana</i>	Jack pine	0-1%	No	Native
<u>Evergreen 2-5 m</u>				
<i>Pinus resinosa</i>	Red pine	0-1%	No	Native
<i>Pinus strobus</i>	Eastern white pine	0-1%	No	Native
<u>Evergreen 0-2 m</u>				
<i>Pinus resinosa</i>	Red pine	25-50%	No	Native
<i>Pinus strobus</i>	Eastern white pine	1-5%	No	Native
<i>Picea glauca</i>	White spruce	0-1%	No	Native
<u>Deciduous 5-20 m</u>				
<i>Betula papyrifera</i>	Paper birch	0-1%	No	Native
<i>Acer rubrum</i>	Red maple	0-1%	No	Native
<u>Deciduous 0-2 m</u>				
<i>Salix humilis</i>	Prairie willow	0-1%	No	Native
<i>Cornus rugosa</i>	Round-leaved dogwood	1-5%	No	Native
<i>Vaccinium myrtilloides</i>	Velvet-leaved blueberry	0-1%	No	Native
<i>Rubus alleghaniensis</i>	Allegheny blackberry	0-1%	No	Native
<i>Corylus cornuta</i>	Beaked hazelnut	1-5%	No	Native
<i>Lonicera canadensis</i>	Fly honeysuckle	1-5%	No	Native
<i>Vaccinium angustifolium</i>	Lowbush blueberry	1-5%	No	Native
<i>Diervilla lonicera</i>	Bush honeysuckle	1-5%	No	Native
<i>Betula papyrifera</i>	Paper birch	0-1%	No	Native
<i>Rubus idaeus</i> subsp. <i>strigosus</i>	Wild red raspberry	5-25%	No	Native
<i>Acer rubrum</i>	Red maple	0-1%	No	Native
<i>Quercus rubra</i>	Northern red oak	0-1%	No	Native
<i>Caragana arborescens</i>	Siberian peashrub	0-1%	No	Invasive
<u>Forbs 0-2 m</u>				
<i>Lycopodium dendroideum</i>	Round-branched groundpine	0-1%	No	Native
<i>Silene latifolia</i>	White campion	0-1%	No	Invasive
<i>Galium triflorum</i>	Sweet-scented bedstraw	0-1%	No	Native
<i>Anaphalis margaritacea</i>	Pearly everlasting	0-1%	No	Native
<i>Athyrium filix-femina</i>	Lady fern	0-1%	No	Native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Cirsium arvense</i>	Canada thistle	0-1%	No	Invasive
<i>Diphysastrum complanatum</i>	Northern groundcedar	0-1%	No	Native
<i>Pyrola chlorantha</i>	Green-flowered pyrola	0-1%	No	Native
<i>Symphyotrichum ciliolatum</i>	Lindley's aster	0-1%	No	Native
<i>Pteridium aquilinum</i>	Bracken fern	1-5%	No	Native
<i>Maianthemum canadense</i>	Canada mayflower	1-5%	No	Native
<i>Hieracium aurantiacum</i>	Orange hawkweed	0-1%	No	Invasive
<i>Viola adunca</i>	Sand violet	0-1%	No	Native
<i>Aralia nudicaulis</i>	Wild sarsaparilla	0-1%	No	Native
<i>Anemone quinquefolia</i>	Wood anemone	0-1%	No	Native
<i>Fragaria virginiana</i>	Common strawberry	1-5%	No	Native
<i>Lycopodium clavatum</i>	Running clubmoss	0-1%	No	Native
<i>Comandra umbellata</i>	Bastard toadflax	0-1%	No	Native
<i>Apocynum androsaemifolium</i>	Spreading dogbane	0-1%	No	Native
<u>Graminoids 0-0.5 m</u>				
<i>Calamagrostis canadensis</i>	Bluejoint	0-1%	No	Native
<i>Dichanthelium xanthophyllum</i>	Yellow panic grass	0-1%	No	Native
<i>Bromus ciliatus</i>	Fringed brome	1-5%	No	Native
<i>Schizachne purpurascens</i>	False melic grass	1-5%	No	Native
<i>Danthonia spicata</i>	Poverty grass	1-5%	No	Native
<i>Oryzopsis asperifolia</i>	Mountain rice grass	1-5%	No	Native
<u>Mosses 0-0.1 m</u>				
<i>Pleurozium schreberi</i>	Red-stemmed feathermoss	5-25%	No	Native

Site Photographs



Photo 9-1 Norway spruce being hauled to the landing sites after timber harvest at McCarthy Beach State Park in November 2011.



Photo 9-2 Timber harvest area in December 2011 after removal of Norway spruce.



Photo 9-3 Natural pine regeneration from several cohorts was observed throughout the timber sale area.



Photo 9-4 Natural pine regeneration in an opening 10 years after Norway spruce removal at McCarthy Beach State Park.



Photo 9-5 Cut Norway spruce left behind after timber sale and hand harvest by CCM crews.

11 Lake Vermilion State Park Forest Enhancement (Planting Site #6)

Project Background

Project Name: Lake Vermilion State Park Forest Planting Site 6

Project Site: Planting Site #6

Township/Range Section: Township 62N Range 15W Section 25

Project Manager / Affiliated Organization: Tony Lenocho – MNDNR Parks and Trails Division

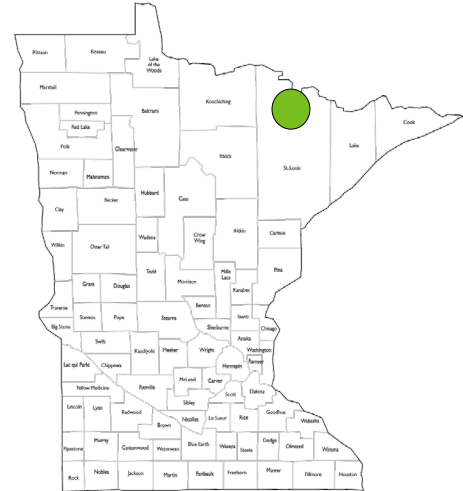
Fund: PTF **Fiscal Year Funds:** 2013

Project Start Date: Spring 2013

Predominant Habitat type: Forest

Additional Habitat types:

Project Status: Post Establishment Phase



County: St. Louis

Primary Activity: Forest Restoration

Project Size: 13 acres

Project Completed: 2017

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

The Lake Vermilion State Park Planting Site #6 is one of eleven mixed conifer, bare root plantings that occurred over three years – 2012 (three), 2013 (two), 2016 (six). White pine, red pine, and jack pine were planted under varying levels of canopy closure. A northern red oak planting occurred at one site. Site 6 was one of two sites that was clearcut by US Steel in winter 2009-2010 prior to state ownership and had little canopy before planting. Planting directive outlined in the forest development proposal was 300 seedlings per acre in sunny areas not patterned in rows. Recommended species mix was 40% white pine, 30% white spruce, 15% red pine, and 15% jack pine. The Conservation Corps of Minnesota conducted the planting in Spring 2013, and actual species makeup in the form of 12-16" bare root seedlings was: 75% white pine (2,000), 19% red pine (500), and 6% jack pine (150) for a final density of

204 seedlings per acre. Additional bud capping and timber stand improvement (brush saw removal of competing deciduous shrubs) occurred in 2017.

2. *What plans / record of project decisions / prescription worksheets are available? Provide location for the data?*

- Forest development proposals (2)
- Map of planting site locations and checklist of necessary bud cap and TSI activities for 2017
- Tree planting quantities for all 11 sites
- Map of balsam fir mortality
- Notes from climate change adaptation workshop relevant to restoration project

3. *What are the stated goals of the project?*

The goal was to plant the recently clearcut, early successional aspen-birch forest with mixed conifer tree species.

4. *What are the desired outcomes of achieving the stated goals of the project?*

The long-term desired outcome is a mature FDN43a (northern mesic white pine – red pine forest) native plant community similar to that found in the western end (i.e., the “Soudan” side) of the park. The mid-term desired outcome is establishing a canopy of seed tree conifers that continually facilitates new cohort establishment over time. Finally, the immediate desired outcome is a 10-20% survival rate of planted conifers to reach reproductive age and provide a coniferous component to the otherwise uniform aspen-birch canopy.

5. *Were measures of restoration success identified in plans? No*

If yes, list specific measurements.

NA

6. *Are plan Sets available? Yes Have project maps been created? Yes*

If yes, provide in “site maps” and list maps provided:

- Map of planting site locations
- Map of balsam fir mortality

7. *Provide list of best management practices, standards, guidelines identified in plan set?*

- Purposeful planting in sunny openings but not patterned in plantation rows
- Bud capping newly planted pine seedlings to protect against browse
- Timber Stand Improvement (TSI) removal of competing deciduous shrubs

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. *Were alterations made to the plan during project implementation?*

Yes

Original plan of planting white spruce along with the white pine, red pine, and jack pine did not occur. Also, the forest development proposal called for 300 seedlings per acre, but planted density was 204 seedlings per acre.

9. In what ways did alterations change the proposed project outcome?

White spruce seedlings were minimally observed during the meander survey. This species is unlikely to be a component of the near-term forest. Planted pine seedling density was lower than initially planned, possibly affecting the survival rate.

Site Assessment

Field Review Date: 9/15/2021

Field Visit Attendees: Tony Lenocho – MNDNR Parks and Trails Division, Cathy Handrick – MNDNR Parks and Trails Division, Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

10. Surrounding Landscape Characteristics:

The project area is located at the eastern end of Lake Vermilion State Park, between the south shore of Cable Bay and just south of MN-1. The park is located within the Border Lakes Ecological Subsection and barely crosses into the Nashwauk Uplands Subsection at its southeastern boundary. At the finer Land Type Association level, the project area falls within Vermilion Bedrock Complex and Ely-Knife Lake Bedrock Complex LTAs. Soil parent material is generally loamy drift over bedrock or loamy drift over dense gravelly lodgment till.

11. Site Characteristics:

a. Soil Series:

F3D—Eveleth-Eaglesnest-Conic complex, bouldery, 6 to 18 percent slopes, very rocky

b. Topography:

Topography is rugged with areas of exposed bedrock. Wetlands occur in between upland bedrock highs. Site #6 includes valley drainage slopes that funnel water towards an adjacent swamp to the east. Swamp and wet-mesic species occur in these drainages.

c. Hydrology:

These are well drained to moderately well drained upland soils with underlying densic till. Runoff and subsurface water flows downslope to adjacent wetlands (forested peatlands, fens, and beaver wetland complexes).

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

The project area is primarily FDn43b1: Northern Mesic Mixed Forest, Aspen-Birch Forest Balsam Fir Subtype (mapping by Tavis Westbrook, PAT). Within the project area, non-native species had between 5-25% cover: tansey, bird's-foot trefoil, ox-eye daisy, Canada thistle, orange hawkweed, tall buttercup, common speedwell, and Sylvan bluegrass. Sylvan bluegrass (*Poa nemoralis*) contributed the greatest cover; however, distinguishing this species from the native *Poa interior* is difficult especially when surveyed late in the growing season.

12. Is the plan based on current science? Yes

Tree species suitable for [FDn43](#) are set forth in the *NPC silviculture strategies for forest stand prescriptions* published by the ECS program in the Division of Forestry, MNDNR. White pine, red pine, and jack pine all have “Excellent” suitability indices and crop tree potential. The use of bud caps to

protect growing shoots of pine seedlings from deer browse is widely practiced in the restoration and forestry communities. Timber Stand Improvement (TSI) through competing brush removal allows shade intolerant red pine and moderately shade tolerant white pine to be more competitive against faster growing trembling aspen and paper birch.

13. List indicators of project goals at this stage of project:

During the meander survey, both planted white pine and red pine were observed. Jack pine, however, was infrequently observed.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes. Planting of mixed pine, followed by bud capping and TSI work should hypothetically allow for achieving goal and desired outcomes.

15. Are corrections or modifications needed to achieving proposed goals?

Yes. CCM crew planted very quickly and plantings may have been limited to the near perimeter of the site and was sparse in the interior. Subsequent interior planting may be needed.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

- The greatest threat to the success of the restoration plantings is the severe deer browse on pine seedlings. Though hare browse was also observed during the meander survey, deer browse appeared to be most prevalent. Unless the deer population is reduced, extensive bud capping and/or caging will be required to protect pine seedlings until they grow to beyond browse height. Many of the planted pine seedlings observed during the meander survey were stunted by repeated browse and foliar density on remaining shoots was low. These seedlings, in their current state, are unlikely to successfully outcompete the more vigorous trembling aspen and woody shrubs dominating the site. An additional round of plantings may be required, and planting crews should ensure a greater distribution of seedlings throughout the site and at greater densities.
- Using container grown seedling stock may also be better than bare root stock for future plantings. The vigor of the former may afford better growth and resilience against the shock of transplantation.
- Though prescribed fire is not currently being considered, its future application could be beneficial. FDn43 is a fire-dependent community, and average fire rotation of all fires was historically about 115 years. It is a tool for preparing seed beds and reducing fire-intolerant woody competition.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No. All activities have been and are in support of restoring an open clearcut to the FDn43 native plant community.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Yes. If another round of planting occurs, the Restoration Evaluation Program should conduct a new assessment. This is especially true if the new planting significantly deviates from the original planting in scope, species mix, planting density, seedling protection, or active deer management.

19. Additional comments on the restoration project.

The restoration activities are part of a larger effort by the park to adapt to a changing climate. Long-term goals include species diversification with high genetic variability, restoring *ca.* 1800 conditions or disturbance regimes, fuels reduction, and engagement of the public with frequent communication. The principles of ecosystem resistance, resilience, and transition dictate how the park applies future management activities.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Minimally achieved the stated goals.

21. The project will:

Minimally meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

The needle evergreen stratum, comprised of white pine, red pine, jack pine, white spruce, and balsam fir, up to 2 m tall only had 1-5% cover (Table 1). There were no overstory pines to provide natural seeding. These two limitations in addition to the rigorous clonal sprouting of trembling aspen, high deer browse pressure, and lack of regular fire disturbance suggest that the desired outcomes will minimally be attained under the current successional trajectory.

Pine regeneration, both natural and human assisted, is commonly sparse in most northeastern Minnesota FDn43 communities. This is the most mesic of the fire-dependent classes, where trembling aspen, paper birch, and red maple can better outcompete coniferous species in the absence of fire when compared to other, more xeric fire-dependent classes (e.g., FDn32 and FDn33). At Site 6, wet-mesic and even some wet species were observed during the meander survey. The underlying soil has densic till capable of perching up water. This results in favorable mesic growing conditions for a diversity of shrubs and tree species that are capable of faster growth than pine species. The persistence of pines in FDn43 *ca.* 1800 relied on frequent ground fires and much lower deer densities than currently.

23. Site Assessor(s) conducting field review

Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

Site Maps, Project Plans or Vegetation Tables

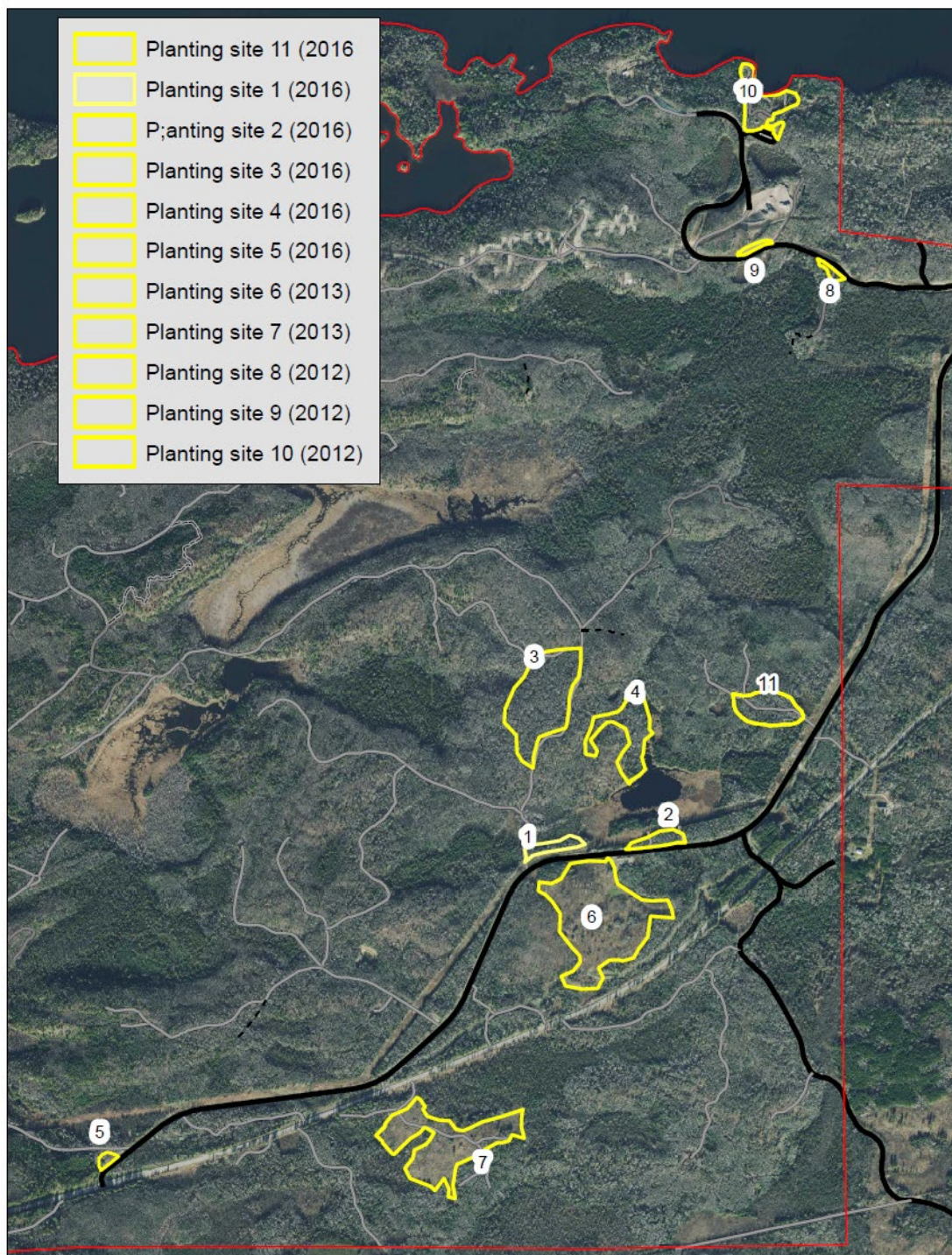


Figure 10-1 Planting sites in Lake Vermillion-Soudan Underground Mine State Park. Some plantings occurred in areas with a more closed canopy such as site 3. Other planting sites were much more open as planting occurred after timber harvest such as site 6.

Table 10-1 Meander survey for Lake Vermilion State Park forest planting site #6. Species are listed by physiognomy and height strata.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<u>Evergreen 2-10 m</u>				
<i>Picea glauca</i>	White spruce	0-1%	No	Native
<i>Abies balsamea</i>	Balsam fir	0-1%	No	Native
<u>Evergreen 0-2 m</u>				
<i>Pinus strobus</i>	Eastern white pine	1-5%	Yes - planted	Native
<i>Pinus resinosa</i>	Red pine	1-5%	Yes - planted	Native
<i>Abies balsamea</i>	Balsam fir	1-5%	No	Native
<i>Pinus banksiana</i>	Jack pine	0-1%	Yes – planted	Native
<i>Picea glauca</i>	White spruce	0-1%	No	Native
<u>Deciduous 10-20 m</u>				
<i>Quercus rubra</i>	Northern red oak	0-1%	No	Native
<u>Deciduous 2-10 m</u>				
<i>Populus tremuloides</i>	Trembling aspen	50-75%	No	Native
<i>Betula papyrifera</i>	Paper birch	0-1%	No	Native
<i>Fraxinus nigra</i>	Black ash	0-1%	No	Native
<i>Salix humilis</i>	Prairie willow	0-1%	No	Native
<i>Quercus rubra</i>	Northern red oak	0-1%	No	Native
<i>Acer rubrum</i>	Red maple	0-1%	No	Native
<u>Deciduous 0-2 m</u>				
<i>Rosa acicularis</i>	Prickly rose	0-1%	No	Native
<i>Diervilla lonicera</i>	Bush honeysuckle	1-5%	No	Native
<i>Amelanchier cf. humilis</i>	Low juneberry	0-1%	No	Native
<i>Cornus sericea</i>	Red-osier dogwood	0-1%	No	Native
<i>Acer rubrum</i>	Red maple	1-5%	No	Native
<i>Ribes triste</i>	Swamp red currant	0-1%	No	Native
<i>Prunus virginiana</i>	Chokecherry	1-5%	No	Native
<i>Cornus rugosa</i>	Round-leaved dogwood	5-25%	No	Native
<i>Rubus idaeus subsp. strigosus</i>	Wild red raspberry	5-25%	No	Native
<i>Lonicera hirsuta</i>	Hairy honeysuckle	0-1%	No	Native
<i>Fraxinus nigra</i>	Black ash	1-5%	No	Native
<i>Corylus cornuta</i>	Beaked hazelnut	1-5%	No	Native
<i>Lonicera canadensis</i>	Fly honeysuckle	1-5%	No	Native
<i>Viburnum rafinesquianum</i>	Downy arrowwood	0-1%	No	Native
<i>Vaccinium angustifolium</i>	Lowbush blueberry	0-1%	No	Native
<i>Rubus allegheniensis</i>	Allegheny blackberry	0-1%	No	Native
<i>Prunus pumila var. susquehanae</i>	Sand cherry	0-1%	No	Native
<u>Forbs 0-2 m</u>				

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Tanacetum vulgare</i>	Tansey	0-1%	No	Invasive
<i>Lathyrus ochroleucus</i>	Pale vetchling	0-1%	No	Native
<i>Iris versicolor</i>	Northern blue flag	0-1%	No	Native
<i>Geum</i> cf. <i>canadense</i>	White avens	0-1%	No	Native
<i>Cornus canadensis</i>	Bunchberry	0-1%	No	Native
<i>Dryopteris carthusiana</i>	Spinulose shield fern	0-1%	No	Native
<i>Lotus corniculatus</i>	Bird's-foot trefoil	0-1%	No	Invasive
<i>Pteridium aquilinum</i>	Bracken fern	0-1%	No	Native
<i>Solidago gigantea</i>	Giant goldenrod	1-5%	No	Native
<i>Apocynum androsaemifolium</i>	Spreading dogbane	0-1%	No	Native
<i>Leucanthemum vulgare</i>	Ox-eye daisy	0-1%	No	Invasive
<i>Aralia nudicaulis</i>	Wild sarsaparilla	1-5%	No	Native
<i>Cirsium arvense</i>	Canada thistle	0-1%	No	Invasive
<i>Vicia americana</i>	American vetch	0-1%	No	Native
<i>Ranunculus acris</i>	Tall buttercup	0-1%	No	Invasive
<i>Lathyrus venosus</i>	Veiny pea	0-1%	No	Native
<i>Cynoglossum virginianum</i> var. <i>boreale</i>	Wild comfrey	0-1%	No	Native
<i>Veronica officinalis</i>	Common speedwell	1-5%	No	Invasive
<i>Hieracium aurantiacum</i>	Orange hawkweed	1-5%	No	Invasive
<i>Actaea rubra</i>	Red baneberry	0-1%	No	Native
<i>Trientalis borealis</i>	Starflower	0-1%	No	Native
<i>Maianthemum canadense</i>	Canada mayflower	1-5%	No	Native
<i>Rubus pubescens</i>	Dwarf raspberry	1-5%	No	Native
<i>Fragaria virginiana</i>	Common strawberry	1-5%	No	Native
<i>Anaphalis margaritacea</i>	Pearly everlasting	1-5%	No	Native
<i>Eurybia macrophylla</i>	Large-leaved aster	25-50%	No	Native
<u>Graminoids 0-0.5 m</u>				
<i>Schizachne purpurascens</i>	False melic grass	0-1%	No	Native
<i>Oryzopsis asperifolia</i>	Mountain rice grass	1-5%	No	Native
<i>Calamagrostis canadensis</i>	Bluejoint	1-5%	No	Native
<i>Poa palustris</i>	Fowl bluegrass	5-25%	No	Native
<i>Carex intumescens</i>	Bladder sedge	0-1%	No	Native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Brachyelytrum aristosum</i>	Northern shorthusk	1-5%	No	Native
<i>Poa</i> cf. <i>nemoralis</i>	Sylvan bluegrass	5-25%	No	Invasive
<i>Carex arctata</i>	Drooping wood sedge	0-1%	No	Native

Site Photographs



Photo 10-1 A mix of openings and clonal growth of trembling aspen typical of planting site 6.



Photo 10-2 Deer browse was observed on pines throughout planting site 6.



Photo 10-3 Planted white pine growing next to thick aspen/birch growth.



Photo 10-4 Evidence of successful brush clearing and release work was observed throughout planting site 6.

12 Lake Vermilion State Park Forest Restoration (Planting Site #3)

Project Background

Project Name: Lake Vermilion State Park Forest Planting Site 3

Project Site: Planting Site #3

Township/Range Section: Township 62N Range 15W Section 25

Project Manager / Affiliated Organization: Tony Leno – MNDNR Parks and Trails Division

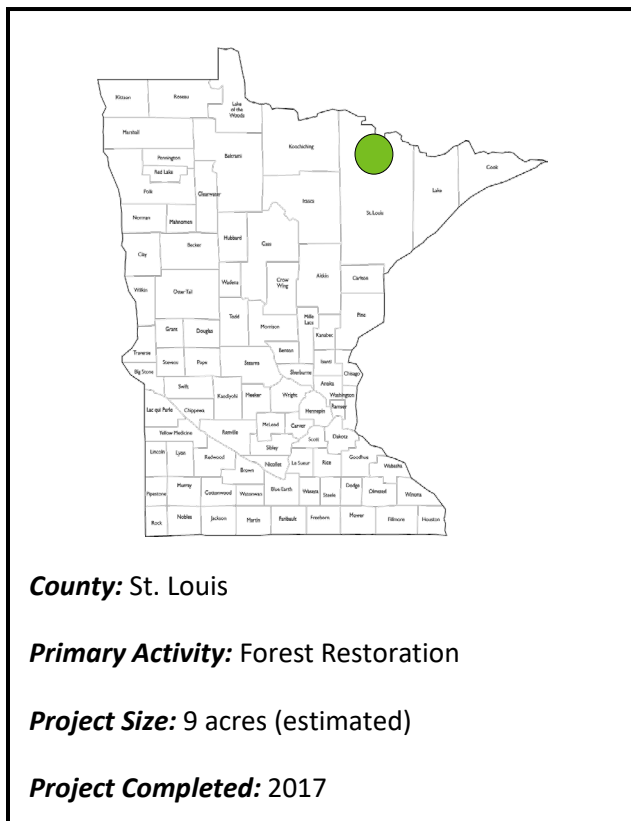
Fund: PTF **Fiscal Year Funds:** 2016

Project Start Date: 2016

Predominant Habitat type: Forest

Additional Habitat types:

Project Status: Post Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

The Lake Vermilion State Park Planting Site #3 is one of eleven mixed conifer, bare root plantings that occurred over three years – 2012 (three), 2013 (two), 2016 (six). White pine, red pine, and jack pine were planted under varying levels of canopy closure. A northern red oak planting occurred at one site. For Site #3, the Conservation Corps of Minnesota conducted the planting in Spring 2016, and species makeup in the form of 12-16" bare root seedlings was: 91% white pine (2,000) and 9% red pine (200) for a final density of approximately 244 seedlings per acre. Additional bud capping occurred in 2017. Site #3 experienced pockets of high balsam fir mortality due to spruce budworm and caused the formation of canopy openings. CCM crews were instructed to focus pine plantings in these natural openings. Canopy openings were generally small and occurred within a canopy of paper birch, trembling aspen, and red maple (Table 1). Dead standing balsam fir were left as snags and allowed to fall down naturally.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

- Forest development proposals (2)
- Map of planting site locations and checklist of necessary bud cap and TSI activities for 2017
- Tree planting quantities for all 11 sites
- Map of balsam fir mortality
- Notes from climate change adaptation workshop relevant to restoration project

3. *What are the stated goals of the project?*

The goal was to underplant white pine and red pine seedlings in canopy gaps formed from balsam fir-induced mortality caused by spruce budworm.

4. *What are the desired outcomes of achieving the stated goals of the project?*

The desired outcome is establishment of a reproducing population of white and red pines so that upon eventual paper birch and trembling aspen senescence, there would be enough seed trees to naturally regenerate the forest to a mixed conifer FDN43a (northern mesic white pine – red pine forest) native plant community similar to that found in the western end (i.e., the “Soudan” side) of the park.

5. *Were measures of restoration success identified in plans?* No

If yes, list specific measurements.

NA

6. *Are plan sets available? Yes Have project maps been created?* Yes

If yes, provide in “site maps” and list maps provided:

- Map of planting site locations
- Map of balsam fir mortality

Provide list of best management practices, standards, guidelines identified in plan set?

- Purposeful planting in sunny openings
- Bud capping newly planted pine seedlings to protect against browse

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. *Were alterations made to the plan during project implementation?*

No

8. *In what ways did alterations change the proposed project outcome?*

NA

Site Assessment

Field Review Date: 9/15/2021

Field Visit Attendees: Tony Lenocho – MNDNR Parks and Trails Division, Cathy Handrick – MNDNR Parks and Trails Division, Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

9. Surrounding Landscape Characteristics:

The project area is located at the eastern end of Lake Vermilion State Park, between the south shore of Cable Bay and just south of MN-1. The park is located within the Border Lakes Ecological Subsection and barely crosses into the Nashwauk Uplands Subsection at its southeastern boundary. At the finer Land Type Association level, the project area falls within Vermilion Bedrock Complex and Ely-Knife Lake Bedrock Complex LTAs. Soil parent material is generally loamy drift over bedrock or loamy drift over dense gravelly lodgment till.

10. Site Characteristics:

a. Soil Series:

F35D—Eveleth, bouldery-Conic, bouldery-Aquepts, rubbly, complex, 0 to 18 percent slopes

b. Topography:

Topography is rugged with areas of exposed bedrock. Wetlands occur in between upland bedrock highs. Site #3 includes narrow drainages with slightly moister conditions than adjacent backslopes.

c. Hydrology:

These are well drained upland soils with underlying densic till. Runoff and subsurface water flows downslope to adjacent wetlands (forested peatlands, fens, and beaver wetland complexes).

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

The project area is primarily FDn43b1: Northern Mesic Mixed Forest, Aspen-Birch Forest Balsam Fir Subtype (mapping by Tavis Westbrook, PAT). Within the project area, non-native species had less than 5% cover: orange hawkweed, ox-eye daisy, and Sylvan bluegrass.

11. Is the plan based on current science? Yes

Tree species suitable for [FDn43](#) are set forth in the NPC silviculture strategies for forest stand prescriptions published by the ECS program in the Division of Forestry, MNDNR. White pine and red pine both have “Excellent” suitability indices and crop tree potential. The use of bud caps to protect growing shoots of pine seedlings from deer browse is widely practiced in the restoration and forestry communities.

12. List indicators of project goals at this stage of project:

During the meander survey, planted white pine was observed. Red pine, however, was not observed.

13. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes. Planting of mixed pine in blowdown openings, followed by bud capping could allow for achieving goal and desired outcomes.

14. Are corrections or modifications needed to achieving proposed goals?

No, the CCM crew successfully planted white and red pine bare root seedlings under canopy openings and bud capped the leader shoots.

15. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

- The greatest threat to the success of the restoration plantings is the severe deer browse on pine seedlings. Though hare browse was also observed during the meander survey, deer browse appeared to be most prevalent. Unless the deer population is reduced, extensive bud capping and/or caging will be required to protect pine seedlings until they grow to beyond browse

height. Many of the planted pine seedlings observed during the meander survey were stunted by repeated browse and foliar density on remaining shoots was low. These seedlings, in their current state, are unlikely to successfully recruit into the overstory.

- The canopy openings are generally small and offer only speckled light emittance down to the understory. Since white pine is moderately shade tolerant and red pine is shade intolerant, the light conditions together with the browse severity cause slow seedling growth. Additional future underplantings may require increasing the size of canopy openings. Girdling or felling the dominant paper birch and trembling aspen could provide more light. Targeted herbicide application may be required to control aspen sucker sprouts.
- Using container grown seedling stock may also be better than bare root stock for future plantings. The vigor of the former may afford better growth and resilience against the shock of transplantation.
- Though prescribed fire is not currently being considered, its future application could be beneficial. FDn43 is a fire-dependent community, and average fire rotation of all fires was historically about 115 years. It is a tool for preparing seed beds and reducing fire-intolerant woody competition. However, consideration must be given to smoke production, potential wildfire escape, and public education and engagement.

16. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No, all activities have been and are in support of furthering the succession towards a pine-dominated FDn43a native plant community.

17. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Yes. If another round of planting occurs, the Restoration Evaluation Program should conduct a new assessment. This is especially true if the new planting significantly deviates from the original planting in scope, species mix, planting density, seedling protection, or active deer management.

18. Additional comments on the restoration project.

The restoration activities are part of a larger effort by the park to adapt to a changing climate. Long-term goals include species diversification with high genetic variability, restoring *ca.* 1800 conditions or disturbance regimes, fuels reduction, and engagement of the public with frequent communication. The principles of ecosystem resistance, resilience, and transition dictate how the park applies future management activities.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

19. The project has:

Achieved the stated goals.

20. The project will:

Likely not meet proposed outcomes.

Confidence of outcome determination:

High.

21. Provide explanation of reason(s) for determination.

The needle evergreen stratum, comprised of white pine and balsam fir, up to 2 m tall only had 1-5% cover (Table 1). Red pine was not observed. There were no overstory pines to provide natural seeding. These two limitations in addition to the current canopy shading by paper birch and trembling aspen, high deer browse pressure, and lack of regular fire disturbance suggest that the desired outcomes will not be attained under the current successional trajectory. Many of the bud caps were missing, deteriorated, or insufficient to prevent browse.

Pine regeneration, both natural and human assisted, is commonly sparse in most northeastern Minnesota FDn43 communities. This is the most mesic of the fire-dependent classes, where trembling aspen, paper birch, and red maple can better outcompete coniferous species in the absence of fire when compared to other, more xeric fire-dependent classes (e.g., FDn32 and FDn33). At Site #3, the underlying soil has densic till capable of perching up water. This results in favorable mesic growing conditions for a diversity of shrubs and tree species that are capable of faster growth than pine species. The persistence of pines in FDn43 ca. 1800 relied on frequent ground fires and much lower deer densities than currently.

22. Site Assessor(s) conducting field review

Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

Site Maps, Project Plans or Vegetation Tables

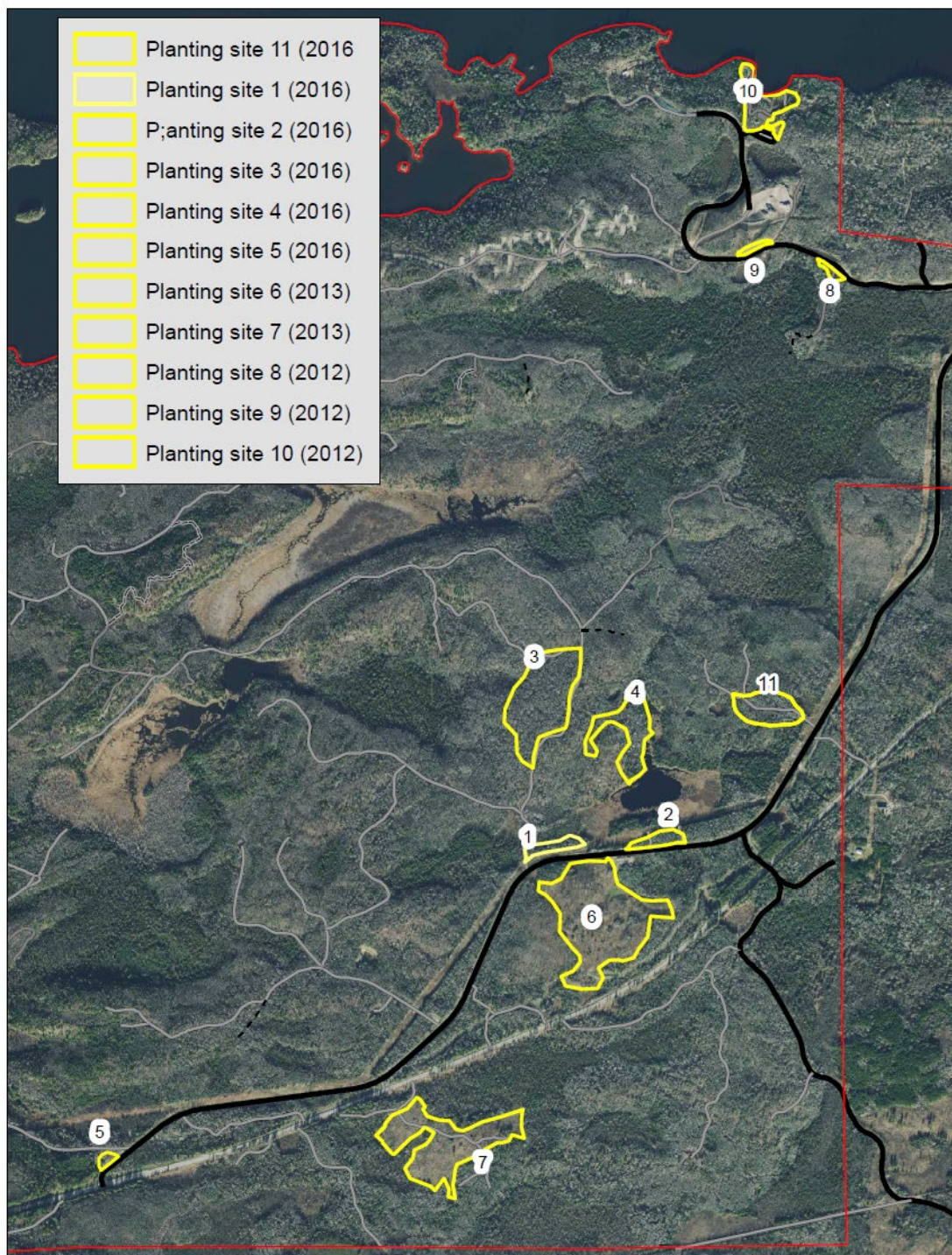


Figure 11-1 Planting sites in Lake Vermillion-Soudan Underground Mine State Park. Some plantings occurred in areas with a more closed canopy such as site 3. Other planting sites were much more open as planting occurred after timber harvest such as site 6.

Table 11-1 Meander survey for Lake Vermilion State Park forest planting site #3. Species are listed by physiognomy and height strata.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<u>Evergreen 0-2 m</u>				
<i>Pinus strobus</i>	Eastern white pine	1-5%	Yes - planted	Native
<i>Abies balsamea</i>	Balsam fir	1-5%	No	Native
<i>Pinus resinosa</i>	Red pine	ABSENT	Yes - planted	Native
<u>Deciduous 5-20 m</u>				
<i>Betula papyrifera</i>	Paper birch	50-75%	No	Native
<i>Populus tremuloides</i>	Trembling aspen	25-50%	No	Native
<i>Acer rubrum</i>	Red maple	5-25%	No	Native
<u>Deciduous 2-5 m</u>				
<i>Corylus cornuta</i>	Beaked hazelnut	0-1%	No	Native
<u>Deciduous 0-2 m</u>				
<i>Diervilla lonicera</i>	Bush honeysuckle	0-1%	No	Native
<i>Betula papyrifera</i>	Paper birch	0-1%	No	Native
<i>Cornus rugosa</i>	Round-leaved dogwood	1-5%	No	Native
<i>Rubus idaeus subsp. strigosus</i>	Wild red raspberry	0-1%	No	Native
<i>Corylus cornuta</i>	Beaked hazelnut	1-5%	No	Native
<i>Lonicera canadensis</i>	Fly honeysuckle	1-5%	No	Native
<i>Viburnum rafinesquianum</i>	Downy arrowwood	0-1%	No	Native
<i>Vaccinium angustifolium</i>	Lowbush blueberry	0-1%	No	Native
<i>Vaccinium myrtilloides</i>	Velvet-leaved blueberry	0-1%	No	Native
<i>Acer spicatum</i>	Mountain maple	0-1%	No	Native
<i>Populus tremuloides</i>	Trembling aspen	0-1%	No	Native
<i>Amelanchier cf. humilis</i>	Low juneberry	0-1%	No	Native
<u>Forbs 0-2 m</u>				
<i>Cornus canadensis</i>	Bunchberry	0-1%	No	Native
<i>Hieracium aurantiacum</i>	Orange hawkweed	0-1%	No	Invasive
<i>Pteridium aquilinum</i>	Bracken fern	5-25%	No	Native
<i>Lycopodium clavatum</i>	Running clubmoss	0-1%	No	Native
<i>Trientalis borealis</i>	Starflower	0-1%	No	Native
<i>Doellingeria umbellata</i>	Flat-topped aster	0-1%	No	Native
<i>Galium triflorum</i>	Sweet-scented bedstraw	1-5%	No	Native
<i>Lathyrus ochroleucus</i>	Pale vetchling	0-1%	No	Native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Clintonia borealis</i>	Bluebead lily	1-5%	No	Native
<i>Lycopodium dendroideum</i>	Round-branched groundpine	1-5%	No	Native
<i>Maianthemum canadense</i>	Canada mayflower	1-5%	No	Native
<i>Anaphalis margaritacea</i>	Pearly everlasting	1-5%	No	Native
<i>Lathyrus venosus</i>	Veiny pea	0-1%	No	Native
<i>Aralia nudicaulis</i>	Wild sarsaparilla	1-5%	No	Native
<i>Rubus pubescens</i>	Dwarf raspberry	1-5%	No	Native
<i>Vicia americana</i>	American vetch	0-1%	No	Native
<i>Leucanthemum vulgare</i>	Ox-eye daisy	1-5%	No	Invasive
<i>Eurybia macrophylla</i>	Large-leaved aster	25-50%	No	Native
<i>Anemone quinquefolia</i>	Wood anemone	0-1%	No	Native
<i>Linnaea borealis</i>	Twinflower	0-1%	No	Native
<i>Actaea rubra</i>	Red baneberry	0-1%	No	Native
<i>Monotropa uniflora</i>	Indian pipe	0-1%	No	Native
<u>Graminoids 0-0.5 m</u>				
<i>Schizachne purpurascens</i>	False melic grass	1-5%	No	Native
<i>Oryzopsis asperifolia</i>	Mountain rice grass	1-5%	No	Native
<i>Poa cf. nemoralis</i>	Sylvan bluegrass	1-5%	No	Invasive
<i>Carex arctata</i>	Drooping wood sedge	0-1%	No	Native
<u>Mosses 0-0.1 m</u>				
<i>Pleurozium schreberi</i>	Red-stemmed feathermoss	1-5%	No	Native
<i>Rhytidiadelphus triquetrus</i>	Pipe cleaner moss	1-5%	No	Native

Site Photographs



Photo 11-1 Typical opening from balsam fir mortality in planting site 3.



Photo 11-2 Snags and down trees from balsam fir mortality in an opening in planting site 3.



