



LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES

100 REV. DR. MARTIN LUTHER KING JR. BLVD.
ROOM 65 STATE OFFICE BUILDING
ST. PAUL, MINNESOTA 55155-1201

Phone: (651) 296-2406
Email: lccmr@lccmr.mn.gov
Web: www.lccmr.mn.gov

Becca Nash, Director

Date: January 13, 2023

To: Governor Tim Walz
Chair, Senate Finance Committee, Senator John Marty
Minority Lead, Senate Finance Committee, Senator Eric Pratt
Chair, Senate Environment, Climate, and Legacy Committee, Senator Foung Hawj
Minority Lead, Senate Environment, Climate, and Legacy Committee, Senator Justin Eichorn
Chair, House Ways and Means Committee, Representative Liz Olson
Minority Lead, House Ways and Means Committee, Representative Pat Garofalo
Chair, House Environment and Natural Resources Finance and Policy Committee, Representative Rick Hansen
Minority Lead, House Environment and Natural Resources Finance and Policy Committee, Representative Josh Heintzman
Legislative Reference Library

From: Legislative-Citizen Commission on Minnesota Resources (LCCMR)

Subject: Biennial Report required by M.S. 116P.09, Subd. 7

The LCCMR biennial report as required in M.S. 116P.09, Subd. 7 from the Legislative-Citizen Commission on Minnesota Resources (LCCMR) due January 15, 2023 is hereby transmitted. It is available in a CD or print format upon request or on the LCCMR web site at:

https://www.lccmr.leg.mn/documents/biennial_rpt/2023/2023_biennial_report.html.

The report covers LCCMR actions from January 1, 2021 to December 31, 2022, including summaries of past funding accomplishments and new recommendations for funding from the Environment and Natural Resources Trust Fund (ENRTF).

There is \$79,644,000 available for expenditure in each year of the FY24-25 biennium from the ENRTF (for a biennial total of \$159,288,000). The amount available for expenditure is determined by the Minnesota Constitution, which states: "The amount appropriated each year of a biennium....may be up to 5.5% of the market value of the fund on June 30 one year before the start of the biennium". The value of the ENRTF on June 30, 2022 was \$1,448,074,000.

The LCCMR is making a funding recommendation to the 2023 Legislature totaling \$79,833,000 (FY24) which includes \$79,644,000 from the ENRTF and \$189,000 from the Great Lakes Protection Account (GLPA). \$79,644,000 (FY25) would be available for recommendation by the LCCMR to the 2024 Legislature. As stated in M.S. 116P, the LCCMR may make an annual or a biennial funding recommendation.

The list of FY24 recommended appropriations totaling \$79,833,000 from the ENRTF and GLPA is provided in "Section V. Recommendations." The projects and funding levels were adopted by the LCCMR on August 30, 2022. The proposed legislative bill language is pending review by LCCMR at our upcoming meeting in January.

LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES

Please let me know if you have questions or would like additional discussion. Thank you for the opportunity to serve the Legislature in this capacity.

Sincerely,

A handwritten signature in blue ink that reads "Becca Nash".

Becca Nash, Director
On behalf of the LCCMR

cc: LCCMR Members as of January 13, 2023

Legislative-Citizen
Commission
on
Minnesota Resources

Biennial Report
January 15, 2023



Pursuant to: M.S. 116P.09, Subd. 7

Commission Members

LCCMR Membership January 1, 2021 – January 1, 2023

REPRESENTATIVES

Rep. Patty Acomb
Rep. Rob Ecklund
(delegated Rep. Kelly Morrison 1/2022)
Rep. Rick Hansen*
Rep. Dale Lueck
Rep. Kelly Morrison
Rep. Tama Theis*

SENATORS

Sen. Gary Dahms
Sen. Kari Dziedzic*
Sen. Foung Hawj
Sen. Bill Ingebrigtsen*
Sen. David Tomassoni
(delegated Sen. Gary Dahms 5/2022)
Sen. Torrey Westrom

APPOINTED NON-LEGISLATIVE MEMBERS

GOVERNOR APPOINTMENTS

Rita Albrecht
(appointed: 4/5/2021 - term ends: 12/31/2024)
William Faber*
(appointed: 3/7/2022 - term ends: 12/31/2025)
Nancy Gibson*
(appointed: 4/5/2021 - term ends: 12/31/2023)
Seth Moore
(appointed: 3/7/2022 - term ends: 12/31/2025)
Jeremy Peichel
(appointed: 4/19/2021 - term ends: 12/31/2024)
Della Young
(appointed: 12/20/2017 - term ends: 12/31/2021)

SENATE APPOINTMENTS

Michael Reese
(appointed: 5/24/2018 - term ends: 12/31/2021)

HOUSE OF REPRESENTATIVES APPOINTMENT

Denny McNamara
(appointed: 5/2/2018 - term ends: 12/31/2021)
Shona Langseth
(appointed: 12/22/2021 - term ends: 12/31/2025)

LCCMR Staff

Becca Nash, Director
Michael Lind Varien, Senior Project Analyst
Corrie Layfield, Senior Project Analyst
Mike Campana, Senior Project Analyst
Diana Griffith, Commission Assistant

Legislative-Citizen Commission on Minnesota Resources
Room 65, State Office Building
100 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, MN 55155

Phone: (651) 296-2406
E-Mail: lccmr@lccmr.mn.gov
Web: www.lccmr.mn.gov

*Denotes Executive Committee Members

**Legislative-Citizen Commission on Minnesota Resources
Biennial Report to the Legislature, M.S. 116P.09, Subd. 7
January 15, 2023**

TABLE OF CONTENTS

- I. Strategic Plan**
“a copy of the current strategic plan;”
 - A. Six Year Strategic Plan
 - B. Request for Proposal Funding Priorities for M.L. 2021 and M.L. 2022
- II. Projects Funded Preceding Biennium**
“a description of each project receiving money from the trust fund during the preceding biennium;”
Project Abstracts for Laws 2021 and 2022
- III. Completed Research Projects**
“a summary of any research project completed in the preceding biennium;”
Project Abstracts of all projects completed between January 1, 2021 – December 31, 2022, including research.
- IV. Agency Implementation**
“recommendations to implement successful projects and programs into a state agency’s standard operations;”
- V. Recommendations**
“to the extent known by the commission, descriptions of the projects anticipated to be supported by the trust fund during the next biennium;”
- VI. Revenues and Distributions**
“the source and amount of all revenues collected and distributed by the commission, including all administrative and other expenses;”
- VII. Assets and Liabilities**
“a description of the assets and liabilities of the trust fund;”
- VIII. Findings to Legislature**
“any findings or recommendations that are deemed proper to assist the legislature in formulating legislation;”
Capital Projects Report
- IX. Gifts and Donations**
“a list of all gifts and donations with a value over \$1,000;”
- X. Environmental Spending Comparisons**
“a comparison of the amounts spent by the state for environment and natural resources activities through the most recent fiscal year; and”
- XI. Compliance Audit**
“a copy of the most recent compliance audit.”

APPENDIX A

- Environment and Natural Resources Trust Fund Constitutional Language
- M.S. 116P, The Minnesota Environment and Natural Resources Trust Fund (Trust Fund)
- M.S. 116Q.02, Great Lakes Protection Account
- M.S. 4.071, Oil Overcharge Money

I. Strategic Plan / RFP

“a copy of the current strategic plan...”

The following documents include:

- A. Six Year Strategic Plan – Adopted July 1, 2020
- B. Request for Proposal (RFP)
 - 1. RFP adopted January 16, 2020 for FY2022 (funding beginning July 1, 2021)
 - 2. RFP adopted December 17, 2020 for FY2023 (funding beginning July 1, 2022)

LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES (LCCMR)

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund



**Revised and Adopted
December 10, 2013**

**Readopted
July 1, 2020**

Jeff Broberg, Tom Cook, Sen. Gary Dahms, Sen. Kari Dziedzic, William Faber, Rep. Dan Fabian, Nancy Gibson, Bonnie Harper-Lore, John Herman, Sen. John Hoffman, Rep. Leon Lillie, Norman Moody, Rep. John Persell, Sen. David Tomassoni, Rep. Paul Torkelson, Rep. Jean Wagenius, Sen. Torrey Westrom

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

Legislative-Citizen Commission on Minnesota Resources

The Legislative-Citizen Commission on Minnesota Resources (LCCMR) is made up of 17 members: 5 Senators, 5 Representatives, 5 citizens appointed by the governor, 1 citizen appointed by the Senate, and 1 citizen appointed by the House. The function of the LCCMR is to make funding recommendations to the legislature for special environment and natural resource projects, primarily from the Environment and Natural Resources Trust Fund (ENRTF). The LCCMR developed from a program initiated in 1963. Since 1963, nearly \$800 million has been appropriated to more than 1,800 projects recommended to the legislature by the Commission to protect and enhance Minnesota's environment and natural resources.

Contact Information

Phone: (651) 296-2406

Email: lccmr@lccmr.leg.mn

Website: <http://www.lccmr.leg.mn>

Address: 100 Rev. Dr. Martin Luther King Jr. Blvd.

State Office Building Room 65

Saint Paul, Minnesota 55155

Availability of this Publication

- Information from this document may be copied and distributed to others.
- This publication can be made available in alternate formats, such as large print or audio formats, upon request. Contact (651) 296-2406 or lccmr@lccmr.leg.mn.

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

TABLE OF CONTENTS

I.	Overview	3
II.	Background	4
	A. Governing Law for Environment and Natural Resources Trust Fund	4
	B. About Minnesota's Environment and Natural Resources Trust Fund	5
	C. About the Legislative-Citizen Commission on Minnesota Resources	6
	D. Legislative-Citizen Commission on Minnesota Resources Proposal and Funding Process	6
	E. Vision and Mission Statements for Minnesota's Environment and Natural Resources Trust Fund	6
III.	Six-Year Strategic Plan for the Environment and Natural Resources Trust Fund	8
	A. Strategic Plan Development and Implementation	8
	B. General Issues and Framework for Six-Year Strategic Plan	8
	C. Funding Priority Areas of the Request for Proposal	9
	D. Goals of Six-Year Strategic Plan	9
	E. Strategies for Six-Year Strategic Plan	10
	F. Outcomes for the Environment and Natural Resources Trust Fund	11
	G. Relationship of Environment and Natural Resources Trust Fund to Other State Funds and Programs	11
IV.	Most Recent Request for Proposal (RFP)	13
	Appendix 1: Environment and Natural Resources Plans, Documents and Reports	29

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

I. OVERVIEW

The Environment and Natural Resources Trust Fund (ENRTF) is a permanent dedicated fund in the Minnesota state treasury that was established by 77% voter approval of a constitutional amendment in 1988. The amendment directs forty percent of net proceeds from the Minnesota State Lottery, or approximately seven cents of every dollar spent on playing the lottery, into the ENRTF, where the money is then invested by the State Board of Investment for continued growth. The ENRTF is intended to provide a long-term, stable source of funding for innovative and far-sighted activities that protect, conserve, preserve, and enhance the state's air, water, land, fish, wildlife, and other natural resources. Up to 5.5% of the existing market value of the ENRTF can be expended on these types of activities each year.

Under Minnesota Statute (MS) 116P.05, Subdivision 2, the Legislative-Citizen Commission on Minnesota Resources (LCCMR) is tasked with making recommendations to the Minnesota Legislature for expenditures from the ENRTF. As part of that responsibility, per MS 116P.08, Subdivision 3, the LCCMR must develop, adopt, and periodically review and update a strategic plan intended to look ahead and help guide investments of the ENRTF on a six-year basis.

Minnesota Statutes, Chapter 116P. Environment and Natural Resources Trust Fund

116P.08 TRUST FUND EXPENDITURES

Subdivision 3. Strategic plan required.

- (a) The commission shall adopt a strategic plan for making expenditures from the trust fund, including identifying the priority areas for funding for the next six years. The strategic plan must be reviewed every two years. The strategic plan must have clearly stated short- and long-term goals and strategies for trust fund expenditures, must provide measurable outcomes for expenditures, and must determine areas of emphasis for funding.*
- (b) The commission shall consider the long-term strategic plans of agencies with environment and natural resource programs and responsibilities and plans of conservation and environmental organizations during the development and review of the strategic plan.*

This document, *Six-Year Strategic Plan for the Environment and Natural Resources Trust Fund*, was developed through deliberative consensus by the LCCMR and is intended to fulfill the duties indicated in MS 116P.08, Subd. 3. It consists of two main components:

1. This document outlining general goals, strategies, and areas of emphasis for funding from the ENRTF.
2. Request for Proposal (RFP) documents issued on an annual or biennial basis outlining more delineated areas of emphasis. Once issued, RFP documents are appended to and shall be considered an extension of and update to this document.

Additionally, other documents used in developing and updating the plan are appended to this document as supplemental information as needed or appropriate.

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

II. BACKGROUND

A. Governing Law for Environment and Natural Resources Trust Fund

The Environment and Natural Resources Trust Fund (ENRTF) is governed by Minnesota Constitution Article XI, Section 14, and Minnesota Statute (MS) Chapter 116P.

Minnesota Constitution Article XI, Sec.14

Sec. 14. Environment and Natural Resources Trust Fund. *A permanent environment and natural resources trust fund is established in the state treasury. Loans may be made of up to five percent of the principal of the fund for water system improvements as provided by law. The assets of the fund shall be appropriated by law for the public purpose of protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources. The amount appropriated each year of a biennium, commencing on July 1 in each odd-numbered year and ending on and including June 30 in the next odd-numbered year, may be up to 5-1/2 percent of the market value of the fund on June 30 one year before the start of the biennium. Not less than 40 percent of the net proceeds from any state-operated lottery must be credited to the fund until the year 2025. [Adopted, November 8, 1988; Amended, November 6, 1990; November 3, 1998]*

NOTE: The "other natural resources" cited in Article XI, Section 14 of the Minnesota Constitution, as it pertains to the ENRTF, is further defined in MS 116P.02, Subdivision 5, as follows:

116P.02 Definitions

Subdivision 5. Natural resources.

"Natural resources" includes the outdoor recreation system under section 86A.04 and regional recreation open space systems as defined under section 473.351, subdivision 1.

MS 86A.04 Composition of System

The outdoor recreation system shall consist of all state parks; state recreation areas; state trails established pursuant to sections 84.029, subdivision 2, 85.015, 85.0155, and 85.0156; state scientific and natural areas; state wilderness areas; state forests; state wildlife management areas; state aquatic management areas; state water access sites, which include all lands and facilities established by the commissioner of natural resources or the commissioner of transportation to provide public access to water; state wild, scenic, and recreational rivers; state historic sites; state rest areas, which include all facilities established by the commissioner of transportation for the safety, rest, comfort and use of the highway traveler, and shall include all existing facilities designated as rest areas and waysides by the commissioner of transportation; and any other units not listed in this section that are classified under section 86A.05. Each individual state park, state recreation area, and so forth is called a "unit."

MS 473.351 Metropolitan Area Regional Parks Funding

Subdivision 1. Definitions.

(d) "Regional recreation open space systems" means those parks that have been designated by the Metropolitan Council under section 473.145.

Permissible expenditures from the ENRTF are indicated in MS 116P.08, Subdivision 1, and prohibited expenditures are delineated in MS 116P.08, Subdivision 2.

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

Minnesota Statutes, Chapter 116P. Environment and Natural Resources Trust Fund

116P.08 TRUST FUND EXPENDITURES

Subdivision 1. Expenditures.

Money in the trust fund may be spent only for:

- (1) the reinvest in Minnesota program as provided in section 84.95, subdivision 2;*
- (2) research that contributes to increasing the effectiveness of protecting or managing the state's environment or natural resources;*
- (3) collection and analysis of information that assists in developing the state's environmental and natural resources policies;*
- (4) enhancement of public education, awareness, and understanding necessary for the protection, conservation, restoration, and enhancement of air, land, water, forests, fish, wildlife, and other natural resources;*
- (5) capital projects for the preservation and protection of unique natural resources;*
- (6) activities that preserve or enhance fish, wildlife, land, air, water, and other natural resources that otherwise may be substantially impaired or destroyed in any area of the state;*
- (7) administrative and investment expenses incurred by the State Board of Investment in investing deposits to the trust fund; and*
- (8) administrative expenses subject to the limits in section 116P.09.*

Subdivision 2. Exceptions.

Money from the trust fund may not be spent for:

- (1) purposes of environmental compensation and liability under chapter 115B and response actions under chapter 115C;*
- (2) purposes of municipal water pollution control under the authority of chapters 115 and 116;*
- (3) costs associated with the decommissioning of nuclear power plants;*
- (4) hazardous waste disposal facilities;*
- (5) solid waste disposal facilities; or*
- (6) projects or purposes inconsistent with the strategic plan.*

B. About Minnesota's Environment and Natural Resources Trust Fund

Minnesota's Environment and Natural Resources Trust Fund (ENRTF) is a permanent fund in the state treasury that was established in the Minnesota Constitution (Art. XI, Sec.14) by 77% voter approval of a constitutional amendment in 1988. The ENRTF was created to provide a long-term, consistent, and stable source of funding for innovative activities directed at protecting and enhancing Minnesota's environment and natural resources for the benefit of current citizens and future generations and it holds assets that can be appropriated by law, "for the public purpose of protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources." Up to 5.5% of the existing market value of the ENRTF can be expended each year.

The money in the ENRTF originates from a combination of contributions and investment income. Forty percent of the net proceeds from the Minnesota State Lottery, or approximately seven cents of every dollar spent on playing the lottery, are contributed to the ENRTF each year; this source of contribution is guaranteed by the Minnesota Constitution through December 31, 2024. The ENRTF may also receive contributions from other sources, such as private donations. Once deposited into the ENRTF contributions become part of the principal balance and are invested by the State Board of Investment. The income generated from the investments is reinvested back into the ENRTF. Initially, growth of the ENRTF originated primarily from contributions, but as the principal balance of the ENRTF has grown so

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

has the income from investing that principal. Eventually annual growth from investment income will equal and then surpass annual growth from contributions.

C. About the Legislative-Citizen Commission on Minnesota Resources

The Legislative-Citizen Commission on Minnesota Resources (LCCMR) is made up of 17 members: five Senators, five Representatives, five citizens appointed by the governor, one citizen appointed by the Senate, and one citizen appointed by the House. Legislative members are appointed by legislative leadership and must include representation from both majority and minority parties. The citizen members appointed must have experience or expertise in the science, policy, or practice of the protection, conservation, preservation, and enhancement of the state's environment and natural resources.

The function of the LCCMR is to make funding recommendations to the Minnesota State Legislature for special environment and natural resource projects, primarily from the Environment and Natural Resources Trust Fund (ENRTF), and to provide oversight over projects funded through this process. The LCCMR developed from a program initiated in 1963. Between 1991 and 2013 nearly \$800 million has been appropriated to approximately 1,800 projects recommended to protect and enhance Minnesota's environment and natural resources.

D. Legislative-Citizen Commission on Minnesota Resources Proposal and Funding Process

The Legislative-Citizen Commission on Minnesota Resources (LCCMR) has a competitive, multi-step proposal and selection process. On an annual or biennial cycle, a Request for Proposal (RFP) is issued for selected funding priorities based upon an adopted strategic plan and ongoing information gathering activities, including expert-led seminars and visits to natural resource sites around the state. All proposals received in response to the RFP are reviewed, evaluated, and ranked by LCCMR members; a selection of high ranking proposals are chosen for further consideration and invited to present before the commission; and a subset of proposals is chosen to recommend to the legislature for funding based on consistency with funding priorities and total dollars available. Funding recommendations go before the legislature for consideration in the form of an appropriations bill and upon passage must be signed into law by the governor.

Funded projects are required to submit a work plan that must be approved by the LCCMR before a project can begin. Work plans provide a detailed description and statement of agreement regarding all work that will be completed and all outcomes that will be achieved with the Environment and Natural Resources Trust Fund (ENRTF) appropriation. During the period that funds are made available project managers are required to provide two status update reports per year to the LCCMR using their approved work plan.

Anyone may respond to the RFP and apply for funds from the ENRTF providing the proposal is consistent with public purposes. Funding recipients have included state agencies, local government units, academic institutions, non-profit organizations, and private corporations. The LCCMR's process is a competitive one and more proposals are generally received than can be funded based on the dollars available.

E. Vision and Mission for Minnesota's Environment and Natural Resources Trust Fund

Environment and Natural Resources Trust Fund Vision Statement

All Minnesotans have an obligation to use and manage our natural resources in a manner that promotes wise stewardship and enhancement of the state's resources for ourselves and future generations. The

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

Environment and Natural Resources Trust Fund is a perpetual fund that provides a legacy from one generation of Minnesotans to the many generations to follow. It shall be used to preserve, protect, restore, and enhance all of the bountiful, rare, and threatened natural resources that are the collective heritage of every Minnesotan. It shall also be used to nurture a sense of responsibility by all and to further our understanding of Minnesota's resource base and the consequences of human interaction with the environment.

Environment and Natural Resources Trust Fund Mission Statement

The mission of the Environment and Natural Resources Trust Fund is to ensure a long-term secure source of funding for environmental and natural resource activities whose benefits are realized only over an extended period of time.

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

III. SIX-YEAR STRATEGIC PLAN FOR THE ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

A. Strategic Plan Development and Implementation

The Six-Year Strategic Plan for the Environment and Natural Resources Trust Fund is to guide the work and process used by the Legislative-Citizen Commission on Minnesota Resources (LCCMR) in making recommendations for expenditures. Specifically, the Six-Year Strategic Plan, as required by MS 116P.08, Subd. 3, is to provide short and long-term goals and strategies for the ENRTF expenditures, require measurable outcomes for the expenditures, and identify areas of emphasis for funding.

The Six-Year Strategic Plan consists of two main components:

1. This document outlining general goals, strategies, and areas of emphasis for funding from the ENRTF.
2. The most recently issued Request for Proposal (RFP) outlining more delineated areas of emphasis.

Additionally, other documents used in developing and updating the plan are appended to this document as supplemental information as appropriate or needed.

In development, and periodic updating, of its Six-Year Strategic Plan the LCCMR has relied on a number of resources to help identify the most pressing natural resource issues facing Minnesota along with the opportunities to address them, particularly:

- The Statewide Conservation and Preservation Plan developed with financial support from the ENRTF by the University of Minnesota Institute on the Environment.
- Information gathered on an ongoing basis from presentations, information requests, and site visits involving technical experts, citizens, state agencies, local units of government, private individuals, and nonprofit organizations.
- Other adopted plans of environment and natural resources organizations.

In implementing its Six-Year Strategic Plan, the LCCMR will identify specific priority areas for funding through each RFP it issues. In selecting the priority areas for funding in each RFP, the LCCMR will maintain a continued awareness of issues identified by the Statewide Conservation and Preservation Plan, public input, the LCCMR's evaluation of natural resource issues, and major funding initiatives identified by the MN legislature. As the most current RFP is issued it shall be appended to this Six-Year Strategic Plan document as an extension and update of the document indicating the most current statement of specific funding priorities for the strategic plan.

B. Key Issues and Strategic Framework for Six-Year Strategic Plan

In initial development of the Strategic Plan, several key issues were identified that are having the most pressing impacts on Minnesota's environment and natural resources:

- Land and water habitat fragmentation, degradation, loss, and conversion
- Land use practices
- Transportation
- Energy production and use
- Resource Consumption
- Invasive species

To most strategically address these key issues the following five core areas of potential action were identified and form the strategic framework for this plan:

- Integrated planning

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

- Critical land protection
- Land and water restoration and protection
- Sustainability practices
- Economic incentives for sustainability

C. Funding Priority Areas of the Request for Proposal

The implementation of the Six-Year Strategic Plan occurs through the LCCMR's proposal and funding process for individual funding cycles, which occur on either an annual or biennial basis. Each funding cycle the LCCMR develops a Request for Proposal (RFP) with specific identified funding priority areas. While the RFP can and does vary from year to year, the funding priority areas generally occur in the following seven broader categories with more specificity for each category identified within the actual RFP:

- Air Quality, Climate Change, and Renewable Energy
- Aquatic and Terrestrial Invasive Species
- Environmental Education
- Foundational Natural Resource Data and Information
- Land Acquisition for Habitat and Recreation
- Methods to Protect, Restore, and Enhance Land, Water, and Habitat
- Water Resources

D. Goals of Six-Year Strategic Plan

The five core areas identified as the strategic framework for this plan provide an integrated approach to resource conservation and protection. The following goals address one or more of the strategic framework areas.

Land and Water Protection

- Protect and conserve land and water (surface and ground) resources that are important for overall ecosystem integrity.
- Provide protection to fragile or unique natural resources, such as prairies, shorelands, trout streams, ground water resources, surface water flows, wetlands, fens, and aquatic habitat where further development or neglect could cause irreparable harm or loss.
- Protect land resources such as large contiguous tracts of forests, prairies that are threatened by fragmentation, high quality natural areas such as those listed in the county biological survey, and important habitat areas.
- Protect and promote habitat, native species, and water quality through land protection, acquisition, and land use practices.
- Protect and promote habitat, native species, and water quality through protection from invasive species.
- Protect and promote habitat, native species, and water quality through reduction and elimination of harmful environmental contaminants.

Research, Planning, and Demonstration

- Improve natural resource data management, conservation, and use statewide through the acquisition, management, and distribution of critical natural resource data by funding efforts to generate natural resource "foundation documents" to increase accuracy, efficiency, and ease of access to the data (including maps, inventories, and surveys).

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

- Address emerging issues and provide critical information to assist in our understanding and wise management of natural resources.
- Support research, planning, and/or demonstration projects that protect and conserve sensitive lands, surface and ground water resources, and ecologic integrity.
- Support evaluation of climate change impacts and reduction strategies.
- Support community-based conservation planning.

Encourage Participation in Outdoor Recreation, Hunting, and Fishing

- Promote interest and participation in angling, hunting, outdoor recreation, and environmental and natural resource education. Partnerships to accomplish this goal are encouraged.
- Acquire, enhance, construct, manage, and maintain a variety of accessible outdoor recreation opportunities throughout the state.

Evaluation and Selection Criteria

All proposals should strive to maximize efficiency and return on investment for the proposed expenditures. Additionally, the following criteria, as applicable, are considered in evaluating and selecting proposals to recommend for funding :

- **Funding Priorities:** Responds to RFP funding priorities and LCCMR Six-Year Strategic Plan for the Environment and Natural Resources Trust Fund articulated and adopted by the LCCMR.
- **Multiple Benefits:** Delivers multiple benefits to Minnesota's environment and natural resources.
- **Outcomes:** Identifies clear objectives likely to result in measurable, demonstrated, and meaningful outcomes.
- **Knowledge Base:** Contributes to the knowledge base or disseminates information that will benefit other efforts.
- **Extent of Impacts:** Results in broad, long-term impacts of statewide or regional significance.
- **Innovation:** Employs or demonstrates innovative approaches to more effectively and efficiently solve specific environment and natural resources issues.
- **Scientific/Technical Basis:** Reflects current scientific and technical knowledge, standards, and best practices.
- **Urgency:** Addresses an issue for which immediate future action is necessary and essential to avoid undesirable consequences.
- **Capacity and Readiness:** Demonstrates capacity and readiness for efforts to be managed and completed in a timely, accountable, and effective manner.
- **Leverage:** Leverages collaborative partnerships and additional efforts, resources, and non-state funds.

E. Strategies for Six-Year Strategic Plan

Priority will be given to innovative projects providing multiple ecological and other public benefits to Minnesota's environment and natural resources. More specifically, the Environment and Natural Resources Trust Fund should support efforts that:

- Identify, protect, and enhance strategic land areas that make the largest contribution to multiple benefits for conservation and increase the management of those lands to enhance the conservation, quality, and diversity of natural resources.
- Establish statewide highest value habitat corridors using consistent conservation biology methodology and criteria for habitat, water quality and quantity, and native species.

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

- Acquire the most recent and accurate baseline natural resource data on a regular basis – data such as topography, parcel and land cover, soil and geological survey, and ground water quality and quantity.
- Identify and manage lands suited for human activity by using best management conservation practices to minimize the negative effects on natural resources.
- Increase understanding of potential effects of climate change on resources and develop strategies for reducing the impact of climate change on natural resources.
- Increase understanding of effects of contaminants on natural resources, including ground water, and develop strategies for reducing contamination.
- Increase public understanding of the need for better conservation, preservation, and restoration of Minnesota's habitats and landscapes.
- Develop strategies for delivery of environmental education to Minnesota students and residents at school, home, work, and play.
- Develop strategies to prevent introductions and reduce spread of aquatic and terrestrial invasive species and restore or reestablish terrestrial or aquatic habitats impacted by invasive species.
- Develop land use strategies for sustainable, renewable energy production (electricity and fuels) that protect, enhance and restore native species, water quality, habitat, and prairies.
- Evaluate renewable energy options in Minnesota, including energy conservation, based on greenhouse gas and other emissions reductions, surface and ground water use, effects on the economy, and use by the electric and transportation sectors.
- Increase involvement of citizens and communities in scientific efforts pertaining to Minnesota's environment and natural resources.

F. Outcomes for the Environment and Natural Resources Trust Fund

Outcomes for the Environment and Natural Resources Trust Fund (ENRTF) will be specifically defined by the individual work plans of the projects receiving funding recommendations. However there are some broad outcomes that are hoped to be achieved:

- Funding recommendations are consistent with and accelerate implementation of the Statewide Conservation and Preservation Plan and other related environment and natural resource plans, documents, reports, or recommendations. See "Appendix I: Environment and Natural Resources Plans, Documents, and Reports".
- Complete acquisition of baseline natural resource data, including the County Biological Survey, Soil Survey, wetlands inventory, restorable wetlands inventory, and the County Geologic Atlas by 2020.
- Funding recommendations in the aggregate include work in all ecoregions, as defined by the Minnesota Department of Natural Resources.
- To the extent possible, funding recommendations support the creation and continuation of "green jobs" in Minnesota.

G. Relationship of Environment and Natural Resources Trust Fund to Other State Funds and Programs

Overall

Funding from the Environment and Natural Resources Trust Fund (ENRTF) represents only a small portion of total state spending relating to the environment and natural resources. Historically, ENRTF

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

appropriations have equaled less than one percent of the total state spending on environment and natural resources. The bulk of spending in these areas comes from the general fund, bonding, and user fees. Additionally, the Legacy Amendment to the Minnesota Constitution (Article XI, Section 15), adopted by voter approval in November 2008, dedicates portions of a state sales tax of three-eighths of one percent to specific types of environment and natural resources projects through June 30, 2034, which has added a significant boost to state spending in these areas.

One aspect of the ENRTF that sets it apart from the bulk of funding for environment and natural resources in Minnesota (i.e., traditional funds: general fund, bonding, and user fees) is that it is intended to be used for “special” efforts. M.S. 116P.03 stipulates that the ENRTF is not to be used as a substitute for traditional sources of funding for the environment and natural resources. This same stipulation, that the funds cannot supplant existing funding, applies to the Legacy Amendment Funds.

116P.03. Trust Fund Not to Supplant Existing Funding; Appropriations.

(a) The trust fund may not be used as a substitute for traditional sources of funding environmental and natural resources activities, but the trust fund shall supplement the traditional sources, including those sources used to support the criteria in section 116P.08, subdivision 1. The trust fund must be used primarily to support activities whose benefits become available only over an extended period of time.

Another aspect of the ENRTF that is unique from other environment and natural resources funding, including Legacy Amendment Funds, is that it is a permanent fund structured like an endowment to provide funding for “special” environment and natural resources efforts in Minnesota in perpetuity. This permanent status can only be altered by an additional amendment to the Minnesota Constitution.

Relationship Between Environment and Natural Resources Trust Fund and Legacy Amendment Funds

There is some overlap between the Environment and Natural Resources Trust Fund (ENRTF) and the Legacy Amendment funds. Three of the four funds created by the Legacy Amendment have purposes directly related to Minnesota’s environment and natural resources: Outdoor Heritage Fund, Clean Water Fund, and Parks and Trails Fund. However, there are also differences.

One difference is the purpose of the different funds. The Outdoor Heritage Fund, Clean Water Fund, and Parks and Trails Fund are each all limited to very targeted types of environment and natural resources projects. Whereas the ENRTF has a broader mandate with greater flexibility in the types of projects it can fund.

Another difference between the ENRTF and the Legacy Amendment funds is the revenue stream that generates them in terms of the types of public money each represents and the permanency of these revenue streams as funding sources. Money from the Legacy Amendment funds comes from public tax dollars generated through a state sales tax. The structure of the three funds makes all of the money directly available for expenditure on projects as it becomes available. However, since the sales tax is only in effect until June 30, 2034, the revenue stream is not permanent. The sources of money for the ENRTF fund are not tax generated dollars but a combination of forty percent of net proceeds from the Minnesota State Lottery and income to the state generated from investing those proceeds. In order to provide a permanent source of funds and help these dollars have the greatest impact over time, the ENRTF is structured like an endowment: money is accumulated, it is invested for continued growth, and 5.5% of the compounding principal balance is available for projects each year. Lottery proceeds are only dedicated to the Trust Fund through December 31, 2024. However, at that point the cumulative balance of the Trust Fund is projected to be large enough to ensure self-sustaining growth through investment income while still providing ongoing funding for projects.

Six-Year Strategic Plan for Minnesota's Environment and Natural Resources Trust Fund

IV. MOST RECENT REQUEST FOR PROPOSAL

B. Request for Proposal (RFP)

1. RFP adopted January 16, 2020 for FY2022
(funding beginning July 1, 2021)

Legislative-Citizen Commission on Minnesota Resources

2021 ENRTF Request for Proposal



Minnesota's Environment and Natural Resources Trust Fund

Minnesota Constitution Art. XI, Sec.14: "The assets of the fund shall be appropriated by law for the public purpose of protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources."

SUMMARY

The Legislative-Citizen Commission on Minnesota Resources (LCCMR) welcomes proposals for projects of all sizes that address the priorities and requirements described within this RFP and that aim to protect, conserve, preserve, and enhance Minnesota's air, water, land, fish, wildlife, and other natural resources. The LCCMR reviews applications and makes funding recommendations to the Minnesota Legislature from the Environment and Natural Resources Trust Fund (ENRTF). Approximately \$70 million is anticipated to be available from the Trust Fund through this RFP for projects beginning July 1, 2021. Most projects funded are 2-3 years in duration.

Proposals must be submitted online at <https://lccmrprojectmgmt.leg.mn> by ~~April 15, 2020~~ **extended to April 30, 2020** at 4:30PM.

Funding Available

Approximately \$70 million is anticipated to be available through this RFP for projects beginning July 1, 2021. The LCCMR makes funding recommendations to the Minnesota Legislature from the Environment and Natural Resources Trust Fund. Recommended projects must be approved by the 2021 Legislature through an appropriation, signed into law by the Governor, and have a work plan approved by LCCMR before funds can be spent. For non-state entities, payment is made by reimbursement for expenses incurred and fiscal oversight is provided through a grant agreement with the Minnesota Department of Natural Resources. Most projects are 2-3 years, however more or less time can be requested.

Amount of Request

There is no minimum or maximum request amount. All proposals should strive to maximize efficiency and return on investment for the proposed expenditures.

Applicant Eligibility

The RFP is open to all who want to apply and who have demonstrated fiscal capacity. Applicants must be available to make a formal presentation to LCCMR if selected and to be available for staff or commission member questions.

New Online System

LCCMR has launched a new [online proposal submission system](#). All proposals will be submitted online. Early account registrations and proposal submissions are encouraged.

Deadline for Submission

Final proposals must be submitted online by 4:30PM on ~~Wednesday, April 15, 2020~~ **extended to Thursday, April 30, 2020**.

Information from this document may be copied and distributed to others. This publication can be made available in alternate formats, such as large print or audio format, upon request.

Legislative-Citizen Commission on Minnesota Resources
Room 65, State Office Building
100 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, MN 55155
Phone: 651-296-2406
Email: lccmr@lccmr.leg.mn
Web: www.lccmr.leg.mn

2021 Funding Priorities

All proposals must meet the constitutional aim to protect, conserve, preserve, and enhance Minnesota's air, water, land, fish, wildlife, and other natural resources, especially those that may be substantially impaired or destroyed in any area of the state.

Proposals are strongly encouraged that address prevention strategies for protecting natural resources, that include citizen and community involvement in scientific efforts, and that implement or identify clear strategies for implementing research results.

Proposals should also address one or more of the priorities described in the categories below; however, proposals pertaining to new or emerging environmental or natural resource issues not directly addressed below may also be eligible for consideration. Priorities are listed by category and not in order of importance.

A. Foundational Natural Resource Data and Information

1. Data acquisition, information management, research, or analysis to develop foundational natural resource, wildlife, pollinator, or plant data and information.
2. Coordination, facilitation, or training pertaining to statewide sharing, distribution, or innovative application of natural resource data (e.g., maps, inventories, and surveys) and information tools (e.g., Geographic Information Systems (GIS), Light Detection and Ranging (LiDAR), and other remote sensing techniques).
3. Quantification and analysis pertaining to the economic value of services provided by natural resources and conservation, including analysis that quantifies public savings and costs of water or air pollution prevention.

B. Water Resources

1. Research, monitoring, or evaluation to increase protection, conservation, and sustainability of the quality, quantity, or function of water resources. This includes, but is not limited to, efforts pertaining to:
 - I. Ground and surface water interaction, including stream flow and groundwater flow;
 - II. Aquifer recharge;
 - III. Wetland, river, and lake ecosystems, including Lake Superior;
 - IV. Mitigation of impacts resulting from artificial hydrological modifications in both urban and agricultural areas;
 - V. Effects of climate change on water resources;
 - VI. Drinking Water.
2. Research, evaluation, technology development, or engineering design pertaining to regulated, unregulated, or emerging water contaminants, including sources, fates, movements, or effects of these contaminants within ground or surface waters or across ecological communities. Contaminants of interest include, but are not limited to, nitrates, phosphates, estrogenic compounds, pharmaceuticals, personal care products, chlorides, PAHs (polycyclic aromatic hydrocarbons), and pesticides. Efforts pertaining to the following are of particular interest:
 - I. Understanding the impacts of contaminants on the health of humans or terrestrial or aquatic species;
 - II. Preventing or reducing levels of contaminants in ground and surface waters;
 - III. Advancing development or implementation of standards for contaminants.

2021 Funding Priorities (Continued)

C. Environmental Education

Proposals must address education, information dissemination, and training efforts that will increase the knowledge and skills of students or the public to cultivate a sustainable lifestyle, improve and maintain water quality, reduce and monitor energy and water consumption, or restore and maintain a healthy and biodiverse natural environment. Funding for capital projects (e.g., buildings or building infrastructure) will not be considered in this category. Of particular interest are projects that address one or more of the following:

1. Efforts that involve broad-based partnerships, engage diverse and changing demographics, provide outdoor experiences, or are committed to building a long-lasting and action-based conservation ethic in a community.
2. Efforts that deliver and implement existing curriculum, especially integration of environmental education into school curriculum. Proposals to develop new curriculum will not be considered.

D. Aquatic and Terrestrial Invasive Species

"Invasive species" includes any plants, animals, worms, insects, microbes, and diseases that are non-native, introduced species in the state and that are currently having, or pose a threat to have, significant adverse impacts on Minnesota's native ecosystems and biodiversity. All research proposals related to invasive species research must consider the research priorities established by the University of Minnesota's (UMN) Minnesota Invasive Terrestrial Plants and Pests Center or Minnesota Aquatic Invasive Species Center. All UMN proposals and others should apply to the Centers when applicable. The Centers will keep the LCCMR updated on the status of proposals received. Projects must propose to do one or more of the following:

1. Prevent introduction or provide early detection of new invasive species.
2. Reduce the spread of invasive species with best management practices along streams, rivers, land transportation routes, and other vectors.
3. Develop or demonstrate alternative control techniques—particularly involving biocontrol, integrated pest management, or minimization of non-target effects including pollinators—for containing or suppressing invasive species already present in Minnesota. Standard control, removal, and maintenance activities of invasive species will not be considered.
4. Restore lands with native vegetation as practicable following implementation of invasive species control techniques on disturbed lands where a native seed bank no longer exists.
5. Inform and educate landowners about all invasive species threats to their land and offer actions they can take in response.

E. Air Quality, Climate Change, and Renewable Energy

Funding for capital projects (e.g., buildings or building infrastructure) will not be considered in this category.

1. Innovative approaches to air quality improvement that reduce impacts on human health, the environment, or natural resources, such as by preventing, reducing, or mitigating airborne contaminants including PAHs (polycyclic aromatic hydrocarbons).
2. Acquisition of data at a scale appropriate to assess natural resource changes attributable to climate change.
3. Research to help understand how to mitigate, adapt, or make Minnesota's ecosystems more resilient to climate change impacts, including drought and extreme weather events.
4. Implementation of innovative efforts aimed at mitigating, adapting, or making Minnesota's ecosystems more resilient to climate change impacts, including drought and extreme weather events.
5. Reduction of greenhouse gas emissions through new and innovative approaches to waste reduction or energy efficiency. Standard, required, and ongoing efforts will not be considered.

2021 Funding Priorities (Continued)

F. Methods to Protect or Restore Land, Water, and Habitat

Please review “Additional Requirements for Land Acquisition, Easements, and Restoration Projects.” (see page 6)

1. Innovative protection or restoration of lands with high-quality natural resources, ecological value, water protection value, or habitat, particularly for pollinators.
2. Long term preservation of native forest, wetland, or prairie plant genetics and viability.
3. Technical assistance for stewardship of prairies, forests, wetlands, or other habitat, or technical assistance for agricultural land management in order to protect water quality and aquatic habitat or to improve pollinator habitat.
4. Planning and implementation of community-based efforts to permanently conserve natural resources and reduce habitat fragmentation impacts on natural resources, including the impacts of transportation and other infrastructure.

G. Land Acquisition, Habitat, and Recreation

Please review “Additional Requirements for Land Acquisition, Easements, and Restoration Projects.” (see page 6)

1. The Reinvest in Minnesota program as provided in M.S. section 84.95, subdivision 2.
2. Acquisition or development of strategic lands with high quality natural resources, ecological value, recreational value, water protection value, or habitat, particularly for pollinators.
3. Acquisition or development of lands that have the greatest capacity to contribute multiple conservation benefits to wildlife, humans, and ground and surface water quality.
4. Efforts based on precision conservation methods and analysis that quantifiably identify the lands most critical to acquire. Precision conservation is a practice that considers lands in terms of the interconnected systems of which they are a part. As a practice, precision conservation compiles and integrates multiple types of available data layers and analysis (e.g., terrain analysis, soil productivity, habitat potential, economic analysis, erosion potential, proximity to surface water) to identify and guide efforts that will maximize conservation benefits.
5. Efforts involving Scientific and Natural Areas (SNA) or other areas that aim to protect unique ecosystems, such as native prairie as defined in M.S. 84.02, Subd. 5, or rare, endangered, or threatened species. Areas of these types that may not presently qualify as a priority for other State of Minnesota funds directed toward land acquisition for habitat or recreation are of particular interest.
6. Efforts that enhance habitat connectivity, benefit ground or surface water quality, improve access for natural resource management, or increase public access for recreation, particularly in areas of the state with limited protected public lands.
7. Efforts expanding outdoor recreational opportunities through additions and connections to state, regional, or local parks and trails.

H. Small Projects

The LCCMR encourages proposals under \$200,000, especially from local government units and non-profits, to quickly and efficiently provide environment and natural resource benefits in Minnesota. Proposals should address one or more of the priorities listed in the above categories A through G.

Funding May Be Available Through Other Programs

Projects eligible for established, topic-specific state agency grant programs - such as for renewable energy, sustainable agriculture, clean water implementation, regional and local parks and trails, and habitat acquisition and restoration - are encouraged to apply directly to the particular state agency grant program as funds may be available in a timelier manner.

Requirements

Project Requirements

All projects must comply with [Article XI, Section 14 of the Minnesota Constitution](#), [Minnesota Statute 116P](#), and other requirements provided in the following summary document:

- Environment and Natural Resources Trust Fund (ENRTF) [Project Requirements](#)

Professional, Technical, and Services Contracts

- State contracting and competitive bidding requirements apply.

Financial Capacity

To help us evaluate financial capacity, non-profit organizations and for-profit businesses with an annual income:

- over \$750,000 should submit their most recent certified financial audit
- between \$50,000 and \$750,000 must provide their most recent IRS Form 990.
- under \$50,000 or that have not been in existence long enough to have completed IRS Form 990 or an audit must submit their most recent board-reviewed financial statements

Work Plan and Progress Reports

Project managers of recommended projects must submit a work plan. Successfully funded projects must have an approved work plan and the project manager must submit annual or semiannual progress reports. Modifications to the approved work plan and budget expenditures must be made through the LCCMR amendment process.

Additional Requirements for Land Acquisitions, Easements, and Restorations

All fee title and conservation easement acquisition proposals must include funding for development and implementation of a management and restoration plan. If no funding is requested, your proposal must address why funding for this work is not needed to achieve a high quality restoration.

All acquisition and restoration applicants must read and understand the following summary documents:

- Environment and Natural Resources Trust Fund (ENRTF) [Fee Title Acquisition Project Requirements](#)
- Environment and Natural Resources Trust Fund (ENRTF) [Conservation Easement Acquisition Project Requirements](#)
- Environment and Natural Resources Trust Fund (ENRTF) [Restoration Project Requirements](#)

A map must be submitted with your proposal that shows the site specific location of your proposed fee title or conservation easement acquisition or restorations within the city, county, region, and/or state. The map must be legible as black and white and include a north arrow and scale.

A parcel list must be provided with your proposal that identifies proposed fee title and conservation easement acquisitions and restorations by parcel name, estimated cost, county, ecological significance, activity description, proposed number of acres, proposed shoreline or trail miles, type of landowner, and proposed title/easement holder (if applicable).

Additional information for acquisitions, easements, and restorations must be provided with your proposal that describes, among other things, how restoration, future management, and easement enforcement requirements will be met.

Guidance on Allowable Expenses

Eligible Expenses

Eligible expenses are those expenses solely incurred through project activities that are directly related to and necessary for producing the project outcomes described in the proposal. All proposed expenses must be specified in the proposal submitted. Please note that for non-state entities all funds are awarded on a reimbursement basis, unless otherwise authorized, and all eligible expenses will need to be documented. Eligible expenses may include:

- a. Eligible expenditures incurred only after the effective date as approved by LCCMR.
- b. Wages and expenses of salaried Recipient employees if specified, documented, and approved. For State Agencies: use of unclassified staff only OR request approval for the use of classified staff accompanied by an explanation of how the agency will backfill that part of the classified staff salary proposed to be paid for with these funds. This is subject to specific discussion and approval by LCCMR.
- c. Fringe benefit expenses, such as FICA/Medicare, retirement, and health insurance of Recipient's employees, if specified.
- d. Professional and technical services specified in the approved Work Plan that are rendered by individuals or organizations not a part of the Recipient;
- e. Equipment, tools, materials, and supplies specific to the project and incoming freight charges for them.
- f. Capital expenditures for facilities, equipment, and other capital assets as expressly approved. For expenditures greater than \$5,000, the Recipient must provide an explanation as to how all the equipment purchased with the appropriation will continue to be used for the same program through its useful life, or, if the use changes, a commitment to pay back to the Environment and Natural Resources Trust Fund an amount equal to either the cash value received or a residual value approved by the director of the LCCMR if it is not sold.
- g. Publication and printing/copying expenses necessary for contract administration, work products production, and semi-annual reports relating to accomplishments.
- h. In-state transportation and travel expenses such as lodging, meals, and mileage of personnel directly involved in the Project in the same manner and in no greater amount than provided for in the current "[Commissioner's Plan](#)" promulgated by the Commissioner of Management of Budget and as provided by LCCMR or, for University of Minnesota projects, the [University of Minnesota plan](#). Allowable meal and lodging expenses are for employees only. Purchasing meals or providing lodging for others is not an allowable expense.

Generally Ineligible Expenses—Unless Explicitly Approved

Generally ineligible expenses for reimbursement mean all expenses not defined as eligible expenses, but for which an explicit exception can be sought from LCCMR if the expenses can be clearly justified and individually documented as directly related to and necessary for a project. No broad allocations for costs in either dollars or percentages are allowed. In deciding whether to seek exception for these costs consider that cash and in-kind leverage are criteria considered in proposal evaluation. Generally ineligible expenses include but are not limited to:

- a. General operations, overhead, and other indirect expenses, including office maintenance, office utility expenses, and office materials and supplies.
- b. Office rental fees (including storage space rental).
- c. Communication expenses incurred for telephone calls, web access, postage, and similar services.
- d. Insurance, except title insurance.
- e. Attorney fees, except to acquire and clear title to land.
- f. Purchase of communication devices such as pagers, cell phones, or smart phones.
- g. Purchase of computers, tablets, or audiovisual equipment.
- h. Generally available food and refreshments, except if explicitly approved for certain types of events.
- i. Conference attendance and associated costs and fees, except if to participate in formal presentation of project findings.
- j. Out of state transportation and travel expenses.
- k. Single-source contracts. Justification for an exception must also include the specific entity by name, why the single source is needed, and how the recipient is ensuring a competitive price for the contracted work.

Prohibited Expenses

Prohibited expenses for reimbursement mean all expenses indicated below, including but not limited to:

- a. Any expenses incurred before the project is authorized, before July 1, 2021, or before LCCMR work plan approval—whichever is latest.
- b. Fundraising.
- c. Taxes, except sales tax on goods and services.
- d. Lobbyists or political contributions.
- e. Advertising and marketing expenses.
- f. Loans, grants, or subsidies to persons or entities for development.
- g. Bad debts, late payment fees, finance charges, or contingency funds.
- h. Interest or investment management fees.
- i. Directors or officers salary.
- j. Merit awards and bonuses.
- k. Memberships (including subscriptions and dues).
- l. Publications, periodicals, and subscriptions.
- m. Employee workplace parking.
- n. Entertainment, decorations, gifts, and prizes.

Environment and Natural Resources Trust Fund: MN Constitution and Statutory Expenditures

Minnesota Constitution Art. XI, Sec.14: Environment and Natural Resources Trust Fund Established

A permanent environment and natural resources trust fund is established in the state treasury. Loans may be made of up to five percent of the principal of the fund for water system improvements as provided by law. The assets of the fund shall be appropriated by law for the public purpose of protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources. The amount appropriated each year of a biennium, commencing on July 1 in each odd-numbered year and ending on and including June 30 in the next odd-numbered year, may be up to 5-1/2 percent of the market value of the fund on June 30 one year before the start of the biennium. Not less than 40 percent of the net proceeds from any state-operated lottery must be credited to the fund until the year 2025. [Adopted, November 8, 1988; Amended, November 6, 1990; November 3, 1998]

M.S. 116P.08 Environment and Natural Resources Trust Fund Expenditures and Exceptions

Subdivision 1. **Expenditures.** (a) Money in the trust fund may be spent ONLY for:

- (1) the reinvest in Minnesota program as provided in section 84.95, subd. 2;
- (2) research that contributes to increasing the effectiveness of protecting or managing the state's environment or natural resources;
- (3) collection and analysis of information that assists in developing the state's environmental and natural resources policies;
- (4) enhancement of public education, awareness, and understanding necessary for the protection, conservation, restoration, and enhancement of air, land, water, forests, fish, wildlife, and other natural resources;
- (5) capital projects for the preservation and protection of unique natural resources;
- (6) activities that preserve or enhance fish, wildlife, land, air, water, and other natural resources that otherwise may be substantially impaired or destroyed in any area of the state;
- (7) administrative and investment expenses incurred by the state board of investment in investing deposits to the trust fund; and
- (8) administrative expenses subject to the limits in section 116P.09.

(b) In making recommendations for expenditures from the trust fund, the commission shall give priority to funding programs and projects under paragraph (a), clause (1) and (6). Any request for proposals issued by the commission shall clearly indicate these priorities.

Subdivision 2. **Exceptions.** Money from the trust fund may not be spent for:

- (1) purposes of environmental compensation and liability under chapter 115B and response action under chapter 115C;
- (2) purposes of municipal water pollution control in municipalities with a population of 5,000 or more under the authority of chapters 115 and 116;
- (3) costs associated with the decommissioning of nuclear power plants;
- (4) hazardous waste disposal facilities;
- (5) solid waste disposal facilities; or
- (6) projects or purposes inconsistent with the strategic plan.

Evaluation Criteria

The following criteria, as applicable, will be considered in evaluating proposals:

- **Funding Priorities:** Responds to RFP funding priorities.
- **Multiple Benefits:** Delivers multiple benefits to Minnesota's environment and natural resources.
- **Outcomes:** Identifies clear objectives likely to result in measurable, demonstrated, and meaningful outcomes.
- **Knowledge Base:** Contributes to the knowledge base or disseminates information that will benefit other efforts.
- **Extent of Impact:** Results in broad, long-term impacts of statewide, regional, or local significance.
- **Innovation:** Employs or demonstrates innovative approaches to more effectively and efficiently solve specific environment and natural resources issues.
- **Scientific/Technical Basis:** Reflects current scientific and technical knowledge, standards, and best practices.
- **Urgency:** Addresses an issue for which immediate future action is urgent and critical to avoid undesirable consequences.
- **Capacity and Readiness:** Demonstrates capacity and readiness for efforts to be managed and completed in timely, accountable, and effective manner.
- **Leverage:** Leverages collaborative partnerships and additional efforts, resources, and non-state funds.

How To Apply

Proposals due by 4:30PM on Wednesday, April 15, 2020 **extended to Thursday, April 30, 2020**

1. Register for an account on the [LCCMR Proposal and Grant Management System](#).
2. Login and click "Create a New Proposal."
3. Follow the instructions for completing your proposal.
If you would like to view blank sample proposals, you can find them on our [2021 Funding Process page](#).
4. Upload your completed attachments as required:
 - A. Visual component or map (1 page limit)
 - B. Letter or resolution from your governing board authorizing submission of the proposal (non-profits, tribes, and local units of government only)
 - C. 990 tax information, certified audit, or board-reviewed financial statements as required
5. Review all information and attachments.
6. Click "Submit." (Note: state and federal agencies, colleges, and universities must have an authorized representative submit the proposal).
7. Save or print the confirmation email. Please check your junk mail folder if the confirmation email does not appear in your inbox. Contact LCCMR if you did not receive a confirmation email or if your proposal status does not appear as "Final Submitted" on your dashboard.
8. To follow along with the 2021 funding process, visit our [2021 Funding Process page](#).

B. Request for Proposal (RFP)

2. RFP adopted December 17, 2020 for FY2023
(funding beginning July 1, 2022)

Legislative-Citizen Commission on Minnesota Resources

2022 ENRTF Request for Proposal



Minnesota's Environment and Natural Resources Trust Fund *Minnesota Constitution Art. XI, Sec.14:*
"The assets of the fund shall be appropriated by law for the public purpose of protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources."

SUMMARY

The Legislative-Citizen Commission on Minnesota Resources (LCCMR) welcomes proposals for projects of all sizes that address the priorities and requirements described within this RFP and that aim to protect, conserve, preserve, and enhance Minnesota's air, water, land, fish, wildlife, and other natural resources. The LCCMR reviews applications and makes funding recommendations to the Minnesota Legislature from the Environment and Natural Resources Trust Fund (ENRTF). Approximately \$70 million is anticipated to be available from the Trust Fund through this RFP for projects beginning July 1, 2022. Most projects funded are two to three years in duration. Proposals must be submitted online at <https://lccmrprojectmgmt.leg.mn> by April 2, 2021 at 4:30PM.

Funding Available

Approximately \$70 million is anticipated to be available through this RFP for projects beginning July 1, 2022. The LCCMR makes recommendations to the Minnesota Legislature for funding from the Environment and Natural Resources Trust Fund. Recommended projects must be approved by the 2022 Legislature through an appropriation, signed into law by the Governor, and have a work plan approved by LCCMR before funds can be spent. For non-state entities, payment is made by reimbursement for expenses incurred and fiscal oversight is provided through a grant agreement with the Minnesota Department of Natural Resources. Most projects are two to three years long, however more or less time can be requested.

Amount of Request

There is no minimum or maximum request amount. All proposals should strive to maximize efficiency and return on investment for the proposed expenditures.

Applicant Eligibility

The RFP is open to all who want to apply and who have demonstrated fiscal capacity. Applicants must be available to make a formal presentation to LCCMR if selected and to be available for staff or commission member questions.

Online Proposal System

LCCMR launched an [online proposal submission system](#) last year. All proposals must be submitted through the online system. Early account registrations and proposal submissions are strongly encouraged.

Deadline for Submission

Final proposals must be submitted online by April 2, 2021 at 4:30PM.

Information from this document may be copied and distributed to others. This publication can be made available in alternate formats, such as large print or audio format, upon request.

Legislative-Citizen Commission on Minnesota Resources
Room 65, State Office Building
100 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, MN 55155
Phone: 651-296-2406
Email: lccmr@lccmr.leg.mn
Website: www.lccmr.leg.mn

Proposal and Appropriation Timeline

LCCMR MEMBERS

(as of 12/31/20)

Sen. Gary Dahms
 Sen. Kari Dziedzic
 Rep. Rob Ecklund
 William Faber
 Rep. Josh Heintzman
 Nicole Kessler
 Denny McNamara
 Norman Moody
 Mike Reese
 Sen. Torrey Westrom
 Rep. Jean Wagenius

Co-Chairs

Nancy Gibson
 Rep. Rick Hansen
 Sen. Bill Ingebrigtsen

Co-Vice Chairs

Rep. Tama Theis
 Sen. David Tomassoni
 Della Young

LCCMR STAFF

Becca Nash
 Director
 Michael Varien
 Senior Project Analyst
 Corrie Layfield
 Senior Project Analyst
 Rory Anderson
 Project Analyst and
 Communications Specialist
 Diana Griffith
 Commission Assistant

Connect with us

 @mnenrtf
 facebook.com/mnenrtf

Up-to-date information on deadlines and meetings can be found on the [calendar page](#) of our website.

December 17, 2020	Funding priorities determined and 2022 RFP adopted
January 11, 2021	2022 RFP issued
April 2, 2021	Final submission deadline for proposals responding to 2022 RFP
May 2021	All submitted proposals distributed to LCCMR members for review, evaluation, and ranking
June 16-17, 2021	A subset of high-ranking proposals selected for further consideration and invited to give presentations before the LCCMR
July 6-8, 2021	Selected proposals present before the LCCMR
July 13-15, 2021	
July 28-29, 2021	Subset of proposals selected for recommendation to the Legislature for funding
August - October 2021	Projects recommended for funding begin submitting work plans for LCCMR staff review and research projects recommended for funding undergo peer review
November - December 2021	Funding recommendations are adopted by the LCCMR in legislative bill format, as they will be presented to the Legislature
January - May 2022	LCCMR recommendations presented to the Legislature for consideration via introduction as an appropriations bill Bill is considered and acted upon by the Minnesota House and Senate Upon passage, the bill goes before the governor to be signed into law
June 2022	LCCMR approves work plans for projects funded
July 2022	Minnesota DNR sends grant agreements to non- state agencies receiving ENRTF funds
July 1, 2022	Money from the Environment and Natural Resources Trust Fund becomes available for expenditure and approved projects can begin

About LCCMR

The LCCMR is made up of 17 members: 5 Senators, 5 Representatives, 5 citizens appointed by the governor, 1 citizen appointed by the Senate, and 1 citizen appointed by the House. The function of the LCCMR is to make funding recommendations to the Legislature for special environment and natural resource projects, primarily from the Environment and Natural Resources Trust Fund.

2022 Funding Priorities

All proposals must meet the constitutional aim to protect, conserve, preserve, and enhance Minnesota's air, water, land, fish, wildlife, and other natural resources, especially those that may be substantially impaired or destroyed in any area of the state.

Proposals are strongly encouraged that address prevention strategies for protecting natural resources, that include citizen and community involvement in scientific efforts, and that implement or identify clear strategies for implementing research results.

Proposals should also address one or more of the priorities described in the categories below; however, proposals pertaining to new or emerging environmental or natural resource issues not directly addressed below may also be eligible for consideration. Priorities are listed by category and not in order of importance.

A. Foundational Natural Resource Data and Information

1. Data acquisition, information management, research, or analysis to develop foundational natural resource, wildlife, pollinator, or plant data and information.
2. Coordination, facilitation, or training pertaining to statewide sharing, distribution, or innovative application of natural resource data (e.g., maps, inventories, and surveys) and information tools (e.g., Geographic Information Systems (GIS), Light Detection and Ranging (LiDAR), and other remote sensing techniques).
3. Quantification and analysis pertaining to the economic value of services provided by natural resources and conservation, including analysis that quantifies public savings and costs of water or air pollution prevention.

B. Water Resources

1. Research, monitoring, or evaluation to increase protection, conservation, and sustainability of the quality, quantity, or function of water resources. This includes, but is not limited to, efforts pertaining to:
 - I. Ground and surface water interaction, including stream flow and groundwater flow;
 - II. Aquifer recharge;
 - III. Wetland, river, and lake ecosystems, including Lake Superior;
 - IV. Mitigation of impacts resulting from artificial hydrological modifications in both urban and agricultural areas;
 - V. Effects of climate change on water resources;
 - VI. Drinking Water.
2. Research, evaluation, technology development, or engineering design pertaining to regulated, unregulated, or emerging water contaminants, including sources, fates, movements, or effects of these contaminants within ground or surface waters or across ecological communities. Contaminants of interest include, but are not limited to, nitrates, phosphates, estrogenic compounds, pharmaceuticals, personal care products, chlorides, PAHs (polycyclic aromatic hydrocarbons), and pesticides. Efforts pertaining to the following are of particular interest:
 - I. Understanding the impacts of contaminants on the health of humans or terrestrial or aquatic species;
 - II. Preventing or reducing levels of contaminants in ground and surface waters;
 - III. Advancing development or implementation of standards for contaminants.

2022 Funding Priorities (Continued)

C. Environmental Education

Proposals must address education, information dissemination, and training efforts that will increase the knowledge and skills of students or the public to cultivate a sustainable lifestyle, improve and maintain water quality, reduce and monitor energy and water consumption, or restore and maintain a healthy and biodiverse natural environment. Funding for capital projects (e.g., buildings or building infrastructure) will not be considered in this category. Of particular interest are projects that address one or more of the following:

1. Efforts that involve broad-based partnerships, engage diverse and changing demographics, provide outdoor experiences, or are committed to building a long-lasting and action-based conservation ethic in a community.
2. Efforts that deliver and implement existing curriculum, especially integration of environmental education into school curriculum. Proposals to develop new curriculum will not be considered.

D. Aquatic and Terrestrial Invasive Species

"Invasive species" includes any plants, animals, worms, insects, microbes, and diseases that are non-native, introduced species in the state and that are currently having, or pose a threat to have, significant adverse impacts on Minnesota's native ecosystems and biodiversity. All research proposals related to invasive species research must consider the research priorities established by the University of Minnesota's (UMN) Minnesota Invasive Terrestrial Plants and Pests Center or Minnesota Aquatic Invasive Species Center. All UMN proposals and others should apply to the Centers when applicable. The Centers will keep the LCCMR updated on the status of proposals received. Projects must propose to do one or more of the following:

1. Prevent introduction or provide early detection of new invasive species.
2. Reduce the spread of invasive species with best management practices along streams, rivers, land transportation routes, and other vectors.
3. Develop or demonstrate alternative control techniques—particularly involving biocontrol, integrated pest management, or minimization of non-target effects including pollinators—for containing or suppressing invasive species already present in Minnesota. Standard control, removal, and maintenance activities of invasive species will not be considered.
4. Restore lands with native vegetation as practicable following implementation of invasive species control techniques on disturbed lands where a native seed bank no longer exists.
5. Inform and educate landowners about all invasive species threats to their land and offer actions they can take in response.

E. Air Quality, Climate Change, and Renewable Energy

Funding for capital projects (e.g., buildings or building infrastructure) will not be considered in this category.

1. Innovative approaches to air quality improvement that reduce impacts on human health, the environment, or natural resources, such as by preventing, reducing, or mitigating airborne contaminants including PAHs (polycyclic aromatic hydrocarbons).
2. Acquisition of data at a scale appropriate to assess natural resource changes attributable to climate change.
3. Research to help understand how to mitigate, adapt, or make Minnesota's ecosystems more resilient to climate change impacts, including drought and extreme weather events.
4. Implementation of innovative efforts aimed at mitigating, adapting, or making Minnesota's ecosystems more resilient to climate change impacts, including drought and extreme weather events.
5. Reduction of greenhouse gas emissions through new and innovative approaches to waste reduction or energy efficiency. Standard, required, and ongoing efforts will not be considered.

2022 Funding Priorities (Continued)

F. Methods to Protect or Restore Land, Water, and Habitat

Please review “Additional Requirements for Land Acquisition, Easements, and Restoration Projects.” (see page 6)

1. Innovative protection or restoration of lands with high-quality natural resources, ecological value, water protection value, or habitat, particularly for pollinators.
2. Long term preservation of native forest, wetland, or prairie plant genetics and viability.
3. Technical assistance for stewardship of prairies, forests, wetlands, or other habitat, or technical assistance for agricultural land management in order to protect water quality and aquatic habitat or to improve pollinator habitat.
4. Planning and implementation of community-based efforts to permanently conserve natural resources and reduce habitat fragmentation impacts on natural resources, including the impacts of transportation and other infrastructure.

G. Land Acquisition, Habitat, and Recreation

Please review “Additional Requirements for Land Acquisition, Easements, and Restoration Projects.” (see page 6)

1. The Reinvest in Minnesota program as provided in M.S. section 84.95, subdivision 2.
2. Acquisition or development of strategic lands with high quality natural resources, ecological value, recreational value, water protection value, or habitat, particularly for pollinators.
3. Acquisition or development of lands that have the greatest capacity to contribute multiple conservation benefits to wildlife, humans, and ground and surface water quality.
4. Efforts based on precision conservation methods and analysis that quantifiably identify the lands most critical to acquire. Precision conservation is a practice that considers lands in terms of the interconnected systems of which they are a part. As a practice, precision conservation compiles and integrates multiple types of available data layers and analysis (e.g., terrain analysis, soil productivity, habitat potential, economic analysis, erosion potential, proximity to surface water) to identify and guide efforts that will maximize conservation benefits.
5. Efforts involving Scientific and Natural Areas (SNA) or other areas that aim to protect unique ecosystems, such as native prairie as defined in M.S. 84.02, Subd. 5, or rare, endangered, or threatened species. Areas of these types that may not presently qualify as a priority for other State of Minnesota funds directed toward land acquisition for habitat or recreation are of particular interest.
6. Efforts that enhance habitat connectivity, benefit ground or surface water quality, improve access for natural resource management, or increase public access for recreation, particularly in areas of the state with limited protected public lands.
7. Efforts expanding outdoor recreational opportunities through additions and connections to state, regional, or local parks and trails.

H. Small Projects

The LCCMR encourages proposals under \$200,000, especially from local government units and non-profits, to quickly and efficiently provide environment and natural resource benefits in Minnesota. Proposals should address one or more of the priorities listed in the above categories A through G.

Funding May Be Available Through Other Programs

Projects eligible for established, topic-specific state agency grant programs - such as for renewable energy, sustainable agriculture, clean water implementation, regional and local parks and trails, and habitat acquisition and restoration - are encouraged to apply directly to the particular state agency grant program as funds may be available in a timelier manner.

Requirements

Project Requirements

All projects must comply with [Article XI, Section 14 of the Minnesota Constitution](#), [Minnesota Statute 116P](#), and other requirements provided in the following summary document:

- Environment and Natural Resources Trust Fund (ENRTF) [Project Requirements](#)

Professional, Technical, and Services Contracts

- State contracting and competitive bidding requirements apply.

Financial Capacity

To help us evaluate financial capacity, non-profit organizations and for-profit businesses with an annual income:

- over \$750,000 should submit their most recent certified financial audit
- between \$50,000 and \$750,000 must provide their most recent IRS Form 990.
- under \$50,000 or that have not been in existence long enough to have completed IRS Form 990 or an audit must submit their most recent board-reviewed financial statements

Work Plan and Progress Reports

Project managers of recommended projects must submit a work plan. Successfully funded projects must have an approved work plan and the project manager must submit annual or semiannual progress reports. Modifications to the approved work plan and budget expenditures must be made through the LCCMR amendment process.

Additional Requirements for Land Acquisitions, Easements, and Restorations

All fee title and conservation easement acquisition proposals must include funding for development and implementation of a management and restoration plan. If no funding is requested, your proposal must address why funding for this work is not needed to achieve a high quality restoration.

All acquisition and restoration applicants must read and understand the following summary documents:

- Environment and Natural Resources Trust Fund (ENRTF) [Fee Title Acquisition Project Requirements](#)
- Environment and Natural Resources Trust Fund (ENRTF) [Conservation Easement Acquisition Project Requirements](#)
- Environment and Natural Resources Trust Fund (ENRTF) [Restoration Project Requirements](#)

A map must be submitted with your proposal that shows the site specific location of your proposed fee title or conservation easement acquisition or restorations within the city, county, region, and/or state. The map must be legible as black and white and include a north arrow and scale.

A parcel list must be provided with your proposal that identifies proposed fee title and conservation easement acquisitions and restorations by parcel name, estimated cost, county, ecological significance, activity description, proposed number of acres, proposed shoreline or trail miles, type of landowner, and proposed title/easement holder (if applicable).

Additional information for acquisitions, easements, and restorations must be provided with your proposal that describes, among other things, how restoration, future management, and easement enforcement requirements will be met.

Guidance on Allowable Expenses

Eligible Expenses

Eligible expenses are those expenses solely incurred through project activities that are directly related to and necessary for producing the project outcomes described in the proposal. All proposed expenses must be specified in the proposal submitted. Please note that for non-state entities all funds are awarded on a reimbursement basis, unless otherwise authorized, and all eligible expenses will need to be documented. Eligible expenses may include:

- a. Eligible expenditures incurred only after the effective date as approved by LCCMR.
- b. Wages and expenses of salaried Recipient employees if specified, documented, and approved. For State Agencies: use of unclassified staff only OR request approval for the use of classified staff accompanied by an explanation of how the agency will backfill that part of the classified staff salary proposed to be paid for with these funds. This is subject to specific discussion and approval by LCCMR.
- c. Fringe benefit expenses, such as FICA/Medicare, retirement, and health insurance of Recipient's employees, if specified.
- d. Professional and technical services specified in the approved Work Plan that are rendered by individuals or organizations not a part of the Recipient;
- e. Equipment, tools, materials, and supplies specific to the project and incoming freight charges for them.
- f. Capital expenditures for facilities, equipment, and other capital assets as expressly approved. For expenditures greater than \$5,000, the Recipient must provide an explanation as to how all the equipment purchased with the appropriation will continue to be used for the same program through its useful life, or, if the use changes, a commitment to pay back to the Environment and Natural Resources Trust Fund an amount equal to either the cash value received or a residual value approved by the director of the LCCMR if it is not sold.
- g. Publication and printing/copying expenses necessary for contract administration, work products production, and semi-annual reports relating to accomplishments.
- h. In-state transportation and travel expenses such as lodging, meals, and mileage of personnel directly involved in the Project in the same manner and in no greater amount than provided for in the current "[Commissioner's Plan](#)" promulgated by the Commissioner of Management of Budget and as provided by LCCMR or, for University of Minnesota projects, the [University of Minnesota plan](#). Allowable meal and lodging expenses are for employees only. Purchasing meals or providing lodging for others is not an allowable expense.

Generally Ineligible Expenses—Unless Explicitly Approved

Generally ineligible expenses for reimbursement mean all expenses not defined as eligible expenses, but for which an explicit exception can be sought from LCCMR if the expenses can be clearly justified and individually documented as directly related to and necessary for a project. No broad allocations for costs in either dollars or percentages are allowed. In deciding whether to seek exception for these costs consider that cash and in-kind leverage are criteria considered in proposal evaluation. Generally ineligible expenses include but are not limited to:

- a. General operations, overhead, and other indirect expenses, including office maintenance, office utility expenses, and office materials and supplies.
- b. Office rental fees (including storage space rental).
- c. Communication expenses incurred for telephone calls, web access, postage, and similar services.
- d. Insurance, except title insurance.
- e. Attorney fees, except to acquire and clear title to land.
- f. Purchase of communication devices such as pagers, cell phones, or smart phones.
- g. Purchase of computers, tablets, or audiovisual equipment.
- h. Generally available food and refreshments, except if explicitly approved for certain types of events.
- i. Conference attendance and associated costs and fees, except if to participate in formal presentation of project findings.
- j. Out of state transportation and travel expenses.
- k. Single-source contracts. Justification for an exception must also include the specific entity by name, why the single source is needed, and how the recipient is ensuring a competitive price for the contracted work.

Prohibited Expenses

Prohibited expenses for reimbursement mean all expenses indicated below, including but not limited to:

- a. Any expenses incurred before the project is authorized, before July 1, 2022, or before LCCMR work plan approval—whichever is latest.
- b. Fundraising.
- c. Taxes, except sales tax on goods and services.
- d. Lobbyists or political contributions.
- e. Advertising and marketing expenses.
- f. Loans, grants, or subsidies to persons or entities for development.
- g. Bad debts, late payment fees, finance charges, or contingency funds.
- h. Interest or investment management fees.
- i. Directors or officers salary.
- j. Merit awards and bonuses.
- k. Memberships (including subscriptions and dues).
- l. Publications, periodicals, and subscriptions.
- m. Employee workplace parking.
- n. Entertainment, decorations, gifts, and prizes.

Environment and Natural Resources Trust Fund: MN Constitution and Statutory Expenditures

Minnesota Constitution Art. XI, Sec.14: Environment and Natural Resources Trust Fund Established

A permanent environment and natural resources trust fund is established in the state treasury. Loans may be made of up to five percent of the principal of the fund for water system improvements as provided by law. The assets of the fund shall be appropriated by law for the public purpose of protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources. The amount appropriated each year of a biennium, commencing on July 1 in each odd-numbered year and ending on and including June 30 in the next odd-numbered year, may be up to 5-1/2 percent of the market value of the fund on June 30 one year before the start of the biennium. Not less than 40 percent of the net proceeds from any state-operated lottery must be credited to the fund until the year 2025. [Adopted, November 8, 1988; Amended, November 6, 1990; November 3, 1998]

M.S. 116P.08 Environment and Natural Resources Trust Fund Expenditures and Exceptions

Subdivision 1. **Expenditures.** (a) Money in the trust fund may be spent ONLY for:

- (1) the reinvest in Minnesota program as provided in section 84.95, subd. 2;
- (2) research that contributes to increasing the effectiveness of protecting or managing the state's environment or natural resources;
- (3) collection and analysis of information that assists in developing the state's environmental and natural resources policies;
- (4) enhancement of public education, awareness, and understanding necessary for the protection, conservation, restoration, and enhancement of air, land, water, forests, fish, wildlife, and other natural resources;
- (5) capital projects for the preservation and protection of unique natural resources;
- (6) activities that preserve or enhance fish, wildlife, land, air, water, and other natural resources that otherwise may be substantially impaired or destroyed in any area of the state;
- (7) administrative and investment expenses incurred by the state board of investment in investing deposits to the trust fund; and
- (8) administrative expenses subject to the limits in section 116P.09.

(b) In making recommendations for expenditures from the trust fund, the commission shall give priority to funding programs and projects under paragraph (a), clause (1) and (6). Any request for proposals issued by the commission shall clearly indicate these priorities.

Subdivision 2. **Exceptions.** Money from the trust fund may not be spent for:

- (1) purposes of environmental compensation and liability under chapter 115B and response action under chapter 115C;
- (2) purposes of municipal water pollution control in municipalities with a population of 5,000 or more under the authority of chapters 115 and 116;
- (3) costs associated with the decommissioning of nuclear power plants;
- (4) hazardous waste disposal facilities;
- (5) solid waste disposal facilities; or
- (6) projects or purposes inconsistent with the strategic plan.

Evaluation Criteria

The following criteria, as applicable, will be considered in evaluating proposals:

- **Funding Priorities:** Responds to RFP funding priorities.
- **Multiple Benefits:** Delivers multiple benefits to Minnesota's environment and natural resources.
- **Outcomes:** Identifies clear objectives likely to result in measurable, demonstrated, and meaningful outcomes.
- **Knowledge Base:** Contributes to the knowledge base or disseminates information that will benefit other efforts.
- **Extent of Impact:** Results in broad, long-term impacts of statewide, regional, or local significance.
- **Innovation:** Employs or demonstrates innovative approaches to more effectively and efficiently solve specific environment and natural resources issues.
- **Scientific/Technical Basis:** Reflects current scientific and technical knowledge, standards, and best practices.
- **Urgency:** Addresses an issue for which immediate future action is urgent and critical to avoid undesirable consequences.
- **Capacity and Readiness:** Demonstrates capacity and readiness for efforts to be managed and completed in timely, accountable, and effective manner.
- **Leverage:** Leverages collaborative partnerships and additional efforts, resources, and non-state funds.

How To Apply

Proposals due by April 2, 2021 at 4:30PM

1. Register for an account on the [LCCMR Proposal and Grant Management System](#).
2. Login and click "Create a New Proposal."
3. Follow the instructions for completing your proposal.
If you would like to view blank sample proposals, you can find them on our [2022 Funding Process page](#).
4. Upload your completed attachments as required:
 - A. Visual component or map (1 page limit)
 - B. Letter or resolution from your governing board authorizing submission of the proposal (non-profits, tribes, and local units of government only)
 - C. 990 tax information, certified audit, or board-reviewed financial statements as required
5. Review all information and attachments.
6. Click "Submit." (Note: state and federal agencies, colleges, and universities must have an authorized representative submit the proposal).
7. Save or print the confirmation email. Please check your junk mail folder if the confirmation email does not appear in your inbox. Contact LCCMR if you did not receive a confirmation email or if your proposal status does not appear as "Final Submitted" on your dashboard.
8. To follow along with the 2022 funding process, visit our [2022 Funding Process page](#).