Photo 11-3 Stunted white pine in the 2021 growing season, five years after planting.



Photo 11-4 Bud caps on planted white pine saplings.

13 MN Moose Habitat Collaborative Forest Enhancement (Bill Lake)

Project Background

Project Name: MN Moose Habitat Collaborative Phase II

Project Site: Bill Lake

Township/Range Section: Township 61N Range 06W Section 01 AND T62N 06W Sec. 36

Project Manager / Affiliated Organization: David Grosshuesch, US Forest Service (Superior NF)

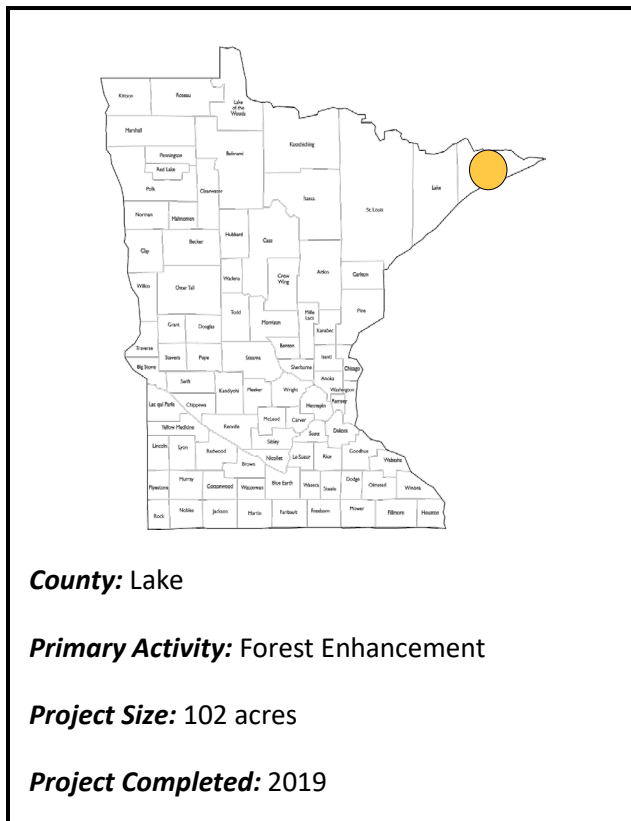
Fund: OHF **Fiscal Year Funds:** 2014

Project Start Date: 2018

Predominant Habitat type: Forest

Additional Habitat types:

Project Status: Post Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

Site prep by dozer shearing during winter 2018/2019. Shearing contractor was instructed to avoid existing advanced regeneration of trembling aspen, balsam fir thickets, and large mature trees. Planting of white spruce, black spruce, and white pine seedlings at 180 trees per acre occurred in 2019. Spruce species were planted in the more poorly drained areas and white pine was planted in the more well drained areas.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

No hardcopy plans available

3. What are the stated goals of the project?

The goal for the Bill Lake Units was to winter shear (site prep) the understory followed by conifer seedling plantings at 180 trees per acre. The choice of site location was dictated by size and contract work cost. Large treatment parcels have lower costs per acre than smaller ones. The Bill Lake Units have a complementary site that is 180 acres, and together, David Grosshuesch identified them as ideal candidates for moose habitat enhancement.

4. What are the desired outcomes of achieving the stated goals of the project?

Through shearing, the desired outcome is to create a new flush of nutritious woody moose forage in the immediate term. Through conifer plantings, the desired outcome is increased structural diversity in the long term.

5. Were measures of restoration success identified in plans? No

If yes, list specific measurements.

NA

6. Are plan Sets available? No Have project maps been created? Yes

If yes, provide in "site maps" and list maps provided:

- Map of Bill Lake management boundary

7. Provide list of best management practices, standards, guidelines identified in plan set?

None identified as there are no hardcopy plan sets or prescription documentation. However, shearing occurred in the winter because somewhat poorly drained and poorly drained low areas are present. Heavy equipment usage on frozen soil minimizes potential for soil rutting and compaction. Additionally, the contractor had ample oversight by Forest Service personnel as communication between parties occurred daily. The contractor had shearing instructions to avoid existing advanced regeneration of trembling aspen, balsam fir thickets, and large mature trees. Planting of seedlings followed the physiological requirements of each species: white and black spruce in wet areas and white pine in dry areas.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

No

9. In what ways did alterations change the proposed project outcome?

NA

Site Assessment

Field Review Date: 10/25/2021

Field Visit Attendees: Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division, Chris Dunham – The Nature Conservancy, David Grosshuesch – US Forest Service

10. Surrounding Landscape Characteristics:

The project area is located within the Laurentian Uplands Ecological Subsection. At the finer Land Type Association level, it is within the Timber Freer Till Plain LTA. Additionally, the project area falls within a 'High' Site of Biodiversity Significance, as reported by the MNDNR's MN Biological Survey. It is located immediately north of Cramer Road (County Road 7) and 2 km southeast of Bill Lake. Surrounding forests

are a mix of mature and early successional plant communities. The most common native plant communities are Northern Mesic Mixed Forest (FDn43), Northern Poor Dry-Mesic Mixed Woodland (FDn32), and Northern Rich Spruce Swamp (Basin) (FPn62).

11. Site Characteristics:

a. Soil Series:

Not mapped to SSURGO level. Broad taxonomy is coarse-loamy, isotic, frigid Typic Dystrudepts. Soil parent material is Rainy Lobe till. Superior National Forest Land Type Phase mapping is LTP 30 and LTP 31: well drained to moderately well drained loam/fine sandy loam 12-40" over gravelly loamy sand/sandy loam; lower horizons may be compacted.

b. Topography:

The till plain is rolling with broad hills. Wetlands occur at lower elevations and along drainages in between hills.

c. Hydrology:

Lower soil horizons may be compacted and capable of perching water. The project area straddles two minor watersheds (HUC 12): Hog Creek and Perent River. Water drains into adjacent wetlands that eventually flows northward into the Rainy River.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Native Plant Community mapping by Chel Anderson, EWR, indicates the project area is Northern Mesic Mixed Forest – Aspen-Birch Forest, Balsam Fir Subtype (FDn43b1). No non-native species were encountered during the meander survey.

12. Is the plan based on current science? Yes

Site prep through understory shearing is a well-known restoration tool to stimulate clonal sprouting of certain woody plant species. The scope of the project adheres to moose habitat recommendations set forth in the 2009 Report to the Minnesota Department of Natural Resources (DNR) by the Moose Advisory Committee available at <https://www.lrl.mn.gov/lrl>:

- Upland brush communities should be identified, protected, and maintained by mechanical treatment and/or prescribed fire to provide moose browse.
- Utilize forest management/habitat management techniques that will promote browse production and diversity while maintaining juxtaposition of winter and summer thermal cover.
- In order to protect desirable browse species while reducing competition with conifer seedlings, the use of mechanical treatment or hand release should be encouraged.

13. List indicators of project goals at this stage of project:

Sprouting of various woody species were observed during the meander survey indicating the success of shearing. The meander survey also confirmed the plantings of white and black spruce seedlings. White pine seedlings, however, were not observed.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes. Though no project plan documentation is available, both shearing and planting goals were successfully met.

15. Are corrections or modifications needed to achieving proposed goals?

No.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Yes. Both white and black spruce planted seedlings appeared to be doing well at the time of the meander survey. By the third year after planting, conifer seedlings are ready to be released from surrounding competition. The Forest Service does not employ chemical herbicides but instead relies on brush saws to accomplish this task. They intend to conduct this release in 2022. Based on white pine numbers in the 2021 stocking survey, David Grosshuesch suggested the need for another white pine planting soon. Increasing seedling density and favoring planting sites with appropriate drainage conditions with minimal soil coarse fragments (cobbles, stones, boulders) will help ensure survival. Though deer browse impact appears minimal in this area, it may be worth considering bud capping or caging to protect against hare browse.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No. All activities have been and are in support of creating forage opportunities for moose while enhancing stand structural and compositional diversity.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Maybe. If there is another round of white pine seedling plantings followed by brush saw release, it may be beneficial to compare the recruitment differential, if present, between the spruce and pine seedlings.

19. Additional comments on the restoration project.

During the meander survey, moose browse was detected at great frequency and at different browse heights on pussy willow, paper birch, pin cherry, red maple, beaked hazelnut, and red-osier dogwood. This project is one of many conducted by the Minnesota Moose Collaborative in which relatively small parcels are treated by mechanical or ignitable means to regenerate woody browse in the absence of large-scale natural disturbances more typical of remote wilderness areas (e.g., wildfire and blowdown events in the Boundary Waters Canoe Area Wilderness). Additionally, the collaborative seeks to diversify the structure and composition of these parcels by planting conifers in some of the project areas. The objective is to encourage mixed conifer-deciduous stands that exhibit characteristics like those formed under historical disturbance regimes and which provide winter cover and thermal regulation for moose.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

The project has achieved stated goals with high confidence. Both site prep and planting activities occurred as planned. The desired outcome from shearing (creating a flush of woody forage for moose) has also been achieved with high confidence: fresh moose dung was visible and browse observed on pussy willow, paper birch, pin cherry, red maple, beaked hazelnut, and red-osier dogwood. Other present species that are available for browse include balsam fir, Bebb's willow, and trembling aspen. The desired outcome from conifer plantings to achieve future structural and compositional diversity is currently unknown and therefore given medium confidence. It will take several years to gauge the survival and recruitment of black spruce, white spruce, and white pine. The 2022 brush saw release on spruce seedlings and re-planting of white pine will help in this endeavor.

23. Site Assessor(s) conducting field review:

Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

Site Maps, Project Plans or Vegetation Tables

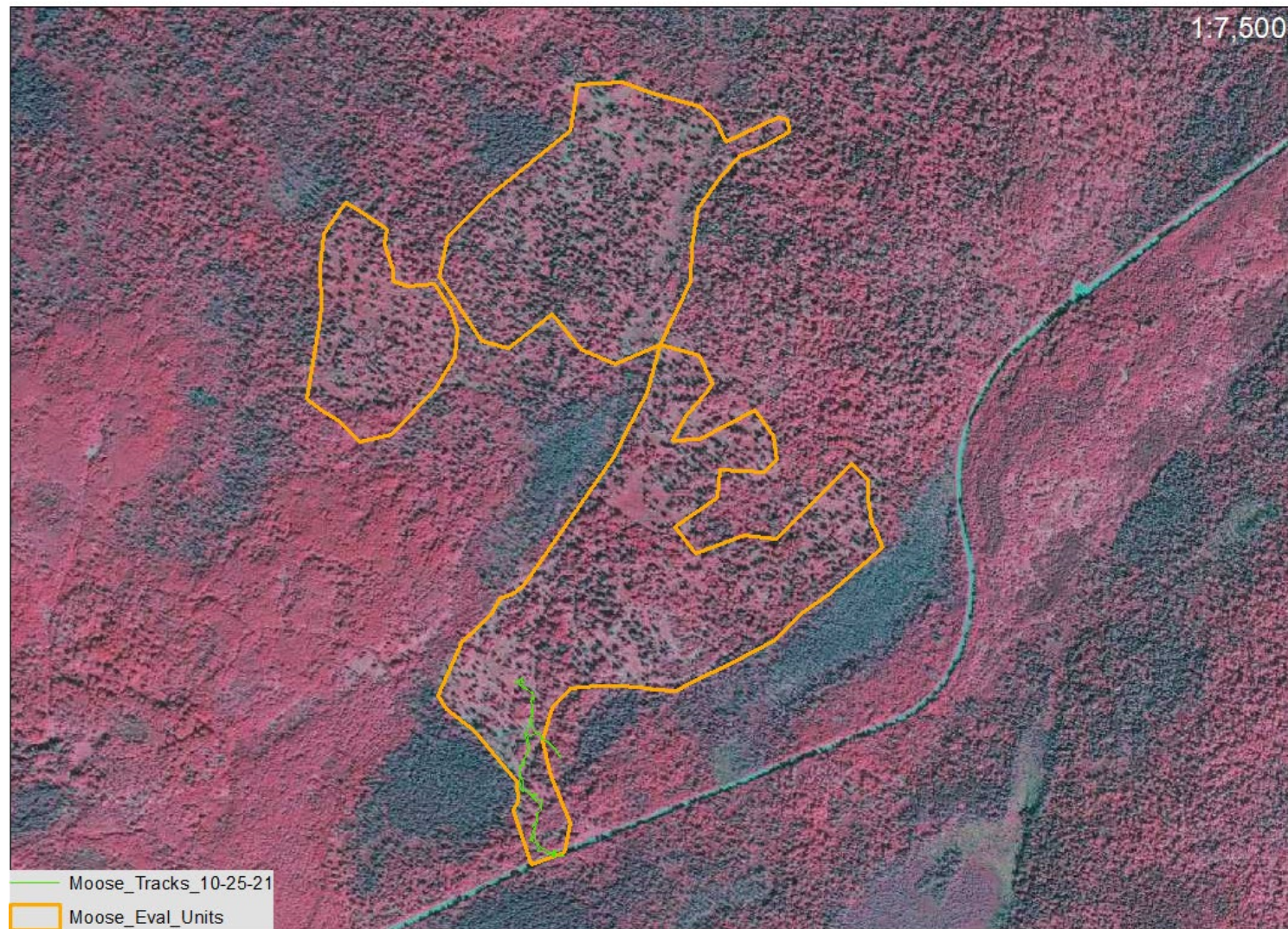


Figure 12-1 Boundary of moose habitat enhancement work and meander survey route at Bill Lake Units. 2019 CIR aerial imagery.



Report Live Tree Stocking

Analysis: Single



Setting	0909070004900	Region:	09	Proc	09	District	07	Locatio	00049	Stan	0021	Acres
GIS Link:	090907000490	EV Code:		Year of		No. of	28	Meas		2021-06-07		
Remarks												

Liv Trees Per Acre/Basal Area

Diameter

Species		Null	<1"	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32+	Total	QMD >0	QMD >=5
ABBA	TPA	43																		43		
	BA/A																					
ACSP2	TPA	1221																		1221		
	BA/A																					
ALNUS	TPA	204																		204		
	BA/A																					
BEPA	TPA	64	32																	96	0.2	
	BA/A		0																	0		
CORYL	TPA	5957	75																	6032	0.2	
	BA/A		0																	0		
FRNI	TPA	86																		86		
	BA/A																					
PIGL	TPA	64																		64		
	BA/A																					
PIST	TPA	43																		43		
	BA/A																					

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Report 26: Live Tree Stocking

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Figure 12-2 Stocking survey for the Bill Lake site. Diameter class limits are as follows: Class <1 minimum 0" maximum 0.99", Class 2 minimum 1" maximum 2.99", Class 4 minimum 3" maximum 4.00 "...Class 32 minimum 31" maximum not applicable.



Report Live Tree Stocking

Analysis: Single



Species		Null	<1"	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32+	Total	QMD >0	QMD ≥5
POTR5	TPA	1254	96																	1350	0.2	
	BA/A		0																	0		
PRPE2	TPA	225																		225		
	BA/A																					
PRVI	TPA	321																		321		
	BA/A																					
SALIX	TPA	32																		32		
	BA/A																					
Total	TPA	9514	204																	9718	0.2	
	BA/A		0																	0		

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Report 26: Live Tree Stocking

Page 2 of 3

Figure 12-3 Stocking survey for the Bill Lake site continued. Diameter class limits are as follows: Class <1 minimum 0" maximum 0.99", Class 2 minimum 1" maximum 2.99", Class 4 minimum 3" maximum 4.00 "...Class 32 minimum 31" maximum not applicable.

Table 12-1 Meander survey for Bill Lake Units moose habitat enhancement. Species are listed by physiognomy and height strata.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<u>Evergreen 10-20 m</u>				
<i>Abies balsamea</i>	Balsam fir	5-25%	No	Native
<i>Picea mariana</i>	Black spruce	5-25%	No	Native
<i>Picea glauca</i>	White spruce	1-5%	No	Native
<u>Evergreen 2-10 m</u>				
<i>Abies balsamea</i>	Balsam fir	5-25%	No	Native
<i>Picea mariana</i>	Black spruce	5-25%	No	Native
<u>Evergreen 0-2 m</u>				
<i>Picea glauca</i>	White spruce	1-5%	Yes – planted	Native
<i>Picea mariana</i>	Black spruce	1-5%	Yes – planted	Native
<i>Abies balsamea</i>	Balsam fir	1-5%	No	Native
<i>Pinus strobus</i>	Eastern white pine	ABSENT	Yes - planted	Native
<u>Deciduous 10-20 m</u>				
<i>Populus tremuloides</i>	Trembling aspen	25-50%	No	Native
<i>Betula papyrifera</i>	Paper birch	1-5%	No	Native
<u>Deciduous 0-2 m</u>				
<i>Salix bebbiana</i>	Bebb's willow	0-1%	No	Native
<i>Lonicera hirsuta</i>	Hairy honeysuckle	0-1%	No	Native
<i>Rosa acicularis</i>	Prickly rose	0-1%	No	Native
<i>Salix discolor</i>	Pussy willow	0-1%	No	Native
<i>Vaccinium myrtilloides</i>	Velvet-leaved blueberry	0-1%	No	Native
<i>Betula papyrifera</i>	Paper birch	1-5%	No	Native
<i>Prunus pensylvanica</i>	Pin cherry	0-1%	No	Native
<i>Acer rubrum</i>	Red maple	0-1%	No	Native
<i>Rubus idaeus</i>	Wild red raspberry	1-5%	No	Native
<i>Populus tremuloides</i>	Trembling aspen	5-25%	No	Native
<i>Corylus cornuta</i>	Beaked hazelnut	5-25%	No	Native
<i>Diervilla lonicera</i>	Bush honeysuckle	5-25%	No	Native
<i>Cornus sericea</i>	Red-osier dogwood	5-25%	No	Native
<u>Forbs 0-2 m</u>				
<i>Lathyrus ochroleucus</i>	Pale vetchling	0-1%	No	Native
<i>Symphyotrichum ciliolatum</i>	Lindley's aster	0-1%	No	Native
<i>Lycopodium clavatum</i>	Running clubmoss	0-1%	No	Native
<i>Lactuca biennis</i>	Biennial blue lettuce	0-1%	No	Native
<i>Dryopteris carthusiana</i>	Spinulose shield fern	0-1%	No	Native
<i>Potentilla norvegica</i>	Rough cinquefoil	0-1%	No	Native
<i>Linnaea borealis</i>	Twinflower	0-1%	No	Native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Galium triflorum</i>	Sweet-scented bedstraw	0-1%	No	Native
<i>Pteridium aquilinum</i>	Bracken fern	50-75%	No	Native
<i>Solidago gigantea</i>	Giant goldenrod	0-1%	No	Native
<i>Cornus canadensis</i>	Bunchberry	1-5%	No	Native
<i>Lycopodium annotinum</i>	Bristly clubmoss	1-5%	No	Native
<i>Lycopodium dendroideum</i>	Round-branched groundpine	1-5%	No	Native
<i>Eurybia macrophylla</i>	Large-leaved aster	5-25%	No	Native
<u>Graminoids 0-2 m</u>				
<i>Carex pedunculata</i>	Long-stalked sedge	0-1%	No	Native
<i>Carex arctata</i>	Drooping wood sedge	1-5%	No	Native
<i>Calamagrostis canadensis</i>	Bluejoint	25-50%	No	Native
<i>Oryzopsis asperifolia</i>	Mountain rice grass	1-5%	No	Native
<i>Bromus ciliatus</i>	Fringed brome	1-5%	No	Native

Site Photographs



Photo 12-1 Bill Lake planting site with structural diversity in the woody vegetation and numerous down snags scattered throughout the area.



Photo 12-2 Smaller spruce trees three years after planting at the Bill lake planting site.



Photo 12-3 Larger spruce trees three years after planting that the Bill Lake planting site.



Photo 12-4 Shrubs with evidence of extensive moose browse at the Bill Lake planting site.



Photo 12-5 Moose bed at the Bill Lake planting site.

14 MN Moose Habitat Collaborative Forest Enhancement (USFS Mid Temp4)

Project Background

Project Name: MN Moose Habitat Collaborative Phase II

Project Site: USFS MidTemp4

Township/Range Section: Township 60N Range 04W Section 05

Project Manager / Affiliated Organization: David Grosshuesch, US Forest Service (Superior NF)

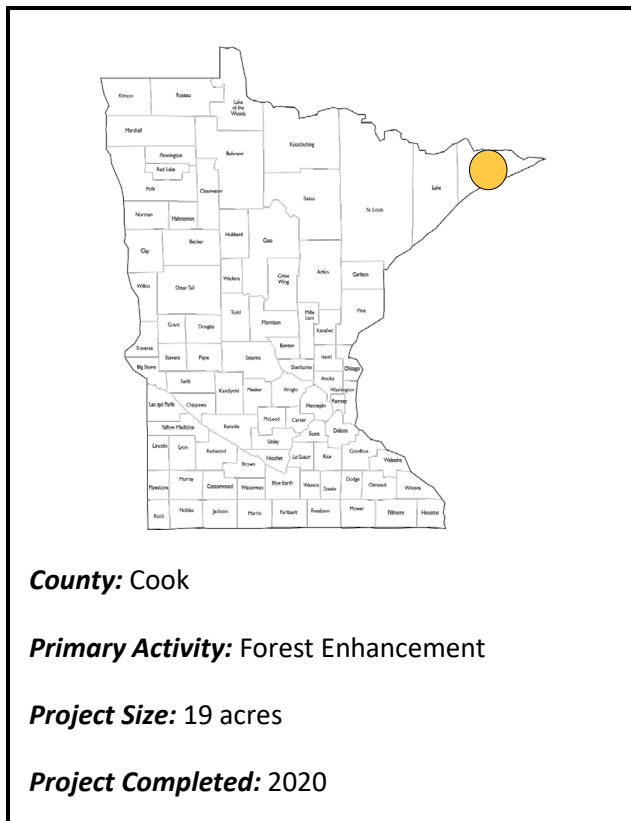
Fund: OHF **Fiscal Year Funds:** 2014

Project Start Date: 2016

Predominant Habitat type: Forest

Additional Habitat types:

Project Status: Post Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

This is a non-timber USFS unit because of low merchantable volume. Site prep with mowing occurred during winter 2016-2017. Afterwards, the project area was planted in 2017 at 265 trees per acre with white spruce, white pine, cedar, and paper birch. Brush saw release occurred in 2019 and re-planting occurred in 2020 to white spruce and white pine. No deer browse protection measures were employed due to the low browse impact of the area.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

- Stocking survey on 8/30/2017

3. What are the stated goals of the project?

The goal for the MidTemp4 unit was to mow (site prep) the understory followed by initial conifer and deciduous seedling plantings at 265 trees per acre. Follow-up brush saw release would occur approximately three years after planting. Subsequent plantings and brush saw release would occur as necessary. Because the USFS previously identified this unit as unsuitable for timber management, it was instead chosen to be a moose management unit.

4. What are the desired outcomes of achieving the stated goals of the project?

Through mowing, the desired outcome is to create a new flush of nutritious woody moose forage in the immediate term. Through conifer and deciduous plantings, the desired outcome is increased structural and compositional diversity that creates moose thermal cover in the long term.

5. Were measures of restoration success identified in plans? No

If yes, list specific measurements.

NA

6. Are plan Sets available? No Have project maps been created? Yes

If yes, provide in "site maps" and list maps provided:

- Map of USFS MidTemp4 management boundary

7. Provide list of best management practices, standards, guidelines identified in plan set?

None identified as there are no hardcopy plan sets or prescription documentation. However, mowing occurred in the winter because somewhat poorly drained low areas are present. Heavy equipment usage on frozen soil minimizes potential for soil rutting and compaction.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

Yes

There was a need to re-plant in 2020 because the planted seedlings from 2016/2017 did not respond to the 2019 brush saw release with favorable growth. Only white spruce and possibly white pine were planted in 2020.

9. In what ways did alterations change the proposed project outcome?

During the meander survey, white spruce seedlings had 1-5% cover. No white pine seedlings were observed. Seedlings of cedar and paper birch, from the 2016/2017 plantings, were also not observed. Regarding paper birch, however, the late season survey impacted the assessor's ability to identify deciduous seedling species.

Site Assessment

Field Review Date: 10/25/2021

Field Visit Attendees: Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division, Chris Dunham – The Nature Conservancy, David Grosshuesch – US Forest Service

10. Surrounding Landscape Characteristics:

The project area is located within the North Shore Highlands Ecological Subsection. At the finer Land Type Association level, it is within the Honeymoon Mountain Till Plain LTA. The project area is 275 m east of the Sawbill Trail (County Road 2) and south of the Honeymoon Trail (National Forest Road 164). The Temperance River is about 900 m to the west. Surrounding forests are a mix of mature and early-successional plant communities. The most common native plant communities are Northern Mesic Mixed

Forest (FDn43), Northern Mesic Hardwood (Cedar) Forest (MHn45), Northern Wet Cedar Forest (WFn53), and Northern Rich Spruce Swamp (Basin) (FPn62). Rich open and forested peatland communities immediately surround the project area upland island.

11. Site Characteristics:

a. Soil Series:

Not mapped to SSURGO level. Broad taxonomy is coarse-loamy, mixed, active, frigid Humic Dystrudepts. Soil parent material is Superior Lobe till. Superior National Forest Land Type Phase mapping is LTP 55 – moderately well drained, sandy loam/loam/silt loam greater than 40 inches deep.

b. Topography:

The till plain is rolling with broad hills. Wetlands occur at lower elevations and along drainages in between hills.

c. Hydrology:

Water drains west into adjacent peatlands and beaver wetlands en route to the Temperance River. Streams are generally oriented northwest to southeast.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Based on aerial photo interpretation of the project area, the native plant community is Northern Mesic Mixed Forest – Aspen-Birch Forest, Balsam Fir Subtype (FDn43b1). No non-native invasive species were found during the meander survey.

12. Is the plan based on current science? Yes

Site prep through understory mowing is a well-known restoration tool to stimulate clonal sprouting of certain woody plant species. The scope of the project adheres to moose habitat recommendations set forth in the 2009 Report to the Minnesota Department of Natural Resources (DNR) by the Moose Advisory Committee available at <https://www.lrl.mn.gov/lrl>:

- Upland brush communities should be identified, protected, and maintained by mechanical treatment and/or prescribed fire to provide moose browse.
- Utilize forest management/habitat management techniques that will promote browse production and diversity while maintaining juxtaposition of winter and summer thermal cover.
- In order to protect desirable browse species while reducing competition with conifer seedlings, the use of mechanical treatment or hand release should be encouraged.
- Promote regeneration techniques that encourage mixed stands similar in composition, age, and size to those existing under the range of natural variation and discourage the establishment of stands uniformly dominated by a single species.

13. List indicators of project goals at this stage of project:

Sprouting of various woody species were observed during the meander survey indicating the success of mowing. The meander survey also confirmed the plantings of white spruce seedlings. White pine, cedar, and paper birch seedlings, however, were not observed.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes. Though no project plan documentation is available, the mowing, planting, and mechanical release goals were successfully met.

15. Are corrections or modifications needed to achieve proposed goals?

No.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Yes. White spruce seedlings appeared to be doing well at the time of the meander survey. By the third year after planting, conifer seedlings are ready to be released from surrounding competition. The Forest Service does not employ chemical herbicides but instead relies on mechanical means to accomplish this task. They intend to conduct another release soon following the second planting of white spruce and white pine that occurred in 2020. Because white pine, cedar, and paper birch are not performing as well as white spruce, it may be prudent to increase their planting density if future plantings occur. It is also worth considering bud capping or caging to protect against hare browse despite the low deer impact in this area.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No. All activities have been and are in support of creating forage opportunities for moose while enhancing stand structural and compositional diversity.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Maybe. Mechanical release with brush saws appears to be effective at creating woody browse for moose forage. Creation of a compositionally and structurally diverse forest community, however, will take time. The current overstory of white spruce and paper birch provides 25-50% canopy cover but there is a noticeable reduction of cover in the regenerating tree seedling and sapling strata: conifer seedlings (mostly white spruce and balsam fir) only provide 1-5% cover, and the deciduous understory is dominated by shrub species such as tag alder, red-osier dogwood, beaked hazelnut, and red berried elder. Trembling aspen clones are the only significantly abundant understory deciduous tree species. It may be worthwhile to return in 5-10 years to inspect the recruitment success or failure of the most recent planting and brush saw release work.

19. Additional comments on the restoration project.

During the meander survey, moose browse was detected at great frequency and at different browse heights on pin cherry, red-osier dogwood, trembling aspen, beaked hazelnut, and red-berried elder. This project is one of many conducted by the Minnesota Moose Collaborative in which relatively small parcels are treated by mechanical or ignitable means to regenerate woody browse in the absence of large-scale natural disturbances more typical of remote wilderness areas (e.g., wildfire and blowdown events in the Boundary Waters Canoe Area Wilderness). Additionally, the collaborative seeks to diversify the structure and composition of these parcels by planting conifers in some of the project areas. The objective is to encourage mixed conifer-deciduous stands that exhibit characteristics like those formed under historical disturbance regimes and which provide winter cover and thermal regulation for moose. Dave Grosshuesch mentioned experimenting with different site prep methods, excluding chemical means, to encourage woody clonal sprouting and possible soil scarification.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

The project has achieved stated goals with high confidence. Both site prep and planting activities occurred as planned. The desired outcome from mowing (creating a flush of woody forage for moose) has also been achieved with high confidence: fresh moose dung was visible and browse observed on pin cherry, red-osier dogwood, trembling aspen, beaked hazelnut, and red-berried elder. The desired outcome from plantings to achieve future structural and compositional diversity is currently unknown and therefore given medium confidence. Currently, the project area provides good thermal cover as there is a partially closed canopy of white spruce and paper birch and a dense shrub stratum consisting of tag alder, beaked hazelnut, red-berried elder, red-osier dogwood, and trembling aspen. It will take several years to gauge the survival and recruitment of planted species. Future brush saw release on spruce seedlings and re-planting of white pine and cedar will help in this endeavor.

23. Site Assessor(s) conducting field review:

Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

Site Maps, Project Plans or Vegetation Tables

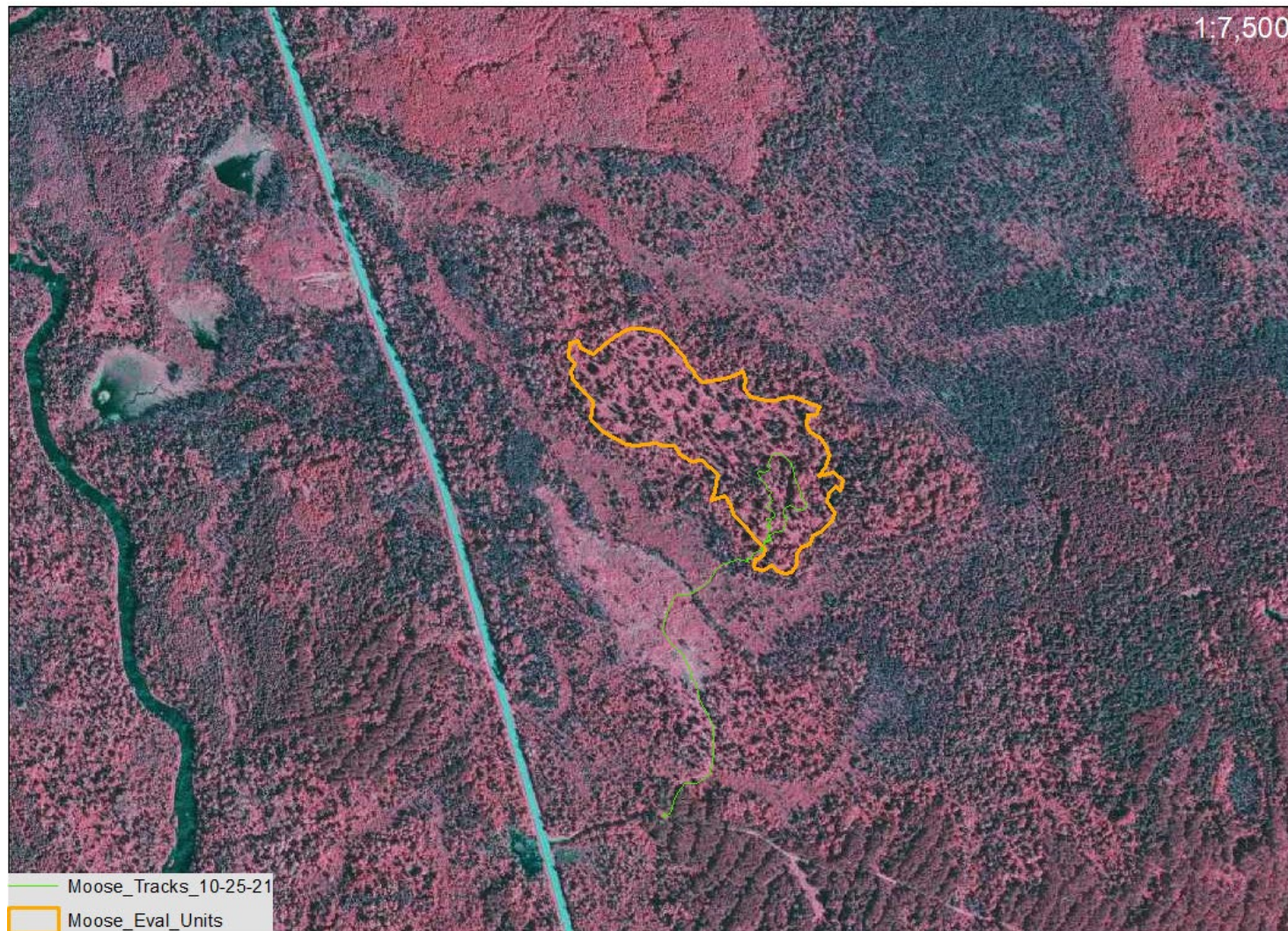


Figure 13-1 Boundary of moose habitat enhancement work and meander survey route at USFS MidTemp4. 2019 CIR aerial imagery.



Report Live Tree Stocking

Analysis: Single



Setting	0909070009300	Region:	09	Proc	09	District	07	Location	00093	Station	0018	Acres	
GIS Link:	090907000930	EV Code:	92	FSHR9		Year of		No. of	8	Meas		2017-08-30	
Remarks	BA 30-110. FDn43. BEPA and PIGL mostly. most appears to have been recently harvested (5-10yrs?). LOTS of rubus. very open canopy; midstory barely present												

Liv Trees Per Acre/Basal Area

Diameter

Species		Null	<1"	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32+	Total	QMD >0	QMD >=5
ABBA	TPA	562	188	150	112	6		5	6	1			1							1032	3.1	10.8
	BA/A		0	3	10	1		2	5	1			2							25		
ACSP2	TPA	638	488	38																1162	0.6	
	BA/A		1	0																1		
ALNUS	TPA	38	300	75																412	0.6	
	BA/A		0	0																1		
AMELA	TPA	525	262																	788	0.5	
	BA/A		0																	0		
BEPA	TPA	262	38		38	25	11	7	5	2	1	1	1							390	6.1	8.9
	BA/A		0		3	5	4	4	4	2	1	1	1							26		
CORYL	TPA	3938	2625																	6562	0.5	
	BA/A		4																	4		
PIGL	TPA	112			38	19	4	9	6	2	2	1		1						195	7.9	10.1
	BA/A				3	4	1	5	5	2	2	2		2						28		
POTR5	TPA	525										1	1	0			0			527	21.2	21.2
	BA/A											1	1	1			1			5		

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Figure 13-2 Stocking survey for site USFS MidTemp4. Diameter class limits are as follows: Class <1 minimum 0" maximum 0.99", Class 2 minimum 1" maximum 2.99", Class 4 minimum 3" maximum 4.00 "...Class 32 minimum 31" maximum not applicable.



Report Live Tree Stocking

Analysis: Single



Species		Null	<1"	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32+	Total	QMD >0	QMD ≥5
PRVI	TPA	112																		112		
	BA/A																					
SOAM3	TPA	1238	112	38																1388	0.7	
	BA/A		0	0																0		
Total	TPA	7950	4012	300	188	51	14	21	18	6	3	3	2	1			0			12569	1.9	10.0
	BA/A		5	3	16	10	5	11	14	6	4	5	5	4			1			90		

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Report 26: Live Tree Stocking

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Figure 13-3 Stocking survey for site USFS MidTemp4 continued. Diameter class limits are as follows: Class <1 minimum 0" maximum 0.99", Class 2 minimum 1" maximum 2.99", Class 4 minimum 3" maximum 4.00 "...Class 32 minimum 31" maximum not applicable.

Table 13-1 Meander survey for USFS MidTemp4 moose habitat enhancement. Species are listed by physiognomy and height strata.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<u>Evergreen 10-20 m</u>				
<i>Picea glauca</i>	White spruce	25-50%	No	Native
<i>Abies balsamea</i>	Balsam fir	1-5%	No	Native
<u>Evergreen 0-0.5 m</u>				
<i>Picea glauca</i>	White spruce	1-5%	Yes – planted	Native
<i>Abies balsamea</i>	Balsam fir	1-5%	No	Native
<i>Pinus strobus</i>	Eastern white pine	ABSENT	Yes – planted	Native
<i>Thuja occidentalis</i>	Northern white cedar	ABSENT	Yes – planted	Native
<u>Deciduous 10-20 m</u>				
<i>Betula papyrifera</i>	Paper birch	25-50%	No	Native
<u>Deciduous 2-5 m</u>				
<i>Alnus incana</i>	Tag alder	5-25%	No	Native
<u>Deciduous 0-2 m</u>				
<i>Prunus pensylvanica</i>	Pin cherry	0-1%	No	Native
<i>Alnus incana</i>	Tag alder	1-5%	No	Native
<i>Populus tremuloides</i>	Trembling aspen	25-50%	No	Native
<i>Corylus cornuta</i>	Beaked hazelnut	25-50%	No	Native
<i>Sambucus racemosa</i>	Red-berried elder	1-5%	No	Native
<i>Rubus idaeus</i>	Wild red raspberry	50-75%	No	Native
<i>Cornus sericea</i>	Red-osier dogwood	0-1%	No	Native
<i>Betula papyrifera</i>	Paper birch	ABSENT	Yes – planted	Native
<u>Forbs 0-0.5 m</u>				
<i>Lycopodium clavatum</i>	Running clubmoss	0-1%	No	Native
<i>Pteridium aquilinum</i>	Bracken fern	5-25%	No	Native
<i>Cornus canadensis</i>	Bunchberry	1-5%	No	Native
<i>Lycopodium annotinum</i>	Bristly clubmoss	1-5%	No	Native
<i>Eurybia macrophylla</i>	Large-leaved aster	1-5%	No	Native
<i>Galium triflorum</i>	Sweet-scented bedstraw	0-1%	No	Native
<i>Lycopodium dendroideum</i>	Round-branched groundpine	5-25%	No	Native
<i>Mertensia paniculata</i>	Panicled bluebells	0-1%	No	Native
<i>Dryopteris carthusiana</i>	Spinulose shield fern	1-5%	No	Native
<u>Graminoids 0-2 m</u>				
<i>Cinna latifolia</i>	Drooping woodreed	0-1%	No	Native
<i>Carex cf. deflexa</i>	Northern sedge	0-1%	No	Native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Carex arctata</i>	Drooping wood sedge	0-1%	No	Native
<i>Calamagrostis canadensis</i>	Bluejoint	50-75%	No	Native
<i>Bromus ciliatus</i>	Fringed brome	1-5%	No	Native

Site Photographs



Photo 13-1 Aerial photo of the USFS MidTemp4 site in 2017, the year of planting. Photo provided by The Nature Conservancy.



Photo 13-2 USFS MidTemp4 restoration site with structural diversity of the woody vegetation and limited canopy cover.



Photo 13-3 Planted spruce after four growing seasons.



Photo 13-4 Evidence of the 2019 brush saw release was observed throughout the USFS MidTem4 site.



Photo 13-5 Evidence of moose browse observed in the USFS MidTemp4 site.



Photo 13-6 Moose beds such as this were observed adjacent to the USFS MidTemp4 project site.

15 MN Moose Habitat Collaborative Forest Enhancement (Cross River 1)

Project Background

Project Name: MN Moose Habitat Collaborative Phase II

Project Site: USFS Cross River 1 and Block B

Township/Range Section: Township 59N Range 05W Section 09

Project Manager / Affiliated Organization: David Grosshuesch, US Forest Service (Superior NF)

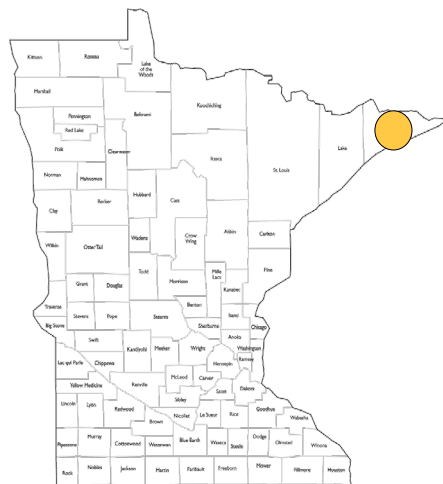
Fund: OHF **Fiscal Year Funds:** 2014

Project Start Date: 2015

Predominant Habitat type: Forest

Additional Habitat types: Wetland

Project Status: Post Establishment Phase



County: Cook

Primary Activity: Forest Enhancement

Project Size: 101 acres (90+11)

Project Completed: 2016

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

Prescribed burns occurred in 2015 and 2016. Prescriptions for both blocks were the same.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

No hardcopy plans available.

3. What are the stated goals of the project?

Cross River 1 and Block B are intended to remain as open brushland with few scattered canopy trees. Therefore, the recurring goal is to utilize prescribe burning at roughly five-year intervals to maintain open conditions suitable for moose browse.

4. What are the desired outcomes of achieving the stated goals of the project?

Through prescribed burns, the desired outcome is to create a new flush of woody moose browse while diversifying the species available to moose.

5. Were measures of restoration success identified in plans? No

If yes, list specific measurements.

6. **Are plan Sets available?** No **Have project maps been created?** Yes
If yes, provide in “site maps” and list maps provided:
- Map of Cross River Blocks 1 and B management boundary
7. **Provide list of best management practices, standards, guidelines identified in plan set?**
None identified as there are no hardcopy plan sets or prescription documentation.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. **Were alterations made to the plan during project implementation?**
Yes
The 2015 prescribed burn was deemed insufficient due to weather challenges at the time of burn. Therefore, a 2016 burn was added to attain more complete burn coverage of the project area.
9. **In what ways did alterations change the proposed project outcome?**
The additional burn likely stimulated more woody plant re-growth and coppice sprouting of favored moose browse species than would a single burn. Furthermore, since woody species respond differently to varying severity burns, the additional burn likely diversified the community makeup of the resulting woody regeneration.

Site Assessment

Field Review Date: 10/25/2021

Field Visit Attendees: Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division, Chris Dunham – The Nature Conservancy, David Grosshuesch – US Forest Service

10. **Surrounding Landscape Characteristics:**

The project area is located within the North Shore Highlands Ecological Subsection. At the finer Land Type Association level, it is within the Honeymoon Mountain Till Plain LTA. It is within 100 m east of the Cross River, immediately north of National Forest Road 166 (6 Hundred Road), and west of National Forest Road 346 (Richey Lake Road). High-quality mesic northern hardwood forests and northern wet cedar forests surround the project area.