II. Projects Funded Preceding Biennium

“a description of each project receiving money from the trust fund during the preceding biennium;”

The following documents include:

- Summaries and descriptions of the adopted appropriations for projects funded in FY2021 (beginning July 1, 2021).
 - Research projects have been marked as such in the description.
 - Full work plans are available at the LCCMR, Room 65, State Office Building and on the LCCMR website <http://www.lccmr.mn.gov/> (click on the tab titled “Projects Funded”).
- Summaries and descriptions of the adopted appropriations for projects funded in FY2022 (beginning July 1, 2021).
 - Research projects have been marked as such in the description.
 - Full work plans are available at the LCCMR, Room 65, State Office Building and on the LCCMR website <http://www.lccmr.mn.gov/> (click on the tab titled “Projects Funded”).
- Summaries and descriptions of the adopted appropriations for projects funded in FY2023 (beginning July 1, 2022).
 - Research projects have been marked as such in the description.
 - Full work plans are available at the LCCMR, Room 65, State Office Building and on the LCCMR website <http://www.lccmr.mn.gov/> (click on the tab titled “Projects Funded”).
- Legal Citations
 - FY2021 - M.L. 2021, First Special Session, Chapter 6, Article 5, Sec. 2 (86 projects for a total of \$65,319,000 - \$61,387,000 FY21 ENRTF and transfers from FY16 \$100,000, FY17 \$430,000, FY18 \$94,000, FY19 \$540,000 and FY20 \$2,768,000)
 - FY2022 - M.L. 2021, First Special Session, Chapter 6, Article 6, Sec. 2 (89 projects for a total of \$71,721,000 - \$70,881,000 FY23 ENRTF and transfers from FY18 \$270,000, FY19 \$350,000 and FY20 \$200,000)
 - FY2023 - M.L. 2022, Chapter 94, Sec. 2 (80 projects for a total of \$73,344,000 - \$70,881,000 FY23 ENRTF and transfers from FY18 \$1,835,000, FY19 \$550,000 and FY22 \$78,000)

**FY2021 - MN Laws 2021, First Special Session,
Chapter 6, Article 5, Section 2**

M.L. 2021 (2020 RFP) Environment and Natural Resources Trust Fund (ENRTF) Tentative Recommendations by Subdivision

Process for M.L. 2020

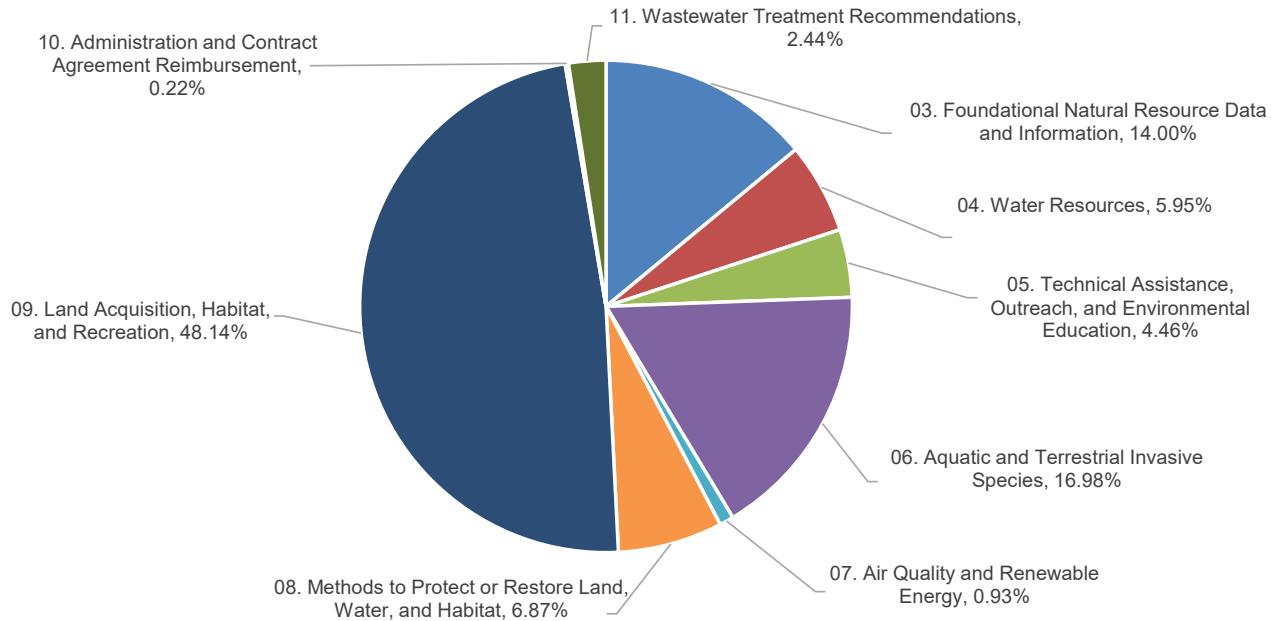
For the FY2020 and FY2021 biennium, approximately \$61 million is available each year for funding from the Environment and Natural Resources Trust Fund (ENRTF). As of July 17, 2019, the Legislative Citizen Commission on Minnesota Resources (LCCMR) has tentatively selected through simple majority 77 projects totaling \$61,387,000 to recommend to the 2020 Minnesota Legislature for funding from the ENRTF. A final decision on recommendations is pending. In response to LCCMR's 2020 Request for Proposal (RFP), 290 proposals requesting a total of approximately \$203 million were received and considered through a competitive, multi stage evaluation. The following tentative recommendations range from funding the full proposal and dollar amount requested to partial funding for specific proposal elements.

January 3, 2019	2020 RFP Issued
April 15, 2019	2020 RFP Proposal Deadline (Received 290 Proposals totaling approximately \$203 million)
June 5-6, 2019	2020 Selection of Proposals for Presentations
June 17 & 24-27, 2019	2020 Proposal Presentations
July 17-18, 2019	2020 Allocation Recommendations
August - December, 2019	Recommended Research Projects Undergo Peer Review
January 16 & 30, 2020	2020 Appropriation Language Review & for possible Adoption

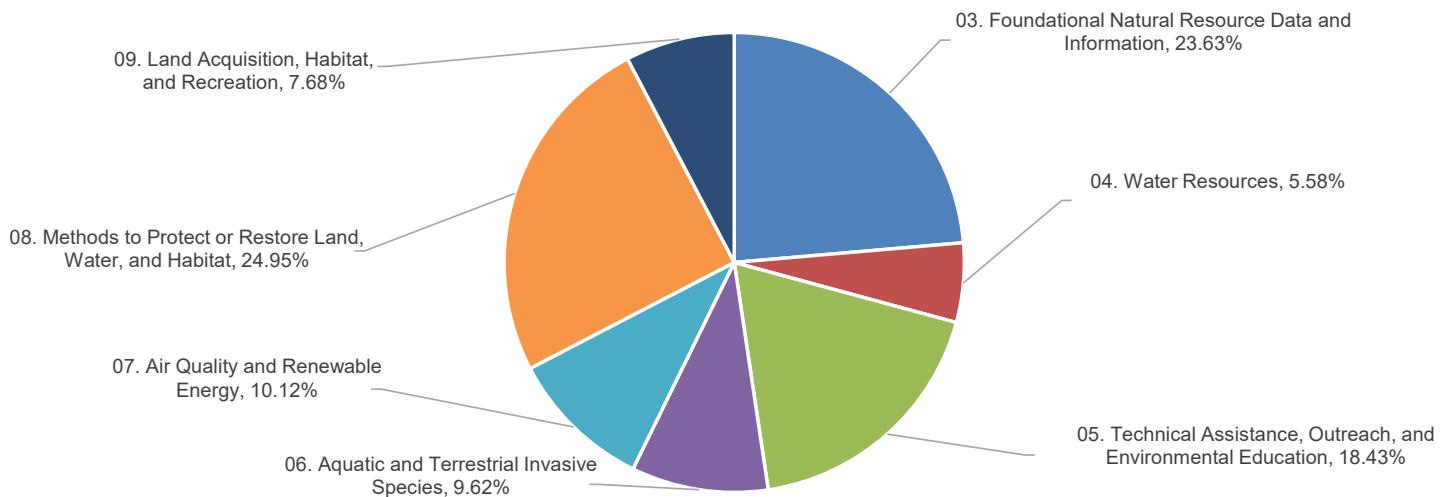
Summary of Recommendations by Subdivision

Subdivision	\$ Recommended	\$ Percent	# Recommended	# Percent
03. Foundational Natural Resource Data and Information	\$8,593,000	14.00%	15	19.48%
04. Water Resources	\$3,653,000	5.95%	8	10.39%
05. Technical Assistance, Outreach, and Environmental Education	\$2,738,000	4.46%	9	11.69%
06. Aquatic and Terrestrial Invasive Species	\$10,425,000	16.98%	7	9.09%
07. Air Quality and Renewable Energy	\$573,000	0.93%	3	3.90%
08. Methods to Protect or Restore Land, Water, and Habitat	\$4,219,000	6.87%	12	15.58%
09. Land Acquisition, Habitat, and Recreation	\$29,551,000	48.14%	21	27.27%
10. Administration and Contract Agreement Reimbursement	\$135,000	0.22%	1	1.30%
11. Wastewater Treatment Recommendations	\$1,500,000	2.44%	1	1.30%
TOTAL RECOMMENDATIONS	\$61,387,000	100%	77	100%

% of Total \$ Recommended by Subdivision



% of Total \$ Recommended In Category H by Subdivision

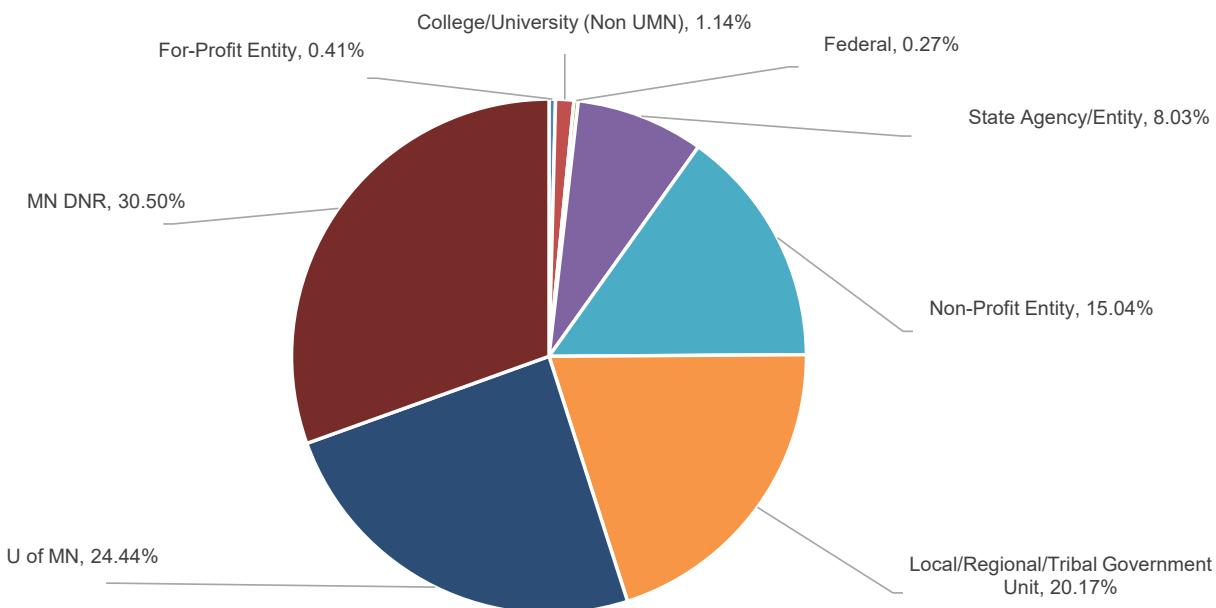


**M.L. 2020 ENRTF TENTATIVE RECOMMENDATIONS
BY AFFILIATION AND AREA OF IMPACT**

Summary of Recommendations by Proposer Affiliation

Affiliation Type by Proposer Affiliation	\$ Recommended	\$ Percent	# Recommended	# Percent
For-Profit Entity	\$250,000	0.41%	1	1.30%
College/University (Non UMN)	\$700,000	1.14%	1	1.30%
Federal	\$168,000	0.27%	1	1.30%
State Agency/Entity	\$4,930,000	8.03%	6	7.79%
Non-Profit Entity	\$9,235,000	15.04%	19	24.68%
Local/Regional/Tribal Government Unit	\$12,382,000	20.17%	12	15.58%
U of MN	\$15,002,000	24.44%	24	31.17%
MN DNR	\$18,720,000	30.50%	13	16.88%
TOTAL RECOMMENDATIONS	\$61,387,000	100.00%	77	100.00%

% of Total \$ Recommended by Affiliation



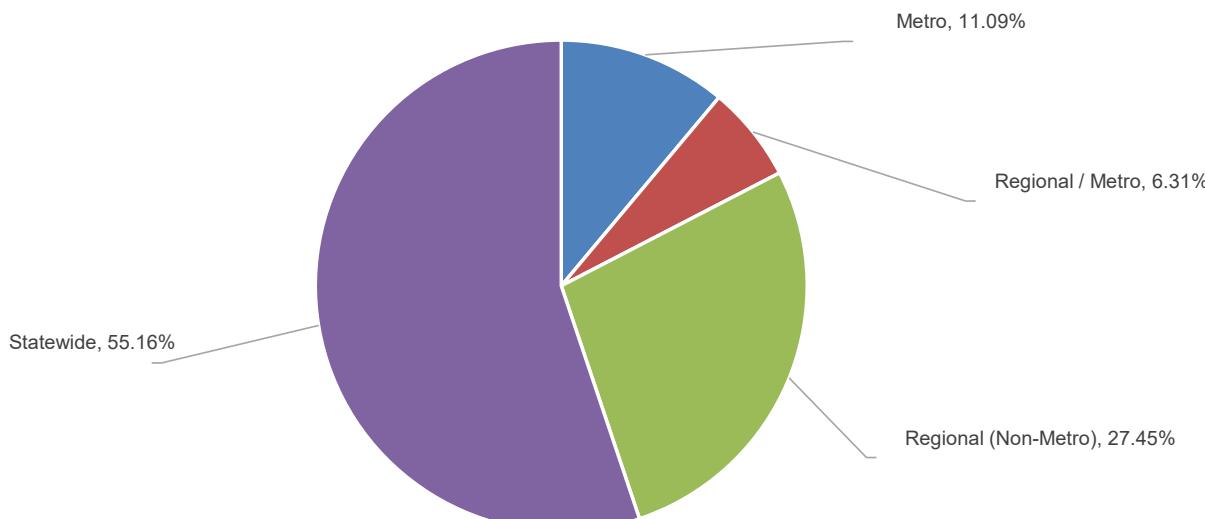
Summary of Recommendations by Area of Impact

Area of Impact	\$ Recommended	\$ Percent	# Recommended	# Percent
Metro*	\$6,806,000	11.09%	8	10.39%
Metro*/Regional**	\$3,873,000	6.31%	7	9.09%
Regional**	\$16,850,000	27.45%	25	32.47%
Statewide	\$33,858,000	55.16%	37	48.05%
TOTAL RECOMMENDATIONS	\$61,387,000	100.00%	77	100.00%

* "Metro" region includes the 11 counties of Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, and Wright.

** "Regional" means area of impact is less than "Statewide" but includes one or more regions of the state ("Northwest", Northeast", "Central", "Southwest", or "Southeast") other than the 11-county "Metro" region.

% Total \$ Recommended by Area of Impact



M.L. 2021 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Appropriations for RFP 2020/FY 2021

On June 25, 2021, the Legislature adopted 74 LCCMR recommendations as tentatively recommended in 2020, provided additional funds to one tentative recommendation, reduced funds for one tentative recommendation, and modified one other. They also added 9 additional appropriations, primarily using unspent funds from prior appropriations that would otherwise return to the Trust Fund, totaling \$3932,000. On June 29, 2021, 86 appropriations were signed into law by the Governor as M.L. 2021, First Special Session, Chapter 6, Article 5, with \$61,387,000 from FY21 and \$3,932,000 recaptured from prior fiscal years, for \$65,319,000 total appropriations.

Topic Area	Total LCCMR \$ Appropriated	Multiple FY's Reallocated \$	FY2021 Trust Fund \$	Percentage of Total Appropriations
Subd. 03 Foundational Natural Resource Data and Information 15 Appropriations	\$8,593,000	\$0	\$8,593,000	13.16%
Subd. 04 Water Resources 7 Appropriations	\$3,457,000	\$0	\$3,457,000	5.29%
Subd. 05 Technical Assistance, Outreach, and Environmental Education 10 Appropriations	\$2,871,000	\$0	\$2,871,000	4.40%
Subd. 06 Aquatic and Terrestrial Invasive Species 7 Appropriations	\$10,425,000	\$0	\$10,425,000	15.96%
Subd. 07 Air Quality and Renewable Energy 3 Appropriations	\$573,000	\$0	\$573,000	0.88%
Subd. 08 Methods to Protect or Restore Land, Water, and Habitat 13 Appropriations	\$4,337,000	\$0	\$4,337,000	6.64%
Subd. 09 Land Acquisition, Habitat, and Recreation 22 Appropriations	\$29,901,000	\$0	\$29,901,000	45.78%
Subd. 10 Emerging Issues Account; Wastewater Renewable Energy Demonstration Grants 1 Appropriation	\$1,095,000	\$0	\$1,095,000	1.68%
Subd. 11 Contract Agreement Reimbursement 1 Appropriation	\$135,000	\$0	\$135,000	0.21%
Subd. 20 Transfers 7 Appropriations (amounts are estimate)	\$3,932,000	\$3,932,000	\$0	6.02%
Total Appropriations	\$65,319,000	\$3,932,000	\$61,387,000	100.00%

Fund Source	\$ Amount
FY 2021 - Environment and Natural Resources Trust Fund (ENRTF)	\$61,387,000
ENRTF Dollars Reallocated from 2019 Appropriations (FY20)	\$2,768,000
ENRTF Dollars Reallocated from 2018 Appropriations (FY19)- estimate	\$540,000
ENRTF Dollars Reallocated from 2017 Appropriations (FY18)- estimate	\$94,000
ENRTF Dollars Reallocated from 2016 Appropriations (FY17)- estimate	\$430,000
ENRTF Dollars Reallocated from 2015 Appropriations (FY16)- estimate	\$100,000
Total \$	\$65,319,000

2020 (FY21) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2021	TOTAL ENRTF \$ Appropriated	Region*
Subd. 03 Foundational Natural Resource Data and Information (15 Projects - Subtotal = \$8,593,000)								
03a	2020-074	Geologic Atlases for Water Resource Management	U of MN - Minnesota Geological Survey	Barbara Lusardi	\$ -	\$ 2,000,000	\$ 2,000,000	Statewide
03b	2020-023	Expanding Minnesota Ecological Monitoring Network	MN DNR	Erika Rowe	\$ -	\$ 800,000	\$ 800,000	Statewide
03c	2020-009	County Groundwater Atlas	MN DNR	Paul Putzier	\$ -	\$ 1,125,000	\$ 1,125,000	Statewide
03d	2020-026	Foundational Hydrology Data for Wetland Protection and Restoration	MN DNR	Jennie Skancke	\$ -	\$ 400,000	\$ 400,000	Statewide
03e	2020-067	Voyageurs Wolf Project – Phase II	U of MN	Joseph Bump	\$ -	\$ 575,000	\$ 575,000	NE
03f	2020-025	Expanding Restoration and Promoting Awareness of Native Mussels	Minnesota Zoological Society	Seth Stapleton	\$ -	\$ 489,000	\$ 489,000	Statewide
03g	2020-032	Improving Pollinator Conservation by Revealing Habitat Needs	U of MN	Colleen Satyshur	\$ -	\$ 500,000	\$ 500,000	Statewide
03h	2020-003	Bee Minnesota - Protect Our Native Bumblebees	U of MN	Declan Schroeder	\$ -	\$ 650,000	\$ 650,000	Statewide
03i	2020-005	Bobcat and Fisher Habitat Use and Interactions	U of MN	Michael Joyce	\$ -	\$ 400,000	\$ 400,000	Central, Metro, NW, NE
03j	2020-030	Healthy Prairies III: Restoring Minnesota Prairie Plant Diversity	U of MN	Ruth Shaw	\$ -	\$ 500,000	\$ 500,000	Central, Metro, NW, SW, SE
03k	2020-027	Freshwater Sponges and AIS: Engaging Citizen Scientists	U of MN	Venugopal Mukku	\$ -	\$ 400,000	\$ 400,000	Statewide
03l	2020-016	Do Beavers Buffer Against Droughts and Floods?	Voyageurs National Park	Steve Windels	\$ -	\$ 168,000	\$ 168,000	NE
03m	2020-022	Enhancing Bat Recovery by Optimizing Artificial Roost Structures	MN DNR	Ed Quinn	\$ -	\$ 190,000	\$ 190,000	Statewide
03n	2020-064	Tools for Supporting Healthy Ecosystems and Pollinators	MN DNR	Jessica Petersen	\$ -	\$ 198,000	\$ 198,000	Statewide
03o	2020-007	Conserving Black Terns and Forster's Terns in Minnesota	U of MN - Duluth NRRI	Annie Bracey	\$ -	\$ 198,000	\$ 198,000	Statewide
Subd. 03 Foundational Natural Resource Data and Information Subtotal =					\$ -	\$ 8,593,000	\$ 8,593,000	
Subd. 04 Water Resources (7 Projects - Subtotal = \$3,457,000)								
04a	2020-037	Managing Highly Saline Waste from Municipal Water Treatment	U of MN	Natasha Wright	\$ -	\$ 250,000	\$ 250,000	Statewide

2020 (FY21) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2021	TOTAL ENRTF \$ Appropriated	Region*
04b	2020-062	Technology for Energy-Generating On-site Industrial Wastewater Treatment	U of MN	Paige Novak	\$ -	\$ 450,000	\$ 450,000	Statewide
04c	2020-040	Microplastics: Transporters of Contaminants in Minnesota Waters	U of MN	Lee Penn	\$ -	\$ 425,000	\$ 425,000	Statewide
04d	2020-013	Developing Strategies to Manage PFAS in Land-Applied Biosolids	Minnesota Pollution Control Agency	Summer Streets	\$ -	\$ 1,404,000	\$ 1,404,000	Statewide
04e	2020-055	Quantifying New Urban Precipitation and Water Reality	U of MN	Joe Magner	\$ -	\$ 500,000	\$ 500,000	Statewide
04f	2020-034	Innovative Solution for Protecting Minnesota from PFAS Contamination	Dem-Con	Bill Keegan	\$ -	\$ 250,000	\$ 250,000	Metro
04g	2020-024	Expanding Protection of Minnesota Water through Industrial Conservation	U of MN	Laura Babcock	\$ -	\$ 178,000	\$ 178,000	Statewide
Subd. 04 Water Resources Subtotal =					\$ -	\$ 3,457,000	\$ 3,457,000	
Subd. 05 Technical Assistance, Outreach, and Environmental Education (10 Projects - Subtotal = \$2,871,000)								
05a	2020-059	Statewide Environmental Education via Public Television Outdoor Series	Pioneer Public Television	Cindy Dorn	\$ -	\$ 300,000	\$ 300,000	Statewide
05b	2020-041	Minnesota Freshwater Quest: Environmental Education on State Waterways	Wilderness Inquiry	Julie Edmiston	\$ -	\$ 500,000	\$ 500,000	Statewide
05c	2020-061	Teach Science: Schools as STEM Living Laboratories	Climate Generation: A Will Steger Legacy	Kristen Poppleton	\$ -	\$ 250,000	\$ 250,000	Statewide
05d	2020-038	Mentoring Next Generation of Conservation Professionals	Minnesota Valley National Wildlife Refuge Trust, Inc.	Deborah Loon	\$ -	\$ 500,000	\$ 500,000	Central, Metro, SE
05e	2020-036	Jay C. Hormel Nature Center Supplemental Teaching Staff	City of Austin	Luke Reese	\$ -	\$ 225,000	\$ 225,000	SE
05f	2020-001	375 Underserved Youth Learn Minnesota Ecosystems by Canoe	YMCA of the Greater Twin Cities	Kurt Simer	\$ -	\$ 375,000	\$ 375,000	Metro, NE
05g	2020-069	YES! Students Take on Water Quality Challenge Phase II	Prairie Woods Environmental Learning Center	Shelli-Kae Foster	\$ -	\$ 199,000	\$ 199,000	Statewide
05h	2020-021	Engaging Minnesotans with Phenology: Radio, Podcasts, Citizen Science	Northern Community Radio, Inc.	Maggie Montgomery	\$ -	\$ 198,000	\$ 198,000	Statewide
05i	2020-017	Driving Conservation Behavior for Native Mussels and Water Quality	Minnesota Zoo	Carol Strecker	\$ -	\$ 191,000	\$ 191,000	Statewide

2020 (FY21) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2021	TOTAL ENRTF \$ Appropriated	Region*
05j	2020-079	Workshops and Outreach to Protect Raptors from Lead Poisoning	U of MN	Julia Ponder	\$ -	\$ 133,000	\$ 133,000	Statewide
Subd. 05 Technical Assistance, Outreach, and Environmental Education Subtotal =					\$ -	\$ 2,871,000	\$ 2,871,000	
Subd. 06 Aquatic and Terrestrial Invasive Species (7 Projects - Subtotal = \$10,425,000)								
06a	2020-043	Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC) - Phase V	U of MN - MITPPC	Robert Venette	\$ -	\$ 5,000,000	\$ 5,000,000	Statewide
06b	2020-054	Protect Community Forests by Managing Ash for Emerald Ash Borer	MN DNR	Valerie McClannahan		\$ 3,500,000	\$ 3,500,000	Statewide
06c	2020-004	Biological Control of White-Nose Syndrome in Bats - Phase III	U of MN	Christine Salomon	\$ -	\$ 440,000	\$ 440,000	Statewide
06d	2020-002	Applying New Tools and Techniques Against Invasive Carp	MN DNR	Brian Nerbonne	\$ -	\$ 478,000	\$ 478,000	Central, SW
06e	2020-020	Emerald Ash Borer and Black Ash: Maintaining Forests and Benefits	U of MN	Alexis Grinde	\$ -	\$ 700,000	\$ 700,000	Statewide
06f	2020-063	Testing Effectiveness of Aquatic Invasive Species Removal Methods	U of MN - Duluth NRRI	Valerie Brady	\$ -	\$ 110,000	\$ 110,000	Statewide
06g	2020-035	Invasive <i>Didymosphenia</i> Threatens North Shore Streams	Science Museum of Minnesota	Mark Edlund	\$ -	\$ 197,000	\$ 197,000	NE
Subd. 06 Aquatic and Terrestrial Invasive Species Subtotal =					\$ -	\$ 10,425,000	\$ 10,425,000	
Subd. 07 Air Quality and Renewable Energy (3 Projects - Subtotal = \$573,000)								
07a	2020-073	Storing Renewable Energy in Flow Battery for Grid Use	U of MN - Morris	Bryan Herrmann	\$ -	\$ 250,000	\$ 250,000	Central
07b	2020-018	Eco-Friendly Plastics from Cloquet Pulp-Mill Lignin	U of MN	Simo Sarkanen	\$ -	\$ 193,000	\$ 193,000	Central, NW, NE
07c	2020-014	Diverting Unsold Food from Landfills and Reducing Greenhouse Gases	Second Harvest Heartland	Julie Vanhove	\$ -	\$ 130,000	\$ 130,000	Metro
Subd. 07 Air Quality and Renewable Energy Subtotal =					\$ -	\$ 573,000	\$ 573,000	
Subd. 08 Methods to Protect or Restore Land, Water, and Habitat (13 Projects - Subtotal = \$4,337,000)								
08a	2020-050	Pollinator Central: Habitat Improvement with Citizen Monitoring	Great River Greening	Rebecca Tucker	\$ -	\$ 750,000	\$ 750,000	Central, Metro
08b	2020-071	Pollinator and Beneficial Insect Strategic Habitat Program	MN Board of Water and Soil Resources	Dan Shaw	\$ -	\$ 750,000	\$ 750,000	Statewide

2020 (FY21) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2021	TOTAL ENRTF \$ Appropriated	Region*
08c	2020-077	Lignin-Coated Fertilizers for Phosphate Control	U of MN - Duluth NRRI	Eric Singsaas	\$ -	\$ 250,000	\$ 250,000	Statewide
08d	2020-031	Implementing Hemp Crop Rotation to Improve Water Quality	Central Lakes College	Keith Olander	\$ -	\$ 700,000	\$ 700,000	Central, Metro, SW
08e	2020-012	Developing Cover-Crop Systems for Sugar Beet Production	U of MN	Anna Cates	\$ -	\$ 300,000	\$ 300,000	Central, NW
08f	2020-047	Native Eastern Larch Beetle Decimating Minnesota's Tamarack Forests	U of MN	Brian Aukema	\$ -	\$ 398,000	\$ 398,000	Central, Metro, NW, NE
08g	2020-029	Habitat Associations of Mississippi Bottomland Forest Marsh Birds	Audubon Minnesota	Rob Schultz	\$ -	\$ 275,000	\$ 275,000	SE
08h	2020-048	Peatland Restoration in the Lost River State Forest	Roseau River Watershed District	Torin McCormack	\$ -	\$ 135,000	\$ 135,000	NW
08i	2020-052	Prescribed Burning for Brushland-Dependent Species - Phase II	U of MN	Rebecca Montgomery	\$ -	\$ 147,000	\$ 147,000	NE
08j	2020-051	Pollinator Habitat Creation Along Urban Mississippi River	Friends of the Mississippi River	Lisa Mueller	\$ -	\$ 129,000	\$ 129,000	Metro
08k	2020-033	Increase Golden Shiner Production to Protect Aquatic Communities	U of MN - Duluth - Sea Grant	Amy Schrank	\$ -	\$ 188,000	\$ 188,000	Statewide
08l	2020-078	Restoring Turf to Native Pollinator Gardens Across Metro	Wilderness in the City	Holly Jenkins	\$ -	\$ 197,000	\$ 197,000	Metro
08m	2020-076	Lawns to Legumes (combined with Subd. 20b +\$880,000)	BWSR	Dan Shaw	\$ -	\$ 118,000	\$ 118,000	Statewide
Subd. 08 Methods to Protect or Restore Land, Water, and Habitat Subtotal =					\$ -	\$ 4,337,000	\$ 4,337,000	
Subd. 09 Land Acquisition, Habitat, and Recreation (22 Projects - Subtotal = \$29,901,000)								
09a	2020-015	DNR Scientific and Natural Areas	MN DNR	Molly Roske	\$ -	\$ 3,000,000	\$ 3,000,000	Statewide
09b	2020-053	Private Native Prairie Conservation through Native Prairie Bank	MN DNR	Judy Schulte	\$ -	\$ 2,000,000	\$ 2,000,000	Central, NW, SW, SE
09c	2020-044	Minnesota State Parks and State Trails Inholdings	MN DNR	Shelby Kok	\$ -	\$ 3,500,000	\$ 3,500,000	Statewide
09d	2020-028	Grants for Local Parks, Trails, and Natural Areas	MN DNR	Audrey Mularie	\$ -	\$ 2,400,000	\$ 2,400,000	Statewide
09e	2020-046	Mississippi River Aquatic Habitat Restoration and Mussel Reintroduction	Minneapolis Park and Recreation Board	Adam Arvidson	\$ -	\$ 1,800,000	\$ 1,800,000	Metro

2020 (FY21) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2021	TOTAL ENRTF \$ Appropriated	Region*
09f	2020-042	Minnesota Hunter Walking Trails: Public Land Recreational Access	Ruffed Grouse Society	Gary Drotts	\$ -	\$ 300,000	\$ 300,000	Central, NW, NE
09g	2020-065	Turning Back to Rivers: Environmental and Recreational Protection	The Trust for Public Land	DJ Forbes	\$ -	\$ 1,000,000	\$ 1,000,000	Central, Metro, SW, SE
09h	2020-072	Metropolitan Regional Parks System Land Acquisition - Phase VI	Metropolitan Council	Jessica Lee	\$ -	\$ 1,000,000	\$ 1,000,000	Metro
09i	2020-045	Minnesota State Trails Development	MN DNR	Kent Skaar	\$ -	\$ 994,000	\$ 994,000	Statewide
09j	2020-019	Elm Creek Restoration - Phase IV	City of Champlin	Todd Tuominen	\$ -	\$ 500,000	\$ 500,000	Metro
09k	2020-060	Superior Hiking Trail As Environmental Showcase	Superior Hiking Trail Association	Lisa Luokkala	\$ -	\$ 450,000	\$ 450,000	NE
09l	2020-066	Upper St. Anthony Falls Enhancements	Friends of the Lock & Dam	Kjersti Monson	\$ -	\$ 2,800,000	\$ 2,800,000	Metro
09m	2020-068	Whiskey Creek and Mississippi River Water Quality, Habitat, and Recreation	Mississippi Headwaters Board	Tim Terrill	\$ -	\$ 500,000	\$ 500,000	Central
09n	2020-049	Perham to Pelican Rapids Regional Trail (West Segment)	Otter Tail County	Matthew Yavarow	\$ -	\$ 2,600,000	\$ 2,600,000	Central
09o	2020-011	Crow Wing County Community Natural Area Acquisition	Crow Wing County	Ryan Simonson	\$ -	\$ 400,000	\$ 400,000	Central
09p	2020-057	Rocori Trail - Phase III	Rocori Trail Construction Board	Pete Weber	\$ -	\$ 1,200,000	\$ 1,200,000	Central
09q	2020-039	Mesabi Trail: New Trail and Additional Funding	St. Louis and Lake Counties Regional Railroad Authority	Bill Dahl	\$ -	\$ 1,000,000	\$ 1,000,000	NE
09r	2020-056	Ranier Safe Harbor and Transient Dock on Rainy Lake	City of Ranier	Sherril Gautreaux	\$ -	\$ 762,000	\$ 762,000	NE
09s	2020-010	Crane Lake Voyageurs National Park Campground and Visitors Center	Town of Crane Lake	Jim Janssen	\$ -	\$ 3,100,000	\$ 3,100,000	NE
09t	2020-006	Chippewa County Acquisition, Recreation and Education	Chippewa County	Scott Williams	\$ -	\$ 160,000	\$ 160,000	SW
09u	2020-058	Sportsmen's Training and Developmental Learning Center	Minnesota Forest Zone Trappers Association	Ray Sogard	\$ -	\$ 85,000	\$ 85,000	NE
09v	2020-097	Birch Lake Recreation Area	City of Babbitt	Cathy Hoheisel	\$ -	\$ 350,000	\$ 350,000	
Subd. 09 Land Acquisition, Habitat, and Recreation Subtotal = \$						\$ 29,901,000	\$ 29,901,000	

2020 (FY21) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2021	TOTAL ENRTF \$ Appropriated	Region*
Subd. 10 Emerging Issues Account; Wastewater Renewable Energy Demonstration Grants (1 Project - Subtotal = \$1,095,000)								
10	2020-080	Wastewater Renewable Energy Demonstration Grants	LCCMR/PFA	Becca Nash	\$ -	\$ 1,095,000	\$ 1,095,000	Statewide
Subd 10 Emerging Issues Account; Wastewater Renewable Energy Demonstration Grants Subtotal = \$ - \$ 1,095,000 \$ 1,095,000								
Subd. 11 Contract Agreement Reimbursement (1 Project - Subtotal = \$135,000)								
11	2020-008	Contract Agreement Reimbursement	MN DNR	Katherine Sherman-Hoehn	\$ -	\$ 135,000	\$ 135,000	Statewide
Subd. 11 Contract Agreement Reimbursement Subtotal = \$ - \$ 135,000 \$ 135,000								
Subd. 20 Transfers (7 projects - Subtotal = \$3,932,000)								
20a1	2020-070	Unprecedented Change Threatens Minnesota's Pristine Lakes	Science Museum of Minnesota	Mark Edlund	\$ 482,000	\$ -	\$ 482,000	Central, NW, NE
20a2	2020-084	Wastewater Pond Optimization	Minnesota Pollution Control Agency	Joel Peck	\$ 700,000	\$ -	\$ 700,000	
20a3	2020-085	Applied Research in State Mineral and Water Resources	U of MN - NRRI	George Hudak	\$ 750,000	\$ -	\$ 750,000	
20a4	2020-086	Chloride Pollution Reduction	MN PCA	Brooke Asleson	\$ 500,000	\$ -	\$ 500,000	
20a5	2020-087	CWD Prion Research in Soils	U of MN	Tiffany Wolf	\$ 336,000	\$ -	\$ 336,000	
20b	2020-076	Lawns to Legumes (combined with Subd 08m +\$118,000)*	BWSR	Dan Shaw	\$ 880,000	\$ -	\$ 880,000	Statewide
20c	2020-090	Emerging Issues Account*	LCCMR	Becca Nash	\$ 284,000	\$ -	\$ 284,000	
Subd. 20 Transfers Subtotal = \$ 3,932,000 \$ - \$ 3,932,000								
TOTAL ENRTF \$					\$ 3,932,000	\$ 61,387,000	\$ 65,319,000	

*Estimate amount, pending final close-out of completing projects being transferred

CHAPTER 6--S.F.No. 20

An act relating to state government; appropriating money for environment, natural resources, and tourism; appropriating money from environment and natural resources trust fund; modifying fees and programs; modifying disposition and expenditure of certain funds; creating accounts; authorizing sales and conveyances of certain state land; adding to and deleting from state parks and recreation areas; modifying state land and school trust land provisions; modifying forestry provisions; modifying aquaculture provisions; modifying game and fish laws; modifying Water Law; modifying natural resource and environment provisions; prohibiting PFAS in food packaging; providing for DUI conformity for operating recreational vehicles; requiring rulemaking; requiring reports; making technical corrections; amending Minnesota Statutes 2020, sections 16B.335, subdivision 2; 17.4982, subdivisions 6, 8, 9, 12, by adding subdivisions; 17.4985, subdivisions 2, 3, 5; 17.4986, subdivisions 2, 4; 17.4991, subdivision 3; 17.4992, subdivision 2; 17.4993, subdivision 1; 35.155, subdivision 7, by adding a subdivision; 84.027, subdivisions 13a, 18; 84.415, by adding a subdivision; 84.63; 84.631; 84.795, subdivision 5; 84.82, subdivisions 1a, 7a; 84.83, subdivision 5; 84.943, subdivisions 3, 5; 84.944, subdivision 1; 84.946, subdivision 4; 84D.11, subdivision 1a; 85.019, by adding a subdivision; 85.052, subdivisions 1, 2, 6, by adding a subdivision; 85.053, subdivision 2, by adding a subdivision; 85.054, subdivision 1; 85.43; 85.47; 86B.705, subdivision 2; 89.021, by adding a subdivision; 89.17; 89.37, subdivision 3; 89A.11; 92.50, by adding a subdivision; 92.502; 94.3495, subdivision 3; 97A.065, subdivision 2; 97A.075, subdivisions 1, 7; 97A.126, by adding a subdivision; 97A.401, subdivision 1, by adding a subdivision; 97A.421, subdivision 1, by adding a subdivision; 97A.475, subdivisions 2, 3, 3a, 4; 97A.505, subdivisions 3b, 8; 97B.022, by adding a subdivision; 97B.036; 97B.055, subdivision 2; 97B.086; 97B.715, subdivision 1; 97B.801; 97B.811, subdivision 4a; 97C.005, subdivision 3; 97C.081, subdivisions 3, 3a; 97C.342, subdivision 2; 97C.401, by adding a subdivision; 97C.605, subdivision 3; 97C.611; 97C.805, subdivision 2; 97C.836; 103C.315, subdivision 4; 103G.271, subdivision 4a, by adding a subdivision; 103G.401; 115A.1310, subdivision 12b; 115A.1312, subdivision 1; 115A.1314, subdivision 1; 115A.1316, subdivision 1; 115A.1318, subdivision 2; 115A.1320, subdivision 1; 115A.5501, subdivision 3; 115A.565, subdivision 1; 115B.17, subdivision 13; 115B.406, subdivisions 1, 9; 115B.407; 115B.421; 116.07, subdivision 7, by adding a subdivision; 116G.07, by adding a subdivision; 116G.15, by adding a subdivision; 127A.353, subdivision 4; 169A.20, subdivision 1; 169A.52, by adding a subdivision; 169A.54, by adding a subdivision; 171.306, by adding a subdivision; 290C.01; 290C.04; Laws 2016, chapter 154, sections 16; 48; Laws 2016, chapter 189, article 3, section 3, subdivision 5; Laws 2017, chapter 96, section 2, subdivision 9, as amended; Laws 2018, chapter 214, article 4, section 2, subdivision 6; Laws 2019, First Special Session chapter 4, article 1, sections 2, subdivision 9; 3, subdivisions 4, 5; article 3, section 109, as amended; proposing coding for new law in Minnesota Statutes, chapters 84; 86B; 92; 103F; 103G; 171; 325F; repealing Minnesota Statutes 2020, sections 84.91, subdivision 1; 85.0505, subdivision 3; 85.0507; 85.054, subdivision 19; 86B.331, subdivision 1; 169A.20, subdivisions 1a, 1b, 1c; Minnesota Rules, part 7044.0350.

ARTICLE 5**ENVIRONMENT AND NATURAL RESOURCES TRUST FUND FISCAL YEAR 2021****Section 1. APPROPRIATIONS.**

The sums shown in the columns marked "Appropriations" are appropriated to the agencies and for the purposes specified in this article. The appropriations are from the environment and natural resources trust fund, or another named fund, and are available for the fiscal years indicated for each purpose. The figures "2020" and "2021" used in this article mean that the appropriations listed under them are available for the fiscal year ending June 30, 2020, or June 30, 2021, respectively. "The first year" is fiscal year 2020. "The second year" is fiscal year 2021. "The biennium" is fiscal years 2020 and 2021.

<u>APPROPRIATIONS</u>	
<u>Available for the Year</u>	
<u>Ending June 30</u>	
<u>2020</u>	<u>2021</u>

Sec. 2. MINNESOTA RESOURCES

<u>Subdivision 1. Total</u>			
<u>Appropriation</u>	\$	<u>-0-</u>	<u>\$ 61,387,000</u>

The amounts that may be spent for each purpose are specified in the following subdivisions. Appropriations in the second year are available for four years beginning July 1, 2020, unless otherwise stated in the appropriation. Any unencumbered balance remaining in the first year does not cancel and is available for the second year or until the end of the appropriation.

Subd. 2. Definition

"Trust fund" means the Minnesota environment and natural resources trust fund established under the Minnesota Constitution, article XI, section 14.

<u>Subd. 3. Foundational Natural Resource Data and Information</u>	<u>-0-</u>	<u>8,593,000</u>
--	------------	------------------

(a) Geologic Atlases for Water Resource Management

\$2,000,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota,

Minnesota Geological Survey, to continue producing county geologic atlases to inform management of surface water and groundwater resources. This appropriation is to complete Part A, which focuses on the properties and distribution of earth materials to define aquifer boundaries and the connection of aquifers to the land surface and surface water resources.

(b) Expanding Minnesota Ecological Monitoring Network

\$800,000 the second year is from the trust fund to the commissioner of natural resources to improve conservation and management of Minnesota's native forests, wetlands, and grasslands by expanding the partially established long-term Ecological Monitoring Network that will provide critical knowledge of how ecosystem dynamics and conditions change through time.

(c) County Groundwater Atlas

\$1,125,000 the second year is from the trust fund to the commissioner of natural resources to continue producing county geologic atlases to inform management of surface water and groundwater resources for drinking water and other purposes. This appropriation is for Part B, to characterize the potential water yields of aquifers and the aquifers' sensitivity to contamination.

(d) Foundational Hydrology Data for Wetland Protection and Restoration

\$400,000 the second year is from the trust fund to the commissioner of natural resources to improve wetland protection, management, and restoration in Minnesota by completing the partially established long-term Wetland Hydrology Monitoring Network that will provide critical knowledge of wetland hydrology dynamics. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(e) Voyageurs Wolf Project - Phase II

\$575,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to

study summertime wolf predation on deer, moose, and other species in the Voyageurs region to inform management of wildlife. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(f) Expanding Restoration and Promoting Awareness of Native Mussels

\$489,000 the second year is from the trust fund to the Minnesota Zoological Garden to promote mussel conservation by rearing juvenile mussels for reintroduction, researching methods to improve growth and survival in captivity, and encouraging public action to benefit water quality. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(g) Improving Pollinator Conservation by Revealing Habitat Needs

\$500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to use citizen scientists and novel analyses to determine the nesting and overwintering needs of wild bees to allow more specific protection and enhancement of pollinator habitat across the state.

(h) Bee Minnesota - Protect Our Native Bumblebees

\$650,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to protect native bee health by investigating the potential to mitigate against pathogens that may be transmissible between honeybees and wild bees and by promoting best practices to beekeepers and the public. This appropriation is subject to Minnesota Statutes, section 116P.10.

(i) Bobcat and Fisher Habitat Use and Interactions

\$400,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to identify potential solutions to reverse the fisher population decline through better understanding of habitat, diet, and activity patterns of bobcats and fishers.

(j) Healthy Prairies III: Restoring Minnesota Prairie Plant Diversity

\$500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to improve Minnesota prairie resiliency by increasing locally sourced seed availability and diversity, evaluating use of beneficial microbes in prairie restorations, and assessing adaptation and adaptive capacity of prairie plant populations.

(k) Freshwater Sponges and AIS: Engaging Citizen Scientists

\$400,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota, Crookston, to use citizen scientists to study the geographic distribution, taxonomic diversity, and antifouling potential of freshwater sponges against aquatic invasive species.

(l) Do Beavers Buffer Against Droughts and Floods?

\$168,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Voyageurs National Park to analyze existing data sets to determine the role of beaver populations and beaver ponds in buffering the region against droughts and floods.

(m) Enhancing Bat Recovery by Optimizing Artificial Roost Structures

\$190,000 the second year is from the trust fund to the commissioner of natural resources to improve the survival of bats by identifying characteristics of successful artificial bat roost structures and optimizing the structures for bat use and reproduction. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(n) Tools for Supporting Healthy Ecosystems and Pollinators

\$198,000 the second year is from the trust fund to the commissioner of natural resources to create a pollination companion guide to the Department of

Natural Resources' Field Guides to the Native Plant Communities of Minnesota for conservation practitioners to better integrate plant-pollinator interactions into natural resource planning and decision-making.

(o) Conserving Black Terns and Forster's Terns in Minnesota

\$198,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to assess the distribution and breeding status of black tern and Forster's tern and to make conservation and restoration recommendations to improve the suitability of habitat for these two bird species in Minnesota.

Subd. 4. Water Resources

-0-

3,457,000

(a) Managing Highly Saline Waste from Municipal Water Treatment

\$250,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop a cost- and energy-efficient method of managing the concentrated saline waste from a municipal water treatment plant to increase the feasibility of using reverse osmosis for centralized water softening and sulfate removal. This appropriation is subject to Minnesota Statutes, section 116P.10.

(b) Technology for Energy-Generating On-site Industrial Wastewater Treatment

\$450,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to improve water quality and generate cost savings by developing off the shelf technology that treats industrial wastewater on-site and turns pollutants into hydrogen and methane for energy. This appropriation is subject to Minnesota Statutes, section 116P.10.

(c) Microplastics: Transporters of Contaminants in Minnesota Waters

\$425,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to

study how several types of common microplastics transport contaminants of concern in Minnesota waters.

(d) Developing Strategies to Manage PFAS in Land-Applied Biosolids

\$1,404,000 the second year is from the trust fund to the commissioner of the Pollution Control Agency to help municipal wastewater plants, landfills, and compost facilities protect human health and the environment by developing strategies to manage per- and polyfluoroalkyl substances (PFAS) in land-applied biosolids.

(e) Quantifying New Urban Precipitation and Water Reality

\$500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to better guide storm water management by evaluating the groundwater and surface water interactions contributing to high water tables and damage to home basements and underground infrastructure in urban areas.

(f) Innovative Solution for Protecting Minnesota from PFAS Contamination

\$250,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Dem-Con Companies to demonstrate a new technology for protecting the state's drinking water and natural resources by eliminating per- and polyfluoroalkyl substances (PFAS) from point source discharges. This appropriation is subject to Minnesota Statutes, section 116P.10, related to royalties, copyrights, patents, and sale of products and assets.

(g) Expanding Protection of Minnesota Water through Industrial Conservation

\$178,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Minnesota technical assistance program in partnership with the Minnesota Rural Water Association to provide technical assistance to businesses to decrease industrial and commercial water

use in communities at risk for inadequate groundwater supply or quality.

Subd. 5. Technical Assistance, Outreach, and Environmental Education

-0-

2,871,000

(a) Statewide Environmental Education via Public Television Outdoor Series

\$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Pioneer Public Television to produce approximately 25 new episodes of a statewide outdoor public television series designed to inspire Minnesotans to connect with the outdoors and restore and protect the environment.

(b) Minnesota Freshwater Quest: Environmental Education on State Waterways

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Wilderness Inquiry for approximately 10,000 underserved Minnesota youth to explore and improve local waterways using the place-based and hands-on Minnesota Freshwater Quest environmental education program.

(c) Teach Science: Schools as STEM Living Laboratories

\$250,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Climate Generation: A Will Steger Legacy to prepare students for the challenges and careers of the future by connecting new science standards, renewable energy, and STEM opportunities in teacher trainings, classroom demonstrations, and program support across the state.

(d) Mentoring Next Generation of Conservation Professionals

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Minnesota Valley National Wildlife Refuge Trust, Inc., to provide paid internships and apprenticeships for diverse young people to learn about careers in the

conservation field from United States Fish and Wildlife Service professionals while working at the Minnesota Valley National Wildlife Refuge and Wetland Management District.

(e) Jay C. Hormel Nature Center Supplemental Teaching Staff

\$225,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Austin to expand the Jay C. Hormel Nature Center environmental education program beyond the city of Austin to students in southeastern Minnesota for three years.

(f) 375 Underserved Youth Learn Minnesota Ecosystems by Canoe

\$375,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the YMCA of the Greater Twin Cities to connect approximately 375 underserved and diverse teens from urban areas and first-ring suburbs to environmental sciences in the natural world through canoeing and learning expeditions with experienced outdoor education counselors. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(g) YES! Students Take on Water Quality Challenge - Phase II

\$199,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Prairie Woods Environmental Learning Center to mobilize local watershed stewardship efforts in approximately 20 communities through student-driven action projects.

(h) Engaging Minnesotans with Phenology: Radio, Podcasts, Citizen Science

\$198,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Northern Community Radio, Inc., in partnership with the Board of Regents of the University of Minnesota to build the next generation of conservationists using phenology, radio broadcasts,

podcasts, and an online, interactive map interface to inspire teachers, students, and the public to get outside and experience nature.

(i) Driving Conservation Behavior for Native Mussels and Water Quality

\$191,000 the second year is from the trust fund to the Minnesota Zoological Garden to develop research-supported strategies to engage the public in specific conservation behaviors to improve water quality and native mussel health across the state.

(j) Workshops and Outreach to Protect Raptors from Lead Poisoning

\$133,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota, Raptor Center, in cooperation with the Department of Natural Resources and other conservation partners, to provide hunters with outreach and workshops on alternatives to lead hunting ammunition, including copper ammunition as an alternative, and to promote voluntary selection of nontoxic ammunition to protect raptors and other wildlife in Minnesota from accidental lead poisoning caused by ingestion of ammunition fragments.

Subd. 6. Aquatic and Terrestrial Invasive Species

-0-

10,425,000

(a) Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC) - Phase V

\$5,000,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to support the Minnesota Invasive Terrestrial Plants and Pests Center to fund approximately 15 new, high-priority research projects that will lead to better management of invasive plants, pathogens, and pests on Minnesota's natural and agricultural lands. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2026, by which time the project must be completed and final products delivered.

(b) Protect Community Forests by Managing Ash for Emerald Ash Borer

\$3,500,000 the second year is from the trust fund to the commissioner of natural resources to reduce emerald ash borer by providing surveys, assessments, trainings, assistance, and grants for communities to manage emerald ash borer, plant a diversity of trees, and engage citizens in community forestry activities. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(c) Biological Control of White-Nose Syndrome in Bats - Phase III

\$440,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to continue assessing and developing a biocontrol agent for white-nose syndrome in bats.

(d) Applying New Tools and Techniques Against Invasive Carp

\$478,000 the second year is from the trust fund to the commissioner of natural resources to apply new monitoring, outreach, and removal techniques and to continue work with commercial anglers to protect Minnesota waters from invasive carp.

(e) Emerald Ash Borer and Black Ash: Maintaining Forests and Benefits

\$700,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to use ongoing experiments to determine statewide long-term emerald ash borer impacts on water, vegetation, and wildlife; to determine optimal replacement species and practices for forest diversification; and to develop criteria for prioritizing mitigation activities. This appropriation is available until June 30, 2026, by which time the project must be completed and final products delivered.

(f) Testing Effectiveness of Aquatic Invasive Species Removal Methods

\$110,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to test how well boat-cleaning methods work, to provide

the Department of Natural Resources with a risk assessment, and to provide recommendations for improving boat-launch cleaning stations to prevent the spread of aquatic invasive species.

(g) Invasive *Didymosphenia* Threatens North Shore Streams

\$197,000 the second year is from the trust fund to the Science Museum of Minnesota to evaluate the recent spread, origin, cause, and economic and ecological threat of didymo formation in North Shore streams and Lake Superior to inform management and outreach.

Subd. 7. Air Quality and Renewable Energy

-0-

573,000

(a) Storing Renewable Energy in Flow Battery for Grid Use

\$250,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota, on behalf of the Morris campus, to analyze the potential of adding a flow battery and solar energy generation to the University of Minnesota Morris's existing renewable-energy-intensive microgrid.

(b) Eco-Friendly Plastics from Cloquet Pulp-Mill Lignin

\$193,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to reduce environmental pollution from plastics by creating eco-friendly replacements using lignin from the pulp mill in Cloquet, Minnesota. This appropriation is subject to Minnesota Statutes, section 116P.10.

(c) Diverting Unsold Food from Landfills and Reducing Greenhouse Gases

\$130,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Second Harvest Heartland to prevent food from going to landfills and reduce greenhouse gas emissions by helping businesses donate unsold prepared food to food shelves.

Subd. 8. Methods to Protect or Restore Land, Water, and Habitat-0-4,337,000(a) Pollinator Central: Habitat Improvement with Citizen Monitoring

\$750,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Great River Greening to restore and enhance approximately 400 acres of pollinator habitat on traditional and nontraditional sites such as roadsides and turf grass from Hastings to St. Cloud to benefit pollinators and build knowledge by engaging approximately 100 citizens in monitoring the impact of habitat improvements. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(b) Pollinator and Beneficial Insect Strategic Habitat Program

\$750,000 the second year is from the trust fund to the Board of Water and Soil Resources for building a new initiative to strategically restore and enhance approximately 1,000 acres of diverse native habitat to benefit multiple insects through grants, cost-share, and outreach. Notwithstanding subdivision 14, paragraph (e), restorations and enhancements may take place on land enrolled in conservation reserve program and reinvest in Minnesota easement programs. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(c) Lignin-Coated Fertilizers for Phosphate Control

\$250,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to test a new, natural, slow-release fertilizer coating made from processed wood to decrease phosphorus runoff from farmland while also storing carbon in soils. This appropriation is subject to Minnesota Statutes, section 116P.10.

(d) Implementing Hemp Crop Rotation to Improve Water Quality

\$700,000 the second year is from the trust fund to the Minnesota State Colleges and Universities System for Central Lakes College to evaluate how hemp crops reduce nitrogen contamination of surface water and groundwater in conventional crop rotations and demonstrate the environmental and economic benefits of hemp production. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(e) Developing Cover-Crop Systems for Sugar Beet Production

\$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop agronomic guidelines to support growers adopting cover-crop practices in sugar beet production in west-central and northwest Minnesota.

(f) Native Eastern Larch Beetle Decimating Minnesota's Tamarack Forests

\$398,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to understand conditions triggering eastern larch beetle outbreaks and develop management techniques to protect tamarack forests from this native insect. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(g) Habitat Associations of Mississippi Bottomland Forest Marsh Birds

\$275,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the National Audubon Society, Minnesota office, to evaluate habitat associations of bottomland forest birds in response to restoration actions to better target restoration efforts for wildlife. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(h) Peatland Restoration in the Lost River State Forest

\$135,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Roseau River Watershed District to collect

physical attribute data from drained peatlands, incorporate the data into a decision matrix, and generate a report detailing peatland restoration potential throughout the Lost River State Forest.

(i) Prescribed Burning for Brushland-Dependent Species - Phase II

\$147,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to compare the effects of spring, summer, and fall burns on birds and vegetation and to provide guidelines for maintaining healthy brushland habitat for a diversity of wildlife and plant species.

(j) Pollinator Habitat Creation Along Urban Mississippi River

\$129,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Friends of the Mississippi River to remove invasive plants and replace them with high-value native species at three urban sites along the Mississippi River to improve habitat for pollinators and other wildlife. This appropriation is available until June 30, 2026, by which time the project must be completed and final products delivered.

(k) Increase Golden Shiner Production to Protect Aquatic Communities

\$188,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Minnesota Sea Grant in Duluth to identify and demonstrate best methods for in-state production of golden shiners to address angler demand while reducing the risk of introducing and spreading invasive species and to communicate findings through reports, manuals, and workshops. Production of shiners in this project must not take place in wetlands.

(l) Restoring Turf to Native Pollinator Gardens Across Metro

\$197,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Wilderness in the City to transition turf to native gardens for pollinator habitat, establish long-term

volunteer stewardship networks, and help connect diverse populations with nature throughout the metropolitan regional park system. A letter of commitment from the respective regional park implementing agency must be provided before money from this appropriation is spent at a regional park within the agency's jurisdiction.

(m) Lawns to Legumes

\$118,000 the second year is from the trust fund to the Board of Water and Soil Resources for demonstration projects that provide grants or payments to plant residential lawns with native vegetation and pollinator-friendly forbs and legumes to protect a diversity of pollinators. The board must establish criteria for grants or payments awarded under this section. Grants or payments awarded under this section may be made for up to 75 percent of the costs of the project, except that in areas identified by the United States Fish and Wildlife Service as areas where there is a high potential for rusty patched bumble bees to be present, grants may be awarded for up to 90 percent of the costs of the project.

Subd. 9. Land Acquisition, Habitat, and Recreation

-0-

29,901,000

(a) DNR Scientific and Natural Areas

\$3,000,000 the second year is from the trust fund to the commissioner of natural resources for the scientific and natural area (SNA) program to restore, improve, and enhance wildlife habitat on SNAs; increase public involvement and outreach; and strategically acquire high-quality lands that meet criteria for SNAs under Minnesota Statutes, section 86A.05, from willing sellers.

(b) Private Native Prairie Conservation through Native Prairie Bank

\$2,000,000 the second year is from the trust fund to the commissioner of natural resources to provide technical stewardship assistance to private landowners, restore and enhance native prairie protected by easements in the native prairie bank, and acquire easements for the native prairie bank in accordance

with Minnesota Statutes, section 84.96, including preparing initial baseline property assessments. Up to \$60,000 of this appropriation may be deposited in the natural resources conservation easement stewardship account, created in Minnesota Statutes, section 84.69, proportional to the number of easement acres acquired.

(c) Minnesota State Parks and State Trails Inholdings

\$3,500,000 the second year is from the trust fund to the commissioner of natural resources to acquire high-priority inholdings from willing sellers within the legislatively authorized boundaries of state parks, recreation areas, and trails to protect Minnesota's natural heritage, enhance outdoor recreation, and promote tourism.

(d) Grants for Local Parks, Trails, and Natural Areas

\$2,400,000 the second year is from the trust fund to the commissioner of natural resources to solicit, rank, and fund competitive matching grants for local parks, trail connections, and natural and scenic areas under Minnesota Statutes, section 85.019. This appropriation is for local nature-based recreation, connections to regional and state natural areas, and recreation facilities and may not be used for athletic facilities such as sport fields, courts, and playgrounds.

(e) Mississippi River Aquatic Habitat Restoration and Mussel Reintroduction

\$1,800,000 the second year is from the trust fund. Of this amount, \$1,549,000 is to the commissioner of natural resources for an agreement with the Minneapolis Park and Recreation Board and \$251,000 is to the commissioner of natural resources to restore lost habitat and reintroduce mussels in the Mississippi River above St. Anthony Falls. This work includes creating habitat and species restoration plans, implementing the restoration plans, and monitoring effectiveness of the restoration for multiple years after implementation. This appropriation is available until June 30, 2027, by which time the project must be completed and final products delivered.

(f) Minnesota Hunter Walking Trails: Public Land Recreational Access

\$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Ruffed Grouse Society to improve Minnesota's hunter walking trail system by restoring or upgrading trailheads and trails, developing new walking trails, and compiling enhanced maps for use by managers and the public.

(g) Turning Back to Rivers: Environmental and Recreational Protection

\$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with The Trust for Public Land to help local communities acquire priority land along the Mississippi, St. Croix, and Minnesota Rivers and their tributaries to protect natural resources, provide buffers for flooding, and improve access for recreation.

(h) Metropolitan Regional Parks System Land Acquisition - Phase VI

\$1,000,000 the second year is from the trust fund to the Metropolitan Council for grants to acquire land within the approved park boundaries of the metropolitan regional park system. This appropriation must be matched by at least 40 percent of nonstate money.

(i) Minnesota State Trails Development

\$994,000 the second year is from the trust fund to the commissioner of natural resources to expand high-priority recreational opportunities on Minnesota's state trails by rehabilitating, improving, and enhancing existing state trails. The high-priority trail bridges to be rehabilitated or replaced under this appropriation include, but are not limited to, those on the Taconite, Great River Ridge, and C. J. Ramstad/Northshore State Trails.

(j) Elm Creek Restoration - Phase IV

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Champlin to conduct habitat and stream restoration of approximately 0.7 miles of Elm Creek

shoreline above Mill Pond Lake and through the Elm Creek Protection Area.

(k) Superior Hiking Trail as Environmental Showcase

\$450,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Superior Hiking Trail Association to rebuild damaged and dangerous segments and create a new trail segment of the Superior Hiking Trail to minimize environmental impacts, make the trail safer for users, and make the trail more resilient for future use and conditions.

(l) Upper St. Anthony Falls Enhancements

\$2,800,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Friends of the Lock and Dam in partnership with the city of Minneapolis to design and install green infrastructure, public access, and habitat restorations on riverfront land at Upper St. Anthony Falls for water protection, recreation, and environmental education purposes. Of this amount, up to \$600,000 is for planning, design, and engagement. No funds from this appropriation may be spent until Congress directs the U.S. Army Corps of Engineers to convey an interest in the Upper St. Anthony Falls property to the city of Minneapolis for use as a visitor center. After this congressional act is signed into law, up to \$100,000 of the planning, design, and engagement funds may be spent. The remaining planning, design, and engagement funds may be spent after a binding agreement has been secured to acquire the land or access and use rights to the land for at least 25 years. Any remaining balance of the appropriation may be spent on installing enhancements after the Upper St. Anthony Falls land has been acquired by the city of Minneapolis.

(m) Whiskey Creek and Mississippi River Water Quality, Habitat, and Recreation

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Mississippi Headwaters Board to acquire and transfer approximately 13 acres of land to the city of Baxter for future construction of water quality, habitat,

and recreational improvements to protect the Mississippi River.

(n) Perham to Pelican Rapids Regional Trail (West Segment)

\$2,600,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Otter Tail County to construct the west segment of the 32-mile Perham to Pelican Rapids Regional Trail that will connect the city of Pelican Rapids to Maplewood State Park.

(o) Crow Wing County Community Natural Area Acquisition

\$400,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Crow Wing County to acquire approximately 65 acres of land adjacent to the historic fire tower property to allow for diverse recreational opportunities while protecting wildlife habitat and preventing forest fragmentation. Any revenue generated from selling products or assets developed or acquired with this appropriation must be repaid to the trust fund unless a plan is approved for reinvestment of income in the project as provided under Minnesota Statutes, section 116P.10.

(p) Rocori Trail - Phase III

\$1,200,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Rocori Trail Construction Board to design and construct Phase III of the Rocori Trail along the old Burlington Northern Santa Fe rail corridor between the cities of Cold Spring and Rockville.

(q) Mesabi Trail: New Trail and Additional Funding

\$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for constructing the Mesabi Trail beginning at the intersection of County Road 20 and Minnesota State Highway 135 and terminating at 1st Avenue North and 1st Street North in the city of Biwabik in St. Louis County. This appropriation may

not be spent until all Mesabi Trail projects funded with trust fund appropriations before fiscal year 2020, with the exception of the project funded under Laws 2017, chapter 96, section 2, subdivision 9, paragraph (g), are completed.

(r) Ranier Safe Harbor and Transient Dock on Rainy Lake

\$762,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Ranier to construct a dock that accommodates boats 26 feet or longer with the goal of increasing public access for boat recreation on Rainy Lake. Any revenue generated from selling products or assets developed or acquired with this appropriation must be repaid to the trust fund unless a plan is approved for reinvestment of income in the project as provided under Minnesota Statutes, section 116P.10.

(s) Crane Lake Voyageurs National Park Campground and Visitor Center

\$3,100,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the town of Crane Lake to design and construct a new campground and to plan and preliminarily prepare a site for constructing a new Voyageurs National Park visitor center on land acquired for these purposes in Crane Lake. Any revenue generated from selling products or assets developed or acquired with this appropriation must be repaid to the trust fund unless a plan is approved for reinvestment of income in the project as provided under Minnesota Statutes, section 116P.10.

(t) Chippewa County Acquisition, Recreation, and Education

\$160,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Chippewa County to acquire wetland and floodplain forest and abandoned gravel pits along the Minnesota River to provide water filtration, education, and recreational opportunities.

(u) Sportsmen's Training and Developmental Learning Center

\$85,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Minnesota Forest Zone Trappers Association to complete a site evaluation and master plan for the Sportsmen's Training and Developmental Learning Center near Hibbing. Any revenue generated from selling products or assets developed or acquired with this appropriation must be repaid to the trust fund unless a plan is approved for reinvestment of income in the project as provided under Minnesota Statutes, section 116P.10.

(v) Birch Lake Recreation Area

\$350,000 the second year is from the trust fund to the commissioner of natural resources for a grant to the city of Babbitt to expand the Birch Lake Recreation Area by adding a new campground to include new campsites, restrooms, and other facilities. This appropriation is available until June 30, 2025.

Subd. 10. Emerging Issues Account; Wastewater Renewable Energy Demonstration Grants

-0- 1,095,000

\$1,095,000 the second year is from the trust fund to an emerging issues account authorized in Minnesota Statutes, section 116P.08, subdivision 4, paragraph (d). Money appropriated under this subdivision must be used for grants in consultation with the Public Facilities Authority for renewable energy demonstration projects at wastewater treatment facilities.

Subd. 11. Contract Agreement Reimbursement

-0- 135,000

\$135,000 the second year is from the trust fund to the commissioner of natural resources, at the direction of the Legislative-Citizen Commission on Minnesota Resources, for expenses incurred for preparing and administering contracts for the agreements specified in this section. The commissioner must provide documentation to the Legislative-Citizen Commission on Minnesota Resources on the expenditure of these funds.

Subd. 12. Availability of Appropriations

Money appropriated in this section may not be spent on activities unless they are directly related to and necessary for a specific appropriation and are specified in the work plan approved by the Legislative-Citizen Commission on Minnesota Resources. Money appropriated in this section must not be spent on indirect costs or other institutional overhead charges that are not directly related to and necessary for a specific appropriation. Costs that are directly related to and necessary for an appropriation, including financial services, human resources, information services, rent, and utilities, are eligible only if the costs can be clearly justified and individually documented specific to the appropriation's purpose and would not be generated by the recipient but for receipt of the appropriation. No broad allocations for costs in either dollars or percentages are allowed. Unless otherwise provided, the amounts in this section are available until June 30, 2024, when projects must be completed and final products delivered. For acquisition of real property, the appropriations in this section are available for an additional fiscal year if a binding contract for acquisition of the real property is entered into before the expiration date of the appropriation. If a project receives a federal grant, the time period of the appropriation is extended to equal the federal grant period.

Subd. 13. Data Availability Requirements

Data collected by the projects funded under this section must conform to guidelines and standards adopted by MN.IT Services. Spatial data must also conform to additional guidelines and standards designed to support data coordination and distribution that have been published by the Minnesota Geospatial Information Office. Descriptions of spatial data must be prepared as specified in the state's geographic metadata guideline and must be submitted to the Minnesota Geospatial Information Office. All data must be accessible and free to the public unless made private under the Data Practices Act, Minnesota Statutes, chapter 13. To the extent practicable, summary data and results of projects funded under this section should be readily accessible on the Internet and identified as

having received funding from the environment and natural resources trust fund.

Subd. 14. Project Requirements

(a) As a condition of accepting an appropriation under this section, an agency or entity receiving an appropriation or a party to an agreement from an appropriation must comply with paragraphs (b) to (l) and Minnesota Statutes, chapter 116P, and must submit a work plan and annual or semiannual progress reports in the form determined by the Legislative-Citizen Commission on Minnesota Resources for any project funded in whole or in part with funds from the appropriation. Modifications to the approved work plan and budget expenditures must be made through the amendment process established by the Legislative-Citizen Commission on Minnesota Resources.

(b) A recipient of money appropriated in this section that conducts a restoration using funds appropriated in this section must use native plant species according to the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines and include an appropriate diversity of native species selected to provide habitat for pollinators throughout the growing season as required under Minnesota Statutes, section 84.973.

(c) For all restorations conducted with money appropriated under this section, a recipient must prepare an ecological restoration and management plan that, to the degree practicable, is consistent with the highest-quality conservation and ecological goals for the restoration site. Consideration should be given to soil, geology, topography, and other relevant factors that would provide the best chance for long-term success and durability of the restoration project. The plan must include the proposed timetable for implementing the restoration, including site preparation, establishment of diverse plant species, maintenance, and additional enhancement to establish the restoration; identify long-term maintenance and management needs of the restoration and how the maintenance, management, and enhancement will be financed; and take advantage of the best-available science and include innovative techniques to achieve the best restoration.

(d) An entity receiving an appropriation in this section for restoration activities must provide an initial restoration evaluation at the completion of the appropriation and an evaluation three years after the completion of the expenditure. Restorations must be evaluated relative to the stated goals and standards in the restoration plan, current science, and, when applicable, the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. The evaluation must determine whether the restorations are meeting planned goals, identify any problems with implementing the restorations, and, if necessary, give recommendations on improving restorations. The evaluation must be focused on improving future restorations.

(e) All restoration and enhancement projects funded with money appropriated in this section must be on land permanently protected by a conservation easement or public ownership.

(f) A recipient of money from an appropriation under this section must give consideration to contracting with Conservation Corps Minnesota for contract restoration and enhancement services.

(g) All conservation easements acquired with money appropriated under this section must:

(1) be permanent;

(2) specify the parties to an easement in the easement;

(3) specify all of the provisions of an agreement that are permanent;

(4) be sent to the Legislative-Citizen Commission on Minnesota Resources in an electronic format at least ten business days before closing;

(5) include a long-term monitoring and enforcement plan and funding for monitoring and enforcing the easement agreement; and

(6) include requirements in the easement document to protect the quantity and quality of groundwater and surface water through specific activities such as keeping water on the landscape, reducing nutrient and contaminant loading, and not permitting artificial hydrological modifications.

(h) For any acquisition of lands or interest in lands, a recipient of money appropriated under this section must not agree to pay more than 100 percent of the appraised value for a parcel of land using this money to complete the purchase, in part or in whole, except that up to ten percent above the appraised value may be allowed to complete the purchase, in part or in whole, using this money if permission is received in advance of the purchase from the Legislative-Citizen Commission on Minnesota Resources.

(i) For any acquisition of land or interest in land, a recipient of money appropriated under this section must give priority to high-quality natural resources or conservation lands that provide natural buffers to water resources.

(j) For new lands acquired with money appropriated under this section, a recipient must prepare an ecological restoration and management plan in compliance with paragraph (c), including sufficient funding for implementation unless the work plan addresses why a portion of the money is not necessary to achieve a high-quality restoration.

(k) To ensure public accountability for using public funds, a recipient of money appropriated under this section must, within 60 days of the transaction, provide to the Legislative-Citizen Commission on Minnesota Resources documentation of the selection process used to identify parcels acquired and provide documentation of all related transaction costs, including but not limited to appraisals, legal fees, recording fees, commissions, other similar costs, and donations. This information must be provided for all parties involved in the transaction. The recipient must also report to the Legislative-Citizen Commission on Minnesota Resources any difference between the acquisition amount paid to the seller and the state-certified or state-reviewed appraisal, if a state-certified or state-reviewed appraisal was conducted.

(l) A recipient of an appropriation from the trust fund under this section must acknowledge financial support from the environment and natural resources trust fund in project publications, signage, and other public communications and outreach related to work completed using the appropriation. Acknowledgment may occur, as appropriate, through use of the trust fund

logo or inclusion of language attributing support from the trust fund. Each direct recipient of money appropriated in this section, as well as each recipient of a grant awarded pursuant to this section, must satisfy all reporting and other requirements incumbent upon constitutionally dedicated funding recipients as provided in Minnesota Statutes, section 3.303, subdivision 10, and chapter 116P.

(m) A recipient of an appropriation from the trust fund under this section that is receiving funding to conduct children's services, as defined in Minnesota Statutes, section 299C.61, subdivision 7, must certify to the commission, as part of the required work plan, that it performs criminal background checks for background check crimes, as defined in Minnesota Statutes, section 299C.61, subdivision 2, on all employees, contractors, and volunteers that have or may have access to a child to whom the recipient provides children's services using the appropriation.

Subd. 15. Payment Conditions and Capital-Equipment Expenditures

(a) All agreements, grants, or contracts referred to in this section must be administered on a reimbursement basis unless otherwise provided in this section. Notwithstanding Minnesota Statutes, section 16A.41, expenditures made on or after July 1, 2020, or the date the work plan is approved, whichever is later, are eligible for reimbursement unless otherwise provided in this section. Periodic payments must be made upon receiving documentation that the deliverable items articulated in the approved work plan have been achieved, including partial achievements as evidenced by approved progress reports. Reasonable amounts may be advanced to projects to accommodate cash-flow needs or match federal money. The advances must be approved as part of the work plan. No expenditures for capital equipment are allowed unless expressly authorized in the project work plan.

(b) Single-source contracts as specified in the approved work plan are allowed.

Subd. 16. Purchasing Recycled and Recyclable Materials

A political subdivision, public or private corporation, or other entity that receives an appropriation under this

section must use the appropriation in compliance with Minnesota Statutes, section 16C.0725, regarding purchasing recycled, repairable, and durable materials and Minnesota Statutes, section 16C.073, regarding purchasing and using paper stock and printing.

Subd. 17. Energy Conservation and Sustainable Building Guidelines

A recipient to whom an appropriation is made under this section for a capital improvement project must ensure that the project complies with the applicable energy conservation and sustainable building guidelines and standards contained in law, including Minnesota Statutes, sections 16B.325, 216C.19, and 216C.20, and rules adopted under those sections. The recipient may use the energy planning, advocacy, and State Energy Office units of the Department of Commerce to obtain information and technical assistance on energy conservation and alternative-energy development relating to planning and constructing the capital improvement project.

Subd. 18. Accessibility

Structural and nonstructural facilities must meet the design standards in the Americans with Disabilities Act (ADA) accessibility guidelines.

Subd. 19. Carryforward; Extension

(a) The availability of the appropriations for the following projects is extended to June 30, 2022:

(1) Laws 2017, chapter 96, section 2, subdivision 8, paragraph (k), Conservation Reserve Enhancement Program (CREP) Outreach and Implementation; and

(2) Laws 2018, chapter 214, article 4, section 2, subdivision 6, paragraph (b), Palmer Amaranth Detection and Eradication Continuation.

(b) The availability of the appropriations for the following projects is extended to June 30, 2023:

(1) Laws 2018, chapter 214, article 4, section 2, subdivision 10, Emerging Issues Account; and

(2) Laws 2019, First Special Session chapter 4, article 2, section 2, subdivision 8, paragraph (f), Lawns to Legumes.

(c) The availability of the appropriation under Laws 2018, chapter 214, article 4, section 2, subdivision 4, paragraph (l), Lake Agnes Treatment, is extended to June 30, 2024.

Subd. 20. Transfers

(a) Sauk River Dam Removal Transfers

The appropriation in Laws 2019, First Special Session chapter 4, article 2, section 2, subdivision 8, paragraph (c), Sauk River Dam Removal and Rock Rapids Replacement, in the amount of \$2,768,000, no longer needed for its original purpose is transferred as follows:

(1) \$482,000 is transferred to the Science Museum of Minnesota to determine how, when, and why lakes in pristine areas of the state without obvious nutrient loading are experiencing algal blooms;

(2) \$700,000 is transferred to the commissioner of the Minnesota Pollution Control Agency, in partnership with the Minnesota Rural Water Association and the University of Minnesota's technical assistance program, to implement a program to optimize existing pond wastewater treatment systems to increase nutrient removal and improve efficiency without requiring costly upgrades;

(3) \$750,000 is transferred to the Board of Regents of the University of Minnesota for academic and applied research through the MnDRIVE program at the Natural Resources Research Institute to develop and demonstrate technologies that enhance the long-term health and management of Minnesota's mineral and water resources. Of this amount, \$300,000 is to support demonstration of three sulfate reduction technologies for improved water quality, and \$450,000 is for continued characterization of Minnesota iron resources and for developing next-generation technologies and iron products. This research must be conducted in consultation with the Mineral Coordinating Committee established under Minnesota Statutes, section 93.0015;

(4) \$500,000 is transferred to the commissioner of the Pollution Control Agency for activities, training, and

grants that reduce chloride pollution. Of this amount, \$250,000 is for grants for upgrading, optimizing, or replacing water softener units. Priority for grants must be given to facilities needing improvements to comply with chloride water quality standards; and

(5) \$336,000 is transferred to the Board of Regents of the University of Minnesota to study chronic wasting disease prions in soils, including the assessment of sites where carcasses with chronic wasting disease have been disposed.

(b) Lawns to Legumes

The following amounts, estimated to be \$880,000, are transferred to the Board of Water and Soil Resources for demonstration projects that provide grants or payments to plant residential lawns with native vegetation and pollinator-friendly forbs and legumes to protect a diversity of pollinators. The board must establish criteria for grants or payments awarded under this clause. Grants or payments awarded under this clause may be made for up to 75 percent of the costs of the project, except that in areas identified by the United States Fish and Wildlife Service as areas where there is a high potential for rusty patched bumble bees to be present, grants may be awarded for up to 90 percent of the costs of the project:

(1) the unencumbered amount, estimated to be \$380,000, in Laws 2016, chapter 186, section 2, subdivision 9, paragraph (b), Minnesota Point Pine Forest Scientific and Natural Area Acquisition; and

(2) the unencumbered amount, estimated to be \$500,000, in Laws 2018, chapter 214, article 4, section 2, subdivision 6, paragraph (d), Developing RNA Interference to Control Zebra Mussels.

(c) Emerging Issues Account

The following amounts, estimated to be \$284,000, are transferred to an emerging issues account authorized in Minnesota Statutes, section 116P.08, subdivision 4, paragraph (d):

(1) the unencumbered amount, estimated to be \$100,000, in Laws 2015, chapter 76, section 2, subdivision 8, paragraph (b), Propagating Native Plants and Restoring Diverse Habitats;

(2) the unencumbered amount, estimated to be \$50,000, in Laws 2016, chapter 186, section 2, subdivision 6, paragraph (c), Advancing Microbial Invasive Species Monitoring from Ballast Discharge;

(3) the unencumbered amount, estimated to be \$11,000, in Laws 2017, chapter 96, section 2, subdivision 5, paragraph (a), Connecting Youth to Minnesota Waterways through Outdoor Classrooms;

(4) the unencumbered amount, estimated to be \$43,000, in Laws 2017, chapter 96, section 2, subdivision 5, paragraph (e), Local Planning and Implementation Efforts for Bird Habitat;

(5) the unencumbered amount, estimated to be \$30,000, in Laws 2017, chapter 96, section 2, subdivision 8, paragraph (a), Optimizing the Nutrition of Roadside Plants for Pollinators;

(6) the unencumbered amount, estimated to be \$10,000, in Laws 2017, chapter 96, section 2, subdivision 8, paragraph (f), Prescribed-Fire Management for Roadside Prairies;

(7) the unencumbered amount, estimated to be \$20,000, in Laws 2018, chapter 214, article 4, section 2, subdivision 4, paragraph (a), Pilot Program to Optimize Local Mechanical and Pond Wastewater-Treatment Plants; and

(8) the unencumbered amount, estimated to be \$20,000, in Laws 2018, chapter 214, article 4, section 2, subdivision 6, paragraph (e), Install and Evaluate an Invasive Carp Deterrent for Mississippi River Locks and Dams.

(d) Transfers and Availability

The transfers under this subdivision are effective June 30, 2021, and the transferred amounts are available until June 30, 2023.

Sec. 3. Laws 2017, chapter 96, section 2, subdivision 9, as amended by Laws 2019, First Special Session chapter 4, article 2, section 4, is amended to read:

Subd. 9. Land Acquisition, Habitat, and Recreation	999,000	13,533,000	-0-
---	---------	------------	-----

(a) Metropolitan Regional Parks System Land Acquisition

\$1,500,000 the first year is from the trust fund to the Metropolitan Council for grants to acquire approximately 70 acres of land within the approved park boundaries of the metropolitan regional park system. This appropriation may not be used to purchase habitable residential structures. A list of proposed fee title acquisitions must be provided as part of the required work plan. This appropriation must be matched by at least 40 percent of nonstate money that must be committed by December 31, 2017. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

(b) Scientific and Natural Areas Acquisition and Restoration, Citizen Science, and Engagement

\$2,500,000 the first year is from the trust fund to the commissioner of natural resources to acquire land with high-quality native plant communities and rare features to be established as scientific and natural areas as provided in Minnesota Statutes, section 86A.05, subdivision 5, restore and improve scientific and natural areas, and provide technical assistance and outreach, including site steward events. At least one-third of the appropriation must be spent on restoration activities. A list of proposed acquisitions and restorations must be provided as part of the required work plan. Land acquired with this appropriation must be sufficiently improved to meet at least minimum management standards, as determined by the commissioner of natural resources. When feasible, consideration must be given to accommodate trails on lands acquired. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

(c) Minnesota State Parks and State Trails Land Acquisition

\$1,500,000 the first year is from the trust fund to the commissioner of natural resources to acquire approximately 373 acres from willing sellers for authorized state trails and critical parcels within the statutory boundaries of state parks. State park land

acquired with this appropriation must be sufficiently improved to meet at least minimum management standards, as determined by the commissioner of natural resources. A list of proposed acquisitions must be provided as part of the required work plan. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

(d) Minnesota State Trails Acquisition, Development, and Enhancement

\$999,000 in fiscal year 2017 and \$39,000 the first year are from the trust fund to the commissioner of natural resources for state trail acquisition, development, and enhancement in southern Minnesota. A proposed list of trail projects on authorized state trails must be provided as part of the required work plan. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

(e) Native Prairie Stewardship and Prairie Bank Easement Acquisition

\$2,675,000 the first year is from the trust fund to the commissioner of natural resources to acquire native prairie bank easements in accordance with Minnesota Statutes, section 84.96, on approximately 250 acres, prepare baseline property assessments, restore and enhance native prairie sites, and provide technical assistance to landowners. Of this amount, up to \$132,000 may be deposited in a conservation easement stewardship account. Deposits into the conservation easement stewardship account must be made upon closing on conservation easements or at a time otherwise approved in the work plan. A list of proposed easement acquisitions must be provided as part of the required work plan. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

(f) Leech Lake Acquisition

\$1,500,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Leech Lake Band of Ojibwe to acquire approximately 45 acres, including 0.67 miles of shoreline of high-quality aquatic and wildlife habitat

at the historic meeting place between Henry Schoolcraft and the Anishinabe people. The land must be open to public use including hunting and fishing. The band must provide a commitment that land will not be put in a federal trust through the Bureau of Indian Affairs.

(g) Mesabi Trail Development

\$2,269,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for engineering and constructing segments of the Mesabi Trail. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

(h) Tower Trailhead Boat Landing and Habitat Improvement - Phase II

\$600,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Tower to construct a trailhead, trail connection to the Mesabi Trail, and boat landing and to restore vegetative habitat on city-owned property. Plant and seed materials must follow the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. This appropriation is available until June 30, 2020 2023, by which time the project must be completed and final products delivered.

(i) Land Acquisition for Voyageurs National Park Crane Lake Visitors Center

\$950,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the town of Crane Lake, in partnership with Voyageurs National Park and the Department of Natural Resources, to acquire approximately 30 acres to be used for a visitor center and campground. Income generated by the campground may be used to support the facility.

EFFECTIVE DATE. This section is effective retroactively from July 1, 2017.

Sec. 4. Laws 2018, chapter 214, article 4, section 2, subdivision 6, is amended to read:

Subd. 6. Aquatic and Terrestrial Invasive Species	-0-	5,760,000
--	-----	-----------

(a) Minnesota Invasive Terrestrial Plants and Pests Center - Phase 4

\$3,500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for high-priority research at the Invasive Terrestrial Plants and Pests Center to protect Minnesota's natural and agricultural resources from terrestrial invasive plants, pathogens, and pests as identified through the center's strategic prioritization process. This appropriation is available until June 30, 2023, by which time the project must be completed and final products delivered.

(b) Palmer Amaranth Detection and Eradication Continuation

\$431,000 the second year is from the trust fund to the commissioner of agriculture to continue to monitor, ground survey, and control Palmer amaranth and other prohibited eradicate species of noxious weeds primarily in conservation plantings natural areas and to develop and implement aerial-survey methods to prevent infestation and protect prairies, other natural areas, and agricultural crops.

(c) Evaluate Control Methods for Invasive Hybrid Cattails

\$131,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Voyageurs National Park to evaluate the effectiveness of mechanical harvesting and managing muskrat populations to remove exotic hybrid cattails and restore fish and wildlife habitat in Minnesota wetlands. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

(d) Developing RNA Interference to Control Zebra Mussels

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement

with the United States Geological Survey to develop a genetic control tool that exploits the natural process of RNA silencing to specifically target and effectively control zebra mussels without affecting other species or causing other nontarget effects. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

(e) Install and Evaluate an Invasive Carp Deterrent for Mississippi River Locks and Dams

\$998,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota in cooperation with the United States Army Corps of Engineers and the United States Fish and Wildlife Service to install, evaluate, and optimize a system in Mississippi River locks and dams to deter passage of invasive carp without negatively impacting native fish and to evaluate the ability of predator fish in the pools above the locks and dams to consume young carp. The project must conduct a cost comparison of equipment purchase versus lease options and choose the most effective option. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

(f) Determining Risk of Toxic Alga in Minnesota Lakes

\$200,000 the second year is from the trust fund to the Science Museum of Minnesota for the St. Croix Watershed Research Station to determine the historical distribution, abundance, and toxicity of the invasive blue-green alga, *Cylindrospermopsis raciborskii*, in about 20 lakes across Minnesota and inform managers and the public about the alga's spread and health risks. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

Sec. 5. EFFECTIVE DATE.

Sections 1, 2, and 4 are effective the day following final enactment.

**FY2022 - MN Laws 2021, First Special Session,
Chapter 6, Article 6, Section 2**

Environment and Natural Resources Trust Fund Recommendations Summary

LCCMR 2021 RFP

Process for M.L. 2021 (FY2022)

For the FY 2022 and FY 2023 biennium (July 1, 2021 -June 30, 2023), approximately \$71 million is available each year for appropriation from the Environment and Natural Resources Trust Fund (ENRTF).

As of November 18, 2020, the Legislative-Citizen Commission on Minnesota Resources (LCCMR) selected 88 projects totaling \$70,881,000 to recommend to the 2021 Minnesota Legislature for funding from the ENRTF. The recommendations are the result of a LCCMR's 2021 Request for Proposal process in which 329 proposals requesting a total of approximately \$240 million were received and considered through a competitive, multi-stage evaluation. The following recommendations range from funding the full proposal and dollar amount requested to partial funding for specific proposal elements.

Check the LCCMR schedule for the most up-to-date information and important process dates.

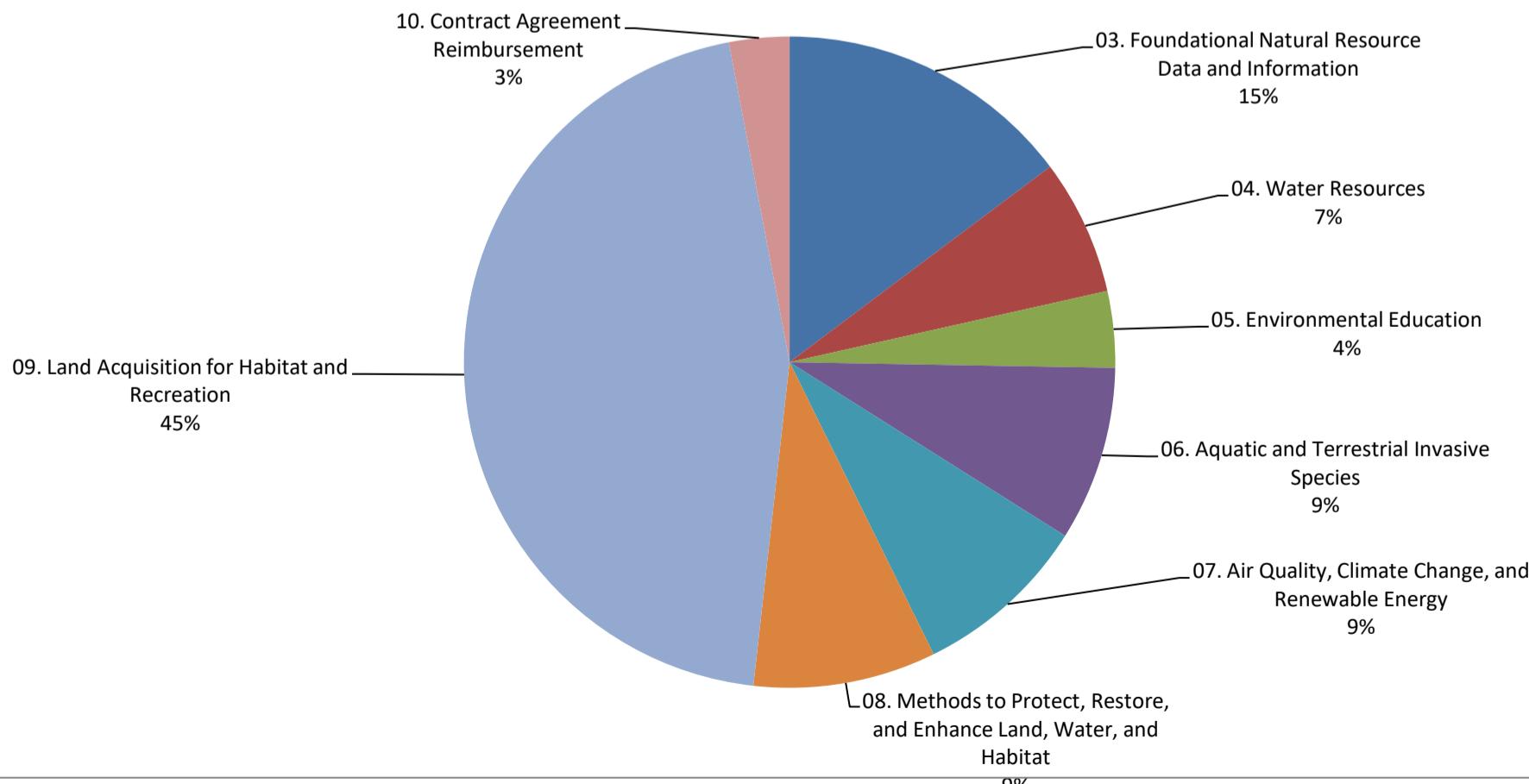
January 3, 2020	RFP Issued
May 22, 2020*	RFP Proposal Deadline (329 Proposals received totaling ~\$240 million)
June 17-18, 2020	Selection of Proposals for Further Consideration and Presentations
July 7-9 & July 14-16, 2020	Proposal Presentations
August 6-7, 2020	Allocation and Recommendations
August - November, 2020	Recommended Research Projects Undergo Peer Review
November 18, & December 9 & 17, 2020	Appropriation Language Review & Adoption

*Deadline extended for 2020 proposals to resubmit

Summary of Recommendations by Category

Subdivision	\$ Recommended	\$ Percent	# Recommended	# Percent
03. Foundational Natural Resource Data and Information	\$10,459,000	15%	14	16%
04. Water Resources	\$4,771,000	7%	10	11%
05. Environmental Education	\$2,687,000	4%	7	8%
06. Aquatic and Terrestrial Invasive Species	\$6,148,000	9%	7	8%
07. Air Quality, Climate Change, and Renewable Energy	\$6,205,000	9%	6	7%
08. Methods to Protect, Restore, and Enhance Land, Water, and Habitat	\$6,429,000	9%	18	20%
09. Land Acquisition for Habitat and Recreation	\$32,062,000	45%	22	25%
10. Contract Agreement Reimbursement	\$2,120,000	3%	4	5%
Total Request	\$70,881,000	100%	88	100%

% of Total \$ Recommended by Category

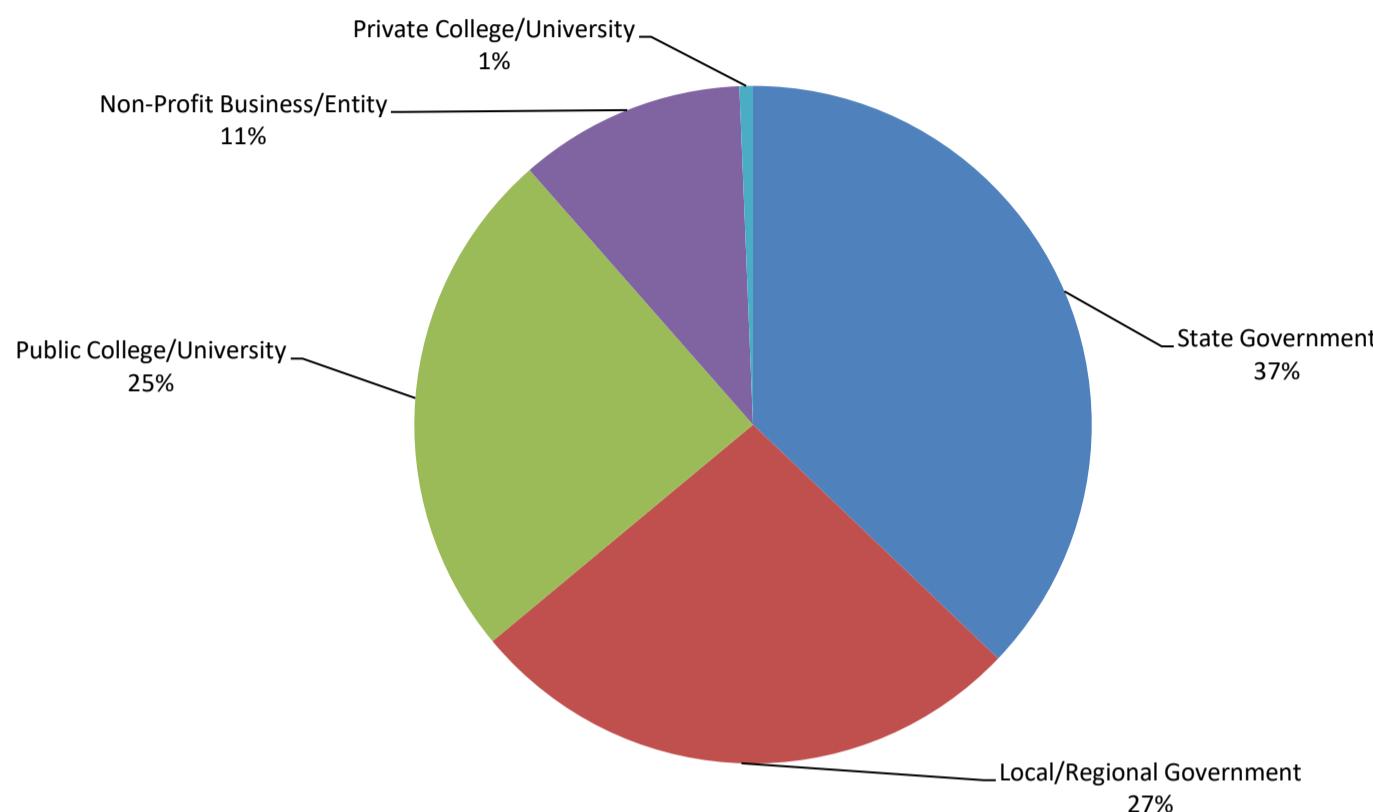


Environment and Natural Resources Trust Fund Recommendations Summary LCCMR 2021 RFP

Summary of Recommendations by Affiliation

Affiliation Type	\$ Recommendations	\$ Percent	# Recommendations	# Percent
State Government	\$26,313,000	37%	20	23%
Local/Regional Government	\$19,027,000	27%	24	27%
Public College/University	\$17,413,000	25%	27	31%
Non-Profit Business/Entity	\$7,671,000	11%	15	17%
Private College/University	\$457,000	1%	2	2%
Total Request	\$70,881,000	100%	88	100%

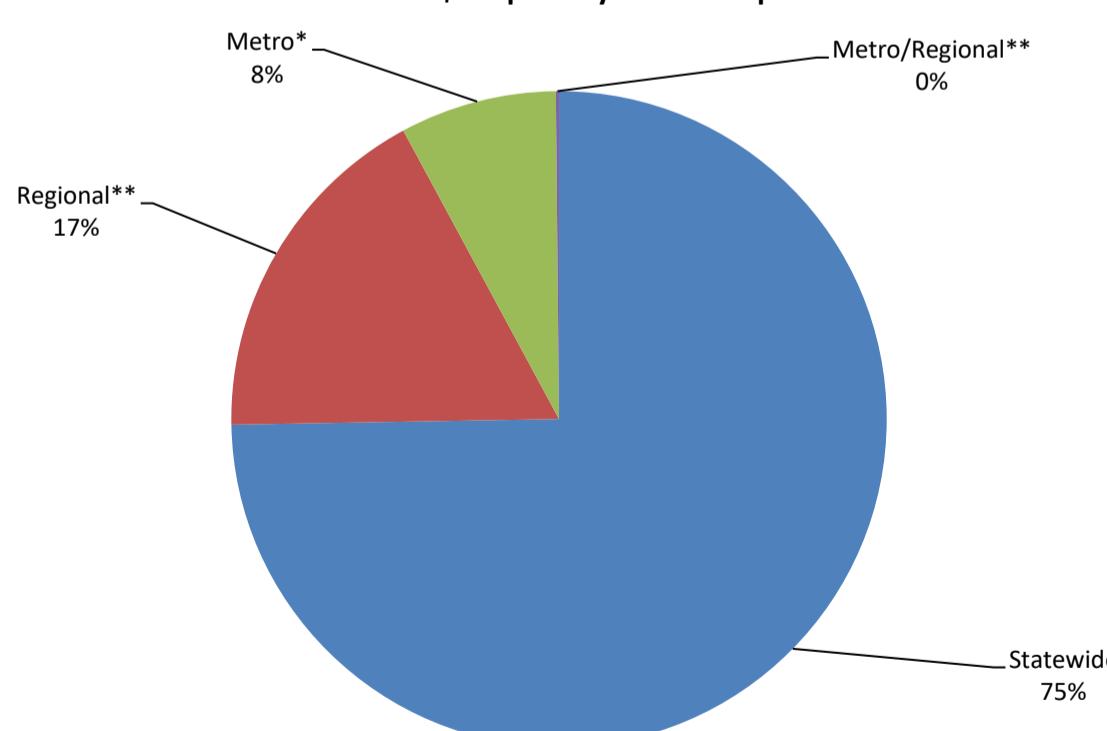
% of Total \$ Recommended by Affiliation



Summary of Proposals by Area of Impact

Areas of Impact	\$ Recommendations	\$ Percent	# Recommendations	# Percent
Statewide	\$52,966,000	75%	61	69%
Regional**	\$12,328,000	17%	18	20%
Metro*	\$5,478,000	8%	8	9%
Metro/Regional**	\$109,000	0%	1	1%
Total Recommendations	\$70,881,000	100%	88	100%

% of Total \$ Request by Area of Impact



* "Metro" region includes the 11 counties of Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, and Wright.

** "Regional" means area of impact is less than "Statewide" but includes one or more regions of the state ("Northwest", Northeast", "Central", "Southwest", or "Southeast") other than the 11-county "Metro" region.

M.L. 2021 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Appropriations for RFP 2021/FY 2022

On June 25, 2021, the Legislature adopted 88 LCCMR recommendations as recommended in 2021. They also added one additional appropriation, primarily using unspent funds from previous projects for \$840,000. On June 29, 2021, 89 appropriations were signed into law by the Governor as M.L. 2021, First Special Session, Chapter 6, Article 6, with \$70,881,000 FY22 and \$840,000 recaptured from prior fiscal years, for \$71,721,000 total appropriations.

Topic Area	Total LCCMR \$ Appropriated	Multiple FY's Reallocated \$	FY2021 Trust Fund \$	Percentage of Total Appropriations
Subd. 03 Foundational Natural Resource Data and Information 14 Appropriations	\$10,459,000	\$0	\$10,459,000	14.58%
Subd. 04 Water Resources 10 Appropriations	\$4,771,000	\$0	\$4,771,000	6.65%
Subd. 05 Environmental Education 7 Appropriations	\$2,687,000	\$0	\$2,687,000	3.75%
Subd. 06 Aquatic and Terrestrial Invasive Species 7 Appropriations	\$6,148,000	\$0	\$6,148,000	8.57%
Subd. 07 Air Quality, Climate Change, and Renewable Energy 6 Appropriations	\$6,205,000	\$0	\$6,205,000	8.65%
Subd. 08 Methods to Protect, Restore, and Enhance Land, Water, and Habitat 18 Appropriations	\$6,429,000	\$0	\$6,429,000	8.96%
Subd. 09 Land Acquisition, Habitat, and Recreation 22 Appropriations	\$32,062,000	\$0	\$32,062,000	44.70%
Subd. 10 Administrative and Emerging Issues 4 Appropriations	\$2,120,000	\$0	\$2,120,000	2.96%
Subd. 19 Transfers; Natural Resources Research Institute 1 Appropriation (amounts are estimate)	\$840,000	\$840,000	\$0	1.17%
Total Appropriations	\$71,721,000	\$840,000	\$70,881,000	100.00%

Fund Source	\$ Amount
FY 2022 - Environment and Natural Resources Trust Fund (ENRTF)	\$70,881,000
ENRTF Dollars Reallocated from 2019 Appropriations (FY20)- estimate	\$220,000
ENRTF Dollars Reallocated from 2018 Appropriations (FY19)- estimate	\$350,000
ENRTF Dollars Reallocated from 2017 Appropriations (FY18)- estimate	\$270,000
Total \$	\$71,721,000

2021 (FY22) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2022	TOTAL ENRTF \$ Appropriated
Subd. 03 Foundational Natural Resource Data and Information (14 Projects - Subtotal = \$10,459,000)							
03a	2021-032	What's Bugging Minnesota's Insect-Eating Birds?	U of MN, Duluth - NRRI	Alexis Grinde	\$ -	\$ 199,000	\$ 199,000
03b	2021-055	Protecting Minnesota's Beneficial Macroalgae: All Stoneworts Aren't Starry	MN DNR, Ecological and Water Resources Division	Donna Perleberg	\$ -	\$ 811,000	\$ 811,000
03c	2021-071	County Groundwater Atlas	MN DNR, Ecological and Water Resources Division	Paul Putzier	\$ -	\$ 1,875,000	\$ 1,875,000
03d	2021-087	Improving Resiliency and Conservation Outcomes For Minnesota Turtles	Minnesota Zoological Society	Tricia Markle	\$ -	\$ 391,000	\$ 391,000
03e	2021-113	Minnesota Biological Survey	MN DNR, Ecological and Water Resources Division	Bruce Carlson	\$ -	\$ 1,500,000	\$ 1,500,000
03f	2021-118	Groundwater Contamination Mapping Project - Phase II	Minnesota Pollution Control Agency	Myrna Halbach	\$ -	\$ 800,000	\$ 800,000
03g	2021-138	Geologic Atlases for Water Resource Management	U of MN, MN Geological Survey	Barbara Lusardi	\$ -	\$ 3,092,000	\$ 3,092,000
03h	2021-140	Redwood County Reinvest in Minnesota Easement Evaluation and Public Outreach	Redwood Soil & Water Conservation District	Scott Wold	\$ -	\$ 197,000	\$ 197,000
03i	2021-159	Collaborative State and Tribal Wild Rice Monitoring Program	MN DNR, Ecological and Water Resources Division	Josh Knopik	\$ -	\$ 644,000	\$ 644,000
03j	2021-238	Morrison County Performance Drainage and Hydrology Management II	Morrison Soil and Water Conservation District	Shannon Wettstein	\$ -	\$ 197,000	\$ 197,000
03k	2021-278	Exploring Minnesota's Wetlands: Our Resource For Future Medicine	U of MN, Crookston	Brian Dingmann	\$ -	\$ 210,000	\$ 210,000
03l	2021-289	A Biodiversity Checkup for Minnesota's Big Woods	U of MN, College of Food, Agricultural and Natural Resource Sciences	Lee Frelich	\$ -	\$ 109,000	\$ 109,000
03m	2021-321	Microbiome In Raptors: A New Tool For Conservation	U of MN, Raptor Center	Julia Ponder	\$ -	\$ 129,000	\$ 129,000
03n	2021-396	Bioacoustics for Broad-Scale Species Monitoring and Conservation	U of MN, College of Food, Agricultural and Natural Resource Sciences	Elena West	\$ -	\$ 305,000	\$ 305,000
Subd. 03 Foundational Natural Resource Data and Information Subtotal = \$ 10,459,000							
Subd. 04 Water Resources (10 Projects - Subtotal = \$4,771,000)							
04a	2021-050	Trout Stream Habitat Restoration Success	U of MN, Duluth - NRRI	Valerie Brady	\$ -	\$ 319,000	\$ 319,000
04b	2021-115	Novel Nutrient Recovery Process from Wastewater Treatment Plants	U of MN, College of Food, Agricultural and Natural Resource Sciences	Bo Hu	\$ -	\$ 200,000	\$ 200,000
04c	2021-121	Monitoring Emerging Viruses In Minnesota's Urban Water Cycles	U of MN, College of Biological Sciences	Sebastian Behrens	\$ -	\$ 416,000	\$ 416,000
04d	2021-144	Microgeographic Impact of Antibiotics Released from Identified Hotspots	U of MN, College of Veterinary Medicine	Randall Singer	\$ -	\$ 508,000	\$ 508,000

2021 (FY22) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2022	TOTAL ENRTF \$ Appropriated
04e	2021-266	Sustainable Irrigation Management: Expanding a Web Application	U of MN, College of Food, Agricultural and Natural Resource Sciences	Bryan Runck	\$ -	\$ 1,139,000	\$ 1,139,000
04f	2021-358	Assessing Membrane Bioreactor Wastewater Treatment Efficacy	Minnesota State Colleges and Universities, St. Cloud State University	Heiko Schoenfuss	\$ -	\$ 419,000	\$ 419,000
04g	2021-364	Evaluating Coronavirus and Other Microbiological Contamination of Drinking Water Sources from Wastewater	U of MN, College of Science and Engineering	Timothy LaPara	\$ -	\$ 594,000	\$ 594,000
04h	2021-376	St. James Pit Water-Level Control Study	City of Aurora	Stefanie Dickinson	\$ -	\$ 259,000	\$ 259,000
04i	2021-384	Long-Term Nitrate Mitigation by Maintaining Profitable Kernza Production	Stearns County Soil and Water Conservation District	Dennis Fuchs	\$ -	\$ 485,000	\$ 485,000
04j	2021-390	Antibiotic Resistance and Wastewater Treatment: Problems And Solutions	University of St. Thomas	Justin Donato	\$ -	\$ 432,000	\$ 432,000

Subd. 04 Water Resources Subtotal = \$ - \$ 4,771,000 \$ 4,771,000

Subd. 05 Environmental Education (7 Projects - Subtotal \$2,687,000)

05a	2021-042	Increasing Outdoor Learning for Young Minnesotans	Wolf Ridge Environmental Learning Center	Peter Smerud	\$ -	\$ 383,000	\$ 383,000
05b	2021-131	Pollinator Education in the Science Classroom	U of MN, College of Food, Agricultural and Natural Resource Sciences	Elaine Evans	\$ -	\$ 366,000	\$ 366,000
05c	2021-132	Minnesota Freshwater Quest: Environmental Education for Youth	Wilderness Inquiry	Julie Edmiston	\$ -	\$ 699,000	\$ 699,000
05d	2021-175	Minnesota Master Naturalist: Nature for New Minnesotans	U of MN, College of Food, Agricultural and Natural Resource Sciences	Robert Blair	\$ -	\$ 293,000	\$ 293,000
05e	2021-186	The Voyageurs Classroom Initiative	Voyageurs National Park Association	Christina Hausman Rhode	\$ -	\$ 348,000	\$ 348,000
05f	2021-320	Restoring Land and Reviving Heritage: Conservation Through Indigenous Culture	Belwin Conservancy	Katie Bloome	\$ -	\$ 420,000	\$ 420,000
05g	2021-323	Expanding Access to Environmental Education for Underserved Communities	U of MN, Raptor Center	Julia Ponder	\$ -	\$ 178,000	\$ 178,000

Subd. 05 Environmental Education Subtotal = \$ - \$ 2,687,000 \$ 2,687,000

Subd. 06 Aquatic and Terrestrial Invasive Species (7 Projects - Subtotal = \$6,148,000)

06a	2021-017	Starch Allocation Patterns of Invasive Starry Stonewort Harvested from Lake Koronis	Minnesota State Colleges and Universities, Minnesota State University Mankato	Ryan Wersal	\$ -	\$ 101,000	\$ 101,000
06b	2021-091	Long-Term Efficacy of Invasive Removal in Floodplain Forests	Macalester College	Mike Anderson	\$ -	\$ 25,000	\$ 25,000
06c	2021-162	Oak Wilt Suppression at the Northern Edge - Phase II	Morrison Soil and Water Conservation District	Shannon Wettstein	\$ -	\$ 423,000	\$ 423,000

2021 (FY22) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2022	TOTAL ENRTF \$ Appropriated
06d	2021-164	Biocontrol of Invasive Species in Bee Lawns and Parklands	U of MN, College of Food, Agricultural and Natural Resource Sciences	Vera Krischik	\$ -	\$ 425,000	\$ 425,000
06e	2021-188	Building Knowledge and Capacity for AIS Solutions	U of MN, MAISRC	Nicholas Phelps	\$ -	\$ 3,750,000	\$ 3,750,000
06f	2021-217	Evaluating Minnesota's Last Best Chance to Stop Carp	U of MN, College of Food, Agricultural and Natural Resource Sciences	Peter Sorensen	\$ -	\$ 424,000	\$ 424,000
06g	2021-313	Stop Starry Invasion with Community Invasive Species Containment	Minnesota Lakes and Rivers Advocates	Jeff Forester	\$ -	\$ 1,000,000	\$ 1,000,000
Subd. 06 Aquatic and Terrestrial Invasive Species Subtotal =					\$ -	\$ 6,148,000	\$ 6,148,000
Subd. 07 Air Quality, Climate Change, and Renewable Energy (6 Projects - Subtotal = \$6,205,000)							
07a	2021-010	Enhanced Thermo-Active Foundations for Space Heating in Minnesota	U of MN, Duluth	Aggrey Mwesigye	\$ -	\$ 312,000	\$ 312,000
07b	2021-169	Storing Renewable Energy in Flow Battery for Grid Use	U of MN, Morris	Bryan Herrmann	\$ -	\$ 2,408,000	\$ 2,408,000
07c	2021-191	Agrivoltaics to Improve the Environment and Farm Resiliency	U of MN, WCROC	Bradley Heins	\$ -	\$ 646,000	\$ 646,000
07d	2021-294	Behavioral Response of Bald Eagles to Acoustic Stimuli	U of MN, St. Anthony Falls Laboratory	Christopher Feist	\$ -	\$ 261,000	\$ 261,000
07e	2021-344	Create Jobs Statewide by Diverting Materials from Landfills	Better Futures Minnesota	Steve Thomas	\$ -	\$ 2,244,000	\$ 2,244,000
07f	2021-402	Strengthening Minnesota's Reuse Economy to Conserve Natural Resources	ReUse Minnesota	Jennifer Kedward	\$ -	\$ 334,000	\$ 334,000
Subd. 07 Air Quality, Climate Change, and Renewable Energy Subtotal =					\$ -	\$ 6,205,000	\$ 6,205,000
Subd. 08 Methods to Protect, Restore, and Enhance Land, Water, and Habitat (18 Projects - Subtotal = \$6,429,000)							
08a	2021-022	Camp Ripley Sentinel Landscape Forest Restoration and Enhancements	Crow Wing Soil and Water Conservation District	Melissa Barrick	\$ -	\$ 731,000	\$ 731,000
08b	2021-039	Restoring Mussels in Streams and Lakes - Continuation	MN DNR, Ecological and Water Resources Division	Mike Davis	\$ -	\$ 619,000	\$ 619,000
08c	2021-058	Pollinator Central II: Habitat Improvement With Community Monitoring	Great River Greening	Rebecca Tucker	\$ -	\$ 631,000	\$ 631,000
08d	2021-062	Preserving Minnesota's Only Ball Cactus Population	U of MN, Landscape Arboretum	David Remucal	\$ -	\$ 103,000	\$ 103,000
08e	2021-065	Prescribed-Fire Management for Roadside Prairies - Phase II	Minnesota Department of Transportation	Nathan Johnson	\$ -	\$ 217,000	\$ 217,000
08f	2021-084	Restoring Upland Forests for Birds	American Bird Conservancy	Kevin Sheppard	\$ -	\$ 193,000	\$ 193,000
08g	2021-097	Minnesota Green Schoolyards	The Trust for Public Land	Eric Weiss	\$ -	\$ 250,000	\$ 250,000
08h	2021-137	Plumbing the Muddy Depths of Superior Hiking Trail	Superior Hiking Trail Association	Lisa Luokkala	\$ -	\$ 187,000	\$ 187,000
08i	2021-212	Reducing Plastic Pollution with Biodegradable Erosion Control Products	Agricultural Utilization Research Institute	Riley Gordon	\$ -	\$ 200,000	\$ 200,000
08j	2021-223	Remote Sensing and Super-Resolution Imaging of Microplastics	U of MN, St. Anthony Falls Laboratory	Ardeshir Ebtehaj	\$ -	\$ 309,000	\$ 309,000

2021 (FY22) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2022	TOTAL ENRTF \$ Appropriated
08k	2021-229	Woodcrest Trail Expansion	Country Manor Campus, LLC	Sara Gabrielson	\$ -	\$ 16,000	\$ 16,000
08l	2021-231	Urban Pollinator and Native American Cultural Site Restoration	Friends of the Mississippi River	Lisa Mueller	\$ -	\$ 213,000	\$ 213,000
08m	2021-280	Demonstrating Real-World Economic and Soil Benefits of Cover Crops and Alternative Tillage	Redwood Soil & Water Conservation District	Scott Wold	\$ -	\$ 288,000	\$ 288,000
08n	2021-308	Creating Cost-Effective Forage and Management Actions for Pollinators	U of MN, College of Food, Agricultural and Natural Resource Sciences	Daniel Cariveau	\$ -	\$ 198,000	\$ 198,000
08o	2021-322	Shoreline Stabilization, Fishing, and ADA Improvements at Silverwood Park	Three Rivers Park District	Jonathan Vlaming	\$ -	\$ 200,000	\$ 200,000
08p	2021-337	Lawns To Legumes Program - Phase II	Board of Water and Soil Resources	Dan Shaw	\$ -	\$ 993,000	\$ 993,000
08q	2021-375	Reintroducing Bison to Spring Lake Park Reserve	Dakota County	Tom Lewanski	\$ -	\$ 560,000	\$ 560,000
08r	2021-377	Elm Creek Habitat Restoration Final Phase	City of Champlin	Todd Tuominen	\$ -	\$ 521,000	\$ 521,000
Subd. 08 Methods to Protect, Restore, and Enhance Land, Water, and Habitat Subtotal =					\$ -	\$ 6,429,000	\$ 6,429,000
Subd. 09 Land Acquisition, Habitat, and Recreation (22 Projects - Subtotal = \$32,062,000)							
09a	2021-012	Perham to Pelican Rapids Regional Trail (McDonald Segment)	Otter Tail County	Matthew Yavarow	\$ -	\$ 2,245,000	\$ 2,245,000
09b	2021-028	Mesabi Trail CSAH 88 to Ely	St. Louis & Lake Counties Regional Railroad Authority	Robert Manzoline	\$ -	\$ 1,650,000	\$ 1,650,000
09c	2021-029	Southwest Minnesota Single-Track Trail	Jackson County	Jeremy Bartosh	\$ -	\$ 190,000	\$ 190,000
09d	2021-043	Local Parks, Trails, and Natural Areas Grant Programs	MN DNR, Grants Unit	Audrey Mularie	\$ -	\$ 2,250,000	\$ 2,250,000
09e	2021-049	Metropolitan Regional Parks System Land Acquisition- Phase VII	Metropolitan Council	Jessica Lee	\$ -	\$ 2,250,000	\$ 2,250,000
09f	2021-069	Sauk Rapids Lions Park Riverfront Improvements	City of Sauk Rapids	Todd Schultz	\$ -	\$ 463,000	\$ 463,000
09g	2021-092	City Of Brainerd - Mississippi Landing Trailhead	City of Brainerd	David Chanski	\$ -	\$ 2,850,000	\$ 2,850,000
09h	2021-105	Native Prairie Stewardship and Prairie Bank Easement Acquisition	MN DNR, Ecological and Water Resources Division	Judy Schulte	\$ -	\$ 1,341,000	\$ 1,341,000
09i	2021-109	Moose Lake - Trunk Highway 73 Trail	City of Moose Lake	Katie Bloom	\$ -	\$ 330,000	\$ 330,000
09j	2021-151	SNA Acquisition, Restoration, Citizen-Science and Outreach	MN DNR, Ecological and Water Resources Division	Molly Roske	\$ -	\$ 3,336,000	\$ 3,336,000
09k	2021-154	Precision Acquisition for Restoration, Groundwater Recharge, and Habitat	Shell Rock River Watershed District	Courtney Phillips	\$ -	\$ 467,000	\$ 467,000
09l	2021-222	Lake Brophy Single-Track Trail Expansion	Douglas County	Brad Bonk	\$ -	\$ 100,000	\$ 100,000
09m	2021-325	Veterans on the Lake	Veterans on the Lake	Neil Olson	\$ -	\$ 553,000	\$ 553,000
09n	2021-329	Crane Lake Voyageurs National Park Visitor Center - Continuation	Town of Crane Lake	JoAnn Pohlman	\$ -	\$ 2,700,000	\$ 2,700,000
09o	2021-330	Brookston Campground, Boat Launch, and Outdoor Recreational Facility Planning	City of Brookston	Kaycee Melin	\$ -	\$ 425,000	\$ 425,000
09p	2021-332	Moose and Seven Beaver Multiuse Trails Upgrade	City of Hoyt Lakes	Becky Lammi	\$ -	\$ 900,000	\$ 900,000

2021 (FY22) Environment and Natural Resources Trsut Fund (ENRTF) Appropriations

M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2

7/2/21

Subd.	ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2022	TOTAL ENRTF \$ Appropriated
09q	2021-338	Above the Falls Regional Park Acquisition	Minneapolis Parks and Recreation Board	Adam Arvidson	\$ -	\$ 950,000	\$ 950,000
09r	2021-339	Silver Lake Trail Improvement Project	City of Virginia	Britt See-Benes	\$ -	\$ 1,071,000	\$ 1,071,000
09s	2021-362	Minnesota State Trails Development	MN DNR, State Parks and Trails Division	Kent Skaar	\$ -	\$ 4,266,000	\$ 4,266,000
09t	2021-363	Highbanks Ravine Bat Habernaculum Project	City of St. Cloud	Lisa Vollbrecht	\$ -	\$ 825,000	\$ 825,000
09u	2021-371	State Parks and State Trails Inholdings	MN DNR, State Parks and Trails Division	Shelby Kok	\$ -	\$ 2,560,000	\$ 2,560,000
09v	2021-380	Accessible Fishing Piers and Shore Fishing Areas	MN DNR, State Parks and Trails Division	Nancy Stewart	\$ -	\$ 340,000	\$ 340,000
Subd. 09 Land Acquisition, Habitat, and Recreation Subtotal =					\$ -	\$ 32,062,000	\$ 32,062,000
Subd. 10 Administrative and Emerging Issues (4 Projects - Subtotal = \$2,120,000)							
10a	2021-027	Contract Agreement Reimbursement	MN DNR, Grants Unit	Katherine Sherman-Hoehn	\$ -	\$ 135,000	\$ 135,000
10b	2021-464	Legislative-Citizen Commission on Minnesota Resources (LCCMR) Administration	LCCMR	Becca Nash	\$ -	\$ 1,750,000	\$ 1,750,000
10c	2021-466	Emerging Issues Account	LCCMR	Becca Nash	\$ -	\$ 233,000	\$ 233,000
10d	2021-465	Legislative Coordinating Commission (LCC) Administration	LCC	Sally Olson	\$ -	\$ 2,000	\$ 2,000
Subd. 10 Administrative and Emerging Issues Subtotal =					\$ -	\$ 2,120,000	\$ 2,120,000
Subd. 19 Transfers; Natural Resources Research Institute (1 Project - Subtotal = \$840,000)							
19	TBD	Forest Health Research, Development and Demonstration (of which \$500k is for 'Forest management assessment tool')*	UMN- NRRI	John DuPlissis	\$ 840,000	\$ -	\$ 840,000
Subd. 19 Transfers; Natural Resources Research Institute Subtotal =					\$ 840,000	\$ -	\$ 840,000
TOTAL ENRTF \$					\$ 840,000	\$ 70,881,000	\$ 71,721,000

*Estimate amount, pending final close-out of completing projects being transferred

CHAPTER 6--S.F.No. 20

An act relating to state government; appropriating money for environment, natural resources, and tourism; appropriating money from environment and natural resources trust fund; modifying fees and programs; modifying disposition and expenditure of certain funds; creating accounts; authorizing sales and conveyances of certain state land; adding to and deleting from state parks and recreation areas; modifying state land and school trust land provisions; modifying forestry provisions; modifying aquaculture provisions; modifying game and fish laws; modifying Water Law; modifying natural resource and environment provisions; prohibiting PFAS in food packaging; providing for DUI conformity for operating recreational vehicles; requiring rulemaking; requiring reports; making technical corrections; amending Minnesota Statutes 2020, sections 16B.335, subdivision 2; 17.4982, subdivisions 6, 8, 9, 12, by adding subdivisions; 17.4985, subdivisions 2, 3, 5; 17.4986, subdivisions 2, 4; 17.4991, subdivision 3; 17.4992, subdivision 2; 17.4993, subdivision 1; 35.155, subdivision 7, by adding a subdivision; 84.027, subdivisions 13a, 18; 84.415, by adding a subdivision; 84.63; 84.631; 84.795, subdivision 5; 84.82, subdivisions 1a, 7a; 84.83, subdivision 5; 84.943, subdivisions 3, 5; 84.944, subdivision 1; 84.946, subdivision 4; 84D.11, subdivision 1a; 85.019, by adding a subdivision; 85.052, subdivisions 1, 2, 6, by adding a subdivision; 85.053, subdivision 2, by adding a subdivision; 85.054, subdivision 1; 85.43; 85.47; 86B.705, subdivision 2; 89.021, by adding a subdivision; 89.17; 89.37, subdivision 3; 89A.11; 92.50, by adding a subdivision; 92.502; 94.3495, subdivision 3; 97A.065, subdivision 2; 97A.075, subdivisions 1, 7; 97A.126, by adding a subdivision; 97A.401, subdivision 1, by adding a subdivision; 97A.421, subdivision 1, by adding a subdivision; 97A.475, subdivisions 2, 3, 3a, 4; 97A.505, subdivisions 3b, 8; 97B.022, by adding a subdivision; 97B.036; 97B.055, subdivision 2; 97B.086; 97B.715, subdivision 1; 97B.801; 97B.811, subdivision 4a; 97C.005, subdivision 3; 97C.081, subdivisions 3, 3a; 97C.342, subdivision 2; 97C.401, by adding a subdivision; 97C.605, subdivision 3; 97C.611; 97C.805, subdivision 2; 97C.836; 103C.315, subdivision 4; 103G.271, subdivision 4a, by adding a subdivision; 103G.401; 115A.1310, subdivision 12b; 115A.1312, subdivision 1; 115A.1314, subdivision 1; 115A.1316, subdivision 1; 115A.1318, subdivision 2; 115A.1320, subdivision 1; 115A.5501, subdivision 3; 115A.565, subdivision 1; 115B.17, subdivision 13; 115B.406, subdivisions 1, 9; 115B.407; 115B.421; 116.07, subdivision 7, by adding a subdivision; 116G.07, by adding a subdivision; 116G.15, by adding a subdivision; 127A.353, subdivision 4; 169A.20, subdivision 1; 169A.52, by adding a subdivision; 169A.54, by adding a subdivision; 171.306, by adding a subdivision; 290C.01; 290C.04; Laws 2016, chapter 154, sections 16; 48; Laws 2016, chapter 189, article 3, section 3, subdivision 5; Laws 2017, chapter 96, section 2, subdivision 9, as amended; Laws 2018, chapter 214, article 4, section 2, subdivision 6; Laws 2019, First Special Session chapter 4, article 1, sections 2, subdivision 9; 3, subdivisions 4, 5; article 3, section 109, as amended; proposing coding for new law in Minnesota Statutes, chapters 84; 86B; 92; 103F; 103G; 171; 325F; repealing Minnesota Statutes 2020, sections 84.91, subdivision 1; 85.0505, subdivision 3; 85.0507; 85.054, subdivision 19; 86B.331, subdivision 1; 169A.20, subdivisions 1a, 1b, 1c; Minnesota Rules, part 7044.0350.

ARTICLE 6**ENVIRONMENT AND NATURAL RESOURCES TRUST FUND FISCAL YEAR 2022****Section 1. APPROPRIATIONS.**

The sums shown in the columns marked "Appropriations" are appropriated to the agencies and for the purposes specified in this article. The appropriations are from the environment and natural resources trust fund and are available for the fiscal years indicated for each purpose. The figures "2022" and "2023" used in this article mean that the appropriations listed under them are available for the fiscal year ending June 30, 2022, or June 30, 2023, respectively. "The first year" is fiscal year 2022. "The second year" is fiscal year 2023. "The biennium" is fiscal years 2022 and 2023.

<u>APPROPRIATIONS</u>	
<u>Available for the Year</u>	
<u>Ending June 30</u>	
<u>2022</u>	<u>2023</u>

Sec. 2. MINNESOTA RESOURCES

<u>Subdivision 1. Total Appropriation</u>	<u>\$</u>	<u>70,881,000</u>	<u>\$</u>	<u>-0-</u>
---	-----------	-------------------	-----------	------------

The amounts that may be spent for each purpose are specified in the following subdivisions. Appropriations in the first year are available for three years beginning July 1, 2021, unless otherwise stated in the appropriation. Any unencumbered balance remaining in the first year does not cancel and is available for the second year or until the end of the appropriation.

Subd. 2. Definition

"Trust fund" means the Minnesota environment and natural resources trust fund established under the Minnesota Constitution, article XI, section 14.

<u>Subd. 3. Foundational Natural Resource Data and Information</u>	<u>10,459,000</u>	<u>-0-</u>
--	-------------------	------------

(a) What's Bugging Minnesota's Insect-Eating Birds?

\$199,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute to examine the relationship between insect abundance, timing of insect availability, and breeding success for multiple bird species across land-use intensities to develop comprehensive guidelines to conserve bird and insect diversity.

(b) Protecting Minnesota's Beneficial Macroalgae: All Stoneworts Aren't Starry

\$811,000 the first year is from the trust fund to the commissioner of natural resources to conduct a statewide inventory to provide baseline data and build in-state knowledge of Minnesota's native stoneworts, a diverse group of aquatic plants that support clear lakes and healthy fish habitat.

(c) County Groundwater Atlas

\$1,875,000 the first year is from the trust fund to the commissioner of natural resources to continue producing county groundwater atlases to inform management of surface water and groundwater resources for drinking and other purposes. This appropriation is for Part B, to characterize the potential water yields of aquifers and aquifers' sensitivity to contamination.

(d) Improving Resiliency and Conservation Outcomes for Minnesota Turtles

\$391,000 the first year is from the trust fund to the Minnesota Zoological Garden to improve the conservation of Minnesota's imperiled turtles through animal husbandry, field conservation, and educational programming. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(e) Minnesota Biological Survey

\$1,500,000 the first year is from the trust fund to the commissioner of natural resources to complete the statewide baseline biological survey by finalizing data, analyses, and publications and by conducting targeted field surveys to fill missing gaps of information needed to support conservation of Minnesota's biodiversity. Any revenues generated through the publication of books or other resources created through this appropriation may be reinvested as described in the work plan approved by the Legislative-Citizen Commission on Minnesota Resources according to Minnesota Statutes, section 116P.10.

(f) Groundwater Contamination Mapping Project - Phase II

\$800,000 the first year is from the trust fund to the commissioner of the Pollution Control Agency to improve protection of groundwater resources for drinking water by expanding the web-based interactive groundwater contamination mapping system to include all other state hazardous and solid waste cleanup programs and by upgrading the system to collect monitoring data.

(g) Geologic Atlases for Water Resource Management

\$3,092,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Minnesota Geological Survey, to continue producing county geologic atlases to inform management of surface water and groundwater resources. This appropriation is to complete Part A, which focuses on the properties and distribution of earth materials to define aquifer boundaries and the connection of aquifers to the land surface and surface water resources.

(h) Redwood County Reinvest in Minnesota Easement Evaluation and Public Outreach

\$197,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Redwood County for the Redwood Soil and Water Conservation District to inventory vegetation, evaluate wetland conditions, and create a countywide stewardship plan for lands protected with permanent conservation easements. This appropriation may also be spent to conduct outreach to volunteers and landowners on effective prairie and wetland habitat management.

(i) Collaborative State and Tribal Wild Rice Monitoring Program

\$644,000 the first year is from the trust fund to the commissioner of natural resources to work with Tribal partners to create a collaborative and comprehensive monitoring program to conserve wild-rice waters, develop remote sensing tools for statewide estimates of wild rice coverage, and collect consistent field data on wild rice health and abundance.

(j) Morrison County Performance Drainage and Hydrology Management II

\$197,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Morrison Soil and Water Conservation District to complete the Morrison County culvert inventory started in 2016 to help solve landowner conflicts, protect wetlands, improve water quality, and design additional water storage throughout the county.

(k) Exploring Minnesota's Wetlands: Our Resource for Future Medicine

\$210,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Crookston, to work with White Earth Tribal and Community College to catalog bog microbe diversity in Minnesota's ecoregions, test for potential antibiotic-producing microorganisms, and establish methods to enhance any antibiotic cultures discovered.

(l) A Biodiversity Checkup for Minnesota's Big Woods

\$109,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to inform conservation strategies by comparing the historic and contemporary flora of Minnesota's Big Woods to determine if all species have survived in the small remaining remnants of that ecosystem.

(m) Microbiome in Raptors: A New Tool for Conservation

\$129,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Raptor Center to improve wildlife care and environmental stewardship by evaluating the impact of antibiotics administered during captivity on raptor gut microbiome, rehabilitation success, and the potential spread of antimicrobial resistance in the natural environment.

(n) Bioacoustics for Broad-Scale Species Monitoring and Conservation

\$305,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to

improve wildlife conservation efforts by using passive acoustic monitoring devices to determine statewide distribution and reproduction of red-headed woodpeckers and developing a protocol for future use of this technology to monitor population trends and responses to habitat management. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

Subd. 4. Water Resources

4,771,000

-0-

(a) Trout Stream Habitat Restoration Success

\$319,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute to evaluate the effectiveness and durability of previous trout stream habitat restoration projects to improve the success and cost effectiveness of future projects. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(b) Novel Nutrient Recovery Process from Wastewater Treatment Plants

\$200,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to conduct lab- and pilot-scale tests of a new process to promote nutrient removal and recovery at rural municipal and industrial wastewater treatment plants for water protection and renewable energy production.

(c) Monitoring Emerging Viruses in Minnesota's Urban Water Cycles

\$416,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to develop rapid testing, quantification, and human exposure risk assessment models for enveloped viruses such as coronaviruses in urban wastewater and drinking water treatment processes.

(d) Microgeographic Impact of Antibiotics Released from Identified Hotspots

\$508,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to inform protection of environmental, animal, and human

health from proliferation of antibiotic resistance by quantifying and mapping the extent of antibiotic spread in waters and soils from locations identified as release hot spots.

(e) Sustainable Irrigation Management: Expanding a Web Application

\$1,139,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to promote responsible use of Minnesota's groundwater resources by expanding an existing irrigation management assistance tool into a mobile-compatible web application for the top agricultural-producing counties in the state. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(f) Assessing Membrane Bioreactor Wastewater Treatment Efficacy

\$419,000 the first year is from the trust fund to the Board of Trustees of the Minnesota State Colleges and Universities system for St. Cloud State University to conduct a comprehensive assessment of membrane bioreactor treatment of wastewater to inform managers of options for updating or replacing aging wastewater infrastructure.

(g) Evaluating Coronavirus and Other Microbiological Contamination of Drinking Water Sources from Wastewater

\$594,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to survey public and private wells to identify sources of and evaluate solutions to microbiological contamination of drinking water sources by wastewater, including from the virus that causes COVID-19.

(h) St. James Pit Water-Level Control Study

\$259,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Aurora to install sampling wells and conduct a study to determine appropriate mitigation of the abandoned St. James pit mine to protect surface

and drinking water and prevent harm to homes and residents.

(i) Long-Term Nitrate Mitigation by Maintaining Profitable Kernza Production

\$485,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Stearns County Soil and Water Conservation District to evaluate the effectiveness of aging Kernza stands on water quality and to continue to develop a sustainable supply chain with a focus on post-harvest processing of Kernza for water protection and local economies.

(j) Antibiotic Resistance and Wastewater Treatment: Problems and Solutions

\$432,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the University of St. Thomas to quantify the ability of full-scale wastewater treatment plants to eliminate antibiotic resistance genes entering or created in the water treatment process before these genes are released into the natural environment.

Subd. 5. <u>Environmental Education</u>	2,687,000	-0-
---	-----------	-----

(a) Increasing Outdoor Learning for Young Minnesotans

\$383,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Wolf Ridge Environmental Learning Center to provide scholarships for equitable access to hands-on learning experiences in the outdoors related to outdoor recreation, air and energy, water, habitat, and fish and wildlife. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(b) Pollinator Education in the Science Classroom

\$366,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to educate approximately 5,000 students about pollinator conservation by providing professional development for science teachers to integrate pollinator education

curriculum and materials into their classrooms and by evaluating the program to improve its effectiveness.

(c) Minnesota Freshwater Quest: Environmental Education for Youth

\$699,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Wilderness Inquiry to provide place-based STEM environmental education to approximately 15,000 diverse and underserved Minnesota youth through exploration of local ecosystems and waterways in the Minnesota Freshwater Quest program.

(d) Minnesota Master Naturalist: Nature for New Minnesotans

\$293,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota in partnership with English-language-learning organizations to adapt and incorporate materials developed for Minnesota Master Naturalists into English-language-learning programs to introduce immigrants and English-language learners to Minnesota's great outdoors.

(e) The Voyageurs Classroom Initiative

\$348,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Voyageurs Conservancy to launch a new initiative to connect Minnesota youth, young adults, and their families to Voyageurs National Park by learning about the park's waters, wildlife, and forests and by engaging in the park's preservation.

(f) Restoring Land and Reviving Heritage: Conservation Through Indigenous Culture

\$420,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Belwin Conservancy in partnership with Anishinabe Academy to conduct environmental education programming that incorporates ecology and indigenous land traditions and to restore an ecologically significant area of land using modern scientific standards and traditional ecological knowledge.

(g) Expanding Access to Environmental Education for Underserved Communities

\$178,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Raptor Center to build environmental literacy and engagement by delivering an environmental education program featuring live raptors and standards-based curriculum to approximately 300 classrooms in underserved communities throughout Minnesota.

<u>Subd. 6. Aquatic and Terrestrial Invasive Species</u>	<u>6,148,000</u>	<u>-0-</u>
--	------------------	------------

(a) Starch Allocation Patterns of Invasive Starry Stonewort Harvested from Lake Koronis

\$101,000 the first year is from the trust fund to the Board of Trustees of the Minnesota State Colleges and Universities System for Minnesota State University, Mankato, to evaluate the starch allocation patterns of the invasive starry stonewort to identify weaknesses in the plant's growth that could be targeted for management.

(b) Long-Term Efficacy of Invasive Removal in Floodplain Forests

\$25,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Macalester College to begin a long-term scientific study at the Ordway Field Station to provide information to land managers on protecting Minnesota's floodplain forests from combined threats of overabundant deer, invasive shrubs, and earthworms. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered. A report on the results of the long-term study must be submitted at the end of the appropriation and an update must be submitted five years after the appropriation ends or at the study's conclusion, whichever is first.

(c) Oak Wilt Suppression at the Northern Edge - Phase II

\$423,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Morrison Soil and Water Conservation District

to continue to eradicate the northernmost occurrences of oak wilt in the state through mechanical means on select private properties to prevent oak wilt's spread to healthy state forests.

(d) Biocontrol of Invasive Species in Bee Lawns and Parklands

\$425,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to establish a biocontrol program to manage the invasive Japanese beetle in a way that reduces insecticide use in bee lawns and pollinator restorations and the associated economic and environmental costs to wildlife and humans.

(e) Building Knowledge and Capacity for AIS Solutions

\$3,750,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Minnesota Aquatic Invasive Species Research Center to conduct high-priority projects aimed at solving Minnesota's aquatic invasive species problems using rigorous science and a collaborative process. Additionally, the appropriation may be spent to deliver research findings to end users through strategic communication and outreach. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(f) Evaluating Minnesota's Last Best Chance to Stop Carp

\$424,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, in cooperation with the United States Army Corps of Engineers and the Department of Natural Resources, to evaluate invasive carp passage and the costs, processes, and potential for a state-of-the-art deterrent system installed at Mississippi River Lock and Dam Number 5 to impede passage of invasive carp at this location to protect the upper river.

(g) Stop Starry Invasion with Community Invasive Species Containment

\$1,000,000 the first year is from the trust fund to the commissioner of natural resources for an agreement

with Minnesota Lakes and Rivers Advocates to work with civic leaders to purchase, install, and operate waterless cleaning stations for watercraft; conduct aquatic invasive species education; and implement education upgrades at public accesses to prevent invasive starry stonewort spread beyond the 16 lakes already infested. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

Subd. 7. Air Quality, Climate Change, and Renewable Energy

6,205,000

-0-

(a) Enhanced Thermo-Active Foundations for Space Heating in Minnesota

\$312,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Duluth, to design and optimize cost-competitive thermally enhanced heat exchanger systems for use in building foundations to improve energy efficiency and conservation of natural resources in Minnesota's cold climate.

(b) Storing Renewable Energy in Flow Battery for Grid Use

\$2,408,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Morris, to implement a rural, community-scale project that demonstrates how a large flow battery connected to solar and wind generation improves grid stability and enhances use of renewable energy.

(c) Agrivoltaics to Improve the Environment and Farm Resiliency

\$646,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, West Central Research and Outreach Center, Morris, to model and evaluate alternative solar energy system designs to maximize energy production while providing other benefits to cattle and farmers.

(d) Behavioral Response of Bald Eagles to Acoustic Stimuli

\$261,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, St. Anthony Falls Laboratory, to protect wildlife by designing and implementing an acoustic deterrence protocol to discourage bald eagles from entering hazardous air space near wind energy installations.

(e) Create Jobs Statewide by Diverting Materials from Landfills

\$2,244,000 the first year is from the trust fund to the commissioner of natural resources for agreements with Better Futures Minnesota and the Natural Resources Research Institute to partner with cities, counties, and businesses to create and implement a collection, restoration, reuse, and repurpose program that diverts used household goods and building materials from entering the waste stream and thereby reduces greenhouse gas emissions. Net income generated by Better Futures Minnesota as part of this appropriation may be reinvested in the project if a plan for reinvestment is approved in the work plan.

(f) Strengthening Minnesota's Reuse Economy to Conserve Natural Resources

\$334,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with ReUSE Minnesota to provide outreach and technical assistance to communities and small businesses to increase reuse, rental, and repair of consumer goods as an alternative to using new materials; to reduce solid-waste disposal impacts; and to create more local reuse jobs. A fiscal management and staffing plan must be approved in the work plan before any trust fund dollars are spent.

Subd. 8. Methods to Protect, Restore, and Enhance Land, Water, and Habitat

6,429,000

-0-

(a) Camp Ripley Sentinel Landscape Forest Restoration and Enhancements

\$731,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Crow Wing Soil and Water Conservation District to partner with the Nature Conservancy and Great River Greening to develop forest stewardship

plans, restore habitat, and conduct prescribed burns to advance forest restoration and enhancement on public and private lands within an approximate ten-mile radius around Camp Ripley. Notwithstanding subdivision 13, paragraph (e), this appropriation may be spent on forest management plans, fires, and restoration on lands with a long-term contract commitment for forest conservation. The restoration must follow the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines.

(b) Restoring Mussels in Streams and Lakes - Continuation

\$619,000 the first year is from the trust fund to the commissioner of natural resources to restore native freshwater mussel assemblages and the ecosystem services they provide in the Mississippi, Cedar, and Cannon Rivers and to inform the public on mussels and mussel conservation.

(c) Pollinator Central II: Habitat Improvement With Community Monitoring

\$631,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Great River Greening to restore and enhance pollinator habitat in the metropolitan area to benefit pollinators and people and to build knowledge of the impact through community-based monitoring.

(d) Preserving Minnesota's Only Ball Cactus Population

\$103,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Minnesota Landscape Arboretum to move the only known remaining ball cactus population in the state from private to protected land and to propagate and bank ball cactus seeds for education and preservation.

(e) Prescribed-Fire Management for Roadside Prairies - Phase II

\$217,000 the first year is from the trust fund to the commissioner of transportation to continue to protect biodiversity and enhance pollinator habitat on roadsides by helping to create a self-sufficient

prescribed-fire program at the Department of Transportation.

(f) Restoring Upland Forests for Birds

\$193,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the American Bird Conservancy to restore deciduous forest in partnership with Aitkin, Beltrami, and Cass Counties using science-based best management practices to rejuvenate noncommercial stands for focal wildlife species.

(g) Minnesota Green Schoolyards

\$250,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with The Trust for Public Land to assess, promote, and demonstrate how schoolyards can be adapted to improve water, air, and habitat quality and to foster next-generation environmental stewards while improving health, education, and community outcomes.

(h) Plumbing the Muddy Depths of Superior Hiking Trail

\$187,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Superior Hiking Trail Association to install and implement water management practices to prevent erosion and improve access to the Superior Hiking Trail.

(i) Reducing Plastic Pollution with Biodegradable Erosion Control Products

\$200,000 the first year is from the trust fund to the Agricultural Utilization Research Institute in partnership with the Departments of Transportation, Agriculture, and Natural Resources to demonstrate use of regionally grown industrial hemp to create biodegradable alternatives to plastic-based erosion and sediment control products used in transportation construction projects.

(j) Remote Sensing and Super-Resolution Imaging of Microplastics

\$309,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, St. Anthony Falls Laboratory, to develop and test remote sensing techniques for cost-effective monitoring of microplastics in lakes, rivers, and streams as well as in wastewater treatment plants. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(k) Woodcrest Trail Expansion

\$16,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Foundation for Health Care Continuum, doing business as Country Manor Campus, LLC, to construct a trail for public recreational use on land owned by the senior living facility in central Minnesota.

(l) Urban Pollinator and Native American Cultural Site Restoration

\$213,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Friends of the Mississippi River to restore three urban natural areas, including an iconic Native American cultural site, to native prairie and forest with a focus on important pollinator and culturally significant native plants.

(m) Demonstrating Real-World Economic and Soil Benefits of Cover Crops and Alternative Tillage

\$288,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Redwood County for the Redwood Soil and Water Conservation District to increase farmer adoption of conservation practices by demonstrating soil improvements and cost savings of cover crops and alternative tillage compared to conventional practices on working farms. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

(n) Creating Cost-Effective Forage and Management Actions for Pollinators

\$198,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to

evaluate pollinator forage across time and in response to burning and mowing and to design an open-access web-based tool to share these data for land managers across Minnesota to inform restoration seed mix selection.

(o) Shoreline Stabilization, Fishing, and ADA Improvements at Silverwood Park

\$200,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Three Rivers Park District to provide water quality improvements through shoreline stabilization, shoreline fishing improvements, and shoreline ADA access on the island in Silver Lake within Silverwood Park.

(p) Lawns to Legumes Program - Phase II

\$993,000 the first year is from the trust fund to the Board of Water and Soil Resources to provide grants, cost-sharing, and technical assistance to plant residential lawns, community parks, and school landscapes with native vegetation and pollinator-friendly forbs and legumes to protect a diversity of pollinators. Notwithstanding subdivision 13, paragraph (e), this appropriation may be spent on pollinator plantings on lands with a long-term commitment from the landowner.

(q) Reintroducing Bison to Spring Lake Park Reserve

\$560,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Dakota County, in partnership with the Minnesota Bison Conservation Herd, to establish the holding facilities and infrastructure needed to reintroduce American plains bison (*Bison bison*) to improve the resiliency and biodiversity of the prairie at Spring Lake Park Reserve.

(r) Elm Creek Habitat Restoration Final Phase

\$521,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Champlin to conduct habitat and stream restoration in Elm Creek upstream of Mill Ponds.

<u>Subd. 9. Land Acquisition, Habitat, and Recreation</u>	<u>32,062,000</u>	<u>-0-</u>
---	-------------------	------------

(a) Perham to Pelican Rapids Regional Trail (McDonald Segment)

\$2,245,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Otter Tail County to construct the McDonald Segment of the Perham to Pelican Rapids Regional Trail to connect the cities of Perham and Pelican Rapids to Maplewood State Park.

(b) Mesabi Trail CSAH 88 to Ely

\$1,650,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority to acquire, engineer, and construct a segment of the Mesabi Trail beginning at the intersection of County State-Aid Highway 88 toward Ely.

(c) Southwest Minnesota Single-Track Trail

\$190,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Jackson County to create a single-track mountain bike trail and expand an associated parking lot in Belmont County Park to address a lack of opportunity for this kind of outdoor recreation in southwest Minnesota.

(d) Local Parks, Trails, and Natural Areas Grant Programs

\$2,250,000 the first year is from the trust fund to the commissioner of natural resources to solicit and rank applications for and fund competitive matching grants for local parks, trail connections, and natural and scenic areas under Minnesota Statutes, section 85.019. Priority must be given to funding projects in the metropolitan area or in other areas of southern Minnesota. For purposes of this paragraph, southern Minnesota is defined as the area of the state south of and including St. Cloud. This appropriation is for local nature-based recreation, connections to regional and state natural areas, and recreation facilities and may

not be used for athletic facilities such as sport fields, courts, and playgrounds.

(e) Metropolitan Regional Parks System Land Acquisition - Phase VII

\$2,250,000 the first year is from the trust fund to the Metropolitan Council for grants to acquire land within the approved park boundaries of the metropolitan regional park system. This appropriation must be matched by an equal amount from a combination of Metropolitan Council and local agency funds.

(f) Sauk Rapids Lions Park Riverfront Improvements

\$463,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Sauk Rapids to design and construct a second phase of upgrades to Lions and Southside Parks including trails, lighting, riverbank restoration, and a canoe and kayak launch to enhance access to the Mississippi River.

(g) City of Brainerd - Mississippi Landing Trailhead

\$2,850,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Brainerd to design and construct Mississippi Landing Trailhead Park to help connect residents and visitors to the Mississippi River through recreation, education, and restoration.

(h) Native Prairie Stewardship and Prairie Bank Easement Acquisition

\$1,341,000 the first year is from the trust fund to the commissioner of natural resources to provide technical stewardship assistance to private landowners, restore and enhance native prairie protected by easements in the native prairie bank, and acquire easements for the native prairie bank in accordance with Minnesota Statutes, section 84.96, including preparing initial baseline property assessments. Up to \$60,000 of this appropriation may be deposited in the natural resources conservation easement stewardship account created in Minnesota Statutes, section 84.69, proportional to the number of easement acres acquired.

(i) Moose Lake - Trunk Highway 73 Trail

\$330,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Moose Lake to design and construct a nonmotorized recreational trail in an off-street pedestrian corridor along Highway 73 to connect to several existing regional trails in the Moose Lake area.

(j) SNA Acquisition, Restoration, Citizen-Science, and Outreach

\$3,336,000 the first year is from the trust fund to the commissioner of natural resources for the scientific and natural areas (SNA) program to restore, improve, and enhance wildlife habitat on SNAs; increase public involvement and outreach; and strategically acquire lands that meet criteria for SNAs under Minnesota Statutes, section 86A.05, from willing sellers.

(k) Precision Acquisition for Restoration, Groundwater Recharge, and Habitat

\$467,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Shell Rock River Watershed District to acquire and restore to wetland a key parcel of land to reduce downstream flooding while providing water storage, groundwater recharge, nutrient reduction, and pollinator and wildlife habitat.

(l) Lake Brophy Single-Track Trail Expansion

\$100,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Douglas County in partnership with the Big Ole Bike Club to design and build new expert single-track segments and an asphalt pump track for the existing trail system at Lake Brophy Park to improve outdoor recreation experiences in west-central Minnesota.

(m) Veterans on the Lake

\$553,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Lake County for Veterans on the Lake to conduct accessibility upgrades to Veterans on the Lake's existing trails, roadway, and buildings to improve

access to the wilderness and outdoor recreation for disabled American veterans.

(n) Crane Lake Voyageurs National Park Visitor Center - Continuation

\$2,700,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Crane Lake to design and construct an approximate 4,500 to 7,000 square-foot visitor center building to serve as an access point to Voyageurs National Park. A fiscal agent or fiscal management plan must be approved in the work plan before any trust fund money is spent. A copy of a resolution or other documentation of the city's commitment to fund operations of the visitor center must be included in the work plan submitted to the Legislative-Citizen Commission on Minnesota Resources.

(o) Brookston Campground, Boat Launch, and Outdoor Recreational Facility Planning

\$425,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Brookston to design a campground, boat launch, and outdoor recreation area on the banks of the St. Louis River in northeastern Minnesota. A fiscal agent must be approved in the work plan before any trust fund dollars are spent.

(p) Moose and Seven Beaver Multiuse Trails Upgrade

\$900,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Hoyt Lakes, in partnership with the Ranger Snowmobile and ATV Club, to design and construct upgrades and extensions to the Moose and Seven Beaver multiuse trails to enhance access for recreation use and connect to regional trails.

(q) Above the Falls Regional Park Acquisition

\$950,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Minneapolis Parks and Recreation Board to develop a restoration plan and acquire approximately 3.25 acres of industrial land for public access and

habitat connectivity along the Mississippi River as part of Above the Falls Regional Park.

(r) Silver Lake Trail Improvement Project

\$1,071,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Virginia to reconstruct and renovate the walking trail around Silver Lake to allow safe multimodal transportation between schools, parks, community recreation facilities, and other community activity centers in downtown Virginia.

(s) Minnesota State Trails Development

\$4,266,000 the first year is from the trust fund to the commissioner of natural resources to expand recreational opportunities on Minnesota state trails by rehabilitating and enhancing existing state trails and replacing or repairing existing state trail bridges. Priority must be given to funding projects in the metropolitan area or in other areas of southern Minnesota. For purposes of this paragraph, southern Minnesota is defined as the area of the state south of and including St. Cloud.

(t) Highbanks Ravine Bat Hibernaculum Project

\$825,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of St. Cloud to reroute and upgrade an existing stormwater system in the Highbanks Ravine area to improve an existing bat hibernaculum, reduce erosion, and create additional green space for wildlife habitat.

(u) State Parks and State Trails Inholdings

\$2,560,000 the first year is from the trust fund to the commissioner of natural resources to acquire high-priority inholdings from willing sellers within the legislatively authorized boundaries of state parks, recreation areas, and trails to protect Minnesota's natural heritage, enhance outdoor recreation, and improve the efficiency of public land management.

(v) Accessible Fishing Piers and Shore Fishing Areas

\$340,000 the first year is from the trust fund to the commissioner of natural resources to provide accessible fishing piers and develop shore fishing sites to serve new angling communities, underserved populations, and anglers with disabilities.

Subd. 10. Administrative and Emerging Issues 2,120,000 -0-

(a) Contract Agreement Reimbursement

\$135,000 the first year is from the trust fund to the commissioner of natural resources, at the direction of the Legislative-Citizen Commission on Minnesota Resources, for expenses incurred in preparing and administering contracts for the agreements specified in this section. The commissioner must provide documentation to the Legislative-Citizen Commission on Minnesota Resources on the expenditure of these funds.

(b) Legislative-Citizen Commission on Minnesota Resources (LCCMR) Administration

\$1,750,000 the first year is from the trust fund to the Legislative-Citizen Commission on Minnesota Resources for administration in fiscal years 2022 and 2023 as provided in Minnesota Statutes, section 116P.09, subdivision 5. This appropriation is available until June 30, 2023. Notwithstanding Minnesota Statutes, section 116P.11, paragraph (b), Minnesota Statutes, section 16A.281, applies to this appropriation.

(c) Emerging Issues Account

\$233,000 the first year is from the trust fund to an emerging issues account authorized in Minnesota Statutes, section 116P.08, subdivision 4, paragraph (d).

(d) Legislative Coordinating Commission (LCC) Administration

\$2,000 the first year is from the trust fund to the Legislative Coordinating Commission for the website required in Minnesota Statutes, section 3.303, subdivision 10.

Subd. 11. Availability of Appropriations

Money appropriated in this section may not be spent on activities unless they are directly related to and necessary for a specific appropriation and are specified in the work plan approved by the Legislative-Citizen Commission on Minnesota Resources. Money appropriated in this section must not be spent on indirect costs or other institutional overhead charges that are not directly related to and necessary for a specific appropriation. Costs that are directly related to and necessary for an appropriation, including financial services, human resources, information services, rent, and utilities, are eligible only if the costs can be clearly justified and individually documented specific to the appropriation's purpose and would not be generated by the recipient but for receipt of the appropriation. No broad allocations for costs in either dollars or percentages are allowed. Unless otherwise provided, the amounts in this section are available until June 30, 2024, when projects must be completed and final products delivered. For acquisition of real property, the appropriations in this section are available for an additional fiscal year if a binding contract for acquisition of the real property is entered into before the expiration date of the appropriation. If a project receives a federal grant, the period of the appropriation is extended to equal the federal grant period.

Subd. 12. Data Availability Requirements

Data collected by the projects funded under this section must conform to guidelines and standards adopted by Minnesota IT Services. Spatial data must also conform to additional guidelines and standards designed to support data coordination and distribution that have been published by the Minnesota Geospatial Information Office. Descriptions of spatial data must be prepared as specified in the state's geographic metadata guideline and must be submitted to the Minnesota Geospatial Information Office. All data must be accessible and free to the public unless made private under the Data Practices Act, Minnesota Statutes, chapter 13. To the extent practicable, summary data and results of projects funded under this section should be readily accessible on the Internet and identified as having received funding from the environment and natural resources trust fund.

Subd. 13. Project Requirements

(a) As a condition of accepting an appropriation under this section, an agency or entity receiving an appropriation or a party to an agreement from an appropriation must comply with paragraphs (b) to (l) and Minnesota Statutes, chapter 116P, and must submit a work plan and annual or semiannual progress reports in the form determined by the Legislative-Citizen Commission on Minnesota Resources for any project funded in whole or in part with funds from the appropriation. Modifications to the approved work plan and budget expenditures must be made through the amendment process established by the Legislative-Citizen Commission on Minnesota Resources.

(b) A recipient of money appropriated in this section that conducts a restoration using funds appropriated in this section must use native plant species according to the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines and include an appropriate diversity of native species selected to provide habitat for pollinators throughout the growing season as required under Minnesota Statutes, section 84.973.

(c) For all restorations conducted with money appropriated under this section, a recipient must prepare an ecological restoration and management plan that, to the degree practicable, is consistent with the highest-quality conservation and ecological goals for the restoration site. Consideration should be given to soil, geology, topography, and other relevant factors that would provide the best chance for long-term success and durability of the restoration project. The plan must include the proposed timetable for implementing the restoration, including site preparation, establishment of diverse plant species, maintenance, and additional enhancement to establish the restoration; identify long-term maintenance and management needs of the restoration and how the maintenance, management, and enhancement will be financed; and take advantage of the best-available science and include innovative techniques to achieve the best restoration.

(d) An entity receiving an appropriation in this section for restoration activities must provide an initial

restoration evaluation at the completion of the appropriation and an evaluation three years after the completion of the expenditure. Restorations must be evaluated relative to the stated goals and standards in the restoration plan, current science, and, when applicable, the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. The evaluation must determine whether the restorations are meeting planned goals, identify any problems with implementing the restorations, and, if necessary, give recommendations on improving restorations. The evaluation must be focused on improving future restorations.

(e) All restoration and enhancement projects funded with money appropriated in this section must be on land permanently protected by a conservation easement or public ownership.

(f) A recipient of money from an appropriation under this section must give consideration to contracting with Conservation Corps Minnesota for contract restoration and enhancement services.

(g) All conservation easements acquired with money appropriated under this section must:

(1) be permanent;

(2) specify the parties to an easement in the easement;

(3) specify all provisions of an agreement that are permanent;

(4) be sent to the Legislative-Citizen Commission on Minnesota Resources in an electronic format at least ten business days before closing;

(5) include a long-term monitoring and enforcement plan and funding for monitoring and enforcing the easement agreement; and

(6) include requirements in the easement document to protect the quantity and quality of groundwater and surface water through specific activities such as keeping water on the landscape, reducing nutrient and contaminant loading, and not permitting artificial hydrological modifications.

(h) For any acquisition of lands or interest in lands, a recipient of money appropriated under this section must not agree to pay more than 100 percent of the

appraised value for a parcel of land using this money to complete the purchase, in part or in whole, except that up to ten percent above the appraised value may be allowed to complete the purchase, in part or in whole, using this money if permission is received in advance of the purchase from the Legislative-Citizen Commission on Minnesota Resources.

(i) For any acquisition of land or interest in land, a recipient of money appropriated under this section must give priority to high-quality natural resources or conservation lands that provide natural buffers to water resources.

(j) For new lands acquired with money appropriated under this section, a recipient must prepare an ecological restoration and management plan in compliance with paragraph (c), including sufficient funding for implementation unless the work plan addresses why a portion of the money is not necessary to achieve a high-quality restoration.

(k) To ensure public accountability for using public funds, a recipient of money appropriated under this section must, within 60 days of the transaction, provide to the Legislative-Citizen Commission on Minnesota Resources documentation of the selection process used to identify parcels acquired and provide documentation of all related transaction costs, including but not limited to appraisals, legal fees, recording fees, commissions, other similar costs, and donations. This information must be provided for all parties involved in the transaction. The recipient must also report to the Legislative-Citizen Commission on Minnesota Resources any difference between the acquisition amount paid to the seller and the state-certified or state-reviewed appraisal, if a state-certified or state-reviewed appraisal was conducted.

(l) A recipient of an appropriation from the trust fund under this section must acknowledge financial support from the environment and natural resources trust fund in project publications, signage, and other public communications and outreach related to work completed using the appropriation. Acknowledgment may occur, as appropriate, through use of the trust fund logo or inclusion of language attributing support from the trust fund. Each direct recipient of money appropriated in this section, as well as each recipient

of a grant awarded pursuant to this section, must satisfy all reporting and other requirements incumbent upon constitutionally dedicated funding recipients as provided in Minnesota Statutes, section 3.303, subdivision 10, and chapter 116P.

(m) A recipient of an appropriation from the trust fund under this section that is receiving funding to conduct children's services, as defined in Minnesota Statutes, section 299C.61, subdivision 7, must certify to the commission, as part of the required work plan, that it performs criminal background checks for background check crimes, as defined in Minnesota Statutes, section 299C.61, subdivision 2, on all employees, contractors, and volunteers that have or may have access to a child to whom the recipient provides children's services using the appropriation.

Subd. 14. Payment Conditions and Capital-Equipment Expenditures

(a) All agreements, grants, or contracts referred to in this section must be administered on a reimbursement basis unless otherwise provided in this section. Notwithstanding Minnesota Statutes, section 16A.41, expenditures made on or after July 1, 2021, or the date the work plan is approved, whichever is later, are eligible for reimbursement unless otherwise provided in this section. Periodic payments must be made upon receiving documentation that the deliverable items articulated in the approved work plan have been achieved, including partial achievements as evidenced by approved progress reports. Reasonable amounts may be advanced to projects to accommodate cash-flow needs or match federal money. The advances must be approved as part of the work plan. No expenditures for capital equipment are allowed unless expressly authorized in the project work plan.

(b) Single-source contracts as specified in the approved work plan are allowed.

Subd. 15. Purchasing Recycled and Recyclable Materials

A political subdivision, public or private corporation, or other entity that receives an appropriation under this section must use the appropriation in compliance with Minnesota Statutes, section 16C.0725, regarding purchasing recycled, repairable, and durable materials

and Minnesota Statutes, section 16C.073, regarding purchasing and using paper stock and printing.

Subd. 16. Energy Conservation and Sustainable Building Guidelines

A recipient to whom an appropriation is made under this section for a capital improvement project must ensure that the project complies with the applicable energy conservation and sustainable building guidelines and standards contained in law, including Minnesota Statutes, sections 16B.325, 216C.19, and 216C.20, and rules adopted under those sections. The recipient may use the energy planning, advocacy, and State Energy Office units of the Department of Commerce to obtain information and technical assistance on energy conservation and alternative-energy development relating to planning and constructing the capital improvement project.

Subd. 17. Accessibility

Structural and nonstructural facilities must meet the design standards in the Americans with Disabilities Act (ADA) accessibility guidelines.

Subd. 18. Carryforward; Extension

(a) Notwithstanding Minnesota Statutes, section 16A.28, or any other law to the contrary, the availability of any appropriation or grant of money from the environment and natural resources trust fund that would otherwise cancel, lapse, or expire on June 30, 2021, is extended to June 30, 2022, if the recipient or grantee does both of the following:

(1) by April 30, 2021, notifies the Legislative-Citizen Commission on Minnesota Resources in the manner specified by the commission that the recipient or grantee intends to avail itself of the extension available under this section; and

(2) modifies the applicable work plan where required by Minnesota Statutes, section 116P.05, subdivision 2, in accordance with the work plan amendment procedures adopted under that section.

(b) The commission must notify the commissioner of management and budget and the commissioner of

natural resources of any extension granted under this section.