11. **Site Characteristics:**

a. **Soil Series:**

Not mapped to SSURGO level. Broad taxonomy is coarse-loamy, mixed, active, frigid Humic Dystrudepts. Soil parent material is Superior Lobe till. Superior National Forest Land Type Phase mapping is primarily LTP 55 – moderately well drained, sandy loam/loam/silt loam greater than 40 inches deep. Minor components include LTP 38 – somewhat poorly drained, sandy loam/loam/silt loam with seasonal saturation between 12 and 40 inches deep; LTP 71 – poorly drained, sandy loam/loam/silt loam with depth to saturation within 6 inches below the surface. Block B falls mostly within LTP 71.

b. Topography:

The till plain is rolling with broad hills. Wetlands occur at lower elevations and along drainages in between hills.

c. Hydrology:

Water flows downhill to the adjacent peatland and then west into the Cross River. Streams are oriented northwest to southeast.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Nearby native plant community mapping suggests that the upland portions of the project area is primarily MHn45c: Sugar Maple Forest (North Shore). The most common inclusions in wetter areas are WFn53a: Lowland White Cedar Forest (North Shore) and FPn73: Northern Alder Swamp. Non-native species encountered during the meander survey had <5% cover: Canada thistle, common dandelion, and hawkweed.

12. Is the plan based on current science? Yes

Prescribed burning is a well-known restoration tool to stimulate clonal sprouting of certain woody plant species while inhibiting other non-desirable species. The scope of the project adheres to moose habitat recommendations set forth in the 2009 Report to the Minnesota Department of Natural Resources (DNR) by the Moose Advisory Committee available at <https://www.lrl.mn.gov/lrl>. In the report, it specifically states, "Upland brush communities should be identified, protected and maintained by mechanical treatment and/or prescribed fire to provide moose browse." Additionally, prescribed fire was mentioned as a tool to "treat fuel loads and/or prepare forest stands for regeneration" and "may serve to remove or reduce populations of winter ticks and gastropods, which are direct parasites or parasite vectors for moose."

13. List indicators of project goals at this stage of project:

Charred wood and woody plant sprouting signify that the prescribed burns were successfully carried out.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes. Though no project plan documentation is available, the goal of carrying prescribed fire through the project area was successful.

15. Are corrections or modifications needed to achieving proposed goals?

No.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Yes. Prescribed burn intervals will occur roughly every five years to stimulate re-growth of young, nutritious browse. This ensures the formation of tender young shoots at heights that are accessible to moose. According to David Grosshuesch, the US Forest Service has adequate resources and personnel to carry out prescribe burns at this frequency. The only challenges and limitations are weather related. Prescribed burns occur on strict schedules and narrow temporal windows. Occasionally, the day of burning cannot be changed, and weather conditions may adversely affect the outcome of burn, as was seen in 2015. The Cross River project area is intended to remain as an open-canopied, brushland community maintained by fire. There is some potential for weedy non-native species to increase in abundance due to the high-light environment and from the frequent foot and equipment traffic during

burn events. However, prescribed fires conducted regularly may limit non-native species to those that are fire tolerant. These species may not pose any detriment to the broader plant community or to the desired outcomes of the project.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No. All activities have been and are in support of maintaining an open vegetation community that provides long-term moose forage.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No.

19. Additional comments on the restoration project.

During the meander survey, moose browse was detected at great frequency and at different browse heights on trembling aspen, pussy willow, red-osier dogwood, and beaked hazelnut. Unbrowsed tag alder serves as thermal cover, though clonal patches remain small in the project area. Moose scat and moose beds were also observed. This project is one of many conducted by the Minnesota Moose Collaborative in which relatively small parcels are treated by mechanical or ignitable means to regenerate woody browse in the absence of large-scale natural disturbances more typical of remote wilderness areas (e.g., wildfire and blowdown events in the Boundary Waters Canoe Area Wilderness). Additionally, the collaborative seeks to diversify the structure and composition of these parcels by planting conifers in some of the project areas. The objective is to encourage mixed conifer-deciduous stands that exhibit characteristics like those formed under historical disturbance regimes and which provide winter cover and thermal regulation for moose.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

Through two successive prescribed burns in 2015 and 2016, the goals for the Cross River project area were successfully met. The meander survey confirmed the presence and usage of moose; we observed recent moose dung and browse marks were plentiful on seedlings and sprouts of trembling aspen, pussy willow, red-osier dogwood, and beaked hazelnut. Woody plants known to be forage for moose and that were present in the project area were pussy willow, trembling aspen, low junberry, red-berried elder, beaked hazelnut, paper birch, and red-osier dogwood.

23. Site Assessor(s) conducting field review:

Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

Site Maps, Project Plans or Vegetation Tables

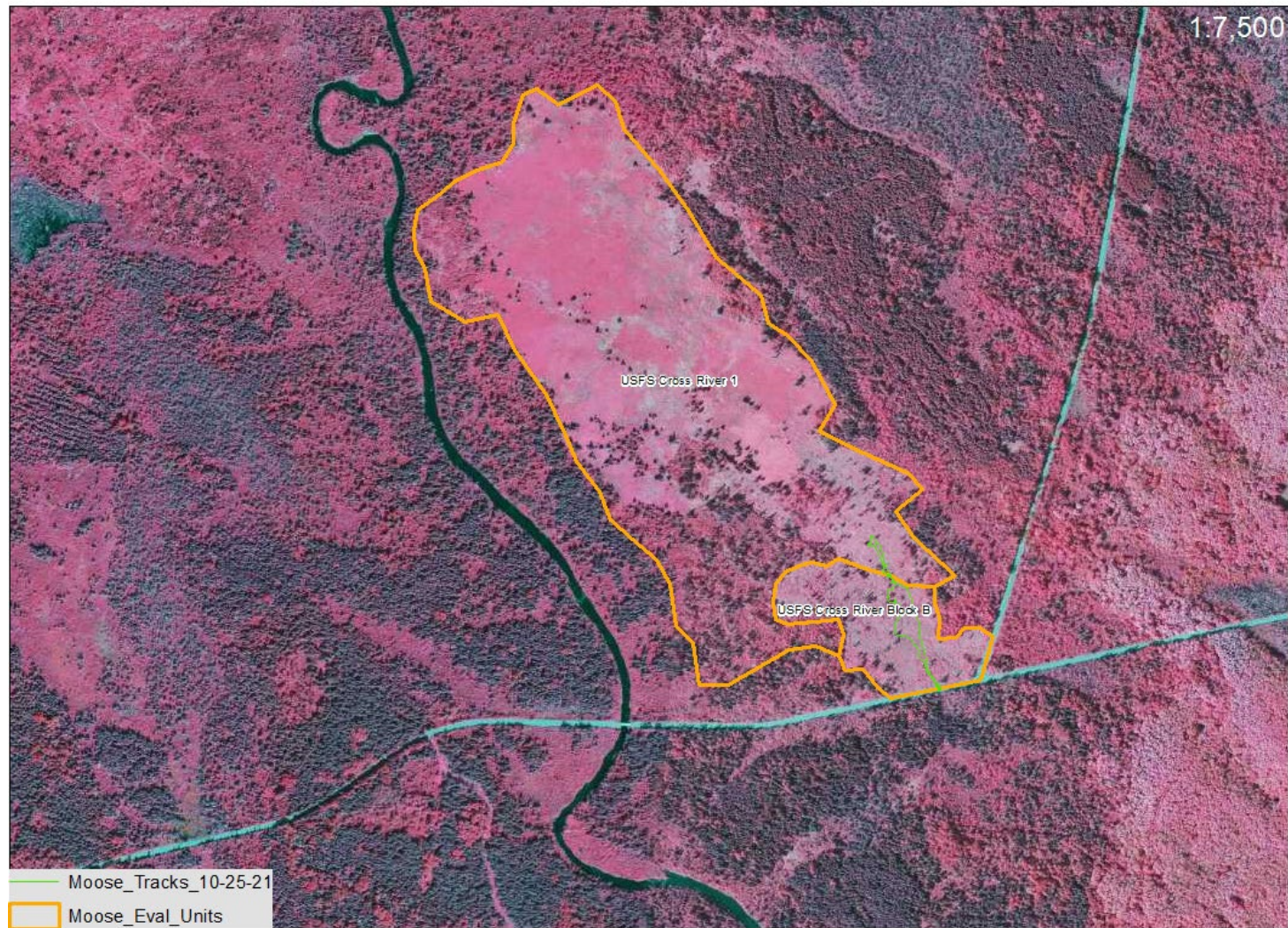


Figure 14-1 Boundary of moose habitat enhancement work and meander survey route at USFS Cross River Blocks 1 and B. 2017 CIR aerial imagery.

Table 14-1 Meander survey for USFS Cross River Blocks 1 and B moose habitat enhancement. Species are listed by physiognomy and height strata.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<u>Evergreen 5-20 m</u>				
<i>Picea glauca</i>	White spruce	0-1%	No	Native
<i>Thuja occidentalis</i>	Northern white cedar	0-1%	No	Native
<i>Picea mariana</i>	Black spruce	0-1%	No	Native
<u>Evergreen 0-0.5 m</u>				
<i>Picea glauca</i>	White spruce	0-1%	No	Native
<u>Deciduous 5-10 m</u>				
<i>Populus tremuloides</i>	Trembling aspen	1-5%	No	Native
<i>Betula papyrifera</i>	Paper birch	0-1%	No	Native
<u>Deciduous 2-5 m</u>				
<i>Salix discolor</i>	Pussy willow	5-25%	No	Native
<i>Alnus incana</i>	Tag alder	1-5%	No	Native
<i>Populus tremuloides</i>	Trembling aspen	1-5%	No	Native
<i>Fraxinus nigra</i>	Black ash	0-1%	No	Native
<u>Deciduous 0-2 m</u>				
<i>Amelanchier humilis</i>	Low junberry	0-1%	No	Native
<i>Rosa acicularis</i>	Prickly rose	0-1%	No	Native
<i>Sambucus racemosa</i>	Red-berried elder	0-1%	No	Native
<i>Corylus cornuta</i>	Beaked hazelnut	5-25%	No	Native
<i>Rubus idaeus</i>	Wild red raspberry	0-1%	No	Native
<i>Betula papyrifera</i>	Paper birch	1-5%	No	Native
<i>Diervilla lonicera</i>	Bush honeysuckle	1-5%	No	Native
<i>Cornus sericea</i>	Red-osier dogwood	1-5%	No	Native
<u>Forbs 0-2 m</u>				
<i>Cirsium arvense</i>	Canada thistle	0-1%	No	Invasive
<i>Taraxacum officinale</i>	Common dandelion	0-1%	No	Invasive
<i>Lycopodium clavatum</i>	Running clubmoss	0-1%	No	Native
<i>Cornus canadensis</i>	Bunchberry	0-1%	No	Native
<i>Pteridium aquilinum</i>	Bracken fern	0-1%	No	Native
<i>Galium asprellum</i>	Rough bedstraw	0-1%	No	Native
<i>Epilobium angustifolium</i>	Fireweed	1-5%	No	Native
<i>Symphyotrichum lanceolatum</i>	Panicled aster	1-5%	No	Native
<i>Solidago juncea</i>	Early goldenrod	1-5%	No	Native
<i>Dryopteris carthusiana</i>	Spinulose shield fern	0-1%	No	Native
<i>Cirsium muticum</i>	Swamp thistle	1-5%	No	Native
<i>Dryopteris cristata</i>	Crested fern	0-1%	No	Native
<i>Geum canadense</i>	White avens	0-1%	No	Native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Hieracium spp.</i>	Hawkweed	1-5%	No	Invasive
<i>Fragaria virginiana</i>	Common strawberry	0-1%	No	Native
<i>Solidago gigantea</i>	Giant goldenrod	1-5%	No	Native
<i>Rubus pubescens</i>	Dwarf raspberry	1-5%	No	Native
<u>Graminoids 0-2 m</u>				
<i>Schizachne purpurascens</i>	False melic grass	0-1%	No	Native
<i>Poa palustris</i>	Fowl bluegrass	1-5%	No	Native
<i>Calamagrostis canadensis</i>	Bluejoint	25-50%	No	Native
<i>Carex arctata/gracillima</i>	Drooping wood sedge or Graceful sedge	5-25%	No	Native
<i>Bromus ciliatus</i>	Fringed brome	5-25%	No	Native
<i>Scirpus cyperinus</i>	Woolgrass	5-25%	No	Native
<u>Mosses 0-0.1 m</u>				
<i>Sphagnum spp.</i>	Sphagnum	0-1%	No	Native

Site Photographs



Photo 14-1 Signage at the USFS Cross River project site recognizing the partners in the MN Moose Habitat Collaborative.



Figure 14-2 Un-browsed woody vegetation that could provide thermal cover for Moose at the USFS Cross River site.



Figure 14-3 Evidence of moose browse at the USFS Cross River site.



Figure 14-4 Further evidence of moose browse at the USFS Cross River site.



Figure 14-5 One of many moose beds observed at the USFS Cross River site.



Figure 14-6 Moose scat observed at the USFS Cross River site.

16 MN Moose Habitat Collaborative Forest Enhancement (USFS 168)

Project Background

Project Name: MN Moose Habitat Collaborative Phase II

Project Site: USFS 168

Township/Range Section: Township 61N Range 03W Section 21

Project Manager / Affiliated Organization: Chris Dunham, The Nature Conservancy

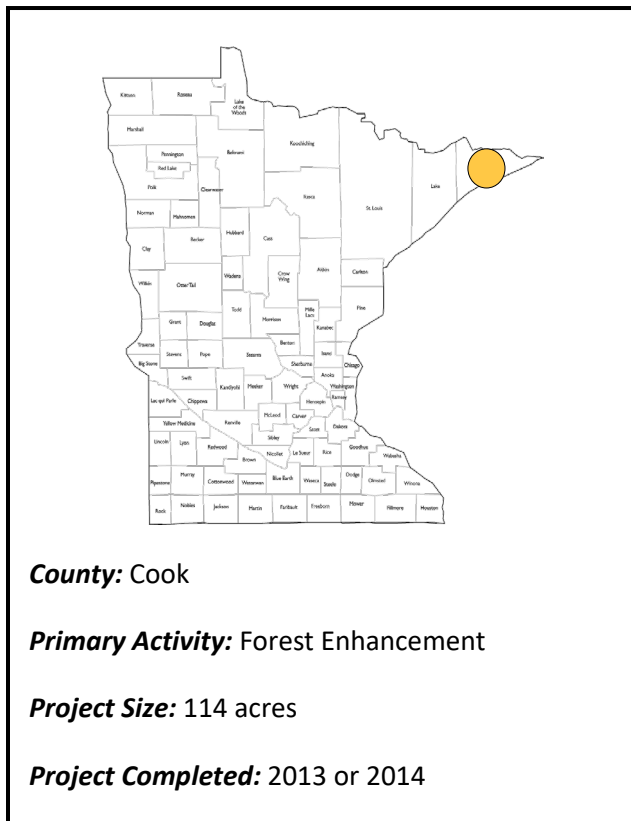
Fund: OHF **Fiscal Year Funds:** 2014

Project Start Date: 2013/2014

Predominant Habitat type: Forest

Additional Habitat types:

Project Status: Post Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

The Nature Conservancy planted the project area with bur oak and white pine seedlings in 2013 or 2014 following a Forest Service clearcut with overstory reserves. Bud capping occurred on the white pine seedlings, while one-meter tall caging enveloped the bur oak seedlings. TNC crews were instructed not to focus planting effort near vigorously regenerating clones of dense trembling aspen but instead to target openings more suited to the moderately shade tolerant seedling species. Three to four years afterwards, TNC crews carried out brush saw release around planted seedlings. Due to low deer impact, bud caps and cages were not maintained and allowed to disintegrate naturally.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

- Stocking survey on 2/2/2016

3. What are the stated goals of the project?

Plant bur oak and white pine in an area that were clearcut with reserves. Cage and bud cap bur oak and white pine, respectively. Brush saw release around planted seedlings. The decision to plant bur oak is

part of TNC's climate adaptation initiative whereby native Minnesota species with more southern affinities are planted in the Arrowhead region in anticipation of a future with warming climate.

4. *What are the desired outcomes of achieving the stated goals of the project?*

Through brush saw release, the desired outcome is to create a new flush of nutritious woody moose forage in the immediate term. Secondly, white pine and bur oak plantings provide for increased structural and compositional diversity in the long term. Establishment of bur oak as a component of the future forest as a response to climate change is part of an exploratory initiative by TNC. Anticipating warming and changes in the water cycle across Northeastern Minnesota, TNC is planting several tree species across the Arrowhead region that have more southern affinities. Bur oak, though already a component of northern forest, is expected to increase in abundance with a warming climate. Understanding its ability to survive and thrive when planted will help with future forest enhancement and restoration projects.

5. *Were measures of restoration success identified in plans?* No

If yes, list specific measurements.

NA

6. *Are plan sets available?* No ***Have project maps been created?*** Yes

If yes, provide in "site maps" and list maps provided:

- Map of USFS 168 management boundary

7. *Provide list of best management practices, standards, guidelines identified in plan set?*

None identified as there are no hardcopy plan sets or prescription documentation. However, bud capping and caging of browse-vulnerable species is a widely used practice in forest enhancement and restoration. Planting in natural openings instead of within dense thickets of trembling aspen regeneration follows best practices in adapting to the landscape and physiological requirements of the planted species.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. *Were alterations made to the plan during project implementation?*

Yes

Maintenance of cages and bud capping did not continue after initial establishment due to low deer impact on the planted seedlings.

9. *In what ways did alterations change the proposed project outcome?*

This had no effect on the success of the project. Deer impact in the project area is minimal and therefore continued deer protection measures were deemed unnecessary. During the meander survey, several cages were seen to be fallen over.

Site Assessment

Field Review Date: 10/25/2021

Field Visit Attendees: Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division, Chris Dunham – The Nature Conservancy, David Grosshuesch – US Forest Service

10. Surrounding Landscape Characteristics:

The project area is located within the North Shore Highlands Ecological Subsection. At the finer Land Type Association level, it is within the Honeymoon Mountain Till Plain LTA. Clara Lake Road (National Forest Road 339) bisects the project area. County Road 4 is adjacent to the east. The nearest water bodies are Mistletoe Lake to the north and Christine Lake to the south. Early successional forests regenerating after past timber harvests typify the surrounding uplands. The most common native plant communities are Northern Mesic Mixed Forest (FDn43) and Northern Wet Cedar Forest (WFn53). Northern Rich Spruce Swamp (Basin) (FPn62) exist as small pockets within the greater landscape.

11. Site Characteristics:

a. Soil Series:

Not mapped to SSURGO level. Broad taxonomy is coarse-loamy, mixed, active, frigid Humic Dystrudepts. Soil parent material is Superior Lobe till. Superior National Forest Land Type Phase mapping is LTP 55 – moderately well drained, sandy loam/loam/silt loam greater than 40 inches deep.

b. Topography:

The till plain is rolling with broad hills. Wetlands occur at lower elevations and along drainages in between hills.

c. Hydrology:

The project area straddles two minor watersheds (HUC 12): Tait River and Mistletoe Creek. Water flows into adjoining wetlands and small streams en route to Lake Superior.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Based on aerial photo interpretation of the project area, the native plant community is Northern Mesic Mixed Forest – Aspen-Birch Forest, Balsam Fir Subtype (FDn43b1). Non-native species encountered during the meander survey had <1% cover: tall buttercup, hawkweed, common dandelion, and bird's-foot trefoil

12. Is the plan based on current science? Yes

Mechanical brush saw release following planting is a well-known tool to stimulate clonal sprouting of certain woody plant species while freeing up growing space and light resources for planted seedlings. The scope of the project adheres to moose habitat recommendations set forth in the 2009 Report to the Minnesota Department of Natural Resources (DNR) by the Moose Advisory Committee available at <https://www.lrl.mn.gov/lrl>:

- Utilize forest management/habitat management techniques that will promote browse production and diversity while maintaining juxtaposition of winter and summer thermal cover.
- In order to protect desirable browse species while reducing competition with conifer seedlings, the use of mechanical treatment or hand release should be encouraged.
- Promote regeneration techniques that encourage mixed stands similar in composition, age, and size to those existing under the range of natural variation and discourage the establishment of stands uniformly dominated by a single species.

Planting of climate-adaptable species, such as bur oak, is a form of assisted migration and follows the hypothesis that climate warming will enhance growth and survival of temperate species at the cold (northern) edge of their range. See information on [B4WARMED](#).

13. List indicators of project goals at this stage of project:

Both bur oak and white pine seedlings were recorded at 1-5% cover during the meander survey. Cages still enveloped some bur oak seedlings and bud caps were visible on some white pine seedlings. Brush saw work was evident as areas around seedlings appeared cleared of competition.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes. Though no project plan documentation is available, TNC successfully planted desired seedlings, established initial deer browse protection measures, and executed brush saw release.

15. Are corrections or modifications needed to achieving proposed goals?

No.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Yes. The forest enhancement work to date will support moose habitat and forage opportunities. The brush saw release caused clonal sprouting of favored browse species: red-osier dogwood, mountain maple, low junberry, Bebb's willow, red maple, pin cherry, trembling aspen, beaked hazelnut, and bur oak. Furthermore, the project area already exhibits a structurally diverse mosaic of different height seedlings, saplings, and reserve trees that promote summer and winter cover for moose. Of note, the previously planted red pine by the Superior National Forest appear to be doing well and add an additional element of diversity.

The planting of bur oak is a novel response to the anticipated warming climate. There should be regular monitoring for the recruitment success or failure of this species into the future. Minimizing deer browse impact and competition from other species are important. Additional mechanical treatments or introduction of prescribed fire may be considered. Regardless of the outcome, this project area will serve as a data point when deciding which species to employ and under what ecologic conditions future plantings should occur.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No. All activities have been and are in support of creating forage opportunities for moose while enhancing stand structural and compositional diversity. It should be noted, however, that bur oak is not a normal component of FDN43b1 native plant community. TNC's decision to include this species for planting does not reflect the ca. 1800 vegetation makeup of this community. Rather, it forecasts the potential shift in community composition under a vastly different climatic regime of the future.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No. However, a quick walk through 5-10 years from now would be worthwhile to check on the recruitment status of the planted white pine and bur oak.

19. Additional comments on the restoration project.

During the meander survey, moose browse was detected at great frequency and at different browse heights on red-osier dogwood, mountain maple, red maple, low junberry, trembling aspen, beaked hazelnut, and bur oak. This project is one of many conducted by the Minnesota Moose Collaborative in which relatively small parcels are treated by mechanical or ignitable means to regenerate woody browse in the absence of large-scale natural disturbances more typical of remote wilderness areas (e.g., wildfire

and blowdown events in the Boundary Waters Canoe Area Wilderness). Additionally, the collaborative seeks to diversify the structure and composition of these parcels by planting conifers in some of the project areas. The objective is to encourage mixed conifer-deciduous stands that exhibit characteristics like those formed under historical disturbance regimes and which provide winter cover and thermal regulation for moose.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

The project has achieved stated goals with high confidence. Planting, establishing initial deer browse protection measures, and brush saw release occurred as planned. The desired outcome from release (creating a flush of woody forage for moose) has also been achieved with high confidence: recent moose dung was visible and browse observed on red-osier dogwood, mountain maple, red maple, low junberry, trembling aspen, beaked hazelnut, and bur oak. Other present species that are available for browse include balsam fir, white pine, red pine, Bebb's willow, pin cherry, and paper birch. The desired outcome from plantings to achieve future structural and compositional diversity is currently unknown and therefore given medium confidence. It will take several years to gauge the survival and recruitment of white pine and bur oak. It may take decades to understand whether bur oak should be included in the planting mix for boreal forest enhancement/restoration under a changing climate scenario.

23. Site Assessor(s) conducting field review:

Jeffrey Lee – MNDNR Ecological and Water Resources Division, Gina Quiram – MNDNR Ecological and Water Resources Division

Site Maps, Project Plans or Vegetation Tables

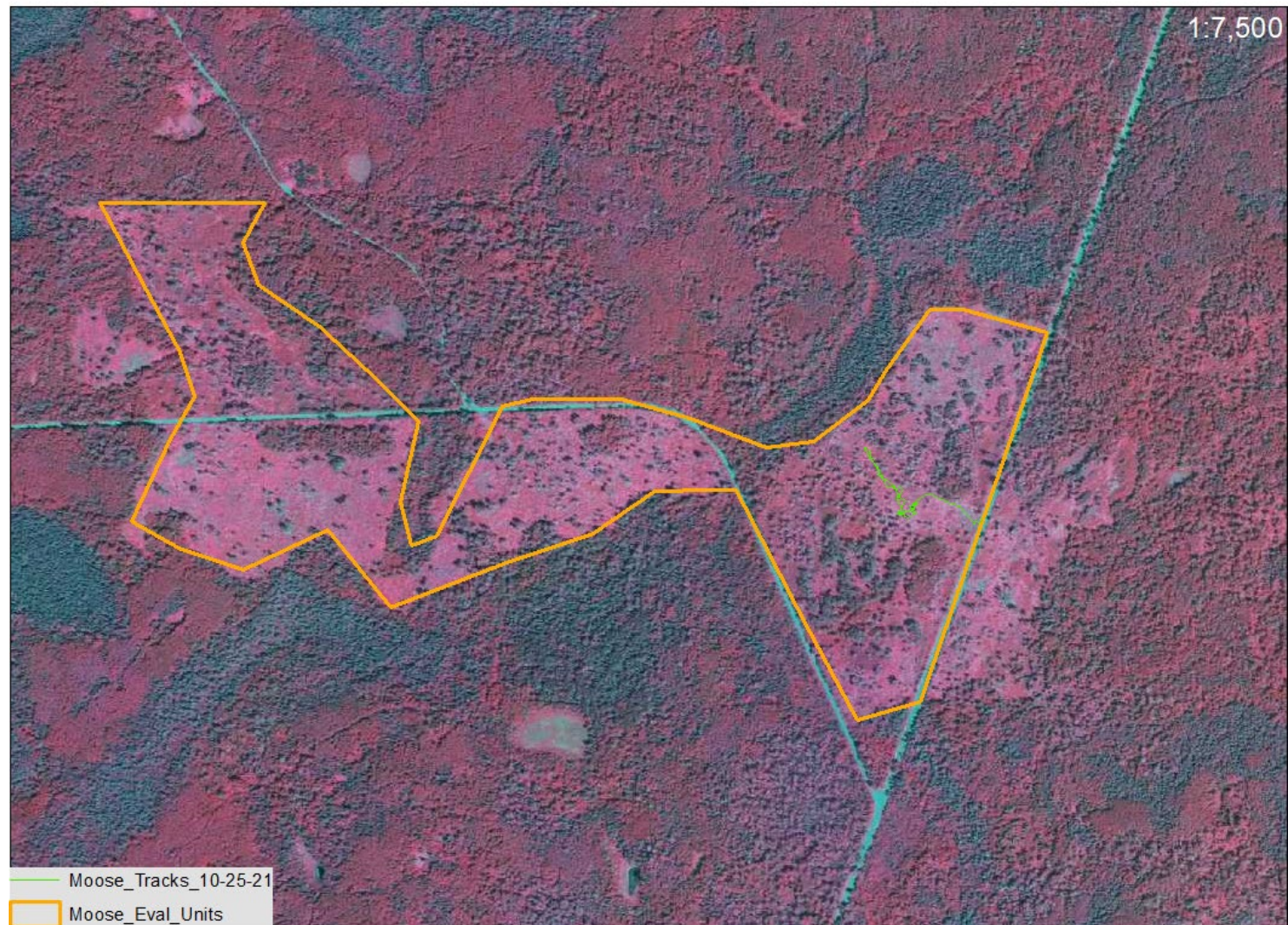


Figure 15-1 Boundary of moose habitat enhancement work and meander survey route at USFS 168. 2019 CIR aerial imagery.



Report Live Tree Stocking

Analysis: Single



Setting	0909070006900	Region:	09	Proc	09	District	07	Location	00069	Station	0002	Acres	42
GIS Link:	090907000690	EV Code:		Year of		No. of	36	Meas				2016-02-02	
Remarks													

Liv Trees Per Acre/Basal Area

Diameter

Species		Null	<1"	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32+	Total	QMD >0	QMD ≥5
ABBA	TPA	125		8																133	1.0	
	BA/A			0																0		
ACRU	TPA	33																		33		
	BA/A																					
ACSP2	TPA	833																		833		
	BA/A																					
BEPA	TPA	150																		150		
	BA/A																					
CORYL	TPA	8775																		8775		
	BA/A																					
PIGL	TPA	8																		8		
	BA/A																					
PIMA	TPA	17																		17		
	BA/A																					
PIRE	TPA	17																		17		
	BA/A																					

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Figure 15-2 Stocking survey for site USFS 168. Diameter class limits are as follows: Class <1 minimum 0" maximum 0.99", Class 2 minimum 1" maximum 2.99", Class 4 minimum 3" maximum 4.00 "...Class 32 minimum 31" maximum not applicable.



Report Live Tree Stocking

Analysis: Single



Species		Null	<1"	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32+	Total	QMD >0	QMD ≥5
PIST	TPA	383																		383		
	BA/A																					
POTR5	TPA	2975	175																	3150	0.3	
	BA/A		0																	0		
PRPE2	TPA	792	175																	967	0.2	
	BA/A		0																	0		
PRVI	TPA	100																		100		
	BA/A																					
QURU	TPA	92																		92		
	BA/A																					
SALIX	TPA	42	167																	208	0.2	
	BA/A		0																	0		
Total	TPA	1434	517	8																14867	0.3	
	BA/A		0	0																0		

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Figure 15-3 Stocking survey for site USFS 168 continued. Diameter class limits are as follows: Class <1 minimum 0" maximum 0.99", Class 2 minimum 1" maximum 2.99", Class 4 minimum 3" maximum 4.00 "...Class 32 minimum 31" maximum not applicable.

Table 15-1 Meander survey for USFS 168 moose habitat enhancement. Species are listed by physiognomy and height strata.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<u>Evergreen 20-35 m</u>				
<i>Pinus strobus</i>	Eastern white pine	0-1%	No	Native
<u>Evergreen 2-5 m</u>				
<i>Abies balsamea</i>	Balsam fir	1-5%	No	Native
<i>Picea glauca</i>	White spruce	0-1%	No	Native
<i>Pinus resinosa</i>	Red pine	0-1%	Yes ¹	Native
<u>Evergreen 0-2 m</u>				
<i>Abies balsamea</i>	Balsam fir	1-5%	No	Native
<i>Pinus strobus</i>	Eastern white pine	1-5%	Yes - planted	Native
<i>Pinus resinosa</i>	Red pine	1-5%	Yes ¹	Native
<u>Deciduous 10-20 m</u>				
<i>Acer rubrum</i>	Red maple	1-5%	No	Native
<u>Deciduous 2-5 m</u>				
<i>Populus tremuloides</i>	Trembling aspen	25-50%	No	Native
<i>Betula papyrifera</i>	Paper birch	1-5%	No	Native
<i>Acer rubrum</i>	Red maple	1-5%	No	Native
<i>Prunus pensylvanica</i>	Pin cherry	1-5%	No	Native
<u>Deciduous 0-2 m</u>				
<i>Cornus sericea</i>	Red-osier dogwood	0-1%	No	Native
<i>Diervilla lonicera</i>	Bush honeysuckle	1-5%	No	Native
<i>Rosa acicularis</i>	Prickly rose	0-1%	No	Native
<i>Salix bebbiana</i>	Bebb's willow	0-1%	No	Native
<i>Acer rubrum</i>	Red maple	5-25%	No	Native
<i>Acer spicatum</i>	Mountain maple	5-25%	No	Native
<i>Amelanchier humilis</i>	Low junberry	0-1%	No	Native
<i>Lonicera hirsuta</i>	Hairy honeysuckle	0-1%	No	Native
<i>Prunus pensylvanica</i>	Pin cherry	1-5%	No	Native
<i>Populus tremuloides</i>	Trembling aspen	50-75%	No	Native
<i>Rubus idaeus</i>	Wild red raspberry	25-50%	No	Native
<i>Corylus cornuta</i>	Beaked hazelnut	25-50%	No	Native
<i>Quercus macrocarpa</i>	Bur oak	1-5%	Yes - planted	Native
<u>Forbs 0-2 m</u>				
<i>Geum canadense</i>	White avens	0-1%	No	Native
<i>Lactuca biennis</i>	Biennial blue lettuce	0-1%	No	Native
<i>Ranunculus acris</i>	Tall buttercup	0-1%	No	Invasive
<i>Hieracium spp.</i>	Hawkweed	0-1%	No	Invasive
<i>Taraxacum officinale</i>	Common dandelion	0-1%	No	Invasive

¹ Planted by USFS prior to moose enhancement work and is unrelated to this project

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Eurybia macrophylla</i>	Large-leaved aster	5-25%	No	Native
<i>Dryopteris carthusiana</i>	Spinulose shield fern	0-1%	No	Native
<i>Cornus canadensis</i>	Bunchberry	1-5%		
<i>Lotus corniculatus</i>	Bird's-foot trefoil	0-1%	No	Invasive
<i>Fragaria virginiana</i>	Common strawberry	0-1%	No	Native
<i>Pteridium aquilinum</i>	Bracken fern	50-75%	No	Native
<u>Graminoids 0-2 m</u>				
<i>Carex brunnescens</i>	Brownish sedge	0-1%	No	Native
cf. <i>Milium effusum</i>	Woodland millet grass	0-1%	No	Native
<i>Poa spp.</i>	Bluegrass	1-5%	No	N/A
<i>Calamagrostis canadensis</i>	Bluejoint	5-25%	No	Native
<i>Bromus ciliatus</i>	Fringed brome	1-5%	No	Native
<i>Carex pedunculata</i>	Long-stalked sedge	0-1%	No	Native
<i>Oryzopsis asperifolia</i>	Mountain rice grass	5-25%	No	Native
<i>Carex cf. deflexa</i>	Northern sedge	0-1%	No	Native
<i>Carex arctata</i>	Drooping wood sedge	1-5%	No	Native

Site Photographs



Photo 15-1 Cages on planted bur oak on the structurally diverse vegetation at the USFS 168 planting site.



Photo 15-2 Planted bur oak emerging from browse protection. The majority of planted bur oaks observed on site had survived and were grow above or out the side of the cages.



Photo 15-3 Limited evidence of moose browse was observed on planted bur oaks.



Photo 15-4 Evidence of release work and subsequent resprouting was observed throughout planting site USFS 168.



Photo 15-5 Structural diversity of woody vegetation characteristic of the USFS 168 planting site.

17 Jefferson German Watershed Shoreline Stabilization (Middle)

Project Background

Project Name: Jefferson German Watershed
Phosphorus Reduction Project

Project Site: German Jefferson shoreline_1-Middle Jefferson

Township/Range Section: Township 109N Range 25W Section 1

Project Manager / Affiliated Organization: Le Sueur County SWCD

Fund: CWF Fiscal Year Funds: 2018

Project Start Date: March 2020

Predominant Habitat type: Aquatic Habitat

Additional Habitat types:

Project Status: Post Establishment Phase



County: Le Sueur

Primary Activity: Lake Shore Restoration

Project Size: 154 linear feet, 13.8 feet wide

Project Completed: August 2020

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

Rip rap stabilization of 154 feet of eroding shoreline. Based on long lake fetch of approximately 1.4 miles to the west, project designers felt that hard armoring with riprap was the appropriate solution to stabilize the eroding shoreline at this site and retain existing mature trees.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Middle Jefferson, Lake Shore Protection design set, 2 sheets – Le Sueur SWCD and South Central Technical Service Area, Shoreline Protection Project Manual – Le Sueur SWCD and South Central Technical Service Area, Clifton Lakeshore Protection, project fact sheet – Le Sueur SWCD,

3. What are the stated goals of the project?

Stabilize eroding shoreline on Middle Jefferson Lake to reduce sediment and nutrient loading to Middle Jefferson Lake

4. What are the desired outcomes of achieving the stated goals of the project?

Improve water quality in the German-Jefferson chain of Lakes and Cannon River

5. Were measures of restoration success identified in plans? Yes

If yes, list specific measurements.

Modeled load reductions include 24.23 tons per year of sediment and 27.87 pounds per year of Phosphorus

6. Are plan Sets available? Yes Have project maps been created? No

If yes, provide in "site maps" and list maps provided:

NA

7. Provide list of best management practices, standards, guidelines identified in plan set?

Project Manual prepared by South Central Technical Service Area includes Operations and Maintenance Plan, construction and material specifications.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

Yes

As built plans noted increase from 150 linear feet to 154 linear feet of rip rap stabilization.

9. In what ways did alterations change the proposed project outcome?

This alteration did not change the project outcomes.

Site Assessment

Field Review Date: 9/13/2021

Field Visit Attendees: Mike Schultz

10. Surrounding Landscape Characteristics:

The site is adjacent to rural residential shoreline properties. Surrounding land uses include row crop and livestock agriculture.

11. Site Characteristics:

a. Soil Series:

Lester-Belview complex, 22 to 40 percent slopes

b. Topography:

Moderately steep slope from lakeshore

c. Hydrology:

The site receives non concentrated runoff from adjacent lawn and house. Wave and wake action from the lake regularly hit the shoreline.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Mature Basswood trees along the top of slope with ruderal shoreline vegetation of Beggerticks, Barnyard grass and Smartweed.

12. Is the plan based on current science? Portions

Riprap underlain with geotextile is a currently accepted practice for structural shoreline stabilization. Minnesota NRCS Construction Specification 61–Rock Riprap and Minnesota NRCS Construction Specification 95 –Geotextile were utilized. It is possible that other “soft armor” bioengineered vegetated approaches could have been used to stabilize this shoreline. These more natural approaches would also benefit habitat to the lake and shoreline with living vegetation. It is a generally accepted best practice for conservation projects to maximize the multiple habitat and sediment reduction benefits of stabilizing a shoreline using vegetation and natural materials.

13. List indicators of project goals at this stage of project:

Riprap is maintaining position and soil/turf and trees at the top of slope are stable and not being eroded. Ruderal, primarily annual, vegetation is establishing at the waters edge providing some

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, the shoreline appears stable and not eroding.

15. Are corrections or modifications needed to achieving proposed goals?

No

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

It is possible that small boulders in riprap may be moved by ice heaving. This could be addressed with larger rock gradation. However, if the installed 12-15 inch rock is not substantially displaced by wave action or ice heave, I would suggest that this stabilization project could have potentially been addressed with “soft armor” techniques such as coir biologs and/or living willow wattles integrated with more woody and native perennial roots. These soft armor techniques would additionally provide greater habitat.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

As noted in question 16, vegetated soft armor techniques would potentially create additional habitat benefits if utilized.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No. The practice is functioning as designed and installed.

19. Additional comments on the restoration project.

None

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Minimally achieved the stated goals.

21. The project will:

Minimally meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. *Provide explanation of reason(s) for determination.*

The goal of reducing sediment and nutrient loading by stabilizing the eroding shoreline has been minimally achieved. The removal of existing vegetation and replacement with synthetic fabric and rock reduced potential habitat along this section of shoreline as there was opportunity to achieve the stabilization goals of this project and provide improved habitat utilizing bioengineered practices. The outcome of improving water quality in the lake should also be supported, though to a limited degree.

23. *Site Assessor(s) conducting field review:* Alyssa Core – MNBWSR, Wade Johnson – MNDNR

Site Maps, Project Plans or Vegetation Tables

Conservation Cooperator

PROJECT FACT SHEET



Lake Shore Protection

Cooperator & Location

Applicant(s): **Rich Clifton**
Address: 46939 Cape Horn Road
City State Zip: Cleveland, MN 56017
Twp/Range: T 109N – R 25W Section: 1
City or Twp: Cleveland Twp
Funding Source: CWF G/I Watershed: 39167

Project Information

Practice

Lake Shore Protection

Resource Protected

Cannon River

Description

Install 150' of shoreline protection 13.8' wide. 4.8' will be in the OHWL while the remaining 9' will be above the OHWL. Any areas that is disturbed will be seeded back to is in the area.