Subd. 19. Transfers; Natural Resources Research Institute

(a) The following amounts, totaling \$840,000, are transferred to the Board of Regents of the University of Minnesota for academic and applied research through the MnDRIVE program at the Natural Resources Research Institute to develop and demonstrate technologies that enhance the long-term health and management of Minnesota's forest resources, extend the viability of incumbent forest-based industries, and accelerate emerging industry opportunities. Of this amount, \$500,000 is for extending the demonstrated forest management assessment tool to statewide application:

(1) the unencumbered amount, estimated to be \$250,000, in Laws 2017, chapter 96, section 2, subdivision 7, paragraph (e), Geotargeted Distributed Clean Energy Initiative;

(2) the unencumbered amount, estimated to be \$20,000, in Laws 2017, chapter 96, section 2, subdivision 8, paragraph (g), Minnesota Bee and Beneficial Species Habitat Restoration;

(3) the unencumbered amount, estimated to be \$350,000, in Laws 2018, chapter 214, article 4, section 2, subdivision 9, paragraph (e), Swedish Immigrant Regional Trail Segment within Interstate State Park; and

(4) the unencumbered amount, estimated to be \$220,000, in Laws 2019, First Special Session chapter 4, article 2, section 2, subdivision 5, paragraph (a), Expanding Camp Sunrise Environmental Program.

(b) The amounts transferred under this subdivision are available until June 30, 2023.

EFFECTIVE DATE. Subdivisions 18 and 19 are effective the day following final enactment.

Presented to the governor June 28, 2021

Signed by the governor June 29, 2021, 1:42 p.m.

FY2023 - MN Laws 2022, Chapter 94, Section 2

**M.L. 2022 Environment and Natural Resources Trust Fund (ENRTF)
Appropriations by Subdivision**

Process for M.L. 2022

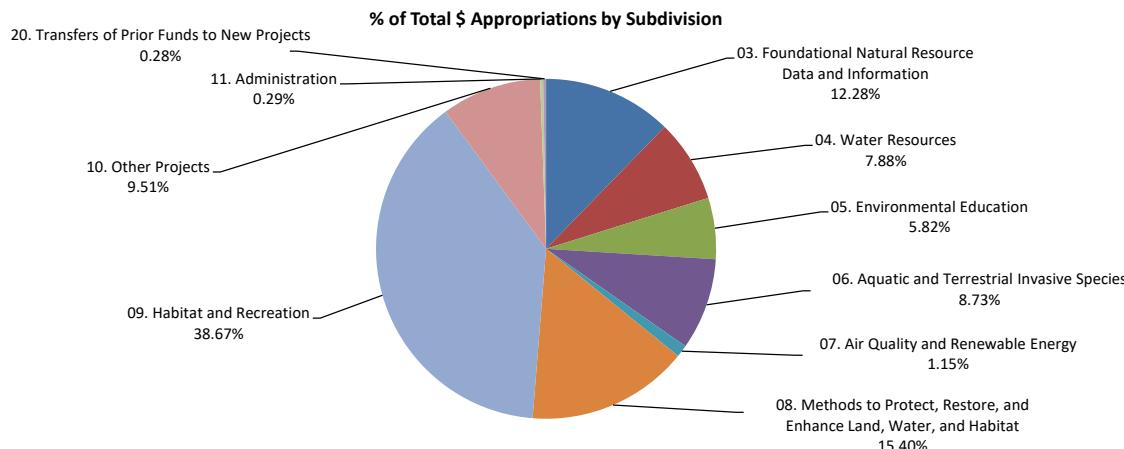
For the FY 2022 and FY 2023 biennium (July 1, 2021 - June 30, 2023), approximately \$70 million was available each year for funding from the Environment and Natural Resources Trust Fund (ENRTF). For funding beginning July 1, 2022 (FY 2023), the Legislative-Citizen Commission on Minnesota Resources (LCCMR) received 220 proposals requesting a total of approximately \$178 million in response to its 2022 Request for Proposals (RFP). Thirty-one proposals withdrew after the passage of the 2020 and 2021 ENRTF appropriations, resulting in a revised total of 189 proposals requesting a total of approximately \$142 million. The LCCMR reviewed and considered the proposals through a competitive, multi-stage evaluation but did not make an official recommendation to the Minnesota Legislature. The House and Senate introduced and heard bills that included projects that went through the LCCMR process. The House bill contained 74 projects, and the Senate bill contained 96 projects.

On May 22, 2022, the Legislature approved 80 projects for funding from the Environment and Natural Resources Trust Fund. Twelve of the approved projects did not go through the LCCMR proposal review process, and the scope of two projects that did go through the process was modified by the Legislature. Twenty-five LCCMR-reviewed projects that were originally included in the House or Senate version of the bill were not included in the final bill. On June 3, 2022, the 80 appropriations were signed into law by the Governor as M.L. 2022, Chapter 94, with \$70,881,000 FY23 and \$2,463,000 recaptured from prior fiscal years, for \$73,344,000 in total appropriations.

January 11, 2021	RFP Issued
April 2, 2021	RFP Proposal Deadline
July 6, 2021	Selection of Proposals for Further Consideration and Presentations
July 13, 15, 20 & 27-28, 2021	Proposal Presentations
August 26, September 23 & December 15, 2021	LCCMR Allocation Discussions
September 2021 - June 2022	Research Projects Undergo Peer Review
January 5, 2022	2022 Minnesota Legislative Session Begins
June 3, 2022	Appropriations Signed into Law by Governor

Summary of Appropriations by Subdivision

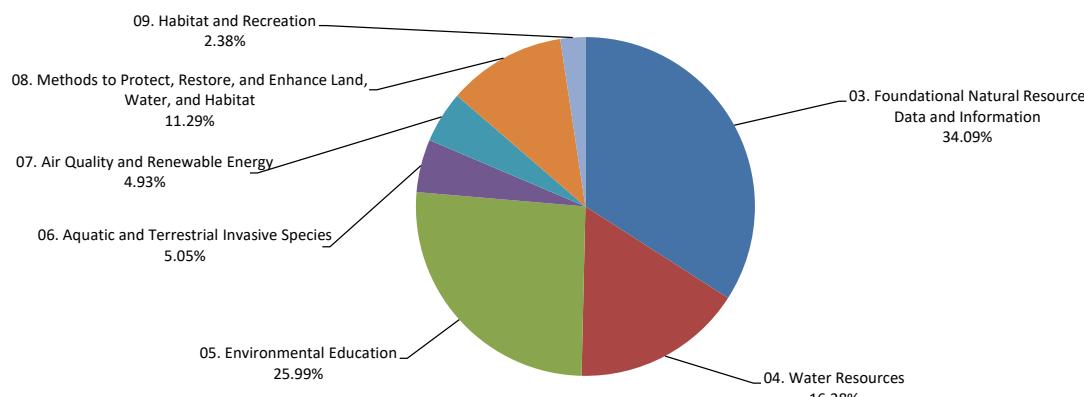
Subdivision	\$ Appropriations	\$ Percent	# Appropriations	# Percent
03. Foundational Natural Resource Data and Information	\$9,004,000	12.28%	15	18.75%
04. Water Resources	\$5,783,000	7.88%	14	17.50%
05. Environmental Education	\$4,269,000	5.82%	9	11.25%
06. Aquatic and Terrestrial Invasive Species	\$6,404,000	8.73%	2	2.50%
07. Air Quality and Renewable Energy	\$843,000	1.15%	2	2.50%
08. Methods to Protect, Restore, and Enhance Land, Water, and Habitat	\$11,294,000	15.40%	11	13.75%
09. Habitat and Recreation	\$28,362,000	38.67%	14	17.50%
10. Other Projects	\$6,973,000	9.51%	11	13.75%
11. Administration	\$210,000	0.29%	1	1.25%
20. Transfers of Prior Funds to New Projects	\$202,000	0.28%	1	1.25%
Total	\$73,344,000	100.00%	80	100.00%



Summary of Category H Appropriations by Subdivision

Subdivision	\$ Appropriations	\$ Percent	# Appropriations	# Percent
03. Foundational Natural Resource Data and Information	\$1,175,000	34.09%	6	33.33%
04. Water Resources	\$561,000	16.28%	3	16.67%
05. Environmental Education	\$896,000	25.99%	4	22.22%
06. Aquatic and Terrestrial Invasive Species	\$174,000	5.05%	1	5.56%
07. Air Quality and Renewable Energy	\$170,000	4.93%	1	5.56%
08. Methods to Protect, Restore, and Enhance Land, Water, and Habitat	\$389,000	11.29%	2	11.11%
09. Habitat and Recreation	\$82,000	2.38%	1	5.56%
Total	\$3,447,000	100.00%	18	100.00%

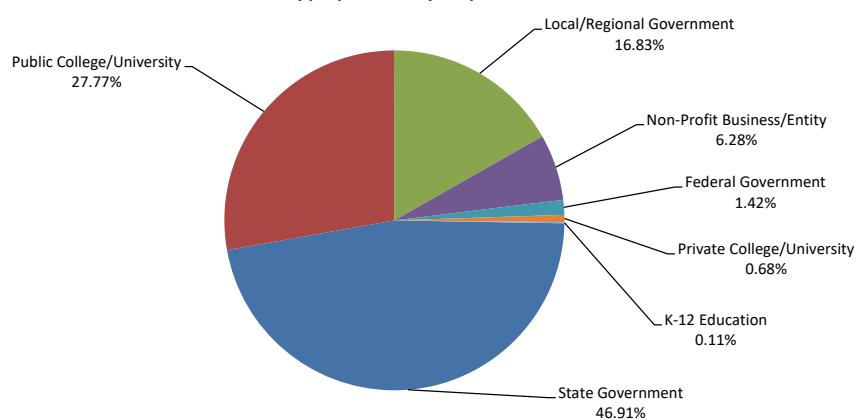
% of Total \$ Appropriations in Category H by Subdivision



Summary of Appropriations by Proposer Affiliation

Affiliation Type	\$ Appropriations	\$ Percent	# Appropriations	# Percent
State Government	\$34,406,000	46.91%	25	31.25%
Public College/University	\$20,368,000	27.77%	29	36.25%
Local/Regional Government	\$12,341,000	16.83%	15	18.75%
Non-Profit Business/Entity	\$4,609,000	6.28%	7	8.75%
Federal Government	\$1,038,000	1.42%	2	2.50%
Private College/University	\$500,000	0.68%	1	1.25%
K-12 Education	\$82,000	0.11%	1	1.25%
Total	\$73,344,000	100.00%	80	100.00%

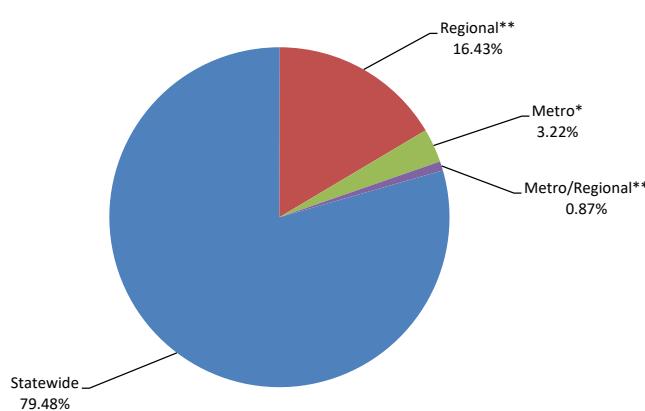
% of Total \$ Appropriations by Proposer Affiliation



Summary of Appropriations by Area of Impact

Areas of Impact	\$ Appropriations	\$ Percent	# Appropriations	# Percent
Statewide	\$58,291,000	79.48%	58	72.50%
Regional**	\$12,051,000	16.43%	16	20.00%
Metro*	\$2,362,000	3.22%	4	5.00%
Metro/Regional**	\$640,000	0.87%	2	2.50%
Total	\$73,344,000	100.00%	80	100.00%

% of Total \$ Appropriations by Area of Impact



* "Metro" region includes the 11 counties of Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, and Wright.

** "Regional" means area of impact is less than "Statewide" but includes one or more regions of the state ("Northwest", Northeast", "Central", "Southwest", or "Southeast") other than the 11-county "Metro" region.

M.L. 2022 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Appropriations for RFP 2022/FY 2023

On May 22, 2022, the Legislature approved 80 projects for funding from the Environment and Natural Resources Trust Fund. Twelve of the approved projects did not go through the LCCMR proposal review process, and the scope of two projects that did go through the process was modified by the Legislature. Twenty-five LCCMR-reviewed projects that were originally included in the House or Senate version of the bill were not included in the final bill. On June 3, 2022, the 80 appropriations were signed into law by the Governor as M.L. 2022, Chapter 94, with \$70,881,000 FY23 and \$2,463,000 recaptured from prior fiscal years, for \$73,344,000 in total appropriations.

Topic Area	Multiple FY's Reallocated \$	FY2023 Trust Fund \$	Total LCCMR \$ Appropriated	Percentage of Total Appropriations
Subd. 03 Foundational Natural Resource Data and Information 15 Appropriations	\$0	\$9,004,000	\$9,004,000	12.28%
Subd. 04 Water Resources 14 Appropriations	\$0	\$5,783,000	\$5,783,000	7.88%
Subd. 05 Environmental Education 9 Appropriations	\$0	\$4,269,000	\$4,269,000	5.82%
Subd. 06 Aquatic and Terrestrial Invasive Species 2 Appropriations	\$0	\$6,404,000	\$6,404,000	8.73%
Subd. 07 Air Quality and Renewable Energy 2 Appropriations	\$0	\$843,000	\$843,000	1.15%
Subd. 08 Methods to Protect, Restore, and Enhance Land, Water, and Habitat 11 Appropriations	\$0	\$11,294,000	\$11,294,000	15.40%
Subd. 09 Habitat and Recreation 14 Appropriations	\$2,183,000	\$26,179,000	\$28,362,000	38.67%
Subd. 10 Other Projects 11 Appropriations	\$0	\$6,973,000	\$6,973,000	9.51%
Subd. 11 Administrative 1 Appropriation	\$78,000	\$132,000	\$210,000	0.29%
Subd. 20 Transfers 1 Appropriation (amounts are estimate)	\$202,000	\$0	\$202,000	0.28%
Total Appropriations	\$2,463,000	\$70,881,000	\$73,344,000	100.00%

Fund Source	\$ Amount
FY 2023 - Environment and Natural Resources Trust Fund (ENRTF)	\$70,881,000
ENRTF Dollars Reallocated from 2021 Appropriations (FY20)- estimate	\$78,000
ENRTF Dollars Reallocated from 2018 Appropriations (FY19)- estimate	\$550,000
ENRTF Dollars Reallocated from 2017 Appropriations (FY18)- estimate	\$1,835,000
Total \$	\$73,344,000

M.L. 2022 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Appropriations for RFP 2022/FY 2023

Bill Subd.	Original Proposal ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2023	TOTAL ENRTF \$ Appropriated
Subd. 03 Foundational Natural Resource Data and Information (15 Appropriations - Subtotal = \$9,004,000)							
03a	2022-043	Improving Golden-Winged Warbler Conservation and Habitat Restoration	U of MN, Duluth - NRRI	Alexis Grinde	\$0	\$197,000	\$197,000
03b	2022-048	Enhancing Natural Resource Conservation Through Species Distribution Modeling	MN DNR, Ecological and Water Resources Division	Holly Bernardo	\$0	\$200,000	\$200,000
03c	2022-076	Modernizing Minnesota's Digital Lake Inventory	MN DNR, Ecological and Water Resources Division	Steve Kloiber	\$0	\$787,000	\$787,000
03d	2022-091	How Do Prescribed Fires Affect Native Prairie Bees?	Negaunee Institute for Plant Conservation Science and Action at the Chicago Horticultural Society	Stuart Wagenius	\$0	\$500,000	\$500,000
03e	2022-109	Status of Minnesota Blueberries and Related Berry Species	U of MN, Duluth	Briana Gross	\$0	\$191,000	\$191,000
03f	2022-122	Distribution and Movements of Fishers in Southern Minnesota	U of MN, Duluth - NRRI	Michael Joyce	\$0	\$340,000	\$340,000
03g	2022-149	Offal Wildlife Watching: How Do Hunters' Provisions Impact Scavengers?	U of MN, College of Food, Agricultural and Natural Resource Sciences	Joseph Bump	\$0	\$473,000	\$473,000
03h	2022-163	Land-Use and Climate Impacts on Minnesota's Whitewater River	U of MN, St. Anthony Falls Laboratory	Andrew Wickert	\$0	\$199,000	\$199,000
03i	2022-185	Protecting Minnesota's Spruce-Fir Forests from Tree-Killing Budworm	U of MN, College of Food, Agricultural and Natural Resource Sciences	Brian Aukema	\$0	\$189,000	\$189,000
03j	2022-193	Restoration of Eastern Hemlock, Minnesota's Endangered Tree Species	U of MN, College of Food, Agricultural and Natural Resource Sciences	Andrew David	\$0	\$199,000	\$199,000
03k	2022-217	Establishing a Center for Prion Research and Outreach	U of MN, College of Veterinary Medicine	Peter Larsen	\$0	\$3,877,000	\$3,877,000
03l	2022-266	Sweetening the Crop: Perennial Flax for Ecosystem Benefits	U of MN, College of Food, Agricultural and Natural Resource Sciences	Neil Anderson	\$0	\$490,000	\$490,000
03m	2022-275	Beavers, Trees, and Climate - Increasing Floodplain Forest Resilience	National Park Service, Mississippi National River and Recreation Area	Nancy Duncan	\$0	\$430,000	\$430,000
03n	---	Chronic Wasting Disease Prion Soil Research	U of MN	OPEN	\$0	\$732,000	\$732,000

M.L. 2022 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Appropriations for RFP 2022/FY 2023

Bill Subd.	Original Proposal ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2023	TOTAL ENRTF \$ Appropriated
03o	2022-081	Strategic Framework to Guide Local Water Storage Implementation	Board of Water and Soil Resources	Henry Van Offelen	\$0	\$200,000	\$200,000
Subd. 03 Foundational Natural Resource Data and Information Subtotal =					\$0	\$9,004,000	\$9,004,000
Subd. 04 Water Resources (14 Appropriations - Subtotal = \$5,783,000)							
04a	2022-049	Methods to Destroy PFAS in Landfill Leachates	U of MN, College of Food, Agricultural and Natural Resource Sciences	Roger Ruan	\$0	\$200,000	\$200,000
04b	2022-087	High Temperature Anaerobic Digestion of Sewage Sludge	U of MN, College of Science and Engineering	Timothy LaPara	\$0	\$208,000	\$208,000
04c	2022-099	Mitigating Cyanobacterial Blooms and Toxins Using Clay-Algae Flocculation	U of MN, St. Anthony Falls Laboratory	Judy Yang	\$0	\$326,000	\$326,000
04d	2022-103	Changing Winters and Game Fish in Minnesota Lakes	U of MN, Duluth - Large Lakes Observatory	Ted Ozersky	\$0	\$238,000	\$238,000
04e	2022-116	Rainy River Drivers of Lake of the Woods Algal Blooms	US Geological Survey, Upper Midwest Water Science Center	Anna Baker	\$0	\$608,000	\$608,000
04f	2022-152	Water and Climate Information to Enhance Community Resilience	U of MN, College of Food, Agricultural and Natural Resource Sciences	Tracy Twine	\$0	\$564,000	\$564,000
04g	2022-155	Catch and Reveal: Discovering Unknown Fish Contamination Threats	U of MN, Duluth - NRRI	Bridget Ulrich	\$0	\$246,000	\$246,000
04h	2022-166	Increased Intense Rain and Flooding in Minnesota's Watersheds	Science Museum of Minnesota, St. Croix Watershed Research Station	Jason Ulrich	\$0	\$192,000	\$192,000
04i	2022-224	Is the Tire Chemical 6PPDq Killing Minnesota's Fish?	U of MN, College of Food, Agricultural and Natural Resource Sciences	Nicholas Phelps	\$0	\$437,000	\$437,000
04j	2022-251	Mitigation Strategies for Agroplastic PFAS and Microplastic Contamination	U of MN, WCROC	Joel Tallaksen	\$0	\$169,000	\$169,000
04k	2022-265	Innovative Technology for PFAS Destruction in Drinking Water	U of MN, Southern Research and Outreach Center	Shaobo Deng	\$0	\$445,000	\$445,000
04l	2022-272	Salt Threatens Minnesota Water Quality and Fisheries	Science Museum of Minnesota, St. Croix Watershed Research Station	Mark Edlund	\$0	\$1,228,000	\$1,228,000
04m	2022-286	PFAS Contaminant Mitigation Using Hybrid Engineered Wetlands	St. Louis County	Mark St. Lawrence	\$0	\$446,000	\$446,000
04n	2022-046	Scaling a Market-Driven Water-Quality Solution for Row-Crop Farming	U of MN, College of Food, Agricultural and Natural Resource Sciences	Nicholas Jordan	\$0	\$476,000	\$476,000
Subd. 04 Water Resources Subtotal =					\$0	\$5,783,000	\$5,783,000
Subd. 05 Environmental Education (9 Appropriations - Subtotal \$4,269,000)							

M.L. 2022 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Appropriations for RFP 2022/FY 2023

Bill Subd.	Original Proposal ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2023	TOTAL ENRTF \$ Appropriated
05a	2022-026	Teacher Field School: Stewardship through Nature-Based Education	Hamline University	Patty Born	\$0	\$500,000	\$500,000
05b	2022-029	Increasing K-12 Student Learning to Develop Environmental Awareness, Appreciation, and Interest	Osprey Wilds Environmental Learning Center	Bryan Wood	\$0	\$1,602,000	\$1,602,000
05c	2022-066	Expanding Access to Wildlife Learning Bird by Bird	MN DNR, Ecological and Water Resources Division	Alison Cariveau	\$0	\$276,000	\$276,000
05d	2022-107	Engaging a Diverse Public in Environmental Stewardship	Great River Greening	Amy Kilgore	\$0	\$300,000	\$300,000
05e	2022-162	Bugs Below Zero: Engaging Citizens in Winter Research	U of MN, College of Food, Agricultural and Natural Resource Sciences	Rebecca Swenson	\$0	\$198,000	\$198,000
05f	2022-169	ESTEP: Earth Science Teacher Education Project	Minnesota Science Teachers Association	Lee Schmitt	\$0	\$495,000	\$495,000
05g	2022-236	YES! Students Take Action to Complete Eco Projects	Prairie Woods Environmental Learning Center	Joseph Dunlavy	\$0	\$199,000	\$199,000
05h	2022-250	Increasing Diversity in Environmental Careers	MN DNR, Operational Services Division (OSD)	Mimi Daniel	\$0	\$500,000	\$500,000
05i	2022-279	Diversity and Access to Wildlife-Related Opportunities	U of MN, College of Food, Agricultural and Natural Resource Sciences	Alexandrea Safiq	\$0	\$199,000	\$199,000
Subd. 05 Environmental Education Subtotal =					\$0	\$4,269,000	\$4,269,000
Subd. 06 Aquatic and Terrestrial Invasive Species (2 Appropriations - Subtotal = \$6,404,000)							
06a	2022-067	Minnesota Invasive Terrestrial Plants and Pests Center	U of MN, MITPPC	Heather Koop	\$0	\$6,230,000	\$6,230,000
06b	2022-089	Purple Loosestrife Biocontrol Citizen Science Program	St. Croix River Association	Katie Sickmann	\$0	\$174,000	\$174,000
Subd. 06 Aquatic and Terrestrial Invasive Species Subtotal =					\$0	\$6,404,000	\$6,404,000
Subd. 07 Air Quality and Renewable Energy (2 Appropriations - Subtotal = \$843,000)							
07a	2022-180	Green Solar Cells from a Minnesota Natural Resource	U of MN, College of Science and Engineering	Chris Leighton	\$0	\$673,000	\$673,000
07b	2022-291	Morris GHG Emissions Inventory and Mitigation Strategies	City of Morris	Blaine Hill	\$0	\$170,000	\$170,000
Subd. 07 Air Quality and Renewable Energy Subtotal =					\$0	\$843,000	\$843,000
Subd. 08 Methods to Protect, Restore, and Enhance Land, Water, and Habitat (11 Appropriations - Subtotal = \$11,294,000)							
08a	2022-006	Minnesota's Volunteer Rare Plant Conservation Corps	U of MN, Landscape Arboretum	David Remucal	\$0	\$859,000	\$859,000
08b	2022-034	Conservation Corps Veterans Service Corps Program	Conservation Corps Minnesota	Brian Miller	\$0	\$1,339,000	\$1,339,000

M.L. 2022 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Appropriations for RFP 2022/FY 2023

Bill Subd.	Original Proposal ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2023	TOTAL ENRTF \$ Appropriated
08c	2022-061	Creating Seed Sources of Early-Blooming Plants for Pollinators	MN DNR, Ecological and Water Resources Division	Christina Locke	\$0	\$200,000	\$200,000
08d	2022-065	Hastings Lake Rebecca Park Area	City of Hastings, Parks & Recreation	Chris Jenkins	\$0	\$1,000,000	\$1,000,000
08e	2022-167	Pollinator Plantings and the Redistribution of Soil Toxins	U of MN, College of Biological Sciences	Emilie Snell-Rood	\$0	\$610,000	\$610,000
08f	2022-188	PFAS Fungal-Wood Chip Filtering System	U of MN, College of Food, Agricultural and Natural Resource Sciences	Jiwei Zhang	\$0	\$189,000	\$189,000
08g	2022-214	Phytoremediation for Extracting Deicing Salt	U of MN, College of Food, Agricultural and Natural Resource Sciences	Bo Hu	\$0	\$451,000	\$451,000
08h	2022-221	Mustinka River Fish and Wildlife Habitat Corridor Rehabilitation	Bois de Sioux Watershed District	Jamie Beyer	\$0	\$2,692,000	\$2,692,000
08i	2022-244	Bohemian Flats Savanna Restoration	Minneapolis Parks and Recreation Board	Adam Arvidson	\$0	\$286,000	\$286,000
08j	2022-260	Watershed and Forest Restoration: What a Match!	Board of Water and Soil Resources	Lindberg Ekola	\$0	\$3,318,000	\$3,318,000
08k	2022-142	River Habitat Restoration and Recreation in Melrose	City of Melrose	Colleen Winter	\$0	\$350,000	\$350,000
Subd. 08 Methods to Protect, Restore, and Enhance Land, Water, and Habitat Subtotal =						\$0	\$11,294,000

Subd. 09 Habitat and Recreation (14 Appropriations - Subtotal = \$28,362,000)

09a	2022-005	Mesabi Trail: Wahlsten Road (CR 26) to Tower	St. Louis & Lake Counties Regional Railroad Authority	Bill Dahl	\$0	\$1,307,000	\$1,307,000
09b	2022-041	Environmental Learning Classroom with Trails	Independent School District #712, Mountain Iron Buhl Public Schools	Reggie Engebrition	\$0	\$82,000	\$82,000
09c	2022-057	Local Parks, Trails, and Natural Areas Grant Programs	MN DNR, Grants Unit	Audrey Mularie	\$0	\$3,560,000	\$3,560,000
09d	2022-088	St. Louis River Re-Connect	City of Duluth	Cliff Knettel	\$0	\$500,000	\$500,000
09e	2022-101	Native Prairie Stewardship and Prairie Bank Easement Acquisition	MN DNR, Ecological and Water Resources Division	Judy Schulte	\$0	\$1,353,000	\$1,353,000
09f	2022-111	Minnesota State Parks and State Trails Maintenance and Development	MN DNR, State Parks and Trails Division	Shelby Kok	\$2,183,000	\$1,600,000	\$3,783,000
09g	2022-135	Minnesota State Trails Development	MN DNR, State Parks and Trails Division	Kent Skaar	\$0	\$7,387,000	\$7,387,000

M.L. 2022 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Appropriations for RFP 2022/FY 2023

Bill Subd.	Original Proposal ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2023	TOTAL ENRTF \$ Appropriated
09h	2022-158	SNA Habitat Restoration and Public Engagement	MN DNR, Ecological and Water Resources Division	Molly Roske	\$0	\$5,000,000	\$5,000,000
09i	2022-008	The Missing Link: Gull Lake Trail, Fairview Township	Fairview Township	Marla Yoho	\$0	\$1,394,000	\$1,394,000
09j	2022-127	Silver Bay Multimodal Trailhead Project	City of Silver Bay	Lana Fralich	\$0	\$1,000,000	\$1,000,000
09k	2022-140	Brookston Campground, Boat Launch, and Outdoor Recreational Facility	City of Brookston	Kaycee Melin	\$0	\$453,000	\$453,000
09l	2022-143	Silver Lake Trail Connection	City of Virginia	Britt See-Benes	\$0	\$727,000	\$727,000
09m	2022-150	Floodwood Campground Improvement Project	City of Floodwood	Corinne Suonvieri	\$0	\$816,000	\$816,000
09n	2022-165	Ranier Safe Harbor/Transient Dock - Phase 2	City of Ranier	Sherril Gautreaux	\$0	\$1,000,000	\$1,000,000
Subd. 09 Habitat and Recreation Subtotal =					\$2,183,000	\$26,179,000	\$28,362,000
Subd. 10 Other Projects (11 Appropriations - Subtotal = \$6,973,000)							
10a	---	Aggregate Resource Mapping	MN DNR	OPEN		\$500,000	\$500,000
10b	---	Leaded Gasoline Contamination Analysis	City of Paynesville	OPEN		\$200,000	\$200,000
10c	---	Living Snow Fence Program	Minnesota Department of Transportation	OPEN		\$200,000	\$200,000
10d	---	Forest Data Inventory	MN DNR	OPEN		\$500,000	\$500,000
10e	---	Conservation Reserve Program State Incentives	Board of Water and Soil Resources	OPEN		\$750,000	\$750,000
10f	---	Groundwater Storage and Recovery Database	MN DNR	OPEN		\$400,000	\$400,000
10g	---	Rural and Farmstead Ring Levees	MN DNR	OPEN		\$360,000	\$360,000
10h	---	Replacing Failing Septic Systems to Protect Groundwater	Minnesota Pollution Control Agency	OPEN		\$2,000,000	\$2,000,000
10i	---	Forever Green	U of MN	OPEN		\$763,000	\$763,000
10j	---	Pig's Eye Landfill Task Force	Minnesota Pollution Control Agency	OPEN		\$800,000	\$800,000
10k	---	Developing Markets for Continuous Living Cover Crops	Minnesota Department of Agriculture	OPEN		\$500,000	\$500,000
				Subd. 10 Other Projects Subtotal =	\$0	\$6,973,000	\$6,973,000
Subd. 11 Administrative (1 Appropriation - Subtotal = \$210,000)							
11	2022-121	Contract Agreement Reimbursement	MN DNR, Grants Unit	Katherine Sherman-Hoehn	\$78,000	\$132,000	\$210,000
				Subd. 11 Administrative Subtotal =	\$78,000	\$132,000	\$210,000
Subd. 20 Transfers* (1 Appropriation - Subtotal = \$202,000)							
20a	2022-111	SEE SUDB. 09f- Minnesota State Parks and State Trails Maintenance and Development (\$2,183,000)	MN DNR, State Parks and Trails Division	Kent Skaar	---	---	---
20b	---	Emerging Issues Account	Legislative-Citizen Commission on Minnesota Resources	Becca Nash	\$202,000	\$0	\$202,000

M.L. 2022 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Appropriations for RFP 2022/FY 2023

Bill Subd.	Original Proposal ENRTF ID	Title	Organization	Project Manager	ENRTF \$ Multiple FYs	ENRTF \$ FY2023	TOTAL ENRTF \$ Appropriated
20c	2022-121	SEE SUBD. 11 - 2022 Contract Agreement Reimbursement (\$78,000)	MN DNR, Grants Unit	Katherine Sherman-Hoehn	---	---	---
Subd. 20 Transfers Subtotal =					\$202,000	\$0	\$202,000
					Total \$ =	\$2,463,000	\$70,881,000
							\$73,344,000

*Estimate amount, pending final close-out of completing projects being transferred

CHAPTER 94--H.F.No. 3765

An act relating to natural resources; appropriating money from environment and natural resources trust fund; providing for extensions and transfers; modifying requirements for expending trust fund money; requiring a report; amending Minnesota Statutes 2020, section 116P.08, subdivision 2.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MINNESOTA:

Section 1. **APPROPRIATIONS.**

The sums shown in the columns marked "Appropriations" are appropriated to the agencies and for the purposes specified in this act. The appropriations are from the environment and natural resources trust fund and are available for the fiscal years indicated for each purpose. The figures "2022" and "2023" used in this act mean that the appropriations listed under them are available for the fiscal year ending June 30, 2022, or June 30, 2023, respectively. "The first year" is fiscal year 2022. "The second year" is fiscal year 2023. "The biennium" is fiscal years 2022 and 2023. Any unencumbered balance remaining in the first year does not cancel and is available for the second year or until the end of the appropriation. These are onetime appropriations.

APPROPRIATIONS	
<u>Available for the Year</u>	
<u>Ending June 30</u>	
<u>2022</u>	<u>2023</u>

Sec. 2. **MINNESOTA RESOURCES**

<u>Subdivision 1. Total Appropriation</u>	<u>\$</u>	<u>-0- \$</u>	<u>70,881,000</u>
---	-----------	---------------	-------------------

This appropriation is from the environment and natural resources trust fund. The amounts that may be spent for each purpose are specified in the following subdivisions.

Subd. 2. Definition

"Trust fund" means the Minnesota environment and natural resources trust fund established under the Minnesota Constitution, article XI, section 14.

<u>Subd. 3. Foundational Natural Resource Data and Information</u>	<u>-0-</u>	<u>9,004,000</u>
--	------------	------------------

(a) Improving Golden-Winged Warbler Conservation and Habitat Restoration

\$197,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to develop restoration and habitat management guidelines for protecting the imperiled golden-winged warbler by assessing habitat use and behavior of this species.

(b) Enhancing Natural Resource Conservation Through Species Distribution Modeling

\$200,000 the second year is from the trust fund to the commissioner of natural resources to create distribution models for rare species in Minnesota to provide new tools for natural areas conservation.

(c) Modernizing Minnesota's Digital Lake Inventory

\$787,000 the second year is from the trust fund to the commissioner of natural resources to conduct a comprehensive update of Minnesota's lake and pond GIS data to enhance lake conservation planning by state and local partners while also creating efficiencies for ongoing data maintenance.

(d) How Do Prescribed Fires Affect Native Prairie Bees?

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Negaunee Institute for Plant Conservation Science and Action at the Chicago Horticultural Society to investigate how prescribed fire in Minnesota's tallgrass prairies affects the nesting habitat, food resources, and diversity of ground-nesting bees.

(e) Status of Minnesota Blueberries and Related Berry Species

\$191,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota, Duluth, to assess how land management practices impact the genetic health and reproduction of several native edible blueberry and related berry species of Minnesota. This appropriation is available until June 30, 2026, by which time the project must be completed and final products delivered.

(f) Distribution and Movements of Fishers in Southern Minnesota

\$340,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to determine the distribution, status, and habitat use of fishers in southern Minnesota to inform fisher management.

(g) Offal Wildlife Watching: How Do Hunters' Provisions Impact Scavengers?

\$473,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to recruit hunters statewide and use remote cameras at field-dressed deer gut piles to study the impacts of these offal resources on scavengers and other wildlife.

(h) Land-Use and Climate Impacts on Minnesota's Whitewater River

\$199,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the St. Anthony Falls Laboratory to augment, digitize, and disseminate unique and historic topographical survey data showing changes in the Whitewater River valley to inform future land and water management.

(i) Protecting Minnesota's Spruce-Fir Forests from Tree-Killing Budworm

\$189,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to evaluate conditions contributing to Minnesota's uniquely high population of the native and lethal spruce budworm to provide better management options for protecting the state's spruce-balsam fir forests.

(j) Restoration of Eastern Hemlock, Minnesota's Endangered Tree Species

\$199,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop guidelines for restoring eastern hemlock, Minnesota's only endangered tree species, by testing methods and seed sources at different sites across northern Minnesota.

(k) Establishing a Center for Prion Research and Outreach

\$3,877,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to form a multidisciplinary center to perform coordinated research on the detection, prevention, and treatment of chronic wasting and other prion diseases threatening wildlife across Minnesota. Money appropriated in this paragraph may also be spent on a strategic plan, capital equipment, and staff as approved in the work plan required under Minnesota Statutes, section 116P.05. Money appropriated in this paragraph may not be spent on activities unless they are directly related to and necessary for the purposes of this paragraph. Money appropriated in this paragraph must not be spent on indirect costs or other institutional overhead charges that are not directly related to and necessary for the purposes of this paragraph. This appropriation is subject to Minnesota Statutes, section 116P.10. This is a onetime appropriation and is available until June 30, 2026.

(l) Sweetening the Crop: Perennial Flax for Ecosystem Benefits

\$490,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to produce, select, and evaluate how perennial flax provides pollinator and other ecosystem services while enhancing yield for oilseed, fiber, and honey production.

(m) Beavers, Trees, and Climate - Increasing Floodplain Forest Resilience

\$430,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the National Park Service, Mississippi National River and Recreation Area, to identify solutions for saving floodplain wildlife habitat from beaver herbivory, changes in climate, and emerald ash borer.

(n) Chronic Wasting Disease Prion Soil Research

\$732,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to study chronic wasting disease prions in soils, including the assessment of sites where carcasses with chronic wasting disease have been disposed.

(o) Strategic Framework to Guide Local Water Storage Implementation

\$200,000 the second year is from the trust fund to the Board of Water and Soil Resources to create a framework for prioritizing water storage projects throughout the state. The framework will use existing data and local stakeholder input, be scalable, and emphasize projects that provide multiple benefits, including for water quality, flood control, and habitat.

Subd. 4. Water Resources

-0-

5,783,000

(a) Methods to Destroy PFAS in Landfill Leachates

\$200,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop and examine methods for destruction of per- and polyfluoroalkyl substances (PFAS) in landfill leachate. This appropriation is subject to Minnesota Statutes, section 116P.10.

(b) High Temperature Anaerobic Digestion of Sewage Sludge

\$208,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to demonstrate that high temperature anaerobic digestion is effective at treating sewage sludge and preventing disease-causing microorganisms and antibiotic resistance genes from being released into the environment.

(c) Mitigating Cyanobacterial Blooms and Toxins Using Clay-Algae Flocculation

\$326,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for St. Anthony Falls Laboratory to develop and test a clay-algae flocculation method to mitigate cyanobacterial blooms that can contaminate drinking water and cause mass fish mortality. This appropriation is subject to Minnesota Statutes, section 116P.10.

(d) Changing Winters and Game Fish in Minnesota Lakes

\$238,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for

the Large Lakes Observatory in Duluth to determine how changing winter conditions such as ice cover, snowfall patterns, and water quality affect Minnesota's game fish populations.

(e) Rainy River Drivers of Lake of the Woods Algal Blooms

\$608,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the United States Geological Survey, Upper Midwest Water Science Center, to guide the reduction of phosphorus inputs to Lake of the Woods by examining sources, mobility, and storage of sediment-bound phosphorus in the Rainy River. This appropriation is available until June 30, 2026, by which time the project must be completed and final products delivered.

(f) Water and Climate Information to Enhance Community Resilience

\$564,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to provide information on potential future water resources to communities and individuals to guide adaptation planning.

(g) Catch and Reveal: Discovering Unknown Fish Contamination Threats

\$246,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to identify contaminants present in Minnesota water bodies using passive sampling and discovery-based chemical analysis and rank the contaminants' potential threat to Minnesota's fisheries. This appropriation is available until June 30, 2026, by which time the project must be completed and final products delivered.

(h) Increased Intense Rain and Flooding in Minnesota's Watersheds

\$192,000 the second year is from the trust fund to the Science Museum of Minnesota for the St. Croix Watershed Research Station to partner with local communities to determine the causes of increased

flooding and the most cost-effective solutions for reducing flood risk in the Cottonwood River watershed and other agricultural watersheds in southern Minnesota.

(i) Is the Tire Chemical 6PPDq Killing Minnesota's Fish?

\$437,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to optimize detection methods, determine environmental occurrence, and evaluate risk to Minnesota's fish populations of the toxic tire-derived chemical 6PPDq.

(j) Mitigation Strategies for Agroplastic PFAS and Microplastic Contamination

\$169,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center, Morris, to study plastic use in the agricultural supply chain and to research and communicate strategies to reduce impacts of this plastic use, including water and land contamination from microplastics, PFAS, and related compounds.

(k) Innovative Technology for PFAS Destruction in Drinking Water

\$445,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Southern Research and Outreach Center to develop and demonstrate a treatment process based on continuous liquid-phase plasma discharge technology to destroy per- and polyfluoroalkyl substances (PFAS) in drinking water. This appropriation is subject to Minnesota Statutes, section 116P.10.

(l) Salt Threatens Minnesota Water Quality and Fisheries

\$1,228,000 the second year is from the trust fund to the Science Museum of Minnesota for the St. Croix Watershed Research Station to determine chloride tipping points that lead to water-quality and food-web degradations, measure how and when lakes are salinized, identify lake and food-web resilience to chloride, and test impacts of deicing alternatives.

(m) PFAS Contaminant Mitigation Using Hybrid Engineered Wetlands

\$446,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with St. Louis County to design, implement, and evaluate an innovative method for protecting water resources through mitigation of per- and polyfluoroalkyl substances (PFAS) from landfill leachate using engineered wetland treatment systems.

(n) Scaling a Market-Driven Water-Quality Solution for Row-Crop Farming

\$476,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to work with farmers to accelerate adoption of grain-camelina rotations in targeted watersheds as a scalable and market-driven way to enhance stewardship of soil, water, and wildlife.

Subd. 5. Environmental Education

-0-

4,269,000

(a) Teacher Field School: Stewardship through Nature-Based Education

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Hamline University to create an immersive, research-backed field school for teachers to use nature-based education to benefit student well-being and academic outcomes while increasing stewardship habits.

(b) Increasing K-12 Student Learning to Develop Environmental Awareness, Appreciation, and Interest

\$1,602,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Osprey Wilds Environmental Learning Center to partner with Minnesota's five other accredited residential environmental learning centers to provide needs-based scholarships to at least 25,000 K-12 students statewide for immersive multiday environmental learning experiences.

(c) Expanding Access to Wildlife Learning Bird by Bird

\$276,000 the second year is from the trust fund to the commissioner of natural resources to engage young people from diverse communities in wildlife conservation through bird-watching in schools, outdoor leadership training, and participating in neighborhood bird walks.

(d) Engaging a Diverse Public in Environmental Stewardship

\$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Great River Greening to increase participation in natural resources restoration efforts through volunteer, internship, and youth engagement activities that target diverse audiences more accurately reflecting local demographic and socioeconomic conditions in Minnesota.

(e) Bugs Below Zero: Engaging Citizens in Winter Research

\$198,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to raise awareness about the winter life of bugs, inspire learning about stream food webs, and engage citizen scientists in research and environmental stewardship.

(f) ESTEP: Earth Science Teacher Education Project

\$495,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Minnesota Science Teachers Association to provide professional development for Minnesota science teachers in environmental and earth science to strengthen environmental education in schools.

(g) YES! Students Take Action to Complete Eco Projects

\$199,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Prairie Woods Environmental Learning Center, in partnership with Ney Nature Center and Laurentian Environmental Center, to empower Minnesota youth to connect with natural resource experts, identify ecological challenges, and take action to complete innovative projects in their communities.

(h) Increasing Diversity in Environmental Careers

\$500,000 the second year is from the trust fund to the commissioner of natural resources, in cooperation with Conservation Corps Minnesota and Iowa, to encourage a diversity of students to pursue careers in the environment and natural resources through internships, mentorships, and fellowships with the Department of Natural Resources, the Board of Water and Soil Resources, and the Pollution Control Agency.

(i) Diversity and Access to Wildlife-Related Opportunities

\$199,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to broaden the state's conservation constituency by researching diverse communities' values about nature and wildlife experiences and identifying barriers to engagement.

Subd. 6. Aquatic and Terrestrial Invasive Species-0-6,404,000**(a) Minnesota Invasive Terrestrial Plants and Pests Center**

\$6,230,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to support the Minnesota Invasive Terrestrial Plants and Pests Center to fund high-priority research projects to better manage invasive plants, pathogens, and pests on Minnesota's natural and agricultural lands. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2027, by which time the project must be completed and final products delivered.

(b) Purple Loosestrife Biocontrol Citizen Science Program

\$174,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Wild Rivers Conservancy to protect and restore native ecosystems by identifying purple loosestrife in priority management areas and engaging, educating, and empowering citizens to use an approved purple loosestrife biocontrol in Minnesota's St. Croix River watershed.

Subd. 7. Air Quality and Renewable Energy -0- 843,000

(a) Green Solar Cells from a Minnesota Natural Resource

\$673,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop an efficient, low cost, and nontoxic pyrite solar cell and conduct a feasibility study for using Iron Range resources to manufacture this product. This appropriation is subject to Minnesota Statutes, section 116P.10.

(b) Morris GHG Emissions Inventory and Mitigation Strategies

\$170,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Morris to conserve natural resources by conducting a greenhouse gas (GHG) emissions inventory of city and county operations as part of the Morris Model partnership, implementing policy to achieve targeted reductions, and disseminating findings. This appropriation is available until June 30, 2026, by which time the project must be completed and final products delivered.

Subd. 8. Methods to Protect, Restore, and Enhance Land, Water, and Habitat -0- 11,294,000

(a) Minnesota's Volunteer Rare Plant Conservation Corps

\$859,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Minnesota Landscape Arboretum to partner with the Department of Natural Resources and the Minnesota Native Plant Society to establish and train a volunteer corps to survey, monitor, and bank seed from Minnesota's rare plant populations and enhance the effectiveness and efficiencies of conservation efforts.

(b) Conservation Corps Veterans Service Corps Program

\$1,339,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Conservation Corps Minnesota to create a

Veterans Service Corps program to accelerate natural resource restorations in Minnesota while providing workforce development opportunities for the state's veterans.

(c) Creating Seed Sources of Early-Blooming Plants for Pollinators

\$200,000 the second year is from the trust fund to the commissioner of natural resources to establish new populations of early-season flowers by hand-harvesting and propagating species that are currently lacking in prairie restorations and that are essential to pollinator health. This appropriation is available until June 30, 2026, by which time the project must be completed and final products delivered.

(d) Hastings Lake Rebecca Park Area

\$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Hastings to develop an ecological-based master plan for Lake Rebecca Park and to enhance habitat quality and construct passive recreational facilities consistent with the master plan. No funds for implementation may be spent until the master plan is complete.

(e) Pollinator Plantings and the Redistribution of Soil Toxins

\$610,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to map urban and suburban soil toxins of concern, such as heavy metals and microplastics, and to test whether pollinator plantings can redistribute these toxins in the soil of yards, parks, and community gardens and reduce exposure to humans and wildlife.

(f) PFAS Fungal-Wood Chip Filtering System

\$189,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to identify, develop, and field-test various types of waste wood chips and fungi to sequester and degrade PFAS leachate from contaminated waste sites. This appropriation is subject to Minnesota Statutes, section 116P.10.

(g) Phytoremediation for Extracting Deicing Salt

\$451,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to protect lands and waters from contamination by collaborating with the Department of Transportation to develop methods for using native plants to remediate roadside deicing salt.

(h) Mustinka River Fish and Wildlife Habitat Corridor Rehabilitation

\$2,692,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Bois de Sioux Watershed District to permanently rehabilitate a straightened reach of the Mustinka River to a naturally functioning stream channel and floodplain corridor for water, fish, and wildlife benefits.

(i) Bohemian Flats Savanna Restoration

\$286,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Minneapolis Park and Recreation Board to restore an area of compacted urban turf within Bohemian Flats Park and adjacent to the Mississippi River to an oak savanna ecosystem.

(j) Watershed and Forest Restoration: What a Match!

\$3,318,000 the second year is from the trust fund to the Board of Water and Soil Resources, in cooperation with soil and water conservation districts, the Mille Lacs Band of Ojibwe, and the Department of Natural Resources, to accelerate tree planting on privately owned, protected lands for water-quality protection and carbon sequestration.

(k) River Habitat Restoration and Recreation in Melrose

\$350,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Melrose to conduct habitat restoration and create fishing, canoeing, and camping opportunities along a segment of the Sauk River within the city of Melrose and to provide public education

about stream restoration, fish habitat, and the importance of natural areas.

Subd. 9. Habitat and Recreation

-0-

26,179,000

(a) Mesabi Trail: Wahlsten Road (CR 26) to Tower

\$1,307,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority to acquire easements, engineer, and construct a segment of the Mesabi Trail beginning at the intersection of Wahlsten Road (CR 26) and Benson Road in Embarrass and extending to Tower.

(b) Environmental Learning Classroom with Trails

\$82,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Mountain Iron-Buhl Public Schools to build an outdoor classroom pavilion, accessible trails, and a footbridge within the Mountain Iron-Buhl School Forest to conduct environmental education that cultivates a lasting conservation ethic.

(c) Local Parks, Trails, and Natural Areas Grant Programs

\$3,560,000 the second year is from the trust fund to the commissioner of natural resources to solicit, rank, and fund competitive matching grants for local parks, trail connections, and natural and scenic areas under Minnesota Statutes, section 85.019. This appropriation is for local nature-based recreation, connections to regional and state natural areas, and recreation facilities and may not be used for athletic facilities such as sport fields, courts, and playgrounds.

(d) St. Louis River Re-Connect

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Duluth to expand recreational access along the St. Louis River and estuary by implementing the St. Louis River National Water Trail outreach plan, designing and constructing upgrades and extensions to the Waabizheshikana Trail, and installing

interpretive features that describe the cultural and ecological significance of the area.

(e) Native Prairie Stewardship and Prairie Bank Easement Acquisition

\$1,353,000 the second year is from the trust fund to the commissioner of natural resources to provide technical stewardship assistance to private landowners, restore and enhance native prairie protected by easements in the native prairie bank, and acquire easements for the native prairie bank in accordance with Minnesota Statutes, section 84.96, including preparing initial baseline property assessments. Up to \$60,000 of this appropriation may be deposited in the natural resources conservation easement stewardship account created under Minnesota Statutes, section 84.69, proportional to the number of easements acquired.

(f) Minnesota State Parks and State Trails Maintenance and Development

\$1,600,000 the second year is from the trust fund to the commissioner of natural resources for maintenance and development at state parks, recreation areas, and trails to protect Minnesota's natural heritage, enhance outdoor recreation, and improve the efficiency of public land management.

(g) Minnesota State Trails Development

\$7,387,000 the second year is from the trust fund to the commissioner of natural resources to expand recreational opportunities on Minnesota state trails by rehabilitating and enhancing existing state trails and replacing or repairing existing state trail bridges.

(h) SNA Habitat Restoration and Public Engagement

\$5,000,000 the second year is from the trust fund to the commissioner of natural resources for the scientific and natural areas (SNA) program to restore and enhance exceptional habitat on SNAs and increase public involvement and outreach.

(i) The Missing Link: Gull Lake Trail, Fairview Township

\$1,394,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Fairview Township to complete the Gull Lake Trail by engineering and constructing the trail's final segment through Fairview Township in the Brainerd Lakes area.

(j) Silver Bay Multimodal Trailhead Project

\$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Silver Bay to develop a multimodal trailhead center to provide safe access to the Superior, Gitchi-Gami, and C.J. Ramstad/North Shore trails; Black Beach Park; and other recreational destinations.

(k) Brookston Campground, Boat Launch, and Outdoor Recreational Facility

\$453,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Brookston to build a campground, boat launch, and outdoor recreation area on the banks of the St. Louis River in northeastern Minnesota. Before any trust fund dollars are spent, the city must demonstrate that all funds to complete the project are secured and a fiscal agent must be approved in the work plan.

(l) Silver Lake Trail Connection

\$727,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Virginia to design, engineer, and construct a multiuse trail that will connect Silver Lake Trail to a new Miners Entertainment and Convention Center and provide lighting on Bailey Lake Trail.

(m) Floodwood Campground Improvement Project

\$816,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Floodwood to upgrade the Floodwood Campground and connecting trails to provide high-quality nature and recreation experience for people of all ages.

(n) Ranier Safe Harbor/Transient Dock - Phase 2

\$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Ranier to construct a safe harbor and transient dock to accommodate watercraft of many sizes to improve public access for boat recreation on Rainy Lake. Before trust fund dollars are spent, a fiscal agent must be approved in the work plan. Before any trust fund dollars are spent, the city must demonstrate that all funds to complete the project are secured. Any revenue generated from selling products or assets developed or acquired with this appropriation must be repaid to the trust fund unless a plan is approved for reinvestment of income in the project as provided under Minnesota Statutes, section 116P.10.

<u>Subd. 10. Other Projects</u>	<u>-0-</u>	<u>6,973,000</u>
---------------------------------	------------	------------------

(a) Aggregate Resource Mapping

\$500,000 the second year is from the trust fund to the commissioner of natural resources for continued mapping of the aggregate resource potential in the state of Minnesota and to make the information available in print and electronic format to local units of government for use in planning and zoning.

(b) Leaded Gasoline Contamination Analysis

\$200,000 the second year is from the trust fund to the commissioner of administration for a grant to the city of Paynesville to procure an analysis of the extent of leaded gasoline contamination in or near the cities of Paynesville, Foley, Alexandria, and Blaine, and of the threat posed by the contamination to each city's drinking water supply. The vendor selected to perform the analysis must use the same methodology to conduct the analysis for each city and must produce findings that are comparable between cities. The cities must work cooperatively to select a vendor. By January 15, 2024, the city administrator of the city of Paynesville must report the results of the analysis to the chairs and ranking minority members of the house of representatives and senate committees and divisions with jurisdiction over environment and natural resources.

(c) Living Snow Fence Program

\$200,000 the second year is from the trust fund to the commissioner of transportation for contracts to build and improve living snow fences consisting of trees, shrubs, native grasses, and wildflowers. Money appropriated in this paragraph may only be used to acquire and plant trees native to Minnesota. This appropriation is available until June 30, 2026.

(d) Forest Data Inventory

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an enhanced forest inventory on county and private lands.

(e) Conservation Reserve Program State Incentives

\$750,000 the second year is from the trust fund to the Board of Water and Soil Resources to provide onetime state incentive payments to enrollees in the federal Conservation Reserve Program (CRP) during the continuous enrollment period and to enroll land in conservation easements consistent with Minnesota Statutes, section 103F.515. The board may establish payment rates based on land valuation and on environmental benefit criteria, including but not limited to surface water or groundwater pollution reduction, drinking water protection, soil health, pollinator and wildlife habitat, and other conservation enhancements. The board may use state funds to implement the program and to provide technical assistance to landowners or their agents to fulfill enrollment and contract provisions. The board must consult with the commissioners of agriculture, health, natural resources, and the Pollution Control Agency and the United States Department of Agriculture in establishing program criteria. This appropriation is available until June 30, 2026.

(f) Groundwater Storage and Recovery Database

\$400,000 the second year is from the trust fund to the commissioner of natural resources to complete a centralized aquifer property database to provide needed data for site characterization.

(g) Rural and Farmstead Ring Levees

\$360,000 the second year is from the trust fund to the commissioner of natural resources for grants to assist in constructing rural and farmstead ring levees for flood protection in the Red River watershed. A grant may not exceed 50 percent of the cost of the project.

(h) Replacing Failing Septic Systems to Protect Groundwater

\$2,000,000 the second year is from the trust fund to the commissioner of the Pollution Control Agency to counties for grants to low-income landowners to address septic systems that pose an imminent threat to public health or safety or fail to protect groundwater. The issuance of a loan under Minnesota Statutes, section 17.117, for the purpose of replacing a failed septic system, shall not preclude a rural landowner from obtaining a grant under this paragraph or vice versa. This appropriation is available until June 30, 2025.

(i) Forever Green

\$763,000 the second year is from the trust fund to the commissioner of agriculture for grants to the Board of Regents of the University of Minnesota to fund the Forever Green Agriculture Initiative and protect the state's natural resources while increasing the efficiency, profitability, and productivity of Minnesota farmers by incorporating perennial and winter-annual crops into existing agricultural practices.

(j) Pig's Eye Landfill Task Force

\$800,000 the second year is from the trust fund to the commissioner of the Pollution Control Agency to establish a Pig's Eye Landfill Task Force to coordinate efforts to remediate and restore the Pig's Eye Landfill Superfund site and address perfluoroalkyl and polyfluoroalkyl substances (PFAS) contamination of Battle Creek, Pig's Eye Lake, and nearby groundwater. The task force must be made up of at least the commissioner of the Pollution Control Agency, the commissioner of natural resources, the commissioner of health, a representative from the Metropolitan Council, a representative from the city of St. Paul, a representative from the city of South St. Paul, a representative from the city of Newport, a

representative from Ramsey County, a representative from Dakota County, a representative from Washington County, and representatives from relevant federal agencies. The task force is subject to Minnesota Statutes, section 15.059, subdivision 6. The task force must submit an annual report to the chairs and ranking minority members of the legislative committees and divisions with jurisdiction over the environment and natural resources on the status of the task force's work. The final report is due February 15, 2026. The task force expires June 30, 2026. This appropriation is available until June 30, 2026.

(k) Developing Markets for Continuous Living Cover Crops

\$500,000 the second year is from the trust fund to the commissioner of agriculture for grants to organizations in Minnesota to develop enterprises, supply chains, and markets for continuous living cover crops and cropping systems in the early stage of commercial development, including but not limited to regenerative poultry silvopasture systems, Kernza perennial grain, winter camelina, and elderberry.

Subd. 11. Administrative

-0-

132,000

\$132,000 the second year is from the trust fund to the commissioner of natural resources, at the direction of the Legislative-Citizen Commission on Minnesota Resources, for expenses incurred in preparing and administering contracts, including for the agreements specified in this section.

Subd. 12. Availability of Appropriations

Money appropriated in this section may not be spent on activities unless they are directly related to and necessary for a specific appropriation and are specified in the work plan approved by the Legislative-Citizen Commission on Minnesota Resources. Money appropriated in this section must not be spent on indirect costs or other institutional overhead charges that are not directly related to and necessary for a specific appropriation. Costs that are directly related to and necessary for an appropriation, including financial services, human resources, information services, rent, and utilities, are eligible only if the costs

can be clearly justified and individually documented specific to the appropriation's purpose and would not be generated by the recipient but for receipt of the appropriation. No broad allocations for costs in either dollars or percentages are allowed. Unless otherwise provided, the amounts in this section are available for three years beginning July 1, 2022, and ending June 30, 2025, when projects must be completed and final products delivered. For acquisition of real property, the appropriations in this section are available for an additional fiscal year if a binding contract for acquisition of the real property is entered into before the expiration date of the appropriation. If a project receives a federal award, the period of the appropriation is extended to equal the federal award period to a maximum trust fund appropriation length of six years.

Subd. 13. Data Availability Requirements Data

Data collected by the projects funded under this section must conform to guidelines and standards adopted by Minnesota IT Services. Spatial data must also conform to additional guidelines and standards designed to support data coordination and distribution that have been published by the Minnesota Geospatial Information Office. Descriptions of spatial data must be prepared as specified in the state's geographic metadata guideline and must be submitted to the Minnesota Geospatial Information Office. All data must be accessible and free to the public unless made private under the Data Practices Act, Minnesota Statutes, chapter 13. To the extent practicable, summary data and results of projects funded under this section should be readily accessible on the Internet and identified as having received funding from the environment and natural resources trust fund.

Subd. 14. Project Requirements

(a) As a condition of accepting an appropriation under this section, an agency or entity receiving an appropriation or a party to an agreement from an appropriation must comply with paragraphs (b) to (l) and Minnesota Statutes, chapter 116P, and must submit a work plan and annual or semiannual progress reports in the form determined by the Legislative-Citizen Commission on Minnesota Resources for any project

funded in whole or in part with funds from the appropriation. Modifications to the approved work plan and budget expenditures must be made through the amendment process established by the Legislative-Citizen Commission on Minnesota Resources.

(b) A recipient of money appropriated in this section that conducts a restoration using funds appropriated in this section must use native plant species according to the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines and include an appropriate diversity of native species selected to provide habitat for pollinators throughout the growing season as required under Minnesota Statutes, section 84.973.

(c) For all restorations conducted with money appropriated under this section, a recipient must prepare an ecological restoration and management plan that, to the degree practicable, is consistent with the highest-quality conservation and ecological goals for the restoration site. Consideration should be given to soil, geology, topography, and other relevant factors that would provide the best chance for long-term success and durability of the restoration project. The plan must include the proposed timetable for implementing the restoration, including site preparation, establishment of diverse plant species, maintenance, and additional enhancement to establish the restoration; identify long-term maintenance and management needs of the restoration and how the maintenance, management, and enhancement will be financed; and take advantage of the best-available science and include innovative techniques to achieve the best restoration.

(d) An entity receiving an appropriation in this section for restoration activities must provide an initial restoration evaluation at the completion of the appropriation and an evaluation three years after the completion of the expenditure. Restorations must be evaluated relative to the stated goals and standards in the restoration plan, current science, and, when applicable, the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. The evaluation must determine whether the restorations are meeting planned goals, identify any problems with implementing the restorations, and,

if necessary, give recommendations on improving restorations. The evaluation must be focused on improving future restorations.

(e) All restoration and enhancement projects funded with money appropriated in this section must be on land permanently protected by a conservation easement or public ownership.

(f) A recipient of money from an appropriation under this section must give consideration to contracting with Conservation Corps Minnesota for contract restoration and enhancement services.

(g) All conservation easements acquired with money appropriated under this section must:

(1) be permanent;

(2) specify the parties to an easement in the easement;

(3) specify all provisions of an agreement that are permanent;

(4) be sent to the Legislative-Citizen Commission on Minnesota Resources in an electronic format at least ten business days before closing;

(5) include a long-term monitoring and enforcement plan and funding for monitoring and enforcing the easement agreement; and

(6) include requirements in the easement document to protect the quantity and quality of groundwater and surface water through specific activities such as keeping water on the landscape, reducing nutrient and contaminant loading, and not permitting artificial hydrological modifications.

(h) For any acquisition of lands or interest in lands, a recipient of money appropriated under this section must not agree to pay more than 100 percent of the appraised value for a parcel of land using this money to complete the purchase, in part or in whole, except that up to ten percent above the appraised value may be allowed to complete the purchase, in part or in whole, using this money if permission is received in advance of the purchase from the Legislative-Citizen Commission on Minnesota Resources.

(i) For any acquisition of land or interest in land, a recipient of money appropriated under this section

must give priority to high-quality natural resources or conservation lands that provide natural buffers to water resources.

(j) For new lands acquired with money appropriated under this section, a recipient must prepare an ecological restoration and management plan in compliance with paragraph (c), including sufficient funding for implementation unless the work plan addresses why a portion of the money is not necessary to achieve a high-quality restoration.

(k) To ensure public accountability for using public funds, a recipient of money appropriated under this section must, within 60 days of the transaction, provide to the Legislative-Citizen Commission on Minnesota Resources documentation of the selection process used to identify parcels acquired and provide documentation of all related transaction costs, including but not limited to appraisals, legal fees, recording fees, commissions, other similar costs, and donations. This information must be provided for all parties involved in the transaction. The recipient must also report to the Legislative-Citizen Commission on Minnesota Resources any difference between the acquisition amount paid to the seller and the state-certified or state-reviewed appraisal, if a state-certified or state-reviewed appraisal was conducted.

(l) A recipient of an appropriation from the trust fund under this section must acknowledge financial support from the environment and natural resources trust fund in project publications, signage, and other public communications and outreach related to work completed using the appropriation. Acknowledgment may occur, as appropriate, through use of the trust fund logo or inclusion of language attributing support from the trust fund. Each direct recipient of money appropriated in this section, as well as each recipient of a grant awarded pursuant to this section, must satisfy all reporting and other requirements incumbent upon constitutionally dedicated funding recipients as provided in Minnesota Statutes, section 3.303, subdivision 10, and chapter 116P.

(m) A recipient of an appropriation from the trust fund under this section that is receiving funding to conduct children's services, as defined in Minnesota Statutes, section 299C.61, subdivision 7, must certify to the

Legislative-Citizen Commission on Minnesota Resources, as part of the required work plan, that criminal background checks for background check crimes, as defined in Minnesota Statutes, section 299C.61, subdivision 2, are performed on all employees, contractors, and volunteers that have or may have access to a child to whom the recipient provides children's services using the appropriation.

Subd. 15. Payment Conditions and Capital Equipment Expenditures

(a) All agreements, grants, or contracts referred to in this section must be administered on a reimbursement basis unless otherwise provided in this section. Notwithstanding Minnesota Statutes, section 16A.41, expenditures made on or after July 1, 2022, or the date the work plan is approved, whichever is later, are eligible for reimbursement unless otherwise provided in this section. Periodic payments must be made upon receiving documentation that the deliverable items articulated in the approved work plan have been achieved, including partial achievements as evidenced by approved progress reports. Reasonable amounts may be advanced to projects to accommodate cash-flow needs or match federal money. The advances must be approved as part of the work plan. No expenditures for capital equipment are allowed unless expressly authorized in the project work plan.

(b) Single-source contracts as specified in the approved work plan are allowed.

Subd. 16. Purchasing Recycled and Recyclable Materials

A political subdivision, public or private corporation, or other entity that receives an appropriation under this section must use the appropriation in compliance with Minnesota Statutes, section 16C.0725, regarding purchasing recycled, repairable, and durable materials, and Minnesota Statutes, section 16C.073, regarding purchasing and using paper stock and printing.

Subd. 17. Energy Conservation and Sustainable Building Guidelines

A recipient to whom an appropriation is made under this section for a capital improvement project must ensure that the project complies with the applicable

energy conservation and sustainable building guidelines and standards contained in law, including Minnesota Statutes, sections 16B.325, 216C.19, and 216C.20, and rules adopted under those sections. The recipient may use the energy planning, advocacy, and State Energy Office units of the Department of Commerce to obtain information and technical assistance on energy conservation and alternative-energy development relating to planning and constructing the capital improvement project.

Subd. 18. Accessibility

Structural and nonstructural facilities must meet the design standards in the Americans with Disabilities Act (ADA) accessibility guidelines.

Subd. 19. Carryforward; Extensions

(a) The availability of the appropriations for the following projects is extended to June 30, 2024:

(1) Laws 2019, First Special Session chapter 4, article 2, section 2, subdivision 8, paragraph (a), Saving Endangered Pollinators through Data-Driven Prairie Restoration; and

(2) Laws 2019, First Special Session chapter 4, article 2, section 2, subdivision 9, paragraph (e), National Loon Center.

(b) The availability of the transfers for the following projects is extended to June 30, 2024:

(1) Laws 2021, First Special Session chapter 6, article 5, section 2, subdivision 20, paragraph (a), clause (1), for the Unprecedented Change Threatens Minnesota's Pristine Lakes project;

(2) Laws 2021, First Special Session chapter 6, article 5, section 2, subdivision 20, paragraph (a), clause (2), for the Wastewater Pond Optimization project;

(3) Laws 2021, First Special Session chapter 6, article 5, section 2, subdivision 20, paragraph (a), clause (3), for the Applied Research in State Mineral and Water Resources project;

(4) Laws 2021, First Special Session chapter 6, article 5, section 2, subdivision 20, paragraph (a), clause (4), for the Chloride Pollution Reduction project;

(5) Laws 2021, First Special Session chapter 6, article 5, section 2, subdivision 20, paragraph (a), clause (5), for the CWD Prion Research in Soils project;

(6) Laws 2021, First Special Session chapter 6, article 5, section 2, subdivision 20, paragraph (b), clauses (1) and (2), Lawns to Legumes;

(7) Laws 2021, First Special Session chapter 6, article 5, section 2, subdivision 20, paragraph (c), clauses (1) to (8), Emerging Issues Account; and

(8) Laws 2021, First Special Session chapter 6, article 6, section 2, subdivision 19, paragraph (a), clauses (1) to (4), for the Forest Health Research, Development and Demonstration project at the Natural Resources Research Institute.

(c) Notwithstanding Minnesota Statutes, section 16A.28, or any other law to the contrary, the availability of any appropriation or grant of money from the environment and natural resources trust fund that would otherwise cancel, lapse, or expire on June 30, 2022, is extended to June 30, 2023, if the recipient or grantee:

(1) by June 15, 2022, notifies the Legislative-Citizen Commission on Minnesota Resources in the manner specified by the commission that the recipient or grantee intends to avail itself of the extension available under this subdivision; and

(2) modifies the applicable work plan where required by Minnesota Statutes, section 116P.05, subdivision 2, in accordance with the work plan amendment procedures adopted under that section.

(d) The commission must notify the commissioner of management and budget and the commissioner of natural resources of any extension granted under paragraph (c).

Subd. 20. Transfers

(a) The following amounts, estimated to be \$2,183,000, are transferred to the commissioner of natural resources for maintenance and development at state parks, recreation areas, and trails to protect Minnesota's natural heritage, enhance outdoor recreation, and improve the efficiency of public land management:

(1) the unencumbered amount, estimated to be \$925,000, in Laws 2017, chapter 96, section 2, subdivision 7, paragraph (d), District Heating with Renewable Biomass at Camp Ripley Training Center;

(2) the unencumbered amount, estimated to be \$910,000, in Laws 2017, chapter 96, section 2, subdivision 9, paragraph (e), as amended by Laws 2019, First Special Session chapter 4, article 2, section 4, Native Prairie Stewardship and Prairie Bank Easement Acquisition; and

(3) \$348,000 of the unencumbered amount, estimated to be \$550,000, in Laws 2018, chapter 214, section 2, subdivision 9, paragraph (d), Mississippi Blufflands State Trail - Red Wing Barn Bluff to Colvill Park Segment.

(b) The remainder of the unencumbered amount in Laws 2018, chapter 214, section 2, subdivision 9, paragraph (d), not transferred under paragraph (a), clause (3), estimated to be \$202,000, is transferred to an emerging issues account authorized in Minnesota Statutes, section 116P.08, subdivision 4, paragraph (d).

(c) \$78,000 is transferred from the amount appropriated under Laws 2021, First Special Session chapter 6, article 5, section 2, subdivision 4, paragraph (b), to the appropriation in subdivision 11. The commissioner must provide documentation to the Legislative-Citizen Commission on Minnesota Resources on the expenditure of these funds.

(d) The amounts transferred under this subdivision are available until June 30, 2025.

EFFECTIVE DATE. Subdivision 19 is effective the day following final enactment. Subdivision 20 is effective June 29, 2022.

Sec. 3. Minnesota Statutes 2020, section 116P.08, subdivision 2, is amended to read:

Subd. 2. **Exceptions.** Money from the trust fund may not be spent for:

(1) purposes of environmental compensation and liability under chapter 115B and response actions under chapter 115C;

(2) purposes of municipal water pollution control in municipalities with a population of 5,000 or more under the authority of chapters 115 and 116;

(3) costs associated with the decommissioning of nuclear power plants;

- (4) hazardous waste disposal facilities;
- (5) solid waste disposal facilities; ~~or~~
- (6) projects or purposes inconsistent with the strategic plan; or
- (7) acquiring property by eminent domain, unless the owner requests that the owner's property be acquired by eminent domain.

Sec. 4. **INFORMATION SUBMITTED WITH CAPITAL PROJECT PROPOSALS.**

The Legislative Citizen Commission on Minnesota Resources must consider whether statutorily requiring additional information to accompany proposals for capital projects would help the commission better evaluate those proposals. By October 15, 2022, the commission must submit its report and recommendations, along with any proposed statutory changes, to the chairs and ranking minority members of the house of representatives and senate committees and divisions with jurisdiction over environment and natural resources.

Presented to the governor May 24, 2022

Signed by the governor June 3, 2022, 1:05 p.m.

III. Completed Research Projects

“a summary of any research project completed in the preceding biennium;”

The following documents include:

- Summaries of accomplishments for each appropriation year and short abstracts for all projects completed since the previous biennial report of January 15, 2021. Research projects have been marked as such in the description.
- Spreadsheet of all research projects completed between January 1, 2021 and December 31, 2022.

Additional information:

- The abstracts describe the general accomplishments of each completed project and are current as of 12/31/2022. See <http://www.lccmr.mn.gov> for additional project information, including Final Reports.
- 166 projects were completed with a total of \$92,521,240.
- Legal citations for completed projects:
 1. M.L. 2019, First Special Session, Chapter 4, Article, 2, Section 2
 2. M.L. 2018, Chapter 214, Article 4, Section 2
 3. M.L. 2017, Chapter 96, Section 2
 4. M.L. 2016, Chapter 186, Section 2
 5. M.L. 2015, Chapter 76, Section 2
 6. M.L. 2014, Chapter 226, Section 2

**1. M.L. 2019 Projects Completed
January 15, 2021 – January 15, 2023**

**MN Laws 2019, First Special Session, Chapter 4,
Article 2, Section 2**

M.L. 2019 Projects

[MN Laws 2019, First Special Session, Chapter 4](#), Article 4 Section 2 (beginning July 1, 2015)

Visit [the LCCMR website](#) for the most up-to-date project information and reports

Subd. 03 Foundational Natural Resource Data and Information

Subd. 03b Restoring Native Mussels in Streams and Lakes - \$500,000 TF (FY2020)

Mike Davis

MN DNR

2109 North Lakeshore Drive

Lake City, MN 55041

Phone: (651) 314-6302

Email: mike.davis@state.mn.us

Appropriation Language

\$500,000 the first year is from the trust fund to the commissioner of natural resources to restore native freshwater mussel assemblages, and the ecosystem services they provide, in the Mississippi, Cedar, and Cannon Rivers and to inform the public on mussels and mussel conservation. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Reestablishing historical mussel assemblages through laboratory propagation began in 2016 at the MNDNR Center for Aquatic Mollusk Programs (CAMP). Since then, CAMP has released 9,541 sub-adult mussels from five species in three watersheds; restoring ecosystem services and enhancing Minnesota rivers with each mussel.

OVERALL PROJECT OUTCOME AND RESULTS

Minnesota's native mussels are critically important to aquatic ecosystems but have been lost or diminished in many water bodies. Harvest for pearls and buttons, pollution, dams, and destabilized waterways have caused mussel populations to decline dramatically, 80% of Minnesota's species are affected. Improvements from Clean Water Act implementation, stream restoration work, and protective laws are creating opportunities to reverse this trend. However, dams that limit fish movement are still hindering mussel recolonization, because mussels rely on fish as hosts to complete their life cycle. Thus, conservation methods such as laboratory propagation and reintroduction are needed to help mussel populations recover, and ultimately, restore ecosystem benefits. CAMP has implemented this work for three watersheds in Minnesota, which were chosen based on historical records, habitat, and fish communities. We constructed several propagation systems specifically designed for juvenile recovery and culture over time, improving our success along the way. Since 2016, CAMP has produced more than 1.5 million juvenile mussels. Due to the challenges of culture, survivorship varies between species and years. Juvenile survival after 90-days ranged from 0 – 84%. Newly metamorphosed juveniles were placed into various culture containers including a recirculating system, static system, or a flow-through system. Survival rates vary between systems, and within systems. Factors such as dissolved oxygen, ammonia, pH, and conductivity are monitored throughout growing period. Overall, survival is highest in the flow-through system, however, the system requires the most person-hours per juvenile. From July

2019 until June 2021, CAMP has released 7,038 sub-adult mussels from five species in three watersheds. Since our first ENRTF grant CAMP has released more than 9,500 sub-adult mussels. Mussels will enhance water clarity and improve habitat in the Cannon, Cedar, and Mississippi Rivers for years to come.

PROJECT RESULTS USE AND DISSEMINATION

CAMP's efforts to restore native freshwater mussels were featured in several news articles, including an Episode 1 of Season 3 on [MN DNR Prairie Podcast](#). The [Star Tribune](#) and [Cedar Watershed District](#) discussed our efforts to reclaim stretches of the river with mussel populations. Moreover, CAMPs [newsletters](#) reach more than 5,000 users. Lastly, with the upcoming launch of Clam Counter App for IOS and Android platforms, a digital field guide and general information regarding mussels will be available to all smartphone users.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 03c Quantifying Exposure of Minnesota's Raptors to Mercury and PFAS - Research Project - \$250,000 TF (FY2020)

Matthew Etterson

Hawk Ridge Bird Observatory

6770 Haugen Lane

Duluth, MN 55803

Phone: (218) 590-7029

Email: metterso@d.umn.edu

Web: <https://www.hawkridge.org/>

Appropriation Language

\$250,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Hawk Ridge Bird Observatory to quantify the exposure and health risk of two environmental neurotoxins to Minnesota raptors.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

These results are a first look at polyfluoroalkyl substances (PFAS) in Minnesota's Birds of Prey. Among vertebrates, birds appear to be most vulnerable to PFAS effects, which can result in reproductive failure. Birds of prey are vulnerable to PFAS because of their position atop both aquatic and terrestrial food webs.

OVERALL PROJECT OUTCOME AND RESULTS

Polyfluoroalkyl substances (PFAS) are a class of chemicals used in industrial processes and fire suppression. Mercury (Hg) enters the environment from point-source releases due to industrial processes and through combustion of coal for power generation. Both Hg and PFAS are present locally at highly contaminated sites and ubiquitously due to atmospheric deposition. Due to their predatory nature, birds of prey are at unique and elevated risk of exposure to both PFAS and Hg that concentrate in animal tissues; with each link in their food chain, predators consume and concentrate these toxicants contained in their prey. We collected blood and feather samples from 355 birds of prey at two

Minnesota locations, Hawk Ridge in Duluth, and The Raptor Center in St. Paul. We analyzed blood plasma for up to 40 PFAS chemicals and feathers for total mercury concentration. Our objectives were to (1) collect baseline data on exposure of MN raptors to Hg and PFAS and (2) to test specific hypotheses about patterns of exposure in relation to ecological variables such as diet, age, sex, and species identity. As expected, perfluorooctane sulfonate (PFOS) was the PFAS of highest concentration across all species and in each individual species, typically at concentrations ten or more times that of other PFAS. Bald Eagle (*Haliaeetus leucocephalus*) had the highest exposure, probably reflecting the greater representation of aquatic prey (fish) in its diet. However, Cooper's Hawks (*Accipiter cooperii*) had comparable exposures and they consume entirely terrestrial prey. Among ecological variables, species identity offered the greatest explanatory power, followed by a measure of species' tolerance of human activity, which may serve as a proxy for likelihood of exposure. These results will prove invaluable for understanding and managing both human and ecological exposures to PFAS and Hg in Minnesota.

PROJECT RESULTS USE AND DISSEMINATION

Dr. Etterson has presented results at internal meetings of the US Environmental Protection Agency's PFAS Working Group at the Great Lakes Toxicology and Ecology Division, Duluth, MN. Final PFAS results were received from the contract laboratory on 29 June 2022, just prior to the close of the project period and we expect dissemination activity to increase considerably over the next year. Dr. Ponder will present some results from this work at the upcoming International Ornithological Congress in Durban, South Africa, August 2022. We expect at least two manuscripts will be submitted to peer-reviewed journals for publication in the coming year.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03g Mapping Habitat Use and Disease of Urban Carnivores - Research Project - \$500,000 TF (FY2020)

Nicholas McCann

U of MN

B52 Skok Hall, 2003 Upper Buford Circle
St. Paul, MN 55108

Phone: (763) 286-2215

Email: mccan062@umn.edu

Appropriation Language

\$500,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to map habitat use and diseases of urban foxes and coyotes, evaluate risks these animals may pose to people and pets, and generate information needed to reduce human-wildlife conflicts.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This study provides information to residents and managers about coyotes and foxes. Our results reveal key insights, including about habitat requirements, the expansion of coyotes, and relationships between disease prevalence and free-roaming cats. They suggest outreach efforts to reduce free-roaming pets and management to increase natural vegetation in residential greenspaces.

OVERALL PROJECT OUTCOME AND RESULTS

Coyotes and foxes have not been studied in the Twin Cities Metro Area.

1. We captured, collared, and collected biological samples from 17 coyotes, 16 red foxes, and two gray foxes across the TCMA to assess space-use, survival, diet, and disease.
2. We found that coyote survival was greater than for red foxes, suggesting higher population growth. Canid attacks caused most fox mortalities, likely reflecting coyote population expansion and the presence of free-roaming dogs. Coyote and fox diets consisted of natural foods, with few individuals exhibiting diets associated with people. Toxoplasmosis gondii, a cat feces-transmitted a pathogen found in both coyotes and foxes, was especially frequent in red foxes, potentially due to fox selection of residential areas with more free-roaming cats. Higher heavy metal content in the hair of coyotes was likely a result of using industrial areas. Home range sizes suggest coyotes found resources more easily than red foxes. Den sites reflected the more general differences space-use; coyotes denned in non-residential areas while fox dens were in residential. We estimated 0.27 coyotes/km² and 0.21 red foxes/km²; lower than in other cities.
3. Overall, our results suggest coyotes expanded into areas once occupied by red foxes, but both species rarely became nuisances. Outreach promoting leashing pets and keeping cats inside is likely to improve the health of pets, coyotes, and foxes. Communicating the smaller-than-expected weight (males=14.3 kg [31.5 lbs.]; females=11.9 kg [26.2 lbs.]) and low risk of attack should reduce negative perceptions of coyotes. Improving natural habitat in residential greenspaces is likely to benefit red foxes.
4. This study's results provide much-needed information to residents and wildlife managers about two charismatic species that are relatively unstudied in Minnesota.

PROJECT RESULTS USE AND DISSEMINATION

We delivered 17 presentations to colleges (e.g., Anoka Ramsey Community College and Macalester College), grade schools, and municipalities (e.g., Cities of Bloomington). We also provided 12 interviews to news outlets and podcasts (e.g., MPR, BBC, and Three Rivers Park District's "Wandering Naturalist" podcast), content for two Friends of the Mississippi River newsletters, and led over 60 volunteers into the field and coordinated with two UMN courses (60 students total). To further disseminate information, we created a [University website](#), [Facebook page](#), and [iNaturalist page](#) for the project, and we have drafted one scientific manuscript (set to be published this year).

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03i Den Boxes for Fishers and Other Nesting Wildlife - Research Project - \$190,000 TF (FY2020)

Michael Joyce

U of MN - Duluth NRRI
5013 Miller Trunk Hwy
Duluth, MN 55811

Phone: (218) 788-2656

Email: joyc0073@d.umn.edu

Appropriation Language

\$190,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to build, install, and evaluate den boxes as habitat enhancement for fishers and other cavity-nesting wildlife in managed forests where a lack of large trees may be threatening population survival. The final outcome for the project must include guidelines and best practices for use of den boxes for fisher habitat.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Fishers used some den boxes, but it appears fishers find natural cavities to raise young. Den cavity availability alone is likely not causing the fisher population decline. Den boxes were used by many other wildlife species. Installing den boxes could be locally beneficial and increases public involvement with wildlife.

OVERALL PROJECT OUTCOME AND RESULTS

The fisher population in Minnesota declined by 50% from 2000-2015. Large cavity trees are critical habitat resources that female fishers use to raise kits. Previous research on fishers in Minnesota suggested that lack of large cavity trees could be one factor limiting the fisher population. We evaluated whether den boxes could provide critical habitat for fishers where natural cavities are rare. Our objectives were to build, install, and monitor fisher den boxes to describe use of den boxes by fishers and other wildlife, determine what factors influence whether fishers use den boxes, and to develop guidelines and recommendations for using den boxes to improve habitat. We built and installed 99 den boxes during fall and winter 2019-2020 and captured over 3 million images of wildlife visiting and using den boxes. Fishers visited 41% of den boxes and used 11% of den boxes on 43 different occasions. Use by fishers was lower than in other studies. Low use rates by fishers could indicate cavity availability is not limiting fishers, but additional work is needed to more fully understand why fisher use of den boxes was low and to evaluate other potential causes of the fisher population decline. Habitat suitability at den box sites was not associated with use by fishers. Fisher presence at den boxes increased over time, and fishers should continue to find and use den boxes in the future. Martens, red squirrels, gray squirrels, flying squirrels, and weasels also used den boxes to rest, store food, avoid predators, and care for young. Frequent use of den boxes by other wildlife demonstrates the value of den boxes to wildlife despite low use by fishers. Den box plans and guidelines we developed have allowed many members of the public to build and install their own den boxes, increasing public involvement with wildlife.

PROJECT RESULTS USE AND DISSEMINATION

We created den box building instructions and guidelines for den box installation. Throughout the project, we shared these documents directly with 120 members of the public and resource managers who requested information on the project. Project results were disseminated to technical and non-technical audiences through presentations, print and broadcast media, social media posts, and a [Minnesota fisher den box project website](#) we developed. Results are also summarized in a master's thesis. We are currently finalizing a technical report and three manuscripts using data from this project that will be submitted to scientific journals and shared with wildlife managers.

Project Completed: 6/30/2022

FINAL REPORT

[Fisher Den Box Building Plans - 12 pgs](#)

[Fisher Den Box Instructions - 2 pgs](#)

Subd. 03j Red-Headed Woodpeckers as Indicators of Oak Savanna Health - Research Project - \$171,000 TF (FY2020)

David E. Andersen

U of MN

1980 Folwell Avenue, 200 Hodson Hall

St. Paul, MN 55108

Phone: (612) 626-1222

Email: dea@umn.edu

Web: <http://mncoopunit.cfans.umn.edu/>

Appropriation Language

\$171,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to evaluate red-headed woodpecker survival and habitat needs and to use this data to develop and disseminate a long-term oak savanna management plan that supports red-headed woodpeckers and other oak savanna habitat-dependent species.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Our project results provide important information on the factors associated with red-headed woodpecker habitat use, survival, and productivity in savanna ecosystems, which can aid ongoing habitat management and conservation efforts intended to conserve and restore this species in Minnesota.

OVERALL PROJECT OUTCOME AND RESULTS

Red-headed Woodpeckers (*Melanerpes erythrocephalus*) are charismatic cavity-nesters that breed in savannas and open forest systems across the eastern and Midwestern United States and south central and eastern Canada. Historically, they were common across the Midwest, but populations have experienced dramatic regional declines. Habitat restoration initiatives have been challenged by a general lack of information on the factors that make savannas desirable for this species. With collaborators from the University of Toledo in Ohio, we studied red-headed woodpecker demography, habitat associations, and migration ecology from 2017 – 2020 in Ohio and Minnesota to elucidate critical periods, locations, life stages, and habitat characteristics associated with population growth rates and to provide habitat restoration and management recommendations for land managers and the public (separate funding sources for research in Ohio). Our results indicate that red-headed woodpecker productivity is higher in landscapes with both open and closed-canopy forest and that even in large stands of oak savanna, productivity near the center of those stands is predicted to be lower than in savanna closer to other forest types. GPS tracking data show detailed information on the migratory and overwintering locations and behaviors of adult red-headed woodpeckers, which, to our knowledge is the first reported data of its kind for this species in Minnesota. Our results provide information on snag density around nest trees, the importance of nest tree wood hardness, and habitat use by adult and fledgling woodpeckers. We have also gained considerable information on the community of predators that may impact red-headed woodpecker nest survival through our trail camera project, now hosted on Zooniverse. We have engaged with thousands of volunteers from around the world to share more about our research through our cavity camera project. Our best management practices are based on current results and we intend to update our recommendations in consultation with collaborators and other experts.

PROJECT RESULTS USE AND DISSEMINATION

We presented our research at professional conferences (the Annual meeting of the Minnesota Ornithologist's Union, the American Ornithological Society Annual Conference, and at the Toledo Museum of Natural History Forum on Local Natural History and Research). We also presented eight invited talks to public audiences through the University of Minnesota, Cedar Creek Ecosystem Science Reserve, multiple local Audubon Chapter organizations, and a Naturalist club in Brandon Manitoba in Canada. Our research project was featured in articles in the following newspapers and magazines: [Terrain.org](#), [University of Minnesota College of Biological Sciences](#), and the [Minneapolis Star and Tribune](#).

We are also currently in the process of preparing three manuscripts for publication in the peer-reviewed, scientific literature focused on red-headed woodpecker nest survival and nest site selection, landscape productivity, and mating system:

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03n County Geologic Atlases - Part A, Mapping - \$2,000,000 TF (FY2020)

Barbara Lusardi

U of MN - MN Geological Survey
2609 Territorial Road
St. Paul, MN 55114

Phone: (612) 626-5119

Email: lusr001@umn.edu

Web: <https://www.mngs.umn.edu/>

Appropriation Language

\$2,000,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Minnesota Geological Survey, to continue producing county geologic atlases to inform management of surface water and groundwater resources. This appropriation is to complete Part A, which focuses on the properties and distribution of earth materials to define aquifer boundaries and the connection of aquifers to the land surface and surface water resources.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

County Geologic Atlases were completed in two counties and work continued in 17 counties. Based on the time spent, this is equivalent to "completing" about five atlases. Atlas maps and data provide foundational information that supports water management activities to the benefit of drinking water and aquatic habitat.

OVERALL PROJECT OUTCOME AND RESULTS

A Geologic Atlas provides the geologic framework of our state. It describes the materials and features at the land surface and extends all the way down to the bedrock surface. An atlas provides information useful for resource management and land-use planning. Each Atlas typically requires more than 7,000 person-hours of work. Some of that work is in the field: drilling test borings, examining, sampling, and

describing outcrops. Much of the work follows afterward: interpreting field measurements, recognizing and formally naming geologic units described in well records, and making maps. The result is a detailed account of the distribution and properties of the rock and sediment that lie below the land surface. These materials, and their ability to store or transmit water, determine where we can find water, and how we can protect and make wise use of that water. This includes our lakes and rivers as well as groundwater.

As part of this 2019 award, Rock and Nobles counties were completed. Over 8,000 well construction records, primarily located by County staff, were compiled into the database to support mapping, document water use in specific aquifers, and to help resolve well problems. Progress continued on mapping the bedrock and surficial geology, subsurface Quaternary stratigraphy, bedrock topography and glacial sediment thickness in 17 other counties. We've described hundreds of outcrops, taken thousands of hand samples, and drilled 13 continuous cores allowing us to sample rocks and sediment up to 300 feet deep.

Continuing under the M.L 2020 award, atlases for St. Louis, Aitkin, and Steele counties should be complete within the next three months. Lake, Ottartail and Lac Qui Parle counties should be finished within the next 12-18 months. Work on the remaining counties, Lincoln, Pipestone, Pennington, Cook, Yellow Medicine, Polk and Chippewa, will continue. The County Geologic Atlas program began in 1981 and continues with support of the Environment and Natural Resources Trust Fund as well as the Clean Water Fund, the Department of Natural Resources, and the U.S. Geological Survey. To date we have completed atlases for 46 counties, 29 are underway; and 16 have yet to be started. All of our mapping products and data are available in print or digital formats.

PROJECT RESULTS USE AND DISSEMINATION

Completed atlas products have been posted to the MGS website and linked to the University's Digital Conservancy as noted above. PDF products as well as all of the related GIS data are available on these pages. In addition, the MGS hosts an [Open Data Portal](#) on which many of our county geologic atlases are presented as "Story Maps" that allow for direct access of the data without any special software or interface.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03o County Geologic Atlases - Part B, Mapping Aquifer Hydrology - \$2,400,000 TF (FY2020)

Paul Putzier
MN DNR
Box 25, 500 Lafayette Rd N.
St. Paul, MN 55155

Phone: (651) 259-5692
Email: paul.putzier@state.mn.us
Web: http://www.dnr.state.mn.us/waters/groundwater_section/mapping

Appropriation Language

\$2,400,000 the first year is from the trust fund to the commissioner of natural resources to continue producing county geologic atlases to inform management of surface water and groundwater resources for drinking water and other purposes. This appropriation is for Part B, which uses the geologic formations mapped in Part A of the county geologic atlases to characterize the potential water yields of aquifers and the aquifers' sensitivity to contamination.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Groundwater Atlas provides foundational, science-based, information for use and management of Minnesota groundwaters. The atlas is valuable to government, industry, and for research. The grant supported work on nineteen atlases and publication of county groundwater atlases (County Atlas Part B) for Brown, Hennepin, Kanabec, Meeker, Morrison, Redwood, and Winona counties.

OVERALL PROJECT OUTCOME AND RESULTS

The Groundwater Atlas provides foundational, science-based, information for use and management of Minnesota groundwaters. The atlas is valuable to government, industry, and research. During the period of the grant, county groundwater atlases (County Atlas Part B) were published for Brown, Hennepin, Kanabec, Meeker, Morrison, Redwood, and Winona counties. Mapping activities also continued through the end of the grant in Aitkin, Becker, Cass, Dodge, Houston, Hubbard, Isanti, Kandiyohi, Nobles, Olmsted, Rock, and Wadena, with publication of completed groundwater atlases for Becker, Cass, Dodge, Houston, Hubbard, Isanti, and Wadena expected in 2023.

The following related reports were also published:

- The Karst Landscape Unit Map for Winona and Houston counties.
- Minnesota Groundwater Provinces 2021. This document is one of the most widely used reference documents from the Atlas Program.
- Groundwater Atlas Users Guide.

Groundwater sampling is a key element in the completion of an atlas. Sampling efforts necessarily slowed during the pandemic. However, groundwater sampling was completed in Dodge, Kandiyohi, Nobles, Olmstead, Rock, and Steele counties. Letter reports with all sampling results were provided to well owners for all wells sampled as part of this grant.

DNR Groundwater Atlas staff completed field work for the geophysical investigation of Pennington County as part of the atlas process. DNR Groundwater Atlas staff also completed planning for the geophysical investigations in fall 2022 of Douglas, Grant, Polk, and Red Lake counties.

As part of the atlas development process, DNR staff conduct reviews of draft County Geologic Atlases (Part A) prepared by the MGS. During the grant this included DNR reviews for Aitkin, Becker, Cass, Dakota, Lac qui Parle, Lake, Otter Tail, Steele and St. Louis.

Dissemination and outreach activities continued throughout the grant period including presentations, news releases, GovDelivery list serve (6,000 recipients) notifications, and virtual meetings with county staff and county boards, seminars, and presentations.

PROJECT RESULTS USE AND DISSEMINATION

Dissemination activities focused on notification of sampling activities and publication of atlases through

news releases and GovDelivery (6,000 recipient list serve), participation in seminars, presentations, and educational/technical field trips to a diverse set of stakeholders and resources managers including county SWCDs, county boards, the Clean Water Council, BWRS, MPCA, the Legislative Conference of Minnesota Counties, LCCMR events, and others. Dissemination also included workshops with counties, publication of summary articles, updated website and many personal contacts with users of the atlas. Atlas staff also worked closely with university staff to incorporate atlas materials in the classroom and to collaborate on projects.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03p Unlocking Science of Minnesota's Moose Decline - \$199,000 TF (FY2020)

Nicole Mattson

Minnesota Zoological Garden
13000 Zoo Blvd.
Apple Valley, MN 55124

Phone: (952) 431-9540

Email: nicole.mattson@state.mn.us

Web: <http://mnzoo.org/>

Appropriation Language

\$199,000 the first year is from the trust fund to the Minnesota Zoological Garden to develop educational displays, interactive exhibits, and engaging online programs that summarize and share scientific findings about moose decline in Minnesota. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Minnesota Zoo gathered moose researchers to share their key scientific research findings about Minnesota's moose decline. The research findings were used to develop interactive interpretive features for the Zoo's moose habitat, an educational website, and an engaging online game that highlights the survival challenges influencing Minnesota's moose population.

OVERALL PROJECT OUTCOME AND RESULTS

The moose is an iconic Northwoods animal that has had an important presence in Minnesota and at the Minnesota Zoo. However, moose in Minnesota have experienced periods of dramatic population decline over the last 30 years. They have nearly disappeared from northwestern Minnesota. Since 2004, moose numbers have decreased by roughly 50% in the northeastern part of our state. Significant public resources have been invested in scientific research to understand Minnesota's moose decline. Many Minnesotans are keenly aware of the moose decline and want to know more about its causes and what can be done to help.

With ENRTF support, the Minnesota Zoo collaborated with researchers from across the state to identify key scientific research findings about Minnesota's moose decline and population dynamics. This project used those key research findings to develop interactive interpretive displays at the Minnesota Zoo's

moose habitat. A new, accessible, educational website was created to make the research findings available for broad virtual access. The website features basic moose natural history, information about moose research in Minnesota, and a custom, interactive game. The game encourages a user to experiment with habitat features to create a simulated environment where moose thrive. While the player attempts to manage for a healthy moose population over the course of a year, random, unexpected events occur. Players learn about some of the challenges wildlife managers (and moose) face in Minnesota.

The physical interpretive elements and online resources created from this project focus on complicated research findings in an engaging, accessible, and easily understandable fashion. These deliverables will be maintained by the Minnesota Zoo and will benefit learners of all ages for years to come.

PROJECT RESULTS USE AND DISSEMINATION

Through meetings, presentations and seminars, hundreds of Minnesota Zoo staff and volunteers have learned about Minnesota's moose decline and this ENRTF project. Thousands of guests have interacted with the interpretive elements created for the Zoo's moose exhibit. Thousands of people have also engaged with the virtual components resulting from this project.

Virtual components of this project include:

- [Mission Moose website](#)
- [Aerial Moose Survey video](#)
- [Moose Research video](#)

These online resources have been featured in professional newsletters, publications, listservs, websites and on social media platforms. The Dakota County Tribune also wrote an article about the Mission Moose website and game.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03q Forest and Bioeconomy Research - \$2,200,000 TF (FY2020)

Rolf Weberg

U of MN - Duluth NRRI
1049 University Dr.
Duluth, MN 55812

Phone: (218) 788-2697
Email: rtweberg@d.umn.edu
Web: <https://www.d.umn.edu/>

Appropriation Language

\$2,200,000 the first year is to the Board of Regents of the University of Minnesota for academic and applied research through MnDRIVE at the Natural Resources Research Institute to develop and demonstrate technologies that enhance the long-term health of Minnesota's forests, extend the viability

of current forest-based industries, and accelerate emerging industry opportunities. Of this amount, \$500,000 is to support development of a forest optimization tool for Minnesota forest resources, \$800,000 is for maintenance and expansion of the Natural Resource Atlas to statewide coverage, \$400,000 is to the Minnesota Forest Resource Council for continued advancement of biochar development and application to forest health, and \$500,000 is to advance emerging Minnesota technologies to produce clean syngas to drive high-value markets for forest biomass feedstocks.

Subproject 1 - SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Projections of Minnesota forest composition and associated ecosystem services were developed under different climate and management scenarios from 2020 to 2100. This information was made freely available through a custom website and interactive mapping tool, providing resource managers with critical information for planning.

Subproject 1 - OVERALL PROJECT OUTCOME AND RESULTS

Forest management is an increasingly complex discipline that requires the balancing of economics and ecology in the face of changing markets and climate. Beyond providing lumber, pulp, and other forest products, forests provide many additional goods and services that benefit society. Known as “ecosystem goods and services,” these include sequestering carbon, providing habitat for wildlife, maintaining water quality and quantity, and others. Understanding both how forests will change over time and how society values the goods and services they provide is critical to the successful management of Minnesota’s forests.

This project was designed to provide projections of how forest composition and the goods and services that forests provide will change from 2020 to 2100 under different management and climate scenarios on 3,800,000 acres in northern Minnesota. It also helps users understand how Minnesotans value those forest goods and services. Foundational landscape change modeling was done using the LANDIS-II model, allowing for a better understanding of forest composition and carbon. Subsequent wildlife habitat and water quality and quantity modeling were done using the WHINGS and HSPF models, respectively. All models were run for each of the 12 unique combinations of our management and climate scenarios. Focus groups and surveys were used to quantify value.

Minnesota’s forest managers indicated that they would like to consider ecosystem services when making harvest and management decisions but lack the information to do so. The primary deliverable of this project is the Forest Change Assessment Simulation Tool, or ForCAST. This interactive mapping and decision support tool contains all of our projections of forest composition and associated ecosystem services and estimates of value, allowing for the development of informed, long-term management strategies that aren’t exclusively driven by the economics of timber markets.

Subproject 1 - PROJECT RESULTS USE AND DISSEMINATION

ForCAST, an interactive mapping and decision support tool developed as the main deliverable of this project, is freely and publicly available through the project website. The website also provides access to comprehensive project and methodology documentation. During development, awareness was raised about the project through presentations at the Minnesota GIS/LIS conference and a combined meeting of the Minnesota Society of American Foresters and the Sustainable Forests Education Cooperative’s (SFEC) Forestry and Wildlife Research Review. ForCAST was launched through a SFEC webinar in July 2022 with a subsequent training event scheduled through SFEC in September.

Subproject 2 - SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Minnesota Natural Resource Atlas is an easy to use interactive mapping tool and spatial database that is freely available to all Minnesotans. It lowers or removes the barriers that prevent spatial data from informing the decisions that impact our state's natural resources.

Subproject 2 - OVERALL PROJECT OUTCOME AND RESULTS

Organizations and natural resources managers in Minnesota are often required to make decisions that impact our natural resources while using incomplete information. Spatial data contains valuable information that can improve decision making and outcomes. However, accessing it typically requires specialized software and advanced technical skills. The Minnesota Natural Resource Atlas was designed to be a statewide resource that improves access to spatial data and the information and insights that it contains.

The Atlas project was a statewide expansion and enhancement of an earlier version that served 27 counties in northeast and north central Minnesota. We worked closely with our original Atlas users, target users in the expanded geographic area, and our advisory committee to identify data and functionality needs. More than 500 additional data sets, with an emphasis on agriculture, forestry, and water resources, were developed or acquired. Functionality that allowed users to more easily visualize, analyze, and share data was developed, tested, and deployed. Improvements were also made to make the Atlas more robust, responsive, and reliable.

Training, outreach, and education were used to raise awareness of the project and expand Atlas users. Google analytics on the site indicate a growing user base with typical daily weekday unique visitors ranging from 60 to 100 and their locations distributed throughout the state, with the highest concentration in the Twin Cities metro area and Duluth. Internal software was developed that allows us to monitor which data is being requested and for which geographical area. This software indicates that water, natural and administrative boundaries, and biological data are the most frequently accessed and that users are viewing data for locations throughout the state.

The Minnesota Natural Resource Atlas is a valuable resource for the state. Ultimately, it is making spatial data more accessible for all Minnesotans.

Subproject 2 - PROJECT RESULTS USE AND DISSEMINATION

The [Minnesota Natural Resource Atlas](#) is freely and publicly available online. Dissemination through training, outreach, and education were key components of the project. Articles were contributed to relevant newsletters and publications to raise awareness, and free training sessions were offered to organizations throughout the state. Eight 15 to 30 minute project overview presentations that included Atlas demonstrations were also conducted. In total, 38 training or demonstration events were conducted with over 1000 individuals participating from conservation organizations, K-12 or post-secondary education, academia, and tribal, local, state, and federal governments.

Subproject 3 - SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Biochar is a material that can be produced from residual biomass that can improve soil health and reforestation while storing carbon for the long term in soils. This project demonstrated production and deployment of insect-damaged balsam fir and black ash as biochar to improve seedling regrowth and retain nutrients in sandy forest soils.

Subproject 3 - OVERALL PROJECT OUTCOME AND RESULTS

We demonstrated the concept of using Minnesota black ash and balsam fir as feedstocks for the generation of biochar for forest soil amendments to improve reforestation efforts. We produced biochars from both black ash and balsam fir wood chips at a variety of temperatures and characterized these by measuring different physical and chemical properties.

The fully-characterized biochar samples were evaluated in greenhouse plant growth studies. Biochars from black ash and balsam fir processed at 550°C were the most promising candidates for positive soil health improvements, as these products revealed a) the highest water holding capacities, b) minimization of potentially harmful mobile organics (extractives content), and c) greatest nitrogen and dissolved organic carbon retention. Field trials were then performed at the Cloquet Forestry Center to evaluate biochar impact on red pine and red oak seedling survival. Biochars were added to the soil surrounding newly-planted red pine and red oak seedlings using a randomized nested design with appropriate controls. Early results on photosynthesis and respiration rates from the field study are positive but conclusions on biochar's role on improving seedling survival will require long-term monitoring at the field site, extending beyond the end of this project.

We also produced two literature reviews. The first study examined net carbon sequestration potential of using biochar in forest regeneration projects and concluded that there is ample supply of black ash in Minnesota to support industrial-scale biochar production and that 20 years of biochar production in Minnesota, just from black ash, would sequester approximately 6.7 million tons of CO₂. The second study was a techno-economic analysis performed by Dovetail Partners. This report concluded that the ecological and economical benefits of biochar implementation are best suited for revegetation efforts for jack and red pine in areas with sandy soils. This report can be found online: [Dovetail Partners report](#).

Subproject 3 - PROJECT RESULTS USE AND DISSEMINATION

Toczydlowski, Alan JZ; Robert A Slesak; Rodney T Venterea; Kurt A Spokas. Effect of Biochar Feedstock and Pyrolysis Temperature on Nutrient Cycling in Forest Soil. 2021 ASA, CSSA and SSSA International Annual Meetings, Salt Lake City, Utah. Oral presentation November 7-10, 2021.

1. Reuling, Laura F; Alan JZ Toczydlowski; Robert A Slesak; Marcella A Windmuller-Campione. Effects of biochar on drought tolerance of *Pinus banksiana* seedlings. USFS National Silviculture Workshop, Kellogg, ID. Oral presentation July 12-14, 2022.
2. McFarland, Ashley; Fernholz, Kathryn; Groot, Harry. Biochar Potential in Minnesota's Forests. [Commissioned Report 2021](#).
3. Singsaas, Eric. Engineering functional biochar for specific applications. North American Biochar & Bioenergy Conference, Morgantown, West Virginia. Oral Presentation August 8-11, 2022.
4. Barry, Brian. A new approach for complete pore size distributions and regime-specific total pore volume determinations of biochars. North American Biochar & Bioenergy Conference, Morgantown, West Virginia. Oral Presentation August 8-11, 2022.
5. Singsaas E, Barry B, Kolomitsyna O, Kacharov O, Yemets S, Young M, Toczydlowski A, and Slezak R. 2022. Biochar from insect-damaged trees used as a forest soil amendment: production, characterization, and application. Natural Resources Research Institute, University of Minnesota Duluth, [Technical Report](#) NRRI/TR-2022/16.
6. Singsaas, E., Kolomitsyna, O., Kacharov, O., Young, M., and Barry, B. 2022. Biomass pretreatment to make clean syngas from Minnesota wood residuals. Natural Resources Research Institute, University of Minnesota Duluth, [Technical Report](#) NRRI/TR-2022/17

7. Wright, C. 2022. Biochar Production Scenarios in Minnesota Utilizing Ash (*Fraxinus spp.*) as a Feedstock. Natural Resources Research Institute, University of Minnesota Duluth, [Technical Report NRRI/TR-2022/15](#)

Subproject 4 - SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Synthesis gas (syngas) is a mixture of combustible chemicals that can be used to replace fossil fuels for industrial processes, hydrogen, and fuel production. This project demonstrated that forest residuals from insect-damaged trees can be pretreated to improve their conversion efficiency to make cleaner syngas.

Subproject 4 - OVERALL PROJECT OUTCOME AND RESULTS

Achievement of Minnesota's renewable energy transition and associated greenhouse gas (GHG) reduction goals requires development of non-fossil fuel alternatives for fuels and processes that are impractical to convert to electrical power. Key syngas applications include production of renewable diesel, jet fuel, and hydrogen, as well as direct use of syngas for production of iron and steel products. Our objective was to demonstrate that low-value forest biomass could be used to generate clean syngas for these markets in Minnesota by pretreating the biomass to improve its physical and chemical properties.

Our objective was to determine the best pretreatment conditions for one Minnesota biomass that would improve the yield of syngas components (H₂, CO, CH₄) relative to contaminants (tars) with the minimal processing temperature, time, and handling. Our results showed that addition of temperature and steam during pretreatment significantly reduced the tars produced during gasification, but with some loss in syngas yield. Therefore, we concluded that a mild steam treatment between 240-260°C with low residence time was optimal for pretreating black ash to make syngas.

Pilot-scale gasification trials on pretreated biomass was performed at the University of North Dakota Energy & Environmental Research Center, which ran pilot tests in their fluidized bed gasifier on eight different samples of black ash pretreated between 180 and 300°C and untreated biomass controls. The pilot results confirmed that pretreatment reduced tar production at the expense of reduced syngas yield. More importantly, however, the pilot tests showed that pretreatment improves the grindability of the biomass, making it easier to handle and feed to a gasifier.

These results demonstrate that renewable hydrogen, methane, or fuels can be made from Minnesota's biomass residuals by gasification, and low-temperature pretreatment will help.

Subproject 4 - PROJECT RESULTS USE AND DISSEMINATION

Singsaas E, Kolomitsyna O, Kacharov O, Yemets S, Young M, Barry B. 2022. Biomass pretreatment to make clean syngas from Minnesota wood residuals. Natural Resources Research Institute, University of Minnesota Duluth, Technical Report NRRI/TR-2022/17.

Project Completed: 6/30/2022

FINAL REPORT

[Subproject 1 Abstract](#)

[Subproject 2 Abstract](#)

Subproject 3 Abstract

Subproject 4 Abstract

Subd. 03r Minerals and Water Research - \$883,000 TF (FY2020)

Rolf Weberg

U of MN - Duluth NRRI
1049 University Dr.
Duluth, MN 55812

Phone: (218) 788-2697

Email: rtweberg@d.umn.edu

Web: <https://www.d.umn.edu/>

Appropriation Language

\$883,000 the first year is to the Board of Regents of the University of Minnesota for academic and applied research through MnDRIVE at the Natural Resources Research Institute to develop and demonstrate technologies that enhance long-term Minnesota mineral opportunities. Of this amount:

- (1) \$300,000 is to support continued applied research to advance new technologies to improve water quality;
- (2) \$275,000 is to initiate the characterization of western Mesabi iron resources and development of next-generation Minnesota iron products;
- (3) \$158,000 is to develop emerging hydrometallurgy technology to support high-value mineral product development in Minnesota; and
- (4) \$150,000 is to support efforts of the Natural Resources Research Institute to accelerate demonstration of high-capacity, cost-effective energy storage using Minnesota's historical auxiliary mine lands.

This research must be conducted in consultation with the Minerals Coordinating Committee established under Minnesota Statutes, section 93.0015.

Subproject 1 - SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The project provides a cost-effective process for treating wastewater to meet the wild rice sulfate standard of 10 mg/L. The data gathered from the field pilot trial at two wastewater treatment plants will help in implementing a full-scale treatment system to reduce sulfate level for protecting water resources in Minnesota.

Subproject 1 - OVERALL PROJECT OUTCOME AND RESULTS

The State of Minnesota adopted a sulfate standard of 10 milligrams per liter (mg/L) for wild rice waters in 1973. Compliance with this standard is a challenge for small industries and municipalities as membrane-based technologies typically require high capital and operation costs. The Natural Resources Research Institute (NRRI) has developed a mobile treatment system based on barite precipitation reactions to reduce sulfate levels. In this project, NRRI deployed the trailer-based modular

demonstration treatment system at two municipal wastewater treatment plants (WWTPs) in northeastern Minnesota to perform field pilot trials. The objectives of the field pilot trials were to:

1. Evaluate the efficacy of the chemical precipitation process at a flow rate of 1-2 gallons per minute with different wastewater sources (domestic and industrial wastewater);
2. Optimize the chemical reagent dosage levels; and
3. Estimate the chemical reagent costs.

The pilot tests were conducted using effluent from the Virginia WWTP and the Grand Rapids WWTP from June 2021 until October 2021. The Virginia WWTP treats domestic wastewater exclusively, and the resulting effluent has relatively steady sulfate concentrations of 60 mg/L. The Grand Rapids WWTP treats a mixture of domestic wastewater and industrial wastewater supplied from a regional paper mill with a sulfate level ranging from 85 to 115 mg/L. The pilot test results indicated that the chemical precipitation system consistently reduced the sulfate levels of both wastewaters to below 10 mg/L with optimal chemical dosage rates. The chemical costs were estimated to be \$2.27 and \$5.50 per thousand gallons of effluent from Virginia and Grand Rapids wastewater treatment plants, respectively.

Information gained from the field trials was used to develop guidelines for the future design and operation of a plant-scale system.

Subproject 1 - PROJECT RESULTS USE AND DISSEMINATION

This project has produced materials of interest to a wide variety of stakeholders, including the researchers, city councils, wastewater treatment plant operators, and the community. Among these products are presentations, posters, and videos. Sulfate treatment research results were presented in three conferences (Minnesota Water Resources conference, The Society for Mining, Metallurgy & Exploration Inc. conference, and the International Mine Water Association conference), the Virginia City Council, and the University of Minnesota Duluth University for Seniors class. A YouTube video was created to describe the sulfate problem in Minnesota and our solution.

The full report is publicly available on the University of Minnesota Duluth Natural Resources Research Institute (NRRI) [Website](#).

Subproject 2 - SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This study initiated a long-term characterization program of the iron resources in Minnesota. Analysis of two sections of the iron formation produced a better understanding of the variability and potential for developing new iron-based products. With continued support, this program will provide a foundation for the future iron industry in Minnesota.

Subproject 2 - OVERALL PROJECT OUTCOME AND RESULTS

Iron mining has been an important part of the economy of northern Minnesota for over a century. Today, mining companies process magnetite-rich taconite ore. Magnetite is important due to its chemical, magnetic, and thermal properties. All iron mining companies encounter magnetite that has been oxidized to various degrees. Minor amounts of oxidation can negatively impact the economic processing of iron ore, so oxidized material is either not mined or mined and stockpiled. Significant unoxidized parts of the iron formation are also stockpiled because they cannot be economically processed with current technology.

The purpose of this study was to initiate a long-term comprehensive characterization program of the

remaining iron resources of the Mesabi Iron Range to provide a foundation for future iron industry in Minnesota. This data is being used to direct research in the areas of reducing reliance on fossil fuels, reducing emissions, and to identify and develop value-added iron products that could be produced from under-utilized portions of Minnesota iron resources. This approach can also be applied to understanding and processing waste iron stockpiles. This study has been leveraged to obtain additional State and Federal support for other mineral related studies in Minnesota.

Two complete sections of the iron formation were analyzed in this study. The results have contributed to a better understanding of the mineralogical variability within the iron formation; the impacts of oxidation on iron product quality; the potential for new iron-based products; and the presence of trace elements. Furthermore, this study also indicated that there may be a significant resource of siderite, an iron carbonate mineral, on the Mesabi Range. While siderite is unlikely to be a primary source of metallic iron, there may be other applications for siderite. Future research will focus on opportunities to reduce environmental impact while creating value-added iron products in Minnesota.

Subproject 2 - PROJECT RESULTS USE AND DISSEMINATION

Presentations

- Minnesota Minerals Coordinating Committee 2021 Virtual Cloquet Workshop Agenda Lightning Talks (4/23/2021)
- SME Minnesota Conference 2022 Presentations (4/13/2022)
- Minnesota Iron Ore and the Green Economy webinar (3/16/2022)
- Articles
 - Business North: ‘Iron of the Future’ program looks to new iron making technologies, Lee Bloomquist Sep 16, 2021 [Article](#).
 - Business North: A bright future for mining, Lee Bloomquist Dec 27, 2021 [Article](#).
- [Technical Report](#)
 - Johnson, R.C., Mlinar, M.A., Spigarelli, B.P., Post, S. Western Mesabi Iron Resource of the Future. Natural Resources Research Institute. September, 2022. Report NRRI/TR-2022/11.

Subproject 3 - SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Based on outcomes of “voice of customer survey” and funding opportunities available through federal agencies, the project has identified emerging hydrometallurgical innovations with potential for processing Minnesota’s in-situ and waste mineral resources with a reduced water, energy, and environmental footprint. The project has also identified bench-top hydrometallurgical research equipment required to initiate development of next generation value-added products from under-utilized and under-valued in-situ mineral and waste resources in Minnesota, specifically low-grade ores, waste tailings, metallurgical residues, incinerator ash, power plant combustion residues, and waste electrical and electronic equipment.

Subproject 3 - OVERALL PROJECT OUTCOME AND RESULTS

Minnesota has abundant in-situ mineral resources, including deposits of iron, iron manganese, copper-nickel-cobalt-platinum group elements, titanium-vanadium, copper-zinc, gold with and without silver, sand, and aggregate. Commercial and industrial byproducts such as mine tailings, industrial residues, and waste electrical and electronic equipment also contain valuable mineral resources. To address significant environmental impact concerns associated with mining, collection, and processing of these

materials, new processing technology approaches with reduced water and energy consumption and minimal environmental footprints are needed to support production of value-added products. Emerging hydrometallurgical processing technologies offer promising opportunities. To evaluate the technical, economic, and environmental benefits of emerging hydrometallurgical innovations, the Minnesota Legislative-Citizen's Commission on Minnesota Resources provided funding to the Natural Resources Research Institute (NRRI) to evaluate how to best support the development of emerging hydrometallurgical technologies in the state. The study highlights Minnesota's mineral and waste resources that have the highest potential for hydrometallurgical processing. The report also highlights key challenges anticipated by stakeholders during the commercial development of mineral and waste resources using hydrometallurgical technologies. The emerging hydrometallurgical innovations that may resolve various challenges are also identified by means of the stakeholder engagement survey and funding opportunities available through the federal agencies. The report summarizes research priorities that support development of emerging hydrometallurgical technologies in applications ranging from high-value materials to water remediation to carbon sequestration. The report shortlists key bench-scale and semi-pilot laboratory tools that will help NRRI to advance the readiness level of emerging hydrometallurgical technologies in Minnesota. The capital estimates for bench-top and semi-pilot laboratory prototypes range from \$600,000 to \$1.2 million. The personnel, installation, and collaboration costs range from \$300,000 to \$400,000.

Subproject 3 - PROJECT RESULTS USE AND DISSEMINATION

NRRI conducted a "Voice of Customer" survey through interviews with a broad range of stakeholders around the country. These included current or prospective mineral/metal producers, metal recyclers, hydrometallurgical R&D labs, engineering and technology providers, consultants, academia and educators, regulators, and federal agencies. The study produced a report of investigations of interest to wide variety of stakeholders, including regulators, mineral rights holder, federal agencies, prospective manufacturing and resource extraction companies, and the community.

[Technical Report](#): Rao, S., Mlinar, M., Hudak, G., Kangas, K., and Peterson, D., 2022. Developing Emerging Hydrometallurgical Technologies: Report to the Legislative-Citizen Commission on Minnesota Resources. Natural Resources Research Institute, University of Minnesota Duluth, Report of Investigations NRRI/RI-2022/10. 179 p.

Subproject 4 - SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The purpose of this project was to provide a technology survey and a geographical recommendation of potentially feasible, non-battery, long-duration energy storage technology concepts that can utilize Minnesota's various topographies, geologies, and infrastructure to facilitate the state's renewable energy and greenhouse gas reduction goals. Numerous technology concepts with related siting recommendations are reported for consideration by state leaders.

Subproject 4 - OVERALL PROJECT OUTCOME AND RESULTS

Achievement of Minnesota's renewable energy transition and associated greenhouse gas reduction goals requires development and installation of both short- and long-term energy storage capability. Battery storage options (lithium batteries) readily provide 2-4 hour duration storage. Longer-term (>8hr), high-capacity (35-200 milliwatt) storage can better facilitate capture of available renewable energy and potentially eliminate the need for natural gas-based peaking plants to provide a more stable electrical supply when intermittent resources (e.g., solar or wind) cannot supply the necessary electricity. Non-battery options harnessing physical principles involving gravity, compressed gas, waste

heat and chemical processes can offer storage options with long lifetimes that do not require access to critical minerals and may offer safety improvements. Many of these options are in the development or demonstration phase and can take advantage of Minnesota's natural and man-made (former mine workings) topographical and geological features.

The project consisted of two parts. The first was a thorough survey of existing and emerging long-term, high-capacity, non-battery storage technologies with potential for applications in Minnesota. This entailed engagement with technology leaders, onsite concept evaluations and discussions with energy industry collaborators to characterize each technology. Identified technologies ranged from concepts that take advantage of mineland topographic features in northern Minnesota to others that could be deployed in municipalities or metropolitan areas. This information was collated into a summary format including industry contacts for each concept to facilitate follow-up by the state and/or industry.

The second part of the project entailed development of an interactive mapping tool to identify areas in the state where each identified technology might best be suited, considering the local topography, geology, and proximity to distribution infrastructure, industry, and applicable brownfield areas. This tool shows that there are multiple non-battery storage options in regions across Minnesota, primarily located in the vicinity of distribution infrastructure.

Subproject 4 - PROJECT RESULTS USE AND DISSEMINATION

The full report and three appendices are publicly available on the University of Minnesota Duluth Natural Resources Research Institute (NRRI) [Website](#). NRRI:

- collaborated with Clean Energy Resource Teams (CERTs) personnel to organize two presentations to state stakeholders (agency, industry, academia, government) to communicate report findings and solicit feedback;
- presented to DER Energy Storage Workgroup meeting with Great River Energy and support from CERTs;
- was presented at a Minnesota House Climate and Energy Finance and Policy Committee hearing on renewable energy generation and storage; and
- Continues conversations with Minnesota Department of Commerce in conjunction with CERTs and University of Minnesota colleagues to model energy storage opportunities.

Project Completed: 6/30/2022

FINAL REPORT

- [Subproject 1 Abstract](#)
- [Subproject 2 Abstract](#)
- [Subproject 3 Abstract](#)
- [Subproject 4 Abstract](#)

Subd. 04 Water Resources

Subd. 04c Wastewater Nutrient Reduction through Industrial Source Reduction Assistance - \$200,000 TF (FY2018)

Laura Babcock

U of MN

200 Oak St. SE, Suite 350-1
Minneapolis, MN 55455

Phone: (612) 624-4678
Email: lbabcock@umn.edu
Web: <http://www.mntap.umn.edu/>

Appropriation Language

\$200,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to provide technical assistance for industrial facilities to optimize their processes, reduce nutrient loads to wastewater treatment facilities, and improve water quality. The economic savings and water quality improvements achieved through this work must be documented.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project explored ways to keep Minnesota surface waters at high quality and make municipal wastewater treatment easier by reducing nutrient load sent to wastewater facilities by applying source reduction technical assistance at upstream industrial sites.

OVERALL PROJECT OUTCOME AND RESULTS

Nutrient pollution refers to the presence of excess nitrogen and phosphorus in water and is a major environmental concern. High nutrient levels promote plant growth that can result in eutrophication, algal blooms, or the creation of 'dead zones' in bodies of water where beneficial aquatic life cannot thrive. Wastewater treatment facilities are critical infrastructure sites purposed with reducing nutrient levels in wastewater to levels safe for the environment.

Wastewater treatment operations work hard to discharge high quality treated water. In areas of increasing community growth and industrial expansion, the wastewater infrastructure may not be able to keep up with treatment needs. When discharge exceeds the treatment capacity, communities have few choices: they can regulate load sent to the treatment plant limiting community growth or invest in costly new infrastructure.

The purpose of this project was to explore a third option to improve water quality by reducing nutrient pollution discharged by industrial facilities to municipal wastewater treatment facilities. This reduction is supported by source reduction technical assistance at the industrial site. The primary activities of this project included:

- Engaging industrial facilities in communities with high nutrient discharge;
- Providing technical assistance to identify and implement nutrient reduction; and
- Sharing strategies for industrial nutrient reduction with additional facilities.

By promoting strategies for upstream nutrient source reduction, the treatment intensity needed to meet wastewater discharge requirements may be reduced. This could reduce operating costs and possibly postpone or eliminate capital investment needs for treatment expansion projects. Key outcomes of this project include:

- Completed eight facility assessments that investigated nutrient reduction;
- Completed four intern projects with recommendations for nutrient reduction;

- Implemented 14,730 lbs of nutrient reduction or 67% of the identified opportunity;
- Developed a guide for wastewater operators to identify practical nutrient reduction options; and
- Delivered a webinar highlighting successful upstream nutrient reduction practices.

PROJECT RESULTS USE AND DISSEMINATION

Since nutrient pollution in wastewater can be a challenge for many treatment facilities and treatment costs can drain community resources, MnTAP created two resources to share the strategies developed and tested during this project. A [webinar](#) was created featuring wastewater sites and businesses that participated in activities to reduce discharge nutrient. Speakers provided perspectives on nutrient challenges and the value in collaboration. A [guide](#) was created to provide wastewater operators and community leaders with a framework for identifying and addressing opportunities to reduce nutrient pollution at the source and save of treatment costs. Four intern project summaries are posted on the MnTAP website for [Kerry Ingredients](#), [August Schell Brewing](#), [Minnesota Specialty Yeast](#) and [Rochester Meats](#).

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04d Quantifying Microplastics in Minnesota's Inland Lakes - Research Project - \$200,000 TF (FY2018)

Kathryn Schreiner

U of MN - Duluth

2205 E 5th St

Duluth, MN 55812

Phone: (218) 726-8680

Email: kschrein@d.umn.edu

Appropriation Language

\$200,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to quantify the amount, type, and source of microplastics in the water, sediment, and fishes of a range of Minnesota lakes.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project has helped to determine the sources and fate of microplastics in inland lakes in Minnesota. This includes differences in loading between different watersheds and ecosystems, and differences in ingestion by different fish species.

OVERALL PROJECT OUTCOME AND RESULTS

When this project was funded, our goal was to determine the amount and fate of microplastics in a set of Minnesota lakes that represent a variety of different types of watersheds, degrees of human influence, and ecosystem characteristics. Our partnership with the MN DNR Sentinel Lakes program allowed us to target lakes that already had long-term study data available, including mapped watersheds, lake temperature and residence time, and known fish populations. This three-year project sampled water column particulates, sediments, and fish (cisco, bluegill, and perch) from four Sentinel lakes in Minnesota (Peltier Lake, White Iron Lake, Ten Mile Lake, and Elk Lake) over the course of two

summer field seasons. All four lakes contained microplastics in the water, sediments, and fish, indicating that like other locations throughout the world, microplastic pollution is widespread in the state. Our findings further indicate that the biggest drivers that increase microplastic loadings into lakes are more human infrastructure and building in the watershed, a longer water retention time, and more shoreline development. There appears to be little connection between concentrations of microplastics in the water column and sediments, though more research will be needed to confirm. Finally, filter feeding fish (like cisco) have increased gut microplastic concentrations with increased water column microplastic concentrations, though visual feeders (like bluegill and perch) do not and appear to be able to distinguish plastics from food in the water column. Taken together, these first results from Minnesota inland lakes provide clear information for scientist and managers and further give Minnesota residents vital information about the health of their inland lakes. All data from this project will be accessible on our [project website](#) once publications have been prepared.

PROJECT RESULTS USE AND DISSEMINATION

Results from this project have been disseminated to the scientific community through meeting presentations and scientific publications currently being prepared. We have maintained a [project website](#) that is available to the public, and which we have advertised in our outreach to the Lake Associations associated with our project lakes. Our website has information about our project, videos from public webinars, and will have data from our scientific publications once those are published. Our collaboration with scientists at the MN DNR has meant that the Sentinel Lakes program has access to our project data along with any interpretations or project publications.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04i Extracting Deicing Salt from Roadside Soils with Plants - Research Project - \$360,000 TF (FY2018)

Bo Hu
U of MN
1390 Eckles Ave
St. Paul, MN 55108

Phone: (612) 625-4215
Email: bhu@umn.edu
Web: <https://bbe.umn.edu/directory/faculty/bohu>

Appropriation Language

\$360,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to collaborate with the Department of Transportation to evaluate potential native plants that can be grown on roadsides to adsorb and remove toxic salts accumulated from deicing roads and assess uses for the harvested material.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project screened and evaluated several halophytic plants that can extract sodium chloride, the deicing salt, from soil, and accumulate it into the leafy biomass. The information can be used to develop

phytoremediation methods to address the environmental pollution caused by the application of roadside deicing agents.

OVERALL PROJECT OUTCOME AND RESULTS

Massive applications of road salts to melt the snow and ice on sidewalks and roads can negatively affect the health of surrounding ecosystem as the salts are leached into lakes, rivers, and groundwater, causing significantly increased salinity and high salt conditions can also negatively affect both plant growth and soil structure. Many agricultural fields have similar concerns over the growing salinity in the soil, especially under the conditions of prolonged drought and improper irrigations. We collaborated with the Minnesota Department of Transportation (MnDOT) to screen and evaluate several halophytic plants that can extract sodium chloride, the deicing salt, from soil, and accumulate it into the leafy biomass. The information can be used to develop phytoremediation methods to address the environmental pollution caused by the application of roadside deicing agents. The research detailed in this project showed that common sunflower and pitseed goosefoot so far are the most promising species for phytoremediation of deicing salt. It is recommended they be mixed in with perennials from MnDOT's seed mixes to improve soil structure and help prevent the salt from reaching the soil surface or the groundwater. Another high salt accumulating plant species, sugar beet and beets in the other cultivar groups, are more suited for agricultural and thus could be used to remediate salt from the growing number of salt-impacted agricultural fields. The harvest and utilization of each of these plants can provide additional value such as animal feed, oil, or reuse of salt in ash if burned for energy. This project and the following phytoremediation method developments can provide a long term sustainable solution to the de-icing salt pollution to our Minnesota environment.

PROJECT RESULTS USE AND DISSEMINATION

The detailed research results are in the final report, and we are drafting two manuscripts for possible publications. Leif was accepted for presenting this work at [AIChE Annual Meeting](#) in November 2022 in Phoenix, Arizona and he was invited to give a presentation at the [MECA \(Minnesota Erosion Control Association\) Annual Conference](#) in January 2023. We have been working at MnROAD site with support and help from MnDOT. Cindy Dorn, writer/producer with Prairie Sportsman, an outdoor show produced by Pioneer PBS that airs on all Minnesota PBS stations is drafting a story on absorbing deicing salts with plants.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04k Accelerating Perennial Crop Production to Prevent Nitrate Leaching - \$440,000 TF (FY2018)

Dennis Fuchs

Stearns County Soil and Water Conservation District
110 Second Street S. Suite 128
Waite Park, MN 56387

Phone: (320) 345-6477

Email: dennis.fuchs@mn.nacdnet.net

Appropriation Language

\$440,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Stearns County Soil and Water Conservation District to reduce nitrate leaching on sandy soils of central Minnesota by developing water-efficient production methods, supply chains, and end-use markets for three perennial crops: Kernza, prairie species, and alfalfa. Net income from the sale of products or assets developed or acquired through this project may be reinvested as described in the work plan approved by the Legislative-Citizen Commission on Minnesota Resources according to Minnesota Statutes, section 116P.10.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Perennial cropping systems that include Kernza and alfalfa are effective in reducing nitrate leaching in sandy soils of Central Minnesota. Improved Kernza value chains for food, beverage and non-food have increased interest from farmers, food processors and consumers. The potential for Kernza production to provide future ecosystems services is great.

OVERALL PROJECT OUTCOME AND RESULTS

The City of Cold Spring in Central Minnesota has long struggled with increasing nitrate concentrations in its public water supply. Perennial cropping systems may reduce the amount of nitrate leached into groundwater. In partnership with the University of Minnesota Forever Green the project measured nitrate leaching under three perennial plant systems: 1) native prairie, 2) intermediate wheatgrass (Kernza), and alfalfa under irrigation and dryland plots. This research was conducted at the Rosholt Research Farm in Pope County (managed by the Pope Soil and Water Conservation District). The site has similar sandy soils as in the Cold Spring area. The native prairie planting had limited growth during study because of its slow growth and weed pressure. The perennial cropping systems that included Kernza and alfalfa were effective in reducing the nitrate concentrations in groundwater. Kernza was slightly more effective than alfalfa. Averaged across the growing season, the concentration of nitrate in the soil water measured by lysimeters was 0.64 mg/L, which is consider very low and like other reports below Kernza. It was also discovered that Kernza grain yields were highly affected by drought conditions in 2021, even under irrigation, significantly reducing yields. In partnership with the Agricultural Utilization Research Institute (AURI) value chains for Kernza were explored which will ultimately increase demand for production by farmers. Local breweries and bakeries developed products that provided valuable feedback for new product development. Field day attendance indicated that farmers were interested in growing more Kernza if a market exists. Also, consumers in attendance were interested in Kernza food and beverage products. In addition, both food and non-food value chains will need additional investment to fully develop the market. Kernza production in drinking water supply management areas could reduce nitrate leaching. This could save cities millions of dollars in water treatment costs.

PROJECT RESULTS USE AND DISSEMINATION

The SWCD's [final grant report](#) is posted online. The [full AURI report](#) is also available online. University of Minnesota will be preparing a peer-reviewed report to be submitted as a future addendum to this report. Several field days and outreach events were completed during the project period, information about which are included in the SWCD final report.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04m Setting Realistic Nitrate Reduction Goals in Southeast Minnesota - Research Project - \$350,000 TF (FY2018)

John Nieber
U of MN
1390 Eckles Ave.
St. Paul, MN 55108

Phone: (612) 625-6724
Email: nieber@umn.edu
Web: <https://bbe.umn.edu/directory/faculty/johnnieber>

Appropriation Language

\$350,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to develop advanced water-flow and age-dating tools to improve the ability of state agencies to assess how well nitrate reduction best management practices are working in southeastern Minnesota.

Sound bite of Project Outcomes and Results

The long travel time of nitrate in groundwater negatively impacts our ability to assess the effectiveness of best management practices to reduce the nitrate contamination of groundwater resources. This project developed field monitoring and modeling tools to quantify nitrate travel time and enhance the ability to assess BMP effectiveness.

Overall Project Outcome and Results

Nitrate contamination of groundwater resources results from land management practices that ineffectively control the balance of nitrogen in the soil. This inadequate control leads to excessive leaching of nitrate from the soil, eventually loading the groundwater aquifers underlying the managed area. Best Management Practices (BMPs) have been developed to reduce the leaching of nitrate from the soil profile, and this should then have a positive impact on the quality of water in the groundwater aquifers located in the area of BMP presence. The response of the nitrate concentration at a given location in an aquifer, say for instance at a private or municipal well, will be affected by the history of landuse activity in the landscape upgradient (upstream) of the location of concern. The history is important because of the lag time, that is, the travel time (on the order of years to centuries) required for contaminated water to flow in the groundwater from the point of contamination to the well. This lagging of the response of the nitrate concentration at the well confounds the interpretation of the causes for the nitrate found in the well, thereby making it difficult to determine whether BMPs implemented in upgradient fields are actually working effectively. This project involved the development of methodologies to quantify the lag time for groundwater to flow from a landscape point to a well. The methods developed involved using chemical tracers to quantify the age of groundwater collected at wells, and development of models that can be utilized to calculate lag times. With this information, and a history of landuse practices on the landscape it is then possible to evaluate the effectiveness of BMPs in the landscape. It is also possible to identify, with some degree of certainty, the source of nitrate that is contaminating a given well.

Project Results Use and Dissemination

The project involved an ongoing collaboration with Mr. Kevin Kuehner, director of the Field-to-Streams Partnership in Preston. A complex groundwater model we developed for Trout Brook is being shared with the Dakota County SWCD to assist with the assessment of BMPs for reducing nitrate concentrations in Trout Brook. A simplified model of groundwater flow and chemical transport was developed to facilitate relatively easy assessment of the effect of landuse practices, and will be available to consultants, agency personnel, and academic institutions. The project has resulted in the submission of follow-up research proposals to one federal agency and one non-profit institution.

Project Completed: 6/30/2022

Work Plan

Subd. 04n Mapping Unprofitable Cropland for Water and Wildlife - Research Project - \$100,000 TF (FY2018)

Jason Ulrich

Science Museum of Minnesota - St. Croix Research Station
16910 152nd St N
Marine on St Croix, MN 55047

Phone: (651) 433-5953

Email: julrich@smm.org

Web: <https://www.smm.org/scwrs>

Appropriation Language

\$100,000 the first year is from the trust fund to the Science Museum of Minnesota for the St. Croix Watershed Research Station to conduct the first statewide analysis that maps the extent of Minnesota's unprofitable cropland and estimates both the water-quality and habitat benefits of converting these lands to perennial crops and vegetation. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project mapped an estimated 550,000 acres of unprofitable cropland in southern Minnesota. It was then estimated that converting 20% of these acres could significantly improve stream health and wildlife habitat.

OVERALL PROJECT OUTCOME AND RESULTS

Despite investing millions of dollars on agricultural conservation, the health of southern Minnesota's streams and rivers has not improved demonstrably. At the same time, increases in agricultural cropland have resulted in dramatic declines in grassland habitat critical for migratory birds, butterflies, and pollinators. An approach for improving both stream health and wildlife habitat lies in replacing portions of southern Minnesota's agricultural land with prairie and wetlands. However, most cropland is profitable and thus too costly for a farmer to take out of production. But what about parts of crop fields that often too wet or too dry to turn a profit - could these be replaced with prairie or wetlands more economically? This project set out to answer the following questions: 1) How much corn and soybean cropland in southern Minnesota is unprofitable? 2) What are the environmental benefits of converting portions of this unprofitable cropland to prairie or wetlands? Our project used county agricultural

financial data and detailed soil maps to pinpoint an estimated 550,000 acres of unprofitable cropland in a 40-county region of southern Minnesota. Next, the project estimated the improvement to streams and wildlife habitat if the most unprofitable of these acres located next to streams (114,000 acres) were converted to prairie or wetlands. The results suggest that targeting unprofitable croplands in this way would significantly improve stream health and wildlife habitat in southern Minnesota and provide a good bang for the buck. The project outcomes are intended to be useful for the public and policymakers to understand the amount and distribution of unprofitable cropland in southern Minnesota and its great potential for improving environmental health in an economical way.

PROJECT RESULTS USE AND DISSEMINATION

The project content was presented at several Science Museum member events over Zoom. And in October 2022, the work will be presented at the MN Water Resources Conference, a premier venue for this type of research.

The results of this project including the GIS files and attached fact sheet will be linked from this Science Museum website when our new web portal is up and running fall of 2022. Interested visitors will be able to download the GIS files and conduct their own analyses based upon those in the study.

Announcements about these deliverables and about the key points and highlights of the project will be shared on the Science Museum's social media accounts in fall 2022.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04o Evaluating Locally Sourced Materials for Road Salt Reduction - Research Project - \$162,000 TF (FY2018)

Chanlan Chun

U of MN - Duluth NRRI
5013 Miller Trunk Hwy
Duluth, MN 55811

Phone: (218) 788-2613

Email: chun0157@d.umn.edu

Web: <https://scse.d.umn.edu/about/departments-and-programs/civil-engineering-department>

Appropriation Language

\$162,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to evaluate the effectiveness and benefits of using locally sourced wood chips, corncobs, and iron-bearing minerals as alternative abrasive materials to lower salt use for protecting Minnesota's water resources. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project evaluated local ecological abrasive materials for use as alternative materials to lower road

salt use in winter maintenance and consequent environmental impacts. The findings are useful for the development of the formulation and application practice for both water resource protection and safe winter roadway.

OVERALL PROJECT OUTCOME AND RESULTS

The use of chloride-based salt as a deicer for winter road maintenance has been a longstanding practice throughout the state of Minnesota and the country. However, once chloride enters the water, it is not naturally broken down, transformed, or removed from the environment, resulting in accumulation in the watershed and detrimental ecological and water quality impacts in freshwater systems. To protect freshwater resources and to prevent this issue from worsening with time, an alternative method for providing sustainable and effective winter road maintenance is needed. In some cold regions of Minnesota, sand is mixed with salt as an abrasive to provide additional traction to the roads; however, its effectiveness is not well established. This project investigated the potential of regionally available organic and inorganic industrial byproducts as alternatives to conventional sand and salts. Candidate materials include corn grit, timber waste, and taconite waste rocks local to Minnesota. Chemical and physical properties of the materials were characterized, including material elemental composition, morphology, particle size distribution, and specific gravity to establish a foundational understanding of the material. Skid resistance and deicing tests with environmental impact assessment were performed to evaluate traction effectiveness and material safety. The results showed potential for bio-based materials such as corn grit and bark mulch as a sorbent for salt brine deicer with less salt impact and for the waste iron-bearing minerals to be used as effective abrasives in the realm of winter road maintenance. The use of alternative materials for winter road maintenance show promise for lower environmental impact, lower/controlled chloride pollution, increased friction enhancement, and beneficial reuse of industry waste material. In addition, this work provided a streamlined method for evaluating potential abrasives/deicers which will be valuable for expediting future studies of alternative materials.

PROJECT RESULTS USE AND DISSEMINATION

The project findings have been disseminated via reports to LCCMR, master student's thesis, and presentations at regional conferences (Minnesota Water Resources Conference and UMD seminar series). The project findings were shared with the public through public outreach activities for 6th-12th graders and general audience: engineering discussion with middle school students of Arcadia Charter School, Northfield, MN and a video clip, [Safe Roads and Healthy Water](#) to present and discuss our project for achieving safe roads and healthy water using local materials for the [UMD's STEM Discovery Day](#).

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04p Minnesota Spring Inventory Final Phase - \$71,000 TF (FY2018)

Paul Putzier
MN DNR
Box 25, 500 Lafayette Rd N.
St. Paul, MN 55155

Phone: (651) 259-5692

Email: paul.putzier@state.mn.us

Web: https://www.dnr.state.mn.us/waters/groundwater_section/mapping/springs.html

Appropriation Language

\$71,000 the first year is from the trust fund to the commissioner of natural resources to complete the Minnesota Spring Inventory that identifies, catalogs, and assists resource managers in monitoring, assessing, and protecting important and threatened statewide water springs. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Springs are natural points of groundwater discharge that provide flow for trout streams and cool water fisheries, base flow during to streams, and unique ecological habitats. Management of this resource is only possible when we know their location. The MSI project located and makes available information on over 7,200 springs.

OVERALL PROJECT OUTCOME AND RESULTS

Springs are natural points of groundwater discharge that provide flow for trout streams and cool water fisheries, base flow during to streams, and unique ecological habitats. Management of this resource is only possible when we know their locations and characteristics. The primary objective of this project was to find unmapped springs, add the location of those new springs to the existing Minnesota Spring Inventory (MSI) and field verify and characterize as many currently mapped but unverified springs as possible.

For the project, DNR conducted field investigations of targeted parts of the state to find, characterize and map new springs locations. The existing MSI database also held ‘non-verified’ spring locations added to the database from old maps and studies and from the MSI Citizens App. DNR conducted ‘field verification’ by traveling to many of those features to confirm their existence and update the database. Approximately 350 spring locations were added to the MSI through the Citizen App.

The Covid-19 Pandemic and Minnesota’s Stay Safe at Home order limited MSI fieldwork for over twelve months of the two-year project. When restrictions were relaxed in 2021, fieldwork resumed for the MSI team and many springs and features were added to the database.

Because of this project (all phases), Minnesotans benefit by having easy access to approximately 7,200 features in the MSI including a combination of field verified springs, and many likely, but non-verified spring locations. The MSI project resulted in a 76% increase in mapped springs and increased from holding verified springs in 22 counties, primarily in the southeast, to verified springs located in 71 counties.

The DNR established special MSI accounts for MPCA and SWCD field staff from the Duluth/ Northern MN region and provide guidance documents and training, allowing them to add springs directly to the MSI using the Survey 123 application.

PROJECT RESULTS USE AND DISSEMINATION

DNR conducts dissemination through individual contacts, presentations and news releases. One example is online at [St. Croix 360](#). Another example came from an environmental consultant in a June 2021 email:

"Can (you) help assist with information gathering regarding seeps & springs in the St Paul area. I'm working with the Capitol Region Watershed District to identify springs within their boundary, and prioritize the springs in order of level of prevalence/risk to become a public comment or threat to infrastructure."

The spring data is accessible at [Minnesota Spring Inventory](#) and GIS files are at the [Minnesota Geospatial Commons](#), and at [Showcase](#).

Project Completed: 6/30/2021

[FINAL REPORT](#)

Subd. 04q Restoring Impaired Lakes through Citizen-Aided Carp Management - \$106,000 TF (FY2018)

Andrew Dickhart

Carver County Water Management Organization
600 E. 4th Street
Chaska, MN, 55318

Phone: (952) 361-1871

Email: adickhart@co.carver.mn.us

Web: <https://www.co.carver.mn.us/departments/public-services/planning-water-management/water-management>

Appropriation Language

\$106,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Carver County Water Management Organization to quantify water quality improvements and the cost-effectiveness of a new citizen-aided carp management method for restoring impaired lakes in Minnesota.

Project Completed: 6/30/2022

[FINAL REPORT](#)

Subd. 05 Technical Assistance, Outreach, and Environmental Education

Subd. 05a Expanding Camp Sunrise Environmental Program - \$237,000 TF (FY2020)

Lori Arnold

YouthCARE MN
2701 University Ave SE, Suite 205
Minneapolis, MN 55414

Phone: (612) 338-1233

Email: larnold@youthcaremn.org

Web: <http://www.youthcaremn.org/>

Appropriation Language

\$237,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with YouthCare Minnesota to expand camp opportunities to more school districts and implement improved hands-on environmental education programs for economically disadvantaged youth.

Note: Dollars returned

Project Completed: 6/30/2022

Subd. 05c Mississippi National River and Recreation Area Forest Restoration - \$199,000 TF (FY2020)

Mary Hammes

Mississippi Park Connection
111 Kellogg Blvd E, Suite 105
St. Paul, MN 55101

Phone: (651) 291-9119

Email: mhammes@parkconnection.org

Web: <https://parkconnection.org/>

Appropriation Language

\$199,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Mississippi Park Connection to work with Conservation Corps Minnesota, local communities, and volunteers to address the loss of ash trees to emerald ash borer by planting approximately 15,000 native trees and plants in affected areas in the Mississippi National River and Recreation Area.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Mississippi Park Connection and its partners planted 15,069 native trees and shrubs in the Mississippi National River and Recreation Area to address tree canopy loss due to Emerald Ash Borer. The project also established a Mississippi River Crew with the Conservation Corps of Minnesota and Iowa and engaged volunteers.

OVERALL PROJECT OUTCOME AND RESULTS

Emerald ash borer (EAB) is a small insect without natural predators that is killing up to 99% of all native ash trees in the Twin Cities Metropolitan Area. In parklands with large natural areas, dying ash trees are creating hazardous conditions for park visitors and creating a gap in the canopy as they die. These canopy gaps are negatively impacting wildlife habitat along the Mississippi River. This project aimed to identify areas where ash trees were being lost to Emerald Ash Borer and support overall forest ecosystem health by planting a diverse set of native trees and shrubs to support the ash-elm-mixed-hardwood ecotype within the Mississippi National River and Recreation Area. Major outcomes achieved during the project include:

1. 15,069 native trees and shrubs were planted in the ash-elm-mixed-hardwood forests of the Mississippi National River and Recreation Area (MNRRA) in order to address tree canopy loss due to Emerald Ash Borer.
2. Trees were protected from herbivory through the installation of tree tubes. Additional measures to support establishment, like watering and the removal of encroaching understory, were also performed.
3. We conducted 246 plant surveys throughout the grant period and worked in 52 different parks within MNRRA. Working in those parks, we consulted with the land managers to identify where EAB infestations had occurred and, throughout the course of the grant, monitor the progression of the infestations. Dead ash trees in areas of high habitat value were kept when possible for habitat and removed as necessary in order to create gaps in the canopy for future plantings. Hazardous ash trees were also removed at the request of land managers. Protocols for working in forested areas with high levels of canopy loss due to EAB are currently being developed as a direct result of working in these late-phase infested forests.

PROJECT RESULTS USE AND DISSEMINATION

The work received recognition in a [Star Tribune Article](#). We also talked about this work in Mississippi Park Connection's e-newsletters, which has 8,806 subscribers. We also celebrated this work in an Earth Day virtual event with over 70 registrants. Finally, we worked with thousands of volunteers who learned more about Emerald Ash Borer and forests and the support that LCCMR has provided to this project. This work is also highlighted on Mississippi Park Connection's [website](#). We created a [video](#) describing the work of the Mississippi River Crew. A document regarding natural resource professional safety working in EAB-affected forests is forthcoming.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 06 Aquatic and Terrestrial Invasive Species

Subd. 06b Oak Wilt Suppression at its Northern Edge - \$100,000 TF (FY2020)

Shannon Wettstein

Morrison Soil and Water Conservation District
16776 Heron Rd
Little Falls, MN 56345

Phone: (320) 631-3553

Email: shannon.wettstein@morrisonswcd.org

Web: <http://morrisonswcd.org/about-us>

Appropriation Language

\$100,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Morrison Soil and Water Conservation District to eradicate the northern-most occurrences of oak wilt in the state through mechanical means on select private properties to prevent oak wilt's spread to healthy state forest habitats.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Morrison SWCD partnered with DNR Forest Health Specialists and local DNR Foresters to suppress oak wilt at 18 sites within Morrison County through mechanical means. These sites are the northern-most occurrences of oak wilt in the state through on the edge of healthy state forest habitats.

OVERALL PROJECT OUTCOME AND RESULTS

Morrison SWCD partnered with DNR Forest Health Specialists and local DNR Foresters to suppress oak wilt at 18 sites within Morrison County. Control work was done by an experienced contractor using successful vibratory plow and tree destruction methods. Morrison County is at the leading edge of the known disease range in Minnesota. While the project was focused on private lands, the public good comes from controlling the spread to public forests of the state, and the continued habitat for turkey, grouse, deer and other wildlife.

The DNR Forest Health Specialist made numerous trips to the area to help train local resource professional staff on identification of oak wilt and confirm new spots and local DNR Foresters painted wilting trees throughout the season. At the time of grant execution, the number of known infection sites had jumped from ten to 65 triggering Morrison SWCD and DNR to prioritize work zones based on the proximity of the site to northern public forests. Highest priority sites were largely rural with large intact forests and lower priority sites were found near Little Falls, Minnesota in an actively developing residential area.

Landowners were approached by the SWCD to gain interest in oak wilt suppression activities on their properties. These property owners signed a Landowner Agreement that outlined program requirements, landowner and contractor responsibilities and timelines for treatment. The SWCD received overwhelming support from property owners, with 50 landowners signing on to be part of the program, and because of this, all the known oak wilt pockets in the high and highest priority zones were treated.

The SWCD and DNR continue to educate the public and work with landowners affected by oak wilt in the medium and low priority areas to guide them in properly addressing the disease on their properties until additional funding can be secured.

PROJECT RESULTS USE AND DISSEMINATION

The SWCD received overwhelming support from property owners, with 50 landowners signing on to be part of the program, and because of this, all the known oak wilt pockets in the high and highest priority zones were treated. The SWCD and DNR have both released articles to local newspapers, submitted articles for the Forest Health Unit newsletter and alerted landowners of the presence of Oak Wilt in Morrison County and grant opportunities through talk show programs on the local radio station. Both agencies have updated their websites to reflect current grant opportunities. Website addresses for both of these are located here: https://www.dnr.state.mn.us/treecare/forest_health/oakwilt/index.html ; <https://morrisonswcd.org/gallery/fy2019-projects-events/oak-wilt-main>. Both organizations will include this grant award and outcomes in their 2019 annual reports.

Informational packets were created to easily send in the mail or hand to interested landowners over the counter. These packets include a contractor list of certified arborists and experienced vibratory plow operators, handouts on how to identify oak wilt along with best management practices for suppressing oak wilt and links to additional resources and references. Landowners in the low and medium priority zones where oak wilt was not addressed with these funds were given or sent a packet and told they will be notified in the future if additional funds are secured. Morrison SWCD and DNR will continue to

provide technical support to these landowners so diseased pockets of oak are managed properly. The SWCD is also offering a 10% discount known affected property owners order trees through the office to help offset the cost of reforestation.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 07 Air Quality and Renewable Energy

Subd. 07a Development of Clean Energy Storage Systems for Farms - Research Project - \$650,000 TF (FY2020)

William Northrop
U of MN - WCROC
111 Church Street
Minneapolis, MN 55455

Phone: (612) 625 6854

Email: wnorthro@umn.edu

Appropriation Language

\$650,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center at Morris to develop and test novel clean energy storage systems for farms using wind-generated ammonia to displace fossil fuels and reduce greenhouse gas emissions. This appropriation is subject to Minnesota Statutes, section 116P.10.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 07b White Earth Nation Community Solar for Economic Resilience - \$500,000 TF (FY2020)

Nicole Saccoman
Rural Renewable Energy Alliance
3963 8th Street SW
Backus, MN 56435

Phone: (218) 947-3779

Email: Nicole@rreal.org

Web: <https://www.rreal.org/cs4ca>

Appropriation Language

\$500,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Rural Renewable Energy Alliance to install a 200-kW White Earth community-owned solar garden to reduce greenhouse gas emissions, increase economic development through environmental education and solar workforce training, and improve energy resilience.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

200 kWs of solar community gardens were installed on the White Earth tribal reservation. This project will greatly reduce greenhouse gas emissions for years to come, in addition to providing energy resilience to the White Earth community. Furthermore, this project has increased economic development through environmental education and solar workforce training.

OVERALL PROJECT OUTCOME AND RESULTS

Five 40 kW ground-mounted solar arrays have been completed, were commissioned, and are now operating at 100% at each of the five chosen sites. Those sites are DOVE Shelter, Head Start Daycare Center, Maadaazizi Workforce Center, Naytahwaush Complex, and the Tribal College; all are located within the White Earth reservation tribal community.

Eight interns, in two rounds of four, completed a 45-hour paid internship at a rate of \$15/hour. They each received a Minnesota Installers Certificate and a professional electronic instrument kit. Each student, as part of the 45 hours, spent 15 hours at the solar construction sites during installation. Rural Renewable Energy Alliance (RREAL) and the White Earth Tribal and Community College are expanding this program into a full Associate Degree program in 2022, including work experiences with Minnesota Power and several rural Habitat for Humanity affiliates.

PROJECT RESULTS USE AND DISSEMINATION

This project has directly led to a second year of Solar Tech Customized Education at the White Earth Tribal and Community College. It is also providing the tribal community with sustainable energy to promote energy independence and resiliency. RREAL is continuing to partner with the White Earth tribe to create long-lasting energy sustainability solutions. Please enjoy this video for further information on the collaboration between RREAL and the White Earth nation and how this project will continue to increase economic development and sustainability within the community.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 08 Methods to Protect or Restore Land, Water, and Habitat

Subd. 08c Sauk River Dam Removal and Rock Rapids Replacement - \$2,768,000 TF (FY2020)

Colleen Winter

City of Melrose
225 First St NE
Melrose, MN 56352

Phone: (320) 256-4278

Email: cwinter@cityofmelrose.com

Web: <https://www.cityofmelrose.com/>

Appropriation Language

\$2,768,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Melrose to remove an existing fixed-elevation dam, construct a rock arch rapids, and conduct in-stream and shoreline habitat restoration to improve water quality and native fish passage in the Sauk River. This project requires a match of at least \$1,400,000 that must be secured before trust fund money is spent. At least \$700,000 of this match must come from the city of Melrose.

City of Melrose expenses for the Sauk River dam removal and rock rapids replacement incurred before July 1, 2019, may be counted toward the match.

Note: Dollars returned

Project Completed: 06/30/2022

Subd. 09 Land Acquisition, Habitat, and Recreation

Subd. 09f Accessible Fishing Piers - \$320,000 TF (FY2020)

Nancy Stewart

MN DNR
500 Lafayette Rd
St. Paul, MN 55155

Phone: (651) 259-5616

Email: nancy.stewart@state.mn.us

Web: <https://www.dnr.state.mn.us/>

Appropriation Language

\$320,000 the first year is from the trust fund to the commissioner of natural resources to provide accessible fishing piers in locations that have a high potential to serve new angling communities, underserved populations, and anglers with physical disabilities. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Nine (9) new accessible fishing piers have been installed in various locations around the state to improve fishing opportunities for people of all ages and abilities. The DNR worked with multiple sponsors and donors who brought funding and enthusiasm to the projects.

OVERALL PROJECT OUTCOME AND RESULTS

Accessible fishing piers make fishing safe, easy, and fun for all ages especially children, elderly, disabled, veterans, families, small and large groups, and anyone who doesn't own a boat. Fishing piers provide the "classroom" to teach fishing skills and outdoor education classes. Data shows that 40% of people with fishing licenses do not own a boat (approximately 480,000 anglers). The demand for fishing piers is increasing as more people want to fish close to home and from a safe location. Each fishing pier is expected to last 20 to 25 years with proper maintenance. Below are the nine new fishing pier locations:

- Duck Lake, Blue Earth County (Duck Lake County Park)
- Lake Koronis in Stearns County, City of Paynesville (Veterans Park)
- St. James Lake in Watonwan County, City of St. James (St. James Lake Park)
- Maple Lake, Polk County (Maple Lake East Boat Launch)
- Bingham Lake, Cottonwood County, City of Bingham Lake (Bingham Lake Park)
- Black Oak Lake, Stearns County (Black Oak Lake Public Water Access)
- Hoot Lake, Otter Tail County, City of Fergus Falls (Godel Park)
- Lake Frances (Francis), Le Sueur County, City of Elysian (Lake Frances Public Water Access)

- St. Croix River, Chisago County, City of Taylors Falls (South Lions Park)

PROJECT RESULTS USE AND DISSEMINATION

DNR now has approximately [364 public fishing sites](#); with 282 on partner owned and operated lands, and 82 on state-owned land. Since 1984, the fishing pier program has relied on funds from competitive capital funding sources to grow the program and add new fishing piers (and shore fishing sites) such as Bonding, Legacy and now LCCMR. In a typical year each existing fishing pier is checked and repaired as needed. Summer storms and winter ice are the most common causes for damage. Piers past their useful life are prioritized for rehabilitation or replacement at a rate four to eight each year. The program is hugely successful because of the many partnerships with local units of governments.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 09g Mesabi Trail Extensions - \$3,000,000 TF (FY2020)

Bob Manzoline

St. Louis & Lake Counties Regional Railroad Authority
111 Station 44 Rd
Eveleth, MN 55734

Phone: (218) 744-2653

Email: bmanzoline@rrauth.com

Web: <https://www.mesabitail.com/>

Appropriation Language

\$3,000,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for environmental assessment, permitting, right-of-way easements or other acquisition as needed, and engineering for and construction of four trail segments beginning and ending at the following approximate locations: Darwin Meyers Wildlife Management Area to County Road 21, Embarrass to Kugler, County Road 128 to the Eagles Nest Town Hall, and Wolf Creek to the Highway 169 underpass.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project was an important part on nearing the completion of a planned 162 mile long paved bicycle trail stretching from Grand Rapids to Ely, MN. The ENRTF funding along with other funds allowed for the completion of four (4) segments of the Mesabi Trail which are: Darwin Meyers Wildlife Management Area to County Road 21 (approximately 2 miles), Embarrass to Kugler Township (approximately 9 miles), County Road 128 to Eagles Nest Town Hall (approximately 2 miles), and Wolf Creek to the Highway 169 underpass (approximately 3 miles).

OVERALL PROJECT OUTCOME AND RESULTS

For Segment 1: Darwin Meyers WMA to CR 21, we completed about 90% (approximately 1.5 miles) of the trail construction for this segment by June 30th, 2022. We will be using funds from our IRRRB grant to complete the remaining construction management and trail construction for this segment. Segment 2: Embarrass to Kugler, this segment is 100% completed, approximately 9 miles. Our engineering and construction costs were under our original engineering estimates and finished favorable compared to

our budget for this segment. Segment 3: CR 128 to Eagles Nest Townhall, this segment is 100% completed, approximately 2 miles. Our engineering and construction costs were under our original engineering estimates and finished favorable compared to our budget for this segment. Segment 4: Wolf Creek to Highway 169 Underpass, this segment is 100% completed, approximately 3 miles. Typical challenges arose from designing and building these paved bicycle trail segments, such as land formations, wetlands and mitigation, land acquisitions, and rising material costs. To complete these four (4) segments, each required environmental assessments and permitting, engineering plans, services, management, right-of-way acquisition and construction. These key segments allow connections to various communities from the Giants Ridge Golf and Ski Resort in Biwabik through Embarrass and Kugler Township; Eagles Nest Township, Bear Head State Park and the Wolf Creek area towards Ely.

PROJECT RESULTS USE AND DISSEMINATION

The Mesabi Trail news and updates are provided through a variety of media, marketing and publications. Web site is: Mesabitrail.com. The following are some of the groups & organizations that disseminate Mesabi Trail information and typically include updates of newly completed trail segments and activities:

- Club Mesabi (10,000 maps & web site: Mesabitrail.com)
- Iron Range Tourism (30,000 brochures & web site)
- MN Office of Tourism
- amperes radio
- Parks & Trails, Home & Away, other private magazines
- Over 250,000 trail users per year
- Great River Energy/Mesabi Trail annual tour
- Named by the Star Tribune as “Best of Minnesota” in year 2013
- Named by Bicycle Magazine as “top 10 in the country”
- Information distributed at over 70 locations including Chambers of Commerce, visitor centers, businesses
- MN DOT/Pedal MN bikeways map
- “Second best trail in Midwest USA” Dubuque Iowa, 2017

The Environmental and Natural Resources Trust Fund is acknowledged as a funder for the Mesabi Trail with recognition posted in each kiosk along the trail.

The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the ENRTF Acknowledgement Guidelines.