Environmental Benefits

Parameter	Before	After	Saved
Soil Erosion (tons/yr)	24.23	0	24.23
Sediment Load (tons/yr)	24.23	0	24.23
Phosphorus Load (lbs/yr)	27.87	0	27.87
Runoff Reduction (acre-ft)	N/A	N/A	N/A

Dates

SWCD Review

1/1/2020

Project Start

3/10/2020

Project Finish

10/7/2020

Photo



Completed Project Site Photo

Cost Analysis

PROJECT COSTS

Other:	
Construction:	\$15,650.00
Total:	\$15,650.00

FUNDING SOURCES

		%
Landowner:	\$3,912.50	25
Federal:		
State:		
Match:	\$11,737.50	75



Figure 4 Lake Shore project fact sheet – Le Sueur SWCD

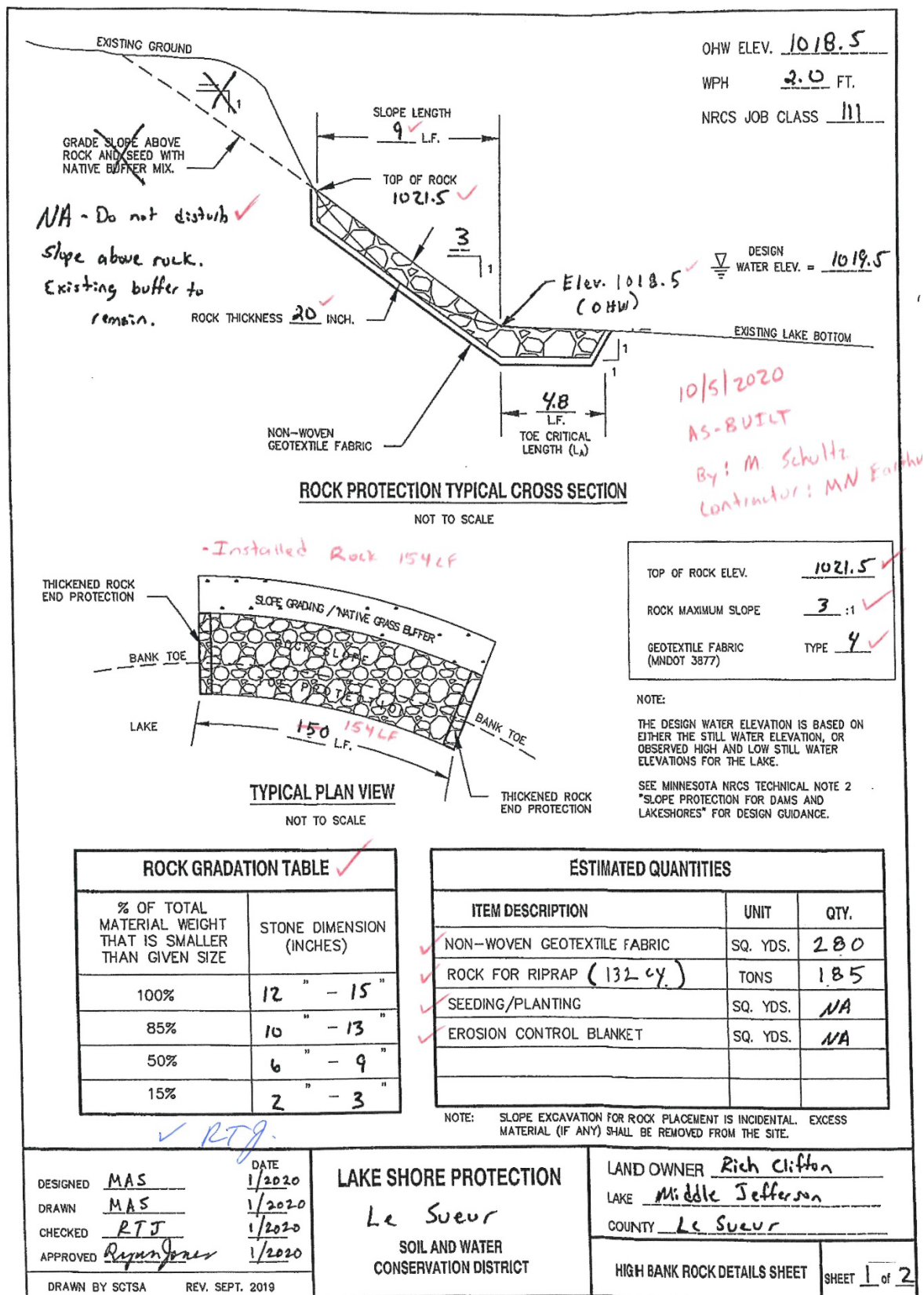
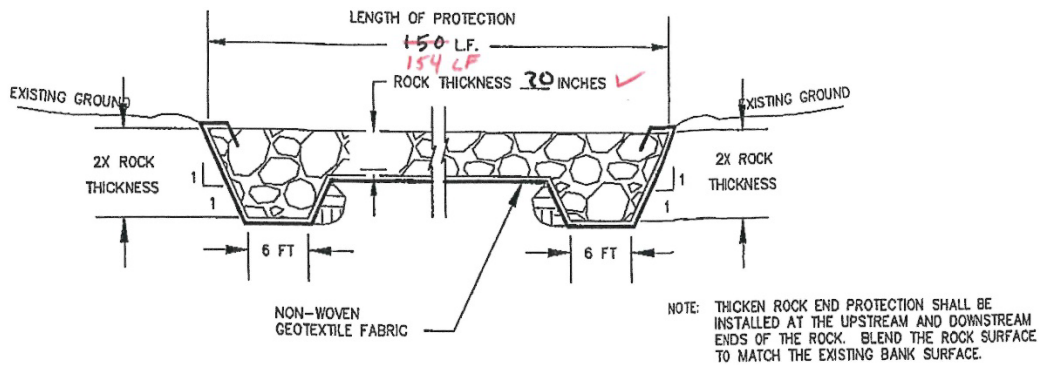


Figure 5 As built project plan page 1 – Le Sueur SWCD and South Central Technical Service Area



TYPICAL SECTION FOR 'THICKEN' ROCK END PROTECTION

ROCK INSTALLATION NOTES:

MATERIAL SPECIFICATIONS

ROCK

1. FIELD STONE SHALL MEET THE GRADATION PROVIDED.
2. IF RIPRAP IS USED, IT SHALL CONFORM TO THE REQUIREMENTS OF MINNESOTA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATION 3601. USE THE GRADATION PROVIDED, OR COORDINATE WITH SWCD TO DETERMINE A STANDARD MNDOT RIPRAP CLASS THAT WILL BE ACCEPTABLE.
3. LIMESTONE RIPRAP IS NOT ACCEPTABLE AND SHALL NOT BE APPROVED FOR INSTALLATION OR COST-SHARE.
4. THE ROCK SHALL BE FREE FROM DIRT, CLAY, SAND, ROCK FINES, AND OTHER MATERIAL NOT MEETING THE REQUIRED GRADATION LIMITS.
5. THE PLACED ROCK OR RIPRAP SHALL CONTAIN LESS THAN 10 PERCENT OF UNDESIRABLE MATERIALS BY MASS. UNDESIRABLE MATERIALS ARE DEFINED AS:
 - (1) INDIVIDUAL PIECES OF STONE WITH DEFECTS THAT ARE VISUALLY DIFFERENTIATED FROM ACCEPTABLE PIECES, OR
 - (2) STONE THAT IS SLABBY OR ELONGATED (HAVING WIDTH OR THICKNESS LESS THAN 30 PERCENT OF THE LENGTH).

GEOTEXTILE FABRIC

1. UNLESS OTHERWISE NOTED IN THE PLAN, THE GEOTEXTILE FABRIC SHALL BE NON-WOVEN, MEETING THE REQUIREMENTS OF MINNESOTA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATION 3733, TYPE 4.

CONSTRUCTION

EXCAVATED MATERIAL FOR ROCK INSTALLATION SHALL BE REMOVED FROM THE SITE. GEOTEXTILE AND ROCK SHALL NOT BE PLACED UNTIL THE SUBGRADE SURFACE HAS BEEN INSPECTED/APPROVED BY THE TECHNICIAN.

THE SURFACE ON WHICH THE GEOTEXTILE IS TO BE PLACED SHALL BE GRADED AS SHOWN ON THE DRAWINGS. IT SHALL BE REASONABLY SMOOTH AND FREE OF LOOSE ROCK, CLODS, HOLES, DEPRESSIONS, AND PROJECTIONS.

THE GEOTEXTILE SHALL BE LOOSELY LAID, MINIMUM FOLDING, IN SUCH A MANNER THAT IT CONFORMS TO THE SURFACE IRREGULARITIES WHEN ROCK IS PLACED ON OR AGAINST IT. THE GEOTEXTILE MAY BE FOLDED AND OVERLAPPED TO PERMIT PROPER PLACEMENT IN DESIGNATED AREAS.

THE GEOTEXTILE SHALL BE JOINED BY OVERLAPPING IN A SHINGLE LIKE MANNER A MINIMUM OF 18 INCHES AND SECURED AGAINST THE UNDERLYING FOUNDATION MATERIAL.

SECURING PINS ARE ACCEPTABLE BUT NOT REQUIRED. THE GEOTEXTILE CAN BE ANCHORED BY SMALL, ROUND "BASEBALL SIZED" ROCKS OR OTHER EQUIVALENT METHODS THAT HOLD THE GEOTEXTILE IN PLACE.

ROCK SHALL NOT BE PUSHED OR ROLLED OVER THE GEOTEXTILE.

THE ROCK SHALL BE INSTALLED TO THE FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID SERIOUS DISPLACEMENT OF THE UNDERLYING FABRIC MATERIAL. THE ROCK SHALL BE DELIVERED AND PLACED IN A MANNER THAT ENSURES THE MATERIAL IS REASONABLY HOMOGENEOUS, WITH THE LARGER ROCKS UNIFORMLY DISTRIBUTED AND FIRMLY IN CONTACT ONE TO ANOTHER WITH THE SMALLER ROCKS AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER ROCKS. SOME HAND PLACING MAY BE REQUIRED TO PROVIDE A NEAT AND UNIFORM SURFACE.

ROCK SHALL NOT BE DROPPED MORE THAN 3 FEET ONTO GEOTEXTILE.

SITE-SPECIFIC CONSTRUCTION NOTES:

CONSTRUCTION CERTIFICATION STATEMENT

I HEREBY CERTIFY THAT A FINAL INSPECTION OF THIS PROJECT HAS BEEN PERFORMED AND THAT THE WORK COMPLETED IS IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. ANY CHANGES TO THE PLANS AND SPECIFICATIONS ARE SO NOTED.

I HEREBY CERTIFY THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

Ryan T. Jensen
 SIGNATURE
 44622
 LICENSE NO. 10/7/2020
 DATE

DESIGNED <u>MAS</u> DATE <u>1/2020</u> DRAWN <u>MAS</u> <u>1/2020</u> CHECKED <u>RTJ</u> <u>1/2020</u> APPROVED <u>Ryan Jensen</u> <u>1/2020</u> DRAWN BY SGTSA REV. AUGUST 2019	LAKE SHORE PROTECTION Le Sueur SOIL AND WATER CONSERVATION DISTRICT	LANDOWNER <u>Rich Clifton</u> LAKE <u>Middle Jefferson</u> SWCD <u>Le Sueur</u>	ROCK DETAIL SHEET	SHEET 2 of 2
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Figure 6 As built project plan page 2 – Le Sueur SWCD and South Central Technical Service Area

OPERATION AND MAINTENANCE PLAN

Lake Shore Protection

Rich Clifton
46939 Cape Horn Road
Cleveland, Minnesota

Shoreline Protection with rock revetment is designed for a minimum life expectancy of 25 years. Proper inspection and maintenance are necessary for successful operation of this erosion control practice. Listed below are recommended inspection and maintenance activities.

Periodic Inspection (Annually and after large storm events)

1. Inspect the rock for excessive movement, dislodged rocks in the lakebed, fractured rock, exposed geotextile, undermining of rock, or flanking.
2. Replace any rock that has been displaced.
3. If any holes occur in the filter fabric, repair immediately by overlaying damaged fabric with new material and replacing the rock with material consistent with the original design.
4. Repair any erosion that occurs at or near the upstream or downstream ends of the project.
5. Repair any settlement or erosion that occurs with soil and reseed or resurface as needed.
6. Vegetation, where specified, shall be maintained. Control undesirable trees and brush by chemical or mechanical means. Where mowing, time the first mowing after nesting birds have hatched. Remove excess growth.

Damages listed above could threaten the performance of the shoreline protection. Contact the local SWCD office for technical assistance.

Landowner/operator signature

Date

Figure 7 Operation and Maintenance Plan agreement. Excerpt from Project Manual – Le Sueur SWCD and South Central Technical Service Area

Table 2 List of plant species observed during site visit 09/13/2021. No planting or seeding was completed as part of this project.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Echinochloa crus-galli</i>	Barnyard Grass	1-5%	No	nonnative
<i>Bidens vulgata</i>	Common Beggarticks	1-5%	No	Native
<i>Cirsium arvense</i>	Canada Thistle	1-5%	No	Invasive
<i>Cyperus esculentus</i>	Yellow Nutsedge	1-5%	No	Invasive
<i>Hemerocallis sp</i>	Day Lily	1-5%	No	Nonnative
<i>Persicaria lapathifolia</i>	Nodding Smartweed	1-5%	No	Native
<i>Populus deltoides</i>	Plains Cottonwood	1-5%	No	Native
<i>Tilia americana</i>	American Basswood	25-50%	No	Native

Site Photographs



Photo 6 Pre-project photo of shoreline looking north 2019. Project manager reported that the toe was continually eroding and beginning to undercut the roots of existing Basswood trees.



Photo 7 Site photo during construction facing north 2020.



Photo 8 Completed project viewed from the water during site visit 09/13/2021.



Photo 9 Looking north along shoreline during site visit 09/13/2021.

18 Jefferson German Watershed Shoreline Enhancement (Swedes Bay)

Project Background

Project Name: Jefferson German Watershed Phosphorus Reduction Project

Project Site: German Jefferson shoreline 2_Swedes Bay

Township/Range Section: Township 109N Range 23W Section 7

Project Manager / Affiliated Organization: Le Sueur County SWCD

Fund: CWF **Fiscal Year Funds:** 2018

Project Start Date: June 2019

Predominant Habitat type: Aquatic Habitat

Additional Habitat types:

Project Status: Post Establishment Phase



County: Le Sueur

Primary Activity: Lake Shore Enhancement

Project Size: 75 linear feet of shoreline, 25 feet inland of shoreline

Project Completed: December 2020

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

Native plant planting along 75 feet of eroding low gradient shoreline. Planting extended 25 feet landward of ordinary high water level.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Critical Area Planting, project fact sheet – Le Sueur SWCD, Dembouski cost share application and as built notes – Le Sueur SWCD, Invoices for cost share materials February and March 2020 – Le Sueur SWCD, Shoreline Protection Project Manual – Le Sueur SWCD and South Central Technical Service Area, ,

3. What are the stated goals of the project?

Enhance shoreline native plant diversity and increase stability of low gradient shoreline where it is beginning to undercut and sluff. Reduce sediment and nutrient loading to Middle Jefferson Lake through reduced erosion and increased filtering of upland runoff.

4. What are the desired outcomes of achieving the stated goals of the project?

Improve water quality in the German-Jefferson chain of Lakes and Cannon River

5. Were measures of restoration success identified in plans? Yes

If yes, list specific measurements.

Modeled load reductions include 2.7 tons per year of sediment and 3.1 pounds per year of Phosphorus

6. Are plan Sets available? Yes Have project maps been created? No

If yes, provide in "site maps" and list maps provided:

NA

7. Provide list of best management practices, standards, guidelines identified in plan set?

NA

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

No

9. In what ways did alterations change the proposed project outcome?

NA

Site Assessment

Field Review Date: 9/13/2021

Field Visit Attendees: Mike Schultz

10. Surrounding Landscape Characteristics:

The site is adjacent to rural residential shoreline properties. Surrounding land uses include row crop and livestock agriculture.

11. Site Characteristics:

a. Soil Series:

Lester-Hawick-Storden complex, 12 to 18 percent slopes

b. Topography:

Low gradient shoreline and littoral zone. Nearly level for 25 feet landward of shoreline then steep north-facing slope.

c. Hydrology:

Shallow water shoreline with no apparent concentrated flow paths from the uplands

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Project site is dominated by native perennials planted as part of this project. Shoreline is interspersed with small ash trees. Reed Canary Grass dominates adjacent shorelines where they are not mowed.

12. Is the plan based on current science? Yes

Plug planting of diverse native perennials is an accepted practice for shoreline buffers.

13. List indicators of project goals at this stage of project:

Vegetation is well established and planted species are dominant within the project area.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, the species selected, density of planting and ongoing maintenance by the landowner points to achieving intended goals for this shoreline Critical Area Planting.

15. Are corrections or modifications needed to achieving proposed goals?

Reed Canary Grass should be diligently managed to enable planted species to flourish.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

More thorough treatment of Reed Canary Grass through multiple herbicide treatments could have benefited long-term management.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

This project appears to only benefit habitat.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No. This project appears to be on a good trajectory and has diligent landowner maintenance.

19. Additional comments on the restoration project.

The project plans show that 24 cubic yards of “compost black dirt” was brought into the site to support robust plant growth in the poor, compacted shoreline soils. Given the vigorous plant growth, this appears to have benefited the plants. However this application of a nutrient rich soil amendment may have caused a contribution of nutrients to the lake through runoff and leaching.

Project managers noted that neighboring property owners have stopped mowing their turf grass to the shoreline as a result of this project serving as an example.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Minimally meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

This project clearly achieved the goals of enhanced shoreline native plant diversity and increased stability. Additionally, shoreline habitat is improved on this project site. The desired outcomes of improving water quality in the German-Jefferson chain of lakes is likely only minimally achieved through this project, due to its relative scale and the potential that compost amendments may at least temporarily add nutrient inputs to the lake. Overall, the project is quite successful and can serve as a

positive example for neighboring lakeshore property owners for reducing turf and increasing native plant diversity along their shorelines.

23. *Site Assessor(s) conducting field review:* Alyssa Core – MNBWSR, Wade Johnson - MNDNR

Site Maps, Project Plans or Vegetation Tables

Conservation Cooperator

PROJECT FACT SHEET



Critical Area Planting

Cooperator & Location

Applicant(s): **Lisa Dembouski**
Address: 24970 Swedes Bay Ln
City/State/Zip: Elysian, MN 56028
Twp/Range: T 109N – R 23W Section: 7
City or Twp: Kilkenny Twp
Funding Source: CWF G/I Watershed: 39085

Project Information

Practice

Critical Area Planting

Resource Protected

Cannon River

Description

Install a critical area planting along her Swede Bay shoreline 75' by 25'. Erosion control blankets will be used, native plants will be installed as plugs and any remaining area will have mulch and compost placed on it.

Environmental Benefits

<u>Parameter</u>	<u>Before</u>	<u>After</u>	<u>Saved</u>
Soil Erosion (tons/yr)	2.7	0	2.7
Sediment Load (tons/yr)	2.7	0	2.7
Phosphorus Load (lbs/yr)	3.1	0	3.1
Runoff Reduction (ac-ft)	N/A	N/A	N/A

Cost Analysis

PROJECT COSTS

Other:	
Construction:	\$4,456.23
Total:	\$4,456.23

FUNDING SOURCES

		<u>%</u>
Landowner:	\$1,500.00	34
Federal:		
State:		
Match:	\$1,500.00	34



Completed Project Site Photo



Figure 8 Project fact sheet – Le Sueur SWCD. Top photo shows pre project conditions in winter. Bottom photo shows project after planting above the shoreline. Based on vegetation observed during the site visit, the Reed Canary Grass strip along the shoreline shown in the bottom photo has been substantially removed and replaced with native plants.

LE SUEUR COUNTY LAND ALTERATION PLAN

LE SUEUR COUNTY ENVIRONMENTAL SERVICES
88 South Park Avenue
Le Center MN 56057-1600

507-357-8538

For Office Use Only

Shoreland Alteration Plan

P&Z Approval

☒ Approved

☐ Denied

☐ Moved to Permitting Process

By: [Signature] (Signature)

Date: 4/17/19

Date: 2 April 19

Parcel ID Number: 04.740.0170

Applicant: Last Name Dembowski First Name Lisa

Phone: 651.489.1039 E-mail lisa.dembowski@gmail.com

If you are not the property owner, state your business name: _____

Contractor's Name: SELF Phone: _____

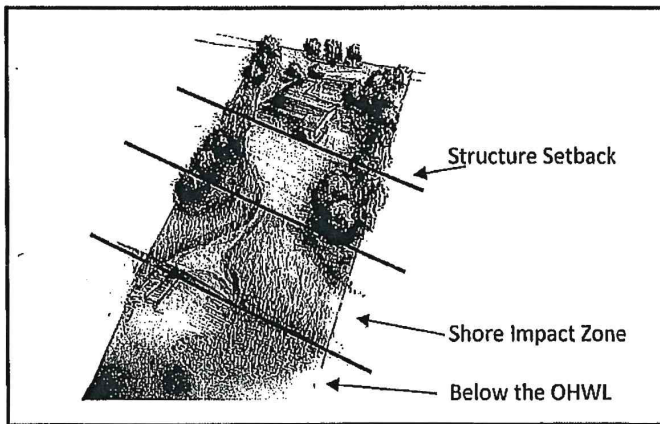
Property Owner: SELF Phone: _____

Project Address: 24970 Suedas Bay Ln, Elysian, MN 56028

Mailing Address: _____

What is Shoreland? Shoreland area is 1,000 feet from the Ordinary High Water Level (OHWL) of a lake and 300 feet from a river or stream.

What is a Shore Impact Zone? The shore impact zone is land located between the OHWL and one-half of the structure setback.



Project location on property: ☐ Within the Shore Impact Zone ☐ Above the Shore Impact Zone ☒ Both

** Any work below the Ordinary High Water Level requires a MN DNR permit or approval.

Please check the proposed project:

Rip rap, armor bank	☒	Vegetation Removal (grasses & weeds in exchange for)
Grading and Filling	☐	Increase in impervious surface
Retaining Wall	☒	Rain Garden (Bioretention) native wildflowers & shrubs
Sand Beach (Sand Blanket)	☒	Other (describe) plantings throughout the shore impact zone of my lot

Figure 9 Shoreline project review page 1 – Le Sueur SWCD

Location of project in relation to the OHWL and the shore impact zone	Cubic yards of earth movement (Earth movement: bringing in and/or moving dirt/rock/gravel/sand material; also moving material from point A to point B on the property)
Estimate of vegetation to be cleared (what kind of vegetation, number to be cleared)	Retaining wall linear length and wall height and material
Erosion control plan and map	Vegetation replacement

clusters
of sedges
or flowers

A hand-drawn map of a wetland area, likely a marsh or pond. The map is oriented with a north arrow pointing towards the top right. The left side of the map shows a body of water with a "path to water" and a "kayak rack" indicated by a curved line. A "tree" is marked with a circle and a cross. The water area is labeled "water; sun-lover plants". The central and right areas are divided into zones: "part-sun plants" and "more shade-tolerant plants". Various plant types are represented by different symbols: circles for "bush", small circles for "ferns", and larger circles for "water; sun-lover plants". A red arrow points from the top left towards the top right, labeled "Add coral tag @ waters edge if needed". A red circle highlights the number "75" at the bottom. The bottom of the map is labeled "Bank (approx. 30' up to catin)" with a scale bar indicating "75'".

tree

path to water

kayak rack

ferns

water; sun-lover plants

part-sun plants

more shade-tolerant plants

Bank (approx. 30' up to catin)

75'

Add coral tag @ waters edge if needed

AS

AS-BUILT
Installed As
Planned
6/25/2020
Mike Schult

Signature: Lisa Demander Title: (homeowner)
Date: 2 April 19

✓ Ryan Jones 6-11-19

243



Le Sueur County Soil & Water Conservation District

Le Sueur County SWCD
181 W Minnesota St
Le Center, MN 56057

Tel. (507) 357-4879 Ext. 3
Website: www.lesueurswcd.org

Lisa Dembouski
24970 Swedes Bay Lane,
Elysian, MN 56028
651-489-1039

PID: 04.740.0170

Native Shoreline Planting:

Installing:

- ✓ • Erosion Control blankets on a 25 x 75 foot shoreline site (~\$500.00)
- ✓ • Native plants (perennials, shrubs, see list below) (~\$1,000)
- ✓ • Mulch and compost to cover the entire area (~\$1,500) -- **Total estimated costs: \$3,000.00**

Wildflowers and shrubs (examples of what will be planting):

- ✓ • Plugs or 4" pots of native shade perennials (i.e. ferns, sedges, solomon's seal, bloodroot, etc.)
- ✓ • Plugs or 4" pots of native part-sun perennials (i.e. milkweeds, asters, other prairie flowers, particularly those loved by pollinators)
- Small native shrubs for habitat including serviceberry, hazelnut, currant
- Plants will be installed 12"-18" OC spacing (based on species list, See Attached)

Consider adding a staked coir log at the lakeshore/water's edge to protect against wave action, if needed

*✓ Ryan Jones
4-11-19*

Figure 11 Shoreline management review page 3, showing materials to be used – Le Sueur SWCD



Figure 12 Aerial image with contours of project site – Le Sueur SWCD.



2020 Native Plant Sale

Butterfly Kit



Butterfly Milkweed, Black-eyed Susan, Narrow-leaved Purple Coneflower, Sky Blue Aster, Early Sunflower, Bergamot, New England Aster, Meadow Blazing Star, Stiff Goldenrod, Red Columbine, Purple Prairie Clover, Canada Wild Rye

Order Deadline:
May 1, 2020

Rain Garden Kit



Swamp Milkweed, New England Aster, Joe-Pye Weed, Common Boneset, Sneezeweed, Blue Flag Iris, Cardinal Flower, Blue Vervain, Culver's Root, Prairie Blazing Star, Bottle Brush Sedge, Little Bluestem

Each kit contains four each of 12 species (48 total plants). Recommended planting density is 1 plant per square foot of space for most applications.

NEW!

Pollinator Booster



Butterfly Milkweed, Purple Giant Hyssop, Slender Beardstongue, Sneezeweed, Prairie Spiderwort, Side Oats Grama, Common Boneset, Meadow Blazing Star, Bottle Gentian, Joe-Pye Weed, Smooth Aster, Golden Alexander

Order Pickup: June 5, 2020
Noon to 4:00 pm at the Rice SWCD office at 1810 30th Street NW in Faribault.

Figure 13 Species list for plant plug kits used. This project installed 2 Butterfly kits: 8 plugs of each plant listed, 2 Rain Garden kits: 8 plugs of each plant and 3 Pollinator Booster kits: 12 plugs of each plant listed. Vegetation observed during the site visit 09/13/2021 included all species from these kits with a cover range of 5-25% within the project site. In addition to these planted species, four other species were observed within the project site primarily in or near the receding waters edge, each in a cover range of 5-25%: *Phalaris arundinacea* (Reed Canary Grass), *Impatiens capensis* (Spotted Jewelweed), *Persicaria lapathifolia* (Nodding Smartweed) and *Bidens sp.* (Beggerticks).

Site Photographs



Photo 10 Project site observed from the top of slope during site visit 09/13/2021.



Photo 11 Representative photo on the ground with planted species Bottle Brush Sedge, Gray Headed Coneflower, Sneezeweed, and Blue Lobelia.

19 Jefferson German Watershed Wetland Enhancement (Koppelman)

Project Background

Project Name: Jefferson German Watershed Phosphorus Reduction Project

Project Site: German Jefferson 1_wetland

Township/Range Section: Township 110N Range 25W Section 35

Project Manager / Affiliated Organization: Le Sueur County SWCD

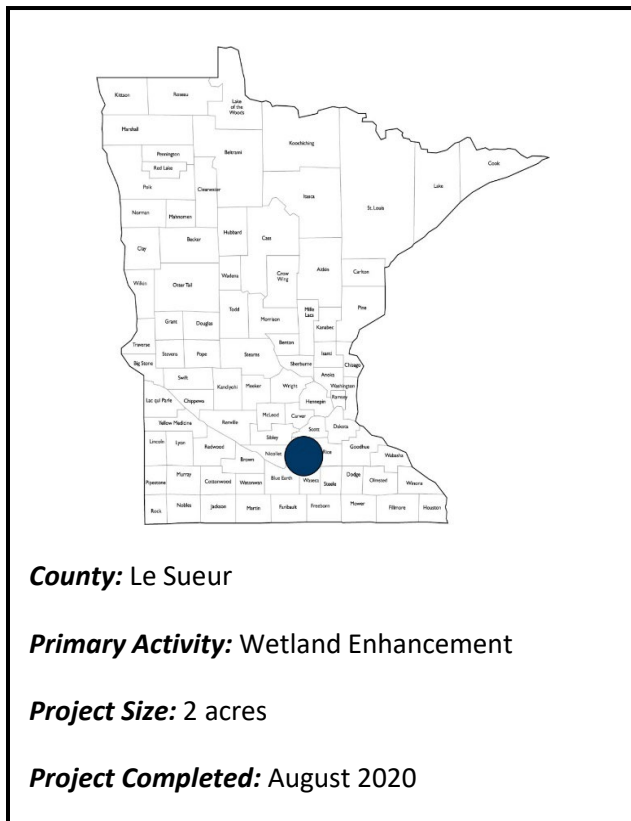
Fund: CWF **Fiscal Year Funds:** 2018

Project Start Date: September 2019

Predominant Habitat type: Wetland

Additional Habitat types:

Project Status: Establishment Phase



County: Le Sueur

Primary Activity: Wetland Enhancement

Project Size: 2 acres

Project Completed: August 2020

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

Wetland excavated for increased flood storage and drainage modified through a culvert to connect the upper watershed. The wetland now receives runoff from about 200 acres of cropland fertilized with cow and hog manure as well as a tile outlet that enters from the east.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Koppelman Wetland Enhancement design set, 6 sheets – South Central Technical Service Area, Wetland Enhancement Project Manual – Le Sueur SWCD and South Central Technical Service Area, Koppelman Wetland Enhancement, project fact sheet – Le Sueur SWCD,

3. What are the stated goals of the project?

Reduce sediment and nutrient loading to Middle Jefferson Lake

4. What are the desired outcomes of achieving the stated goals of the project?

Improve water quality in the German-Jefferson chain of Lakes and Cannon River

5. Were measures of restoration success identified in plans? Yes

If yes, list specific measurements.

Modeled load reductions include 69 tons per year of sediment and 79 pounds per year of Phosphorus

6. ***Are plan Sets available? Yes Have project maps been created? No***

If yes, provide in "site maps" and list maps provided:

NA

7. ***Provide list of best management practices, standards, guidelines identified in plan set?***

Project Manual prepared by South Central Technical Service Area includes Operations and Maintenance Plan, construction and material specifications and design details for engineered practices.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. ***Were alterations made to the plan during project implementation?***

Yes

As built plans note minor changes to plan during construction.

9. ***In what ways did alterations change the proposed project outcome?***

These changes do not appear to substantively change the project outcomes.

Site Assessment

Field Review Date: 9/13/2021

Field Visit Attendees: Mike Schultz – Le Sueur SWCD, Alyssa Core – MNBWSR, Wade Johnson – MNDNR

10. ***Surrounding Landscape Characteristics:***

Agricultural land uses including row crops and livestock.

11. ***Site Characteristics:***

a. Soil Series:

The project site is primarily Glencoe clay loam, 0 to 1 percent slopes

b. Topography:

Shallow basin within moderately 1-10% sloped landscape

c. Hydrology:

Shallow open water wetland basin receives rainwater runoff from approximately 200 acres

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Wetland and mesic prairie species, see Table 1 species observed. Common species include

12. ***Is the plan based on current science?*** Yes

The plan includes newer forms of stabilization and the most up-to-date BWSR seed mixes. Seeding was also done according to current methods including utilizing seed that meets standards for purity and germination.

13. ***List indicators of project goals at this stage of project:***

Vegetation is well established and there is no erosion evident around culverts, inlets and outlets.

14. ***Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?***

It appears that the project plan will be successful as long as the maintenance directed in the project manual is followed. Invasive species will also need to be controlled to improve the success of the project.

15. Are corrections or modifications needed to achieving proposed goals?

Since this project is in its first year, vegetation is still establishing. Considering how dry this last year has been, it's hard to know if there are any issues in terms of handling flow. Future normal years will be better indicators of success.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

The O&M plan provides satisfactory direction for this type of project with regards to the engineered practices. At this early stage, the seeded vegetation in the buffer is establishing. Persistent invasive species, particularly Reed Canary Grass, will likely be difficult to control as a dominant component. There is a maintenance agreement in place for the first two years to manage invasives and support the desired plant communities.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

The seeding of native species should improve habitat and potentially be a source for pollinators.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

A follow up visit does not appear necessary. The structural components of the project appear functional and stable. Adequate vegetation is present to support soil stability for the structural practices. The establishment of the wetland and prairie plant communities surrounding the wetland will require ongoing management by the project manager and landowner.

19. Additional comments on the restoration project.

Project managers noted that the property owners were invested and advocated for designing the project to achieve treatment of all of the runoff and tile outlet water passing through their property.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

The project supports the goal of reducing sediment and nutrient loading to Middle Jefferson Lake through 1. treatment provided by routing previously untreated nutrient rich cropland runoff through the wetland, though it is unclear what the level of treatment will be at differing water levels within the basin and 2. Reduced ditch channel erosion through flow attenuation. Since this is the first year and the year

was extremely dry, we haven't seen normal conditions to accurately reflect the conditions that the project is meant to handle.

23. *Site Assessor(s) conducting field review:* Alyssa Core – MNBWSR, Wade Johnson - MNDNR

Site Maps, Project Plans or Vegetation Tables

Conservation Cooperator

PROJECT FACT SHEET



Dean Koppelman/Wetland Enhancement

Cooperator & Location

Applicant(s): **Dean Koppelman**

Address: 26548 Lake Jefferson Rd

City/State/Zip: Cleveland, MN 56017

Twp/Range: T 110N – R 25W Section: 35

City or Twp: Cleveland Twp

Funding Source: Jefferson German CWF Watershed: 39107

Aerial Photo



Project Information

Practice: **Wetland Enhancement**

Resource Protected: **Middle Jeffers on Lake, Cannon River**

Description:

Install a 2 acre wetland enhancement. The wetland will treat over 200 acres of water during low flow periods as the wetland is designed to divert low flow water into the wetland and allow peak flows to discharge directly to the lake. The wetland will be beneficial for treating water prior to entering Middle Jefferson Lake.

Environmental Benefits:

Parameter	Before	After	Saved
Soil Erosion (tons/yr)	161	0	161
Sediment Load (tons/yr)	69.01	0	69.01
Phosphorus Load (lbs/yr)	79.36	0	79.36
Runoff Reduction (acrefit)	N/A	N/A	N/A

Completed Project



Cost Analysis

PROJECT COSTS	
<blank>>	
Construction:	\$38,410.00
Total:	\$38,410.00

FUNDING SOURCES			%
Landowner:	\$3,841.00		10
Federal:			
State:			
Grant:	\$34,569.00		90



Figure 14 Project fact sheet, Le Sueur SWCD 2020

CONSTRUCTION NOTES:

THE OWNER IS RESPONSIBLE FOR OBTAINING LAND RIGHTS AND LOCAL, STATE, AND FEDERAL PERMITS OR OTHER PERMISSION NECESSARY TO PERFORM AND MAINTAIN THE PRACTICE.

BEFORE START OF CONSTRUCTION, THE OWNER OF ANY UTILITIES INVOLVED MUST BE NOTIFIED. THE EXCAVATOR IS RESPONSIBLE FOR GIVING NOTICE BY CALLING "GOPHER STATE ONE-CALL" AT (800) 252-1166 AT LEAST 48 HOURS PRIOR TO ANY EXCAVATION.

THE CONTRACTOR SHALL COORDINATE WITH THE OWNER TO LOCATE ANY PRIVATE UTILITIES THAT MAY BE IN THE VICINITY OF THE PROJECT. THE SOUTH CENTRAL TECHNICAL SERVICE AREA MAKES NO REPRESENTATION OF THE EXISTENCE OR NON-EXISTENCE OF UTILITIES. THE ABSENCE OF UTILITIES ON DRAWINGS DOES NOT ASSURE THAT THERE ARE NO UTILITIES ON SITE.

A PRE-CONSTRUCTION CONFERENCE WITH THE OWNER, CONTRACTOR(S), SWCD REPRESENTATIVE, AND SOUTH CENTRAL TSA ENGINEER OR TECHNICIAN SHALL BE SCHEDULED ONE WEEK PRIOR TO START OF CONSTRUCTION. ANY WORK DONE BEFORE CONFERENCE WILL JEOPARDIZE PROJECT APPROVAL AND FUNDING.

MINNESOTA SPECIFICATIONS FOR CONSERVATION PRACTICES APPLY FOR ALL MATERIALS AND CONSTRUCTION WORK. THESE SPECIFICATIONS ARE PART OF THIS PLAN.

CHANGES IN THE DRAWINGS OR SPECIFICATIONS MUST BE AUTHORIZED BY THE OWNER AND THE RESPONSIBLE ENGINEER.

SITE PREPARATION:

MOW THE GRASS WITHIN THE PROPOSED PROJECT AREA PRIOR TO THE START OF EXCAVATION. COORDINATE WITH TECHNICIAN.

MNDOT STANDARD SPECIFICATIONS:

THE FOLLOWING SECTIONS OF THE MINNESOTA DEPARTMENT OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION" 2018 EDITION ARE REFERENCED IN THE PLANS:

SECTION	DESCRIPTION
3138	AGGREGATE FOR SURFACE AND BASE COURSES
3601	RIPRAP MATERIAL
3733	GEOTEXTILES
3876	SEED
3881	FERTILIZER
3885	ROLLED EROSION CONTROL PRODUCTS
3897	SEDIMENT CONTROL LOG

ESTIMATED QUANTITIES

ITEM	ITEM DESCRIPTION	QUAN.	UNIT	CONST. SPEC.	MATERIAL SPEC.	NOTES
1	MOBILIZATION	1	L.S.			
2	MOW VEGETATION IN WORK AREA	2	ACRES	MN-2		
3	EARTHWORK - WETLAND SCRAPE & FLATTEN DITCH SIDE SLOPES (See sheet 3 for details)	1500	C.Y.	MN-21 MN-23		(P) (CV)
4	FURNISH & INSTALL GEOTEXTILE FABRIC (TYPE 4) (See chart on this sheet)	325	S.Y.	SEE SHEET 3	3733	
5	FURNISH & INSTALL RIPRAP, MNDOT CLASS III (QUARTZITE) (See chart on this sheet)	154	TONS	SEE SHEET 3	3601	
6	FURNISH & INSTALL RIPRAP, MNDOT CLASS IV (QUARTZITE) (See chart on this sheet)	72	TONS	SEE SHEET 3	3601	
7	FURNISH & INSTALL 24" DIA. CORRUGATED METAL PIPE (ALUMINIZED STEEL TYPE 2) (See sheet 4 for details)	40	L.F.	MN-51	MS-551	
8	FURNISH & INSTALL 24" METAL APRON (ALUMINIZED STEEL TYPE 2) (See sheet 4 for details)	2	EACH	MN-51	MS-551	
9	FURNISH AND INSTALL CLASS 5 AGGREGATE (MNDOT 3138)	7	TONS		3138	
10	FERTILIZER, MNDOT TYPE 4 (NATURAL BASED) (18-1-8 ANALYSIS)	180	LBS	MN-6	3881	
11	SEEDING	1.5	ACRE	MN-6		
12	SEED MIX 34-262 (WET PRAIRIE)	10	LBS	MN-6	3876	
13	SEED MIX 35-641 (MESIC PRAIRIE SOUTHEAST)	8	LBS	MN-6	3876	
14	SEED MIX 25-131 (LOW MAINTENANCE TURF)	32	LBS	MN-6	3876	
15	MULCH MATERIAL, DISK-ANCHORED	3	TONS	MN-6		
16	EROSION CONTROL BLANKET, MNDOT CATEGORY 3N	625	S.Y.	MN-6	3885	
17	SEDIMENT CONTROL LOG, TYPE COMPOST	200	L.F.	MN-6	3897	

NOTES:

(P) PLAN QUANTITY FOR WHICH NO DIRECT MEASUREMENT SHALL BE MADE.
(CV) COMPACTED VOLUME

SUMMARY OF RIPRAP ESTIMATED QUANTITIES

ITEM DESCRIPTION	UNIT	RIPRAP OUTLET	CHECK DAM	TOTAL
FURNISH & INSTALL NON-WOVEN GEOTEXTILE FABRIC, MNDOT TYPE 4	SQ. YDS.	260	65	325
FURNISH & INSTALL RIPRAP, MNDOT CLASS III (QUARTZITE)	TONS	130	24	154
FURNISH & INSTALL RIPRAP, MNDOT CLASS IV (QUARTZITE)	TONS	60	12	72

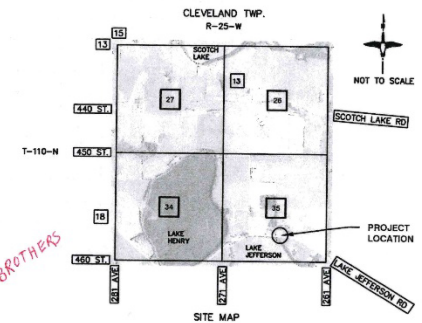
WETLAND ENHANCEMENT

PREPARED FOR

LEO KOPPELMAN

AND THE

**LE SUEUR COUNTY
SOIL & WATER
CONSERVATION DISTRICT**

**SHEET INDEX**

SHEET NO.	TITLE
1	COVER SHEET
2	PLAN VIEW SHEET
3	RIPRAP OUTLET DETAIL SHEET
4	RIPRAP CHECK DAM DETAIL SHEET
5	SEEDING PLAN

CONSTRUCTION CERTIFICATION STATEMENT

I HEREBY CERTIFY THAT A FINAL INSPECTION OF THIS PROJECT HAS BEEN PERFORMED AND THAT THE WORK COMPLETED IS IN ACCORDANCE WITH THE PLAN AND SPECIFICATIONS. ANY CHANGES TO THE PLANS AND SPECIFICATIONS ARE SO NOTED.