Project Completed: 06/30/2022

FINAL REPORT

Subd. 091 Vergas Long Lake Trail - \$290,000 TF (FY2020)

Julie Lammers

City of Vergas

PO Box 32

Vergas, MN 56587-0032

Phone: (218) 342-2091

Email: cityofvergas@arvig.net

Web: <https://www.cityofvergas.com/>

Appropriation Language

\$290,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Vergas to construct a bicycle and pedestrian bridge, trail, and floating boardwalk along Long Lake including shoreline restoration and stabilization with native plants. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 09m Glacial Edge Trail and Downtown Pedestrian Bridge - \$600,000 TF (FY2020)

Andrew Bremseth

City of Fergus Falls
112 Washington Avenue W
Fergus Falls, MN 56537

Phone: (218) 332-5403

Email: Andrew.Bremseth@ci.fergus-falls.mn.us

Web: <https://www.ci.fergus-falls.mn.us/>

Appropriation Language

\$600,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Fergus Falls to acquire easements for and construct a trail along the Otter Tail River in downtown Fergus Falls and a bicycle and pedestrian bridge crossing the river. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

On June 30, 2022, the City of Fergus Falls celebrated its 150th anniversary by unveiling a new segment of a shared use path enhancing the riverfront in downtown Fergus Falls.

OVERALL PROJECT OUTCOME AND RESULTS

This project, bolstered by the outcomes of a 2016 Downtown Riverfront Master Plan and colloquially referred to as Downtown Riverfront Improvements, has spanned multiple City Councils, elections, bonding bills, engineers, redesigns, and even a pandemic. Thanks to a shared vision and the strength of public-private partnerships, the City was able to unveil a segment of new shared use path and pedestrian improvements in downtown Fergus Falls at a community celebration on June 30, 2022.

The initial aims of the project included land acquisitions to complete two segments of new trail and a pedestrian bridge over the Otter Tail River. In 2020, land acquisition was removed to reflect an adjusted trail route. Due to impacts from COVID-19 and after additional engineering analysis, the project scope

was further reduced to reflect the community's ability to feasibly finance the intended project, focusing efforts on a first phase section of trail leading up to and crossing a pedestrian bridge. When it came time to finalize design and financing, resistance from the community (specifically and surprisingly to the proposed pedestrian bridge) further impacted project timeline and budget.

Consequently, the work completed by June 30, 2022 was a much reduced scope from the original work plan, but the project unveiled in celebration of the City's 150th anniversary remains impactful. Minnesotans benefit from the completion of a segment of trail that will connect to State and regional trails, the enhancement of a riverfront once flanked by crumbling parking lots and industrial sites, and the recreational and educational opportunities now available to local residents and visitors that increased access to pedestrian infrastructure and the river bring. The successful completion of pedestrian upgrades despite hurdles along the way strongly suggest that Minnesotans see the value in the natural beauty surrounding them and wish to preserve and enjoy that natural beauty.

PROJECT RESULTS USE AND DISSEMINATION

Project updates were shared periodically through a [project website run by Bolton & Menk](#). More consistently, information about this project has been disseminated in in-person updates to City Council and in an unveiling speech given by Mayor Ben Schierer on June 30.

Though not posted before June 30, the kiosk in the project area will include attribution to the ENTRF based on ENTRF acknowledgment requirements.

Project Completed: 06/30/2022

FINAL REPORT

Subd. 09o Restoring Five Sections of the Superior Hiking Trail - \$191,000 TF (FY2020)

Lisa Luokkala

Superior Hiking Trail Association
731 7th Avenue, Suite 2
Two Harbors, MN 55616

Phone: (218) 834-2700

Email: lluokkala@superiorhiking.org

Web: <https://superiorhiking.org/>

Appropriation Language

\$191,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Superior Hiking Trail Association to restore and repair the most damaged parts of five sections of the Superior Hiking Trail and restore an abandoned route to a natural footpath for hikers.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Superior Hiking Trail (SHT), which traverses the ridgeline of Minnesota's North Shore, was repaired in some its most damaged sections. A well maintained SHT keeps people on the trail and water off of it, the adjacent land and water are protected, and a human connection to nature is preserved.

OVERALL PROJECT OUTCOME AND RESULTS

The 310-mile Superior Hiking Trail (SHT), part of the larger North Country National Scenic Trail, is nationally recognized as a premier long trail in the United States. Almost the entire trail was built without application of modern trail-building standards. As a result, and due to the extreme popularity of the Trail, the SHT is in rough shape: decrepit built structures (boardwalks, bridges), severe erosion, and long stretches of muddy trail. With earlier assistance from LCCMR, we were able to complete multiple professional assessments of some of its most damaged sections, which came to known as “the Big Bad Five.”

Using the assessments as a framework to identify distinct projects within those five sections of trail, we worked in partnership with land managers/owners to determine the project scope and type of trail renewal application. We rebuilt, replaced or rerouted trail segments to eliminate around a dozen dangerously built structures (e.g., stairways, small bridges); repaired 1.5 miles of the most eroded or degraded segments.; and replaced or built 1,500 feet of boardwalk.

Ability to maintain the Trail at a level that meets or exceeds industry standards has long-lasting impacts on both the critical role the Trail plays to connecting people to nature and to stewarding the land and water through which the Trail passes. Every year, thousands of Minnesotans utilize the unique access the Superior Hiking Trail affords, allowing people to interact with public lands otherwise not available to them and leaving them with the tenants of land stewardship and conservation that carries on after they return home.

PROJECT RESULTS USE AND DISSEMINATION

The project results (construction) are very tangible and can be seen and experienced. The processes we developed in the implementation, such as the development of design plan sets and identifying alignments through particularly challenging terrain are well documented so they can be used internally and by fellow trail organizations as a resource. [Our Trail Maintenance Manual](#), which highlights many of the sustainable design and maintenance techniques used in our projects is available on our website for the public to access.

Project Completed: 06/30/2022

FINAL REPORT

Subd. 10 Administration and Contract Agreement Reimbursement

Subd. 10a Contract Agreement Reimbursement - \$135,000 TF (FY2020)

Katherine Sherman-Hoehn

MN DNR

500 Lafayette Road

St. Paul, MN 55155-4010

Phone: (651) 259-5533

Email: Katherine.Sherman-Hoehn@state.mn.us

Web: <https://www.dnr.state.mn.us/>

Appropriation Language

\$135,000 the first year is from the trust fund to the commissioner of natural resources, at the direction of the Legislative-Citizen Commission on Minnesota Resources, for expenses incurred for preparing and administering contracts for the agreements specified in this section. The commissioner must provide documentation to the Legislative-Citizen Commission on Minnesota Resources on the expenditure of these funds. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This appropriation was used to support the ENRTF contract management program, which ensured that ENRTF grantees expended grant funds in compliance with state law, session law, approved work plans, and Office of Grants Management grants policies.

OVERALL PROJECT OUTCOME AND RESULTS

This appropriation was used to support the ENRTF contract management program, which ensured that ENRTF grantees expended grant funds in compliance with state law, session law, approved work plans, and Office of Grants Management grants policies.

The DNR Grants Unit managed 78 grants active in FY 2020. In FY 2021, the Grants Unit managed 72 active grants.

Between 1/1/2020 when billing began and 12/31/2020 when it ended, the DNR Grants Unit:

- Made 136 reimbursements to grantees totaling \$7,395,420
- Finished executing 18 project amendments due to COVID extensions, including implementation of electronic signature process
- Monitored all grants in compliance with Office of Grants Management policies.
- Billed 1,257 hours at the FY 2020 professional services rate of \$66.00/hr and 754 at the FY2021 rate of \$69/hr

PROJECT RESULTS USE AND DISSEMINATION

Project personnel were in frequent contact with appropriation recipients and LCCMR staff. Information was disseminated through manuals, training sessions, orientations, meetings, memos, letters, emails, newsletter, and phone.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 10c Legislative Coordinating Commission (LCC) Administration - \$3,000 TF (FY2020)

Sally Olson

Legislative Coordinating Commission
100 Rev. Dr. Martin Luther King Jr. Blvd.
Room 72 State Office Bldg
St. Paul, MN 55155

Phone: (651) 296-9002
Email: Sally.Olson@lcc.mn.gov

Appropriation Language

\$3,000 the first year is from the trust fund to the Legislative Coordinating Commission for the website required in Minnesota Statutes, section 3.303, subdivision 10.

Project Completed: 06/30/2022

Subd. 11 Wastewater Treatment Recommendations

Subd. 11a Water Infrastructure Loans - \$0 TF (FY2020)

Jeff Freeman
Public Facilities Authority
322 Minnesota Street, Suite W820
St. Paul, MN 55101-1378

Phone: (651) 259-7465
Email: jeff.freeman@state.mn.us
Web: <https://mn.gov/deed/pfa/>

Appropriation Language

Up to \$5,000,000 of the money in the trust fund is available to the State Board of Investment to invest in loans through the Public Facilities Authority's clean water revolving fund under Minnesota Statutes, section 446A.07. Notwithstanding Minnesota Statutes, section 446A.07, repayments of principal and interest and any investment income must be credited to the trust fund and are available for reinvestment in the clean water revolving fund.

Project Completed: 06/30/2022

Subd. 11b Optimization Local Mechanical and Pond Wastewater-Treatment Plants - \$500,000 TF (FY2020)

Joel Peck
Minnesota Pollution Control Agency
520 Lafayette Rd. N.
St. Paul, MN, 55110

Phone: (651) 757-2202
Email: joel.peck@state.mn.us
Web: <https://www.pca.state.mn.us/>

Appropriation Language

\$500,000 the first year is from the trust fund to the commissioner of the Pollution Control Agency for the pilot program created under Laws 2018, chapter 214, article 4, section 2, subdivision 4, paragraph (a). This appropriation is available until June 30, 2021, by which time projects must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Wastewater treatment systems are critical infrastructure to manage waste effluent within hundreds of communities throughout Minnesota. Optimization means getting better results through existing infrastructure. This project determined that both mechanical and pond wastewater treatment systems can be optimized, and new effluent limits met, without adding substantial new infrastructure.

OVERALL PROJECT OUTCOME AND RESULTS

Achieving better nutrient treatment in wastewater treatment facilities serves to reduce the likelihood of algal blooms in Minnesota's water bodies resulting in cleaner lakes and rivers.

This project found that Minnesota's mechanical wastewater treatment plants can achieve better biological nutrient removal (BNR) through low-cost operational changes. These improvements were modeled using the Activated Sludge SIMulation Model (ASIM) in order to determine the specific plant operational parameters required to achieve BNR. On average, mechanical plants in this pilot were modeled to have average nitrogen reduction of 14.14 mg/L, average phosphorus reduction of 1.84 mg/L (most sites already treat phosphorus chemically to 1 mg/L) and chemical reductions of 886 lb chemical/Million Gallons (MGal) flow.

Wastewater ponds can achieve much better nutrient treatment by utilizing the 'Steady-State Primary' strategy developed during this project. This strategy involves holding the first pond at six feet, or the maximum depth permitted) with a slide gate. Raw influent continues flowing into pond 1, while treated effluent from pond 1 is used to fill pond 2. Meanwhile, pond 3 is also held full. This strategy maximizes treatment time and drastically improves nutrient treatment quality. The two developed case studies showcase a 69% reduction in phosphorus and 43% reduction in nitrogen when compared to the prior year's effluent. Secondary recommendations to wastewater ponds is to reduce inflow and infiltration, reduce fecal loading from waterfowl, and to encourage the growth of aquatic plants, with a specific emphasis on the growth of coontail.

By quantifying the role that optimization has in effective wastewater treatment, Minnesota's lakes and streams can meet standards in a more cost effective means.

PROJECT RESULTS USE AND DISSEMINATION

The project and its results have been presented in 17 different events and conferences by members of this team, including Minnesota Rural Water Association's annual conference, Minnesota Pollution Control Agency's annual conference, the Conference on the Environment, and many others. However, only one mechanical treatment plant has elected to move ahead with a pilot study, and one additional has expressed interest in doing so in the near future. The team has heard from staff and consultants of participating facilities that without a nitrogen standard as a driver, they feel little urgency to adopt optimization recommendations. Other facilities are meeting phosphorous limits under current flow, but would face difficulty at increased flow. Additionally, BNR design and operation is not a common treatment system in our Minnesota climate, and there may be some trepidation to moving toward that form of treatment until other facilities lead the way.

We have seen eight pond systems adopt the steady-state-primary flow regime in their operations, with more hoping to do so in the near future. Those that have done so already have reported roughly 50 percent reduction in nutrient discharge. The flow regime still needs additional validation. But, more discharge events will add more confidence with additional datasets from daily monitoring reports. Better flow management through infrastructure maintenance – making sure the control structures function as designed – is going to continue to be an area of importance in order to prevent short circuiting of the treatment in isolated pond cells.

The final report, the final work product of operator field guides for mechanical and pond treatment facilities, case studies of participating facilities, and additional findings, can all be found here, at the [Minnesota Technical Assistance Program's wastewater webpages](#).

Project Completed: 06/30/2021

FINAL REPORT

**2. M.L. 2018 Projects Completed
January 15, 2021 – January 15, 2023**

MN Laws 2018, Chapter 214, Article 4, Section 2

M.L. 2018 Projects

[MN Laws 2018, Chapter 214](#), Article 4, Section 2 (beginning July 1, 2018)

Visit [the LCCMR website](#) for the most up-to-date project information and reports

Subd. 03 Foundational Natural Resource Data and Information

Subd. 03b Providing Critical Water-Quality Information for Lake Management - \$250,000 TF

Jeffrey Peterson

U of MN
1985 Buford Ave, 173 McNeal Hall
St. Paul, MN 55108

Phone: (612) 624-9282

Email: impeter@umn.edu

Web: <https://www.wrc.umn.edu/>

Appropriation Language

\$250,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop a semiautomated system to acquire, process, and deliver new satellite-derived water-quality data in near real time on water clarity, algae, and turbidity for Minnesota lakes. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project created an automated system, which is capable of delivering satellite derived near real-time data and maps of key water quality measures (chlorophyll, clarity, CDOM), and updated the [Minnesota LakeBrowser](#) with new data and capabilities to visualize the water quality of all Minnesota lakes to improve data-driven resource management.

OVERALL PROJECT OUTCOME AND RESULTS

Using satellite imagery, we have been assessing lake water quality in Minnesota for over 20 years. For early assessments, we used analyst directed image processing techniques using remote sensing software and empirically calibrated each satellite overpass with in situ water clarity data. These assessments were at around five year intervals due to the effort required and availability of clear satellite imagery. Recent advances in satellite technology (improved spectral, spatial, radiometric and temporal resolution) and atmospheric correction, along with cloud and supercomputing capabilities have enabled the use of satellite data for automated regional scale measurements of water resource characteristics. These new capabilities provide opportunities to improve lake and fisheries management by measuring more variables (chlorophyll, colored dissolved organic matter (CDOM) and total suspended matter, the main determinants of water clarity) more often.

To utilize these capabilities this project developed field-validated methods and implemented them in an automated water quality monitoring system on University supercomputers. The system acquires satellite imagery, removes clouds, cloud shadows, haze, smoke, and land, and applies water quality models to deliver satellite-derived water quality products. Using this system we created statewide

monthly open water (May through October) pixel level mosaics and lake level data for each clear image occurrence. The lake level (2017-2020) data included 603,678 lake measurements of chlorophyll, clarity and CDOM (1,811,034 total) that were compiled into a database that was used to calculate water quality variables for different timeframes (e.g. monthly, summer (June-Sept)) and linked to a lake polygon layer that was used for geospatial analysis and included in a web map interface. The [Minnesota LakeBrowser](#) was updated with monthly chlorophyll, clarity and CDOM data from 2017 to 2020 and new capabilities for citizens, resource managers and researcher to easily access the data for specific lakes and regions.

PROJECT RESULTS USE AND DISSEMINATION

Communication of project results used a range of outlets. The primary mode of dissemination is the update and expanded [Minnesota LakeBrowser](#). This website provides content for diverse users including citizen scientists, lake users, homeowners, classrooms, natural resource managers, researchers at agencies and academic institutions. The updates improved search and allow visualization of long term (1975-2020) and seasonal (May-October) trends for individual lakes in graphs, and for individual lakes or regions in pixel or lake level maps. Results were also disseminated through social media and in presentations made at conferences and state agencies and will be disseminated in peer reviewed literature.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 03c Minnesota Biodiversity Atlas - Phase 2 - \$350,000 TF

George Weiblen

U of MN - Bell Museum of Natural History
10 Church St SE
Minneapolis, MN 55455

Phone: (612) 624-3461

Email: gweiblen@umn.edu

Web: www.bellmuseum.umn.edu

Appropriation Language

\$350,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to expand the biodiversity atlas project by adding more than 800,000 records and images of Minnesota wildlife, plants, and fungi, including observations from state agencies and other museum collections, to enhance research, guide field surveys, and inform conservation planning. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Minnesota Biodiversity Atlas provides online access to 150 years' of natural history information by integrating and disseminating data from state agencies, museums, colleges, and universities. It enables the general public, natural resource managers, educators' and researchers to investigate past and present biodiversity patterns and make predictions about future directions.

OVERALL PROJECT OUTCOME AND RESULTS

This project expanded an online natural resource database situated at the University of Minnesota's Bell Museum to include data from multiple state agencies and museum collections. Extensive records of Minnesota biodiversity, past and present, are the product of ongoing biological surveys by agencies and organizations beginning with the Public Land Survey in 1848. As the official state museum of natural history, the Bell Museum is responsible for preserving and making available records of Minnesota plant and animal life. These records are the bellwether of informed responses to environmental change but literally millions of data points remain scattered among state agencies, museum collections and academic institutions.

The [Minnesota Biodiversity Atlas](#) serves to integrate and disseminate biodiversity data online. This second phase II of this project increased the size of the Atlas from 640,000 to 1,585,000 records of mammals, birds, fish, amphibians, reptiles, crustaceans, invertebrates, plants, and fungi. Additions included expert observations from the Minnesota Department of Natural Resources and the Minnesota Pollution Control Agency and also specimen records from the University of Minnesota Duluth, the Science Museum of Minnesota, the College of St. Benedict's/St. John's University, and Minnesota State University, Mankato.

Understanding biodiversity change in Minnesota and adapting to it are essential for cultural, economic, and environmental health. The Minnesota Biodiversity Atlas provides the historical baseline against which contemporary observations are compared to manage our natural heritage today and into the future. The Atlas is used by natural resource professionals, educators, and the public for species identification, distribution mapping, habitat assessment, restoration planning, management decision making, and learning. During the project, the Atlas grew to 500,000 digital images and 1.4 million mapped records. Software development needs for a mobile phone-friendly version of the Atlas were also identified.

PROJECT RESULTS USE AND DISSEMINATION

Online retrieval of data from the Minnesota Biodiversity Atlas grew from 76,000 page views in 2018 to 307,000 in 2021. Visitors to the Bell Museum also learn about the Biodiversity Atlas in the Minnesota Journeys gallery and it featured in a traveling exhibit that received over 70,000 in-person visitors. Two training workshops in using the Atlas were offered to over 30 natural resource professionals from across the state. In local media, it was twice featured on the "Grow with KARE" segment on channel 11 and in the Minnesota Daily.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03d Peatland Forest Management - \$600,000 TF

Marcella Windmuller-Campione

U of MN

1530 Cleveland Ave N, 115 Green Hall
St. Paul, MN 55108

Phone: (847) 772-5458

Email: mwind@umn.edu

Web: <https://www.forestry.umn.edu/marcella-windmuller-campione>

Appropriation Language

\$600,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to identify management actions to maximize benefits to wildlife, water quality, timber production, and native plant communities in peatland forests. This appropriation is available until June 30, 2022, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project monitored 48 peatland sites for four years providing critical new information on hydrology during wet and dry years, boreal chickadee breeding habitats (some of the first data of its kind), and plant diversity. Data show regeneration harvests do not significantly impact the water table and vegetation responds quickly.

OVERALL PROJECT OUTCOME AND RESULTS

Peatlands provide critical ecosystem services for Minnesotans, which include helping to maintain clean drinking water, providing important forest products, serving as critical habitat for many wildlife species including the boreal chickadee, and storing huge amounts of carbon. However, these are very understudied systems and climate change and other forest health threats are impacting peatland forests. Over a four year period, we've monitored 48 sites that span four different age classes and three different forest cover types (eastern larch, productive black spruce, and stagnant black spruce) to understand how vegetation, hydrology, soils, and wildlife species interact within peatland forest communities. Over the course of the 48 years, we have measured thousands of trees and hundreds of different plant species to gain a fuller picture of plant species diversity and growth within peatland forest communities. We have some of the most robust data on boreal chickadee habitat use and early survival, which is critical for this species of great conservation need in Minnesota. Finally, we have hundreds of data points over multiple years on the daily hydrology within these systems to understand how water levels change over the growing season. All of this is critical base line data that can help inform management practices within peatland forest communities. Results have been shared locally, regionally, and nationally through presentations and webinars, which include the basic data and sharing how to gather collectively across multiple disciplines to inform holistic management practices within forest ecosystems. Our results show that peatlands are not negatively impacted by harvesting in the vegetation and hydrology. Additional work is needed to consider how different harvest strategies may influence wildlife use within peatland forest ecosystems.

PROJECT RESULTS USE AND DISSEMINATION

We are currently working on final edits and submission for two peer reviewed papers with an additional two papers in progress that will continue outside of the granting program. Results have been shared through multiple forms including local news stories, including [Scientists hang 500 birdhouses in Sax-Zim Bog to study boreal chickadees](#), presentations to forest managers at the [Research Review](#) hosted by the Sustainable Forest Education Cooperative, to a special symposium on [wet forests](#) which brought together researchers and managers to discuss opportunities and challenges within peatland forest communities.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03e Assessing Natural Resource Benefits Provided by Lichens and Mosses - Research Project - \$213,000 TF

Daniel Stanton
U of MN
1479 Gortner Ave, 140 Gortner Labs
St. Paul, MN 55108

Phone: (651) 494-7625
Email: stan0477@umn.edu

Appropriation Language

\$213,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to survey, map, and analyze mosses and lichens across the state, including their moisture-retention capacity, effects on hydrology, and ability to filter airborne pollutants. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

We documented the potential impact of moss and lichen on the flow of water and pollutants through Minnesota forests. This impact varies across the state depending on the forest type but can reach more than 15% of each rain event. Pollutant filtering effects are smaller but not unimportant.

OVERALL PROJECT OUTCOME AND RESULTS

Moss and lichen are common in forests, and yet they are often overlooked. But this does not mean unimportant: they retain water and heavy metals, and so a mossy forest may function quite differently from a barren one. This project aimed to quantify how much moss and lichen is in Minnesota forests and to estimate their impact on water flows and pollutant retention.

To reflect the diversity of Minnesota's landscape, we established 83 plots in 30 counties across the state to provide detailed and region-specific coverage of all of the major forest types recognized by the DNR. We recorded which species were present, their abundance (on forest floor, tree trunks and fallen branches), and collected the most abundant ones for lab analyses. 1650 unique specimens were collected.

The amounts vary greatly across the state, from less than one pound per acre to over 1,500 pounds per acre. These translate into sometimes considerable water storage capacity. With respect to heavy metals, contents were often quite low, at fractions of a pound per acre. We will follow up with future work on urban lichens to determine whether this is due to the lack of pollutants in forest sites. By combining our results with existing maps of forest coverage, we've been able to map these contributions across the state.

Another objective of the work aimed to test these estimates with experiments of how much water and elements are retained in the lab and field. Due to delays, these experiments were only installed in Spring 2022, and their continued monitoring and analysis will be funded from other sources.

Overall, our findings draw needed attention to an overlooked component of our forests, both in terms of diversity and impact on water cycles.

PROJECT RESULTS USE AND DISSEMINATION

The activities and findings in this project have been shared with the general public through a number of venues, including public presentations through Minnesota Master Naturalists, Minnesota Mycological Society, and the Bell Museum of Natural History; workshops attended by 30-50 people each at Minnesota Naturalists Association Annual Meeting (2019) and Cedar Creek Ecosystem Reserve (2019, 2022-115 participants!); a booth in the University of Minnesota pavilion at the MN State Fair and several other events. Scientific dissemination has so far included an [undergraduate-led peer-reviewed publication](#) and oral presentations at three international conferences. Further scientific publications are planned for late 2022.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03g Conserving Minnesota's Forest Birds of Management Concern - Research Project - \$500,000 TF

Alexis Grinde

U of MN - Duluth NRRI
5013 Miller Trunk Hwy
Duluth, MN 55811

Phone: (320) 496-0016

Email: agrinde@d.umn.edu

Appropriation Language

\$500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to identify forest-management actions and guidelines to conserve birds in Minnesota's forests. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Golden-winged Warbler, Veery, and American Woodcock are species of conservation concern in Minnesota and have had significant population declines throughout their breeding ranges. We documented nest success and used radiotelemetry to study juvenile survival to identify habitat characteristics and management actions that maximize productivity and inform conservation efforts.

OVERALL PROJECT OUTCOME AND RESULTS

Minnesota's forests provide critical breeding habitat for hundreds of resident and migrating bird species. Current land use practices and future modifications to Minnesota's forests are likely to substantially transform native forest bird communities. Golden-winged Warbler, Veery, and American Woodcock are species of conservation concern in Minnesota and have had significant population declines throughout their breeding ranges. For breeding birds, conservation efforts are most effective when management plans include recommendations aimed at maximizing breeding season (nesting to post-fledgling) productivity. However, the period of time directly after young birds leave the nest and

before they disperse and/or migrate (i.e., the post-fledging period), remains an understudied life stage for most bird species. To address this knowledge gap, we documented nest success and used radiotelemetry to study juvenile survival and habitat use for Golden-winged Warbler, Veery, and American Woodcock in managed forests. Our results showed that nest success (one or more birds fledged per brood) was 47% for Golden-winged Warblers (n= 51), 39% for Veery (n= 43), and 67% for American Woodcock (n= 13). Documented nest failure for all species was due to predation and weather events. A total of 72 Golden-winged Warbler fledglings were tagged with a survival rate of 39%. Juvenile survival was highest for Veery fledglings (n= 35) at 83%. A total of 31 American Woodcock hatchlings were tagged during the study with a survival rate of 71%. Over 85% of mortality events occurred when birds were less than seven days post-fledge, indicating this as a high-risk time period for these species. Vegetation surveys were completed at all locations where birds were detected using handheld telemetry (Golden-winged Warblers (n= 620), Veery (n= 384), and American Woodcock (n= 281)). These data are being used to provide breeding cycle habitat recommendations for managing forested landscapes to maximize productivity and prioritize conservation efforts.

PROJECT RESULTS USE AND DISSEMINATION

The preliminary results of the research were presented at 13 conferences during the course of project; the study was featured on MPR; and four articles have been written about different aspects of the study. Data from this research was incorporated into a fact sheet [“Managing for Birds of Conservation Interest in the Great Lakes Region”](#), which features habitat and management recommendations for Golden-winged Warbler. Three peer-reviewed publications are expected to be published in 2023. The final results will be incorporated into the Golden-winged Warbler habitat management recommendations.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 03h Mapping Avian Movement in Minnesota - Research Project - \$200,000 TF

Alexis Grinde

U of MN - Duluth NRRI
5013 Miller Trunk Hwy
Duluth, MN 55811

Phone: (218) 788-2747

Email: agrinde@d.umn.edu

Web: <http://www.nrri.umn.edu>

Appropriation Language

\$200,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to pilot the establishment of a network of automated radio-telemetry stations to monitor bird migration and local movements and to develop strategic plans for using the infrastructure long term to monitor animal movement for conservation. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

We used automated radio telemetry to understand habitat needs of Minnesota's birds. Specifically, we tracked birds across large and local-scales to document breeding, migratory and winter movements. Automated radio telemetry systems are useful for studying animal movements and can help to increase public awareness and impact for conservation efforts.

OVERALL PROJECT OUTCOME AND RESULTS

We explored the use of automated radio telemetry for tracking Minnesota's birds. We documented large-scale movements along the north shore of Lake Superior with Blue Jays and Northern Saw-whet Owls, colonial waterbird behavior on Interstate Island with Common Terns, local-scale migratory stopover in the St. Louis River Estuary with Rusty Blackbirds, and winter activity levels and movements in Hartley Park with Black-capped Chickadees. Each of these studies provided us with a greater understanding of the flexibility and adaptability of automated radio telemetry technology to answer a range of questions in different situations and seasons. Overall, we found the use of this technology to document small-scale movements of Rusty Blackbirds, Black-capped Chickadees, and Common Tern to be the most valuable and suggest it as a relatively low-cost way to study local movements while potentially enhancing migration studies simultaneously. For example, using an automated telemetry station at Interstate Island allowed us to obtain additional behavioral information on breeding Common Terns before the birds left and interacted with any foreign automated radio telemetry towers registered on the Motus system. We suggest researchers that are deploying VHF tags for the purposes of long-range migratory studies strongly consider deploying automated telemetry stations like those we developed for this project in strategic locations nearby tagging sites. In this way, researchers will be able to obtain potentially large amounts of local-scale data that can then be used to inform and enhance any large-scale detections after a bird migrates from the trapping site. Bird tracking research has broad public appeal, and stories of bird migrations provide an effective way to engage non-scientists and even non-birders in understanding the many threats small migratory landbirds face.

PROJECT RESULTS USE AND DISSEMINATION

The preliminary results of the research were presented at eight conferences during the course of project and the study was featured on MPR in 2019. Two peer-reviewed publications are expected to be published in 2022, one focusing on Common Tern and other on Rusty Blackbirds. We set up an additional Motus station at Sax-Zim Bog in 2020 to help facilitate research in this important area of the state. We established a [website](#) for the citizen science portion of the Black-capped Chickadee study in Hartley Park. A full report for this study is available on the Natural Resources Research Institute [website](#).

Project Completed: 6/30/2021

FINAL REPORT

Subd. 03j Develop Sonar Data Mapping on Three Rivers to Assess Suitability for Native Mussel Habitat - Research Project - \$200,000 TF

Nancy Duncan

National Park Service
111 E Kellogg Blvd, Ste 105
St. Paul, MN 55101

Phone: (651) 293-8434

Email: nancy_duncan@nps.gov

Web: <https://www.nps.gov/miss/index.htm>

Appropriation Language

\$200,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the National Park Service to create high-resolution sonar data maps to identify critical native mussel habitat for the designated Lower St. Croix National Scenic Riverway and the Mississippi National River and Recreation Area including part of the Minnesota River.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Baseline information in the form of bathymetry and imagery were developed for the National Park Service for native mussel habitat suitability. These data have the analytic capabilities to be viewed and modeled in a digital environment to help understand mussel distribution, define preferred habitat parameters, and identify key habitat locations for restoring imperiled mussels.

OVERALL PROJECT OUTCOME AND RESULTS

The U. S. Geological Survey (USGS) collected depth information and sidescan imagery for areas of the National Park Service (NPS) Mississippi National River and Recreation Area (MISS) and the St. Croix National Scenic Riverway (SACN). For known locations of preferred mussel habitat, additional collection efforts of river flow velocities and underwater video of bed composition were collected. Prior to this project, MISS had no accessible bathymetry data above Pool 1, and SACN did not have any accessible bathymetry (other than a small area near Prescott, Wisconsin). The LCCMR ENRTF provided the opportunity to acquire bathymetry data where needed and make this information available to NPS resource management to help aid decision-making for the conservation of native mussels. Goals for this project were to collect high-resolution sonar data of three rivers where none previously existed. The data is delivered in digital format for modeling hydraulic variables related to native mussel habitat suitability. The USGS provided usable information in the form of bathymetry and topography (hillshades and sidescan imagery) for areas of full collection, and habitat measures of flow velocities and bed characterization for priority areas. Initially implemented as a two-year project, data collection was planned for each park in consecutive years. Due to the pandemic, some data collection was delayed a year. Bathymetric surveys for the lower SACN consisted of approximately 1,775 hectares (4,385 acres), and approximately 1,358 hectares (3,335 acres) were collected for MISS. Outcomes consisted of high-resolution bathymetry in the form of 0.5-meter digital elevation models, 3-D hillshade representations of the surface (using patterns of light and shadow), and sidescan images mosaics — which provide an underwater view of geomorphic features. Flow velocities and bed composition combined with bathymetry can be used to locate areas with similar features as the NPS priority areas. In order to provide complete coverage for MISS, the U.S. Corps of Engineers (USACE) main channel data were used for Pools 1, 2, and 3. The resulting merged bathymetry were generated at a lower resolution (5 meters) due to USACE collection parameters. This project is significant because it provides bathymetry where none previously existed for Minnesotans, and it provides valuable information to the NPS for imperiled mussel habitat modeling by locating other suitable areas for conservation efforts. Natural resource management and policy makers face an increasing number of environmental issues. These data combined with other river conditions can be used to help inform decision-making for aquatic invasive species, agricultural practices, riverfront development, erosion, sedimentation, and climate change.

PROJECT RESULTS USE AND DISSEMINATION

Dissemination included a formal USGS review for data and metadata, prior to release on the [USGS data](https://www.usgs.gov)

repository. Datasets and metadata for the [St. Croix National Scenic Riverway](#) and the [Mississippi National River and Recreational Area](#) can be found online. This project was posted as a resource for current USGS projects at [Develop Sonar Data Mapping on Three Rivers to Assess Suitability for Native Mussel Habitat \(usgs.gov\)](#).

The information resulting from this project is currently being incorporated into a Freshwater Mussel Database (NPS Focused Condition Assessment) for MISS and SACN, which will further be linked to a Freshwater Mussel Decision Support System (USGS Natural Resource Preservation Program) for resource management. Furthermore, the NPS and USGS partnership plan to pursue additional funding for MISS to map untapped information that can be derived from the sonar data; and to collect additional bathymetry and flow data where none still exists on SACN.

Project Completed: 6/30/2021

[FINAL REPORT](#)

Subd. 03k Conserving Minnesota's Nine Species of Freshwater Turtles - Research Project - \$300,000 TF

Seth Stapleton
Minnesota Zoological Garden
13000 Zoo Blvd
Apple Valley, MN 55124

Phone: (952) 431-9443
Email: seth.stapleton@state.mn.us
Web: www.mnzoo.org

Appropriation Language

\$300,000 the second year is from the trust fund to the Minnesota Zoological Garden to improve the long-term viability of Minnesota's imperiled turtle populations by researching threats, identifying mitigation strategies, implementing mechanisms to reduce threats and mortality, and creating related outreach and educational materials. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Minnesota Zoo conducted research and implemented conservation actions including nest site protection and head-starting to bolster wood turtle populations. We studied methods to mitigate road mortality of turtles, with results suggesting that simple tube barriers may be effective. Our outreach efforts raised awareness and encouraged action to benefit conservation.

OVERALL PROJECT OUTCOME AND RESULTS

Native turtles are a key component of diverse, healthy, and resilient aquatic ecosystems, inspiring connections to nature for children and adults alike. However, populations of turtles in Minnesota face numerous threats, including habitat loss and degradation, high predation of incubating nests, and mortality on roadways. With this project, the Minnesota Zoo sought to improve the conservation of turtles by 1) collecting data to quantify two key threats – road mortality and nest predation – and

implement and evaluate mechanisms to mitigate these threats; and 2) building public awareness by developing educational and outreach materials for use during on- and off-site programming.

We outfitted imperiled wood turtles with radio and GPS transmitters, improving our understanding of their habitat needs and allowing us to identify and protect nesting sites. We reared hatchling wood turtles in captivity for their first year of life to improve their chances of survival in the wild and bolster depleted populations while other threats are addressed. To date, we have successfully released 68 one-year-old wood turtles back to the wild.

We also investigated strategies to mitigate mortality of turtles on Minnesota's roadways via cost-effective mechanisms including wildlife warning signs and small barriers. Although warning signs did not significantly reduce turtle mortality, corrugated pipe barriers were promising and yielded a decline in mortality of ~50%.

Finally, a variety of materials, including interpretive signage, a 3-dimensional snapping turtle model, and a children's book, were created to support educational and outreach programming and inspire public action to benefit the conservation of turtles. Healthy populations of turtles are an integral component of aquatic systems, and we anticipate that our results will inform effective management strategies that can benefit conservation at sites state-wide.

PROJECT RESULTS USE AND DISSEMINATION

Sharing information about the importance of turtles and their conservation was a key objective of this project. The Minnesota Zoo used a variety of platforms to disseminate significant findings and engage the general public in the conservation of Minnesota's aquatic resources, ranging from informal talks, public lectures and tabling events to media spotlights and distributing content on our social media channels. Media highlights include features on PBS's Prairie Sportsman, Kare 11's Minnesota Bound, a Minnesota Lottery commercial, and a variety of other print and television media outlets. This professionally produced [video](#) highlights the ecology and conservation of turtles in Minnesota.

Project Completed: 6/30/2022

FINAL REPORT

[Reduce Vehicle-Animal Collisions with Installation of Small Animal Exclusion Fencing - 45 pgs](#)

[Poster - Mitigating Road Mortality](#)

[Poster - Building Public Awareness](#)

[Poster - Tracking Imperiled Turtles](#)

Subd. 04 Water Resources

Subd. 04a Pilot Program to Optimize Local Mechanical and Pond Wastewater-Treatment Plants - \$700,000 TF

Joel Peck

Minnesota Pollution Control Agency
520 Lafayette Rd N
St. Paul, MN 55155

Phone: (651) 757-2202

Email: joel.peck@state.mn.us
Web: <https://pca.state.mn.us>

Appropriation Language

\$89,000 the first year and \$611,000 the second year are from the trust fund to the commissioner of the Minnesota Pollution Control Agency, in partnership with the Minnesota Rural Water Association and the University of Minnesota's Technical Assistance Program, to implement a pilot program to optimize existing local mechanical and pond wastewater-treatment systems to increase nutrient removal and improve efficiency without requiring costly upgrades.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Wastewater treatment systems are critical infrastructure to manage waste effluent within hundreds of communities throughout Minnesota. Optimization means getting better results through existing infrastructure. This project determined that both mechanical and pond wastewater treatment systems can be optimized, and new effluent limits met, without adding substantial new infrastructure.

OVERALL PROJECT OUTCOME AND RESULTS

Achieving better nutrient treatment in wastewater treatment facilities serves to reduce the likelihood of algal blooms in Minnesota's water bodies resulting in cleaner lakes and rivers.

This project found that Minnesota's mechanical wastewater treatment plants can achieve better biological nutrient removal (BNR) through low-cost operational changes. These improvements were modeled using the Activated Sludge SIMulation Model (ASIM) in order to determine the specific plant operational parameters required to achieve BNR. On average, mechanical plants in this pilot were modeled to have average nitrogen reduction of 14.14 mg/L, average phosphorus reduction of 1.84 mg/L (most sites already treat phosphorus chemically to 1 mg/L) and chemical reductions of 886 lb chemical/Million Gallons (MGal) flow.

Wastewater ponds can achieve much better nutrient treatment by utilizing the 'Steady-State Primary' strategy developed during this project. This strategy involves holding the first pond at six feet, or the maximum depth permitted) with a slide gate. Raw influent continues flowing into pond 1, while treated effluent from pond 1 is used to fill pond 2. Meanwhile, pond 3 is also held full. This strategy maximizes treatment time and drastically improves nutrient treatment quality. The two developed case studies showcase a 69% reduction in phosphorus and 43% reduction in nitrogen when compared to the prior year's effluent. Secondary recommendations to wastewater ponds is to reduce inflow and infiltration, reduce fecal loading from waterfowl, and to encourage the growth of aquatic plants, with a specific emphasis on the growth of coontail.

By quantifying the role that optimization has in effective wastewater treatment, Minnesota's lakes and streams can meet standards in a more cost effective means.

PROJECT RESULTS USE AND DISSEMINATION

The project and its results have been presented in 17 different events and conferences by members of this team, including Minnesota Rural Water Association's annual conference, Minnesota Pollution Control Agency's annual conference, the Conference on the Environment, and many others. However, only one mechanical treatment plant has elected to move ahead with a pilot study, and one additional has expressed interest in doing so in the near future. The team has heard from staff and consultants of

participating facilities that without a nitrogen standard as a driver, they feel little urgency to adopt optimization recommendations. Other facilities are meeting phosphorous limits under current flow, but would face difficulty at increased flow. Additionally, BNR design and operation is not a common treatment system in our Minnesota climate, and there may be some trepidation to moving toward that form of treatment until other facilities lead the way.

We have seen eight pond systems adopt the steady-state-primary flow regime in their operations, with more hoping to do so in the near future. Those that have done so already have reported roughly 50 percent reduction in nutrient discharge. The flow regime still needs additional validation. But, more discharge events will add more confidence with additional datasets from daily monitoring reports. Better flow management through infrastructure maintenance – making sure the control structures function as designed – is going to continue to be an area of importance in order to prevent short circuiting of the treatment in isolated pond cells.

The final report, the final work product of operator field guides for mechanical and pond treatment facilities, case studies of participating facilities, and additional findings, can all be found here, at the [Minnesota Technical Assistance Program's wastewater webpages](#).

Project Completed: 6/30/2021

FINAL REPORT

Subd. 04b Assess and Develop Strategies to Remove Microscopic Plastic-Particle Pollution from Minnesota Water - \$300,000 TF

Filippo Coletti

U of MN

110 Union St SE

Minneapolis, MN 55455

Phone: (650) 289-8216

Email: fcoletti@umn.edu

Appropriation Language

\$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to assess, track, and develop methods to remove microscopic plastic particles that are dispersed and accumulating as pollution in Minnesota water bodies. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

We performed a comprehensive study on the motions of microscopic plastic particles in water flows. Extensive experiments have been conducted utilizing innovative imaging techniques on laboratory apparatuses, assisted by state-of-the-art simulations on supercomputers. Valuable data have been collected and analyzed for addressing the plastic pollution in Minnesota water bodies.

OVERALL PROJECT OUTCOME AND RESULTS

The amount of plastic waste in lakes and rivers is projected to increase, driven by the rise in plastics

consumption. New federal and state legislation has banned the sale of certain products containing micro-beads, but thousands of tons of micro-plastic pollution are already in our waters and will take thousands of years to biodegrade. The objective of this project is to utilize the advanced facilities at the St. Anthony Falls Laboratory to carry out a series of experiments and use powerful computation simulations to investigate the motions of microplastics.

This project carried out extensive laboratory measurements of the motion of spherical and non-spherical particles (fibers and disks) in water channel flows. We also conducted the first-ever field measurements of particles transported on the water surface of a small river facility in the Outdoor StreamLab at the St. Anthony Falls Laboratory. Extensive analyses have been performed on the measurement data. We discovered that fibers tend to orient mostly in the streamwise direction while disks maintain their symmetry axis quasi-normal to the water bottom. The fibers undergo strong tumbling near the bottom in response to the mean shear and turbulent fluid velocity fluctuations, whereas the disks wobble about their preferential bottom-normal orientation. We also developed an advanced computer simulation method for the motions of plastic particles in water flows that can capture particle-particle interactions and particle-flow interactions with unprecedented realism and accuracy. We conducted numerical experiments using a supercomputer to study the effect of breaking waves on the surfaces of lakes and rivers on the transport of microplastics. Using computer simulation, we have also revealed the relationship between microplastic's preferential orientation in water waves and particle shapes. We have also elucidated the microplastics transport process through comparing the motions of spherical particles, oblate particles, and a mixture of both particles to quantify their transport characteristics in water bodies.

PROJECT RESULTS USE AND DISSEMINATION

In this project, substantial efforts have been put into sharing the knowledge gained from the research through presentations at national conferences, such as the annual meetings of the American Physical Society, Division of Fluid Dynamics and the Fall Meetings of the American Geophysical Union. A paper has been published in the Journal of Fluid Mechanics ("Experimental investigation of inertial fibres and disks in a turbulent boundary layer" by Lucia Baker and Filippo Coletti, vol. 943, A27), which is a leading journal in the field.

Project Completed: 6/30/2022

FINAL REPORT

[**Experimental investigation of inertial fibres and disks in a turbulent boundary layer**](#)

Subd. 04c Reduce Chlorides in Minnesota Waters by Evaluating Road-Salt Alternatives and Pavement Innovations - \$400,000 TF

John Gulliver

U of MN

2 Third Ave SE

Minneapolis, MN 55414

Phone: (612) 625-4080

Email: gulli003@umn.edu

Appropriation Language

\$400,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to investigate road-salt alternatives and pavement innovations to reduce lake, stream, and groundwater degradation caused by road-salt chlorides. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project produced background information, guidance and recommendations on the benefits and consequences of chloride-based road salt and non-chloride alternatives for de-icing and anti-icing Minnesota's roadways, which will assist road maintenance decision makers in reducing pollution from winter road management.

OVERALL PROJECT OUTCOME AND RESULTS

Over 100,000 tons of road salt are applied to Minnesota's roads each year to prevent or reduce snow and ice cover during the winter season. Sodium chloride is typically used because it is inexpensive and effective, but it can corrode vehicles, pavement, and metal structures (e.g., bridges), and it increases chloride concentration in surface and ground waters throughout the state. This results in additional costs for replacing roadway infrastructure and reduces water quality, habitat, and biodiversity in our natural resources. This project investigated alternatives to sodium chloride-based road salt that reduce snow and ice on roadways with less environmental impact. The project team reviewed scientific research papers, performed laboratory experiments, and used computer models to predict the potential environmental impacts of these chemicals on Minnesota's natural resources.

This project found several outcomes, including: 1) chloride-based road salt concentration can exceed the chronic and acute water quality standards during a typical year; 2) acetate-based alternatives only exceeded water quality standards for low flow rates (low dilution); 3) potassium-based chemicals can be toxic at low concentration, and toxicity thresholds are exceeded when potassium is applied over all roadways for all winter storms; 4) other alternatives such as formate, glycol, glycerol, and succinate have varying performance, application rate, and toxicity thresholds; 5) water-heated sand improves friction compared to bare ice or dry sand on bare ice and can be removed from the environment with simple grit collection chambers; and 6) non-chloride alternatives can reduce the bonding strength of ice to a solid surface. Thus, water-heated sand as an abrasive and organic or hydrophobic non-chloride alternatives can be used to reduce the use of chloride-based road salt and provide more winter benefit on Minnesota's roadways, but modeling predicts that some of these chemicals could exceed toxicity thresholds if applied for all conditions.

PROJECT RESULTS USE AND DISSEMINATION

The results from this project have been shared via presentations, interviews, reports, academic journals, and with stakeholders and decision makers during conferences and networking events. Some examples include a [web article](#), two invited annual Minnesota Salt Symposium presentations (2019 & 2021), WCCO's 10 o'clock news "[Good Question: How Does Salt Melt Ice?](#)" with Jeff Wagner, the Transportation Research Board Annual meeting (2022), and several conference presentations and professional meetings. We believe sharing this information has enlightened decisions makers about the dangers of chloride road salts and non-chloride alternatives and how best to use each.

Project Completed: 6/30/2022

FINAL REPORT

Road Salt Alternatives and Pavement Innovations

Subd. 04d Protect Water Quality with Efficient Removal of Contaminants in Treatment Ponds for Storm Water - \$325,000 TF

Heiko Schoenfuss

St. Cloud State University
720 Fourth Ave S WSB-273
St. Cloud, MN 56301

Phone: (320) 308-3130

Email: hschoenfuss@stcloudstate.edu

Web: <http://web.stcloudstate.edu/aquatictox/>

Appropriation Language

\$325,000 the second year is from the trust fund to the Board of Trustees of the Minnesota State Colleges and Universities system for St. Cloud State University to evaluate the effectiveness of best management practices in removing contaminants from storm water to safeguard aquatic habitats. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Our study demonstrates that pharmaceuticals and pesticides are commonly found in urban stormwater and can impact aquatic life. Stormwater ponds, especially when augmented with iron-enhanced sand filtration, can often reduce these pollutants, and lessen their impact on Minnesota aquatic environments.

OVERALL PROJECT OUTCOME AND RESULTS

Urban stormwaters carry pollutants, including pharmaceuticals and pesticides, into Minnesota streams, rivers, and lakes. Stormwater ponds have not been studied to determine whether they are effective in removing these pollutants. The goal of this study was, therefore, to assess stormwater composition and treatment to inform natural resource managers to the best options for reducing urban stormwater related pollution to Minnesota waters. Our approach combined water chemistry analysis and assessment of biological toxicity in a range of species living in Minnesota waters. We sampled inflow and outflow of seven urban stormwater ponds across seasons and included traditional ponds and those augmented with additional iron-enhanced sand filters. Each water sample was analyzed for a range of pollutants and was also used to expose cells of animals living in Minnesota waters to assess the samples' toxic potential. Pharmaceuticals and pesticides were commonly found in stormwater. In nearly three-quarters of paired water samples (pond inflow and pond outflow), pharmaceutical concentrations were reduced in the outflow when compared to the inflow. Similarly, in about half of paired samples, pesticide concentrations were lower in the outflow sample. The measured reduction in pollutants was also reflected in improved cell health, but this effect was neither as pronounced nor as widespread as predicted by the water chemistry results. In some instances, exposed cells from some, but not all species did better in inflow water than outflow water and in some instances no changes in cell health were observed. The inconsistency in observed biological improvement may be the result of seasonal differences and/or conditions in specific stormwater ponds. This study demonstrates for the first time

that stormwater ponds are effective treatment options to reduce the impact of pharmaceuticals and pesticides on urban aquatic environments. Adding additional filtration, such as iron-enhanced sand filtration can further reduce stormwater pollutants.

PROJECT RESULTS USE AND DISSEMINATION

Despite the challenges associated with the Covid-19 pandemic, our team was able to give seven presentations related to this study. These include presentations to natural resource managers in Minnesota and to toxicologists at national and international scientific meetings. A St. Cloud State University graduate student completed a thesis on this project in 2020 which is currently being developed into a manuscript. Water chemistry data were integrated into a national USGS data base. Additional manuscripts are being prepared for future publication.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04e Develop Small and Inexpensive Purification System for Community Drinking Water - \$425,000 TF

Tianhong Cui
U of MN
111 Church St SE
Minneapolis, MN 55455

Phone: (612) 626-1636
Email: tcui@me.umn.edu

Appropriation Language

\$425,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop a small and inexpensive purification-technology system for community drinking-water facilities to remove toxic contaminants, make water safe to drink, and improve drinking-water quality. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project designed a small water purification system for drinking water that can simultaneously remove the organic pollutants and heavy metal ions in the water. The system can be connected either to domestic drinking water taps or to water in lakes and rivers.

OVERALL PROJECT OUTCOME AND RESULTS

This project is dedicated to providing clean drinking water to the Minnesota community by designing and manufacturing a small water purification system and providing a possible solution for the water treatment of large water plants. A compact size prototype was first designed to verify the mechanism. Photocatalysis technology was used to remove the organic pollutants, and titanium dioxide was selected as the photocatalyst. Electrochemical reduction was applied to remove heavy metal ions in the water. Finally, the team innovatively combined photocatalysis and electrochemistry to develop a photoelectrocatalytic solution that can simultaneously remove organic matter and heavy metal ions from water. The result shows that the compact system can remove 91.6% percent of the 10-micrometer

methylene blue when the mass flow rate is 14.4 milliliters per hour (mL/h), and around 97.5% of 200 parts per million of copper(II) cations (Cu^{2+}) can be removed at the same time. After the theory of photoelectrocatalysis was verified, standard-sized systems were designed and fabricated comprising an ultraviolet lamp, a chamber with active carbon, and a microfluidic system with immobilized photocatalyst. The standard-size system can remove nearly 100% of the 10-micrometer methylene blue and 96% of the Cu^{2+} in the water with a flow rate of 50 mL/h. The team conducted the field test with the drinking water from Commonwealth Terrace Cooperative, a community for University of Minnesota students and their families, and the water from Mississippi River. The testing results demonstrate the capability of using the designed system to remove organic pollutants and heavy metal ions in the water.

PROJECT RESULTS USE AND DISSEMINATION

On-site demonstration and tests as described in the activities at a student housing community and Mississippi river from May through June 2022. Communications with interested entrepreneurs have been ongoing with interested parties including local companies and individuals.

The following papers published in archived journals and prestigious conferences:

1. Zhou, P., & Cui, T. (2020). Enhanced photocatalytic efficiency by layer-by-layer self-assembly of graphene and titanium dioxide on shrink thermoplastic film. *Microsystem Technologies*, 26(12), 3793-3798.
2. Zhou, P., Zhang, T., Simon, T. W., & Cui, T. (2021). Simulation and Experiments on a Valveless Micropump With Fluidic Diodes Based on Topology Optimization. *Journal of Microelectromechanical Systems*, 31(2), 292-297.
3. Zhang, T., Zhou, P., Simon, T., & Cui, T. (2022). Vibrating an air bubble to enhance mass transfer for an ultra-sensitive electrochemical sensor. *Sensors and Actuators B: Chemical*, 354, 131218.

Professor Tianhong Cui presented five invited public seminars and talks on water sensors:

Invited Talk, University of Bath, July 4, 2022

Invited Talk, University of Cambridge, July 11, 2022

Invited Talk, EcoLab, May 4, 2022

Invited Talk, French-American Innovation Days, Water Management in Cities, April 8, 2021 (on-line)

Invited Talk, University of Texas at San Antonio, September 13, 2019

Project Completed: 6/30/2022

FINAL REPORT

Enhanced photocatalytic efficiency by layer-by- layer self-assembly of graphene and titanium dioxide on shrink thermoplastic film

Simulation and Experiments on a Valveless Micropump With Fluidic Diodes Based on Topology Optimization

Vibrating an air bubble to enhance mass transfer for an ultra-sensitive electrochemical sensor

Subd. 04f Evaluate Emerging Pathogens in Lakes, Rivers, and Tap Water to Keep Drinking Water Safe - Research Project - \$325,000 TF

Timothy LaPara

U of MN

500 Pillsbury Dr SE
Minneapolis, MN 55455

Phone: (612) 624-6028
Email: lapar001@umn.edu
Web: <http://web.stcloudstate.edu/aquatictox/>

Appropriation Language

\$325,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to evaluate emerging pathogens including Legionella and mycobacteria to ensure that surface water used for drinking water and tap water is safe to drink. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Seven full-scale drinking water systems were investigated for the presence of Legionella and Mycobacteria, opportunistic bacterial pathogens of health concern. This research demonstrates these organisms are commonly found in drinking water during the late summer/early fall; water utilities are encouraged to sustain a residual disinfectant to help suppress these pathogens.

OVERALL PROJECT OUTCOME AND RESULTS

The goal of this project was to investigate the presence of opportunistic pathogens at seven public water utilities within the State of Minnesota that treat surface water (i.e., lakes and rivers), as those water sources are expected to be at greater risk of pathogen contamination than deep groundwater wells. Samples were collected from the water prior to treatment (i.e., the water supply), the water immediately after treatment (i.e., finished water), and at two locations from within each drinking water distribution system. Each of the seven utilities was sampled from one to five times at the four locations for a total of 94 unique sample events.

This project demonstrated that known opportunistic pathogens (e.g., Legionella species) can be routinely detected throughout the year in surface water supplies in Minnesota and that water treatment is effective at removing them by 99% or more in most cases. The most concerning opportunistic pathogens that we tested for, Legionella pneumophila and Mycobacterium avium complex (MAC), were rarely detected and all the observed concentrations in tap water were well below the levels whereby these organisms would be of direct concern (i.e., none of our research results suggest a direct concern with respect to human health). Our results, however, are of indirect concern because these organisms could multiply within a drinking water distribution system should the conditions become favorable for their growth. Hence, our recommendation is that water utilities meticulously maintain a residual disinfectant throughout their distribution systems, particularly in the late summer/early fall when the warmer water creates conditions where Legionella species and MAC are most likely to multiply in the system and to be detected.

PROJECT RESULTS USE AND DISSEMINATION

Dissemination activities related to this project were severely hindered by the COVID-19 pandemic. We were, however, able to make two different presentations of our preliminary results to the Minnesota Section of the American Water Works association; these presentations were titled “Emerging Pathogens in Lakes, Rivers, and Tap Water” (September 24, 2020) and “Opportunistic Pathogens in Lakes, Rivers, and Tap Water” (September 16, 2021). We are currently writing three different manuscripts for

publication in the peer-reviewed literature that will include the results from this study. We will also share our results with Minnesota Department of Health personnel.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04g Characterize Unregulated Contaminants in Source Water and Drinking Water - \$1,000,000 TF

Stephen Robertson

Minnesota Department of Health
625 Robert St N
St. Paul, MN 55164

Phone: (651) 201-4648

Email: steve.robertson@state.mn.us

Web: <http://www.health.state.mn.us/>

Appropriation Language

\$1,000,000 the second year is from the trust fund to the commissioner of health to establish monitoring networks of public water-system wells and surface-water intakes to determine if contaminants persist after standard public water treatment. This appropriation is available until June 30, 2022, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Analysis of drinking water resources reveals the presence of a range of unregulated contaminants at low levels. Most of these levels are below health-based guidance, if available. Results are being used to inform development of new health-based guidance and to perpetuate drinking water ambient monitoring.

OVERALL PROJECT OUTCOME AND RESULTS

This project sampled water from 105 public water systems statewide for a wide spectrum of drinking water contaminants. Participating public water systems were organized into three groups: systems that use surface water, systems that use groundwater potentially influenced by wastewater, and systems that use groundwater potentially affected by agricultural land uses. Depending on the group, samples were analyzed for as many as 600 different contaminants, including pharmaceuticals, per- and polyfluoroalkyl substances (PFAS), organic wastewater indicators, and pesticides.

Results for individual systems showed that most contaminants analyzed were not detected in drinking water, but some contaminants were present at low levels. The detections included 84 pesticides, 51 pharmaceuticals, 43 wastewater indicators, 15 PFAS, eight benzotriazoles, and one inorganic compound. Some contaminants were detected at multiple systems. Results were compared against health-based guidance values, if available, although most contaminants analyzed lack health-based guidance values. A few results exceeded available guidance values. In those instances, Minnesota Department of Health staff coordinated with the public water system to validate results and take action where appropriate.

There were detections of contaminants from most classes analyzed, but pesticides and PFAS were the most commonly detected. The most frequently detected contaminants across the study included lithium, pesticides (metolachlor, atrazine, deethylatrazine), PFAS (PFBA, PFHxS, PFOS, PFOA), and tribromomethane. Differences in occurrence or concentration were observed in source versus finished water samples for some groups (e.g., pharmaceuticals, benzotriazoles) but not for others (e.g., PFAS, pesticides). Samples collected in geologically vulnerable settings generally showed higher contaminant concentrations than those collected from non-vulnerable sites.

Results have been used to prioritize and nominate contaminants for the development of health-based guidance. Also, the project has led to creation of a permanent drinking water ambient monitoring program. This ongoing work will help mitigate and manage the exposure to unregulated contaminants through Minnesota's drinking water.

PROJECT RESULTS USE AND DISSEMINATION

The project and associated materials are described on the MDH website. This project has spurred creation of risk communication resources for public water systems and MDH staff.

A project summary report has been prepared and will be available on the MDH website by October 2022.

Preliminary results from the project have been presented at the University of Minnesota's Water Resource Conference (October 2020). A complete analysis of the results is forthcoming and will be prepared for publication.

A professional paper describing the ELISA methodology used in this project is in press for publication. (Krall, Aliesha L., et al, 2022)

Project Completed: 6/30/2022

FINAL REPORT

[**Comparison of the Results of Enzyme-Linked Immunosorbent Assay \(ELISA\) to Mass-Spectrometry Based Analytical Methods for Six Unregulated Contaminants in Source Water and Finished Drinking-Water Samples**](#)

[**MN Department of Health - Monitoring Plan - Unregulated Contaminants Monitoring Project**](#)

Subd. 04h Mapping Antibiotic Resistance in Minnesota to Help Protect Environmental, Animal, and Human Health - Research Project - \$750,000 TF

Randall Singer

U of MN

1971 Commonwealth Ave

St. Paul, MN 55108

Phone: (612) 625-6271

Email: rsinger@umn.edu

Appropriation Language

\$750,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota

to quantify and map antibiotic and antibiotic-resistance gene contamination in Minnesota waters and soils to identify locations in need of mitigation to protect environmental, animal, and human health. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Our project mapped and quantified antibiotics and antibiotic resistance genes in Minnesota waters and soils. These findings are now used to target hotspots to better understand their fate and transformation in waterbodies. Ultimately, this information will be used for antimicrobial resistance mitigation strategies to protect environmental, human, and animal health.

OVERALL PROJECT OUTCOME AND RESULTS

Antimicrobial resistance (AMR) threatens human, animal, and ecosystem health. Antibiotic use in hospitals, long-term care facilities, and animal husbandry operations (point sources) play a major role in AMR emergence. Discharges and runoff from these point sources which may include AMR and antibiotics enter the natural environment, especially waterbodies, in some cases after going through a treatment system at the point source itself or at a wastewater treatment plant. The project goals included a) developing an “antibiotic footprint” map of Minnesota’s natural environment that would predict areas where antibiotics, resistant bacteria, and antimicrobial resistance genes (ARG) are most likely to accumulate; b) quantifying concentrations of antibiotics and ARG at sites variably impacted by anthropogenic activities; and c) validating the prediction maps with the data collected across the state to develop a risk-based surveillance system that will aid in statewide AMR mitigation efforts in the natural environment. To achieve the overall project goals, an iterative holistic approach was used which included sampling different environmental matrices at different spatial scales, and the use of diverse statistical and spatial methods to map and predict both antibiotics and ARG. The highest antibiotic concentrations were found near human populated areas, while ARG did not present any specific spatial pattern. The macrospatial approach identified hotspot areas of ARG and antibiotic contamination, and the microspatial approach revealed an influence of wastewater on ARG abundance. The maps and predictions created for waterbodies were useful to identify antimicrobial AMR and antibiotic hotspots areas throughout the state, while the maps created for soil can be used for targeted field surveillance of antibiotics. The environment plays a key role in the dissemination and persistence of AMR, which affects human, animal, and environmental health; therefore, these findings are critical to continue developing mitigation strategies of AMR spread in Minnesota.

PROJECT RESULTS USE AND DISSEMINATION

This project has produced two peer-reviewed publications (Bueno, I., et al., 2021; and Bueno, I., et al., 2022), and there will be two others submitted soon summarizing the data for the 2020-2021 field seasons. This project has been presented at nine international and domestic conferences both as poster and oral presentations, and during at least two teaching courses. Also, a graduate student used data from this project to conduct her Master’s. One of the dissemination goals was to engage the general public at the state fair, but the COVID-19 pandemic halted that.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04i Farmer-Led Expansion of Alfalfa Production to Increase Water Protection - \$500,000
TF

Nicholas Jordan

U of MN

1991 Upper Buford Cir, 411 Borlaug Hall
St. Paul, MN 55108

Phone: (612) 625-3754

Email: jorda020@umn.edu

Appropriation Language

\$500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop a farmer-led, market-based working-lands approach to increase water protection in agricultural areas by targeted expansion of alfalfa production and development of methods to convert alfalfa to high-value bioproducts. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Farmers working together in watersheds can build the base of supply chains for new crops that provide continuous living cover of farmland, thereby providing healthy soil, clean water, and abundant wildlife. These supply chains will meet demand for sustainably produced commodities, providing a market-driven pathway to clean water.

OVERALL PROJECT OUTCOME AND RESULTS

We advanced a novel prevention-based strategy for protecting water resources, based on market-driven integration of alfalfa—and other perennial and annual crops that provide continuous living cover (CLC) of farmland—into corn/soybean-based farming operations. Integration of CLC crops will protect water resources, improve soil health, support wildlife, and enhance agricultural production and profit.

Specifically, we 1) tested a farmer-led working lands approach for using alfalfa and other CLC crops to improve agricultural effects on water, and 2) did R&D to open new markets for alfalfa. Under 1), we worked with farmers in the Rogers Creek watershed near St. Peter, MN to develop and implement a watershed-scale protection plan based on adoption of alfalfa and other CLC crops, including on-farm implementation plans, and supported pilot-scale production of several novel CLC crops. We monitored water quality, showing that current farming systems are releasing relatively high levels of nutrients. Simulation modeling showed that increased production of alfalfa and other CLC crops can efficiently produce significant improvements in water quality. Economic analyses showed that integrating alfalfa and other CLC crops had good potential to support profitable production. Under 2), we assessed advanced processing and storage practices to reduce moisture-related spoilage and nutrient leaching of alfalfa, identifying viable practices that reduce these historical impediments to profitable alfalfa production; we developed and assessed new applications for alfalfa, which revealed multiple promising options: biochemicals, nutraceuticals, and high-value sustainably-produced animal and aquaculture feeds; and developed supply-chain connections and identified market opportunities, via development of pilot projects, outreach and knowledge sharing, and novel collaborations. Overall, the project illuminated methods for building new production systems and supply chains needed to support increased production of alfalfa and other CLC crops as a scalable, non-regulatory approach for improving agricultural effects on water resources.

PROJECT RESULTS USE AND DISSEMINATION

We have disseminated results in reports, provided as appendices to the final project report (available in

the Research Reports section here), and many presentations as detailed in the project's reports. These include the 2019 Minnesota River Congress meeting on "Profitable Farming in Time of Climate Change" meeting, a February 2020 industry meeting on alfalfa utilization, a February 2021 exhibition on value-added alfalfa applications at the Midwest Forage Association's Symposium, a July 2021 field day at a Kernza® field attended by 75 industry stakeholders, and a June 2022 "Fields of Opportunity" webinar in June that presented an overview of project findings to a large internet audience.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 04j Using Perennial Grain Crops in Wellhead Protection Areas to Protect Groundwater - \$250,000 TF

Margaret Wagner

Minnesota Department of Agriculture
625 Robert St N
St. Paul, MN 55155

Phone: (651) 201-6014

Email: margaret.wagner@state.mn.us

Web: <https://www.mda.state.mn.us>

Appropriation Language

\$250,000 the second year is from the trust fund to the commissioner of agriculture to establish demonstration plots of Kernza, a new intermediate perennial grain crop, to evaluate the potential to profitably reduce nitrate contamination of groundwater in vulnerable wellhead protection regions of Minnesota. Any income generated as part of this appropriation may be used to expand the project.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This study established demonstration fields of Intermediate wheatgrass (Kernza®) within wellhead protection areas in central and southeast Minnesota and research results showed the nitrate reduction potential of targeted placement of perennials in areas with vulnerable groundwater.

OVERALL PROJECT OUTCOME AND RESULTS

Nitrate-nitrogen is one of the most common pollutants in Minnesota's groundwater. In some areas of the state, public and private wells have elevated nitrate levels. Groundwater is most vulnerable to nitrate contamination in central and southeast Minnesota. Areas in central are vulnerable because of widespread sandy soil and in southeast because of shallow bedrock, sinkholes and other geologic features. Intermediate wheatgrass (IWG) is a perennial grass that produces a novel grain, Kernza® and has the potential to reduce nitrate leaching compared to common annual row crop production. This study 1) established demonstration fields of IWG within wellhead protection areas in central and southeast Minnesota and 2) conducted an experiment that compared grain yields, biomass yields, soil nitrate, soil water content, and root biomass under IWG and a corn-soybean rotation for three years on a sandy soil in Central Minnesota. We also 3) conducted grain testing to determine optimum processing of Kernza for various end-use products (crackers, bread, beer, etc). Outcomes included targeted planting of 68 acres of IWG in wellhead protection areas near Chatfield and Verdi. A field day was held at both

sites, engaging over 60 people. Results from Activity 2 found that the mean soil nitrate was 77 to 96% lower under IWG than an annual rotation of corn and soybean. Total soil water content did not differ among cropping treatments. Root biomass was 82% lower under soybean than under IWG. Results from Activity 3 include the development of multiple Kernza cleaning and dehulling process workflows that include equipment needs, costs, and Kernza grain quality outcomes. The results from this project show that IWG effectively reduces the risk of nitrate leaching when grown on wellhead protection areas, and that the farming and food community is eager to continue exploring IWG as a new crop for water protection.

PROJECT RESULTS USE AND DISSEMINATION

Field days at two locations with ~60 participants on site. Events highlighted in newspaper articles. Case study/ project summaries written by Green Lands Blue Waters. Master's student research is in process of being submitted for publication in a peer-reviewed journal. Deliverable for Activity 3 includes a technical report on cleaning intermediate wheatgrass (Kernza) as well as resources for food processors to integrate it into their business operations.

The research supported by this grant is part of a larger network of research and implementation efforts around Kernza. Resources are compiled on a [Kernza website](#), including resources for the [cleaning and dehulling process](#).

Project Completed: 6/30/2021

FINAL REPORT

Subd. 04k Implement a Pilot Credit-Trading System for Storm Water in Shell Rock River Watershed to Improve Water Quality - \$300,000 TF

Courtney Phillips

Shell Rock River Watershed District
214 West Main St
Albert Lea, MN 56007

Phone: (507) 379-8782

Email: Courtney.Phillips@co.freeborn.mn.us

Web: <http://www.shellrock.org>

Appropriation Language

\$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Shell Rock River Watershed District to develop and implement a pilot water-quality credit-trading program for storm water that provides voluntary and cost-effective options to reduce pollution on a watershed scale.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This pilot project developed a water management framework plan along with associated appendices to submit an overlay permit for water quality credit trading to the Minnesota Pollution Control Agency. This work may provide water quality solutions to MS4 permittees bound by funding constraints.

OVERALL PROJECT OUTCOME AND RESULTS

This project was a collaborative effort between the SRRWD, the City of Albert Lea and utilized a technical advisory committee that consisted of Minnesota Pollution Control Agency (MPCA), Board of Water and Soil Resources, and Department of Agriculture staff.

Stormwater credit trading begins when an upstream landowner, or discharger, reduces pollution or nutrients below levels that are required by law. Those nutrient reductions are then verified, and measured by third party scientists and translated into “credits” that are sold to a credit bank. Downstream towns or cities could then purchase those credits instead of spending multi-million dollars in stormwater system retrofits.

The outcome of this project is the Fountain Lake Phosphorus Stormwater Water Quality Trading Management Plan. This document includes the regulatory requirements, policies, trade ratio, credit transaction value, and program administration behind stormwater credit trading. Attached to this plan are the appendices that support the management plans reasoning and forms that could be used to establish a credit trading program. The end result is a set of documents that are ready for an MS4 entity to submit to MPCA for possible approval of stormwater credit trading to take place. Please note the MPCA would have the authority to approve, modify or deny a stormwater credit trading program in the State of Minnesota. A working credit trading program such as this can provide water quality benefits at a reduced cost, contributing to the fishable, swimmable, drinkable waters initiative.

PROJECT RESULTS USE AND DISSEMINATION

Documents that are available for dissemination include the Fountain Lake Phosphorus Stormwater Water Quality Trading Management Plan and the cost effectiveness for water quality trading report. These documents will be sent to the Minnesota Pollution Control Agency, the Board of Water and Soil Resources, and Department of Agriculture. Both documents can also be found on [the Shell Rock River Watersheds District website](#) and submitted to LCCMR staff.

Project Completed: 6/30/2021

FINAL REPORT

[Fountain Lake Stormwater Water Quality Trading Management Plan, including template forms and letters](#)

Subd. 05 Technical Assistance, Outreach, and Environmental Education

Subd. 05b YES! Students Take on Minnesota Water-Quality Challenge - \$213,000 TF

Shelli-Kae Foster

Prairie Woods Environmental Learning Center
12718 10th Street NE
Spicer, MN 56288

Phone: (320) 441-9254

Email: Shelli-kae.Foster@co.kandiyohi.mn.us

Web: www.youthenergysummit.org

Appropriation Language

\$213,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Prairie Woods Environmental Learning Center to expand the Youth Energy Summit (YES!) model to improve local waterways by training and mobilizing over 20 youth-led teams in Minnesota communities to complete 30 or more projects related to water quality including monitoring and reporting.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Our project, YES! Students Take on Water Quality Challenge, brought water quality and conservation knowledge and expertise to over 800 students from 126 communities across Minnesota. In 3 years, 81 hands-on water quality and prairie/habitat restoration projects were completed, and 20 waterbodies were improved while engaging with 30 resource experts.

OVERALL PROJECT OUTCOME AND RESULTS

Our project goal was to engage Minnesota's youth in taking on the challenge to improve our state's water ways. We accomplished this goal by:

- Supporting 54 youth-led YES! teams, with over 800 students, in 126 Minnesota communities
- Completing 81 new student-driven water quality and prairie/habitat restoration projects
- Providing 3 Fall Summit events and 27 regional workshops
- Leveraging the expertise and kindness of 6,564 volunteer hours including 3,125 hours of YES! student volunteer hours and \$75,000 in community funds
- Awarding the Water Quality Stewardship award in 2019 and 2020

Our aim was to help students to better understand the interconnectedness of their daily actions and water quality. We accomplished this through leveraging the expertise of 30 water quality experts who educated and trained our students about local water quality challenges, techniques to improve and conserve water quality and then assisted them in doing related student-driven projects.

YES! student-driven projects benefited Minnesota communities by improving waterways, cleaning up shorelines, restoring native prairies and establishing new native plantings and habitats. Other projects included Aquatic Invasive Species (AIS) monitoring, assessing drinking water, installing hydration stations, storm drain stenciling (Adopt-a-Drain), water usage tracking and water-related events and peer education.

As one YES! student from Minnewaska said, "I enjoy YES! because of the positive interactions-people taking time out of their day to teach you things. It's something for yourself and it's something to do for your community." Another student from Carlton stated, "It feels really rewarding to know that we are actually making a difference!" Resource expert Phil Votruba commented, "You guys serve as an inspiration for youth across the state and across the country!"

A Sleepy Eye Student remarked "As a part of YES! team I got to participate in River Watch which consists of monitoring Minnesota's rivers and helping to keep them safe. I was able to learn more about what makes the rivers healthy or unhealthy and was able to help in the monitoring process."

PROJECT RESULTS USE AND DISSEMINATION

During this project (July 1, 2018, to June 30, 2021) YES! staff have tabled or presented at 20 events. YES! was featured in 22 outside articles, radio broadcasts and videos. They are listed on our website and can

be accessed here at [YES! in the News](#). In addition, staff posted 86 blog posts to our [YES! website](#) which were shared on our social media pages including [Facebook](#), [YouTube](#), and [LinkedIn](#).

Project Completed: 6/30/2021

FINAL REPORT

**Subd. 05d Connecting Students with Water Stewardship through Hands-on Learning -
\$400,000 TF**

John Lenczewski

Minnesota Trout Unlimited
PO Box 845
Chanhassen, MN 55317

Phone: (612) 670-1629

Email: jlenczewski@comcast.net

Web: <http://www.mntu.org>

Appropriation Language

\$400,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Minnesota Trout Unlimited to engage students in classroom and outdoor hands-on learning focused on water quality, groundwater, aquatic life, and watershed stewardship and providing youth and their families with fishing experiences. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project connected approximately 10,000 Minnesota youth with their local watersheds. Through a combination of habitat site explorations, field studies, classroom learning, and outdoor recreation, students gained an appreciation for the natural world and understanding of how their decisions can positively impact water quality and watershed health.

OVERALL PROJECT OUTCOME AND RESULTS

In today's technology-based society, youth are increasingly becoming disconnected from the natural environment. This disconnect can foster apathy about the environment, natural resources, and outdoor recreation, and impact their ability to make well informed decisions about the environment as adults. The program countered this by using tangible education tools and getting students outdoors for hands-on learning activities that connected them to aquatic ecosystems. It utilized classroom aquariums where students studied the development of trout from egg to juvenile. This served as a springboard for field trips to streams and as a focal point for reinforcing learning about water, watersheds, and ecology. Introductions to outdoor recreation were offered to encourage lifelong, tangible connections to aquatic ecosystems.

The number of schools and nature centers participating in this outdoor education program doubled from 29 during the 2018-2019 school year to 60 during the 2021-2022 school year. The program expanded from Twin Cities metropolitan area to schools in Duluth, Bemidji, Alexandria, Willmar, Winona, and other outstate communities. Despite the serious challenges that the COVID-19 pandemic

created for conducting in-person field day and classroom learning, our education team conducted more than 260 hands-on environmental education programs for nearly 9,000 students. In addition, we developed remote learning lessons for teachers, students, and parents to extend learning outside the classroom. We reinforced learning about watershed health with a recreational component that creates lifelong interest in waters through fishing and conservation. Minnesota Trout Unlimited's (MNTU) instructors led nearly 70 introductory fishing skills programs for over 1,000 youth and their families. These clinics were made possible by partnerships with local governments and civic organizations, and numerous Trout Unlimited volunteers.

Approximately 10,000 students developed greater understanding of, and connections to, aquatic ecosystems, which will help them to make well informed decisions that positively impact water quality and watershed health.

PROJECT RESULTS USE AND DISSEMINATION

Our [website](#) was revamped with updated information about [educational opportunities](#), including [Trout in the Classroom](#) and fishing skills programs. The [Facebook](#) and [Instagram](#) pages were started in 2018 and gained hundreds of followers during this project. A suite of youth [educational videos](#) and other resources were developed and are available online. Our team wrote education updates and youth series articles for all three MNTU [newsletter](#) editions publish each year. Thousands of hard copies of the newsletters were distributed to teachers for classroom use and/or to send home with students.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 05e Expanding River Watch Program on the Minnesota River With High School Teams - \$100,000 TF

Ted Suss

Friends of the Minnesota Valley
6601 Auto Club Road
Bloomington, MN 55438

Phone: (507) 828-3377

Email: tedsuss@gmail.com

Appropriation Language

\$100,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Friends of the Minnesota Valley to expand a River Watch program on the Minnesota River to recruit at least 15 additional teams of high school students in monthly monitoring and reporting of water quality.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

With funding from the ENRTF, we were able to expand River Watch from four high school teams to 14 teams and recruited at least two additional teams to participate in future years. Through the program, approximately 250 students learned how to conduct water quality monitoring, the pollutants that affect water quality, how to operate monitoring equipment, and to report the data. Students learned sources of pollution and actions that can be taken to reduce future water pollution.

OVERALL PROJECT OUTCOME AND RESULTS

The River Watch program engaged high school students from 18 high schools in lessons about surface water quality, students learned how to operate sophisticated electronic equipment to test water quality. Data collected was submitted to the Minnesota Pollution Control Agency through the Citizen Water Quality Monitoring program.

Although data collection is an important purpose of the River Watch program, providing students with a meaningful experiential learning opportunity that teaches them the importance of water quality is the primary purpose. River Watch participants learn more than just facts, they develop understanding about water quality they will carry with them for their entire lives. Based on student feedback, River Watch achieved this goal of a meaningful educational experience.

Another goal Friends of the Minnesota Valley hoped to accomplish with ENRTF funding was to grow our River Watch program from a trial program working with four teams to a program working with 15-20 teams. Through the use of ENRTF funding, Friends was able to develop high quality informational brochures, a website, and other supporting materials to promote the River Watch program. We succeeded by working with 18 different high schools and will begin the 2021-2022 school year with 16 teams participating in River Watch and other teams considering joining. Covid limitations significantly reduced our ability to take students directly to rivers for sampling during the 2021 school year, but desired program growth did occur.

A third objective was to raise public awareness of the River Watch program and public awareness of the water quality problems facing the Minnesota River. On several occasions, local news media covered student monitoring events. Public awareness of River Watch is well established and the program is set to continue in future years due to the foundation built during the three years that the program was funded by LCCMR.

The Minnesota River is widely seen as one of the most polluted rivers in Minnesota. Teaching today's high school students (tomorrow's adult citizens and leaders) the seriousness of this problem, giving them the knowledge and understanding of the problem, and inculcating a desire to solve the problem will benefit the State of Minnesota as these young people move into positions in which their personal actions and the public decisions they make or influence lead to river water quality protections. As the River Watch program grows, an ever-growing number of young people will be motivated and equipped to "clean up" the Minnesota River.

The data collected to date and in the future will enable policy makers at the local and state level to make better informed decisions that will improve and protect water quality in the Minnesota River basin and downstream in the Mississippi River.

PROJECT RESULTS USE AND DISSEMINATION

Each time a River Watch Team conducted a water quality monitoring event, local news media including radio, newspapers, and television was informed and invited to provide coverage. Several local newspaper articles covering such events were published and at least one television story was broadcast.

The very process of recruiting River Watch teams involved communication with every secondary school administrator in the Minnesota River basin. These communications were often shared with local school boards as part of the participation approval process. Students and staff in River Watch have been invited

to speak at local service group meetings. Each communication included reference to LCCMR/ENRTF funding.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 05f Pollinator Ambassadors Program for Gardens - \$250,000 TF

Elaine Evans

U of MN
1980 Folwell Ave, 219 Hodson Hall
St. Paul, MN 55108

Phone: (651) 644-1227

Email: evan0155@umn.edu

Web: <https://www.beelab.umn.edu>

Appropriation Language

\$250,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to increase knowledge of pollinators in gardens and yards and improve pollinator habitat by expanding outreach, training, and tools for Minnesota communities as part of the Pollinator Ambassadors program. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Pollinator Ambassadors for Gardens program broadened pollinator education access across Minnesota, particularly to traditionally underserved audiences, through training 43 youth Pollinator Ambassadors and distributing 250 Pollinator Education Toolkits. Broader adoption of pollinator conservation action-steps will help Minnesotans conserve pollinator diversity, which will support food production, water quality, and healthy ecosystems.