SIGNATURE: *Ryan T. Jones* DATE: *8/25/2020*

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINT NAME: RYAN T. JONES
SIGNATURE: *Ryan T. Jones*
DATE: *8/20/19* LICENSE # *44622*

SURVEY		DESIGN		GPS	
Surveyed	Date	Designed	Date	UNITS	U.S. SURVEY FEET
GPS, RTJ	11/6/2015	RTJ	6/19	COORDINATE SYSTEM	UTM 15 NORTH
Drawn	Date	Drawn	Date	DATUM	NAD1983 (CONUS)
GPS	11/12/2015	GPS	6/19	GEOD	GEOD12A (CONUS)
Checked	Date	Checked	Date		
		RTJ	8/8/19		

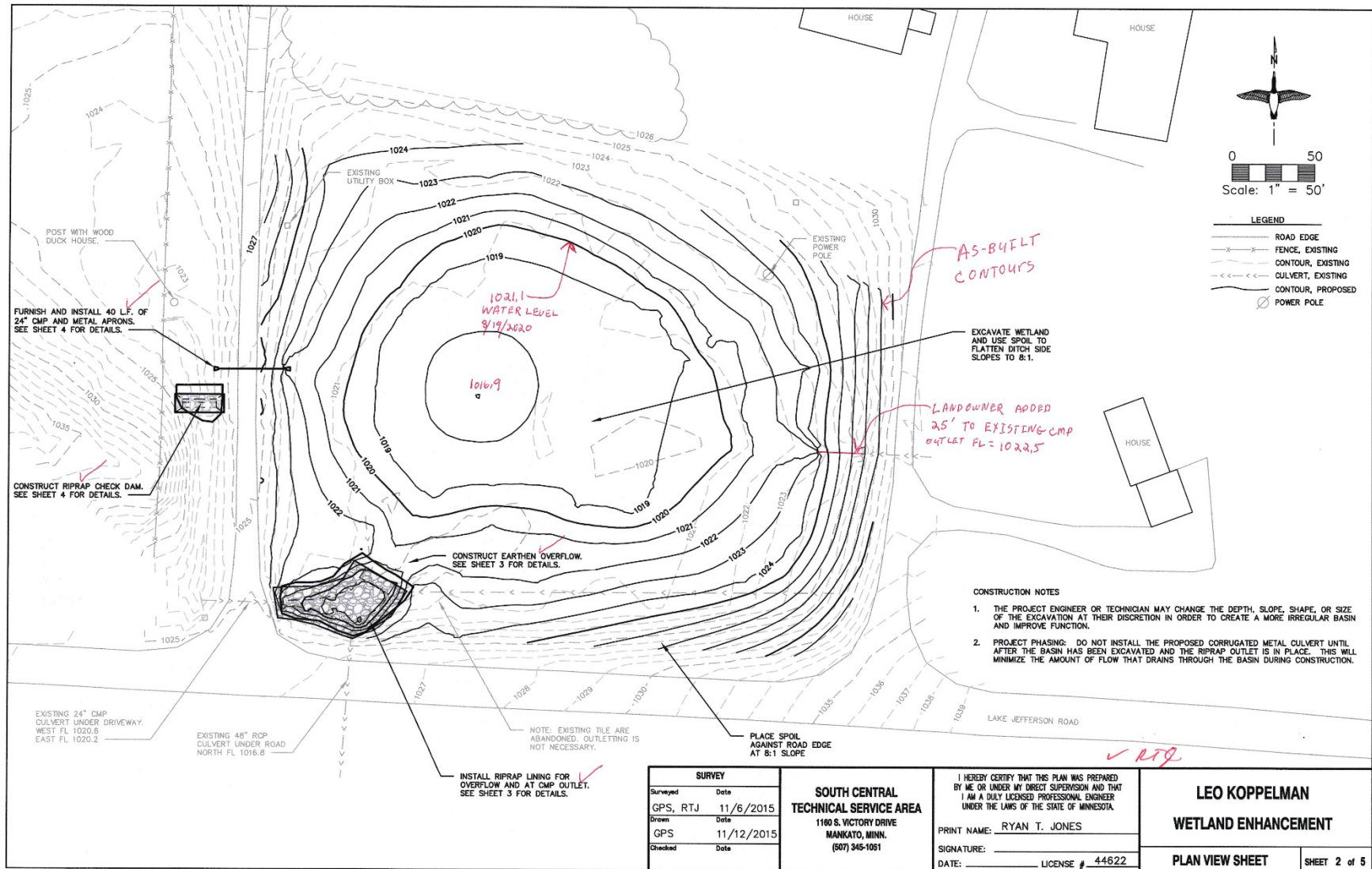
**SOUTH CENTRAL
TECHNICAL SERVICE AREA**
1160 S. VICTORY DRIVE
MANKATO, MINN.
(507) 345-1051

**LEO KOPPELMAN
WETLAND ENHANCEMENT**

COVER SHEET

Sec. 35	T. 110 N.	R. 25 W.
County: LE SUEUR		
Township: CLEVELAND		
Near: CLEVELAND		SHEET 1 of 5

Figure 15 Plan set Sheet 1 cover sheet



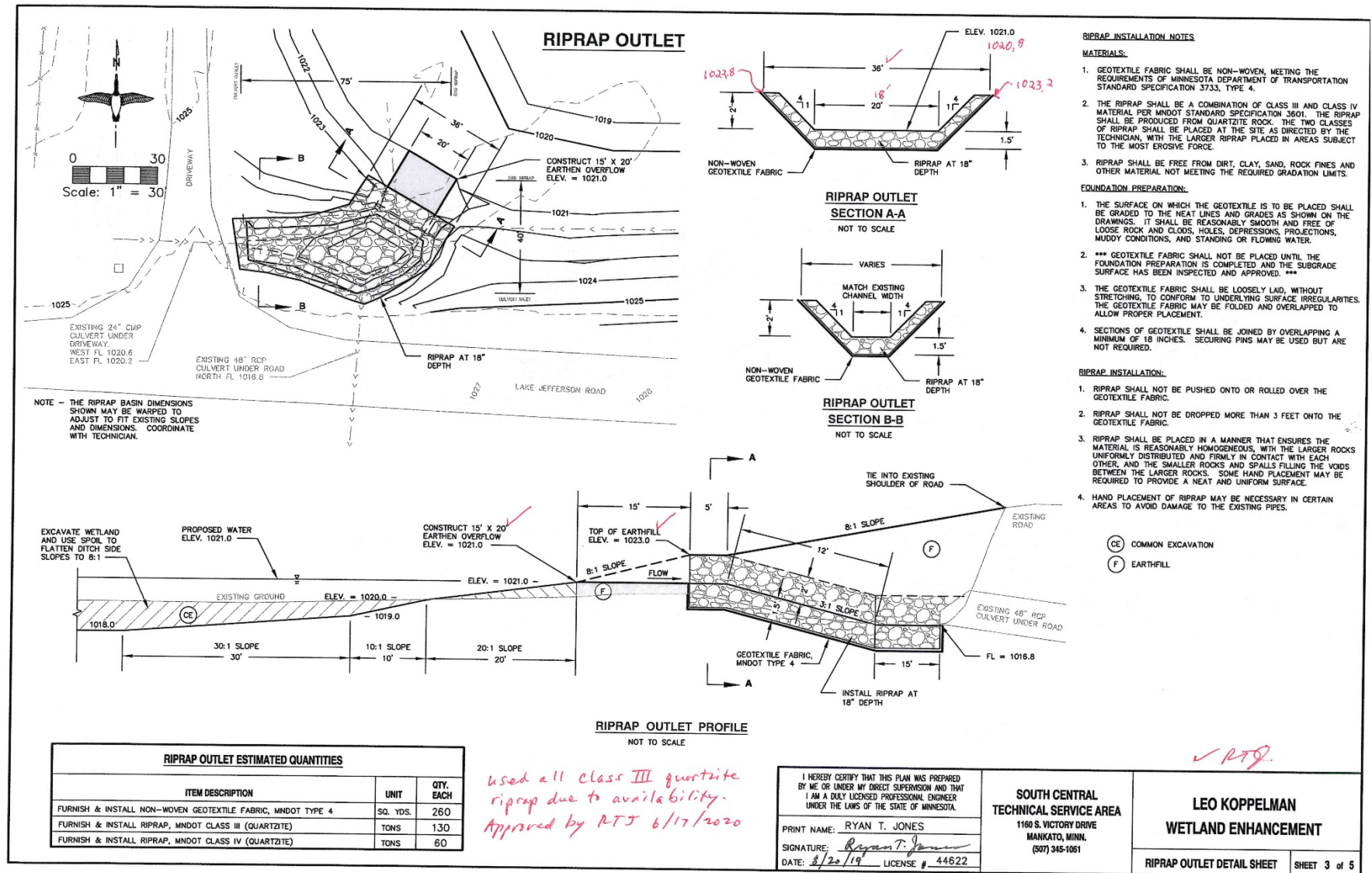


Figure 17 Plan set sheet 3 Rip rap outlet details

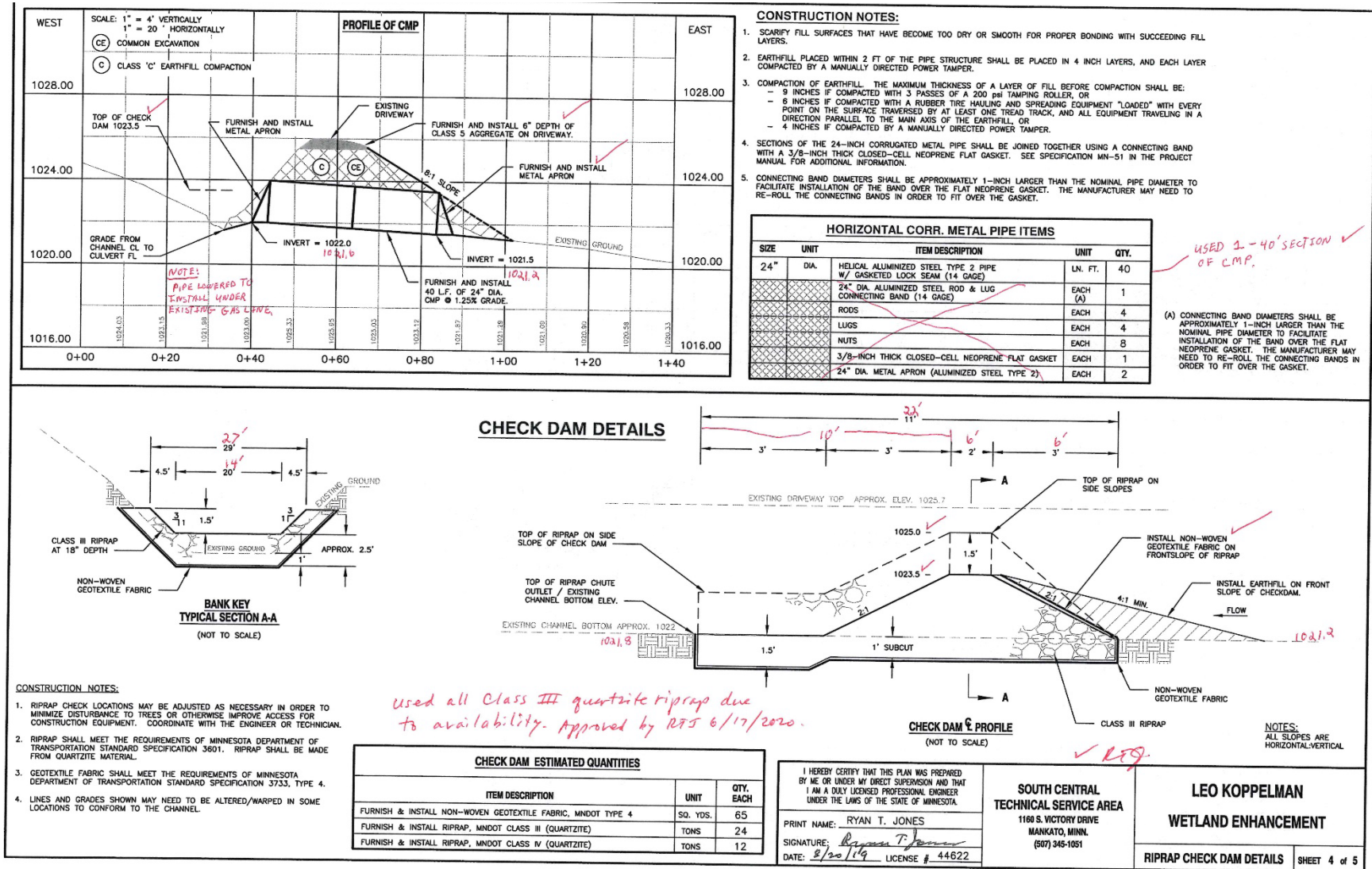


Figure 18 Plan set sheet 4 Riprap check dam details

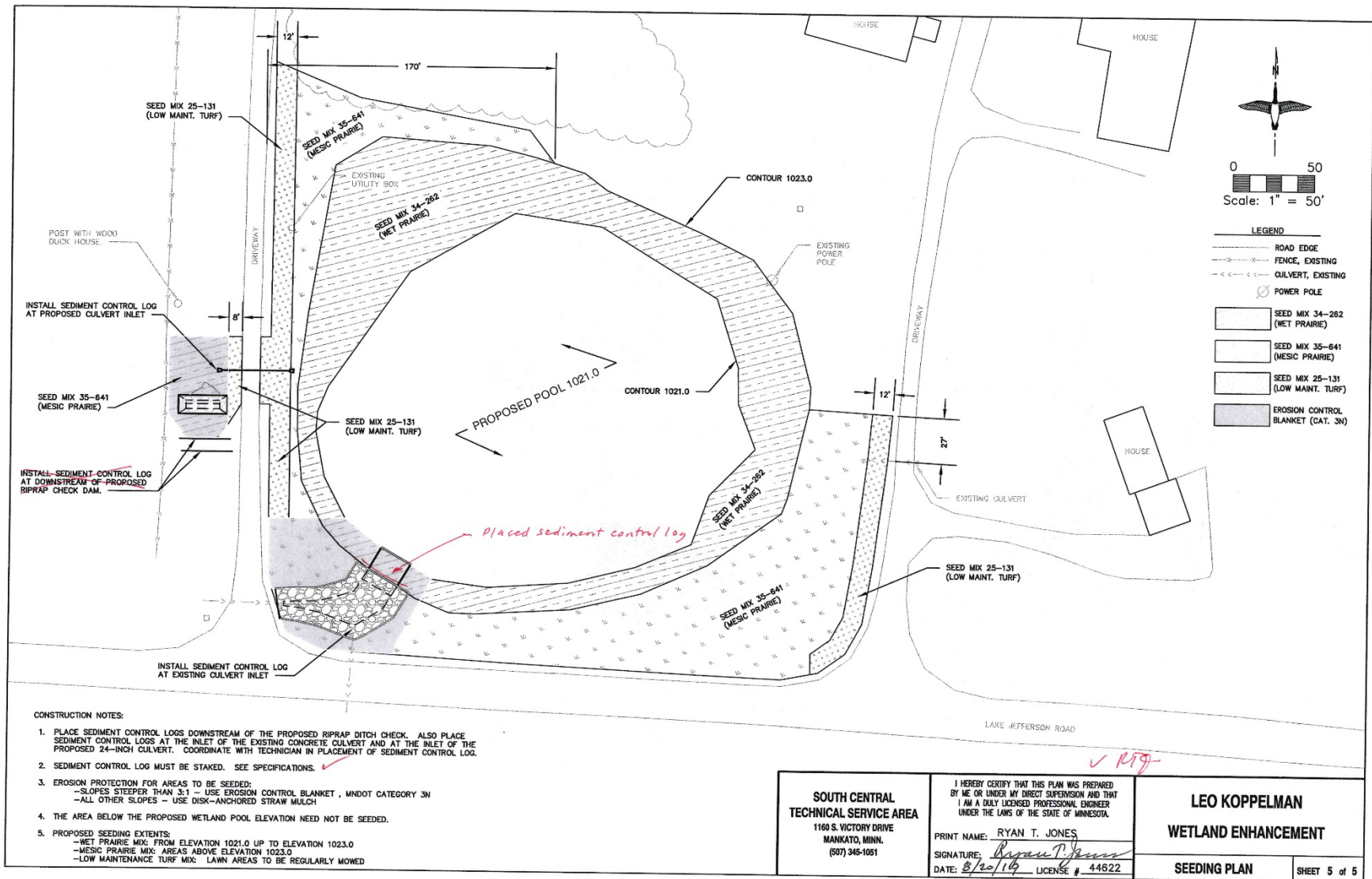


Figure 19 Plan set sheet 5 Seeding Plan. Seed mixes shown in figures 7 and 8.

34-262

Wet Prairie

Common Name	Scientific Name	Rate (kg/ha)	Rate (lb/ac)	% of Mix (% by wt)	Seeds/sq ft
big bluestem	<i>Andropogon gerardii</i>	1.12	1.00	6.89%	3.67
fringed brome	<i>Bromus ciliatus</i>	1.68	1.50	10.38%	6.08
bluejoint	<i>Calamagrostis canadensis</i>	0.04	0.04	0.27%	4.00
Virginia wild rye	<i>Elymus virginicus</i>	1.96	1.75	12.07%	2.70
tall manna grass	<i>Glyceria grandis</i>	0.17	0.15	1.02%	3.80
fowl manna grass	<i>Glyceria striata</i>	0.12	0.11	0.73%	3.50
switchgrass	<i>Panicum virgatum</i>	0.84	0.75	5.16%	3.85
fowl bluegrass	<i>Poa palustris</i>	0.22	0.20	1.39%	9.60
Indian grass	<i>Sorghastrum nutans</i>	0.56	0.50	3.44%	2.20
prairie cordgrass	<i>Spartina pectinata</i>	0.56	0.50	3.41%	1.20
	Total Grasses	7.29	6.50	44.76%	40.60
wooly sedge	<i>Carex pellita</i>	0.06	0.05	0.32%	0.47
tussock sedge	<i>Carex stricta</i>	0.02	0.02	0.17%	0.48
fox sedge	<i>Carex vulpinoidea</i>	0.11	0.10	0.66%	3.50
dark green bulrush	<i>Scirpus atrovirens</i>	0.11	0.10	0.72%	17.74
woolgrass	<i>Scirpus cyperinus</i>	0.03	0.03	0.18%	16.00
	Total Sedges and Rushes	0.34	0.30	2.05%	38.19
Canada anemone	<i>Anemone canadensis</i>	0.03	0.03	0.21%	0.09
marsh milkweed	<i>Asclepias incarnata</i>	0.09	0.08	0.55%	0.14
Canada tick trefoil	<i>Desmodium canadense</i>	0.56	0.50	3.41%	1.00
flat-topped aster	<i>Doellingeria umbellata</i>	0.06	0.05	0.34%	1.20
common boneset	<i>Eupatorium perfoliatum</i>	0.03	0.03	0.23%	2.00
grass-leaved goldenrod	<i>Euthamia graminifolia</i>	0.02	0.02	0.11%	2.00
spotted Joe pye weed	<i>Eutrochium maculatum</i>	0.04	0.04	0.30%	1.50
autumn sneezeweed	<i>Helenium autumnale</i>	0.06	0.05	0.35%	2.39
sawtooth sunflower	<i>Helianthus grosseserratus</i>	0.06	0.05	0.38%	0.30
great blazing star	<i>Liatris pycnostachya</i>	0.02	0.02	0.17%	0.10
great lobelia	<i>Lobelia siphilitica</i>	0.01	0.01	0.05%	1.40
blue monkey flower	<i>Mimulus ringens</i>	0.01	0.01	0.05%	6.40
Virginia mountain mint	<i>Pycnanthemum virginianum</i>	0.09	0.08	0.55%	6.50
red-stemmed aster	<i>Symphyotrichum puniceum</i>	0.09	0.08	0.56%	2.40
blue vervain	<i>Verbena hastata</i>	0.17	0.15	1.06%	5.25
bunched ironweed	<i>Vernonia fasciculata</i>	0.03	0.03	0.23%	0.30
Culver's root	<i>Veronicastrum virginicum</i>	0.02	0.02	0.14%	6.00
golden alexanders	<i>Zizia aurea</i>	0.28	0.25	1.76%	1.03
	Total Forbs	1.68	1.50	10.45%	40.00
Oats	<i>Avena sativa</i>	6.95	6.20	42.74%	2.76
	Total Cover Crop	6.95	6.20	42.74%	2.76
	Totals:	16.25	14.50	100.00%	121.55
Purpose:	Wet prairie reconstruction for wetland mitigation or ecological restoration.				
Planting Area:	Tallgrass Aspen Parklands, Prairie Parkland, and Eastern Broadleaf Forest Provinces. Mn/DOT Districts 2(west), 3B, 4, Metro, 6, 7 & 8.				

Figure 20 MN DOT 34-262 Wet Prairie seed mix. 10 pounds specified in project plans.

Mesic Prairie Southeast

35-641

Common Name	Scientific Name	Rate (kg/ha)	Rate (lb/ac)	% of Mix (% by wt)	Seeds/ sq ft
big bluestem	<i>Andropogon gerardii</i>	1.01	0.90	7.49%	3.30
side-oats grama	<i>Bouteloua curtipendula</i>	1.54	1.37	11.38%	3.01
nodding wild rye	<i>Elymus canadensis</i>	1.18	1.05	8.77%	2.01
slender wheatgrass	<i>Elymus trachycaulus</i>	1.01	0.90	7.50%	2.28
switchgrass	<i>Panicum virgatum</i>	0.24	0.21	1.78%	1.10
little bluestem	<i>Schizachyrium scoparium</i>	1.42	1.27	10.59%	7.00
Indian grass	<i>Sorghastrum nutans</i>	2.24	2.00	16.68%	8.82
	Total Grasses	8.63	7.70	64.19%	27.52
butterfly milkweed	<i>Asclepias tuberosa</i>	0.07	0.06	0.53%	0.10
whorled milkweed	<i>Asclepias verticillata</i>	0.01	0.01	0.10%	0.05
Canada milk vetch	<i>Astragalus canadensis</i>	0.18	0.16	1.33%	1.00
partridge pea	<i>Chamaecrista fasciculata</i>	0.67	0.60	5.00%	0.60
white prairie clover	<i>Dalea candida</i>	0.01	0.01	0.07%	0.06
purple prairie clover	<i>Dalea purpurea</i>	0.10	0.09	0.76%	0.50
Canada tick trefoil	<i>Desmodium canadense</i>	0.17	0.15	1.24%	0.30
ox-eye	<i>Heliopsis helianthoides</i>	0.06	0.05	0.43%	0.12
rough blazing star	<i>Liatris aspera</i>	0.03	0.03	0.21%	0.15
great blazing star	<i>Liatris pycnostachya</i>	0.03	0.03	0.29%	0.14
wild bergamot	<i>Monarda fistulosa</i>	0.01	0.01	0.06%	0.18
stiff goldenrod	<i>Oligoneuron rigidum</i>	0.02	0.02	0.17%	0.31
gray-headed coneflower	<i>Ratibida pinnata</i>	0.02	0.02	0.15%	0.20
black-eyed susan	<i>Rudbeckia hirta</i>	0.06	0.05	0.38%	1.54
heath aster	<i>Symphotrichum ericoides</i>	0.01	0.01	0.05%	0.40
smooth aster	<i>Symphotrichum laeve</i>	0.06	0.05	0.41%	1.00
bracted spiderwort	<i>Tradescantia bracteata</i>	0.04	0.04	0.34%	0.15
blue vervain	<i>Verbena hastata</i>	0.04	0.04	0.37%	1.50
hoary vervain	<i>Verbena stricta</i>	0.11	0.10	0.85%	1.05
golden alexanders	<i>Zizia aurea</i>	0.08	0.07	0.60%	0.29
	Total Forbs	1.79	1.60	13.34%	9.64
Oats	<i>Avena sativa</i>	3.03	2.70	22.47%	1.20
	Total Cover Crop	3.03	2.70	22.47%	1.20
	Totals:	13.45	12.00	100.00%	38.36
Purpose:	Regional mesic prairie reconstruction for wetland mitigation, ecological restoration, or conservation program plantings.				
Planting Area:	Eastern Broadleaf Forest Province excluding Hardwood Hills subsection. Mn/DOT Districts Metro & 6.				

Figure 21 MN DOT 35-641 Mesic Prairie Southeast seed mix. 8 pounds specified in project plans.

OPERATION AND MAINTENANCE PLAN

Leo Koppelman Wetland Enhancement Section 35 – Cleveland Township – Le Sueur County

Wetland enhancement projects are designed for a minimum life expectancy of 15 years. This can only be accomplished by proper maintenance. Listed below are recommended maintenance practices:

1. Remove accumulated debris and grass from the structure inlet at least once per year. The inlet controlling water elevation must be kept free of obstructions to function as designed. Higher than designed water levels create the potential structure failure.
2. Maintain a good grass cover on earth embankments and outlet structures. Do not allow trees to become established on these areas. Trees inhibit dense vegetative cover and weaken the structural integrity of the earthfill.
3. Monitor and control invasive species.
4. Check earth embankments after large storms and at least once a year for rodent damage, seepage, slope erosion, slope failure, spillway erosion, etc. Contact Le Sueur SWCD for assistance.

Figure 22 Operation and Maintenance Plan for wetland enhancement. Page 5 of 32 from Koppelman Project Manual – South Central Technical Service Area and Le Sueur Soil and Water Conservation District.

Le Sueur SWCD stokes conservation



Farmers implement practices to slow and filter runoff. Lake association members support phosphorus-reduction measures. In the Jefferson German chain of lakes watershed, Clean Water Funds spark cooperation.



LE CENTER — The most conspicuous of Le Sueur County Soil & Water Conservation District's (SWCD) water quality improvement projects within the Jefferson German watershed restored a 2.5-acre wetland at the edge of a hog farm directly across a county road from Middle Jefferson Lake.

"The water doesn't come off of our farm, but we get blamed for it because it runs across our property," said Leo Koppelman, who runs the feeder pig operation with his brother and son. "All I've heard is, 'Koppelman's hog farm is polluting the lake.'"

Middle Jefferson — one of five lakes in the chain that includes German, East Jefferson, West Jefferson and Swede's Bay — is impaired for aquatic recreation due to nutrient loading.

The SWCD's \$484,000 phosphorus reduction project aims to improve water quality in the chain with strategically placed best management practices that help to reduce nutrient loading. The chain lies within the Cannon River watershed, which drains into the Mississippi River.

"Whenever you have a landowner who wants to do something along

With his brother and son, Leo Koppelman runs a contract feeder pig operation. About 3,000 mixed-breed Hampshire-Duroc-Yorkshires are on the farm at any one time. He raised his first litter of pigs as a Cleveland High School Future Farmers of America project in 1955. The 100-acre farm site has been in Koppelman's family since 1862. Before they switched to hogs in the late 1960s, his father had raised mink for about 50 years. Koppelman talked about the operation and the farm's history with Mike Schultz, center photo. Photo Credits: Ann Wessel, BWSR



Contractors in summer 2020 excavated more of the wetland to increase flood storage, and installed a culvert connecting it to the upper watershed. Photo Credit: Le Sueur County SWCD

Figure 23 Page 1 of an article from the Board of Water and Soil Resources regarding this wetland project.

a major recreational lake, you want to be able to do that,” said Ryan Jones, the Mankato-based South Central Technical Service Area (TSA) engineer who worked on the wetland design.

The \$40,000 wetland project on Koppelman’s land now diverts water from a ravine and treats runoff from about 200 acres — most of it from neighboring fields fertilized with cow manure and hog manure — before it enters the lake.

The Cleveland Township site is one of 13 identified as high priorities within the 15,400-acre watershed, based on terrain analysis, the Total Maximum Daily Load (TMDL) study and onsite verification. It’s one of 10 that Mankato Water Resource Center monitoring had identified and prioritized years earlier.

A \$387,000 Clean Water Fund grant from the Minnesota Board of Water and Soil Resources (BWSR) made it possible for Le Sueur County SWCD staff to pursue projects with willing landowners. Matching funds include \$34,000 from Le Sueur County’s aggregate mining tax. Landowners’ share was tiered, based on projects’ priority.

“That’s what I’ve always wanted to do, but I’ve never had the resources to do it myself, or never felt that I wanted to do it for somebody else just to appease them,” said Koppelman, whose share of the project cost was 10%.

Over the years, the Koppelmans had taken steps to curb runoff.

In the 1970s when the county determined that

“ Our goal is to work with anyone and everyone around the chain of lakes that is interested in preserving the quality of the water. ”

— Ralph Redding,
Greater Jefferson German Lakes Association president



overflow caused by rain and snowmelt was polluting the lake, the Koppelmans built a lagoon and closed a couple of barns. Six years ago, Koppelman enrolled land in the federal Conservation Reserve Program (CRP) and replaced a 1960s-built gabion basket. Designed for erosion control, it no longer functioned properly.

Most recently, Environment and Natural Resources Trust Fund dollars made a bluff stabilization possible.

When he meets with lake association members, Le Sueur County SWCD Manager Mike Schultz stresses the need for cooperation — and money.

“I always tell these lake associations, ‘If you want to do something for the lake, you need money. Pancake feeds. Do something. If you can’t bring something to the table, how are we going to have the other half come to the table?’ ” Schultz said. “I feel like our role is bringing these two together and making sure that we understand that we’re moving forward together. Leo’s been a great example of how this works.”

The Greater Jefferson German Lakes Association contributed \$12,000 toward Jefferson German water quality improvements.

“Our goal is to work with anyone and everyone around the chain of lakes that is

interested in preserving the quality of the water,” said association President Ralph Redding. He’s one of about 130 shoreland property owners on Middle Jefferson Lake, and one of about 900 on the chain of lakes.

The 136-member association raised \$10,000 through a raffle and event at Beaver Dam Resort. To raise the rest, Redding asked area businesses to contribute items for an auction.

“What benefits are we going to obtain from the phosphorus runoff project?” Redding said. “The quality of the water should improve.”

The 21 best management practices completed by early December 2020 represent about 70% of the work planned in connection with the Clean Water Fund grant, which runs through December 2021. Practices tied to the grant include structures designed to slow and filter runoff, 275 acres of cover crops, and two wetland restorations totaling about 27 acres.

The Koppelman project alone is projected to reduce soil erosion by 161 tons a year, curb sediment loading by 69 tons a year and reduce phosphorus loading by slightly more than 79 pounds a year.

“If they’re all completed and function at their fullest, we will address 40% to

50% of the recommended phosphorus (reductions) from the WRAPS,” Schultz said, referring to the Minnesota Pollution Control Agency’s (MPCA) Watershed Restoration and Protection Strategy.

Phosphorus feeds the algae that can turn lakes green.

Nutrient impairments are just one factor affecting the watershed. Schultz said the SWCD also is dealing with higher-than-average lake levels and flooding caused in part by increasingly frequent heavy rains.

The Jefferson chain of lakes’ water level in 2019 was 1.63 feet higher than the historical average, which dates to 1971. (Technically, German Lake levels are recorded separately. Because German Lake is connected to the chain, its levels vary only slightly.)

Todd Piepho, the Minnesota Department of Natural Resources’ (DNR) Waterville-based area hydrologist, said 2019 water levels remained high nearly all season. Coupled with high winds, sustained high-water levels can cause significant shoreline damage.

A 6-inch rain put Koppelman’s wetland restoration to the test shortly after construction finished in summer 2020.

“Everything worked exactly the way it was supposed to work. It took all the water that would run down the ditch and (across) our driveways. It stopped everything. It backed that excess water up in the wetland area,” Koppelman said.

Figure 24 Page 2 of an article from the Board of Water and Soil Resources regarding this wetland project.

Table 3 Vegetation observed during the project meander survey, 09/13/2021 10:45 to 11:15 AM.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Andropogon gerardi</i>	Big Bluestem	1-5%	Yes	Native
<i>Avena sativa</i>	Oats	5-25%	Yes	Nonnative
<i>Bromus ciliates</i>	Fringed Brome	1-5%	Yes	Native
<i>Calamagrostis canadensis</i>	Canada bluejoint	1-5%	Yes	Native
<i>Echinochloa crus-galli</i>	Barnyard Grass	5-25%	No	nonnative
<i>Elymus Canadensis</i>	Canada Wild Rye	5-25%	Yes	Native
<i>Elymus trachycaulus</i>	Slender Wheatgrass	5-25%	Yes	Native
<i>Glyceria grandis</i>	Tall Manna Grass	5-25%	Yes	Native
<i>Glyceria striata</i>	Fowl Manna Grass	5-25%	Yes	Native
<i>Panicum capillare</i>	Witchgrass	1-5%	No	Native
<i>Panicum virgatum</i>	Switchgrass	5-25%	Yes	Native
<i>Phalaris arundinacea</i>	Reed canary grass	25-50%	No	Invasive
<i>Schizachyrium scoparium</i>	little bluestem	5-25%	Yes	Native
<i>Setaria pumila</i>	yellow foxtail	5-25%	No	Nonnative
<i>Sorghastrum nutans</i>	Indian Grass	5-25%	Yes	Native
<i>Spartina pectinata</i>	Prairie cordgrass	1-5%	Yes	Native
<i>Carex pellita</i>	Wooly sedge	1-5%	Yes	Native
<i>Carex vulpinoidea</i>	Fox sedge	1-5%	Yes	Native
<i>Scirpus atrovirens</i>	Dark green bulrush	5-25%	Yes	Native
<i>Scirpus cyperinus</i>	Woolgrass	1-5%		
<i>Acalypha rhomboidea</i>	Three Seed Mercury	5-25%	No	Native
<i>Abutilon theophrasti</i>	Velvet leaf	1-5%	No	Invasive
<i>Ambrosia artemisiifolia</i>	Common Ragweed	1-5%	No	Native
<i>Ambrosia trifida</i>	Giant Ragweed	1-5%	No	Native
<i>Asclepias syriaca</i>	Common milkweed	1-5%	No	Native
<i>Asclepias incarnata</i>	Marsh milkweed	5-25%	Yes	Native
<i>Asclepias verticillata</i>	Whorled milkweed	1-5%	Yes	Native
<i>Bidens vulgata</i>	Common Beggarticks	5-25%	No	Native
<i>Brassica rapa</i>	Field Mustard	1-5%	No	Nonnative
<i>Chamaecrista fasciculata</i>	Partridge Pea	1-5%	Yes	Native
<i>Chenopodium album</i>	Lamb's Quarters	1-5%	No	Nonnative
<i>Cirsium arvense</i>	Canada Thistle	1-5%	No	Invasive
<i>Conyza canadensis</i>	Horseweed	1-5%	No	Native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Dalea purpurea</i>	Purple Prairie Clover	1-5%	Yes	Native
<i>Desmodium canadense</i>	Canada Tick Trefoil	5-25%	Yes	Native
<i>Doellingeria umbellata</i>	Flat-topped aster	1-5%	Yes	Native
<i>Eupatorium perfoliatum</i>	Common boneset	5-25%	Yes	Native
<i>Eutrochium maculatum</i>	Spotted Joe-pye weed	1-5%	Yes	Native
<i>Helenium autumnale</i>	Sneezeweed	5-25%	Yes	Native
<i>Helianthus grosseserratus</i>	Sawtooth Sunflower	1-5%	Yes	Native
<i>Heliopsis helianthoides</i>	Ox-eye	5-25%	Yes	Native
<i>Lemna spp.</i>	Duckweek	25-50%	No	Native
<i>Lobelia siphilitica</i>	Blue lobelia	1-5%	Yes	Native
<i>Melilotus officinalis</i>	Yellow Clover	1-5%	No	Invasive
<i>Monarda fistulosa</i>	Wild Bergamot	5-25%	Yes	Native
<i>Oligoneuron rigidum</i>	Stiff Goldenrod	5-25%	Yes	Native
<i>Persicaria lapathifolia</i>	Nodding Smartweed	5-25%	No	Native
<i>Pycnanthemum virginianum</i>	Mountain mint	1-5%	Yes	Native
<i>Solidago canadensis</i>	Canada goldenrod	5-25%	No	Native
<i>Ratibida pinnata</i>	Gray-headed Coneflower	1-5%	Yes	Native
<i>Rumex crispus</i>	Curly Dock	5-25%	No	Nonnative
<i>Urtica dioica</i>	Stinging nettle	1-5%	No	Native
<i>Verbena hastata</i>	Blue vervain	5-25%	Yes	Native
<i>Vernonia fasciculata</i>	Ironweed	1-5%	Yes	Native
<i>Veronicastrum virginicum</i>	Culver's Root	1-5%	Yes	Native

Site Photographs



Photo 12 Looking north where new culvert crosses under driveway in center left of photo. This new culvert connects runoff from the upper watershed to the wetland basin on the right.



Photo 13 Looking east across the southern half of the wetland basin from that same perspective as photo 1 above.



Photo 14 Culvert outlet into west side of wetland basin. Seeded and ruderal vegetation is well established from the outlet to the wetland pond.



Photo 15 Riprap outlet at southwest corner of wetland basin leading to road culvert. Standing water with duckweed in culvert is the result of recent rains prior to site visit. Plan detail shown figure 4



Photo 16 Seed Manna Grasses (*Glyceria* spp) are the dominate cover in some sections near the waters edge.



Photo 17 Looking west across the wetland basin.

20 Blue Lake Shoreline Enhancement (Stanford Boat Launch)

Project Background

Project Name: Blue Lake Priority Action Plan – Isanti County SWCD

Project Site: Blue Lake shoreline 1. Stanford boat launch

Township/Range Section: Township 34N Range 25W Section 6

Project Manager / Affiliated Organization: Isanti SWCD

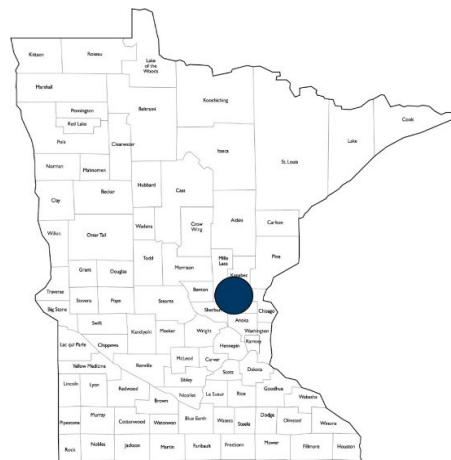
Fund: CWF **Fiscal Year Funds:** 2018

Project Start Date: 2018

Predominant Habitat type: Aquatic Habitat

Additional Habitat types:

Project Status: Establishment Phase



County: Isanti

Primary Activity: Lake Shore Enhancement

Project Size: 160 liner Feet

Project Completed: Fall 2018

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

This project is located at the Stanford Township boat access on Blue Lake in Isanti County. The completed project includes a rain garden, a shoreline restoration with native plants and a hillside and gully stabilization.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Design set *Blue Lake Best Management Practices* – HR Green 2017, Project profile *Stanford Township Boat Access Restoration* – Isanti SWCD, Operation and Maintenance Guidelines for Lakeshore Stabilization - Isanti SWCD, Quote for 2018-2020 Vegetation Management of Rain Garden and Shoreline Planting at Blue Lake – Minnesota Native Landscapes

3. What are the stated goals of the project?

From Isanti SWCD project profile: “The goal of this project is to protect and improve the water health of Blue Lake by filtering stormwater runoff, reducing shoreland and hillside erosion. The project also creates important wildlife habitat.”

4. What are the desired outcomes of achieving the stated goals of the project?

Improved water quality and aquatic habitat in Blue Lake.

5. **Were measures of restoration success identified in plans?** No

If yes, list specific measurements.

NA

6. **Are plan Sets available? Yes Have project maps been created?** No

7. **Provide list of best management practices, standards, guidelines identified in plan set?**

Practices include stabilization of shoreline toe with biologs integrated with a vegetated buffer of site appropriate native plants. Guidance also includes Operations and Maintenance Guidelines from Isanti SWCD.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. **Were alterations made to the plan during project implementation?**

No

9. **In what ways did alterations change the proposed project outcome?**

NA

Site Assessment

Field Review Date: 9/24/2021

Field Visit Attendees: John Hiebert, Wade Johnson – MN35NDNR, Todd Kulaf – Isanti SWCD

10. Surrounding Landscape Characteristics:

The site is bordered by rural residential development. The parking lot for the Stanford Township boat launch is at the top of a

11. Site Characteristics:

a. Soil Series:

Sanburn fine sandy loam, 7 to 18 percent slopes

b. Topography:

West facing ~20% slope to lake. A boulder wall at the toe of the slope, installed as part of this project, drops to a 5% sloped bench for 10 to 15 feet to the shoreline.

c. Hydrology:

Receives surface runoff from roads and ditch system.

d. Vegetation: Plant Communities, Dominant Species & Invasive % Cover:

Rain garden along parking lot planted with native perennials. Mowed turf under mature Oak trees on slope to the lakeshore. Shoreline buffer dominated by planted native perennials. Reed Canary Grass present in 15% of shoreline buffer.

12. Is the plan based on current science? Yes

Project managers looked at the entire scope of the problem on site (erosion, runoff, nutrient in-flow) and attempted to address them with current science based practices. A rain-garden was installed at the top of the steep slope to the lake to catch runoff from the public access before it reached the lake. The

hillside was re-sloped and stabilized to reduce erosion and the shoreline toe of the slope was stabilized with bio-logs and a strip of native vegetation.

13. List indicators of project goals at this stage of project:

The rain garden is installed and vegetated. The hillside has been re-sloped and vegetated. Biologs installed at the toe of the shoreline are well installed and stable. Erosion has been addressed and vegetation has been established above the shoreline stabilization site. The goal of creating important wildlife habitat is a question. While it is better to have a 6' strip of native vegetation versus none at all, the amount of important wildlife habitat created is minimal.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, the water quality goals can reasonably be achieved, which is the focus of this project. Project managers have addressed the hillside runoff issues and shoreline erosion. The creation of wildlife habitat, which is not a primary focus of the project, is limited by the narrowness of the shoreline buffer.

15. Are corrections or modifications needed to achieving proposed goals?

The rain garden is installed but has issues with the edging around it, that are acting as a dam/barrier to water entering the rain garden in certain key sections. This should be addressed by notching the edging to allow water flow or removing it all together. The hillside has been stabilized but lacks native, deep rooted vegetation. It would help the quality of the project and long-term stability of the site to plant the hillside with native grasses, forbs, shrubs or trees. The buffer contained native plants but needed some weeding/invasive control. There was also an issue with mower creep from the grass strip above the restoration, mowing down and shrinking the restoration and putting mowing clippings into the restoration. I understand the focus of this is water quality and they want a walking path along this area, but maybe a smaller wood chipped path to stop mowing and an expansion of the buffer with edging would improve the habitat of this site. The biologs looked well installed and already have vegetation growing into them and the shoreline to provide long-term stability.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

The main long-term management I could see was for the buffer and the steps outlined and the management of the site by a private vendor looked acceptable.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

The narrowness of the shoreline buffer with the rocks at the base of slope and the wide mowed grass strip above it can lead to impacts on the buffer from mowing and foot traffic

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Yes, to assess whether the rain garden edging and lawn mowing infringement on the buffer planting has been addressed.

19. Additional comments on the restoration project.

The rain garden edging should be modified to ensure it functions properly to allow unobstructed flow into the garden. Additionally, project managers should discuss potential buffer planting impacts with the Townships lawn mower and potentially create some type of edging or barrier to prevent mowing encroachment on the shoreline buffer plantings.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. *The project has:*

Achieved the stated goals.

21. *The project will:*

Meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. *Provide explanation of reason(s) for determination.*

The water quality goals of the project should be achieved. The slope and the shoreline show no signs of erosion since the project was completed. The shoreline buffer could potentially be expanded by planting native vegetation on the slope to ensure the best chance to meet its intended water quality and habitat goals.

23. *Site Assessor(s) conducting field review:* John Hiebert – MNDNR – Lake Habitat Consultant

Site Maps, Project Plans or Vegetation Tables

Blue Lake- Stanford Township Boat Access Restoration

This project is located at the Stanford Township boat access on Blue Lake in Isanti County. The completed project includes a raingarden, a shoreline restoration with native plants and a hillside and gully stabilization. Funds to install the projects came from a grant obtained from the Clean Water Land and Legacy Act.

Stanford Township contributed 25% of the total project cost to make this water quality project possible. The goal of the project is to protect and improve the water health of Blue Lake by filtering stormwater runoff and reducing shoreland and hillside erosion. The project also creates important wildlife habitat.

Stanford Township in among several other townships in Isanti County that have dedicated efforts towards protecting and improving water health in the area. This project would not be possible without their partnership.



Project Details

Target Water: Blue Lake
Date Installed: Fall 2018

Project Partners

Isanti SWCD
Stanford Township
BLID

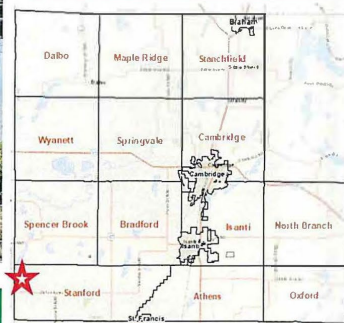
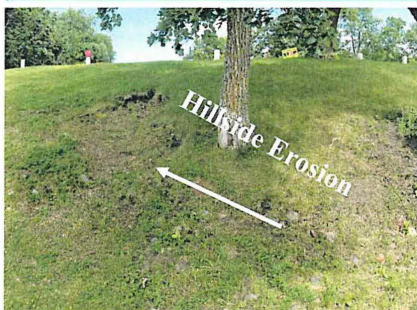
Project Funding

Clean Water Fund: \$41,123
Stanford Township: \$13,707
Total Project Cost: \$54,830

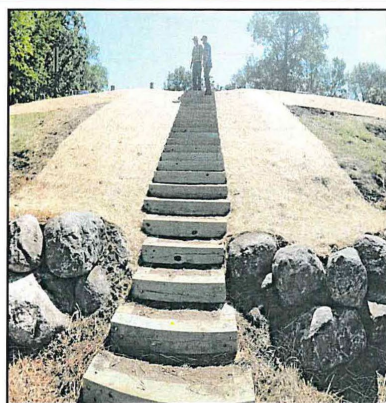
Pollution Reduction

Phosphorus: 6.32 pounds/yr
Sediment: 13,352 pounds/yr

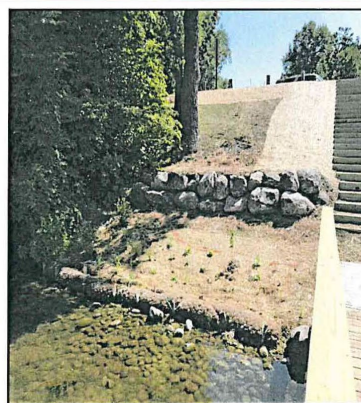
Before Installation-2017



After Installation-2018



Hillside Stabilization



Shoreline Restoration



Rain Garden

Isanti Soil and Water Conservation District
110 Buchanan St. North
Cambridge, MN 55008
763-689-3271
www.IsantiSWCD.org



Figure 0-1. Project profile from Isanti SWCD, page 1.