OVERALL PROJECT OUTCOME AND RESULTS

Minnesotans are aware of the importance of pollinators to healthy food systems and ecosystem health but lack prepared educators and education materials to provide action steps for pollinator conservation. The Pollinator Ambassadors Program for Gardens aimed to 1) provide direct training to youth to engage their communities in pollinator education and 2) create a Pollinator Education Toolkit with expert-designed materials that educators state-wide can use to teach pollinator conservation action steps. We have successfully trained 43 Pollinator Ambassadors between the ages of 14 and 18 through in-person and virtual workshops. Pollinator Ambassadors have directly engaged approximately 3,000 Minnesotans. We distributed 250 Pollinator Education Toolkits across Minnesota to 53 nature centers, 91 classroom educators, 33 Master Gardeners and Master Naturalists, 42 non-profits, 14 federal, state, or municipal agencies, and 17 University of Minnesota Extension programs. These Pollinator Education Toolkit holders estimate reaching 100,000 people annually. Many organizations receiving Pollinator Education Toolkits prioritize service to or primarily serve low-income audiences (40%), recent immigrants (15%), Latinx communities (15%), African American communities (13%), Asian American communities (9%), and Native American communities (9%). Toolkits are also available publicly through Inter Library Loan and check out at four University of Minnesota Extension and Outreach Centers across

Minnesota. Over 400 educators across the world have accessed the Digital Pollinator Education Toolkit with an estimated annual reach of 180,000. The Pollinator Ambassadors Program for Gardens has increased capacity to reach a broad geographic range of audiences in Minnesota, with youth trained in Big Stone, Hennepin, Ramsey, Wright, and Olmsted counties and toolkits with educators in 60 of Minnesota's 87 counties, as well as increasing reach to traditionally underserved audiences. Broader adoption of pollinator action steps by Minnesotans will help conserve pollinator diversity, which in turn will support food production, water quality, and healthy ecosystems.

PROJECT RESULTS USE AND DISSEMINATION

We have several resources that should be shared broadly. A summary of the impact of the Pollinator Ambassadors for Gardens program is available on the [Bee Lab YouTube channel](#). The University of Minnesota Bee Lab website has a page dedicated to the [Pollinators Ambassadors program](#). Pollinator Education Toolkits are available for checkout out through Interlibrary Loan and at the University West Central, North Central, Southwest and Rosemount Research & Outreach Centers. Digital Pollinator Education Toolkit resources are available to everyone who fills out our [application form](#). We have created a "[Learn to Use Pollinator Education Toolkits](#)" video playlist to provide extra background, and a "[Pollinator Ambassadors](#)" video playlist to complement activities from the Toolkits. The [Habitat Assessment Guide for Yards and Gardens](#) is available as a pdf document.

Project Completed: 6/30/2022

FINAL REPORT

[Habitat Assessment Guide for Pollinators in Yards, Gardens, and Parks - 12 pgs](#)

[Checklist of Actions - To Promote Pollinators In Yards, Gardens & Parks](#)

[A Bee Nest Round The Year](#)

[Bees or Wanna-Bees?](#)

[Four Actions to Help Pollinators](#)

[How are the Pollinators Doing?](#)

[Rare Minnesota Bees](#)

[Myths and Realities for Polinators](#)

[Abejas O Mimicas](#)

[Como Les Esta Yendo A Los Polinizadores](#)

[Cuatro Acciones Para Ayudar A Los Polinizadores](#)

[Mitos Y Realidades Sobre Los Polinizadores](#)

Subd. 05g Morris Prairie Pollinator Demonstration Area and Education - \$550,000 TF

Steven Poppe

U of MN - Morris

WC Research and Outreach Ctr

Morris, MN 56267

Phone: (320) 589-1711

Email: poppesr@morris.umn.edu

Web: <http://www.wcroc.cfans.umn.edu>

Appropriation Language

\$550,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota

for the West Central Research and Outreach Center at Morris to restore 17 acres of native prairie for pollinators and to construct wayside shelters and kiosks along an existing trail to provide information to visitors on the importance of pollinators and native prairie ecosystems. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project restored 17 acres to a native prairie habitat to enhance the local ecosystem for beneficial pollinators and native species of plants. The project site also provides educational opportunities for visitors on how to protect or enhance native habitats and beneficial pollinators.

OVERALL PROJECT OUTCOME AND RESULTS

The Pomme de Terre River watershed area in west central Minnesota was once a sprawling prairie, home to beneficial pollinator species and prairie vegetation. Now, however, we've seen a devastating decline of beneficial pollinator species and a disruption to the remaining native prairie ecosystem due to land conversion to other uses. To address this concern, we worked with prairie restoration specialists to restore a 17-acre habitat in Morris, Minnesota. All non-native vegetation was removed, and a diversity of prairie plant seeds were seeded throughout the site to offer food sources for pollinators known to our region. Fifty Bur Oak trees were planted to create an oak savannah for improved wildlife habitat. Regular maintenance was conducted on the site to control both perennial and annual weeds, which allowed the prairie species to establish. The outcome was an improved landscape that supports bees, butterflies, and other beneficial pollinators as well as an enhanced ecosystem. The addition of native plants sequesters carbon and other air pollutants and filters runoff entering the watershed. Since restoration, biodiversity of plant and wildlife species has visibly increased. The native plant species are beginning to dominate over unwanted vegetation and attract a multitude of pollinator species.

Educational interpretation was installed throughout the demonstration site to encourage visitors to connect with the prairie habitat and learn how to create or enhance habitats on their own properties. We partnered with University of Minnesota Morris faculty and students to design, develop, and evaluate an interactive educational activity on pollinators and prairie restoration. The local high school uses the restoration site as an outdoor classroom to learn about beekeeping, pollinator health, and pollinator habitats.

PROJECT RESULTS USE AND DISSEMINATION

Two educational kiosks were installed on the site, along with two interpretive signs. Information available to the public at the kiosks includes why we need pollinators, the steps we've taken to restore the area, and the types of native pollinators in our region. A pamphlet from the [Minnesota Department of Agriculture](#) is available at the northern most kiosk. Interpretive signs along the trail include information about pesticide use in a pollinator friendly way and the environmental benefits of prairie restoration. Updates and articles about the project are available on the [West Central Research and Outreach](#) website.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 05h Expanding Nature Knowledge and Experience with New Interactive Exhibits at North Mississippi Regional Park - \$500,000 TF

MaryLynn Pulscher
Minneapolis Parks and Recreation Board
3800 Bryant Ave S
Minneapolis, MN 55419

Phone: (612) 313-7784
Email: mpulscher@minneapolisparks.org
Web: <http://www.minneapolisparks.org>

Appropriation Language

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Minneapolis Park and Recreation Board to develop new interactive exhibits at North Mississippi Regional Park to encourage the approximately 326,000 annual visitors to better understand and explore the river and surrounding natural area.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The new Nature in the City exhibit at North Mississippi Regional Park features compelling design with interactive components that spark curiosity about Nature, increase knowledge about Nature, entice visitors to explore the outdoors, and become better stewards of the environment.

OVERALL PROJECT OUTCOME AND RESULTS

Nestled between I-94 and the Mississippi River in north Minneapolis, North Mississippi Regional Park serves more than 300,000 annual visitors. Located within the park is the Carl Kroening Interpretive Center which featured an outdated and worn educational exhibit focused on human relationships to the Mississippi River as drinking water, transportation corridor, and job source. However, park staff discovered that what visitors really wanted was to learn more about the natural resources found in the park - the land, the water, animals, birds and insects - and connect with Nature in a hands-on, immersive way.

The overarching objective of the project is to educate and inspire park visitors so they can make better decisions to positively impact the natural world. Minneapolis Park & Recreation Board staff worked with Split Rock Studios (SRS) to imagine and develop content and components for a new educational exhibit titled Nature in the City. SRS then designed, fabricated, sculpted, and installed the landforms, interactives, super graphics, taxidermy, technology, signs and more. The exhibit features current research, compelling interpretation and visuals, and interactive components to spark wonder and curiosity about the Mississippi River, stormwater runoff, native plants and pollinators, wildlife and their adaptations to city living, plus migration, the Mississippi flyway, and more. Designed to foster repeat visitation, parts of the exhibit can change out seasonally, while others provide space to add stories and information in response to park visitor interests. The exhibits, along with programs led by staff, promote ways people can take action to benefit land and water. Park visitors are also encouraged to apply their new knowledge while exploring the park and contribute to citizen science field work.

PROJECT RESULTS USE AND DISSEMINATION

Due to the pandemic, the Kroening Interpretive Center remains closed to the public. When restrictions are lifted, staff look forward to welcoming the estimated 326,000 annual visitors to North Mississippi Regional Park to explore the new Nature in the City exhibit.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 05j Expanding the State's Reuse Economy to Conserve Natural Resources - \$275,000 TF

Jenny Kedward

ReUse Minnesota

2446 University Ave W

St. Paul, MN 55114

Phone: (612) 352-9119

Email: info@reusemn.org

Web: <https://www.reusemn.org/>

Appropriation Language

\$275,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with ReUSE Minnesota to provide outreach and technical assistance to communities and small businesses to create and expand opportunities for reusing, renting, and repairing consumer goods as an alternative to using new materials so solid-waste disposal and its impacts are measurably reduced and more local reuse jobs are created. Net income generated as part of this appropriation may be reinvested in the project if a plan for reinvestment is approved in the work plan.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

ReUSE MN connected businesses and consumers to organizations providing reuse, repair, and rental services through two conferences and 24 educational events. Research conducted revealed the Minnesota reuse sector makes up 1/3 of the retail economy. By avoiding new products, reuse saves 67 billion gallons of freshwater from being used each year.

OVERALL PROJECT OUTCOME AND RESULTS

Current practices of throwing away usable items and unnecessarily producing new goods depletes finite natural resources and pollutes our environment at an unsustainable pace. Reuse helps slow this process and keeps materials and products in use longer. The goal for this project was to promote the benefits of reuse, repair, and rental, including the organizations providing these services. Encouraging consumers to reuse results in more sustainable consumption patterns and supports the local economy.

LCCMR funding allowed ReUSE MN, a small, volunteer-run non-profit, to hire a management company to streamline organizational processes, update our website, and improve our membership structure.

Over the past two years, we hosted two conferences that highlighted reuse innovations, programs, policies, and research. The 2019 conference was the state's first reuse-focused conference, and welcomed 118 attendees. The 2020 virtual national conference saw 212 attendees representing 23 states and 3 Canadian provinces. ReUSE MN also hosted 20 webinars and educational sessions, and staffed booths/presented about reuse at 17 partner-hosted events.

The organization grew its reuse network of nonprofits, businesses, policymakers, educators, and consumers with paid memberships increasing to 205 – a nearly 7-fold increase over the grant period.

Using survey responses and purchased business data, ReUSE MN created a report summarizing the environmental, economic, and social impacts of reuse. Minnesota's reuse sectors:

- make up 1/3 of the retail economy, generating \$5.8 billion (2017).
- avoid over 2.7 million metric tons of greenhouse gas emissions and 67 billion gallons of freshwater extraction per year (ground or surface water sources) from products that would have been newly manufactured.

Reuse organizations play an important role in communities, keeping money and services local, offering spaces for learning and skills-building, and bringing like-minded individuals together around shared goals. Data and stories gathered throughout this grant will help advocate for Minnesota reuse organizations and show the importance of extending the life of our belongings and protecting the state's resources.

PROJECT RESULTS USE AND DISSEMINATION

ReUSE Minnesota provides regular updates and resources through monthly e-newsletters and social media. We reached more than 2,100 people through 36 educational sessions, member meetings, and two conferences. The ReUSE MN website acts as a directory for rental, repair, and reuse businesses as well as a resource for events and news about the reuse economy.

The final measurement and methodology report is housed on the ReUSE MN website. The new Reuse Impact map provides an interactive look at how reuse benefits the economy and environment across the state and by county. Nearly 100 listeners heard about the impact study results on a webinar. Results have already helped start conversations in counties that want to boost their reuse business sector to reduce waste.

Project Completed: 12/31/2020

FINAL REPORT

Subd. 05k Expand Materials Reuse and Recycling Jobs Program - \$800,000 TF

Steve Thomas

The Network for Better Futures (D/B/A) Better Futures Minnesota
PO Box 6596
Minneapolis, MN 55406

Phone: (612) 455-6133

Email: sThomas@betterfutures.net

Web: <https://www.betterfuturesminnesota.com>

Appropriation Language

\$665,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Better Futures Minnesota, in cooperation with the Northwest Indian Community Development Corporation, and \$135,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to expand building deconstruction and material-reuse practices and jobs in partnership with counties, tribes, and

municipalities statewide and to document the environmental, health, and economic benefits of these practices. Net income generated by Better Futures as part of this or a previous related appropriation from the environment and natural resources trust fund may be reinvested in the project if a plan for reinvestment is approved in the work plan.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project funded: the deconstruction of 29 properties; 10.5 FTE jobs; transitional employment of 200 people; a reuse project at a county landfill; and the promotion of deconstruction and material reuse throughout the State. The project generated close to net zero emissions by diverting 80% of 8,000,000 pounds of material from landfills.

OVERALL PROJECT OUTCOME AND RESULTS

This project supported the growth of building material stewardship, an essential and viable alternative to burying 70% of the State's building waste in landfills. Practical alternatives to dumping are needed to avert the serious health, financial, and environmental costs of landfill use.

Three activities were completed. First, by providing advice and assistance to counties, a deconstruction incentive grant program for homeowners in Hennepin County was implemented and a diversion/reuse program at the Becker County landfill was established.

Second, through presentations and outreach the partners made significant progress in making the reuse and recycling of building materials a preferred practice statewide. One result is the Sustainable Building Materials Stakeholder group with staff support from the MPCA. This work group is focused on informing rule changes for landfills, expanding deconstruction work in the State, and expanding the marketplace for the reuse of materials.

This outreach was combined with deconstructing 29 properties in 22 communities, launching a diversion and reuse program at a county landfill, and training and offering transitional employment for 200 people. The results of this effort - types and value of materials harvested and reused; jobs created; and the benefits for our air, water, and land - demonstrated to many audiences the value of this project.

The third activity focused on documenting that 80% (3,117 tons or 6,234,000 pounds) of the 4,000 tons collected was diverted from landfills. The most beneficial environmental outcome is that 346 tons or 9% of the material was reused.

Overall, the benefits of the deconstruction and reuse, as an alternative to demolition, are broad and generous. Project data shows deconstruction generates 70% less emissions than demolition. This project also approached net zero emissions per ton of material collected: .63 metric tons of CO₂ for deconstruction compared to 2.23 metric tons of CO₂ for demolition.

This project can inform economic development and healthy environmental practices Statewide. The formula is practical: take apart and reuse buildings rather than dumping them in landfills and begin diverting reusable materials at landfills. These new methods create more jobs, provide quality materials for consumers, and dramatically reduces harmful pollutants.

PROJECT RESULTS USE AND DISSEMINATION

The highlights of the partners' many and varied dissemination efforts included: an opportunity to introduce building material stewardship and deconstruction practices to more than 150 government,

tribal, and business owners during statewide MPCA stakeholder meetings; an opportunity to describe this projects' value and impact to an international audience during a "virtual" conference sponsored by the Ellen McArthur Foundation in London, England; and, a presentation at the 2021 Environmental Initiative awards ceremony (Better Futures and Becker County received the 2021 Rural Innovation Award).

The partner's deconstruction pilot with St Louis County generated opportunities to promote the benefits and impact of deconstruction and material reuse.

Articles on this project were included in the [Duluth Monitor](#), [WDIO Radio](#), [Duluth News Tribune](#), [FOX21](#), and [KBJR6](#).

Becker County staff created a significant number of followers (over 2500) on Facebook Marketplace. This site along with Craig's List are effective venues for promoting the reuse pilot and promoting sales events. Staff also promote reuse on a local weekly radio show.

Project Completed: 6/30/2021

[FINAL REPORT](#)

Subd. 06 Aquatic and Terrestrial Invasive Species

Subd. 06b Palmer Amaranth Detection and Eradication Continuation - \$431,000 TF

Monika Chandler

Minnesota Department of Agriculture
625 Robert St N
St. Paul, MN 55155

Phone: (651) 201-6537

Email: monika.chandler@state.mn.us

Appropriation Language

\$431,000 the second year is from the trust fund to the commissioner of agriculture to continue to monitor, ground survey, and control Palmer amaranth primarily in conservation plantings and to develop and implement aerial-survey methods to prevent infestation and protect prairies, other natural areas, and agricultural crops.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Palmer amaranth is an aggressive weed that is expensive and damaging to control. It was found as a contaminant in a small number of conservation planting seed mixes sold in Minnesota. Rapid response to the situation resulted in Palmer amaranth eradication from impacted conservation plantings.

OVERALL PROJECT OUTCOME AND RESULTS

Palmer amaranth is an invasive plant that threatens row crop production and prairies. In 2016, it was found in a small number of conservation planting seed mixes. There were concerns that Palmer amaranth would spread to nearby crop fields and cause high yield losses, up to 91% in corn and 78% in soybeans. Palmer amaranth can be resistant to multiple herbicides making it difficult to control. There

was a lot of concern about the conservation planting pathway for Palmer amaranth and it was declared an agricultural emergency by the commissioner of agriculture.

This project enabled rapid response to the situation as it unfolded.

- Palmer amaranth was controlled in the field by Conservation Corps Minnesota using propane torches, prescribed fire and hand pulling. As a result, Palmer amaranth was eradicated from all impacted conservation plantings. There were 92 infestations (some in crop fields) of which 67 were eradicated, 13 were negative (no Palmer found in field planted with contaminated seed mix) and 12 are active infestations in crop fields that MDA will continue to monitor.
 - Intensive infestation monitoring was required to achieve this successful outcome.
- Drones were utilized to help look for Palmer amaranth in large fields. This work with drones was experimental and led by the University of Minnesota's UAV Lab. We learned much that can be applied for future aerial survey efforts.
 - MDA now uses a drone for aerial survey.

Palmer amaranth control efforts were so effective that some Conservation Corps Minnesota funding could be diverted to control other priority target species infestations including black swallow-wort, common teasel, cutleaf teasel, Japanese hops, oriental bittersweet, poison hemlock and knotweeds.

PROJECT RESULTS USE AND DISSEMINATION

Presentations, articles, and a paper were the primary dissemination means. There were 40 presentations, trainings or updates about Palmer amaranth and this project. In trainings, we used resources developed for the ENRTF project Elimination of Target Invasive Plant Species including 3D printed models of Palmer amaranth seedlings, pressed plant samples, and large format printed displays. Two popular press articles were written and sent to outstate media. Our paper [Timeline of Palmer amaranth invasion and eradication in Minnesota](#) was open access published in Weed Technology. To date, it was accessed via HTML by 741 and via PDF by 4,580.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 06c Evaluate Control Methods for Invasive Hybrid Cattails - Research Project - \$131,000 TF

Steve Windels

Voyageurs National Park
360 Hwy 11 E
International Falls, MN 56649

Phone: (218) 283-6692

Email: steve_windels@nps.gov

Appropriation Language

\$131,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Voyageurs National Park to evaluate the effectiveness of mechanical harvesting and managing muskrat populations to remove exotic hybrid cattails and restore fish and wildlife habitat in

Minnesota wetlands. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Invasive hybrid cattails can be effectively controlled by mechanical treatments, creating space for native plants like wild rice and other native aquatic plants, and enhancing habitat for wetland-loving wildlife like muskrats, mink, otters, bitterns, rails, grebes, and more.

OVERALL PROJECT OUTCOME AND RESULTS

Invasive hybrid cattails are rapidly expanding throughout Minnesota's wetlands. Hybrid cattails grow in dense stands that crowd out native plant species and create single species stands that can degrade both fish and wildlife habitat and negatively impacts biodiversity and wetland function. Starting in 2016, Park staff, securing both state and federal funding, initiated the Voyageurs Wetland Restoration Project to restore wetlands within the large lakes of the park that have been infested by invasive hybrid cattails. Through this LCCMR grant, we documented that we achieved reductions of invasive hybrid cattail cover from all six mechanical treatments that were tested. Lethal treatments showed the greatest reduction in cattail coverage with all treatments, showing approximately a 90% reduction in cattail cover up to 3-years post-treatment. Treatment of cattails increased cover and diversity of native wetland plants across all treatment types, which we lumped into 4 functional plant groups: rushes, sedges, grasses, and herbaceous plants. Our project represented the first attempt to translocate muskrats and assess post-translocation survival and movements. Additionally, our project was the first to experimentally investigate feeding preferences of muskrats and also quantify immediate foraging effects of translocated muskrat populations on *T. x glauca* coverage in wetlands. We found that translocated muskrats quickly established home ranges and that survival of post-translocated muskrats was similar to reported survival estimates of other established muskrat populations. Overall, our results suggest that muskrat translocations may be a viable option to re-establish or temporarily increase abundances of muskrat populations, especially in areas with a healthy beaver population. Even though we showed that muskrats do eat invasive hybrid cattails, we do not believe that muskrat densities in our area can be elevated to a high enough density for multiple years to where stands of invasive hybrid cattail can be eliminated or even noticeably reduced in abundance.

PROJECT RESULTS USE AND DISSEMINATION

This collaboration between the National Park Service's Voyageurs Wetland Restoration Project and Kansas State University produced five scientific papers and other reports. Our findings, though many are still preliminary, have influenced wetland restoration techniques throughout the U.S. and Canada through our presentations at local, state, and national scientific conferences; through our outreach efforts via print and online media; and through one-on-one consultations with others working on wetland restoration.

Project Completed: 6/30/2022

FINAL REPORT

[**Supplementary Materials for "Evaluate Control Methods for Invasive Hybrid Cattails" - 85 pgs**](#)

Subd. 06d Developing RNA Interference to Control Zebra Mussels - \$500,000 TF

Christopher Merkes
U.S. Geological Survey

2630 Fanta Reed Rd
La Crosse, WI 54603

Phone: (608) 781-6316
Email: cmerkes@usgs.gov
Web: <https://www.usgs.gov/staff-profiles/chris-m-merkes>

Appropriation Language

\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the United States Geological Survey to develop a genetic control tool that exploits the natural process of RNA silencing to specifically target and effectively control zebra mussels without affecting other species or causing other nontarget effects. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The project did not occur due to challenges the entity encountered receiving state funds.

Project Completed: 6/30/2021

Subd. 06e Install and Evaluate an Invasive Carp Deterrent for Mississippi River Locks and Dams - \$998,000 TF

Peter Sorensen
U of MN - AIS Center
1980 Folwell Ave
St. Paul, MN 55108

Phone: (612) 624-4997
Email: soren003@umn.edu
Web: <http://fwcb.cfans.umn.edu/sorensen/>

Appropriation Language

\$998,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota in cooperation with the United States Army Corps of Engineers and the United States Fish and Wildlife Service to install, evaluate, and optimize a system in Mississippi River locks and dams to deter passage of invasive carp without negatively impacting native fish and to evaluate the ability of predator fish in the pools above the locks and dams to consume young carp. The project must conduct a cost comparison of equipment purchase versus lease options and choose the most effective option. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project discovered that even when equipped with a sound-light deterrent, Lock and Dam 8 has little promise to stop invasive carp but that Lock and Dam 5 could stop over 99% of all carp if equipped with a sound-light deterrent that includes a bubble curtain.

OVERALL PROJECT OUTCOME AND RESULTS

The purpose of our project was to determine how to stop invasive carp. Because all carp must pass through locks-and-dams we focused on these structures, focusing on Lock and Dam 8 (LD8) near the Iowa border. We specifically examined whether and how carp could be stopped at LD8 by adjusting its spillway gates, installing a sound-light deterrent in its lock, and managing native fish predators in its vicinity. While we found that this combination has little promise at LD8, nearly all carp could be stopped upstream at LD5 using a variant of it, sparing Lake Pepin and most of the state. Insight came from several aspects of our research. First, by releasing acoustically-tagged common carp at biweekly intervals and tracking their movements upstream through LD8, we discovered that carp passage through spillway gates only occurs at high discharges as predicted by a fish passage model -- proving that LD8 is a poor location to stop carp because its gates open infrequently, but that LD5 is an excellent location because its gates do. Second, we found that carp passage through locks is predictably low, meaning that the lock at LD5 is an excellent location to install a deterrent because of this LD's low spillway passage rates. Third, while we found that a sound-light deterrent was ineffective at blocking carp, a sound-light-bubbling system (BAFF) is. An engineering analysis supported using a BAFF at LD5. Fourth, when we examined whether native predatory fishes might control invasive carp, we discovered no support: no common predator feeds on fish (carp) eggs and floodplain predators do not favor their young. Finally, we created a numeric model which showed that a BAFF at LD5, coupled with spillway optimization, and carp removal at that site would stop 99.6% of all carp in Minnesota – a solution has been identified.

PROJECT RESULTS USE AND DISSEMINATION

Our findings on carp deterrents are being used by the US Fish and Wildlife Service to test a bioacoustic fish fence. Our findings have been widely disseminated. A recent summary of the project was presented at a carp forum: [Carp Forum](#). In addition, we presented our findings at several public (ex. 2019 Stop Carp Forum), scientific (ex. Midwest Fish and Wildlife meetings) and agency level meetings (ex. annual Mississippi River ANS Task Force Meetings). We have published 3 scientific peer-reviewed articles and have 2 in review. The StarTribune covered our project twice in front page articles as did Minnesota Outdoors.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 06f Determining Risk of a Toxic Alga in Minnesota Lakes - Research Project - \$200,000 TF

Adam Heathcote

Science Museum of Minnesota - St. Croix Research Station
16910 152nd Street N
Marine on St. Croix, MN 55047

Phone: (651) 433-5953

Email: aheathcote@smm.org

Web: <https://www.smm.org/scwrs>

Appropriation Language

\$200,000 the second year is from the trust fund to the Science Museum of Minnesota for the St. Croix

Watershed Research Station to determine the historical distribution, abundance, and toxicity of the invasive blue-green alga, *Cylindrospermopsis raciborskii*, in about 20 lakes across Minnesota and inform managers and the public about the alga's spread and health risks. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project produced the first systematic survey of Minnesota's Sentinel Lakes for the toxic invasive algae *Cylindrospermopsis raciborskii* (Cylindro). Cylindro was contained to the 2 lakes where it was initially found and did not produce toxins in measurable amounts. Sediment records indicated that Cylindro has appeared in the last 10 years and has not spread statewide.

OVERALL PROJECT OUTCOME AND RESULTS

Cylindro is a subtropical invasive species of Cyanobacteria that has been invading lakes in the Upper Midwest since the early 2000s. Cylindro is of particular concern because it is known to produce a potent liver toxin and the presence of its blooms can be difficult to identify. Cylindro was first discovered in two Minnesota lakes in 2013, and that discovery led to the design of this statewide survey of the Minnesota Sentinel Lakes to better understand the spread and invasion history of this species. Our monitoring results, based on DNA and microscopy, show that Cylindro is currently limited to the two lakes where it was initially found, and sediment cores indicate that it has been present in those lakes for under 10 years. Additionally, even in lakes where Cylindro was present, there was no evidence of toxin production in detectable amounts, minimizing the public and wildlife health threat of this species. Thankfully, these results suggest that the threat of Cylindro invasion in Minnesota lakes is currently low, though continued monitoring for this species is important given the trend of warming lake waters across the state.

PROJECT RESULTS USE AND DISSEMINATION

We have shared the progress and results from this project widely over the duration of the project. This includes both articles written by our staff, shared with traditional and social media, and peer reviewed papers. These efforts are summarized below in chronological order:

- ["Invisible" species of exotic algae threatens to poison Minnesota lakes](#), posted to SMM.org on 11/6/2018, (PDF attached in supplemental materials)
- ["Conditions ripe for a record number of algae blooms"](#), Minnesota Public Radio Climate Cast segment on 7/19/2019
- ["Why good algae go bad"](#), talk at the Marine Community Library by Adam Heathcote on 7/14/2019, picture of event on [Twitter](#)
- Adam Heathcote Co-chaired special session on Harmful Algal Blooms at the Minnesota Water Conference and organized a panel of experts to take questions from conference attendees in St. Paul, MN on 10/16/2019
- During the pandemic we provided information on [harmful algal blooms](#) for the public on the Science Museum website in our "Learn From Home" section, posted on 7/7/2020
- Preliminary results from this study were presented to the Minnesota Inter-agency HABs group at their Winter Workshop on 1/25/2021. Attendees includes representatives from the Minnesota DNR, MPCA, MDH and the MVMA
- Results from this study were [published](#) in the peer-reviewed journal PLOS ONE on 3/21/2022. PDF of paper is attached in the supplemental materials

Project Completed: 6/30/2022

FINAL REPORT

Diversity and distribution of sediment bacteria across an ecological and trophic gradient - 20 pgs

Subd. 07 Air Quality and Renewable Energy

Subd. 07a Develop Solar Window Concentrators for Electricity - \$350,000 TF

Uwe Kortshagen

U of MN

111 Church St SE

Minneapolis, MN 55455

Phone: (612) 625-4028

Email: kortshagen@umn.edu

Appropriation Language

\$350,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop, evaluate, and optimize thin film silicon-based luminescent solar window concentrators in order to produce inexpensive, clean energy and reduce air pollution. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project demonstrated the potential of semi-transparent “solar windows” based on silicon nanocrystals to produce carbon-free, renewable electricity. Greenhouses were identified as an attractive application. As greenhouses are becoming more widespread in Minnesota, this project will contribute to reducing their environmental footprint in terms of energy and water usage.

OVERALL PROJECT OUTCOME AND RESULTS

This project focused on exploring inexpensive “solar windows” that are transparent and produce clean electricity. Solar windows are based on solar concentrators using highly luminescent nanometer-sized silicon crystals, a technology developed at the University of Minnesota. The silicon crystals, embedded in or coated onto the windowpane, absorb harmful-to-humans ultraviolet and blue light and turn it into red light, which is guided by internal reflection to the edge of the window pane, where it is concentrated onto a small-area solar cell.

Over the course of this project, the project team learned that these solar windows are of particular interest to greenhouses. While being partially transparent, they can produce electricity while not impeding or even enhancing plant growth. The project team initially focused on exploring experimental prototypes of the technology. Based on characterization of these prototypes, models were developed that allow us to predict the performance of larger scale devices. These models were extended into a comprehensive simulation tool that can describe the renewable electricity produced by a solar greenhouse, the light available for plant growth, as well as the overall energy balance of a greenhouse.

For Minnesotans, results of this research may have significant future benefits. Greenhouses allow us to produce certain crops locally that are hard to grow in open-field farming in Minnesota. Locally grown

produce is fresher and reduces the emissions associated with shipping of produce across the country. Greenhouses also only use a fraction of the water and fertilizer that is required in open-field farming. While generally energy-intensive, this research project has pointed the way to reduce the energy consumption of greenhouses through solar windows.

PROJECT RESULTS USE AND DISSEMINATION

Results of this research have been published in the scientific literature and presented at conferences. Three scientific papers were published related to:

- [The influence of scattering on the performance of silicon luminescent solar concentrators](#)
- [The demonstration of silicon thin film luminescent solar concentrators](#)
- [The application of silicon luminescent solar concentrators to agrivoltaics](#)

Among the conference presentations presented by graduate students working on this project, one was chosen for the “best presentation” award.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 07b Demonstrations for Community-Scale Storage System for Renewable Energy - \$550,000 TF

Ellen Anderson

U of MN - I on E
1954 Buford Ave, 229 19th Avenue S
Minneapolis, MN 55455

Phone: (612) 625-1981

Email: ellena@umn.edu

Appropriation Language

\$550,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to install, demonstrate, and evaluate three community-scale storage systems for renewable energy and develop a guidebook on storing renewable energy for statewide use. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The University of Minnesota’s Institute on the Environment with Renewable Energy Partners, Red Lake Tribal Government Center, and University of Minnesota-Morris, demonstrated community-scale storage for renewable energy, including microgrids and battery systems. This project expanded our knowledge of leading-edge technology, shared lessons learned on battery acquisition, permitting, and installation, and advanced energy justice.

OVERALL PROJECT OUTCOME AND RESULTS

More cities, campuses, nonprofit entities, and businesses across Minnesota are using wind and solar technology to produce cleaner energy. To reach high levels of renewable energy, significantly reduce their emissions, and achieve energy independence, they will need to include energy storage in their energy systems. Currently there are few examples of “community scale” energy storage projects, and

often these entities lack the technical knowledge needed to select and optimize the best energy storage system. The overall goal of this project is to expand community-based, locally-produced renewable energy and reduce air emissions to improve the environment, under the LCCMR's funding priority "Air Quality, Climate Change, and Renewable Energy".

This project included three activities. First, we produced an "[Community-Scale Energy Storage Guide](#)" that describes both the operation of the US electricity grid with renewable energy and battery storage and different battery storage technologies and installation steps, using the sites as case studies. Second, we selected sites - Renewable Energy Partners, Red Lake Tribal Government Center, and University of Minnesota-Morris - and worked with them, using the guidebook research, to identify and acquire the optimal battery technology to meet site needs and provide technical assistance on design, permitting, and battery installation. At this stage, Renewable Energy Partners has a fully functional and tested battery - it will be complete when insurance is registered with Xcel Energy; Red Lake Tribal Government Center is completed; and University of Minnesota-Morris has the battery and installation components finalized and will proceed with installation once it receives permits. Third, given COVID-19, this project pivoted to develop a virtual site that includes highlights of the three demonstration sites, interviews on the benefits of battery storage, and webinars on battery storage lessons learned. Overall, this project expanded our knowledge of leading-edge technology, shared lessons learned on battery acquisition, permitting, and installation, and advanced energy justice.

PROJECT RESULTS USE AND DISSEMINATION

The project team created a "[virtual site visit](#)" that highlights the three demonstration sites and presents interviews with the Project Partners to get the full scope of how the storage system was implemented.

We created a two part webinar that took a deep-dive into battery storage by conducting a panel discussion with industry experts, seminars and workshops.

We published an [Energy Storage guidebook](#) and highlighted this downloadable, user friendly publication at the CERTS events, Energy and Equity workshop, and with the Energy Storage Advisory Committee.

Published Videos on the IonE YouTube page:

Community-Scale Battery Energy Storage in

Minnesota <https://www.youtube.com/watch?v=RpNs6rvGKCI>

Community-Scale Energy Storage: How does it work? <https://www.youtube.com/watch?v=QjTjuJAtrxA>

Project Completed: 6/30/2022

FINAL REPORT

Subd. 07c Develop Inexpensive Energy from Simple Roll-to-Roll Manufacturing - \$300,000 TF

Tianhong Cui

U of MN

111 Church St SE

Minneapolis, MN 55455

Phone: (612) 626-1636
Email: tcui@umn.edu

Appropriation Language

\$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop inexpensive, high-efficiency solar energy with simple roll-to-roll advanced manufacturing technology, using new materials such as perovskite to make solar cells. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Perovskite solar cells and modules were fabricated via two-step deposition method, hybrid chemical vapor deposition and air blade deposition, to produce electricity from free clean solar energy, which could reduce the dependency on the non-renewable energy usage and provide green environment and habitats for both residency and wildlife of Minnesota.

OVERALL PROJECT OUTCOME AND RESULTS

Perovskite material is a promising candidate for the next generation of solar cells with high efficiency and significantly lower cost than silicon solar cells. Potential use of thin film perovskite solar cells may revolutionize the current solar industry to produce clean renewable energy. We met the final objective of this project by developing methods for roll-to-roll manufacturing, including hybrid chemical vapor deposition and air blade deposition. More specifically, chemical vapor deposition processes were optimized, and air blade coating system was developed based on a 3D printer. Perovskite solar cell compositions, structures, and additives were also investigated and optimized to enhance the performance. We developed flexible perovskite solar cells on PEN substrates, which are compatible with the roll-to-roll process, and which show an efficiency of 13.3% via chemical vapor deposition method. We also produced a device with power conversion efficiency of 13.82% via air blade and chemical vapor deposition methods, and we fabricated and field tested 5 cm x 5 cm perovskite solar modules with an active area of 18 cm² square centimeters. The outcomes from this project contribute to the development of next generation photovoltaic industry and help researchers better understand the nature of the perovskite solar cells. By utilizing clean solar energy more efficiently via perovskite solar cells, the dependency on non-renewable energies and pollution may be reduced. Cheap and clean electricity produced from perovskite solar cells via the developed roll-to-roll compatible methods demonstrated during this project may further benefit the residents of Minnesota. By harvesting green solar energy more efficiently and economically.

PROJECT RESULTS USE AND DISSEMINATION

The findings were disseminated through the following publications in archived journals.

1. Rui Zhu, Xiangyang Wei, Gongnan Xie, Terrence Simon, and Tianhong Cui. "Numerical simulation of vapor deposition process of perovskite solar cells: The influence of methylammonium iodide vapor flow to perovskite growth." *Journal of Solar Energy Engineering* 143, no. 1 (2021).
2. Xiangyang Wei, Yangke Peng, Gaoshan Jing, Terrence Simon, and Tianhong Cui, "High Performance Perovskite Solar Cells Fabricated by a Hybrid Physical-Chemical Vapor Deposition", *ASME Journal of Solar Energy Engineering*, Vol. 143, No. 4, 2021: 041006

3. Wei, Xiangyang, Yanke Peng, Gaoshan Jing, and Tianhong Cui. "Planar structured perovskite solar cells by hybrid physical chemical vapor deposition with optimized perovskite film thickness." *Japanese Journal of Applied Physics* 57, no. 5 (2018): 052301.

Project Completed: 6/30/2022

FINAL REPORT

Numerical Simulation of Vapor Deposition Process of Perovskite Solar Cells: The Influence of Methylammonium Iodide Vapor Flow to Perovskite Growth High-Performance Perovskite Solar Cells Fabricated by a Hybrid Physical-Chemical Vapor Deposition

Subd. 08 Methods to Protect or Restore Land, Water, and Habitat

Subd. 08a Nongame Wildlife Program Acceleration - \$220,000 TF

Kristin Hall

MN DNR

500 Lafayette Rd, Box 25

St. Paul, MN 55155

Phone: (651) 259-5104

Email: Kristin.hall@state.mn.us

Web: <http://www.dnr.state.mn.us>

Appropriation Language

\$220,000 the second year is from the trust fund to the commissioner of natural resources to accelerate the nongame wildlife program including rare wildlife data collection, habitat management, collaborative land protection, conservation education, and a new emphasis on promoting nature tourism to benefit wildlife, visitors, and rural communities.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Funds from this grant helped us prioritize collaborative efforts in our Conservation Focus Areas. We successfully conducted 10 habitat improvement projects on over 200 acres for multiple Species in Greatest Conservation Need including: bottomland forest songbirds, prairie pollinators, Blanding's turtles, and oak savanna dependent species.

OVERALL PROJECT OUTCOME AND RESULTS

Results of this project can be broken down into three separate categories: habitat work, monitoring efforts and research. We surpassed our goals for the habitat restoration piece of this grant mainly due to the partnership aspect of Conservation Focus Areas. We were able to provide partial funding that leveraged broader participation in conservation actions. In total, this project enabled us to:

- plant 765 sapling trees in bottomland forest habitat to help with reforestation efforts,
- plant 6,000 oak saplings in oak savanna habitat on 17 acres at Meadow Brook WMA,
- conduct prairie forb inter-seed plantings on 45 acres of prairie grassland at three different locations,
- contribute to 102 acres or prescribed fire management to reduce succession and overgrowth of woody vegetation in grasslands,

- restore a sandy shoreline for turtle nesting habitat.

All activities took place in at least one of the four activated CFAs (see map: Conservation Focus Areas (CFA) Status 2015-205 MN Wildlife Action Plan).

An important component of conducting habitat improvement work is monitoring the species response to management. These efforts were focused primarily on prairie habitat restoration activities in the southwest and southeast portion of the state. Both flora and fauna response has been measured prior to the restoration activity, during the establishment of the restoration and post management. These data will provide managers with information on ways to potentially adapt their management practices to better accommodate the species the habitat restoration is meant to benefit.

Research and monitoring are a top priority for the Nongame Wildlife Program, which uses status and trend data to determine the protection status of many nongame species. This grant helped us to conduct a pilot study for a new research project to better understand the recent declines of American kestrels. The pilot efforts resulted in a full scale project proposal for a federal grant which was awarded in spring of 2021.

PROJECT RESULTS USE AND DISSEMINATION

Conservation Focus Areas are one of the main implementation tools in our State Wildlife Action Plan and we celebrate the work being done throughout the CFA network in many of our communications. Our Nongame Wildlife Program [Facebook page](#) has featured some of the CFA habitat projects as well as the kestrel research. We have also created a 34 page, [Wildlife Action Plan 5-year Report](#), featuring highlights on how the plan is funded and the work we do. This report will be available to the public as well as our supporters to provide a fun “behind the scenes” look at how our program operates.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 08b Develop BioMulch to Replace Plastic Soil Covering in Vegetable and Fruit Production to Increase Yield and Reduce Waste - \$310,000 TF

Paulo Pagliari

U of MN - Lamberton
23669 130th Street
Lamberton, MN 56152

Phone: (507) 752-5065

Email: pagli005@umn.edu

Appropriation Language

\$310,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop and test the performance of biodegradable biomulch to increase yield, conserve water, suppress weeds and pests, add nutrients to the soil, and replace large amounts of nonrecyclable and nondegradable plastic used in vegetable and fruit production. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project was used to develop a biodegradable product that can be used to replace plastic mulch used in vegetable production. The results of research showed that the current formulation of BioMulch worked as expected for watermelon and zucchini; and underperformed (yield was reduced) for tomatoes, peppers, and strawberry.

OVERALL PROJECT OUTCOME AND RESULTS

This project was used to develop a biodegradable product, BioMulch, that can be used to replace plastic mulch used in vegetable production in MN. Plastic mulch cause environmental pollution as it slowly breaks down and creates pollutants such as micro and nanoplastics. Micro and nanoplastic have been proven to be endocrine disruptors and also cause severe health issues to human, animals, and aquatic life. Our intent with this project was to develop a biodegradable product which would replace plastic. Field trials were set up at the University of Minnesota Research and Outreach center at Lamberton. The BioMulch was tested on bell peppers, tomatoes, strawberry, watermelon, and zucchini. Our main goals with this project were to test the efficacy of BioMulch on preventing weeds from emerging and growing and keep the soil moist in comparison with plastic mulch. The results of our project showed that a biodegradable product can be safely created and used to replace plastic mulch used in vegetable production. Yield for watermelon and zucchini were similar between plastic cover and BioMulch; however, yield of tomatoes, peppers, and strawberry were reduced with the use of BioMulch. This management practice should minimize the agricultural footprint on the environment by minimizing the amount of waste being produced in Minnesota by vegetable producers. The use of a biodegradable soil cover means that at the end of the season a simple tillage practice can incorporate the soil cover into the soil and eliminate the waste currently being produced with plastic. Therefore, Minnesotans could benefit from this project by having lower amounts of plastic being used in vegetable production, lower amounts of micro and nanoplastic being created as plastic covers brake-down, and as a result cleaner air, soil, and water. In addition to, healthier Minnesota grown foods.

PROJECT RESULTS USE AND DISSEMINATION

The results of this project have been disseminated to growers that have attended Extension events at the Southwest Research and Outreach Center (SWROC) from 2021 to Summer 2022. The last phase of the research project was completed in June 2022 and now we are working on Extension materials which will be posted on the SWROC [nutrient management](#) website. Technology commercialization efforts continue at AURI.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 08c Develop Market-Based Alternatives for Perennial Crops to Benefit Water Quality and Wildlife - \$150,000 TF

Jason Ulrich

Science Museum of Minnesota
16910 152nd St N
Marine on St Croix, MN 55047

Phone: (651) 433-5953 x28

Email: julrich@smm.org

Appropriation Language

\$150,000 the second year is from the trust fund to the Science Museum of Minnesota for the St. Croix Watershed Research Station to design and evaluate at least six market-based scenarios for perennial cropping systems in Minnesota, including technological and economic feasibility, and estimate their potential to improve water quality and provide wildlife habitat. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The project researched using different types of market incentives to develop policies and programs to fund putting more perennial lands in Minnesota's agricultural areas to benefit water quality and wildlife habitat.

OVERALL PROJECT OUTCOME AND RESULTS

Although as a state we've spent millions of dollars on conservation, the health of our streams and lakes has not improved in most of Minnesota's agricultural areas. At the same time, populations of songbirds, pheasants, bees, and monarch butterflies have continued to decline because of a loss of grassland habitat. The main reason for these issues is the continued loss of grassland to planting row crops like corn and soybeans. Reversing this loss is very difficult because of the high cost required to take profitable cropland out of production without affecting a farmer's bottom-line. In this project we researched new ways to restore our waterways and habitat by economically replacing typical row crops with grass and perennial crops by creating new market incentives. For example, what if a solar company could be paid an incentive by a publicly funded program to place solar arrays on small areas of corn fields near the edges of streams? A subsidy would be paid to the solar companies to install the array and the farmer could grow forage grass for grazing sheep underneath them. This way the farmer gets paid a fair rental rate for having the array on their property and could collect additional income from the livestock, while the solar company has an incentive to spend more to install and maintain the array. Our objective in this project was to research solutions such as these, estimating how much they would cost, and how a program or a policy would have to be structured to pay for them. We investigated several incentive programs and found that economically practical programs are possible right now with the right policies to support them. Our research provides a valuable starting point for policy makers to start thinking about new creative, economical ways to help restore the health of our waterways and grassland habitats.

PROJECT RESULTS USE AND DISSEMINATION

The work has been presented to agencies such as the Minnesota DNR and at several Science Museum member events. Finally, the project team was instrumental in organizing and leading the highly successful AgroEcology Summit in Windom, MN in August 2019, where the project work was presented over several hours to more than one hundred attendees. The concepts of using markets to drive adoption of perennial crops/cropping systems generated considerable interest, and follow-up meetings have been scheduled with several environmental advocacy groups to discuss next steps.

Following the completion of the project, the fact sheet created for this project and link to LCCMR and the final report will be shared via Science Museum social media platforms.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 08d Agricultural Weed Control Using Autonomous Mowers - \$750,000 TF

Eric Buchanan

U of MN - Morris
46352 State Hwy 329
Morris, MN 56267

Phone: (612) 624-8869

Email: buch0123@morris.umn.edu

Web: <http://www.umn.edu>

Appropriation Language

\$750,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center at Morris to design, integrate, and field-test new technology mowers to control weeds, reduce herbicide use, reduce energy costs, and improve native vegetation and forage quality on agricultural lands. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

An autonomous electric mower, along with a solar powered charging trailer, was successfully developed and demonstrated to control weeds in cow pastures. The "Cowbot" eliminates the need for pesticides in conventional pastures and provides a carbon-free solution for organic pastures.

OVERALL PROJECT OUTCOME AND RESULTS

Minnesota farmers and land managers are engaged in an annual battle to control weeds. Each year, significant amounts of herbicide, diesel fuel, labor, and money are expended to stay ahead of weed infestations. Our project team developed an autonomous mowing robot, we call Cowbot, that can design a path to mow a pasture given the GPS coordinates of the pasture corners. The Cowbot can then accurately follow this path and return to its starting point when mowing is completed. A specially designed solar charging trailer is placed at the starting point to recharge the Cowbot when its batteries are low. Widespread adoption of the technology we demonstrated could lead to:

- Significant reductions in the use of herbicides on agricultural and natural lands,
- Replacement of fossil fuel with clean energy produced locally,
- Protection of water resources by preventing surface and ground water contamination with herbicides,
- Reducing the impact of herbicide on wildlife, desired native plant species, and the evolution of herbicide tolerant 'super' weeds.

The project team consisted of researchers at the University of Minnesota from several departments working together to develop a robotic pasture mower in partnership with a Minnesota manufacturing company, The Toro Company. Safety protocols were developed for field testing and safety implications of autonomous farm vehicles in general were researched. The Cowbot was field tested in pastures at the U of MN West Central Research and Outreach Center (WCROC) comparing its performance to a conventional mower deck pulled by a diesel tractor. The Cowbot successfully mowed three, two-acre pasture paddocks demonstrating three different path strategies. It returned to the charging trailer after

mowing each paddock and was successfully recharged. A dairy producer reviewed the mowed pasture and judged the Cowbot mowed paddocks to offer equivalent or better control of weeds than the tractor mowed paddocks.

PROJECT RESULTS USE AND DISSEMINATION

Several academic papers were published relating to technology used to design mowing paths and control the Cowbot. The Cowbot was demonstrated to farmers and land managers at several events like the Midwest Farm Energy Conference at the WCROC in 2019 and 2022. It was also featured in an episode of the PBS television show “The Prairie Sportsman” along with interviews with several project team members airing in March 2021. The Cowbot was a featured live demonstration at a state-wide expo in August 2021 called FarmFest. Finally, the Cowbot appeared in several print media articles including the Star Tribune and AgWeek.

Project Completed: 6/30/2022

FINAL REPORT

Cowbot: System Design and Field Evaluation of an Autonomous Weed Mowing Robot for Cow Pastures - 7 pgs

Subd. 08f Develop Strategies for Timber Harvest to Minimize Soil Impacts to Maintain Healthy and Diverse Forests - Research Project - \$200,000 TF

Charlie Blinn

U of MN
1530 Cleveland Ave N
St. Paul, MN 55108

Phone: (612) 624-3788

Email: cblinn@umn.edu

Web: <https://www.forestry.umn.edu>

Appropriation Language

\$200,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop strategies and practical tools to minimize soil compaction and other impacts across a range of conditions during timber harvest to maintain timber availability, improve regeneration of diverse forests, and benefit wildlife habitat. This appropriation is available until June 30, 2022, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Reduced snowfall predicted with climate change is likely to increase the amount of soil frost during winter, increasing the times when forest harvesting can safely occur. We developed tools that will allow managers to predict when and where optimal soil conditions occur to minimize impacts of forest harvesting.

OVERALL PROJECT OUTCOME AND RESULTS

Soils and forest health can be impacted during forest harvesting depending on how much frost is present during winter and how wet the soils are in summer. Climate change is expected to change these

conditions, creating challenges for managers to determine when the optimal harvest time will occur. Our objectives were to determine how 1) snow cover influences the rate of frost development; 2) soil moisture influences soil strength; and 3) each of those relationships vary across areas that span a range of soil drainage (relative wetness). We conducted snow removal and rainfall reduction treatments in three aspen forests and monitored soil temperature and moisture, frost development, and soil strength for a period of three years. Treatments were conducted across a range of drainage classes that were expected to influence the treatment response and which could be readily identified by managers in the field (to improve application of any findings). We determined that snow removal causes significant increases in frost development and that the relationship is dependent on relative soil wetness of the forest: wetter, more poorly drained soils had lower frost development compared to drier, well-drained soils. Rainfall reduction had limited and inconsistent effects on soil moisture, possibly because of the small plot size. The relationships between soil moisture and soil strength were also inconsistent, hindering identification of the optimal soil moisture content where soil strength is optimal to reduce harvest impacts under non-frozen conditions. Based on our findings and previously developed metrics, we developed a map of harvest suitability for all forested areas in Minnesota under two scenarios, which can be used by managers and landowners to identify the season when forest harvesting is likely to have the smallest impact on soil and forest health. The results provide managers with tools that support sustainable forest management and the benefits it provides.

PROJECT RESULTS USE AND DISSEMINATION

We summarized the primary project findings into peer-reviewed journal articles that highlight key relationships and considerations that managers can use when determining the optimal time to conduct forest harvests. The information was also shared with resource managers at the annual Research Review conducted annually by UMN's Sustainable Forestry Education Cooperative. The journal articles are still in publication, but a graduate student thesis is available here that outlines the primary findings. In addition, we created a map of harvest suitability by season for the forested region of Minnesota that can be accessed here. These two references are missing their hyperlink info.

Project Completed: 6/30/2022

FINAL REPORT

[**The effects of combined throughfall reduction and snow removal on soil physical properties across a drainage gradient in aspen forests of northern Minnesota, USA - 10 pgs**](#)

[**Limited Effects of Precipitation Manipulation on Soil Respiration and Inorganic N Concentrations across Soil Drainage Classes in Northern Minnesota Aspen Forests - 15 pgs**](#)

[**The effects of combined throughfall reduction and snow removal on soil physical properties across a drainage gradient in aspen forests of northern Minnesota, USA - 47 pgs**](#)

Subd. 08g Restoring Wetland Invertebrates to Revive Wildlife Habitat - Research Project - \$400,000 TF

Megan Fitzpatrick
MN DNR
102 23rd Street NE
Bemidji, MN 56601

Phone: (507) 308-2284

Email: megan.fitzpatrick@state.mn.us

Appropriation Language

\$400,000 the second year is from the trust fund to the commissioner of natural resources to assess invertebrate amphipods in wetlands and explore stocking them as a valuable food source for ducks and other wildlife in the Prairie Pothole Region of the state. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Our research showed amphipods are particularly sensitive to their wetland environments. High abundances of amphipods useful as wildlife food requires wetlands with high plant diversity and abundance, low concentrations of pesticides, and few fishes. Our work suggests many ways to manage and protect amphipod populations and their high biodiversity habitats.

OVERALL PROJECT OUTCOME AND RESULTS

Amphipods (shrimp-like aquatic invertebrates) are found in a variety of Minnesota's wetlands and are important food for many species of waterfowl, amphipods, and fish. Two species of prairie amphipods (*Gammarus lacustris* and *Hyalella azteca*) have declined in recent decades and have been linked to decline in the continental population of Lesser Scaup (*Aythya affinis*) ducks. Our project had two objectives: (1) to learn what wetland conditions support high abundances of amphipods, and (2) to assess whether "stocking" amphipods in seemingly high-quality wetlands was successful at establishing new populations.

We surveyed 66 wetlands across western Minnesota for amphipod abundance, fish, aquatic plants, water quality, and surrounding landcover. Key findings included a positive relationship between amphipod abundance and aquatic plant biodiversity, and negative relationships to pyrethroid pesticide levels and several fish species, especially black bullheads (*Ameiurus melas*).

We also collected *G. lacustris* amphipods and stocked them into wetlands at 19 sites. We surveyed amphipods before and up to 3 years after stocking to assess survival and reproduction. *G. lacustris* were detected in only one stocked site after stocking, suggesting that our stocking methods did not create sustained new populations.

Our results will inform management actions to support wetland quality and wildlife populations of interest to Minnesota's waterfowl hunters, birdwatchers, and other wetland enthusiasts. Our results suggest amphipods will benefit from actions that increase aquatic plant diversity, remove and prevent black bullhead and other fish invasions, and reduce impacts of high intensity agriculture. Management might include drawdowns, fish barriers, upland riparian buffers, and reduced agricultural pesticide use. Further, results from Objective 1 can be used to better target stocking wetlands where *G. lacustris* are likely to thrive and spread on the Minnesota landscape. We are sharing results with natural resource managers and the public via publications, presentations, and depositing data in publicly-accessible repositories.

PROJECT RESULTS USE AND DISSEMINATION

We trained, mentored, and provided paid work experience to two successful master's students and 23 undergraduates, producing two theses and five capstone projects. We shared information via [MNDNR Research Summaries](#), two open-access scientific publications describing [invertebrate sampling methods](#) and [amphipod-aquatic plant relationships](#), and 16 oral and poster presentations at professional conferences (see [YouTube](#) and [ResearchGate](#)). We have drafted a third paper and planned four more.

Additional outreach included a MNDNR virtual presentation, Minnesota Conservation Volunteer article, Minnesota Public Radio podcast and article, KSTP-TV broadcast, and informal communication with curious members of the public in the field, site managers, and landowners.

Project Completed: 6/30/2022

FINAL REPORT

High abundance of a single taxon (amphipods) predicts aquatic macrophyte biodiversity in prairie - 21 pgs

High abundance of a single taxon (amphipods) predicts aquatic macrophyte biodiversity in prairie wetlands - 21 pgs

Protocols for Collecting and Processing Macroinvertebrates from the Benthos and Water Column in Depressional Wetlands - 32 pgs

Subd. 08h Preserving Minnesota's Native Orchids - Phase 2 - \$259,000 TF

David Remucal

U of MN - Landscape Arboretum
3675 Arboretum Dr
Chaska, MN 55318

Phone: (952) 443-1418

Email: remu0005@umn.edu

Web: www.arboretum.umn.edu

Appropriation Language

\$259,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Minnesota Landscape Arboretum to expand collection and preservation efforts to enable long-term conservation of at least 25 of the 48 native orchid species in Minnesota and to continue propagation and cultivation research. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Native orchid populations across the state have been stored in a long-term seedbank at the Minnesota Landscape Arboretum, preserving these native jewels. This project also preserved many of the fungal partners that orchids need to survive and establish in the wild.

OVERALL PROJECT OUTCOME AND RESULTS

This project worked to bank the seed of more of Minnesota's native orchid species, a complex and difficult plant family to conserve because of their complex biology. As part of this seed banking effort, there is a wealth of research that must be done with each species, to determine how best to store seed and propagate them and what the soil fungal partners are and how those fungi can be used to establish these notoriously difficult species, either in display beds for visitors to enjoy or in the wild to establish, augment or protect their presence in or landscapes. There are about 46 native orchid species in Minnesota and understanding how to propagate them and store their seed had not previously been well-established for nearly all of them. This project sought to develop that information for as many of those species as possible. Overwhelmingly successful, multiple populations of these plants were banked for nearly all species and research on nearly all 46 species has been successful and continues. A fungal

bank of nearly 500 specimens was also established to grow and work with the fungal partners that orchids need.

This work will not only benefit visitors to the Arboretum, it is already being used by groups across the state, region and country for a variety of projects that would have previously been unthinkable or unsuccessful, including outplantings of native orchids in restored or protected landscapes and transplants and rescues of plants under immediate threat from development or construction. The resulting information we have produced, and continue to produce, is invaluable for any groups wanting to work with these species.

PROJECT RESULTS USE AND DISSEMINATION

Orchids brought into the seedbank and propagated at UMLA have been displayed in existing and new display beds with a series of educational brochures. Displaying orchids at UMLA allows visitors to see many species that they would likely never see in person otherwise. We give talks, in person or virtually, and have been able to reach out in a variety of media formats, including a [website](#). Finally, we have been able to use the techniques, infrastructure and expertise developed during this project to assist a variety of groups in a variety of conservation-aimed projects related to native orchids.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 09 Land Acquisition, Habitat, and Recreation

Subd. 09a Grants for Local Parks, Trails, and Natural Areas - \$2,000,000 TF

Audrey Mularie

MN DNR

500 Lafayette Rd

St. Paul, MN 55155

Phone: (651) 259-5549

Email: audrey.mularie@state.mn.us

Web: <https://www.mndnr.gov>

Appropriation Language

\$2,000,000 the second year is from the trust fund to the commissioner of natural resources to solicit, rank, and fund competitive matching grants for local parks, trail connections, and natural and scenic areas under Minnesota Statutes, section 85.019. The appropriation is for local nature-based recreation and connections to regional and state natural areas and recreation facilities and does not include athletic facilities such as sport fields, courts, and playgrounds. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Provide approximately 14 matching grants to local units of government for local parks, acquisition of locally significant natural areas and trails to connect people safety to desirable community locations and

regional or state facilities. Park development includes nature-based recreation facilities and does not include playgrounds, sports courts or sport fields.

OVERALL PROJECT OUTCOME AND RESULTS

The primary project results include,

- Six Outdoor Recreation grants to provide nature based outdoor recreation opportunities including park trails, natural resource interpretive opportunities, boating and fishing facilities in Andover, Brooklyn Park, Princeton, St. Peter, Wright County and Zumbrota.
- Four Natural and Scenic Area grants to help protect 139.5 acres of significant natural and scenic areas in Bayport, Wright and Washington Counties through fee title and permanent conservation easement.
- Four Local Trail Connection grants to provide safe, accessible trails to parks, schools, and other significant locations within the communities of Austin, Canby, Luverne and Moose Lake.
- Project administration for the grants was completed for \$50,000. Two application cycles were completed, applications reviewed and selected for grants. Active projects were monitored, financial review completed, grantees reimbursed, final site visits completed as needed, projects close, land acquisition report filed.

The Outdoor Recreation (Local Parks), Natural and Scenic Area and Local Trail Connections Grant Programs provide competitive matching grants for local parks, natural areas and trails to local governments for land acquisition and improvements related to parks and trails. Many projects include renovation of existing facilities to improve safety and accessibility, acquisition of locally significant natural and scenic areas, completion of trail linkages to safely connect where people live to desirable locations within the community and/or connecting local trails to regional or state facilities.

PROJECT RESULTS USE AND DISSEMINATION

A Request for Proposal is announced for the programs in December of each year through our park and trail contacts e-mail list and regional and statewide organization. Regional and statewide organizations are encouraged to forward to their members. Program information and applications are available to download on the [DNR Recreation Grants webpage](#) under each specific program. A list of the awarded projects is posted on the program webpages under recent grants.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 09b Develop Mesabi Trail Segment From County Road 88 to Ely - \$600,000 TF

Bob Manzoline

St. Louis & Lake Counties Regional Railroad Authority
111 Station Rd
Eveleth, MN 55734

Phone: (218) 744-2653

Email: bmanzoline@rrauth.com

Appropriation Language

\$600,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for environmental assessment, permitting, right-of-way easements or other acquisition as needed, engineering, and construction of an approximately three-mile-long bituminous surface section of the Mesabi Trail between Ely and the intersection of Highway 169 and County Road 88. This appropriation is available until June 30, 2022, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Mesabi Trail is a project to build a paved trail from Grand Rapids to Ely. At the conclusion of this phase of the project, approximately 150 miles of the trail are complete. With this appropriation, permitting and engineering was completed, and construction began for this segment of the trail from County Road 88 to the City of Ely.

OVERALL PROJECT OUTCOME AND RESULTS

The funds for this project have been spent toward the development of Mesabi Trail segment from County Road 88 to Ely. Engineering design, specifications, environmental and permitting have all been completed. Construction has started. We will now use the funds from our M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 09b – Mesabi Trail: CSAH 88 to Ely (\$1,650,000) to complete the Construction Engineering Management and Construction for this 3.0 mile trail segment.

PROJECT RESULTS USE AND DISSEMINATION

The Mesabi Trail news and updates are provided through a variety of media, marketing and publications. Web site is: Mesabitrail.com. The following are some of the groups & organizations that disseminate Mesabi Trail information and typically include updates of newly completed trail segments and activities:

- Club Mesabi (10,000 maps & web site)
- Iron Range Tourism (30,000 brochures & web site)
- MN Office of Tourism
- amperes radio
- Parks & Trails, Home & Away, other private magazines
- Over 240,000 trail users per year
- Great River Energy/Mesabi Trail annual tour
- Named by the Star Tribune as "Best of Minnesota" in year 2013
- Named by Bicycle Magazine as "top 10 in the country"
- Information distributed at over 70 locations including Chambers of Commerce, visitor centers, businesses
- MN DOT/Pedal MN bikeways map
- "Second best trail in Midwest USA" Dubuque Iowa, 2017

ENRTF Acknowledgement is provided in these dissemination activities per the Acknowledgement Requirements.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 09d Mississippi Blufflands State Trail - Red Wing Barn Bluff to Colvill Park Segment - \$550,000 TF

Jay Owens
City of Red Wing
315 Fourth St W
Red Wing, MN 55066

Phone: (651) 385-3625
Email: jay.owens@ci.red-wing.mn.us
Web: <http://www.red-wing.org>

Appropriation Language

\$550,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Red Wing to be used with other funds to construct an approximate three-quarter-mile-long hard-surfaced segment of the Mississippi Blufflands State Trail along Red Wing's Mississippi River riverfront from Barn Bluff Regional Park to Colvill Park. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project was intended to enhance Minnesotans experience of the natural beauty of the state through the development of 0.75 miles of trail. While much design and planning were completed for this trail, the actual trail could not be built due to land acquisition problems.

OVERALL PROJECT OUTCOME AND RESULTS

This project proposed to construct an approximate a 0.75-mile-long segment of the Mississippi Blufflands State Trail along Red Wing's riverfront from Barn Bluff Regional Park to Colvill Park. A portion of the trail required the purchase of fee interest of a right-of-way held by the Canadian Pacific Railway. Early in the project, the City of Red Wing achieved agreement with the CP Railway to acquire this ROW, and trail planning was underway. Unfortunately, during the project period, CP Railway's director of real estate abruptly left. This, followed by the COVID epidemic, essentially stalled acquisition negotiations. While the project was granted a one-year COVID extension through the legislature, the railway continued to be non-responsive until after the grant expired.

Over the late spring and early summer of 2022, the Canadian Pacific Railway has been responsive to our need to the fee interest in the railroad ROW necessary to build the project. The ENRTF appropriation ended on June 30, 2022. In July the CP Railway agreed to sell the needed ROW. The CP Railway amount needed was identified as approximately 25,473 square feet with approximately 5,248 square feet identified for temporary construction easement needs. CP Railway staff agreed to maintain the price of \$3.55 per square foot to acquire right of way necessary for the project, approximately 25,475 square feet or \$90,429.15, using non-ENRTF funds. No other costs will be associated with the agreement.

On Monday, August 22, 2022, the purchase agreement was approved and executed by the City Council. Although this process took multiple years and required the return of grant funding the city remains committed to seeking full funding for this important Mississippi riverfront trail segment.

We expect the closing for the property to be completed within 90 days.

PROJECT RESULTS USE AND DISSEMINATION

While desired results of this project—0.75 miles of trail built—were not ultimately completed during this appropriation period, the City of Red Wing diligently updated the city council as to progress of this trail, including tours of the proposed trail route. The city also provided press releases regarding ENRTF funding. At the City Council meeting of August 22, 2022, it was stated during the project period no progress was gained on the property acquisition and the ENRTF grant had expired. The project is at 65% design with level three cost estimates completed.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 09e Swedish Immigrant Regional Trail Segment within Interstate State Park - \$2,254,000 TF

Joseph Tart

Chisago County

313 N Main St, Suite 240

Center City, MN 55012

Phone: (651) 213-8960

Email: joseph.tart@chisagocounty.us

Appropriation Language

\$2,254,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Chisago County Environmental Services to construct an approximate one-half-mile regional county trail segment within Interstate State Park from the end point of the existing trail at the park boundary to city hall including a trail bridge over the ravine and parking and trailhead improvements and to conduct a natural and cultural review to determine the feasibility and route of a future section of the trail through the park. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Swedish Immigrant Regional Trail within Interstate Park was designed and constructed to protect the natural resources within the State Park Land while preserving rare plants, native tree species and wetlands. The Interstate State Park trail enhances Minnesota's air, water, and wildlife by avoidance and mitigation of many natural resources that were present. Resulting trail is a 10 ft. wide bituminous surface with a 160 ft. long bridge crossing a ravine.

OVERALL PROJECT OUTCOME AND RESULTS

The Swedish Immigrant Regional Trail project was constructed within Interstate Park State Park and into the City of Taylors Falls. This segment of trail has a ten-foot-wide bituminous trail surface and is approximately .60 miles in length that was designed as an ADA compliant multi-use and non-motorized trail. The main goal of this project was to expand the Swedish Immigrant Regional Trail further east to allow a safe route for pedestrians and bicyclist to travel. The project will benefit many local communities and Minnesotans alike by connecting multiple cities along this trail corridor. The trail will likely attract new visitors each year to enjoy the majestic views of Interstate State Park while also providing health

and wellness benefits.

The overall project was implemented years prior to construction through the vision and involvement of many organizations, stakeholders, cities and residents to construct a County Regional Trail within a State Park and along a historic rail corridor to Taylors Falls. During the construction phase many accomplishments were achieved by excellent planning and cooperation, some of these included a beautiful 160 ft. bridge over a ravine and a trailhead that incorporated many great landscaping features that are prevalent in the region. Throughout the entire construction project one of the main challenges was to find the perfect trail alignment that meet all necessary trail compliances while also minimized impacts to many of the Interstate State Park environmental, natural, and cultural resources.

PROJECT RESULTS USE AND DISSEMINATION

The Minnesota Environmental and Natural Resources Trust Fund (ENRTF) acknowledgement has been very prevalent throughout the entire project. The use of the trust fund logo and attributed language have been printed in newspaper publications and Environmental Services Newsletters, social media platforms and signage along the Swedish Immigrant Regional Trail corridor. Throughout the project we have created several documents and other online resources to help communicate and receive public outreach. Some of these include the use of electronic public surveys and mailing for community input and involvement.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 09g Protecting Mississippi River Headwaters Lands through Local, State, and Federal Partnership - \$700,000 TF

Josh Doty

City of Baxter
13190 Memorywood Dr
Baxter, MN 56425

Phone: (218) 454-5111

Email: jdovy@baxtermn.gov

Web: <http://www.baxtermn.gov/>

Appropriation Language

\$700,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Baxter, in cooperation with Brainerd Public Schools and the Camp Ripley Sentinel Landscape Program, to acquire about 200 acres of forested land on the upper Mississippi River adjacent to Mississippi River Overlook Park for multiple public benefits, including being an outdoor classroom for local schools. To be eligible for reimbursement, costs for real estate transactions must be specific to this acquisition and documented as required in subdivision 15, paragraph (k).

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The project preserved 200 acres of forest on the upper Mississippi River. After the grant was awarded, the project grew to ultimately preserve 1,338.4-acres locally. Of this total, Baxter now has 880-

contiguous acres (including the project 200 acres) of high-quality natural resource property preserved within Baxter.

OVERALL PROJECT OUTCOME AND RESULTS

The 200-acres targeted for this protection project were at risk of being sold for development along the city limits of Baxter and the scenic rolling hills of the Mississippi River. Another downfall of development of the land beyond the conservation impacts are the encroachment that hinders training of soldiers at Camp Ripley. Camp Ripley has prioritized protecting lands near the military base to continue their important training mission without negatively impacting citizens near the base. The major project objective was to purchase and permanently protect the 200-acres that are directly adjacent to Baxter Overlook Park to the west. This land would also become part of Forestview Middle School's outdoor classroom.

After discussions with Potlatch, as well as Sylvan Township, Cass County, and Crow Wing County, it became apparent that this project could utilize more funding and have broader local government support and protect more forestland in a larger context. This Baxter Overlook Park project appraised less than anticipated at the project outset, and utilized \$400,000 in Department of Defense funding, and \$330,322 in LCCMR funding for a total cost of \$730,322 (55% DoD funding; 45% LCCMR funding). Additional non-federal funding was needed for match in the larger project, and the increased LCCMR match allowed for \$2.1 million in DoD funding and \$1.29 million in LSOHC to be applied over the entire project scope of 1,546.84-acres.

This protection project will grant Minnesotans the ability to recreate, hunt, and enjoy the public lands that encompass the entire project area, even beyond the City of Baxter. It will also allow for hundreds of middle school students to learn about Minnesota's forests each year, and perhaps inspire future generations to cherish and continue to protect our shared natural resources.

The project was completed, and the property was purchased by the City of Baxter on June 30, 2020. Along with this 198.5-acre Baxter Overlook Park addition, TCF, Baxter, and Camp Ripley partners were also able to protect 1,338.4-acres of additional forestlands from Potlatch in this area in this same negotiation to also be permanently protected utilizing LSOHC and Department of Defense funding, totaling more than \$3,700,000. Multiple public partners, including Baxter, Cass County, Crow Wing County, and Sylvan Township now hold those properties for public use and wildlife habitat benefits. The scope of the project grew over time and achieved a greater outcome than the partners anticipated in 2018. Additional non-federal funding was needed for match in the larger project, and the additional LCCMR match allowed for \$2.1 million in DoD funding to be applied over the entire project scope.

PROJECT RESULTS USE AND DISSEMINATION

The City notified the public of the environmental, educational, open-space recreational opportunities of the property with an article in the local Baxter newsletter, which is sent to all residents. City staff also joined Camp Ripley Environmental staff, and The Conservation Fund staff by going on-air on WJJY radio to discuss the environmental project and opportunities. Lastly, on November 2, 2021, the City Council authorized City staff to execute a contract with SRF Consulting to guide the City through an Open Space Master Plan study. A significant portion of the study is public outreach and civic engagement to help the City develop an open space master plan for the property.

Pieces about this project were published in [MinnPost](#), the [Brainerd Dispatch](#), and the [Conservation Fund website](#) and a [Conservation Fund press release](#).

Project Completed: 6/30/2020

FINAL REPORT

Subd. 09k Minnesota State Parks and State Trails - \$2,500,000 TF

Shelby Kok

MN DNR

500 Lafayette Rd

St. Paul, MN 55155

Phone: (651) 259-5590

Email: Shelby.Kok@state.mn.us

Web: <https://www.dnr.state.mn.us/>

Appropriation Language

\$2,500,000 the second year is from the trust fund to the commissioner of natural resources to acquire about 163 acres of high-priority in holdings from willing sellers within the legislatively authorized boundaries of state parks and trails in order to protect Minnesota's natural heritage, enhance outdoor recreational opportunities, and improve the efficiency of public land management. Priorities include but are not limited to Tettegouche, Sibley, and Minneopa State Parks and the Goodhue Pioneer State Trail. A list of proposed acquisitions is required in the work plan. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 10 Emerging Issues Account

Sub-Project 01: State-wide Reconnaissance of SARS-CoV-2 in Drinking Water Supplies - \$59,297 TF

Tim LaPara

U of M

500 Pillsbury Dr SE

Minneapolis, MN 55455

Phone: (612) 624-6028

Email: lapar001@umn.edu

Web: <http://www.cege.umn.edu/directory/faculty-directory/lapara.html>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

There were concerns that SARS-CoV-2, the virus that causes COVID-19, could contaminate drinking water supplies. In this study, we investigated 30 drinking water samples from homes around the State of

Minnesota supplied by either a private well or a public water system, testing for SARS-CoV-2. To date, we have not been able to detect SARS-CoV-2 in any Minnesota drinking water samples.

OVERALL PROJECT OUTCOME AND RESULTS

Soon after the COVID-19 pandemic began, it was observed that the SARS-CoV-2 was detectable in the feces of infected individuals and thus was likely to be present in raw sewage. With this knowledge, researchers developed techniques to monitor the extent of COVID-19 spread in communities by quantifying the virus in untreated municipal wastewater. Given the presence of this virus in raw sewage, concerns were expressed that it could contaminate our public and private drinking water supplies, either from leaky sewer pipes, municipal wastewater effluent, or septic systems. Although well-functioning public water and wastewater facilities are typically very good at preventing the spread of disease via the fecal-to-oral route, this project was undertaken to confirm that SARS-CoV-2 was not contaminating our drinking water. Because SARS-CoV-2 is a pathogen that infects the lungs, the risk of exposure from water supplies is via inhalation of water droplets while showering or other uses. We therefore used filters to collect the microorganisms from 30 high-volume drinking water samples (sample volume: 500-1000 liters) from various locations within the State of Minnesota. These samples were obtained from homes supplied by private wells that do not employ any treatment as well as from homes supplied by public water systems that treat the water, including but not necessarily limited to, disinfection with chlorine. We were unable to detect SARS-CoV-2 in any of these samples; positive-control sewage samples collected from a municipal wastewater treatment plant, however, confirmed that our assays were working and could detect SARS-CoV-2 in water samples. Our results, therefore, provided evidence to suggest that, at the time of our study in the spring and summer of 2020, SARS-CoV-2 was not present in our public and private water supplies and that drinking water was not a likely route of exposure to SARS-CoV-2.

PROJECT RESULTS USE AND DISSEMINATION

We have shared our results with LCCMR staff and with Kirsti Marohn from Minnesota Public Radio (MPR) and Greg Stanley from the Minneapolis Star Tribune. We also presented our research results at the annual meeting of the Minnesota section of the American Water Works Association (September 24, 2020) and during an online seminar hosted by the Minnesota Pollution Control Agency (December 9, 2020).

Subproject 01 Completed: 06/30/2021

FINAL REPORT

Sub-Project 03: Environmental Assessment of CWD Prions at the Beltrami County Deer Carcass Dump Site - \$108,232 TF

Peter Larsen
U of MN - College of Veterinary Medicine
1971 Commonwealth Avenue
St. Paul, MN 55108

Phone: (612) 626-1694
Email: plarsen@umn.edu

Web: <https://vetmed.umn.edu/bio/college-of-veterinary-medicine/peter-larsen>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

We confirmed CWD-positive deer remains within the dumpsite and that the positive remains came from the neighboring cervid farm. We recommend: 5 years of CWD surveillance in the region, monitoring water runoff, routine CWD-testing of deceased cervid-farm fawns, monitoring wild mammal health in the area due to documented CWD risks.

OVERALL PROJECT OUTCOME AND RESULTS

In April 2021 we were notified by the DNR that deer carcasses from a CWD positive deer-farm in Beltrami County had been dumped on public land and were asked to help with CWD-testing of the remains. Our initial tests confirmed some remains were CWD positive. CWD-prions remain infectious within the environment for years. Therefore, the goals of our project were to complete testing of deer remains, collect samples of soil, water, and plants for future testing, and perform a CWD-prion risk assessment. We used RT-QuIC testing to identify CWD-prions in biological and ecological samples, and we performed DNA analyses to see if the dump-site carcasses came from the neighboring cervid farm. We collected deer remains, soil, plant, fungi, and water samples from the ~12-acre site. At least 11 deer were deposited, with carcasses subsequently pulled apart by scavengers. Forty-four locations had white-tailed deer remains and 58 carcass samples were suitable for RT-QuIC testing. Of these, 14 were statistically positive for CWD. Fly larvae and soil associated with the positive remains also tested positive for CWD. DNA analyses confirmed positive remains originated from the neighboring cervid farm. Based on our findings we recommend the state: conduct a total of 5 years of CWD surveillance in the region, perform routine testing of deceased fawns in cervid farms, and support research monitoring wildlife health in the region (e.g., recent data show raccoons and voles are susceptible to CWD-prions). Our team will continue monitoring water runoff from the site, as well as soil, plants, and fungi to help monitor CWD-prion contamination in the region. Our recommendations are based on the latest CWD science and will improve CWD monitoring of both wild and captive deer in Minnesota. Our research will ultimately help Minnesotans better understand the environmental risk of CWD prion contamination throughout the state.

PROJECT RESULTS USE AND DISSEMINATION

We presented a poster describing the biological sample-collection and assessment at the dumpsite during the 70th Annual International Conference of the Wildlife Disease Association in Madison, WI. A manuscript was published reporting results of our engagement with Tribal Nations in the region ([available here](#)) and a second paper reporting our research findings is to be submitted to a peer-reviewed journal in October 2022. Updates of the project have been made to the MN Legislature, three public information meetings, the MN Board of Animal Health work conference, and two University of Minnesota events. Additional updates will be provided to our state and tribal nation partners and at MNPRO outreach events in 2023 as well as on the MNPRO [website](#).

Subproject 03 Completed: 06/30/2022

FINAL REPORT

**3. M.L. 2017 Projects Completed
January 15, 2021 – January 15, 2023**

MN Laws 2017, Chapter 96, Section 2

M.L. 2017 Projects

[MN Laws 2017, Chapter 96](#), Section 2 (beginning July 1, 2017)

Visit [the LCCMR website](#) for the most up-to-date project information and reports

Subd. 03 Foundational Natural Resource Data and Information

Subd. 03a County Geologic Atlases – Continuation - \$2,000,000 TF (FY2017)

Barbara Lusardi

U of MN - MN Geological Survey
2609 Territorial Rd
St. Paul, MN 55114

Phone: (612) 626-5119

Email: lusar001@umn.edu

Web: <http://www.mngs.umn.edu>

Appropriation Language

\$2,000,000 in fiscal year 2017 is from the trust fund to the Board of Regents of the University of Minnesota, Minnesota Geological Survey, to continue acceleration of the production of county geologic atlases for the purpose of sustainable management of surface water and groundwater resources. This appropriation is to complete Part A of county geologic atlases, which focuses on the properties and distribution of earth materials in order to define aquifer boundaries and the connection of aquifers to the land surface and surface water resources. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Geologic atlases provide maps and databases essential for management of water resources. Of the 16 county atlases covered by this grant, 5 are complete and 6 are past the halfway mark.