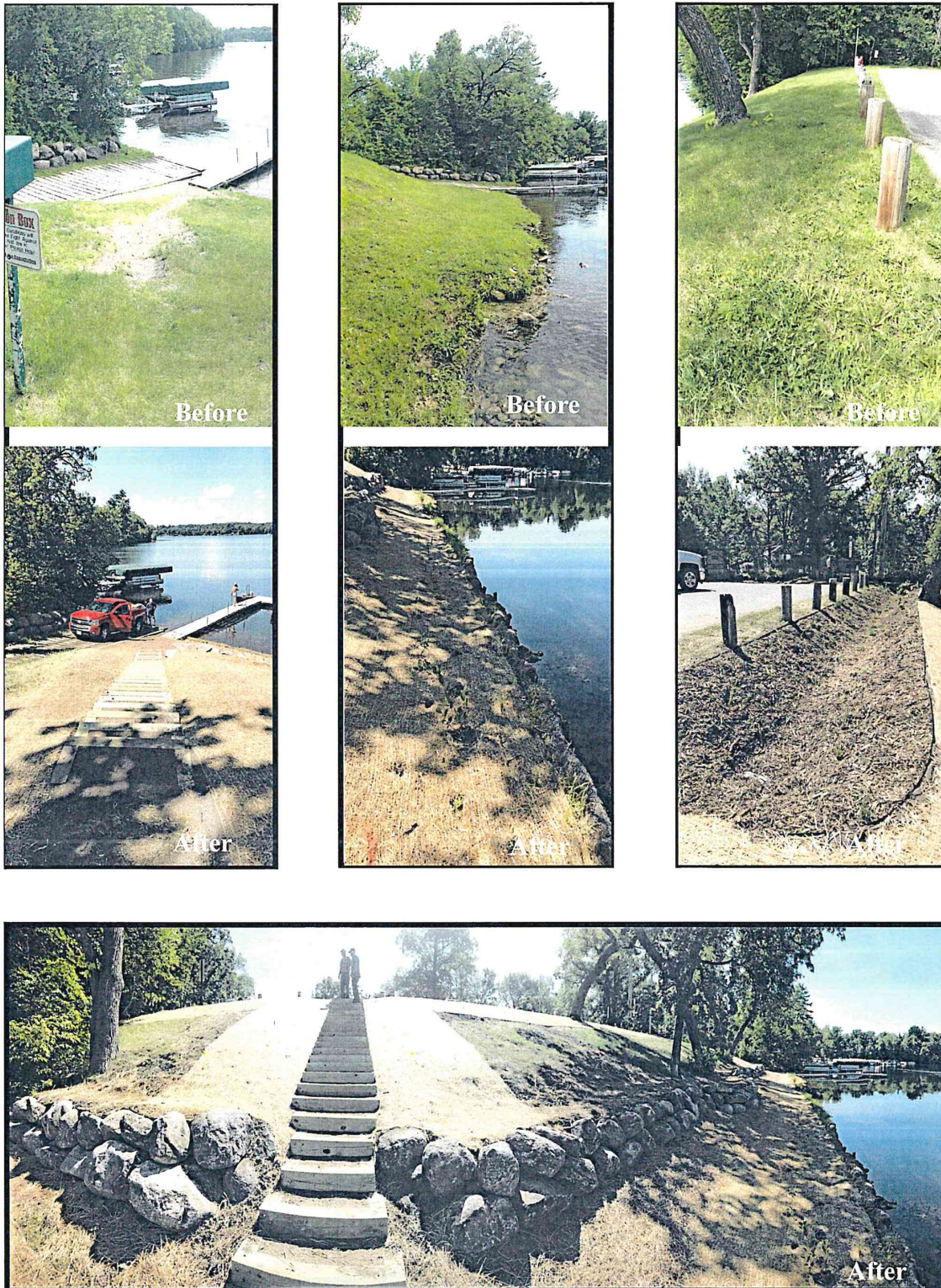


Figure 2. Project profile, Isanti SWCD, page 2. Photos of the project site before and immediately after the project.

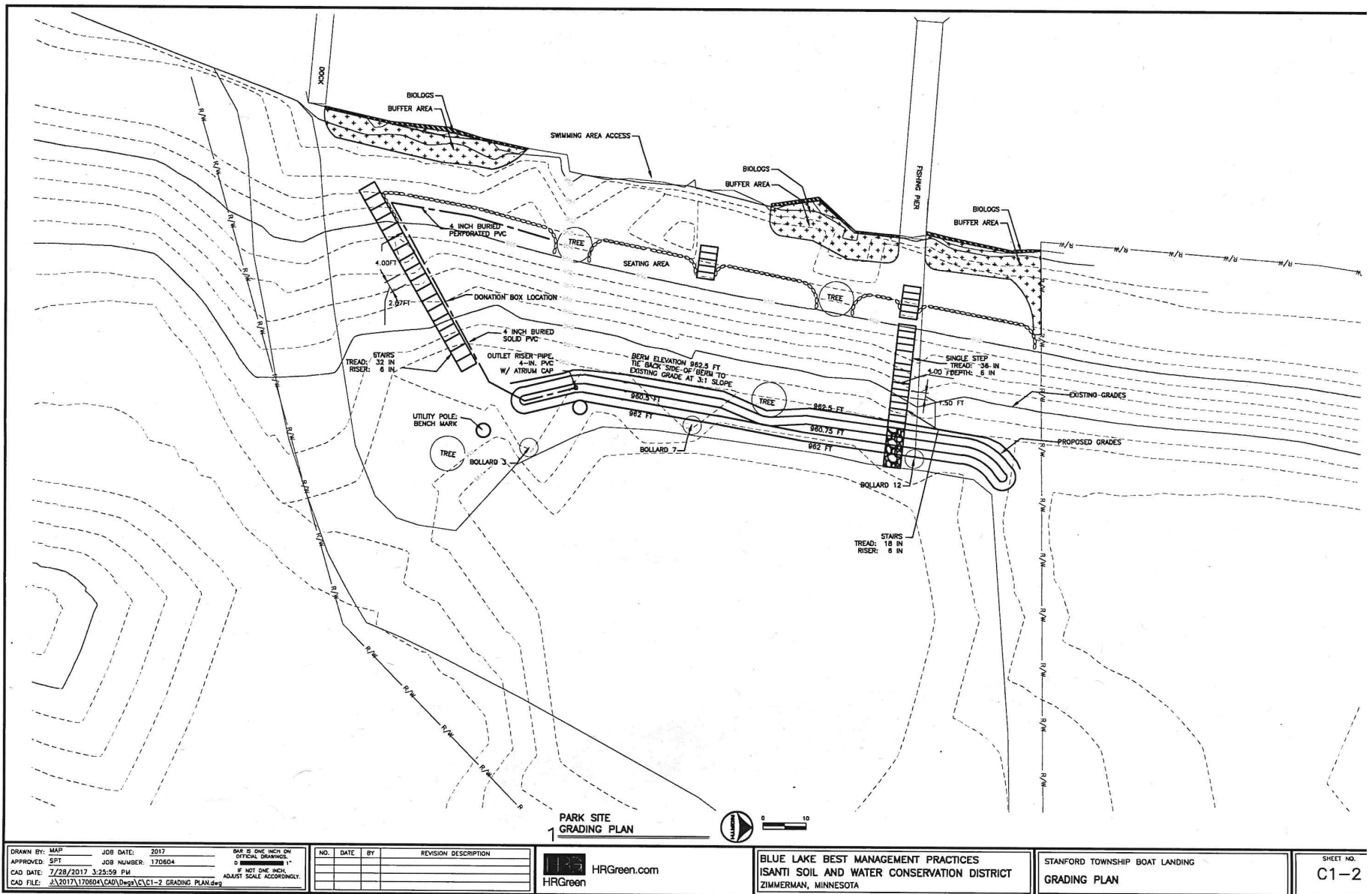


Figure 3 Grading plan showing location of raingarden, slope and shoreline planting area.

PARK SITE			
Raingarden			
Plan Set ID	Common Name	QTY	Size
<i>Shrubs</i>			
A	Black Chokeberry	4	6-in
B	New Jersey Tea	13	6-in
C	Northern Bush Honeysuckle	15	6-in
D	Prairie Rose	22	6-in
<i>Grasses and Sedges</i>			
E	Fox Sedge	20	Plug
F	Little Bluestem	17	6-in
G	Prairie Dropseed	64	Plug
<i>Forbs</i>			
H	Black-eyed Susans	16	Plug
I	Culvers Root	44	Plug
J	Prairie Blazing Star	15	Plug
Buffer			
Plan Set ID	Common Name	QTY	Size
<i>Shrubs</i>			
A	Black Chokeberry	3	6-in
K	Highbush Cranberry	1	6-in
L	Winterberry (2 female, one male)	3	6-in
<i>Grasses and Sedges</i>			
M	Bluejoint Grass	26	Plug
E	Fox Sedge	15	Plug
N	Lake Sedge	15	Plug
O	Wool Grass	15	Plug
<i>Forbs</i>			
P	Blue Flag Iris	15	Plug
Q	Broad-leaved Arrowhead	15	Plug
R	Cardinal Flower	26	Plug
S	Marsh Milkweed	26	Plug
T	Marsh Blazingstar	26	Plug
U	Turtlehead	26	Plug
<i>Seed</i>			
Buffer	BWSR W7 (Wetland Fringe/Shoreland Buffer	0.25-lb	

Figure 5 Plan set table of potted plants, plugs and seed mix used in raingarden and shoreline buffer.



SHOOTING STAR

NATIVE SEEDS

20740 County Road 33 • Spring Grove, MN 55974
(507) 498-3944 Phone • (507) 498-3953 Fax • www.ssns.co

Description: Mixture W7 (DNR NE MN - Wetland Fringe, Shore-land Buffer)

Seeding Rate: 10 Lbs/Acre (175.1 Seeds/Square Foot)

Common Name	Scientific Name	% of Mix	Seeds/Ft	Rate/Acre
Grasses				
Fringed Brome	<i>Bromus ciliatus</i>	21.00%	7.7	2.10 PLS Lbs
Blue Joint Grass	<i>Calamagrostis canadensis</i>	2.00%	20.6	0.20 PLS Lbs
Canada Wild Rye	<i>Elymus canadensis</i>	16.00%	3.1	1.60 PLS Lbs
Virginia Wild Rye	<i>Elymus virginicus</i>	16.00%	2.5	1.60 PLS Lbs
Rattlesnake Grass	<i>Glyceria canadensis</i>	2.00%	5.4	0.20 PLS Lbs
Annual Rye	<i>Lolium italicum</i>	16.00%	8.8	1.60 PLS Lbs
Fowl Bluegrass	<i>Poa palustris</i>	6.50%	31.0	0.65 PLS Lbs
Woolgrass	<i>Scirpus cyperinus</i>	0.50%	31.2	0.05 PLS Lbs
Wildflowers				
Canada Anemone	<i>Anemone canadensis</i>	2.50%	0.7	0.25 PLS Lbs
Swamp Milkweed	<i>Asclepias incarnata</i>	3.00%	0.5	0.30 PLS Lbs
Panicled Aster	<i>Aster simplex</i>	1.20%	6.9	0.12 PLS Lbs
Flat-topped Aster	<i>Aster umbellatus</i>	2.00%	4.9	0.20 PLS Lbs
Joe Pye Weed	<i>Eupatorium maculatum</i>	2.00%	7.0	0.20 PLS Lbs
Boneset	<i>Eupatorium perfoliatum</i>	2.00%	11.8	0.20 PLS Lbs
Grass-leaved Goldenrod	<i>Solidago graminifolia</i>	0.50%	6.4	0.05 PLS Lbs
Northern Blue Flag Iris	<i>Iris versicolor</i>	4.00%	0.2	0.40 PLS Lbs
Monkey Flower	<i>Mimulus ringens</i>	0.30%	25.3	0.03 PLS Lbs
Obedient Plant	<i>Physostegia virginiana</i>	2.50%	1.0	0.25 PLS Lbs

Request a price quote for this mix by contacting info@ssns.co or (507) 498-3944. Substitutions may be necessary based on availability at the time of order.

Figure 6 Shore-land buffer seed mix used in the shoreline planting area.



To: Todd Kulaf - Isanti Soil and Water Conservation District
Date: December 7, 2018

**Quote for 2018-2020 Vegetation Management of the Rain Garden and Shoreline
Planting at Blue Lake
Zimmerman, MN**

Recommended Services:

Weed Control Visits: During the growing season comprehensive weed control visits will occur to control weedy and undesirable vegetation. MNL estimates that four visits will be needed in 2018-2020. A variety of management techniques will be used, including but not limited to; spot weed whipping, hand weeding, and herbicide applications.

Enhancements: During 2019 and 2020 the addition of seed or plants may be needed to supplement/enhance certain areas of the rain garden or shoreline area. This could be done as requested by the owner or as deemed necessary by MNL.

Additional Services: Other services outside the normal scope of work for the rain garden/shoreline can be done at an hourly rate of \$100/hour plus materials (if applicable). These services can include but not be limited to: watering, herbicide treatments outside of the rain garden/shoreline area, mowing or weed whipping outside of the typical treatment area or additional seeding or planting, etc. Minimum of a two hour visit plus \$100 mobilization.

Blue Lake Raingarden/Shoreline Maintenance 2018-2020

Figure 7 Quote for vegetation management services that were utilized for the Stanford boat launch site.

Operation and Maintenance Guidelines for Lakeshore Stabilization

Lakeshore restorations and stabilizations prevent shoreline erosion, filter storm runoff and provide near-shore habitat. This document describes important tasks that should occur on a regular basis to ensure the project's success. Neglected maintenance leads to more severe problems that are more difficult to correct.

Periodic spot checks will be conducted on your site by a soil conservation technician to ensure the project is maintained as in the original plan.

Task	Frequency			Equipment Needed
	Year 1	Year 2	Year 3+	
<u>Watering</u> Ensure 1" of water per week, either through rainfall or irrigation.	Weekly	During drought stress		Water supply; hose and sprinkler, or soaker hose
<u>Weeding</u> All vegetation that was not planted as part of the project should be removed.	Every 2-3 weeks	Monthly	2-4 times per year as needed.	
<u>Replace Vegetation</u> Replant similar species, preferably native species of local ecotype, in the event that original vegetation expires.	If needed.			Trowel, plants
<u>Refresh Mulch</u> Maintain 2-3" of mulch covering over planted areas, with priority on areas without dense plant cover.	Approximately every 3 rd year.			Rake, mulch
<u>Re-secure erosion control materials</u> In the event that erosion control blankets, biologs or other materials become unsecured, they should be re-secured with staking or burying similar to the original installation.	If needed.			
<u>Erosion</u> In the event that the lakeshore of other areas experience erosion, Contact the Isanti SWCD for guidance.	If needed.			Variable
<u>Correct Ice Damage</u> Contact the Isanti SWCD for guidance. Ice damage may be corrected on a case by case basis, and in some instances left as-is. Possible actions include re-grading, moving plant stock back into place, and other measures. Moving rock back into place at the waterline is common.	If needed.			Variable

Figure 8 Operation and maintenance guidance for the project property owner.

Table 4 List of planted species in shoreline buffer.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Calamagrostis canadensis</i>	Canada bluejoint	1-5%	Yes	Native
<i>Bromus ciliates</i>	Fringed Brome	1-5%	Yes	Native
<i>Elymus Canadensis</i>	Canada Wild Rye	1-5%	Yes	Native
<i>Elymus Virginicus</i>	Virginia Wild Rye	1-5%	Yes	Native
<i>Phalaris arundinacea</i>	Reed canary grass	5-25%	No	Invasive
<i>Setaria pumila</i>	yellow foxtail	1-5%	No	Nonnative
<i>Carex lacustris</i>	Lake sedge	5-25%	Yes	Native
<i>Carex vulpinoidea</i>	Fox sedge	1-5%	Yes	Native
<i>Scirpus atrovirens</i>	Dark green bulrush	5-25%	Yes	Native
<i>Scirpus cyperinus</i>	Woolgrass	1-5%	Yes	Native
<i>Ambrosia artemisiifolia</i>	Common Ragweed	1-5%	No	Native
<i>Amphicarpaea bracteata</i>	Hog Peanut	5-25%	No	Native
<i>Asclepias incarnata</i>	Marsh milkweed	5-25%	Yes	Native
<i>Bidens vulgata</i>	Common beggarticks	5-25%	No	Native
<i>Chelone glabra</i>	Turtlehead	1-5%	Yes	Native
<i>Doellingeria umbellata</i>	Flat-topped aster	1-5%	Yes	Native
<i>Eupatorium perfoliatum</i>	Common boneset	1-5%	Yes	Native
<i>Eutrochium maculatum</i>	Spotted Joe-pye weed	1-5%	Yes	Native
<i>Impatiens capensis</i>	Spotted touch-me-not (Jewelweed)	5-25%	No	Native
<i>Iris versicolor</i>	Blue flag	1-5%	Yes	Native
<i>Lobelia cardinalis</i>	Cardinal Flower	1-5%	Yes	Native
<i>Lycopus americanus</i>	Bungleweed	1-5%	No	Native
<i>Plantago major</i>	Broadleaf Plantain	1-5%	No	Nonnative
<i>Physostegia virginiana</i>	Obedient plant	1-5%	Yes	Native
<i>Sagittaria latifolia</i>	Broad Leaved Arrowhead	1-5%	Yes	Native
<i>Solidago canadensis</i>	Canada goldenrod	5-25%	No	Native
<i>Stellaria media</i>	Common Chickweed	1-5%	No	Nonnative
<i>Symphyotrichum lanceolatum</i>	Panicled Aster	1-5%	Yes	Native
<i>Symphyotrichum puniceum</i>	Purple-stemmed Aster	1-5%	No	Native

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Urtica dioica</i>	Stinging nettle	1-5%	No	Native
<i>Aronia melanocarpa</i>	Black Chokeberry	1-5%	Yes	Native
<i>Ilex verticillata</i>	Winterberry	1-5%	Yes	Native
<i>Viburnum opulus</i>	Highbush Cranberry	1-5%	Yes	Native

Site Photographs



Photo 18 Looking south along mowed strip between boulder wall and planted shoreline buffer strip, 09/24/2021.



Photo 19 Shoreline buffer adjacent to fishing pier, 09/24/2021.



Photo 20 Slope and planted shoreline buffer. Installed biologs at the shoreline toe are secure and well vegetated with plant roots. Photo from site visit 09/24/2021.



Photo 21 Close up view of dense native vegetation in shoreline buffer. Photo from site visit 09/24/2021.

21 Blue Lake Shoreline Enhancement (Minx)

Project Background

Project Name: Blue Lake Priority Action Plan – Isanti County SWCD

Project Site: Blue Lake shoreline 2. Minx property

Township/Range Section: Township 35N Range 25 Section 31

Project Manager / Affiliated Organization: Isanti SWCD

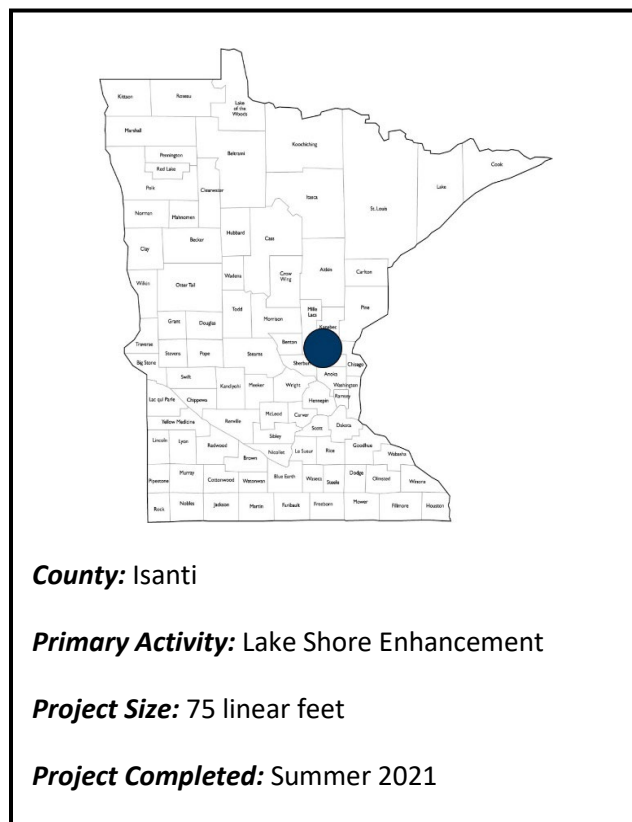
Fund: CWF **Fiscal Year Funds:** 2018

Project Start Date: Summer 2021

Predominant Habitat type: Aquatic Habitat

Additional Habitat types:

Project Status: Establishment Phase



County: Isanti

Primary Activity: Lake Shore Enhancement

Project Size: 75 linear feet

Project Completed: Summer 2021

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

From Isanti SWCD: "This project is located on private landowner property on Blue Lake in Isanti County. From the edge of the water, the 75 ft shoreline transitions to an estimated 10 feet of flat ground then into a moderately steep vegetated slope. The bank had a 3 foot vertical face, some bare spots, sparsely vegetated and moderate undercutting. There is a geotextile lined beach (300sqft) cut into the hill slope. The slope is shaded with trees which hinders vegetation growth. The project installed 75 linear feet of 16" diameter willow waddles, 10 native shrubs into the shoreline directly behind the coir log (excluding in front of the old beach), and 574 native perennials (2" plugs) 1' apart into the shoreline behind the willow waddle and in buffer area. Buffer area (excluding in front of old beach) was seeded with shoreline plant mix. Geotextile was removed from previous sand beach area and seeded with pollinator lawn mix from Minnesota Native Landscapes. Curlex erosion blanket was installed over all bare soil, including the shoreline face behind the willow waddle."

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Blue Lake, Minx Shoreline Restoration – Isanti SWCD.

3. What are the stated goals of the project?

The goal of the project is to filter stormwater runoff and reduce shoreland erosion entering Blue Lake. The project also stated it wanted to create important wildlife habitat.

4. What are the desired outcomes of achieving the stated goals of the project?

Protect and improve the water health of Blue Lake.

5. Were measures of restoration success identified in plans? Yes

If yes, list specific measurements.

Reduction of 1.5 pounds per year of Phosphorus and 2,250 pounds per year of Sediment

6. Are plan Sets available? Yes Have project maps been created? No

If yes, provide in "site maps" and list maps provided:

NA

7. Provide list of best management practices, standards, guidelines identified in plan set?

Stabilization of shoreline toe with willow wattles and native vegetation.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

No

9. In what ways did alterations change the proposed project outcome?

NA

Site Assessment

Field Review Date: 9/24/2021

Field Visit Attendees: John Hiebert, Wade Johnson – MN DNR, Todd Kulaf – Isanti SWCD

10. Surrounding Landscape Characteristics:

Rural residential lakeshore properties

11. Site Characteristics:

a. Soil Series:

Sanburn fine sandy loam, 7 to 18 percent slopes

b. Topography:

Slopes to lakeshore approximately 15%

c. Hydrology:

Runoff from the upslope home and driveway enter the lake in this section of shoreline

d. Vegetation: Plant Communities, Dominant Species & Invasive % Cover:

Maple Basswood forest. Newly establishing native perennials along shoreline bench.

12. Is the plan based on current science? Yes

Willow wattles for stabilization at the shoreline toe in combination with native plugs and seed are accepted practices natural shoreline restoration.

13. List indicators of project goals at this stage of project:

The willow wattles have been installed properly to prevent erosion along the undercutting bank. There was some sign of sprouting on these willow wattles and this willow growth should be encouraged to allow for long-term bank stability. The native vegetation had been planted. It was difficult to assess the quality of the native planting as the area had been recently weed whipped so it was hard to see the level of success of the planting of seedlings or the seeding. Evidence of native plants were seen, but again the success rate was difficult to ascertain. This makes estimating any habitat improvement difficult as well.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, the water quality goals can reasonably be achieved, which is the focus of this project. Project managers implemented a plan to address the shoreline erosion using natural materials which support habitat. However, given the scale, the habitat benefits may be limited and are difficult to determine at this stage of vegetation establishment.

15. Are corrections or modifications needed to achieving proposed goals?

Willow wattles were well installed to address the undercut banks. The invasive vegetation on site (Reed Canary Grass) appeared to be controlled which was an important part of the project manager's plan. The recently planted seed and plugs had been weed whipped to near the ground just prior to our site visit and cut material was removed. This may limit the spread of native seeds and may have impacted newly planted plugs as they were still in the growing season and not yet established. In addition, a boat lift was placed on the restoration site for winter storage. I am not sure of the impact of this activity, but if the boat lift isn't removed early enough in the spring it could suppress some plant growth.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

The long-term management directed for the buffer and the steps outlined and the management of the site by a private vendor looked reasonable.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

This project appears to only benefit habitat on the site. Willow wattles should be encouraged to sprout to provide stability and habitat along the shoreline. Also property owners should try to keep as much of the native vegetation that has died-back on site for over winter habitat and food for wildlife and to allow for natural re-seeding of native vegetation.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Yes, to assess the quality of the native vegetation that had been cut back and to see how well the willow wattles are sprouting/growing.

19. Additional comments on the restoration project.

None

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

The goals of filtering stormwater runoff and reducing shoreland erosion appear to have been met within this project site's limited scale. Allowing the willows to grow and assessing the success of the native planting will be strong indicators of how successful this project will be.

23. Site Assessor(s) conducting field review:

John Hiebert – MNDNR Lake Habitat Consultant, Wade Johnson – MNDNR

Site Maps, Project Plans or Vegetation Tables

Blue Lake- Minx—Shoreline Restoration



Project Summary

This project is located on private landowner property on Blue Lake in Isanti County. The proposed project includes a shoreline restoration with native plants and willow bundles. Funds to install the projects came from a grant obtained from the Clean Water Land and Legacy Act.

The landowner contributed 25% of the total project cost to make this water quality project possible. The goal of the project is to protect and improve the water health of Blue Lake by filtering stormwater runoff and reducing shoreland erosion. The project also creates important wildlife habitat.

This landowner in among several others on Blue Lake that have dedicated efforts towards protecting and improving water health in the area. This project would not be possible without their partnership.

Project Details

Target Water: Blue Lake
Date installed: 2021

Project Partners

Isanti SWCD
Landowner
BLID

Project Funding

Clean Water Fund: \$4,807.35
Private Landowner: \$1,602.45
Total Project Cost: \$6,409.80

Pollution Reduction

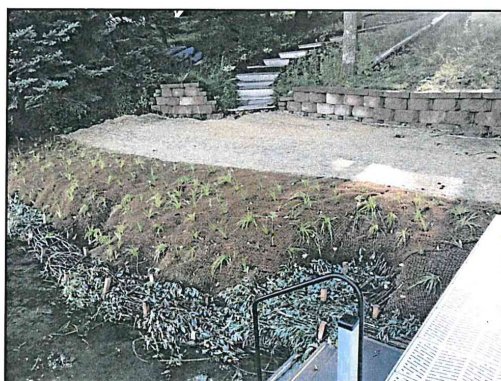
Phosphorus: 1.5 pounds/yr
Sediment: 2,250 pounds/yr

30-yr Average Cost/lb-TP: \$208

Before Installation-2021



After Installation - 2021



Isanti Soil and Water Conservation District
110 Buchanan St. North
Cambridge, MN 55008
763-689-3271
www.IsantiSWCD.org



Figure 9 Minx Shoreline Restoration project summary – Isanti SWCD

Technical Assessment: Cheryl Minx Property 28032 Yak Street NW Zimmerman MN

Current Landscape: From the edge of the water, the 75 ft shoreline transitions to an estimated 10 feet of flat ground then into a moderately steep vegetated slope. The bank has a 3 foot vertical face, some bare spots, sparsely vegetated (reed canary) and moderate undercutting. There is a geotextile lined beach (300sqft) cut into the hill slope. The slope is shaded with trees which hinders vegetation growth.



Project Proposal: Protect and restore 75 ft of undercutting shoreline with a native vegetated buffer and coir log to prevent nutrient and sediment loading to Blue Lake.

Current Conditions	Protection and Restoration Plan
1.5ft vertical bank	Install shrubs and Native Plant Plugs
Exposed soil	Install Shrubs and Native Plant Plugs
Undercutting	Install 16" willow waddle, Shrubs and Native Plants
Reed Canary	Herbicide Treatment
Beach Area	Seed Pollinator Lawn Mix
Upland Runoff	Native Plant Buffer

Resource Concern: 75ft immediate shoreline

- 3ft vertical bank
- Exposed soil
- Undercutting
- Reed Canary
- Beach Area
- Upland Stormwater Runoff

Eroding Face (ft)	1.5
Recession rate (ft/yr)	.2
Shore Length (ft)	75

Severity	Lateral Recession Rate (ft/yr)	Description
Offset	<0.01	Erosion offset from the shoreline. Erosion does not appear to be entering waterbody but bank failure, bluff slumps, and/or seepage visible.
Light	0.01-0.059	Some bare shore, but active erosion is minimal. Minor or no vegetative overhang. No exposed tree roots.
Moderate	0.06-0.29	Shore is predominantly bare, with some undercutting and vegetative overhang. Some exposed tree roots, but no slumps or slips.
Severe	0.3-0.5	Shore is bare, with vertical slope and/or severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails.
Very Severe	0.5+	Shore is bare, with washouts, vertical slopes, and severe vegetative overhang. Many fallen trees eroding out and changes in cultural features as above. Multiple types of erosion present.

Cost estimates and Pollution Reductions

Lakeshore Restorations	
Landowner	Badger
Cost/Removal Analysis	
Treatment	Shoreline Restoration
	Number of BMPs
	Total Size of BMPs* LnFT
	TP (lb/yr)
	TSS (lb/yr)
Cost	Design Costs and Admin
	Construction Costs and Material**
	Total Estimated Project Cost
	Annual O&M***
Efficiency	30-yr Average Cost/lb-TP
	30-yr Average Cost/1,000lb-TSS

Figure 10 Pre-project assessment – Isanti SWCD



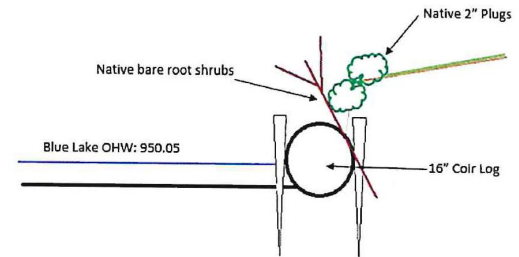
Cheryl Minx Shoreline Restoration 28032 Yak Street NW, Zimmerman MN



Completed By: Isanti Soil and Water Conservation District

Date: 03/07/2020

Coir Log Design



Project Overview:

Install 75 linear feet of 16" diameter willow waddle.

Install 10 native shrubs into the shoreline, directly behind the coir log (excluding in front of the old beach).

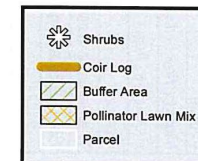
Install 574 native perennials (2" plugs) 1" apart into the shoreline, behind the willow waddle and in buffer area.

Seed buffer area (excluding in front of old beach) with shoreline plant mix.

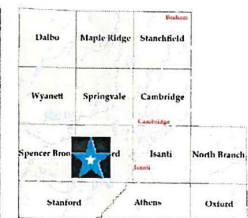
Remove geotextile from previous sand beach area and vegetate with pollinator lawn mix from MNL.

Install Curlex erosion blanket over all bare soil. Including the shoreline face behind the willow waddle.

Install ground flush edging around buffer.



Inset Map



Inset Map

Figure 11 Prescription for project practices – Isanti SWCD



Plant Material List

Landowner:
Address:
Phone:

Project Name:

Minx

Total Plants:

574

Est Planting Date: 6/1/2021

Subtotal:

\$ 768.07

Project Contact:

Todd Kulaf

Total Containers:

104

Date Prepared: 10/21/2020

MN Tax:

Bloom Time and Color

March

April

May

June

July

August

September

October

Scientific Name	Common Name	Plant Type	Soil Type	Sun Exposure	Height	Size (#/tray)	# of plants requested	Notes	March	April	May	June	July	August	September	October
<i>Carex pellita</i>	Woolly Sedge	Sedges	W,M	F,P	1.5-2'	plug	234									
<i>Carex sprengelii</i>	Long Beaked Sedge	Sedges	W-D	P,S	1-2'	plug	234									
<i>Eupatorium maculatum</i>	Joe Pye Weed	Forbs	W, M	F	4-6'	plug	24									
<i>Eupatorium perfoliatum</i>	Boneset	Forbs	W, M	F, P	3-4'	plug	24									
<i>Iris versicolor</i>	Blue Flag Iris	Forbs	W, M	F, P	2-3'	plug	24									
<i>Zizia aurea</i>	Golden Alexanders	Forbs	W-D	F,P	3'	plug	24									
<i>Cornus sericea</i>	Red-osier Dogwood	Shrubs	W,M	F,P	TO 10'	#1	10	10								



Joe Pye Weed



Boneset



Blue Flag Iris



Golden Alexanders



Long Beaked Sedge



Woolly Sedge

Figure 12 List of live plants installed.



MNL Bee Lawn

Planting & Maintenance Guide

Getting Started:

New Lawn: Starting with bare soil: Rake seeding area, sprinkle seeds evenly, lightly rake again. Water during the establishment period, or until the bee lawn has fully filled in.

Existing Lawn: Set your mower deck as low as it can go to “burn” the existing lawn. Mow in warm/dry weather. Repeat this step in approximately 2 weeks. Rake seeding area, sprinkle seeds evenly, lightly rake again. Water during establishment.

Rate: 4.5 lbs per 1,000 square feet or 200 lbs per acre

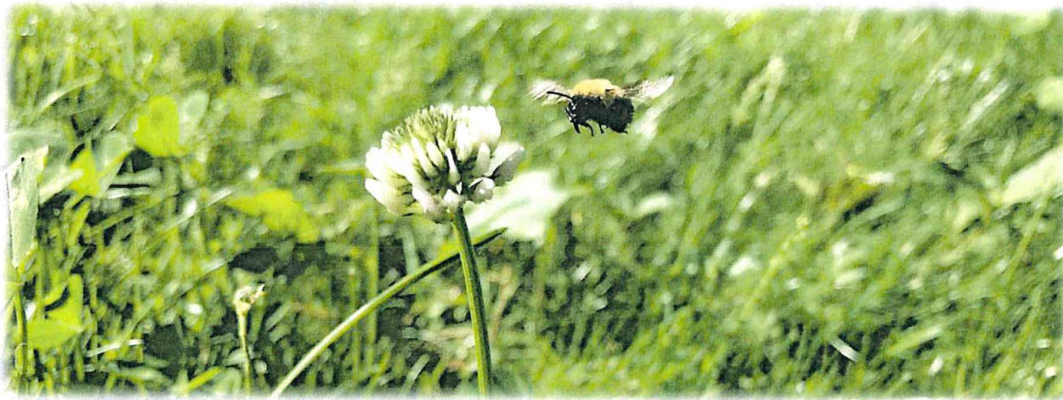


Photo by: Laura Betker

Maintenance:

- You can mow your bee lawn if you prefer a shorter lawn look. If you choose to mow, consider setting your deck height to 4 inches and only mowing every other week or less. If you choose not to mow, enjoy more of a meadow-type look to your lawn.
- Water in periods of drought as bee lawn is becoming established.
- No need to fertilize!
- Hand pull undesirable weeds rather than using herbicides (broadleaf herbicide will kill the Bee Lawn flowers).

More information or to Purchase: <https://mnnativelandscapes.com/product/mnl-bee-lawn/>

Minnesota Native Landscapes 8740 77th St NE Otsego, MN 55362 www.MnNativeLandscapes.com

Figure 13 Planting and Maintenance Guide for utilized Bee Lawn seed mix. Specific seed mix details are not currently known by assessors.

Operation and Maintenance Guidelines for Lakeshore Stabilization

Lakeshore restorations and stabilizations prevent shoreline erosion, filter storm runoff and provide near-shore habitat. This document describes important tasks that should occur on a regular basis to ensure the project's success. Neglected maintenance leads to more severe problems that are more difficult to correct.

Periodic spot checks will be conducted on your site by a soil conservation technician to ensure the project is maintained as in the original plan.

Task	Frequency			Equipment Needed
	Year 1	Year 2	Year 3+	
<u>Watering</u> Ensure 1" of water per week, either through rainfall or irrigation.	Weekly	During drought stress		Water supply; hose and sprinkler, or soaker hose
<u>Weeding</u> All vegetation that was not planted as part of the project should be removed.	Every 2-3 weeks	Monthly	2-4 times per year as needed.	
<u>Replace Vegetation</u> Replant similar species, preferably native species of local ecotype, in the event that original vegetation expires.	If needed.			Trowel, plants
<u>Refresh Mulch</u> Maintain 2-3" of mulch covering over planted areas, with priority on areas without dense plant cover.	Approximately every 3 rd year.			Rake, mulch
<u>Re-secure erosion control materials</u> In the event that erosion control blankets, biologs or other materials become unsecured, they should be re-secured with staking or burying similar to the original installation.	If needed.			
<u>Erosion</u> In the event that the lakeshore of other areas experience erosion, Contact the Isanti SWCD for guidance.	If needed.			Variable
<u>Correct Ice Damage</u> Contact the Isanti SWCD for guidance. Ice damage may be corrected on a case by case basis, and in some instances left as-is. Possible actions include re-grading, moving plant stock back into place, and other measures. Moving rock back into place at the waterline is common.	If needed.			Variable

Figure 14 Operations and Maintenance guidance for landowners – Isanti SWCD.

Table 5 List of plants observed during site visit 09/24/2021. This list does not represent all present or potential vegetation on site as planting and seeding was completed less than two months prior to site visit and the site was weed whipped to near the ground just prior to site visit.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Avena sativa</i>	Oats	50-75%	Yes	Nonnative
<i>Ambrosia artemisiifolia</i>	Common Ragweed	1-5%	No	Native
<i>Anemone canadensis</i>	Canada anemone	1-5%	Unknown	Native
<i>Asclepias incarnata</i>	Marsh milkweed	5-25%	Unknown	Native
<i>Bidens vulgata</i>	Common beggarticks	1-5%	No	Native
<i>Carex sp</i>	Sedge	1-5%	Yes	Native
<i>Eupatorium perfoliatum</i>	Common boneset	1-5%	Yes	Native
<i>Eutrochium maculatum</i>	Spotted Joe-pye weed	1-5%	Yes	Native
<i>Iris versicolor</i>	Blue flag	5-25%	Yes	Native
<i>Monarda fistulosa</i>	Wild Bergamot	1-5%	Unknown	Native
<i>Rudbeckia hirta</i>	Black Eyed Susan	5-25%	Unknown	Native
<i>Solidago canadensis</i>	Canada goldenrod	5-25%	No	Native
<i>Zizia aurea</i>	Golden Alexanders	1-5%	Yes	Native

Site Photographs



Photo 22 Willow wattle anchored to the shoreline toe and seeded and planted vegetation beginning to grow along buffer.



Photo 23 Willow shoots emerge from branches in bundled wattle. Planted species including Golden Alexanders, Marsh Milkweed and Blue Flag Iris are apparent.

22 Blue Lake Shoreline Enhancement (Wilke)

Project Background

Project Name: Blue Lake Priority Action Plan – Isanti County SWCD

Project Site: Blue Lake shoreline 3. Wilke property

Township/Range Section: Township 35N Range 25 Section 31

Project Manager / Affiliated Organization: Isanti SWCD

Fund: CWF **Fiscal Year Funds:** 2018

Project Start Date: 2021

Predominant Habitat type: Aquatic Habitat

Additional Habitat types:

Project Status: Establishment Phase



County: Isanti

Primary Activity: Lake Shore Enhancement

Project Size: 30 linear feet

Project Completed: Summer 2021

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

- A 240 square foot garden type native buffer at the shoreline to capture stormwater runoff.
- 30 feet of 12 to 16 inch diameter willow wattles secured to the shoreline toe. Curlex erosion blanket behind the willow wattle.
- 400 native perennial plugs planted into the the buffer and willow bundles.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Wilke Shoreline Restoration project summary, technical assessment, overview of practices, plant list and Operation and Maintenance plan – Isanti SWCD

3. What are the stated goals of the project?

From Isanti SWCD: Protect and restore 30 feet of eroding shoreline with native vegetation and coir willow wattle with the purpose of preventing nutrient and sediment loading to Blue Lake and install a 240 sqft native buffer at the shoreline to capture storm water runoff in order to prevent nutrient and sediment loading. The project also stated it wanted to create important wildlife habitat

4. What are the desired outcomes of achieving the stated goals of the project?

Protect and improve the water health of Blue Lake.

5. Were measures of restoration success identified in plans? Yes

If yes, list specific measurements.

Calculated reduction of 0.2 pounds per year of Phosphorus and 300 pounds per year of sediment

6. Are plan Sets available? Yes Have project maps been created? No

7. Provide list of best management practices, standards, guidelines identified in plan set?

Stabilization of shoreline toe with willow wattles and native vegetation.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

No

9. In what ways did alterations change the proposed project outcome?

NA

Site Assessment

Field Review Date: 9/24/2021

Field Visit Attendees: John Hiebert, Wade Johnson – MN DNR, Todd Kulaf – Isanti SWCD

10. Surrounding Landscape Characteristics:

The site is surrounded by rural residential lakeshore properties. Upland landscape can be described as steep slope, maintained turf grass and a gravel road reaching from the top of the hill down to the shore area.

11. Site Characteristics:

a. Soil Series:

Stonelake-Sanburn complex, 7 to 18 percent slopes, moderately eroded

b. Topography:

The shoreline bank is mowed to the edge of the water, has a 1 foot vertical face and mild bank erosion. The shoreline area is generally flat, but transitions to a steep slope within 20 feet.

c. Hydrology:

Runoff from the upslope home and driveway enter the lake in this section of shoreline

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Forested low gradient shoreline with mowed turf grass and cattails up to waters edge

12. Is the plan based on current science? Yes

Willow wattles for stabilization at the shoreline toe in combination with native plugs and seed are accepted practices natural shoreline restoration.

13. List indicators of project goals at this stage of project:

The coir willow waddles have been installed properly to prevent erosion along the bank. There was some sign of sprouting on these willow wattles and this willow growth should be encouraged to allow for long-term bank stability. The native vegetation had been planted recently which made it difficult to

assess the quality of the native planting at the time of the inspection. This makes estimating any habitat improvement difficult as well.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

I am not sure how necessary the erosion control was or if as implemented will achieve the full goals of the project. The amount of shoreline erosion at the site is very limited and only in the Area where cattails were removed for lake access and a dock. Because of the type of aquatic vegetation present in front of this site it seems unlikely that wind/wave action or erosion was an issue at this site since dense beds of cattails and waterlilies are usually not present at high energy shorelines. Therefore I am unsure how much the willow waddle/coir logs are necessary or what they are preventing. Runoff from the home (without gutters), steep hill and the existing road funnel water down to the lake and I am not sure how efficiently a 240 sq ft planting will filter this. Adjacent to the road and at the base of a slope is a grassy area that would be a perfect place for a rain garden which may be a better solution to the runoff issues on this site in addition to the buffer.

15. Are corrections or modifications needed to achieving proposed goals?

I would recommend putting in a rain garden either at the top of the slope to catch run off from the house or at the base of the hill to slow down and capture run-off prior to it entering the shoreline planting.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

The main long-term management directed was for the buffer and the steps outlined and the management of the site by a private vendor looked acceptable.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

In general, the addition of the native plantings and potential for living willow wattles should be beneficial to habitat. If the shoreline planting is inadequate to handle the runoff volume or adequately filter the sediment from the runoff, it is possible that habitat could be impacted. In addition, the level of runoff may impact the ability of the shoreline planting to become established

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Yes, to assess how well the planting has become established and assess the level of erosion occurring.

19. Additional comments on the restoration project.

None

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Minimally achieved the stated goals.

21. The project will:

Minimally meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

It is my opinion that there was most likely little erosion on-going on the site prior to removal of emergent vegetation and limited after that time, so I believe the value of the shoreline erosion portion of the project is limited. I recognize that the SWCD encouraged the landowner to look at gutters, rain gardens and diversions from the road to a rain garden, but the landowner was not interested. This is not a criticism of the SWCD but a concern that the scope of the installed project will not fully meet the goals of the project.

23. Site Assessor(s) conducting field review: John Hiebert - MNDNR Lake Habitat Consultant

Site Maps, Project Plans or Vegetation Tables

Blue Lake- Wilke—Shoreline Restoration



Project Summary

This project is located on private landowner property on Blue Lake in Isanti County. The proposed project includes a shoreline restoration with native plants and willow bundles. Funds to install the projects came from a grant obtained from the Clean Water Land and Legacy Act.

The landowner contributed 25% of the total project cost to make this water quality project possible. The goal of the project is to protect and improve the water health of Blue Lake by filtering stormwater runoff and reducing shoreland erosion. The project also creates important wildlife habitat.

This landowner in among several others on Blue Lake that have dedicated efforts towards protecting and improving water health in the area. This project would not be possible without their partnership.

Project Details

Target Water: Blue Lake
Date installed: 2021

Project Partners

Isanti SWCD
Landowner
BLID

Project Funding

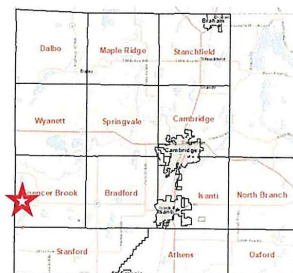
Clean Water Fund: \$3,576.90
Private Landowner: \$516.30
Landowner inkind: \$676.00
Total Project Cost: \$4,769.20

Pollution Reduction

Phosphorus: .37 pounds/yr
Sediment: 300 pounds/yr

30-yr Average Cost/lb-TP: \$639

Before Installation-2021



After Installation - 2021



Isanti Soil and Water Conservation District
110 Buchanan St. North
Cambridge, MN 55008
763-689-3271
www.IsantiSWCD.org



Figure 15 Wilke Shoreline Restoration project summary – Isanti SWCD

Technical Assessment: Wilke Restoration: 28290 Tiger St. NW Zimmerman Mn 55398

Current Landscape: From the edge of the water, the shoreline is generally flat but eventually transitions to a steep slope. The bank is mowed to the edge of the water, has a 1 foot vertical face and mild bank erosion. Upland landscape can be described as steep slope, maintained turfgrass and a gravel road reaching from the top of the hill down to the shore area.



Resource Concern:

30ft immediate shoreline and stormwater runoff

- 1ft vertical bank
- Mild shoreline erosion
- Mild undercutting
- Upland gravel driveway

Inputs:

Eroding face (ft)	1
Recession rate (ft/yr)	0.1
Shore length (ft)	30
Soil bulk density (lbs/ft ³)	100

Severity	Latent Risk Rate (h/yr)	Description
Offset	<0.01	Explosion offset from the shoreline. Explosion does not appear to be entering waterbody but bank failure, fish slumps, and/or seepage viable.
	0.01-0.09	Some bare shore, but active erosion is minimal. Minor or no vegetative churning. No exposed bare roots, but no slumps or slaps.
	0.06-0.29	Shore is predominantly bare, with some undulating and vegetative sheathing. Some exposed bare roots, but no slumps or slaps.
Some	0.3-0.5	Shore is bare, with vertical slaps and/or severe vegetative sheathing. Many exposed bare roots and slumps and slaps or slaps. Some changes in cultural features such as fence corners missing and realignment of roads or trails.
Very severe	0.5+	Shore is bare, with vertical slaps, vertical slaps, and severe vegetative sheathing. Many fallen trees and slaps and changes in cultural features as well. Multiple types of erosion present.

Project Proposal: Protect and restore 30ft of eroding shoreline with native vegetation and coir willow waddle with the purpose of preventing nutrient and sediment loading to Blue Lake. Install a 240 sqft native buffer at the shoreline to capture stormwater runoff.

Current Conditions

Protection and Restoration Plan

1ft vertical bank	Install Native Plant Plugs
Some bare spots	Install Native Plant Plugs
Upland runoff	Install 240sqft native buffer
Shoreline Erosion	Install 12" - 16" willow waddles

Estimated Pollution Reductions

Lakeshore Restorations		
Landowner		Wilke
Cost/Removal Analysis		Shoreline Restoration
Treatment	Number of BMPs	1
	Total Size of BMPs* LnFT	75
	TP (lb/yr)	0.37
	TSS (lb/yr)	300
	Construction Costs and Material**	\$4,090
Cost	Total Estimated Project Cost	\$4,090
	Annual O&M***	\$100
Efficiency	30-yr Average Cost/lb-TP	\$639
	30-yr Average Cost/1,000lb-TSS	\$788

WI NRCS

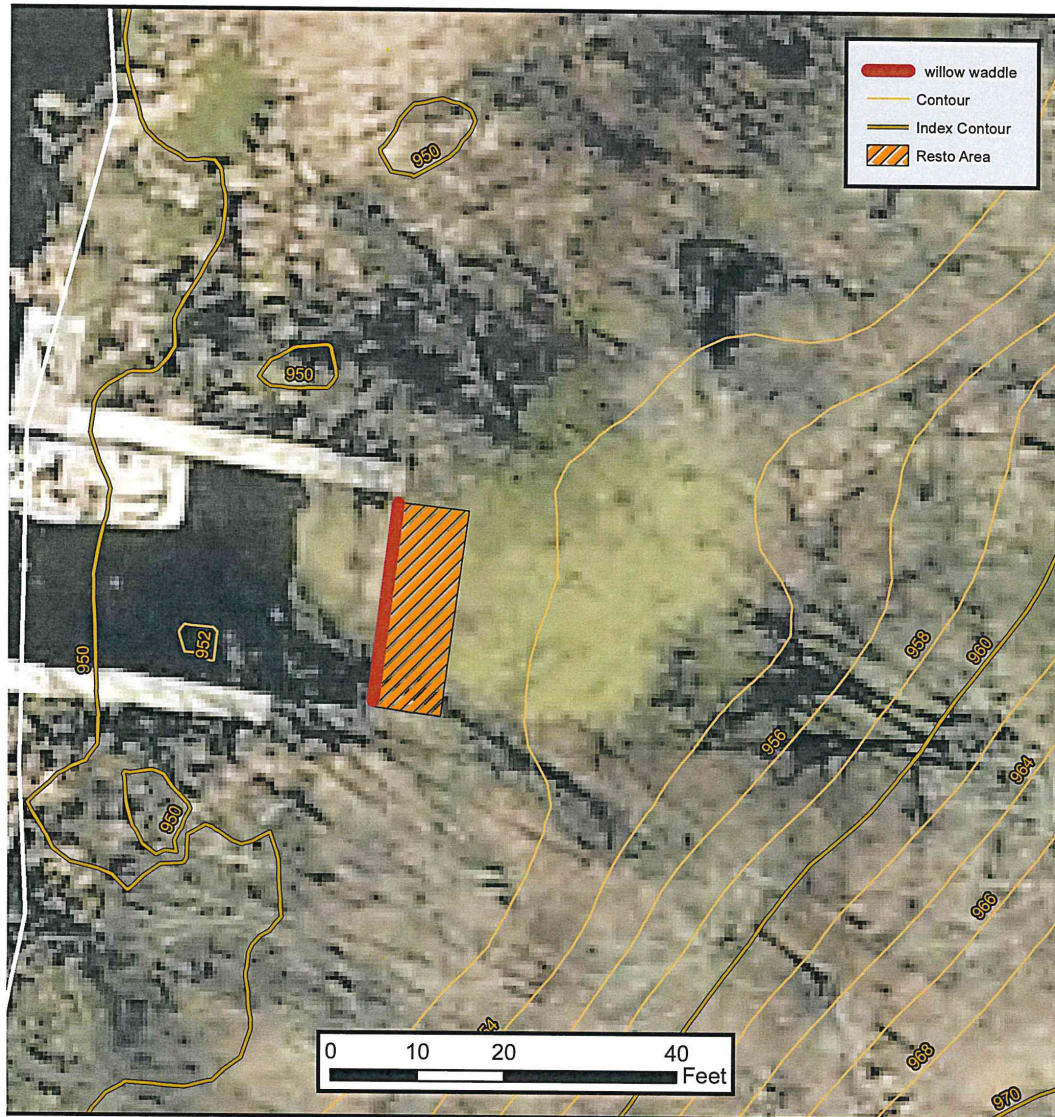
Lakeshore soil loss (lbs/yr)	300 (tons/yr)	0.15
Phosphorus loss (lbs/yr)	0.202566	

WinSlamm

[illegible]

Figure 16 Pre project assessment – Isanti SWCD

Wilke Shoreline Restoration 28290 Tiger St. NW Zimmerman MN 55398



iti Soil and Water Conservation District

Date: 6/14/2021

Project Goal: Protect Blue Lake Water Quality

Capture upland runoff and prevent shoreland erosion using a native plant buffer and natural shoreland protection techniques.

Project Overview:

Install 30ft of 12"-16" Diameter willow waddle.

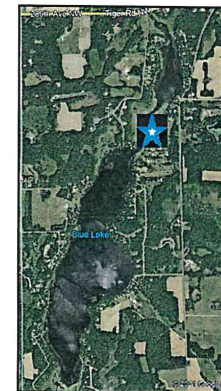
Install 400 native perennials (Plugs), .5"to1" apart project area and into the willow waddle.

Install Curlex erosion blanket behind the willow waddle shoreline and running 2" landward.

Install hardwood mulch 2" thick, throughout the project area.

Install edging around project area.

Project Area Dimensions: 30ft x 10ft



Inset Map



Inset Map

Figure 17 Prescription for project practices – Isanti SWCD

Project Contact:	Todd Kulaf	Total Containers:	58					Bloom Time and Color							
Scientific Name	Common Name	Plant Type	Soil Type	Sun Exposure	Height	Size (#/tray)	# of plants requested	March	April	May	June	July	August	September	October
<i>Aquilegia canadensis</i>	Columbine	Forbs	M, D	F-S	1-3'	plug	18								
<i>Asclepias incarnata</i>	Swamp Milkweed	Forbs	W, M	F	3-4'	plug	24								
<i>Asclepias tuberosa</i>	Butterfly Weed	Forbs	M,D	F,P	1.5-2'	plug	18								
<i>Carex pellita</i>	Woolly Sedge	Sedges	W,M	F,P	1.5-2'	plug	66								
<i>Carex sprengeii</i>	Long Beaked Sedge	Sedges	W-D	P,S	1-2'	plug	66								
<i>Carex vulpinoidea</i>	Brown Fox Sedge	Sedges	W,M	F,P	3'	plug	66								
<i>Eupatorium maculatum</i>	Joe Pye Weed	Forbs	W, M	F	4-6'	plug	18								
<i>Eupatorium perfoliatum</i>	Boneset	Forbs	W, M	F, P	3-4'	plug	18								
<i>Iris versicolor</i>	Blue Flag Iris	Forbs	W, M	F, P	2-3'	plug	18								
<i>Polemonium reptans</i>	Jacob's Ladder	Forbs	W-D	F,P,S	1'	plug	18								
<i>Zizia aurea</i>	Golden Alexanders	Forbs	W-D	F,P	3'	plug	18								



Boneset



Blue Flag Iris



Golden Alexanders



Long Beaked Sedge



swamp Milkweed



Jacob's Ladder



Joe Pye Weed



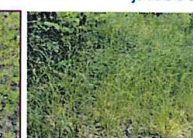
Butterfly Weed



Jacobs Ladder



Fox sedge



Woolly Sedge



Columbine

Figure 18 List of plants installed. This list represents plant species observed during the site visit 09/24/2021.

Operation and Maintenance Guidelines for Lakeshore Stabilization

Lakeshore restorations and stabilizations prevent shoreline erosion, filter storm runoff and provide near-shore habitat. This document describes important tasks that should occur on a regular basis to ensure the project's success. Neglected maintenance leads to more severe problems that are more difficult to correct.

Periodic spot checks will be conducted on your site by a soil conservation technician to ensure the project is maintained as in the original plan.

Task	Frequency			Equipment Needed
	Year 1	Year 2	Year 3+	
<u>Watering</u> Ensure 1" of water per week, either through rainfall or irrigation.	Weekly	During drought stress		Water supply; hose and sprinkler, or soaker hose
<u>Weeding</u> All vegetation that was not planted as part of the project should be removed.	Every 2-3 weeks	Monthly	2-4 times per year as needed.	
<u>Replace Vegetation</u> Replant similar species, preferably native species of local ecotype, in the event that original vegetation expires.	If needed.			Trowel, plants
<u>Refresh Mulch</u> Maintain 2-3" of mulch covering over planted areas, with priority on areas without dense plant cover.	Approximately every 3 rd year.			Rake, mulch
<u>Re-secure erosion control materials</u> In the event that erosion control blankets, biologs or other materials become unsecured, they should be re-secured with staking or burying similar to the original installation.	If needed.			
<u>Erosion</u> In the event that the lakeshore of other areas experience erosion, Contact the Isanti SWCD for guidance.	If needed.			Variable
<u>Correct Ice Damage</u> Contact the Isanti SWCD for guidance. Ice damage may be corrected on a case by case basis, and in some instances left as-is. Possible actions include re-grading, moving plant stock back into place, and other measures. Moving rock back into place at the waterline is common.	If needed.			Variable

Figure 19 Operations and Maintenance guidance for landowners – Isanti SWCD.

Site Photographs



Photo 24 Project site with willow wattles at shoreline and buffer planting above.



Photo 25 Willow wattles at shoreline with emerging shoots.

23 Becker County Shoreline Enhancement (Bad Medicine Lake)

Project Background

Project Name: Becker County Targeted Phosphorus Reduction and Lake Protection Project

Project Site: Becker Co Shoreline 2. Bad Medicine Lake

Township/Range Section: Township 142 Range 037 Section 18

Project Manager / Affiliated Organization: Becker County SWCD

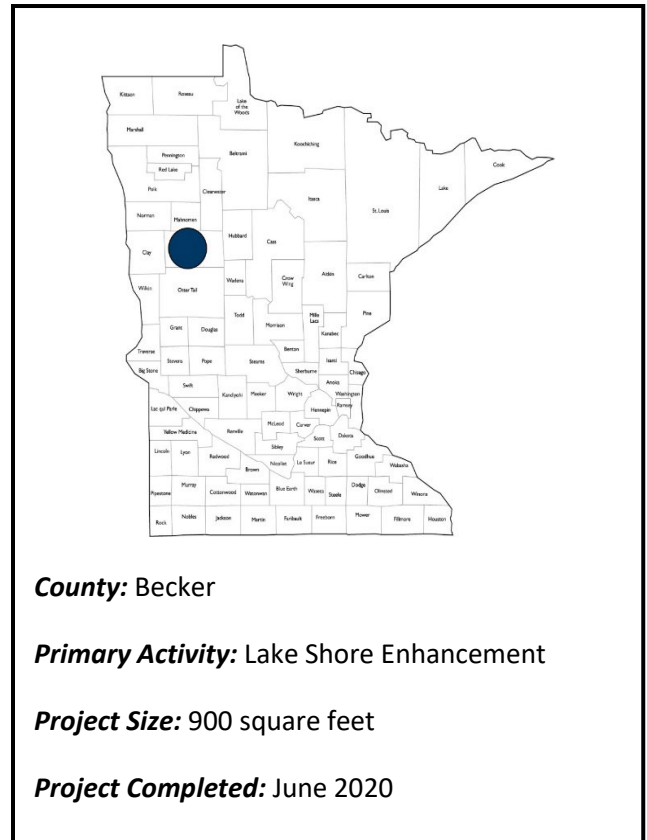
Fund: CWF **Fiscal Year Funds:** 2018

Project Start Date: May 2020

Predominant Habitat type: Prairie / Savanna / Grassland

Additional Habitat types: Aquatic

Project Status: Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

- 1. What are the specific project components and treatments?**
Create new perennial shoreline buffer 14 feet deep (upslope of existing natural shoreline vegetation) and 65 feet wide. Apply 2 herbicide applications to existing turf vegetation within buffer area. Broadcast native seed, install straw erosion control blanket and plant with native perennial plugs.
- 2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?**
Gadberry Project Plan – Becker SWCD
- 3. What are the stated goals of the project?**
Capture and filter upland runoff from residential property before entering Bad Medicine Lake by expanding existing natural shoreline buffer 14 feet further upslope with native perennials to
- 4. What are the desired outcomes of achieving the stated goals of the project?**
Protect water quality in Bad Medicine Lake
- 5. Were measures of restoration success identified in plans? No**

If yes, list specific measurements.

NA

6. ***Are plan Sets available? Yes Have project maps been created? No***

7. ***Provide list of best management practices, standards, guidelines identified in plan set?***

Project plan lists practices (planting and stabilizing native buffer) and materials. Maintenance agreement directs landowner responsibilities for the first 10 years.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. ***Were alterations made to the plan during project implementation?***

Yes

Berms were used to direct upland runoff into natural woodlands in lieu of raingarden.

9. ***In what ways did alterations change the proposed project outcome?***

This change did not effect the shoreline buffer addressed in this evaluation.

Site Assessment

Field Review Date: 9/22/2021

Field Visit Attendees: Heather Baird, Wade Johnson – MN DNR, Bryan Malone, Logan Riedel – Becker SWCD

10. ***Surrounding Landscape Characteristics:***

Lakeshore rural residential and mixed forest.

11. ***Site Characteristics:***

a. Soil Series:

Two Inlets-Sugarbush complex, 8 to 30 percent slopes. Gravelly sand loam.

b. Topography:

Moderate 8-15% slopes to naturally rocky shoreline

c. Hydrology:

Dry hillside receiving runoff from residence home and driveways

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Turf grass upslope. Buffer area was previously planting with crabapple and wild plum seedlings, currently growing in tubes. Scattered mature white and northern pin oak overstory. Woody plants include red osier dogwood and oak seedlings. Existing natural shoreline vegetation including Canada bluejoint grass, softstem bulrush and large leaf aster.

12. ***Is the plan based on current science? Yes***

Buffers are a known practice to filter runoff and nutrients from overland flow.

13. ***List indicators of project goals at this stage of project:***

Buffer seed and planted plugs and trees are growing and filling in.

14. ***Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?***

Yes, also includes a maintenance agreement with the landowners.

15. Are corrections or modifications needed to achieving proposed goals?

No, however continued upslope perennial planting would further increase the buffer goals.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Could add rain garden at end of gutters and/or expand the buffer after a few years, once the project is established.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No, as installed the project appears to be establishing desired species and density well.

19. Additional comments on the restoration project.

Would be nice to see buffer expanded as literature cites wider buffers catch more runoff and filter more nutrients.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

The project as installed expands the native perennial buffer into an area previously maintained a turf grass. This provides increased capacity to capture and filter upland runoff. Project managers report that the landowners engaged and willing to maintain buffer and have expressed interest in potentially expanding the buffer area further upslope in the future.

23. Site Assessor(s) conducting field review: Heather Baird, Wade Johnson – MNDNR

Site Maps, Project Plans or Vegetation Tables

Below is the project plan provided by Becker SWCD:

Gadberry (Bad Medicine Lake)

Project Plan:

- Plan to install two native buffers @ the top of slope/bluff along the shoreline. –Stick to woody veg. Goal to have more privacy from the lake view towards the house.
- Plan to install two grass berms to divert overland water flow into the woods. One on the north side of the house catching water from gutters and upland areas. One on the south side of the house catching water from gutters and upland/driveway area
- Plan to install a rain garden to capture and treat overland flow which contributes to down slope erosion issues.

Buffer A: South buffer/Biggest buffer

14' x 65' = 896 sq. ft -> 900 sq. ft

Total Area = 900sq. ft

Materials:

Double Net Straw Matting: 2 Rolls Needed (780.5 sq. Ft per roll of matting)

Eco Stakes: 1 Box Needed (500 stakes Per box)

Straw Wattles: 3 Wattles Needed (25ft long per Wattle)

1x1 Stakes: 2 Bundles Needed (9 Stakes per bundle)

Project Process:

- May 6, 2020—Part 1 of project install
 - Decided to wait to dig the rain garden because it's not a big area and it won't take very long with the Kubota.
 - Made the cut into the woods with the skid loader for the berm on the south side of the house for the water to follow and divert into the woods.
 - Planted the Red-osier Dogwood, Plum and Crabapple trees.
 - We tubed and staked the Plum and Crabapple trees to keep critters from eating them.
 - We alternated the Crabapple and Plum trees in the project areas.
 - For the dogwood, we planted over the edge of the bluff on the lake side of the project area.
 - Once we were all done, we flagged the project areas for Leo to spray with herbicide.
- May 8, 2020—Leo sprayed 1st round of herbicide treatment.
- May 19, 2020—Leo sprayed 2nd round of herbicide treatment.
- June 4, 2020—Install Part 2 of project
 - Cancelled driveway raingarden; talked with the landowner and decided to just spread black dirt over it and reseed it to grass.

- Spread black dirt throughout both buffers.
 - Seeded, matted, and plugged both areas
 - Spread black dirt and reseeded grass in high traffic areas.
 - Built berm on the south side of house
 - Seeded and matted –Grass seed
 - Also put in a straw wattle and staked it in on the uphill side of the berm
 - Built berm on the north side of house
 - Seeded and matted—Grass seed
 - Did not use a straw wattle on this berm
-

Table 6 Dry to mesic pollinator seed mix used in buffer planting area. 0.25 pounds was used to cover less than approximately 900 square feet.



MNL Pollinator Mix Dry to Mesic Soils

8740 77th Street NE Otsego, MN 55362

Mix approved by the Xerces Society for Pollinator habitat enhancement and restoration.
For dry and well-drained to mesic soils. Height 2-3'

	Scientific Name	Common Name	% of Mix	Seeds/ Sq Ft	PLS lbs/ac	Bloom Season
Grasses:	<i>Bouteloua curtipendula</i>	Side-Oats Grama	16.00	5.85	1.60	
	<i>Bouteloua gracilis</i>	Blue Grama	4.00	5.88	0.40	
	<i>Bromus kalmii</i>	Prairie Brome	3.00	0.88	0.30	
	<i>Elymus trachycaulus</i>	Slender Wheat Grass	2.00	0.51	0.20	
	<i>Koeleria macrantha</i>	Junegrass	0.50	3.21	0.05	
	<i>Schizachyrium scoparium</i>	Little Bluestem	17.00	9.37	1.70	
	<i>Sporobolus heterolepis</i>	Prairie Dropseed	1.50	0.88	0.15	
Sedges/Rushes:	<i>Carex bicknellii</i>	Bicknell's Sedge	1.00	0.62	0.10	
Forbs:	<i>Achillea millefolium</i>	Yarrow	0.20	1.29	0.02	Summer
	<i>Agastache foeniculum</i>	Fragrant Giant Hyssop	0.50	1.65	0.05	Summer
	<i>Allium stellatum</i>	Prairie Onion	0.60	0.24	0.06	Summer
	<i>Amorpha canescens</i>	Leadplant	3.00	1.76	0.30	Summer
	<i>Anemone canadensis</i>	Canada Anemone	1.00	0.29	0.10	Spring
	<i>Aquilegia canadensis</i>	Columbine	0.35	0.49	0.04	Spring
	<i>Asclepias speciosa</i>	Showy Milkweed	0.50	0.08	0.05	Summer
	<i>Asclepias syriaca</i>	Common Milkweed	1.75	0.26	0.18	Summer
	<i>Asclepias tuberosa</i>	Butterfly Milkweed	1.50	0.24	0.15	Summer
	<i>Astragalus canadensis</i>	Canada Milk Vetch	2.00	1.25	0.20	Summer
	<i>Chamaecrista fasciculata</i>	Partridge Pea	7.00	0.69	0.70	Fall
	<i>Coreopsis palmata</i>	Prairie Coreopsis	0.30	0.11	0.03	Summer
	<i>Dalea candida</i>	White Prairie Clover	5.00	3.49	0.50	Summer
	<i>Dalea purpurea</i>	Purple Prairie Clover	7.50	4.13	0.75	Summer
	<i>Desmodium canadense</i>	Canada Tick Trefoil	4.00	0.81	0.40	Summer
	<i>Echinacea angustifolia</i>	Narrow-leaved Coneflower	1.50	0.39	0.15	Summer
	<i>Heliopsis helianthoides</i>	Common Ox-Eye	4.00	0.93	0.40	Summer
	<i>Helianthus pauciflorus</i>	Stiff Sunflower	0.25	0.04	0.03	Fall
	<i>Lespedeza capitata</i>	Round-headed Bushclover	1.50	0.44	0.15	Summer
	<i>Liatris aspera</i>	Rough Blazing Star	0.50	0.29	0.05	Summer
	<i>Liatris ligulistylis</i>	Meadow Blazing Star	1.00	0.37	0.10	Summer
	<i>Monarda fistulosa</i>	Wild Bergamot	0.60	1.54	0.06	Summer
	<i>Penstemon gracilis</i>	Slender Beardtongue	0.15	3.31	0.02	Spring
	<i>Penstemon grandiflorus</i>	Showy Penstemon	0.75	0.39	0.08	Spring
	<i>Phlox pilosa</i>	Prairie Phlox	0.10	0.07	0.01	Spring
	<i>Pycnanthemum virginianum</i>	Mountain Mint	0.20	1.62	0.02	Summer
	<i>Ratibida columnifera</i>	Long-Headed Coneflower	1.25	1.93	0.13	Summer
	<i>Rudbeckia hirta</i>	Black Eyed Susan	1.80	6.08	0.18	Summer
	<i>Solidago nemoralis</i>	Gray Goldenrod	0.20	2.20	0.02	Fall
	<i>Solidago speciosa</i>	Showy Goldenrod	0.20	0.70	0.02	Fall
	<i>Symphyotrichum ericoides</i>	Heath Aster	0.25	1.84	0.03	Fall
	<i>Symphyotrichum laeve</i>	Smooth Blue Aster	1.00	2.02	0.10	Fall
	<i>Symphyotrichum oolentangiense</i>	Sky Blue Aster	1.50	4.41	0.15	Fall
	<i>Tradescantia bracteata</i>	Prairie Spiderwort	0.60	0.22	0.06	Spring
	<i>Verbena stricta</i>	Hoary Vervain	1.50	1.54	0.15	Summer
	<i>Zizia aptera</i>	Heart-leaf Golden Alexanders	0.25	0.11	0.03	Spring
	<i>Zizia aurea</i>	Golden Alexanders	0.70	0.28	0.07	Spring
			100.00	74.69	10.00	

Seeds/sq ft: 75.00
Grass Species: 7
Sedges/Rush Sp: 1
Forb Species: 37

Seed mixes are subject to change based on availability

Table 2 List and number of plugs used in buffer planting. All species listed were observed during the site visit in a cover range of 1-5% within the buffer planting area.

 Plant Material List Landowner: Address: Phone:									
Project Name:	Gadberry	Total Plants:	372	Est Planting Date:		Subtotal:			
Project Contact:	Brandon Dahring	Total Containers:	62	Date Prepared:		MN Tax:			
Scientific Name	Common Name	Plant Type	Soil Type	Sun Exposure	Height	Size (#/tray)	No of Plants	Quantity	# of plants requested
<i>Anemone virginiana</i>	Tall Anemone	Forbs	M, D	F,P,S	3'	plug	6	3	18
<i>Aquilegia canadensis</i>	Columbine	Forbs	M, D	F-S	1-3'	plug	6	6	36
<i>Asclepias syriaca</i>	Common Milkweed	Forbs	W-D	F,P	3'	plug	6	3	18
<i>Asclepias verticillata</i>	Whorled Milkweed	Forbs	M,D	F, P	1-3'	plug	6	3	18
<i>Aster ciliolatus</i>	Lindley's Aster	Forbs	W-D	F,P,S	4'	plug	6	3	18
<i>Aster cordifolius</i>	Blue Wood Aster	Forbs	M,D	P,S	3'	plug	6	3	18
<i>Aster ericoides</i>	Heath Aster	Forbs	M, D	F, P	1-3'	plug	6	3	18
<i>Aster sericeus</i>	Silky Aster	Forbs	D	F, P	1-2'	plug	6	2	12
<i>Bromus pargens</i>	Hairy Wood Chess	Grasses	W-D	P,S	4'	plug	6	2	12
<i>Echinacea angustifolia</i>	Narrow Leaved Coneflower	Forbs	D,M	F	2'	plug	6	2	12
<i>Glyceria striata</i>	Fowl Manna Grass	Grasses	W,M	F,P	1-3'	plug	6	1	6
<i>Koeleria macrantha</i>	June Grass	Grasses	D,M	F,P	2'	plug	6	6	36
<i>Liatris aspera</i>	Rough Blazing Star	Forbs	M,D	F,P	3'	plug	6	3	18
<i>Liatris ligulistylis</i>	Meadow Blazing Star	Forbs	M	F	3-5'	plug	6	1	6
<i>Liatris punctata</i>	Dotted Blazing Star	Forbs	M,D	F,P	1-2'	plug	6	3	18
<i>Monarda fistulosa</i>	Wild Bergamot	Forbs	M, D	F, P	2-4'	plug	6	5	30
<i>Ratibida columnifera</i>	Long-headed Coneflower	Forbs	M,D	F,P	3'	plug	6	2	12
<i>Schizachyrium scoparium</i>	Little Bluestem	Grasses	M,D	F,P	1-3'	plug	6	4	24
<i>Solidago flexicaulis</i>	Zig Zag Goldenrod	Forbs	W-D	F-S	1-3'	plug	6	3	18
<i>Verbena hastata</i>	Blue Vervain	Forbs	W, M	F	1-3.5'	plug	6	1	6
<i>Zizia aurea</i>	Golden Alexanders	Forbs	W-D	F,P	3'	plug	6	3	18

Table 7 Species observed in addition to plug plants listed in table 2 during site visit 09/22/2021.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
Elymus hystrix	Bottle brush grass	1-5%	Yes	Native
Achillea millefolium	Yarrow	1-5%	Yes	Native
Apocynum androsaemifolium	Dogbane	1-5%	No	Native
Asclepias verticillata	Whorled Milkweed	1-5%	No	Native
Conyza canadensis	Horseweed	1-5%	No	NonNative
Dalea purpurea	Purple Prairie Clover	1-5%	Yes	Native
Heliopsis helianthoides	Common Ox-Eye	1-5%	Yes	Native
Lespedeza capitata	Round-headed Bushclover	1-5%	Yes	Native
Melilotus alba	White Sweet Clover	0-1%	No	Invasive
Pycnanthemum virginianum	Mountain Mint	1-5%	Yes	Native
Rosa blanda	Wild Rose	1-5%	No	Native
Rudbeckia hirta	Common Black Eyed Susan	1-5%	Yes	Native
Solidago canadensis	Canada goldenrod	1-5%	No	Native
Trifolium repens	White Clover	1-5%	No	NonNative
Vitis riparia	Wild Grape	1-5%	No	Native
Malus sp	Crabapple	1-5%	Yes	NonNative
Prunus americana	Wild Plum	1-5%	Yes	Native
Fraxinus nigra	Black Ash	1-5%	No	Native
Quercus alba	White Oak	5-25%	No	Native
Quercus ellipsoidalis	Northern Pin Oak	1-5%	No	Native

Site Photographs



Photo 26 Shortly after planting trees, plugs and seeding buffer area Summer 2020. Previously planted crabapple and wild plum seedlings growing inside tree tube browse protection.



Photo 27 Buffer planting during site visit 09/22/2021.

24 Becker County Shoreline Enhancement (Island Lake – Sonstegard)

Project Background

Project Name: Becker County Targeted Phosphorus Reduction and Lake Protection Project

Project Site: Becker Co Shoreline 4. Island Lake, Sonstegard

Township/Range Section: Township 140 Range 38 Section 30

Project Manager / Affiliated Organization: Becker County SWCD

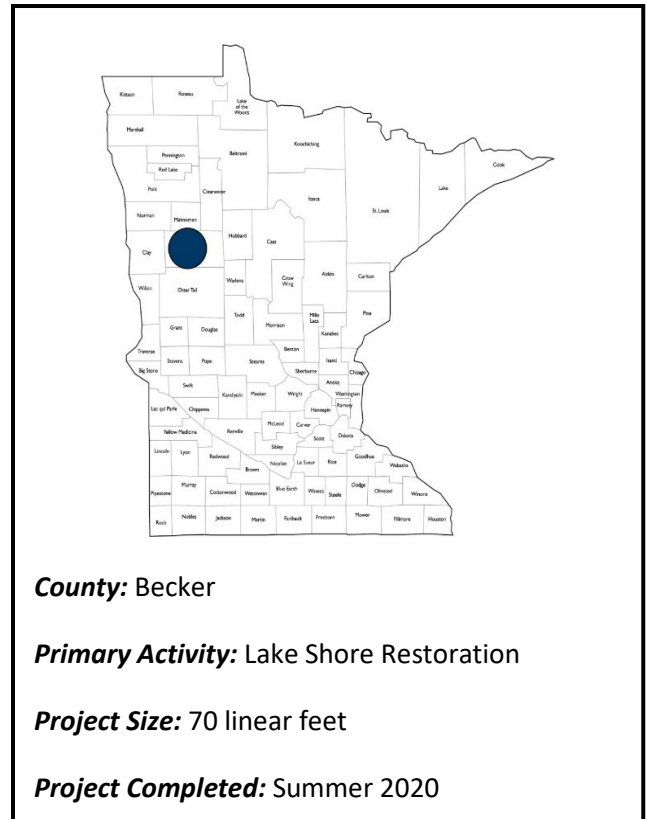
Fund: CWF **Fiscal Year Funds:** 2018

Project Start Date: September 2019

Predominant Habitat type: Aquatic Habitat

Additional Habitat types: Forest

Project Status: Establishment Phase



Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

Pre-project existing conditions were established native forest to the shoreline. Landowner and project managers were concerned that moderate undercutting of shoreline tree roots may continue to degrade and destabilize the shoreline toe due to high water and increased wave and wake action. To address this 70 feet of shoreline toe was secured with a 16 inch biolog. Additionally the biolog and surrounding shoreline forest was planted with plugs of native grasses, forbs and shrubs.

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Sonstegard estimate includes lists of materials and labor. Sonstegard Maintenance agreement directs manangement for the landowner – Becker SWCD

3. What are the stated goals of the project?

Increase stability of existing natural shoreline to reduce erosional undercutting from higher water levels and increased wave and wake action.

4. What are the desired outcomes of achieving the stated goals of the project?

Maintain Island Lake water quality by bolstering existing natural shoreline.

5. Were measures of restoration success identified in plans? No

If yes, list specific measurements.

NA

6. Are plan sets available? Yes *Have project maps been created?* No

7. Provide list of best management practices, standards, guidelines identified in plan set?

Materials list includes: 16 inch coir biologs, 36 inch 2x4 wood stakes and hemp rope for securing the biology and list of plant species. Cost share project maintenance agreement directs landowner management for a minimum of 10 years. A site specific plan/design was not provided.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. Were alterations made to the plan during project implementation?

No

9. In what ways did alterations change the proposed project outcome?

NA

Site Assessment

Field Review Date: 9/22/2021

Field Visit Attendees: Heather Baird, Wade Johnson – MN DNR, Bryan Malone, Logan Riedel – Becker SWCD

10. Surrounding Landscape Characteristics:

Rural lakeshore cabins in predominantly mixed hardwood-conifer forest

11. Site Characteristics:

a. Soil Series:

Snellman sandy loam, 1 to 8 percent slopes

b. Topography:

10% slope within 20 feet of shoreline. The lakeshore is natural cobblestone.

c. Hydrology:

This section of shoreline receives runoff from the adjacent residence, but does not appear to receive highly erosive concentrated flow. Wave and wake from the lake makes this location susceptible to erosion.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Mixed hardwood-conifer forest including basswood, Ironwood, elm, black ash and white pine. Shrubs include red osier dogwood and gooseberry. Groundcover consists of predominantly native planted and existing species, see table 2 species observed.

12. Is the plan based on current science? Yes

Enhancing a buffer to prevent erosion and filter runoff is a documented technique for protecting lake water quality.

13. List indicators of project goals at this stage of project:

Yes, biologs are installed well with 3 foot 2x4 wood stakes and hemp rope. Plant buffer is growing well and enhancing the existing buffer at the site.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, the buffer and biologs are preventing erosion and ensuring more roots are established in the buffer zone to protect the lake from erosion and any upland runoff.

15. Are corrections or modifications needed to achieving proposed goals?

no

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Yes, there is a maintenance agreement in place with the landowner and the landowner owns a greenhouse in town and is very interested in native plants and buffers. This experience in plants will likely insure the maintenance of the project is kept up. Dedication from the landowner is often the key to successful projects.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No, none that I can tell.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No, this project does not detract from habitat.

19. Additional comments on the restoration project.

Great native shoreline enhancement and will likely be a good project in the long run. There is potential that the landowner will expand the project or install a rain garden in the future.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Meet proposed outcomes.

Confidence of outcome determination:

High.

22. Provide explanation of reason(s) for determination.

This project benefits the existing natural lakeshore and enhances native vegetation. This project provides increased protection from high water and increased wave and wake action using natural materials and native vegetation. Dedication of the landowner provides a high degree of confidence that the project will be maintained well.

23. Site Assessor(s) conducting field review: Heather Baird, Wade Johnson – MN DNR

Site Maps, Project Plans or Vegetation Tables

Table 8 Stabilization materials list for shoreline enhancement.

[illegible]

Materials & Supplies Subtotal	\$ 3,504
Earthwork / Labor (Non-tax)	\$ 1,700

Total Materials & Labor	\$ 5,204
-------------------------	----------

Table 9 List of sedges that were planted into biology. These plants were paid for from this Clean Water Fund cost share project. An addition list of plants shown in table 3 was purchased by the landowner and installed at the same time as this project.

 Plant Material List - MN Natives Landowner: Address: Phone:									
Project Name:	Sonstegard	Total Plants:	72	Est Planting Date:		Subtotal:			
Project Contact:	Logan Riedel	Total Containers:	12	Date Prepared:		MN Tax:			
Scientific Name	Common Name	Plant Type	Soil Type	Sun Exposure	Height	Size (#/tray)	No of Plants	Quantity	# of plants requested
<i>Carex comosa</i>	Bottlebrush Sedge	Sedges	W,M	F	2'	plug	6	6	36
<i>Carex pellita</i>	Woolly Sedge	Sedges	W,M	F,P	1.5-2'	plug	6	6	36

Table 10 Plant list of species purchased by landowner and installed along the shoreline and in the upland areas of the property.

 Plant Material List - Boreal Natives							
Project Name:	Sonstegard	Total Plants:	0	Est Planting Date:			
Project Contact:	Logan Riedel	Total Containers:	0	Date Prepared:			
Scientific Name	Common Name	Plant Type	Soil Type	Sun Exposure	Height	Size (#/tray)	No of Plants
<i>Amorpha canescens</i>	Lead Plant	Legumes	M, D	F, P	1-3'	plug	1
<i>Ceanothus americanus</i>	New Jersey Tea	Shrubs	M,D	F,P	2-3'	plug	1
<i>Diervilla lonicera</i>	Dwarf Bush Honeysuckle	Shrubs	D,M	P,S	3'	plug	1
<i>Spiraea alba</i>	Meadowsweet	Shrubs	W,M	F,P	4'	plug	1
<i>Spiraea tomentosa</i>	Steeplebush	Shrubs	W,M	F,P	4'	plug	1
<i>Amelanchier alnifolia</i>	Juneberry	Shrubs	M,D	F,P	4-6'	plug	1
<i>Amorpha fruticosa</i>	False Indigo	Shrubs	W-D	F,P	TO 12'	plug	1
<i>Aronia melanocarpa</i>	Common Black Chokeberry	Shrubs	W-D	F,P	3-6'	plug	1
<i>Ceanothus americanus</i>	New Jersey Tea	Shrubs	M,D	F,P	3'	plug	1
<i>Diervilla lonicera</i>	Dwarf Bush Honeysuckle	Shrubs	D	P,S	3'	plug	1
<i>Spiraea tomentosa</i>	Steeplebush	Shrubs	W,M	F,P	4'	plug	1
<i>Pinus resinosa</i>	Red Pine	Trees	M,D	F,P	50-80'	# 2	1
<i>Pinus resinosa</i>	Red Pine	Trees	M,D	F,P	50-80'	# 5	1
<i>Pinus resinosa</i>	Red Pine	Trees	M,D	F,P	50-80'	# 7	1
<i>Pinus strobus</i>	White Pine	Trees	M,D	F,P	50-80'	# 2	1
<i>Pinus strobus</i>	White Pine	Trees	M,D	F,P	50-80'	# 5	1
<i>Pinus strobus</i>	White Pine	Trees	M,D	F,P	50-80'	# 7	1
<i>Thuja occidentalis</i>	White Cedar	Trees	W,M	F,P,S		# 2	1

COST-SHARE ASSISTANCE:

This project is approved for cost-share assistance covering up to _____ % of eligible components.

1. Owner will review enclosed document to ensure the areas described, plant material chosen and treatment techniques are as you envisioned. If there are any errors or omissions please contact Logan Riedel or Brandon Dahring at (218) 846-7360 to make clarifications or changes.
2. Applications for cost share are considered by the Becker SWCD Board the third Wednesday of every month.
3. All cost-share work may only start after approved by the Becker SWCD Board.
4. The cost-share project will need to be maintained for 10 years, with set checks. *See Site Evaluations section for information.*
5. Fill or excavation resulting in more than 10 cu. yd. may require additional permitting from Becker County Zoning for soil.
6. Property boundary line must be determined by start of project.
7. Utility lines must be determined and flagged by start of project. Call MN Gopher (800)252-1166.
8. All materials used will meet the specifications of the Becker Soil & Water Conservation District.

POST-PLANTING MAINTENANCE AGREEMENT:

(LANDOWNER INITIAL)

I understand the instructions below and acknowledge these are my responsibility to follow & complete.

YEAR ONE

1. **Water** - Provide adequate water supply to the project prior to installation. New plantings and/or seeding are to be watered immediately after installation and throughout growing season (**see Watering Instructions sheet*).
2. **Weeding** - Hand-pull weeds thoroughly every two (2) weeks after flowers start to bloom and prior to seed head formation. Obtain a weed identification handbook. (*see the Identification Resources section*).
3. **No Mow Lawn Areas** (**see No Mow Lawn Instructions sheet*)
4. **Plant Identification** - Become familiar with new native plants in your project. (*see Identification Resources section*).
5. **Mulch** - if project requires (**see Mulch Instructions sheet*)
6. **Rain Garden/Drainage Area** - Check for sediment buildup, debris buildup and mulch flotation. Clean area to restore proper filtration. (**see Mulch Instructions sheet*)

YEAR TWO

1. **Dead Vegetation** - Leave dead vegetation standing in the fall to act as a buffer to keep leaves from blowing in the lake. In the spring if desired, dead vegetation may be cut back and removed. This is only necessary if the appearance of the project is a concern. Standing dried vegetation provides food and cover for birds and other wildlife.
2. **Tree Leaf Removal** - In the fall or early spring, rake or blow off tree leaves. Leaves can smother no mow lawn areas and native grasses. Oak leaves are particularly problematic.
3. **Water** - as needed during periods of drought (**see Watering Instructions sheet*).
4. **Weeding** - Conduct a thorough weeding of the site after green-up and check for weed growth every three (3) weeks. Hand pull weeds. Spot treat noxious and/or problematic weeds with herbicide only with approval of SWCD technician.
5. **No Mow Lawn Areas** (**see No Mow Lawn Instructions sheet*)
6. **Supplemental Planting** - conduct in areas with low native plant survival. Continuous vegetation cover is the goal.
7. **Rain Garden/Drainage Area** - Check for sediment buildup, debris buildup and mulch flotation. Clean area to restore proper filtration. (**see Mulch Instructions sheet*)

YEARS THREE TO TEN

1. **Dead Vegetation** - Leave dead vegetation standing in the fall to act as a buffer to keep leaves from blowing in the lake. Again and every spring following, cut back as desired. This is only necessary if the appearance of the project is a concern.
2. **Tree Leaf Removal** - In the fall or early spring, rake or blow off tree leaves. Leaves can smother no mow lawn areas and native grasses. Oak leaves are particularly problematic.
3. **Weeding** - Once a month check for weed growth and hand-pull. Spot treat noxious and/or problematic weeds with herbicide only with approval of SWCD technician.
4. **No Mow Lawn Areas** (**see No Mow Lawn Instructions sheet*)
5. **Supplemental Planting** - as necessary, continuous vegetation cover is the goal.
6. **Prescribed Burn** - Consult with a SWCD technician and obtain the necessary permits before conducting a prescribed burn. After approximately 3 years or when the vegetation becomes thick enough to carry a fire you may consider a prescribed burn. Prescribed burning is a tool that can be used for weed control, it will also help to increase flowering, seed production and germination of native plants and can reduce invasion by potentially unwanted woody vegetation. Prescribed burns may be conducted on a 3 or 4 year rotation.
7. **Rain Garden/Drainage Area** - Check for sediment buildup, debris buildup and mulch flotation. Clean area to restore proper filtration. (**see Mulch Instructions sheet*)
8. **Project Expansion** - Consider expanding the project.

Figure 20 Excerpt from landowner maintenance agreement – Becker SWCD.

SITE EVALUATIONS:

As you are enjoying your native planting take the opportunity to take photos of your planting, what plants you are seeing, and note any weed issues or concerns you might have with your planting.

Site evaluations will be conducted by a Becker SWCD technician in year 1, year 5 and year 9.

IDENTIFICATION & PERMITTING RESOURCES:

Contact a Becker SWCD technician for assistance with plant identification and/or weed concerns.

Please note Becker SWCD technicians may be unavailable for assistance with plant and weed identification during the month of May due to project workload.

NATIVE PLANT BOOKS:

1. Landscaping with Native Plants of Minnesota, 2nd Edition
by Lunn M Steiner (2005).
2. Wildflowers of Minnesota Field Guide
by Stan Tekiela (1999).

WEBSITES:

1. Minnesota Wildflowers - www.minnesotawildflowers.info
2. Morning Sky Greenery - www.morningskygreenery.com
3. Prairie Moon - www.prairiemoon.com
4. MN DNR - webapps8.dnr.state.mn.us/restoreyourshore/search

WEED HANDBOOK:

1. Weeds of the Midwestern United States and Central Canada
by Charles Bryson (2010).

MOBILE APPS:

1. PlantNet Plant Identification
2. Minnesota Wildflower Search
3. Minnesota Wildflowers



Online permitting and forms:

BECKER COUNTY:

www.co.becker.mn.us/dept/planning_zoning/forms.aspx

PELICAN RIVER WATERSHED:

prwd.org/permits/apply-permit/

MN DNR PERMITTING & REPORTING SYSTEM - (MPARS):

<https://www.dnr.state.mn.us/mpars/index.html>

COST-SHARE & SHORELAND PERMIT AGREEMENT:

I have reviewed and understand the plans and specifications and agree to complete the work accordingly. I understand I am responsible for the operation and maintenance of practices applied under this program to ensure that the conservation objective of the practice is met and the effective life, a minimum of ten (10) years, is achieved. Should I fail to maintain the practice during its effective life, I understand I am liable for up to 150% of the amount of financial assistance received to install and establish the practice, unless failure was caused by reasons beyond my control or if conservation practices that provide equivalent protection of the soil and water resources are installed. Failure to meet these plans and specifications may jeopardize any cost-share applied for.

I understand that due to numerous factors beyond their control, the Becker SWCD is unable to provide a guarantee on the plant material provided.

I understand that it is my responsibility to secure all necessary permits and licenses and to complete the work in accordance with all local, state, and federal laws. Modifications of these plans of specifications must be approved by the Becker SWCD before installation. I assume responsibility for negotiations and agreements with privately hired contractors.

LANDOWNER SIGNATURE

DATE

Figure 21 Excerpt from landowner maintenance agreement – Becker SWCD.

Table 11 List of plant species observed during site visit 09/22/2021. This list addresses only the immediate shoreline area within 8 feet of the lakeshore where project work took place. Some species may have been seeded by the landowner at a different time and listed unknown in the planted/seeded column.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Calamagrostis canadensis</i>	Canada bluejoint	1-5%	Unknown	Native
<i>Carex comosa</i>	Bottlebrush sedge	1-5%	Yes	Native
<i>Carex pellita</i>	Wooly sedge	1-5%	Yes	Native
<i>Phalaris arundinacea</i>	Reed Canary Grass	1-5%	No	Invasive
<i>Bidens vulgata</i>	Beggarticks	1-5%	No	Native
<i>Equisetum pratense</i>	Horsetail	1-5%	No	Native
<i>Impatiens capensis</i>	Spotted touch-me-not	1-5%	No	Native
<i>Lathyrus palustris</i>	Wild Pea	1-5%	Unknown	Native
<i>Lycopus americanus</i>	Water Horehound	1-5%	Unknown	Native
<i>Mentha arvensis</i>	Wild Mint	5-25%	Unknown	Native
<i>Symphyotrichum ericoides</i>	Heath aster	1-5%	Unknown	Native
<i>Taraxacum officinale</i>	Dandelion	1-5%	No	NonNative
<i>Toxicodendron radicans</i>	Poison Ivy	1-5%	No	Native
<i>Cornus sericea</i>	Red-osier dogwood	1-5%	Yes	Native
<i>Diervilla lonicera</i>	Bush Honeysuckle	1-5%	Yes	Native
<i>Ribes sp.</i>	Gooseberry	1-5%	Unknown	Native
<i>Rosa blanda</i>	Wild Rose	1-5%	Unknown	Native
<i>Spiraea alba</i>	Meadowsweet	1-5%	Yes	Native
<i>Betula papyrifera</i>	Paper birch	1-5%	No	Native
<i>Fraxinus nigra</i>	Black Ash	1-5%	No	Native
<i>Ostrya virginiana</i>	Ironwood	1-5%	No	Native
<i>Tilia americana</i>	Basswood	1-5%	No	Native
<i>Ulmus rubra</i>	Red Elm	1-5%	No	Native

Site Photographs

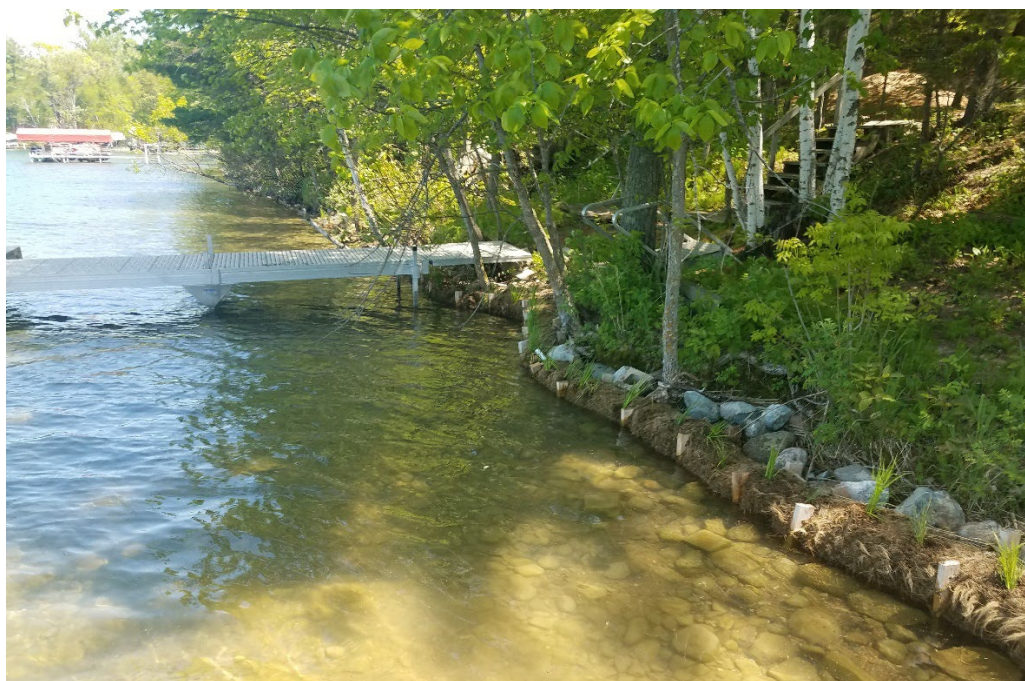


Photo 28 Coir log installed and planted with bottlebrush and wooly sedge, September 2019.



Photo 29 Coir log is well vegetated, evaluation site visit 09/22/2021.



Photo 30 End of the coir log can be seen on the left. Lower water levels in 2021 expose the natural cobble foreshore. Site evaluation visit, 09/22/2021.



Photo 31 Sedges planted into the coir log, site visit 09/22/2021.

25 Becker County Shoreline Enhancement (Island Lake – Valhalla)

Project Background

Project Name: Becker County Targeted Phosphorus Reduction and Lake Protection Project

Project Site: Becker Co Shoreline 3. Island Lake, Valhalla

Township/Range Section: Township 140 Range 038 Section 19

Project Manager / Affiliated Organization: Becker County SWCD

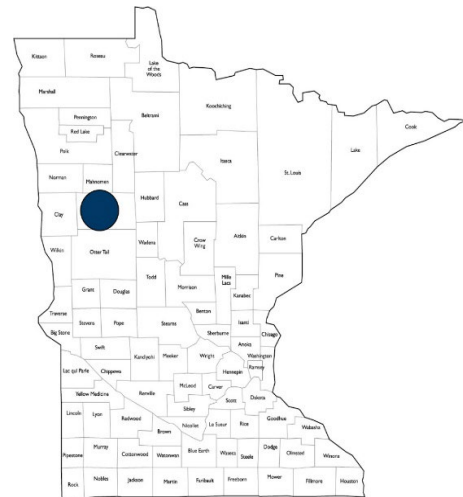
Fund: CWF **Fiscal Year Funds:** 2018

Project Start Date: Summer 2021

Predominant Habitat type: Aquatic Habitat

Additional Habitat types:

Project Status: Establishment Phase



County: Becker

Primary Activity: Lake Shore Restoration

Project Size: 150 linear feet of shoreline, 7 feet wide landward of shoreline

Project Completed: Summer 2021

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

150 feet of shoreline was stabilized with 16 inch biologs, backfilled with topsoil, soil surface secured with degradable coconut-jute erosion control blanket and planted with native perennial plugs. A video was created by Becker SWCD showcasing this project <https://www.youtube.com/watch?v=tkrFpkvACLU>

2. What plans / record of project decisions / prescription worksheets are available? Provide location for the data?

Valhalla Resort Site Visit Form, Restoration Outline, materials lists and Maintenance Agreement – Becker SWCD

3. What are the stated goals of the project?

Reduce shoreline erosion, filter upland runoff and improve shoreline habitat.

4. What are the desired outcomes of achieving the stated goals of the project?

Protect Island Lake water quality.

5. Were measures of restoration success identified in plans? No

6. **Are plan Sets available?** Yes **Have project maps been created?** No

7. **Provide list of best management practices, standards, guidelines identified in plan set?**

Materials list includes: 16 inch coir biologs, 36 inch 2x4 wood stakes and hemp rope for securing the biology and list of plant species. Cost share project maintenance agreement directs landowner management for a minimum of 10 years. A site specific plan/design was not provided.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. **Were alterations made to the plan during project implementation?**

No

9. **In what ways did alterations change the proposed project outcome?**

NA

Site Assessment

Field Review Date: 9/22/2021

Field Visit Attendees: Heather Baird, Wade Johnson – MN DNR, Bryan Malone, Logan Riedel – Becker SWCD

10. **Surrounding Landscape Characteristics:**

The project site is on a resort property with active docks and a boat launch within the site.

11. **Site Characteristics:**

a. **Soil Series:**

Snellman sandy loam, 1 to 8 percent slopes

b. **Topography:**

Gradual slope to lakeshore

c. **Hydrology:**

Upland runoff from gravel access road drains through the project site. Wave and wake from the lake makes this location susceptible to erosion.

d. **Vegetation: Plant Communities, Dominant Species & Invasives % Cover:**

Buffer area is dominated by planted species, see table 3. Surrounding upland area is predominately turf grass and patches of Reed Canary Grass. Reed Canary Grass, Barnyard Grass and Foxtail Grass are also common, but not presently dominant.

12. **Is the plan based on current science?** Portions

Yes, using biologs in the place of rip rap is a proven method to protect banks and prevent erosion from wave action. Native species planted and seeded are appropriate for the site conditions. Current best practice for site preparation would be to suppress existing invasive species with herbicide to allow planted and seeded species ample opportunity to establish without significant invasive competition. Per the landowners preference, the site was not treated with herbicide to control invasive species (Reed Canary Grass) prior to planting.

13. **List indicators of project goals at this stage of project:**

Buffers were installed to measurements. Biologs are holding bank in place preventing further erosion. Planted plug species appear to be surviving and establishing well. However, Reed Canary Grass is present in patches and will present a significant challenge to planted and seeded species establishment.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, erosion was stopped by biologs. Upland buffer will need maintenance to allow for successful establishment of native plant buffer.

15. Are corrections or modifications needed to achieving proposed goals?

Site will need more frequent maintenance and possibly some spot spraying with herbicide or hand pulling. The site could have been prepped better, killing off the non-native plants prior to installation of the native plugs. If not controlled, the non-native plants will outcompete the native plants that were installed.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Yes, the SWCD is committed to helping with maintenance at this site which will be a big help considering the non-native plants present. The landowner did not want herbicide but maybe pulling or a light tilling followed up with more tilling after weed seeds germinated would have been a method to control non-native plants prior to planting. Heavy mulch could have also been used around the native plugs.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

The project does not detract from habitat. This site is a site of boat traffic inside a cove. The buffer is between a cabin and road so there is not room for expansion of the buffer in the future.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

Yes, the site should be checked on again in a year or two to be sure native plants have become established.

19. Additional comments on the restoration project.

The project goal of filtering upland runoff would be improved by widening the 7 foot vegetated buffer by at least 3 times. However existing structures and driveways in the adjacent area prevent this.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Minimally achieved the stated goals.

21. The project will:

Minimally meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

The project succeeded in preventing further erosion using natural materials and plants. The narrow buffer strip does allow for some potential filtering of upland runoff, however this is likely only a minimal benefit to protecting water quality in Island Lake overall. There is also a possibility of non-native plants, primarily Reed Canary Grass taking over the buffer plantings.

23. *Site Assessor(s) conducting field review:* Heather Baird, Wade Johnson – MN DNR

Site Maps, Project Plans or Vegetation Tables

Below is the proposed outline of the restoration process for the Valhalla shoreline, Becker SWCD

Shoreline Restoration Outline:

Pre-Installation

1. Site Visit
 - a. Discuss resource concerns and solutions.
 - i. Wave action?
 1. Coir logs
 - a. Size based on severity of erosion.
 - ii. Upland erosion?
 1. Vegetation buffer
 - b. Discuss potential cost-share opportunities.
 - i. Grant sources and eligible practices.
 - c. Recording site features
 - i. Measurements
 - ii. Photos
 - iii. Sketches
 - iv. Equipment access
2. Project estimation and design
 - a. Quotes
 - i. Materials and labor, plant, and seed selection.

Installation Process:

1. Site Preparation
 - a. Existing vegetation removal
 - i. Chemical herbicide, mowing, dethatching etc.
2. Setting coir logs at Ordinary High-Water mark (elevation)
 - a. Stakes pounded in across from each other → 10 stakes per log.
 - b. Tying stakes and logs together (hemp rope).
3. Backfill coir logs with screened topsoil to create 3:1 slope.
 - a. Use erosion control (coconut husk) matting to hold back soil. Fold matting over itself to create “taco” with matting and topsoil.
 - i. Seed into fresh soil; stake matting into place.
4. Spread screened topsoil throughout restoration area.
 - a. Spread seed mix and quick growing cover crop throughout topsoil.
 - b. Cover fresh topsoil with erosion control straw matting.
5. Plant native plugs throughout entire restoration area.
 - a. Species selected based off traits:
 - i. Soil conditions, sun/shade amounts, plant height, color, bloom time etc.

Table 12 List of plugs planted summer 2021.

Grotnes Project Plant Material List									
Landowner:									
Address:									
Phone:									
Project Name:	Grotnes	Total Plants:	366	Est Planting Date:		Subtotal:			
Project Contact:	Logan Riedel	Total Containers:	61	Date Prepared:		MN Tax:			
Scientific Name	Common Name	Plant Type	Soil Type	Sun Exposure	Height	Size (#/tray)	No of Plants	Quantity	# of plants requested
<i>Asclepias incarnata</i>	Swamp Milkweed	Forbs	W, M	F	3-4'	plug	6	1	6
<i>Asclepias tuberosa</i>	Butterfly Weed	Forbs	M, D	F, P	1.5-2'	plug	6	2	12
<i>Aster novae-angliae</i>	New England Aster	Forbs	W, M	F, P	2-5'	plug	6	2	12
<i>Aster oolentangiensis</i>	Sky Blue Aster	Forbs	M	F, P	2-4'	plug	6	1	6
<i>Bouteloua curtipendula</i>	Sideoats Grama	Grasses	M, D	F, P	2'	plug	6	3	18
<i>Bouteloua gracilis</i>	Blue Grama	Grasses	D, M	F, P	1'	plug	6	3	18
<i>Carex bebbii</i>	Bebb's Oval Sedge	Sedges	W, M	F	3'	plug	6	5	30
<i>Carex comosa</i>	Bottlebrush Sedge	Sedges	W, M	F	2'	plug	6	5	30
<i>Carex crinita</i>	Caterpillar Sedge	Sedges	W, M	F, P, S	3'	plug	6	1	6
<i>Carex lacustris</i>	Common Lake Sedge	Sedges	W, M	F, P, S	2-4'	plug	6	1	6
<i>Carex pellita</i>	Woolly Sedge	Sedges	W, M	F, P	1.5-2'	plug	6	5	30
<i>Carex sprengelii</i>	Long Beaked Sedge	Sedges	W, D	P, S	1-2'	plug	6	1	6
<i>Carex stipata</i>	Awl Fruited Sedge	Sedges	W, M	F, P, S	2-3'	plug	6	1	6
<i>Carex stricta</i>	Tussock Sedge	Sedges	W, M	F, P	2-3'	plug	6	5	30
<i>Carex vulpinoidea</i>	Brown Fox Sedge	Sedges	W, M	F, P	3'	plug	6	1	6
<i>Chrysopsis camporum</i>	Golden Aster	Forbs	D, M	F	2'	plug	6	1	6
<i>Coreopsis lanceolata</i>	Lance Leaf Coreopsis	Forbs	D, M	F	2'	plug	6	1	6
<i>Coreopsis palmata</i>	Prairie Coreopsis	Forbs	M, D	F, P	1-2'	plug	6	1	6
<i>Dalea purpureum</i>	Purple Prairie Clover	Legumes	M, D	F	1-3'	plug	6	2	12
<i>Echinacea angustifolia</i>	Narrow Leaved Coneflower	Forbs	D, M	F	2'	plug	6	1	6
<i>Echinacea pallida</i>	Pale Purple Coneflower	Forbs	M, D	F, P	2-4'	plug	6	1	6
<i>Euthemia graminifolia</i>	Grass Leaved Goldenrod	Forbs				plug	6	1	6
<i>Iris versicolor</i>	Blue Flag Iris	Forbs	W, M	F, P	2-3'	plug	6	2	12
<i>Koeleria macrantha</i>	June Grass	Grasses	D, M	F, P	2'	plug	6	3	18
<i>Liatris aspera</i>	Rough Blazing Star	Forbs	M, D	F, P	3'	plug	6	1	6
<i>Liatris punctata</i>	Dotted Blazing Star	Forbs	M, D	F, P	1-2'	plug	6	1	6
<i>Liatris pycnostachya</i>	Prairie Blazing Star	Forbs	W, M	F	2-4'	plug	6	1	6
<i>Lobelia cardinalis</i>	Cardinal Flower	Forbs	W, M	F, P	2-5'	plug	6	1	6
<i>Lobelia siphilitica</i>	Great Blue Lobelia	Forbs	W, M	F, P	3'	plug	6	1	6
<i>Monarda punctata</i>	Spotted Bee Balm	Forbs	D	F, P	2'	plug	6	1	6
<i>Schizachyrium scoparium</i>	Little Bluestem	Grasses	M, D	F, P	1-3'	plug	6	3	18
<i>Solidago riddellii</i>	Riddell's Goldenrod	Forbs	W, M	F	3'	plug	6	1	6
<i>Verbena hastata</i>	Blue Vervain	Forbs	W, M	F	1-3.5'	plug	6	1	6

Table 13 Lakeshore seed mix used in soil behind biology. 0.5 pounds of seed was used for approximately 1000 square feet.



MNL Lakeshore Mix

8740 77th Street NE Otsego, MN 55362

Shorter grasses/sedges in this mix highlight a diverse list of wildflowers for shoreline areas. Grass/Sedge height 2-3' with taller blooming forbs.

	Scientific Name	Common Name	% of Mix	Seeds/ Sq Ft	PLS lbs/ac	Bloom Season
Grasses:	Calamagrostis canadensis	Blue-Joint Grass	2.00	14.40	0.14	
	Poa palustris	Fowl Bluegrass	8.00	26.74	0.56	
Sedges/Rushes:	Carex comosa	Bottlebrush Sedge	6.00	4.63	0.42	
	Carex lacustris	Lake Sedge	0.50	0.14	0.04	
	Carex retrorsa	Knotsheath Sedge	7.00	1.98	0.49	
	Carex scoparia	Broom Sedge	6.00	12.96	0.42	
	Carex stipata	Common Fox Sedge	5.00	4.37	0.35	
	Carex vulpinoidea	Fox Sedge	9.50	19.79	0.67	
	Schoenoplectus tabernaemontani	Softstem Bulrush	5.00	3.99	0.35	
	Scirpus atrovirens	Green Bulrush	2.00	23.65	0.14	
	Scirpus cyperinus	Woolgrass	1.50	65.56	0.11	
	Bolboschoenus fluviatilis	River Bulrush	5.00	0.55	0.35	
Forbs:	Acorus americanus	Sweet Flag	5.25	0.89	0.37	Summer
	Alisma subcordatum	American Water Plantain	2.00	3.09	0.14	Summer
	Anemone canadensis	Canada Anemone	1.00	0.21	0.07	Spring
	Asclepias incarnata	Swamp Milkweed	6.50	0.80	0.46	Summer
	Chamerion angustifolium	Fireweed	0.25	3.21	0.02	Summer
	Eutrochium maculatum	Joe-Pye Weed	2.00	4.89	0.14	Summer
	Eupatorium perfoliatum	Boneset	0.50	2.06	0.04	Fall
	Helenium autumnale	Sneezeweed	1.55	5.18	0.11	Fall
	Iris versicolor	Northern Blue Flag Iris	4.00	0.13	0.28	Spring
	Liatris ligulistylis	Meadow Blazing Star	0.50	0.13	0.04	Summer
	Liatris pycnostachya	Prairie Blazing Star	2.00	0.57	0.14	Summer
	Lobelia siphilitica	Great Blue Lobelia	0.75	9.64	0.05	Summer
	Lythrum alatum	Winged Loosestrife	0.50	12.15	0.04	Summer
	Mimulus ringens	Monkey Flower	0.50	29.57	0.04	Summer
	Pycnanthemum virginianum	Mountain Mint	0.25	1.41	0.02	Summer
	Rosa blanda	Smooth Rose	3.25	0.22	0.23	Summer
	Sparganium eurycarpum	Giant Burreed	5.50	0.07	0.39	Summer
	Symphyotrichum novae-angliae	New England Aster	2.00	3.39	0.14	Fall
	Verbena hastata	Blue Vervain	2.00	4.78	0.14	Summer
	Vernonia fasciculata	Ironweed	2.00	1.23	0.14	Summer
	Veronicastrum virginicum	Culver's Root	0.20	4.11	0.01	Summer
			100.00	266.49	7.00	
Seeds/sq ft:			266.00			
Grass Species:			2			
Sedges/Rushes:			10			
Forb Species:			21			

Seed mixes are subject to change based on availability

Table 14 Plant species observed within the planted buffer area during site visit 09/22/2021. 17 of the 33 species of plugs planted were observed.

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Bouteloua gracilis</i>	Blue Grama	1-5%	Yes	Native
<i>Carex lacustris</i>	Lake sedge	1-5%	Yes	Native
<i>Carex sprengei</i>	Long Beaked Sedge	1-5%	Yes	Native
<i>Carex vulpinoidea</i>	Brown Fox Sedge	1-5%	Yes	Native
<i>Echinochloa crus-galli</i>	Barnyard Grass	5-25%	No	Nonnative
<i>Phalaris arundinacea</i>	Reed Canary Grass	1-5%	No	Invasive
<i>Schizachyrium scoparium</i>	Little Bluestem	1-5%	Yes	Native
<i>Setaria pumila</i>	yellow foxtail	1-5%	No	Nonnative
<i>Asclepias incarnata</i>	Swamp Milkweed	1-5%	Yes	Native
<i>Aster novae-angliae</i>	New England Aster	1-5%	Yes	Native
<i>Aster oolentangiensis</i>	Sky Blue Aster	1-5%	Yes	Native
<i>Coreopsis lanceolata</i>	Lance Leaf Coreopsis	1-5%	Yes	Native
<i>Dalea purpurea</i>	Purple Prairie Clover	1-5%	Yes	Native
<i>Echinacea pallida</i>	Pale Purple Coneflower	1-5%	Yes	Native
<i>Impatiens capensis</i>	Spotted touch-me-not	1-5%	No	Native
<i>Iris versicolor</i>	Blue Flag Iris	1-5%	Yes	Native
<i>Liatris sp.</i>	Blazing Star	1-5%	Yes	Native
<i>Lobelia cardinalis</i>	Cardinal Flower	1-5%	Yes	Native
<i>Lobelia siphilitica</i>	Blue Lobelia	1-5%	Yes	Native
<i>Solidago riddellii</i>	Riddell's Goldenrod	1-5%	Yes	Native
<i>Taraxacum officinale</i>	Dandelion	1-5%	No	Native
<i>Trifolium pratense</i>	Red Clover	1-5%	No	Native
<i>Verbena hastata</i>	Blue Vervain	1-5%	Yes	Native
<i>Vernonia fasciculata</i>	Ironweed	1-5%	Yes	Native

Site Photographs



Photo 32 Project installation, summer 2021.



Photo 33 Biolog, coconut fiber blanket and plug plantings installed, summer 2021.



Photo 34 Establishing vegetation observed during site visit 09/22/2021.



Photo 35 Planted plug species are surviving and form dominant cover in the buffer. However weedy species such as barnyard grass in this photo and Reed Canary Grass are common and will need to be managed to enable planted species to flourish.

26 Becker County Shoreline Enhancement (Strawberry Lake)

Project Background

Project Name: Becker County Phosphorus Reduction and Lake Protection

Project Site: Becker Co Shoreline 1. Strawberry Lake

Township/Range Section: Township 141 Range 039 Section 2

Project Manager / Affiliated Organization: Becker County SWCD

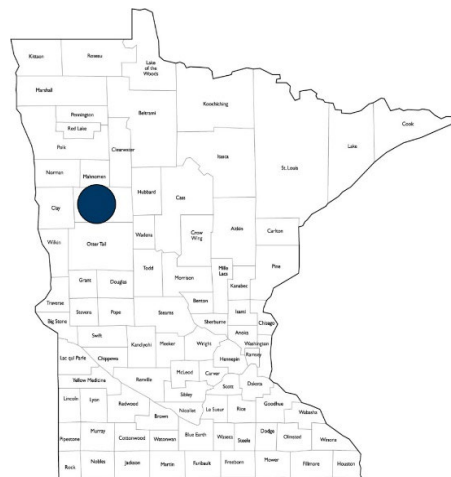
Fund: CWF **Fiscal Year Funds:** 2018

Project Start Date: March 2020

Predominant Habitat type: Forest

Additional Habitat types: Aquatic

Project Status: Establishment Phase



County: Becker

Primary Activity: Lake Shore Enhancement

Project Size: 50 linear feet of shoreline, approximately 40 feet upslope

Project Completed: April 2020

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. What are the specific project components and treatments?

A seep in slope above Strawberry Lake was causing a slump and localized slope instability that could threaten an upslope stairway. Live willow fascines, live stakes of willow and dogwood and a woodland native seed mix were used to stabilize the sluffing section of the slope.

From the project plan:

- “Live staking throughout the bluff.
 - Sandbar Willow collected in NW Becker County.
 - Red-osier Dogwood collected in NW Becker County and ordered through annual Becker SWCD tree order.
- Three fascine lines with cut Sand Willow live stakes.
 - 2 lines @ roughly 20ft long
 - 1 line @ roughly 10ft long
 - 4” – 6” diameter for the logs
 - Stems ¼”-2” diameter

- Broadcast Minnesota Woodland Mix of 28 species, ordered from Minnesota Native Landscapes, throughout entire project area.
- Thin out canopy cover around the project area.

Cutting a few larger trees to allow more sunlight to reach the project area. This is most likely the cause of the initial problem—because of established trees blocking out sun, which then causes very minimal understory growth. A lack of root structure and constant groundwater flow has created tough growing conditions.”

2. *What plans / record of project decisions / prescription worksheets are available? Provide location for the data?*

Strawberry Lake Bluff/Slope Restoration project plan – Becker SWCD

3. *What are the stated goals of the project?*

Establish native vegetation to prevent substantial further slope failure and protect upslope structures.

4. *What are the desired outcomes of achieving the stated goals of the project?*

Maintain water quality in Strawberry Lake by reducing eroded soil entering the lake.

5. *Were measures of restoration success identified in plans?* No

6. *Are plan Sets available?* Yes ***Have project maps been created?*** No

7. *Provide list of best management practices, standards, guidelines identified in plan set?*

Live staking, live willow fascines, broadcast native seed

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

8. *Were alterations made to the plan during project implementation?*

Yes

Pussy Willow (*Salix discolor*) was predominantly used for live stakes due to availability, versus Sandbar Willow (*Salix interior*) indicated in the plan.

9. *In what ways did alterations change the proposed project outcome?*

This alteration does not change project outcomes.

Site Assessment

Field Review Date: 9/22/2021

Field Visit Attendees: Heather Baird, Wade Johnson – MN DNR, Bryan Malone, Logan Riedel – Becker SWCD

10. *Surrounding Landscape Characteristics:*

Rural cabins in mixed hardwood-conifer forest. This section of the lakeshore has steep 20-30% slopes

11. *Site Characteristics:*

a. *Soil Series:*

Snellman-Sugarbush complex, 15 to 30 percent slopes

b. *Topography:*

Steep 20-30% slope to a shallow gradient shoreline

c. *Hydrology:*

An apparently ephemeral seep discharges from the center of the project area. It does not appear that the site receives any directed flow from upslope.

d. Vegetation: Plant Communities, Dominant Species & Invasives % Cover:

Northern mixed hardwood-conifer forest. Common species include: Canopy: Sugar Maple, Hop hornbeam, Balsam Fir, and White Spruce. Shrubs: Sandbar and Pussy Willow (planted), Red-osier Dogwood. Groundcover: Jewelweed, Horsetails, Meadow Rue, Zig Zag Goldenrod

12. Is the plan based on current science? Yes

The use of live fascines and live stakes to stabilize a shoreline bank is based in current science.

Project plan states that live stakes will be cut and installed prior to budding, which is well documented for having the greatest success in growth after staking. An appropriate native seed mix for the woodland site was utilized.

13. List indicators of project goals at this stage of project:

Bank appears stable and any potential eroded soil from the sluffing bank is not reaching the lake. There is some growth of dogwood and willow live stakes and willow in fascines. Though it appears that several of the willow live stake's aerial growth from 2020 has died, there are new shoots of these willows emerging throughout the project site. 5 of the 28 seeded species were observed.

14. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project goals?

Yes, goal of stabilizing the site with native vegetation appears to be achieved. Heavy shade and slow growth of native plants from seed are limiting factors.

15. Are corrections or modifications needed to achieving proposed goals?

Future steps appear to be to monitor site. More plugs vs. seed could have been used to get more immediate growth vs seed that takes more time to germinate and get good roots established. Additional bare root trees could be added in the future. According to project managers the seep in the slope that caused this slope slumping has significantly reduced in flow 2021 compared to the past three years of observation. This could be a result of recent drier conditions and if the seep increases flow in coming years the slope should be monitored.

16. Do proposed or planned future steps, including long term management, appear practical and reasonable? Were or are there any opportunities to improve project goals/outcomes? What are the potential challenges or limitations?

Yes, the vegetation cover is well established. The site should be monitored in case of potential future slumping as it appears to be a natural seep.

17. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No detracting to habitat.

18. Are follow-up assessments by the Restoration Evaluation Program needed? Explain.

No. The site appears stable and will just need time to grow.

19. Additional comments on the restoration project.

Nice use of bioengineering on a tough access site. Continued monitoring by local SWCD will ensure success of this project. The project plan states that overstory trees creating excessive shade was "likely the cause of the initial problem—because of established trees blocking out sun, which then causes very minimal understory growth". It appears that this seep is a naturally occurring phenomenon, as there has not been any local land or hydrologic alteration. Though the overstory trees create significant shade,

these trees root systems likely provide the greatest stability to the slope and any removal should be managed conservatively. It appears that very few trees were removed as part of the project.

Project Evaluation

Projects can be designated as likely to not meet proposed outcomes, minimally meet proposed outcomes, meet proposed outcomes, or exceed proposed outcomes with a low, medium or high degree of confidence in the determination.

20. The project has:

Achieved the stated goals.

21. The project will:

Minimally meet proposed outcomes.

Confidence of outcome determination:

Medium.

22. Provide explanation of reason(s) for determination.

The goal of stabilizing the sluffing slope with native vegetation has been achieved. The larger outcome of maintaining water quality in Strawberry Lake through reduced sediment is likely only minimally be achieved through this project.

23. Site Assessor(s) conducting field review: Heather Baird, Wade Johnson – MNDNR

Site Maps, Project Plans or Vegetation Tables

Below is the project plan from Becker County SWCD:

Taylor, Richard (Strawberry Lake)

Bluff/Slope Restoration

Project plan:

- Live staking throughout the bluff.
 - Sandbar Willow collected in NW Becker County.
 - Red-osier Dogwood collected in NW Becker County and ordered through annual Becker SWCD tree order.
- Three fascine lines with cut Sand Willow live stakes.
 - 2 lines @ roughly 20ft long
 - 1 line @ roughly 10ft long
 - 4" – 6" diameter for the logs
 - Stems ¼"-2" diameter
- Broadcast Minnesota Woodland Mix of 28 species, ordered from Minnesota Native Landscapes, throughout entire project area. *See seed mix within folder.*
 - Goal is for full establishment, but realizing any establishment is better than none.
- Thin out canopy cover around the project area.
 - Cutting a few larger trees to allow more sunlight to reach the project area. This is most likely the cause of the initial problem—because of established trees blocking out sun, which then causes very minimal understory growth. A lack of root structure and constant groundwater flow has created tough growing conditions.

Project materials:

Project materials needed are inexpensive, but labor will dominate the final project costs. Collecting live stakes and installing project will be planned for two separate days; SWCD staff will pursue 50% cost-share.

Project timeline:

Plant material collection and project installation will occur before species selected reach budding stage, around the final weeks of April.



MNL Minnesota Woodland Mix

8740 77th Street NE Otsego, MN 55362

Shade tolerant mix for woodland understories with 75-100% tree cover
Height 2-10'

	Scientific Name	Common Name	% of Mix	Seeds/ Sq Ft	PLS lbs/ac	Bloom Season
Grasses:	Bromus pubescens	Hairy Wood Chess	5.00	1.40	0.50	
	Elymus hystrix	Bottlebrush Grass	23.00	6.42	2.30	
	Elymus villosus	Silky Wild Rye	23.00	4.65	2.30	
Sedges/Rushes:	Carex blanda	Eastern Woodland Sedge	2.00	0.92	0.20	
	Carex radiata	Eastern Star Sedge	6.00	9.04	0.60	
	Carex sprengelii	Long-Beaked Sedge	12.00	4.41	1.20	
Shrubs:	Cornus alternifolia	Pagoda Dogwood	3.00	0.01	0.30	Spring
	Sambucus racemosa	Red Elderberry	1.00	0.40	0.10	Spring
Forbs:	Agastache foeniculum	Fragrant Giant Hyssop	0.75	2.48	0.08	Summer
	Allium tricoccum	Wild Leek	1.25	0.06	0.13	Summer
	Anemone canadensis	Canada Anemone	0.60	0.18	0.06	Spring
	Anemone virginiana	Tall Thimbleweed	0.80	0.82	0.08	Summer
	Aquilegia canadensis	Columbine	0.75	1.05	0.08	Spring
	Campanula americana	Tall Bellflower	0.40	2.50	0.04	Fall
	Caulophyllum thalictroides	Blue Cohosh	7.50	0.02	0.75	Spring
	Cryptotaenia canadensis	Honewort	1.25	0.32	0.13	Summer
	Dicentra cucullaria	Dutchman's Breeches	0.05	0.03	0.01	Spring
	Eupatorium rugosum	White Snakeroot	0.10	0.55	0.01	Fall
	Eurybia macrophylla	Large-leaved Aster	1.00	0.99	0.10	Fall
	Geranium maculatum	Wild Geranium	0.40	0.07	0.04	Spring
	Maianthemum racemosum	Solomon's Plume	3.00	0.04	0.30	Spring
	Mitella diphylla	Bishop's Cap	0.10	0.21	0.01	Spring
	Polemonium reptans	Jacob's Ladder	0.20	0.13	0.02	Spring
	Polygonatum biflorum	Solomons Seal	3.00	0.09	0.30	Spring
	Rudbeckia laciniata	Wild Golden Glow	1.00	0.51	0.10	Summer
	Rudbeckia triloba	Brown-Eyed Susan	1.00	1.25	0.10	Summer
	Sanguinaria canadensis	Bloodroot	0.10	0.01	0.01	Spring
	Thalictrum dioicum	Early Meadow Rue	0.75	0.20	0.08	Spring
	Uvularia grandiflora	Yellow Bellwort	1.00	0.03	0.10	Spring
			100.00	38.78	10.00	

Seeds/sq ft: 39.00
Grass Species: 2
Sedge Species: 3
Shrub Species: 2
Forb Species: 21

Seed mixes are subject to change based on availability

Figure 22 Woodland seed mix utilized. 0.25 pounds was used to cover less than 1000 square feet.

Table 15 List of species observed during site visit 09/22/2021

Scientific Name	Common Name	Cover Range	Species Planted/Seeded	Species Status
<i>Bromus pubescens</i>	Hairy Wood Chess	1-5%	Yes	Native
<i>Elymus villosus</i>	Silky Wild Rye	5-25%	Yes	Native
<i>Carex blanda</i>	Eastern Woodland Sedge	1-5%	Yes	Native
<i>Carex sprengei</i>	Long-Beaked Sedge	1-5%	Yes	Native
<i>Chamaenerion angustifolium</i>	Fireweed	1-5%	No	Native
<i>Equisetum hyemale</i>	Tall Scouring Rush	25-50%	No	Native
<i>Equisetum pratense</i>	Meadow Horsetail	25-50%	No	Native
<i>Impatiens capensis</i>	Spotted Touch-me-not	25-50%	No	Native
<i>Lactuca</i> sp	Wild Lettuce	1-5%	No	Native
<i>Solidago flexicaulis</i>	Zigzag Goldenrod	5-25%	No	Native
<i>Sonchus oleraceus</i>	Sowthistle	1-5%	No	NonNative
<i>Symphyotrichum lateriflorum</i>	Calico Aster	1-5%	No	Native
<i>Thalictrum dioicum</i>	Early Meadow Rue	1-5%	Yes	Native
<i>Urtica dioica</i>	Stinging nettle	1-5%	No	Native
<i>Cornus sericea</i>	Red Osier Dogwood	5-25%	Yes	Native
<i>Salix discolor</i>	Pussy Willow	5-25%	Yes	Native
<i>Salix interior</i>	Sandbar Willow	25-50%	Yes	Native
<i>Abies balsamifera</i>	Balsam Fir	1-5%	No	Native
<i>Acer saccharum</i>	Sugar Maple	5-25%	Yes	Native
<i>Ostrya virginiana</i>	Ironwood	1-5%	No	Native
<i>Picea glauca</i>	White Spruce	1-5%	No	Native

Site Photographs



Photo 36 Top of sluffing slope pre-project 2019.



Photo 37 Bottom of sluffing slope pre-project 2019. Adjacent lakeshore is visible in the upper right.



Photo 38 Harvesting willow for the project, April 2020.



Photo 39 Site Conditions immediately prior to installation.



Photo 40 Installation of fascines and live stakes, April 2020.



Photo 41 Revegetated area during site visit 09/22/2021



Photo 42 Shoots from successful Dogwood stakes at the bottom of the slope.