OVERALL PROJECT OUTCOME AND RESULTS

The grant funds have been completely expended. This grant funded work in 16 counties including: Lake and St. Louis (\$583,175), Kandiyohi (\$225,315), Hennepin (\$117,254), Hubbard (\$100,206), Aitkin (\$227,156), Isanti (\$37,780), Cass (\$110,692), Rock and Nobles (\$261,732), Steele (\$60,389), Pennington (\$27,824), Lac Qui Parle (\$53,801), Lincoln and Pipestone (\$18,167), and Otter Tail (\$106,227) counties. An additional \$36,000 supported initiation of work in new project areas and \$34,277 was spent to characterize glacial sediments using geochemistry. Atlases for Kandiyohi, Hennepin, Hubbard, Isanti, and Cass are complete. At this time bedrock and surficial mapping in Lake and St. Louis counties is about 75% complete. Good progress has been made on associated databases. Federal cost-sharing has been applied to this work each year. Effort on Olmsted and Dodge counties have been shifted to another funding source, and both should be complete by the end of the summer. In Aitkin County, the bedrock map is nearly ready for review; the bedrock topography is about 75% complete. The Aitkin surficial map is nearly complete, and work on the cross sections and sand models is underway. For the Rock and Nobles CGAs the bedrock maps are about 85% complete and the bedrock topography is nearly ready for review. The surficial geology for both counties is complete, and the work on the cross sections and sand

models is underway. Similarly, in Steele County all bedrock and surficial maps are near completion and work on the cross sections and sand models is underway. The work in Pennington, Lac Qui Parle, Lincoln and Pipestone, and Ottertail counties is still in the early stages with mostly field work underway to support maps. We will conduct rotary sonic drilling in all of these counties (underlined) starting this fall. Counties that are not yet complete have been shifted to the LCCMR18 contract funding.

PROJECT RESULTS USE AND DISSEMINATION

Completed atlas products have been posted to the MGS website and linked to the University's Digital Conservancy as noted above. PDF products as well as all of the related GIS data are available on these pages.

In addition, the MGS hosts an [Open Data Portal](#) on which many of our county geologic atlases are presented as "Story Maps" that allow for direct access of the data without any special software or interface.

The Hennepin County workshop was held on April 22 at the County Library in Ridgedale. An article about the atlas and related workshop was published by the [SWNewsMedia](#). Formal presentations for [Cass](#) and Hubbard counties were held on March 6 in Backus and Park Rapids, respectively. An update to the Cass County Board was held last summer and written up by the [Echo Journal](#).

Project Completed: 6/30/2020

FINAL REPORT

Subd. 03b Assessment of Public Benefits of Protecting Source Water - \$320,000 TF (FY2018)

Bonnie Keeler

U of MN
1954 Buford Ave
St. Paul, MN 55108

Phone: (651) 626-2120

Email: keeler@umn.edu

Web: <http://z.umn.edu/keeler>

Appropriation Language

\$320,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to map and quantify source water risks, determine ecosystem service valuation of clean water, and provide analyses of equity and community capacity to improve decisions about the protection and management of groundwater and surface water. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Source Water protection is associated with multiple economic, environmental, and social benefits. We created new spatially-explicit datasets representing multiple socio-economic benefits of source water protection for all 821 drinking water management units in Minnesota. Our work gives practitioners a more complete picture of the outcomes of source water protection statewide.

OVERALL PROJECT OUTCOME AND RESULTS

The goal of the project was to collect and synthesize economic, social, and environmental data relevant to source water protection in Minnesota. We created new spatially-explicit datasets representing multiple socio-economic benefits of source water protection for all drinking water supply management areas in Minnesota. Project outcomes include:

1. Mapping land use change and land protection costs for all 821 drinking water management areas.
 - Estimated trends in land use change in each DWSMA in order to identify potential threats to source water from increasing agricultural expansion or development.
 - Obtained new spatial data based on estimated market values of hundreds of thousands of parcels in the state in order to quantify the opportunity costs of source water protection in each DWSMA.
2. Valuation of the multiple public benefits of land protection for clean water.
 - Applied best-available estimates for drinking water treatment to calculate potential costs of contamination in each DWSMA as a function of population served.
 - Implemented a methodology for estimating the potential health damages and associated monetary costs of drinking water contamination.
 - Generated 19 spatially-explicit environmental benefit maps that can be used to assess the potential for co-benefits of protection or restoration in each DWSMA.
3. Assessing the equity implications of source water protection and community capacity to protect land and improve water quality.
 - Developed a technique for linking source water protection areas to municipalities served, allowing us to relate census data and demographic characteristics to each DWSMA.
 - Administered and analyzed data from a statewide survey of water values in order to identify perceived threats to water quality and preferences for different water-quality related values and uses.
 - Completed a series of participatory water valuation exercises using a Q-sort methodology to understand stakeholder preferences for water-related expenditures and tradeoffs among water quality objectives.

PROJECT RESULTS USE AND DISSEMINATION

We presented our work at venues targeting academic and state agency audiences, and held meetings with specialists at MDH and the interagency GRAPS team exploring application of the work in MN agency work. We shared findings with state agencies including MPCA, MDH, DNR, and BWSR, along with external stakeholders and advocacy groups such as Freshwater Society and the Environmental Working Group. Our work contributed to multiple students' master's theses and is being written up for publication in a peer-reviewed journal. Our work is summarized in a report (available on our [website](#)) and includes appendices with data useful for further analysis.

Project Completed: 6/30/2021

FINAL REPORT

Minnesota Water Values

Assessment of Public Benefits of Protecting Source Water

Communicating Risk and Increasing Civic Engagement in Water Protection in Minnesota

Nature in the Urban Century

Source Water Protection Challenges and Co-Benefits

**Subd. 03c Preserving Minnesota Prairie Plant Diversity - Phase II – Research Project - \$900,000
TF (FY2018)**

Ruth Shaw and Georgiana May

U of MN

1987 Upper Buford Cir, 100 Ecology Bldg
St. Paul, MN 55108

Phone: (612) 624-7206

Email: shawx016@umn.edu

Web: <http://www.cbs.umn.edu/eeb/faculty/ShawRuth/>

Appropriation Language

\$900,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to continue collecting and preserving germplasm of plants throughout Minnesota's prairie region, study the microbial effects that promote plant health, analyze local adaptation, and evaluate the adaptive capacity of prairie plant populations. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

We gathered seeds of prairie plants and shared them with producers who are expanding seed availability for restorations. We collected, identified and studied many microbes that prairie plants harbor, documenting their effects on their hosts. Our experiments have clarified the geographic scale of plant adaptation and genetics underlying ongoing adaptation.

OVERALL PROJECT OUTCOME AND RESULTS

Minnesota prairies harbor extraordinary diversity of plants and microbes, while also nurturing wildlife, retaining water and topsoil, and beautifying landscapes. Yet habitat loss threatens the persistence of the once vast prairies and their stunning biotic diversity. Limited understanding of this diversity and insufficient seed availability hinder sustainable management of this iconic Minnesota biome. We conducted Healthy Prairies (HP) Phase II to expand availability of seeds for prairie restorations and study approaches to increase success of restorations. Building on our prior accomplishments under ENRTF funding, we have:

1. Preserved diverse seed from 57 rarer prairie species, gathering them from widely separated locations.
2. Obtained, archived, and studied 2,600 naturally occurring microbial partners from two species.
3. Gathered data to assess the geographic scale important to plant survival and reproduction in MN.

Our extensive collections of source-identified seeds and microbes across a wide range of MN's prairie region help to conserve the diversity of MN prairies. We have provided seeds to seed producers, who have, in turn, used them in establishing fields and are seeking certification of the seeds that they obtain from them.

Our studies of effects of microbial associates on prairie plants have indicated that the bacteria providing

nitrogen to prairie clover (*Dalea purpurea*, *D. candida*) disperse widely across MN prairies. Consequently, we can recommend to growers an inoculum that need not be site-specific. In contrast, the communities of fungi associated with roots of *S. scoparium* are spatially restricted, indicating that a regionally-based inoculum may be preferable.

We continued our large-scale experiment to elucidate the geographic scale of adaptation of six prairie species. We gathered extensive data from this experiment and began analyses of the data. We implemented experiments to investigate genetic structure of two populations of little bluestem (*Schizachyrium scoparium*), including genetic variance for fitness and the fitness consequences of inbreeding and of crossing between populations.

PROJECT RESULTS USE AND DISSEMINATION

HP team members have participated in varied opportunities to disseminate findings from this project. These include informal events to communicate with members of the public who are not all well-versed in science and may not be aware of prairies (Market Science), as well as workshops involving other scientists and land managers (Nature Conservancy 'Science Slams', Local Adaptation Workshop, held at UM-TC, March 2019, discussions of seed sourcing guidelines led by staff of MN DNR).

A paper providing an overview of the Local Adaptation Workshop has been published in *New Phytologist* (2020) 225:2246–2248. A manuscript reporting findings about geographic scale of local adaptation has been submitted to *Restoration Ecology* and has received positive reviews. A second manuscript reporting on a study that used focus groups to identify impediments to use of source-identified seeds for prairie restorations has been submitted to *Restoration Ecology* and has received positive reviews. Both manuscripts are under revision and will be resubmitted soon.

Project Completed: 6/30/2021

FINAL REPORT

[**Latitude of Seed Source Impacts Flowering Phenology and Fitness in Translocated Plant Populations**](#)

[**Factors Limiting the Availability of Native Seed for Reconstructing Minnesota's Prairies: Stakeholder Perspectives**](#)

[**Evolutionary Approaches to Seed Sourcing for Grassland Restorations**](#)

Subd. 03d Minnesota Biological Survey – Continuation - \$2,900,000 TF (FY2018)

Bruce Carlson

MN DNR

500 Lafayette Rd

St. Paul, MN 55155

Phone: (651) 259-5083

Email: bruce.carlson@state.mn.us

Web: <http://www.dnr.state.mn.us/eco/mcbs/index.html>

Appropriation Language

\$2,900,000 the first year is from the trust fund to the commissioner of natural resources for continuation of the Minnesota biological survey to provide a foundation for conserving biological diversity by systematically collecting, interpreting, monitoring, and delivering data on plant and animal

distribution and ecology, native plant communities, and functional landscapes. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Minnesota Biological Survey (MBS) collects, interprets and delivers foundational data on native plants, animals, plant communities and functional landscapes. These data help prioritize actions to conserve, manage and restore Minnesota's biological diversity and ecological systems.

OVERALL PROJECT OUTCOME AND RESULTS

MBS baseline terrestrial plant field surveys occurred in Lake of the Woods, St. Louis and Koochiching counties within the Border Lakes, Littlefork-Vermilion Uplands, and Agassiz Lowlands subsections. MBS baseline aquatic lake plant surveys occurred in lakes in central Minnesota counties. Plant surveys documented numerous rare and notable terrestrial and aquatic vascular plant species. Native plant community surveys occurred in areas that are either representative of the native vegetation in these counties and subsections or are rare, unique or unusual for these areas. MBS field surveys were also targeted in other northern Minnesota counties to address questions stemming from GIS mapping of native plant communities and sites of biodiversity significance.

Pollinator surveys in MBS sites of biodiversity significance focused on native and rare moths and butterflies in far northern, northwest, and southeast Minnesota. Over 3,000 specimens of at least 900 species were collected, some of which have potential to be new state records.

Targeted surveys occurred in southeast, east-central, and northern forests in MBS sites of biodiversity significance to update and expand MBS data from surveys that occurred in the 1990s and early 2000s. Likewise, similar surveys occurred in the Prairie Province to document new sites or expand on previous MBS surveys from the 1980s. This work resulted in the documentation of many new and updated records of rare species and high quality native plant communities.

Updates and improvements to the [DNR Rare Species Guide](#) continued that rely heavily on MBS data and technical expertise arising from this a previous MBS ENRTF appropriations. The book, *Sedges and Rushes of Minnesota*, was published by the MN Press and the final manuscript for the book, *Minnesota Red River Valley and Aspen Parkland - A Guide to Native Plant Communities*, was submitted to the UMN Press for publishing.

PROJECT RESULTS USE AND DISSEMINATION

MBS data are stored in the DNR's Natural Heritage Information System and biological specimens accessioned to the UMN Bell Museum of Natural History. This includes information on rare species, native plant communities, sites of biodiversity significance. MBS distributes survey results on the [MBS website](#), DNR GIS QuickLayers, and [MN Geospatial Commons](#). Presentations, technical guidance, biological reports, and published books are delivered that describe and interpret MBS results for use by local government units, conservation groups, citizen advisory groups, scientists, land managers, and students. MBS data, products, and staff expertise are used throughout the state to assist conservation decisions.

Project Completed: 6/30/2021

FINAL REPORT

**Subd. 03f Assessment of Microbes for Improving Wild Rice Restoration – Research Project - \$334,000
TF (FY2018)**

Chan Lan Chun
U of MN - NRRI
1405 University Drive SCiv 221
Duluth, MN 55811

Phone: (218) 788-2613
Email: chun0157@d.umn.edu
Web: <http://www.nrri.umn.edu>

Appropriation Language

\$334,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Natural Resources Research Institute, to evaluate the microbial communities and nutrients associated with wild rice and competing vegetation, with the goal of enhancing restoration success to increase the abundance of wild rice. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The project improved our understanding of microbial and nutrient associations with self-sustaining wild rice wetlands. This information will be useful to develop management strategies for wild rice restoration success, which will improve long-term protection of native species and aquatic biodiversity, and support management of Minnesota's culturally and ecologically important natural resource.

OVERALL PROJECT OUTCOME AND RESULTS

Wild rice (*Zizania palustris*), a native emergent aquatic plant, has a multitude of ecological functions and high cultural and economic value in Minnesota. Wild rice was historically abundant in northern Minnesota but its abundance and distribution have been reduced due to various factors. There have been collaborative efforts to restore wild rice wetlands for improved wildlife habitat and increased opportunities for wild rice harvest. Despite ongoing efforts, restoration has been met with mixed success. Much research was conducted on surface water and sediment chemistry that is conducive to wild rice growth. However, one ecological component of the wild rice ecosystem that remains under-explored is microbial communities that are involved in processing key nutrients. This project characterized microbial communities associated with wild rice wetland. Wild rice and coexisting plant samples were collected from 7 wild rice wetlands along with water and sediment. High-throughput DNA sequencing analyses indicated that wild rice-associated microbial communities were distinct from those found in water and sediment. Moreover, the influence of surface/porewater chemistry and nutrients on the microbial communities were evaluated. The project outcomes will allow the restoration partners to understand why restoration efforts are successful or not and can be immediately transferable to restoration managers for the development of applicable restoration practices. Likewise, if beneficial microbial groups associated with self-sustainable wild rice beds were identified from this project, the methods to encourage their abundance and functions for wild rice growth are needed through seeding with inoculants derived from successful wild rice stands and sediment amendments. If coexisting or invasive species alter nutrients and microbial community structure unfavorable for wild rice fitness by imposing some degree of selective pressures, targeted species control is essential prior to current

restoration efforts. This will be useful to for the partners to develop effective management strategies for wild restoration goals.

PROJECT RESULTS USE AND DISSEMINATION

The project findings have been disseminated via reports to LCCMR, publications, and regional and national presentations at conferences. We held four meetings with wild rice managers and the project partners for field sampling plan, project progress, consultation and outcomes. The project findings were shared with the public through the [university's news article](#), public outreach activities (e.g. Lake Superior Youth Symposium), and [student stories](#). Moreover, microbial DNA sequences of environmental samples collected from wild rice wetlands were archived at National Center for Biotechnology Information.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 03i Landslide Susceptibility, Mapping, and Management Tools - \$500,000 TF (FY2018)

Karen Gran

U of MN, Duluth
1114 Kirby Dr
Duluth, MN 55812

Phone: (218) 726-7406

Email: kgran@d.umn.edu

Appropriation Language

\$500,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to create landslide susceptibility maps using a landslide inventory and quantitative analysis of LiDAR to provide tools and data for mitigation and restoration to reduce impacts on water resources. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Landslides in five regions across Minnesota were mapped and inventoried to identify geologic and topographic conditions vulnerable to slope failures providing resource and emergency managers with better predictive tools to guide land-use decisions. Landslides are a dominant source of sediment to regional waterways, occurring frequently along steep valley walls.

OVERALL PROJECT OUTCOME AND RESULTS

In June 2014, widespread landslides occurred in south-central Minnesota; a similarly rainy period in 2012 caused two deaths. In June 2012, a two-day rain event in Duluth generated hundreds of landslides, extensively damaging Jay Cooke State Park and surrounding areas. In August 2007, a year's worth of rain fell in 36 hours in southeastern Minnesota causing extensive landsliding. Weak clay soils in the Red River valley frequently fail, undermining homes and roads. All of these eroding, hazardous slopes present an acute natural resource and emergency management challenge, yet until now, the state lacked landslide hazard maps. Because mass wasting processes vary with geology, we defined five study areas in which we documented the distribution, failure mechanisms, and frequency of landslides in order to help resource managers make sound mitigation decisions.

Each region was mapped by a different partner institution using established data standards and protocols through: 1) historical research, 2) mapping known slides onto high-resolution lidar base maps, and 3) identifying additional landslides using lidar data; topographically-derived maps (slope, hillshade, and red relief); and aerial imagery. Slide sites were field-checked where possible for geology, hydrogeology, vegetation cover, and land use.

In northeastern Minnesota, where repeat lidar data were available, additional work was done. Repeat lidar data collected before and after a major 2012 storm event were properly aligned to allow erosion and deposition to be quantified, and Object-Based Image Analysis was used to define and classify types of change (erosion, deposition in different settings) across the landscape.

Landslide susceptibility modeling in that same, well documented area illuminated which landscape parameters were most important to slope stability: slope, distance to stream, and depth of glacial deposits overlying competent bedrock. The method developed in northeastern Minnesota can be applied to the other four areas of the state.

PROJECT RESULTS USE AND DISSEMINATION

Project results were disseminated to local and regional stakeholders through presentations at meetings and to the scientific community through conference presentations. The full inventory database is being released through the U. S. Geological Survey with an accompanying U. S. Geological Survey Fact Sheet on Landslides in Minnesota. These products will be available to assist with emergency management planning and natural resource assessments of sediment loading in watersheds across the state. Details on landslide mapping methodologies and results across the state, and multitemporal lidar correction and Object-Based Image Analysis research in northeastern Minnesota will be published through publicly-available scientific papers.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 03k Cedar Creek Natural Area Wolf Recolonization Assessment – Research Project - \$398,000 TF (FY2018)

Forest Isbell

Cedar Creek Ecosystem Science Reserve, U of MN
2660 Fawn Lake Drive NE
East Bethel, MN 55005

Phone: (612) 301-2601

Email: isbell@umn.edu

Web: <https://www.cedarcreek.umn.edu>

Appropriation Language

\$398,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Cedar Creek Ecosystem Science Reserve, to assess wolf recolonization impacts on wildlife, biodiversity, and natural resources and provide educational opportunities at Cedar Creek Ecosystem Science Reserve.

This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Minnesota's wolves are expanding southward. A new pack recently recolonized Cedar Creek Ecosystem Science Reserve, which is one of the best-studied ecosystems worldwide. Our project assessed costs (e.g., unwanted impacts on pets and livestock) and benefits (e.g., impacts on biodiversity and ecosystem functioning, educational opportunities) of this unassisted wolf recolonization.

OVERALL PROJECT OUTCOME AND RESULTS

Minnesota's wolves (*Canis lupus*) are expanding southward. A new pack recently became established at Cedar Creek Ecosystem Science Reserve (henceforth Cedar Creek), which is one of the best-studied ecosystems worldwide, located just north of the Twin Cities. The goals of our project were to assess costs (e.g., unwanted impacts on pets or livestock) and benefits (e.g., potential enhancement of biodiversity and ecosystem functioning, educational opportunities) of this unassisted wolf recolonization. Our project achieved the following outcomes: (1) determine wolf movements inside and nearby Cedar Creek; (2) experimentally test the impacts of wolves on wildlife, biodiversity, and ecosystem functioning; and (3) provide educational programming to K-12 students and adults. We achieved these goals and outcomes by establishing a network of trail cameras, establishing a new experiment to assess wolf impacts on plants and soils, and bringing K-12 students to Cedar Creek for field trips and developing a website for engagement by citizen scientists. We found that wolf pack produced three litters of pups and grew to include up to 19 wolves, but was then lethally removed by federal trappers after preying on livestock and dogs (Mech et al. 2019). We also found that wolf cues shifted when, but not where, deer used the landscape (Palmer et al. 2021). Deer used risky areas at relatively safe times of the day, when wolves are typically less active, attenuating any cascading effects of wolves on plants or soils. Our [Eyes on the Wild](#) citizen science website has thus far engaged 12,625 registered citizen scientists who have provided 7,636,071 classifications of 4,153,218 images generated by our network of trail cameras. These data are being included in several national and global studies of wildlife (e.g., Suraci et al. 2021). More than 7,000 K-12 students and adults engaged in programming related to the project.

PROJECT RESULTS USE AND DISSEMINATION

Project results have been widely disseminated. The [Eyes on the Wild](#) website has engaged 12,625 registered users (and thousands more non-registered users), who provided 7,636,071 classifications of 4,153,218 images from our cameras. Project information and results have been widely shared through in-person and online lectures, K-12 school programs and field trips, summer camps, community events, art shows, educational curricula, and local workshops which reached more than 7,000 community members over the lifetime of the project. Additionally, the project has generated four scientific publications, and regular coverage by local print, radio and television outlets.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 03I Effects of Wolves Predation on Beaver, Moose, and Deer – Research Project - \$293,000 TF (FY2018)

Steve Windels

Voyageurs National Park
360 Hwy 11 E
International Falls, MN 56649

Phone: (218) 283-6692

Email: steve_windels@nps.gov

Appropriation Language

\$293,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Voyageurs National Park to assess the effects of wolf predation on beaver, moose, and deer in the Border Lakes region. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Our studies of how, where, and when wolves prey on beavers, moose, and white-tailed deer shed exciting new light on the interactions of these iconic denizens of Voyageurs National Park, Minnesota's only National Park.

OVERALL PROJECT OUTCOME AND RESULTS

Gray wolves are widely known to prey on adults and fawns/calves of white-tailed deer and moose. Beavers also make up a large portion of wolf diet in areas where beavers are plentiful. Scientists have long pondered how the abundance of beaver prey can affect wolf predation on moose and deer. Voyageurs National Park - Minnesota's only National Park – and the surrounding area offers the perfect natural laboratory to learn about wolf hunting behavior and how that affects deer and moose in an area of high beaver densities, as densities can be 2-10x higher here than anywhere else in the state. We captured and GPS-collared 42 wolves in at least 12 different wolf packs to follow their movements and find sites where they killed their prey during the spring-summer-fall period. We identified >1,045 kills, including kills of 335 beavers, 192 adult and 444 fawn white-tailed deer, 1 adult and 1 calf moose, and 65 kills of ≥12 other species including snowshoe hare, bears, muskrats, raccoons, swans, geese, ducks, and other birds. Some of our key findings include understanding how wolf predation can affect beaver abundance, pond creation, and even water storage; better understand how wolves use ambushing behavior and cooperative hunting techniques to hunt and kill beavers; how wolves use roads and trails and areas of recent timber harvest to target and kill deer fawns; and how wolves use a variety of other food sources such as fish and berries to persist in an environment where food can often be scarce. While issues surrounding management of wolves, deer, and moose tend to generate a variety of opinions, better understanding the summer ecology of wolves, especially in a relatively pristine environment such as in Voyageurs National Park, can only improve the ability for Minnesotans to better co-exist with wolves and their prey.

PROJECT RESULTS USE AND DISSEMINATION

This collaboration between Voyageurs National Park and the University of Minnesota produced 15 scientific papers and other reports. Our findings have influenced the understanding of wolf behavior and the importance of beavers to forested landscapes in the U.S. and beyond. Research about charismatic species like wolves, beavers, moose, and deer are often very interesting to the general public. We capitalized on that interest by engaging the public through several social media outlets, most notably

through a popular Facebook page created by the University of Minnesota. Check out the University of Minnesota's [Voyageurs Wolf Project](#) website for project information.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 03m Mapping Taxonomy and Environmental Toxicology of Minnesota Freshwater Sponges – Research Project - \$258,000 TF (FY2018)

Anthony Schroeder

U of MN, Crookston

2900 University Ave

Crookston, MN 56716

Phone: (218) 281-8252

Email: aschroed@crk.umn.edu

Appropriation Language

258,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Crookston, to determine freshwater sponge distribution, identify and quantify accumulated contaminants, and provide educational research opportunities to undergraduate students. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Our project identified freshwater sponges are widely distributed throughout Minnesota's lakes and rivers. Sponges are thought to be bio-indicators of good water quality, suggesting many rivers and lakes in Minnesota are of relatively good quality. We identified new species of freshwater sponges not described previously, so there is likely significant amounts of biological diversity not described in the state. As filter feeders, it doesn't appear that freshwater sponges are accumulating pollutants that can be passed through the food chain.

OVERALL PROJECT OUTCOME AND RESULTS

Freshwater sponges are the simplest animals and play a vital role in the aquatic ecosystem by functioning as a filter feeder and providing habitat and nutrients for other aquatic life. As filter feeders, freshwater sponges could potentially accumulate pollutants and transfer them through the food chain to game fish and other economically important aquatic and terrestrial organisms. Furthermore, despite their importance, information on the distribution of freshwater sponges in Minnesota lakes and rivers is very limited. The primary goals of this project were to **(1) determine the diversity and distribution of freshwater sponges in Minnesota's water basins and watersheds and to (2) determine if these freshwater sponges are accumulating toxic pollutants.**

From our sampling of freshwater sponges, we found freshwater sponges are widely distributed throughout the state of Minnesota. We sampled over one hundred locations and found freshwater sponges at over 75% of the locations sampled, resulting in a total of 169 individual freshwater sponges collected. The majority of the freshwater sponges collected are species that have previously been identified in the state. We identified one new species of freshwater sponge from this project, while

potentially identifying a few more after additional follow-up analyses.

From the chemical analysis of collected sponges there does not appear to be an accumulation of pollutants within the sponge that could be passed through the food chain. Our chemical analysis did identify interesting and unique chemical compounds in the freshwater sponges that has the potential for having bioactivity and could be used for human purposes.

The results of this project showed that freshwater sponges are widely distributed in the state of Minnesota, supporting the notion that these animals are important for the freshwater ecosystem. We have identified new species of freshwater sponges, and importantly, it doesn't appear that sponges are accumulating pollutants that could remain in the ecosystem. We were also able to train 18 undergraduate students in biological and chemical research. Many of these students have gone on to be scientists, nurses, doctors and other important jobs in Minnesota.

PROJECT RESULTS USE AND DISSEMINATION

The dissemination of the project has occurred through multiple mediums. This project was highlighted in the Minnesota DNR's [Minnesota Conservation Volunteer Magazine](#). The project has also been shared with the general public by being added to the [Minnesota State Parks and Trails Geocaching Aquatic Quest](#). An important aspect of this project was providing research opportunities for our undergraduate students at the University of Minnesota Crookston. The research [involvement by students](#) was highlighted in a number of [publications](#). The results of this project were also presented at multiple scientific and non-scientific conferences by faculty and students.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 04 Water Resources

Subd. 04a Assessment of Household Chemicals and Herbicides in Rivers and Lakes – Research Project - \$236,000 TF (FY2018)

William Arnold

U of MN

500 Pillsbury Dr. SE

Minneapolis, MN 55455

Phone: (612) 625-8582

Email: arnol032@umn.edu

Web: <http://personal.ce.umn.edu/~arnold/>

Appropriation Language

\$236,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to quantify environmental levels of household chemical and herbicide ingredients in rivers and lakes and assess their potential to form toxic by-products.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The levels of quaternary ammonium compounds (QACs), which are used widely as disinfectants and for

other purposes, were measured in Minnesota wastewaters and sediments. The QACs are present at microgram per liter levels in wastewater. While the QACs are slowly degraded in surface waters by bacteria and light, they accumulate in sediments. The QACs form specific suspected carcinogens during water disinfection in very low yield, and QACs are likely less important than other precursors for these toxins. The results provide information on current QAC levels and provide insights on how to lower them if desired.

OVERALL PROJECT OUTCOME AND RESULTS

Quaternary ammonium compound (QACs) are ingredients in personal care products, fabric softeners, disinfectants, and herbicides. QACs, which are biologically active molecules, are unintentionally and intentionally released into the environment. QACs kill bacteria and may affect microbial communities in wastewater treatment and algal communities in surface waters. In this study, the levels of QACs in the effluent from 12 wastewater treatment plants were determined. Plants with more advanced treatment processes had lower levels of QACs. Sediment samples in a lake demonstrated potential inputs from both municipal wastewater effluent and agricultural sources for QACs. In sediment cores taken from lakes, two distinct trends over time were observed. In lakes with large watersheds and mixed domestic and industrial wastewater sources, peak concentrations of QACs were found at depths corresponding to deposition in the 1980s and decreases after this time are attributed to improved wastewater treatment and source control. In a smaller lake with predominantly domestic wastewater inputs, concentrations of QACs increased slowly over time. In surface waters, QACs were found to degrade by reaction with reactive species (hydroxyl radicals) generated by sunlight and by microbial processes. Even with these loss processes, QACs likely persist from days to weeks in the water, leading to their deposition in the sediments. QACs were found to form low levels of a carcinogenic class of compounds (nitrosamines) when reacted with a drinking water disinfectant (chloramine), but this would be of greatest concern in wastewater potable reuse scenarios. The overall results of the work indicate that QACs are being released by wastewater treatment plants. Once in the environment, degradation by bacteria and by sunlight can occur in surface waters, but accumulation in sediments, where the QACs are persistent, is likely the main removal process. During the wastewater disinfection process QACs can form a carcinogen, but QACs are not as important as other chemicals known to form nitrosamines. The findings allow more robust assessment of potential impacts of QACs and insight into wastewater treatment processes that lead to removal, which is important given the increasing use of QACs during the COVID-19 pandemic.

PROJECT RESULTS USE AND DISSEMINATION

Three papers were published: 1) the detection of QACs in wastewater and sediment (the [paper](#) and [data set](#) are available online); 2) [Photolysis of QACs](#); and 3) Potential environmental impacts of elevated QAC usage during the COVID-19 pandemic (available online through [ACS Publications](#) or [PubMed Central](#)). A public lecture that incorporated data for the project was also given at the U of MN, and it is [available on YouTube](#).

Project Completed: 6/30/2019

FINAL REPORT

Subd. 04b Wastewater Nitrogen Removal Technology to Protect Water Quality – Research Project - \$450,000 TF (FY2018)

Paige Novak
U of MN
500 Pillsbury Dr SE, 122 Civil Engineering Bldg
Minneapolis, MN 55455

Phone: (612) 626-9846
Email: novak010@umn.edu
Web: <http://www.ce.umn.edu/people/faculty/novak/>

Appropriation Language

\$450,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to develop a technology for inexpensive low-energy nitrogen removal in wastewater. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

A group of bacteria ("anammox") have received attention for their potential in wastewater treatment, transforming harmful reactive nitrogen into harmless dinitrogen gas. However, anammox perform poorly in typical wastewater environments. In this project we developed new materials to selectively enhance anammox growth/retention, supporting more sustainable removal of harmful nitrogen.

OVERALL PROJECT OUTCOME AND RESULTS

Anammox bacteria have received attention for their ability to completely transform harmful reactive nitrogen compounds in wastewater into harmless dinitrogen gas. In addition, when using anammox bacteria, much less oxygen and no supplemental carbon is needed for nitrogen removal, and there is little production of excess biomass in the form of sludge. This reduces costs and energy use for nitrogen removal. It is estimated that the anammox process saves 60% of the energy used in conventional nitrogen removal. Unfortunately, this process has been difficult to implement in typical wastewater systems. Anammox bacteria are slow growing and the ammonium and carbon concentrations in wastewater result in low anammox activity and competition from faster growing bacteria. This leads to the washout of anammox bacteria. In this collaborative research project, our goals were to develop new polymeric materials that could concentrate ammonium to create localized niches for anammox enrichment and retention. We developed two different materials in this project: (1) a porous polymer carrier and (2) a gas-permeable alumina membrane. Both materials were able to concentrate ammonium, while the membrane could also transfer low quantities of oxygen to the surrounding solution. Both materials were also able to enrich and retain anammox when added to a wastewater environment. Further optimization of these materials is needed to enable scale-up and deployment. Nevertheless, given that in the US, the energy used for wastewater treatment costs approximately \$2B a year, the predicted energy savings if this technology was implemented would be significant. The impact within the state of Minnesota would also be large, saving millions of dollars and providing more complete removal of harmful nitrogen species. A patent was awarded and the University of Minnesota is exploring commercialization and licensing options. Three peer-reviewed manuscripts were published from this work and have been submitted to the LCCMR.

PROJECT RESULTS USE AND DISSEMINATION

Information from this project has been shared with several water technology companies who may be able to assist in optimizing and eventually deploying this technology. As stated above, three peer-

reviewed manuscripts were published from this work and have been submitted to the LCCMR. Multiple presentations about the research have been given to both regional and national/international conferences. Additional funding is being sought from a large infrastructure company. We anticipate submitting a proposal to the National Science Foundation for additional funding. The University of Minnesota Technology Commercialization Office is working with us to further the technology.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 04c Rearing Native Mussels for Reintroduction and Expanding Water Quality Awareness - \$591,000 TF (FY2018)

Seth Stapleton

Minnesota Zoological Garden
13000 Zoo Blvd
Apple Valley, MN 55124

Phone: (952) 431-9443

Email: seth.stapleton@state.mn.us

Web: <http://www.mnzoo.org>

Appropriation Language

\$591,000 the first year is from the trust fund to the Minnesota Zoological Garden in cooperation with the Department of Natural Resources to accelerate the reintroduction of native mussels into Minnesota rivers and streams through expanded mussel rearing, research, and statewide educational activities promoting mussel conservation and water quality. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Minnesota Zoo increased capacity for rearing mussels to more than 10,000 individuals and researched methods to improve husbandry, enabling us to better support efforts to recover depleted populations. The Show Us Your Mussels challenge engaged >2,200 students, with student-created content reaching >150,000 citizens and encouraging action to benefit conservation.

OVERALL PROJECT OUTCOME AND RESULTS

Native mussels are aquatic engineers, providing important ecosystem services such as water filtration and creating habitat for fish and other wildlife. However, many populations are depleted in Minnesota due to factors such as overharvest and pollution. With this project, the Minnesota Zoo sought to support state-wide recovery efforts led by the DNR and improve mussel conservation by 1) increasing our capacity to rear juvenile mussels for reintroduction; 2) advancing our understanding of mussel husbandry to improve the growth and survival of individuals in our care; and 3) raising public awareness about and encouraging action to benefit our aquatic resources.

We constructed a new mussel rearing and research facility on the Zoo's campus and installed associated systems for housing mussels. These improvements significantly increased our capacity for rearing mussels; we currently have space to accommodate >65,000 newly transformed mussels, surpassing our

target of 10,000 individuals. This expansion significantly increases our conservation impact and positions us to better support ongoing recovery efforts that will restore ecosystem services.

We also conducted experiments to evaluate how substrate affects growth and survival of juvenile mussels. Our research documented that the presence of fine sand in rearing pans significantly increases growth rates for some species. As such, we have modified our husbandry methods to incorporate this finding, which will yield larger individuals more suitable for reintroduction and ultimately may accelerate reintroduction efforts.

To encourage local communities to take action on behalf of water quality, we established the Show US Your Mussel Challenge. This project engages middle and high school students in the creation of social media campaigns to expand communications efforts throughout local communities. To date, >2,200 students have participated in the challenge, sharing information about the importance of mussels, Minnesota's aquatic resources, and actions the public can take to protect Minnesota's waterways with >150,000 residents.

PROJECT RESULTS USE AND DISSEMINATION

Communicating the importance of native mussels and water quality was a key goal of this project. The Minnesota Zoo engaged with Minnesotans to share information about mussels, their conservation, and stewardship of aquatic resources via a variety of platforms, ranging from in-person and virtual presentations at schools, camps, and other forums to free school curriculum and teacher professional development in association with the Show Us Your Mussels challenge. We developed an interpretive area on Zoo campus, outfitted with signs, videos, and a water quality activity, shared research findings at scientific meetings and hosted Smart Salt workshops to reduce salt use.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 04d Water Quality Monitoring in Southeastern Minnesota Trout Streams - \$500,000 TF (FY2018)

Neal Mundahl

Winona State University

175 W Mark St W

Winona, MN 55987

Phone: (507) 457-5695

Email: nmundahl@winona.edu

Web: <http://www.winona.edu>

Appropriation Language

\$500,000 the first year is from the trust fund to the Board of Trustees of Minnesota State Colleges and Universities, Winona State University, to develop a system of biological monitoring for water quality protection of trout streams in southeastern Minnesota. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Strobin fungicides were detected in most water samples from the Whitewater River in southeastern Minnesota. Many citizen scientists were trained and continue to monitor stream sites. Stream habitats and fish and aquatic invertebrate communities ranged from excellent to poor, based largely on upstream versus downstream location and adjacent land uses.

OVERALL PROJECT OUTCOME AND RESULTS

Water quality in many trout streams in southeastern Minnesota has been compromised by rain-event runoff, exposing sensitive trout to mixtures of eroded soils, pesticides, urban stormwaters/wastewaters, and animal wastes. The main goal of this project was to better protect at-risk streams by developing an improved water-quality monitoring infrastructure and network within the Whitewater River system. This was achieved by:

- Automated Water Sampling - establishing both continuous and rain-event sampling throughout 3 at-risk trout stream reaches (North, South, Middle Forks of the Whitewater River),
- Citizen Scientists - training an action network of citizen scientists to respond to episodic run-off events and to monitor water quality and aquatic life in these and additional trout stream reaches, and
- Baseline Surveys - conducting inclusive biotic inventories of fish and aquatic invertebrate communities throughout entire at-risk watersheds for broader, complete delineation of baseline conditions.

Water sampling detected various strobin fungicides in >80% of rain event and low-flow samples, with some concentrations above toxic levels for aquatic life. Strobin concentrations were higher in rain-event samples, but concentrations could not be predicted by rain volume or season. Increased monitoring and better chemical management are needed in these and other watersheds to protect our coldwater ecosystems.

More than 30 citizen scientists have been trained to monitor stream water quality and aquatic invertebrate communities with the Whitewater River and nearby stream systems. They assess their chosen stream sites four times per year, and upload their findings directly to the Izaak Walton League's Save Our Streams web portal. In addition to regular seasonal monitoring, citizen scientists can respond to sudden events (e.g., floods, fish kills) to gather additional information as needed.

Based on surveys at 62 sites, stream habitats and biotic communities ranged from excellent to poor, influenced largely by upstream/downstream location, adjacent land uses, and proximity of springs.

PROJECT RESULTS USE AND DISSEMINATION

Results from our project were the basis for two MS theses completed at Winona State University, and a chapter of a PhD dissertation completed at the University of Minnesota. At least two papers reporting our findings will be published in the peer-reviewed scientific literature.

Our 30+ trained citizen scientists have reported and will continue to report their stream monitoring data to the Izaak Walton League's Save Our Streams web portal, where they are continually available to the public.

Project results also have been reported to the scientific community at seven different state, regional, and national science meetings.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 04e Reassessing Toxicity of Petroleum Spills on Ground and Surface Water – Research Project - \$300,000 TF (FY2018)

Dalma Martinovic-Weigelt

St. Thomas University
2115 Summit Ave, OWS 390
St. Paul, MN 55105

Phone: (651) 962-5233

Email: mart6831@stthomas.edu

Web: <http://www.stthomas.edu/biology/research/environmental-toxicology.html>

Appropriation Language

\$300,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the University of St. Thomas to reassess long-term effects of oil spills through the analysis of chemical parameters related to oil degradation and evaluate the impacts on aquatic species, groundwater, and surface waters. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The groundwaters contaminated with chemicals from the decades-old crude oil spill and/or their breakdown products can adversely affect development and hormone and liver functioning if vertebrates were to be exposed to them sufficiently. This project advanced understanding of oil spill remediation and will help protect Minnesota's natural resources/drinking water sources.

OVERALL PROJECT OUTCOME AND RESULTS

A fundamental issue in protecting ecosystem health in Minnesota is the degree to which waters impacted by, relatively common, petroleum releases (e.g., oil or gasoline spills) are toxic, both initially and over time as the oil breaks down into new chemicals. This study was the first to comprehensively screen the toxicity of groundwater from an aged crude oil spill site. The National Crude Oil Spill Fate and Natural Attenuation Research Site near Bemidji, MN is the site of a 1979 pipeline rupture that released 10,000 barrels of crude oil. This site has been extensively studied for over 40 years offering a unique opportunity to study the toxicity of groundwaters impacted by crude oil. Groundwater samples (collected 2016-2019) were analyzed for over 90 different chemical and toxicity parameters using cutting-edge techniques where living cells were exposed to water samples and screened for potential toxic effects. Analysis of the molecular/toxicity targets that were activated in cells indicated that (even 40+ years after the spill) the groundwaters contaminated with chemicals from the original spill and/or chemicals resulting from the breakdown of the oil compounds have the potential to cause adverse impacts on development, endocrine, and liver functioning if vertebrates (fish, turtles, birds, mammals) were to be exposed to them sufficiently. This work clearly shows the need to improve understanding of the identity and toxicity of oil breakdown products. Furthermore, this work shows that commonly used

sampling and analysis methods (including sample extraction and clean-up protocols) can exclude or under-represent oil breakdown products and thus may underestimate risks from these chemicals. This finding is of importance to remediation managers and regulators in Minnesota and nationally because there is an active debate as to which methods and protocols are most suitable for hazard and risk assessment at petroleum spill sites.

PROJECT RESULTS USE AND DISSEMINATION

We published three research manuscripts, presented at numerous research conferences, and raised awareness of the issue with Minnesotans statewide (reached circa 1200 individuals at the State Fair exhibits). We introduced oil industry, and managers and regulators in MN and nationally to a new toolbox of novel cell and artificial intelligence approaches that can streamline hazard assessment and facilitate identification of chemicals/hazards of concern and enhance oil spill remediation monitoring. Results of our work are relevant to Minnesotans as the analyses conducted herein advance an understanding of oil spill remediation and will help protect Minnesota's natural resources/drinking water sources.

Project Completed: 6/30/2021

FINAL REPORT

Toxicity Assessment of Groundwater Contaminated by Petroleum Hydrocarbons at a Well-Characterized, Aged, Crude Oil Release Site - 7 pgs

Biological Effects of Hydrocarbon Degradation Intermediates: Is the Total Petroleum Hydrocarbon Analytical Method Adequate for Risk Assessment? - 9 pgs

Subd. 05 Environmental Education

Subd. 05a Connecting Youth to Minnesota Waterways through Outdoor Classrooms - \$1,200,000 TF (FY2018)

Nell Holden

Wilderness Inquiry
808 14th Avenue SE
Minneapolis, MN 55414

Phone: (612) 676-9400

Email: nell@wildernessinquiry.org

Web: <http://www.wildernessinquiry.org>

Appropriation Language

\$1,200,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Wilderness Inquiry to provide place-based environmental education science water experiences to approximately 20,000 middle- and high-school students. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Floating Classroom served more than 25,000 Minnesota youth by creating opportunities to engage in environmental science through accessing Minnesota waterways and public lands. Youth assessed

natural resources, collected scientific data, developed a stewardship ethic, and learned about outdoor employment opportunities, becoming Minnesota's next generation of natural resource protectors.

OVERALL PROJECT OUTCOME AND RESULTS

All told since the beginning of the project in June 2017, Wilderness Inquiry's Floating Classroom connected more than 25,714 Minnesota youth to environmental science and Minnesota's abundant waterways and public lands.

On live outdoor events, Wilderness Inquiry's Floating Classroom served 24,421 diverse Minnesota youth through placed-based, educational experiences, creating opportunities to engage in environmental science through accessing Minnesota waterways and public lands. Of these youth, 23,600 youth engaged in hands-on exploration, recreation and assessment of said waterways and public lands and 821 youth participated in a multi-day expedition, learning to restore and maintain public lands and discover pathways into outdoor-related employment.

When COVID-19 forced Minnesota schools into distanced learning and limited the gathering of groups, the Floating Classroom quickly pivoted to meet the needs of educators and families educating and learning from home. Wilderness Inquiry's Online Learning Resources were created and this website has been visited by 1,254 unique visitors. Some highlights include pages dedicated to Environmental Science and Natural Resources (visited by 353 visitors) and Jobs in the Outdoors (visited by 126 visitors). The full scope of these resources goes much further with downloadable activities and additional pages being shared among virtual classrooms.

As COVID-19 continued to impact the Floating Classroom's ability for in person programming through summer 2020, Wilderness Inquiry and the National Park Service partnered together to create a free virtual summer camp to connect youth to the mysteries of the Mississippi River. 39 Minnesota Youth took part in this camp focused on the ecology of the Mississippi River.

PROJECT RESULTS USE AND DISSEMINATION

While participating in Floating Classroom activities, students collected water quality data and this data was reported back and disseminated through a citizen science online portal Canoe Quest via GLOBE, a national database for citizen science.

Wilderness Inquiry worked with the University of Minnesota's Center for Applied Research and Educational Improvement (CAREI) to evaluate the project. CAREI produced two reports over the course of the three years which were shared directly with partners and stakeholders, presented at conferences, and can be found on the [Wilderness Inquiry website](#).

Lastly, many local media outlets covered the Floating Classroom's arrival throughout the state. Many of these are included in the Wilderness Inquiry blog, including this story from [MPR](#).

Project Completed: 6/30/2020

FINAL REPORT

Subd. 05b Increasing Diversity in Environmental Careers - \$487,000 TF (FY2018)

Denise Legato

MN DNR

500 Lafayette Rd
St. Paul, MN 55155

Phone: (651) 259-5317
Email: denise.legato@state.mn.us
Web: <http://www.dnr.state.mn.us>

Appropriation Language

\$487,000 the first year is from the trust fund to the commissioner of natural resources in cooperation with Conservation Corps Minnesota and Iowa to encourage a diversity of students to pursue careers in environment and natural resources through internships and mentorships with the Department of Natural Resources, the Board of Water and Soil Resources, and the Pollution Control Agency. This appropriation is available until June 30, 2022, by which time the project must be completed and final products delivered.

Project due to be completed: 6/30/2022

FINAL Abstract

Subd. 05c Interactive Water Resource Programs for Planetariums Minnesota - \$500,000 TF (FY2018)

Sally Brummel
U of MN - Bell Museum of Natural History
10 Church St SE
Minneapolis, MN 55455

Phone: (612) 624-8146
Email: sbrummel@umn.edu
Web: <http://www.bellmuseum.umn.edu>

Appropriation Language

\$500,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Bell Museum of Natural History, to create an interactive planetarium program on water resources, reaching approximately 400,000 citizens statewide through the Bell Museum Planetarium, St. Paul Public Schools, Mayo High School, Mankato East High School, Southwest Minnesota State University, Minnesota State University Moorhead, and University of Minnesota Duluth. This appropriation is available until June 30, 2022, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Water flows out of Minnesota in three directions, and our personal and public choices have impacts far beyond our borders. With Minnesota Water Stories, citizens tour Minnesota in planetariums across the state, to learn about issues in each region and understand what they can do to protect this natural resource.

OVERALL PROJECT OUTCOME AND RESULTS

The planetarium dome is an ideal place to provide an immersive venue for citizens to understand

complex topics such as time, scale, and geographic perspective as they relate to water. The shape of a dome fills our peripheral vision and mirrors the way our eyes see the world around us, which allows the audience to feel they are part of the story, connected to the decisions made by themselves and others. A skilled presenter can tailor the show to the needs of the audience, so each experience is unique. *Minnesota Water Stories* includes a mixture of animation and live-action video from a dozen locations around the state including Park Rapids, Halstad, Breckenridge, Redwood Falls, Waseca, Wabasha, and Tofte.

The outcomes for citizens attending *Minnesota Water Stories* were to increase awareness of challenges facing our waters, understand the challenges' relations to the larger system, and becoming aware of community resources to work toward addressing these problems. Due to the pandemic, we were not able to do a full-scale evaluation of the show in planetariums around the state. We created an online version with similar content as the planetarium show to measure how it meets these outcomes. According to the evaluation report, "general audience and student participants increased their understanding of challenges facing Minnesota waters."

Almost 1,000 Minnesotans saw the interactive and audience participatory experience of *Minnesota Water Stories* in its initial run at the Bell Museum's Whitney and Elizabeth MacMillan Planetarium, and 231 students and public reviewed the web-based version. Over the next few years Minnesota Water Stories will show to thousands of people at planetariums in Baxter, Duluth, Hibbing, Mankato, Marshall, Moorhead, Rochester, St. Cloud, and St. Paul.

PROJECT RESULTS USE AND DISSEMINATION

This project produced a planetarium show and an online StoryMap that all Minnesotans can access. To date, over 900 Minnesotans have seen the show at the Bell Museum. In fall 2022 it will be available for audiences in planetariums in nine cities around the state and can travel to any region with the University of Minnesota's portable planetarium system. In the years to come, thousands of Minnesotans will view *Minnesota Water Stories*.

Project Completed: 6/30/2022

FINAL REPORT

Subd. 05e Local Planning and Implementation Efforts for Bird Habitat - \$280,000 TF (FY2018)

Rob Schultz

Audubon Minnesota
2355 Highway 36 W, Ste 400
Roseville, MN 55113

Phone: (651) 340-2390
Email: rob.schultz@audubon.org
Web: <http://mn.audubon.org/>

Appropriation Language

\$280,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the National Audubon Society, Minnesota office, to engage approximately 60 communities and 400,000 citizens in bird habitat improvement through local planning and implementation efforts using

the National Audubon Bird City program. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Through Bird City Minnesota, Audubon Minnesota has engaged communities in improving the habitat and protecting birds. Nine communities completed the certification program, while many more have been using this conservation roadmap to leverage resources and achieve results in making their communities friendly for birds and wildlife.

OVERALL PROJECT OUTCOME AND RESULTS

Bird City Minnesota has worked to enhance conservation efforts to protect birds and habitats in Minnesota communities. A total of nine communities have received the Bird City Minnesota designation, while many other communities have showed interest and start working to complete the requirements of the program. Bird City Minnesota requirements lead communities in taking steps to accomplishment conservation efforts that improve habitat through restoration, reduce threats to birds, and engage local citizens through projects, training and birding events. Many of the communities that participated made substantial progress in protecting habitat in local parks and engaging citizens in hands-on conservation work that creates a healthier environment for birds. By focusing on these efforts, local communities have engaged their residents in citizen science and conservation. Through public events, residents have learned how to take simple actions that result in improving the landscape for birds and ensuring appropriate habitat.

During the course of this project, the COVID-19 pandemic significantly disrupted the progress that communities were making in attaining Bird City Minnesota recognition. Staff have been flexible to support communities as necessary, made adjustments where appropriate, and encourage continued work towards completing the program even after the funding of this project has ended. Minnesotans have benefited from this work by learning simple steps that they can take in their own communities to make a difference for birds, and what they have learned in this process will benefit communities and birds for decades to come.

PROJECT RESULTS USE AND DISSEMINATION

While the project was significantly affected by the COVID-19 pandemic, we have been able to successfully promote the achievements of communities through significant local news media coverage for cities who have achieved the Bird City Minnesota recognition. Additionally, signage and flags are now displayed in each of the communities that have completed the Bird City Minnesota requirements and were awarded recognition. Application materials have been shared with communities to assist in their continued fulfillment of program requirements, as well as to serve as historical records of the conservation efforts taken.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 05f Developing Youth Watershed Stewardship in Northwest Minnesota - \$121,000 TF (FY2018)

Lee Furuseth
Headwaters Science Center
413 Beltrami Ave NW
Bemidji, MN 56601

Phone: (218) 444-4472
Email: director@hscbemidji.org
Web: <http://www.hscbemidji.org/>

Appropriation Language

\$121,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Headwaters Science Center to accelerate a multiyear environmental science club for middle-school students focused on water quality, watershed evaluation, and aquatic invasive species in northwestern Minnesota. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The project entitled Developing Youth Watershed Stewardship in Northern Minnesota established the Environmental Science Club. Goals were established, pursued and met: skill development, enhanced understanding, recognition of relationships between actions and outcomes, provided positive experiences, shared similar information through presentations, and demonstrated deeper understanding of ecosystems.

OVERALL PROJECT OUTCOME AND RESULTS

Environmental Science Club was established in early 2019 for 10 to 18 students led by HSC staff in each of 2-hour club sessions. Members came to HSC from two sources: Boys & Girls Club of Bemidji with students from fifth grade to eighth grades along with HSC's youth participants. Students explored ground-water, examined rivers & built models of watersheds; culminating with a lakeshore clean-up. The club was expanded into summer where Voyageurs Expeditionary High School students participated in a four-day outdoor ecological study as part of their summer school course curriculum requirements.

Club activities resumed heading into the fall and winter of 2019. Specimens from area water were gathered and examined. Eighteen students participated in Environmental Science Club.

With the turn of the new year, HSC headed into 2020 with twelve more club sessions in January, February, and early March. Then Covid-19 struck & we were soon surrounded by uncertainty with hybrid models for students attending class & afterschool activities virtually. In this phase we co-opted our "Daily Live Science Show" -once a week- with labs testing for chloride & then showing E. coli sampling & lab technique for various local stream studies.

Our hybrid approach shifted again to macroinvertebrate assays, crowd sourced, demonstrating how to gather, sort, classify & count organisms for our pollution intolerance index. With this scale we were able to determine water quality by presence, or lack thereof, pollution intolerant organisms, as well as diversity. This scale allowed us to determine, and present electronically degree of ecological integrity. Despite most environmental news being dire and even depressing, we are pleased to present our

findings of excellent condition for many streams and even found pollution sensitive organisms in places way downstream. We are thankful that this LCCMR grant allowed us to share these insights.

PROJECT RESULTS USE AND DISSEMINATION

Club participants always focused on results -via exploration & the scientific method- utilizing various skills learned for water examination. In the first thirty months of the project, participants presented knowledge they had gained at science fairs & peer-to-peer feedback sessions. Student field journals, notes & posters accompanied project presentations. Final professional production of posters was not completed. Funding for this portion of the project was remains unspent and this portion of the grant should be returned to the ENRTF.

During the last six months of the grant cycle the pandemic overtook us, so we shifted to a hybrid virtual model. Our 3:30 show became a regular afternoon session on three platforms: YouTube, Facebook and Twitch TV with final selected videos appearing on the hscbemidji.org Website.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 06 Aquatic and Terrestrial Invasive Species

Subd. 06a Aquatic Invasive Species Research Center - Phase II – Research Project - \$2,700,000 TF (FY2017)

Nicholas Phelps

U of MN - MAISRC

135 Skok Hall, 2003 Upper Buford Circle

St Paul, MN 55108

Phone: (612) 624-7450

Email: phelp083@umn.edu

Web: <http://www.maisrc.umn.edu/>

Appropriation Language

\$2,700,000 in fiscal year 2017 is from the trust fund to the Board of Regents of the University of Minnesota to support the Minnesota Aquatic Invasive Species Research Center in finding solutions to Minnesota's aquatic invasive species problems through research, control, prevention, and early detection of existing and emerging aquatic invasive species threats. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

Sub-Projects M.L. 2017, Subd. 06a:

- [4.3: Social Learning and Carp Removal - Przemek Bajer - \\$189,475](#)
- [8.2: Impacts of Invader Removal on Native Vegetation Recovery - Daniel Larkin - \\$119,034](#)
- [12.2: Historical Analyses of Spiny Water Flea Invasion Patterns - Donn Branstrator - \\$53,795](#)
- [15: Determining Highest Risk Vectors of Spiny Water Flea Spread* - Valerie Brady - \\$26,581](#)

- [16.2: AIS Impacts on Walleye Populations and Mercury Concentrations - Gretchen Hansen](#) - \$199,862
- [18.2: Genetics to Improve Hybrid and Eurasian Watermilfoil Management - Raymond Newman](#) - \$236,423
- [20: A Novel Technology for eDNA Collection and Concentration*](#) - [Abdennour Abbas](#) - \$96,264
- [21.2: Field validation of multibeam sonar zebra mussel detection \(Year 1\)**](#) - [Jessica Kozarek](#) - \$14,247
- [22: Copper-Based Control – Zebra Mussel Settlement and Non-Target Impacts*](#) - [James Luoma](#) - \$152,090
- [23: Public Values of Aquatic Invasive Species Management*](#) - [Amit Pradhananga](#) - \$110,245
- [24: Genetic Method for Control of Invasive Fish Species*](#) - [Michael Smanski](#) - \$140,004
- [25: What's in Your Bucket? Quantifying AIS Introduction Risk*](#) - [Nicholas Phelps](#) - \$84,094
- [28: Evaluating Innovative Coatings to Suppress Priority AIS](#) - [Mikael Elias](#) - \$51,234
- [30: Managing Midwestern Aquatic Invasions in a Changing Climate](#) - [Ranjan Muthukrishnan](#) - \$39,000

*Subproject is split between M.L. 2013 and M.L. 2017 funding, only M.L. 2017 funds are reflected.

**Subproject is split between M.L. 2017 and M.L. 2019 funding, only M.L. 2017 funds are reflected.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project continued MAISRC's work to develop research-based solutions that can reduce the impacts of aquatic invasive species in Minnesota. Through this appropriation, MAISRC has supported 15 subprojects on many of Minnesota's most important AIS, significantly advanced our scientific understanding and ability to manage AIS and engaged thousands of stakeholders and partners.

OVERALL PROJECT OUTCOME AND RESULTS

The Minnesota Aquatic Invasive Species Research Center (MAISRC) continued to develop research-based solutions that can reduce the impacts of AIS in Minnesota and advance AIS knowledge among natural resources managers, the research community, and the public. In total, 15 subprojects were supported from this project – significantly advancing our scientific understanding and ability to manage AIS. New tools have been developed and knowledge gaps filled on many of Minnesota's most important AIS, including zebra mussels, spiny water flea, bigheaded and common carps, and starry stonewort. The results of this work have been broadly disseminated via research reports, peer-reviewed manuscripts, fact sheets, white papers, news media, newsletters, social media, and direct stakeholder engagement through presentations, workshops/trainings, and public events. Highlights of project outcomes include identifying the highest risk methods of introduction and spread of spiny water flea and baitfish viruses, advancing innovative control tools for established AIS like zebra mussels and common carp, and defining the impact of AIS on ecosystems and sportfish populations. Throughout this project, MAISRC has continued to serve as a global leader in the field of AIS research and a go-to resource for managers, researchers, and members of the public.

This project also supported MAISRC's work to ensure the effectiveness and efficiency of a center-based research model. Progress in this area included an ongoing, comprehensive process for prioritizing research needs; stronger collaboration and coordination between researchers and managers; a competitive, peer-reviewed annual proposal competition; and increased communications and outreach capacity to help managers and community members translate research findings into on-the-ground management.

MAISRC continues to advance Minnesota's resiliency and ability to address AIS issues facing our state through research, collaboration, and stakeholder engagement. This project will continue with Phase II and III appropriations awarded in 2019 and 2021.

PROJECT RESULTS USE AND DISSEMINATION

The MAISRC website has become a resource for AIS stakeholders across the state with an average of 40,000 users visiting the site each year. MAISRC and the AIS Detectors program also have active social media accounts on Twitter, Facebook, and YouTube. MAISRC and AIS Detectors' videos on YouTube, including webinars and project spotlights, have collected nearly 94,000 views, totaling an estimated 2,700 hours of watch time. MAISRC's Twitter account has grown into a popular means of connecting researchers, legislators, community organizations and nonprofits, and other AIS stakeholders. Social media posts continue to disseminate research findings, highlight behind-the-scenes project activities, promote MAISRC events and AIS Detectors workshops, and share invasive species news. In addition, the MAISRC e-newsletter delivers in-depth stories about MAISRC research and management tools to more than 5,300 people and growing.

Project Completed: 06/30/2022

OVERALL FINAL REPORT

Sub-Project 4.3: Social Learning and Carp Removal - \$189,475 TF

Przemek Bajer

U of M - College of Food, Agriculture, and Natural Resource Sciences; Department of Fisheries, Wildlife, and Conservation Biology
135 Skok Hall
2008 Upper Buford Circle
Saint Paul, Minnesota 55108

Phone: (612) 625-6722

Email: bajer003@umn.edu

Web: <http://www.maisrc.umn.edu>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

A new method for removing common carp to improve water quality and habitat was developed. It uses bait to attract carp and remove them. It is very selective and easily scalable. While its efficacy is being improved, it is already being used by lake managers in Minnesota.

OVERALL PROJECT OUTCOME AND RESULTS

Common carp is a widespread, invasive fish that negatively impacts habitat and water quality in lakes. Practical and selective removal strategies are needed for carp. Previous research showed that bait can be used to selectively attract large numbers of carp in lakes. In this experiment, we documented how the carp are attracted to the bait (Objective 1; social structure) and whether they could be removed using nets (Objective 2). In a lake with multiple baiting sites (8 sites in a 258-acre lake) and 300 carp tagged with electronic tags, 54% of carp (164 tags) were attracted to the bait over the whole summer, and ~ 20% of population were attracted daily (60 tags). Some carp ("Superfeeders") visited baited sites

nearly every day, while others only every few days. The Superfeeders were significantly larger than other carp. The carp visited the bait mainly at night. Feeding aggregations were very dynamic – individual feeding bouts included 2-9 tagged carp, lasted <1 minute to over 30 min, and continuously formed and dissolved for several hours each night. We attempted three removal events at the baited sites, on 3 separate nights, collectively capturing 27% of the population (3,602 carp). Native fish bycatch was <1% (released).

Our results indicated that carp foraging is social, easily induced by species-specific bait, dominated by large-bodied individuals, and predictable (nightly). However, only a fraction of carp attracted to the bait were removed because individual feeding groups visited that bait at different times of the night. We suggest that next steps should address how to synchronize carp aggregations at the bait to increase removal efficiency (starts in January 2022 using acoustic conditioning). This line of research resulted in carp removal methods that are already being applied in Minnesota, often involving volunteers to bait the carp. Future optimizations will increase the efficacy of this new management method.

PROJECT RESULTS USE AND DISSEMINATION

To disseminate the results of this work we have presented two talks at scientific conferences focusing on invasive species and lake management:

Bajer P. G. et al. 2019. A new approach to manage common carp: Citizen-aided carp management. International Conference on Aquatic Invasive Species ICAIS, Montreal, Canada.

Hundt, P. J., Bajer P. G. 2020. Common Carp Feeding Aggregations: Responses of Invasive Carp and Native Fish to Corn Baiting, North American Lake Management Society, Minneapolis, MN.

We have published two peer-reviewed manuscripts:

Hundt, P. J., Amberg, J., Sauey, B., Vacura, K., & Bajer, P. G. (2020). Data from: Tests in a semi-natural environment suggest that bait and switch strategy could be used to control invasive Common Carp. Management of Biological Invasions.

Hundt PJ, While LA, Craft ME, Bajer PG. In review. Social associations in common carp: Insights from induced feeding aggregations for targeted management strategies. Ecology and Evolution.

We were featured in a Star Tribune article from January 30, 2021: Corn, Conveyor Belts and a Virus show promise in removing invasive carp from Minnesota Waters. We were also featured in a Minnesota Bound episode on common carp management in Lake Parley <https://www.youtube.com/watch?v=3sSEj3VU4w>.

We have also presented twice at the MAISRC Research & Management Showcase and conducted a webinar on common carp management that included 150 participants from several states. <https://youtu.be/zNXcB1IfhqM>.

Subproject 4.3 Completed: 06/30/2021

FINAL ABSTRACT

FINAL Graphic

Sub-Project 8.2: Impacts of Invader Removal on Native Vegetation Recovery - \$119,034 TF

Daniel Larkin

U of M - College of Food, Agriculture, and Natural Resource Sciences; Department of Fisheries, Wildlife, and Conservation Biology
135 Skok Hall
2008 Upper Buford Circle
Saint Paul, Minnesota 55108

Phone: (612) 625-6350

Email: djlarkin@umn.edu

Web: <http://larkinlab.cfans.umn.edu/>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project adds to the growing understanding that invasive species are often only one of multiple stressors that drive declines in the health of our lakes. Controlling invasive plants is not a silver bullet for restoring turbid, degraded lakes—we have to think more holistically about what's dragging down our lakes' health.

OVERALL PROJECT OUTCOME AND RESULTS

Controlling dominant invasive aquatic plants is a common goal of many stakeholders around the state. These invader-reduction efforts are often motivated as ways to promote the health or recovery of native plant communities—but the potential for these efforts to actually meet those goals is uncertain. We hypothesized that, in addition to potential competitive effects of invasive species, insufficient water clarity and native plant recolonization can also be "rate-limiting" components of restoring lake vegetation. If so, these limitations must be addressed and invader control alone will be inadequate for restoration. We addressed this issue in two ways: (1) By evaluating responses of native plants to actual, on-the-ground management efforts in invaded lakes in MN through synthesis and analysis of monitoring data. This can tell us how management is working across the state at scales relevant to lake managers. (2) We compared those conclusions to results of field experiments designed to untangle how invaders, light limitation, and reproduction can hinder native plant recovery. Overall, our work resulted in the aggregation of more than 4,000 surveys that will be used to evaluate responses of native plants to curlyleaf pondweed, Eurasian watermilfoil, and the management of each of these AIS. The funding supported the completion of all experimental fieldwork, bringing four years of work to a conclusion. In short, our experiments and data synthesis reveal that native plant recovery following invader control is a realistic outcome—but only under certain conditions, i.e., where water clarity and propagule availability are sufficient to foster native plant recovery. In addition, our results show that Eurasian watermilfoil exerts a stronger negative effect on native plants than curlyleaf pondweed. Thus, control of Eurasian watermilfoil is more likely to foster native recovery than is control of curlyleaf pondweed. If lake management is to restore native macrophytes, it must target the factors that are limiting native species recovery, and we show that invasive species are one of multiple limiting factors in Minnesota lakes.

PROJECT RESULTS USE AND DISSEMINATION

This project has produced materials of interest to a wide variety of stakeholders covering a wide breadth of the work the project entailed. Among these products are peer-reviewed publications, videos, presentations, posters, databases, and a data dashboard. Videos include a webinar on the statewide plant survey database, an instructional video describing point-intercept and delineation plant-survey

methods for student and extension audiences, and two short presentations—one describing analysis of statewide data for management evaluation, and another describing ecological work using statewide data to define the niches of macrophytes. A poster and a presentation detail much of the work that went into developing aquatic plant revegetation methods. The statewide database is available as a database and through a beta-version dashboard. Multiple publications will detail the work as it pertains to contributions to the state of knowledge on the ecology and management of aquatic plants. All of these materials are available upon request.

Peer-reviewed publications:

Verhoeven, M. R., D. J. Larkin, and R. M. Newman. (2020). Constraining invader dominance: Effects of repeated herbicidal management and environmental factors on curlyleaf pondweed dynamics in 50 Minnesota lakes. *Freshwater Biology*, 65(5), 849–862. <https://doi.org/10.1111/fwb.13468>

Verhoeven, M. R., W. J. Glisson, and D. J. Larkin. (2020). Niche models differentiate potential impacts of two aquatic invasive plant species on native macrophytes. *Diversity*, 12, 162. <https://doi.org/10.3390/d12040162>

Published datasets and R code:

Verhoeven, M. R., D. J. Larkin, and R. M. Newman. (2020). Complete data and analysis for: Constraining invader dominance: Effects of repeated herbicidal management and environmental factors on curlyleaf pondweed dynamics in 50 Minnesota lakes. Data Repository for the University of Minnesota. <https://doi.org/10.13020/aw92-e606>

Verhoeven, M. R., W. J. Glisson, and D. J. Larkin. (2021). Complete data and analysis for: Niche models differentiate potential impacts of two aquatic invasive plant species on native macrophytes. Data Repository for the University of Minnesota. <https://doi.org/10.13020/cwqe-ge69>

Subproject 8.2 Completed: 06/30/2021

[FINAL ABSTRACT](#)

[FINAL Graphic](#)

Sub-Project 12.2: Historical Analyses of Spiny Water Flea Invasion Patterns - \$53,795 TF

Donn Branstrator

U of M - Duluth - Swenson College of Science and Engineering; Department of Biology
1035 Kirby Drive
Duluth, Minnesota 55812

Phone: (218) 726-8134

Email: dbranstr@d.umn.edu

Web: <http://www.maisrc.umn.edu>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

After spiny water flea was first recorded in North America in the 1980s, sediment core analysis was heralded as a method to document the timing of lake invasions with implications for understanding and

managing spread and threats. Our study casts concern on the method, revealing limitations to pinpoint early detection.

OVERALL PROJECT OUTCOME AND RESULTS

Spiny water fleas threaten Minnesota's lakes, including walleye health, but we do not understand how many years it takes for the threats to manifest once they invade. This project was a continuation of Subproject 12 where we sought to use evidence in lake sediments to determine the timeline of first presence and growth of spiny water fleas in Lake Kabetogama and Lake Mille Lacs. The results of Subproject 12 demonstrated that spiny water fleas have been present in both lakes continuously since the early 1900s. This timeline conflicts with data on first sightings that do not place spiny water fleas in either lake until the early 2000s. This gap of about 100 years suggests that our sediment analysis methods are biased. With Subproject 12.2, our main objective was to conduct two additional lines of inquiry to determine the suitability of our methods by 1) measuring natural rates of mixing in surface sediments of Lake Kabetogama and Lake Mille Lacs, and 2) searching sediment cores that were collected before first sightings of spiny water fleas in Lake Kabetogama. The results demonstrate that 1) natural rates of sediment mixing are not sufficient to explain the early presence of spiny water flea body remains in Lake Kabetogama or Lake Mille Lacs sediments, and 2) there is no evidence in historical core material that places spiny water fleas in Lake Kabetogama before their reported year of first detection in the water. We combined our results with results from scientists at Queen's University (Canada) who have recently used similar methods to ask similar questions, into a forthcoming publication in the Journal of Paleolimnology. In that publication we review our findings and caution the use of our methods to pinpoint early detection of spiny water fleas in lakes until further study of the methods is conducted.

PROJECT RESULTS USE AND DISSEMINATION

We widely disseminated the results of Phase I of Subproject 12 (M.L. 2013) but we have not thus far disseminated any of the results in Phase II for two reasons. First, the COVID pandemic limited our opportunities. Second, the controversial nature of our results led to a hesitancy among us to share them until we had fully analyzed all evidence and lines of inquiry, both in our data set and the data set contributed by our collaborating scientists at Queen's University. Peer-reviewed publications are in process and presentations on results will be given as a part of the MAISRC Showcase.

Subproject 12.2 Completed: 06/30/2021

[**FINAL ABSTRACT**](#)

[**FINAL Graphic**](#)

Sub-Project 15: Determining Highest Risk Vectors of Spiny Water Flea Spread - ML2013 \$92,932/ ML2017 \$26,581 TF

Valerie Brady

U of M - NRRI

5013 Miller Trunk Hwy

Duluth, MN 55811

Phone: (218) 788-2753

Email: vbrady@d.umn.edu

Web: <https://www.nrri.umn.edu/>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Spiny water fleas are an invasive zooplankton that threaten Minnesota lakes. In tests of recreational fishing gear, fishing lines entangled the most spiny water fleas and should be the focus of cleaning efforts. In addition, all water should be removed from bait buckets and livewells to prevent spreading this invader.

OVERALL PROJECT OUTCOME AND RESULTS

Spiny water fleas are a predatory non-native zooplankton that threatens the ecology and recreational value of Minnesota lakes. Estimates are that >40% of northern Minnesota lakes are vulnerable to invasion. These invaders are primarily spread by human recreational activity, but we do not know exactly how this is happening. Our project goals were to 1) determine which types of recreational fishing gear would entangle (and thus spread) spiny water fleas, and 2) widely disseminate our results and gear-cleaning tips. We conducted 7 sampling events on Lake Mille Lacs, collecting 718 samples including zooplankton tows and spiny water flea counts on fishing gear and anchor ropes. We found that fishing lines accumulated the most spiny water fleas and thus should be the focus of angler cleaning efforts. In addition, it is critically important that all water be removed from bait buckets and livewells to prevent spread. To help recreational anglers clean their fishing gear, we printed and/or coordinated the distribution of over 20,000 cellulose dish cloths that were printed with cleaning instructions. 8,000 cloths were printed and distributed to 18 community partners (lake associations, AIS prevention staff, agency partners) as a part of this project and an additional 12,000 were printed and distributed through coordination with partner organizations and additional funders. Cloths were distributed to recreational anglers, focusing on those who move between spiny water flea infested lakes and uninfested lakes. In addition, we launched the stopspiny.org website to disseminate research findings and share prevention resources and created three PSA videos that demonstrated how to use the cloth to clean fishing lines. The videos played on YouTube, Facebook, Twitter, and TV in the Lake Superior, Lake of the Woods, Mille Lacs, Twin Cities markets. Facebook advertising was used to extend the stop spiny PSAs, reaching over 208,000 individual people and resulting in 442,000 impressions. PSA ads were also placed in local, online and print publications with an estimated reach of 103,000 readers. The research team also wrote one scientific manuscript and presented their results 19 times to about 1,500 people.

PROJECT RESULTS USE AND DISSEMINATION

All outreach was done with strong collaboration and support from MAISRC staff.

Stop Spiny Cloths: To help recreational anglers clean their fishing gear, we printed a simple image of a spiny water flea and what they look like when ensnared on fishing lines, along with cleaning instructions and funder logos, on 8,000 cellulose dish cloths. These cloths look like a steam-rolled sponge. Use of these cloths (or any cloth) to wipe fishing line prior to leaving an infested lake will help prevent the spread of spiny water flea from lake to lake. In testing, we found that these cloths are easy to use to clean fishing lines (and a more useful product than our original idea of a sticker). These cloths were distributed this spring to about 18 partners (lake associations, AIS spread prevention staff, agency partners, etc.). In addition, we facilitated the Minnesota Lakes and Rivers Advocates to help about 25 other groups (mostly lake associations and conservation districts) order over 9,000 more spiny wipe cloths for distribution. In total, we have or are in the process of facilitating distribution of over 20,000 cloths (3,000 of these were part of our companion project funded by St. Louis County) to wipe spiny water fleas from angler fishing lines.

To support distribution of the cloths and assist those distributing them, MAISRC staff worked with us to create an outreach campaign that we called the “Stop Spiny” campaign.

Website: The Stop Spiny campaign was chiefly hosted on the MAISRC website at stopspiny.org, which redirects to www.maisrc.umn.edu/stopspiny. The web page was created in Fall 2020 by MAISRC staff. Since its creation, the Stop Spiny campaign page has been viewed over 4,721 times. The average time a visitor spends on the page is nearly two minutes and thirty seconds. The Stop Spiny campaign webpage, as of Jan. 2022, is the seventh most popular page on the entire MAISRC website over the last year and a half.

The Stop Spiny campaign page gives an overview of spiny water flea invasion history and impacts and explains how water recreationists can help prevent the spread of spiny water fleas. A video about the project results is linked on this page. Additional information includes an interactive map showing current spiny water flea invaded lakes in Minnesota and links to additional spiny water flea research and species pages.

MAISRC staff also created a Stop Spiny campaign resources web page. This page hosts a variety of Stop Spiny factsheets, images, videos, fliers, and more for the free use and distribution of educators, resource managers, lakeshore associations, and/or any others hoping to help prevent the spread of spiny water fleas. The average time spent on this page by users was six minutes, which is very long by web page viewing standards and indicates that visitors are taking the time to read and download the information on this webpage.

Videos: To help share the Stop Spiny message in a visually interesting format, we worked with MAISRC and UMD to produce multiple high-quality videos. Three different video lengths were created—15 seconds, 30 seconds, and a full length (~2:30 min). The videos were shared on multiple social channels, including MAISRC’s Facebook and Twitter accounts. The videos were also used in different combinations for Facebook advertisements and a television advertisement. On YouTube alone, the videos have accumulated over 850 views.

Advertisements: The Stop Spiny campaign included a combination of digital and print advertising. Print advertising included placements in the Lake Country Journal (based near the spiny water flea-infested Lake Mille Lacs), the Ely Summer Times (distributed along the Minnesota Iron Range, in the heart of spiny water flea-infested lakes), and Northern Wilds Magazine (another Northern Minnesota distributor). The estimated reach, per outlet, as provided by their respective company websites are as follows; Lake Country Journal—40,000; Ely Summer Times—28,000; Northern Wilds Magazine—18,000.

Northern Wilds Magazine, which also has an online edition and active online community, was contracted for Stop Spiny banner ads. The ads were placed on the Northern Wilds Magazine website at the top column of their side bar. The company estimates that their web pages see roughly 17,000 page views per month. Stop Spiny advertisements were placed on the top side bar for three consecutive months, from June to August 2021.

In addition, extensive Facebook advertising was used to enhance the Stop Spiny campaign. Multiple rounds of advertisements were planned to coincide with time of year and spiny water flea population increases. Since the launch of the campaign in spring 2021, Stop Spiny advertisements on Facebook reached over 208,000 individual people and resulted in 442,000 impressions. Included in all the advertisements were hyperlinks to the Stop Spiny campaign website for additional information and

resources. In total, over 1,500 people clicked from the advertisement to the Stop Spiny campaign page.

On average the amount of time an individual person will watch a video on Facebook is six seconds. Engaging users to watch more than six seconds is a huge engagement success. By the end of the Stop Spiny campaign, over 29,000 users watched the Stop Spiny video they were served to completion (15-30 seconds) and over 60,000 users watched over 50% of the video they were served (7-15 seconds).

Finally, we have had numerous radio and print articles about our project and how to stop the spread of this invasive species, including an outreach article by MAISRC personnel in a Minnesota angling magazine (Activity 2, Outcome 4). Additional outreach has included working with Lake Minnetonka local government staff to use their lighted electronic boards to promote Stop Spiny messages, creating Stop Spiny factsheets and handouts, and sidebar online advertisements on the Northern Wilds website. Our Stop Spiny website hosts all these videos, factsheets, an interactive map, the radio scripts, and presentations for watercraft inspectors. The PIs published one scientific manuscript, and gave 19 presentations to over 1,500 people in total.

Peer-Reviewed Publications

- Donn K. Branstrator, Joshua D. Dumke, Valerie J. Brady & Holly A. Wellard Kelly (2021): [Lines snag spines! A field test of recreational angling gear ensnarement of Bythotrephes](#), Lake and Reservoir Management, DOI: 10.1080/10402381.2021.1941447

Presentation Recordings/Videos

- 2021 MAISRC Research & Management Showcase Presentation
<https://z.umn.edu/2021ShowcaseSpiny>
- 2020 MAISRC Research & Management Showcase Presentation
<https://z.umn.edu/2020ShowcaseSpiny>
- AIS Detectors Webinar: Lines Snag Spines! Preventing the Spread of Spiny Water Flea
<https://z.umn.edu/DetectorsWebinarLinesSnagSpines>
- MAISRC Video: Preventing the Spread of Spiny Water Flea
<https://z.umn.edu/MAISRCPreventingSpinySpread>

Select Media Coverage

- Minnesota Opinion: Avoid catches you don't want this fishing season – West Central Tribune
<https://www.wctrib.com/opinion/editorials/minnesota-opinion-avoid-catches-you-dont-want-this-fishing-season>
- New ways to stop spiny water flea spread – Mesabi Tribune
https://www.mesabatribune.com/opinion/columnists/new-ways-to-stop-spiny-water-flea-spread/article_daea21e8-bca9-11eb-ae17-0b26c8aa0317.html

Subproject 15 Completed: 12/31/2021

[FINAL ABSTRACT](#)

[Manuscript](#)

[Map](#)

[Visual](#)

Sub-Project 16.2: AIS Impacts on Walleye Populations and Mercury Concentrations - \$199,862
TF

Gretchen Hansen

U of M - Department of Fisheries, Wildlife and Conservation Biology
135 Skok Hall
2003 Upper Buford Circle
Saint Paul, Minnesota 55108

Phone: (612) 624-4228

Email: ghansen@umn.edu

Web: <http://gretchenhansen.squarespace.com/>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Invasive zebra mussels impact lakes supporting walleye in Minnesota. Our research demonstrates that zebra mussels are associated with lower recruitment (reproduction and survival) of walleye in their first year. Furthermore, walleye and yellow perch alter their feeding habits in lakes with zebra mussels, which is associated with increased mercury concentrations.

OVERALL PROJECT OUTCOME AND RESULTS

Invasive zebra mussels profoundly affect lake ecosystems, but their impacts on walleye are not well understood. We used a multi-pronged approach to understanding zebra mussel impacts on walleye in Minnesota lakes. First, we evaluated how walleye recruitment (reproduction and survival) to their first fall was affected. We used statistical models applied to data collected by the Minnesota Department of Natural Resources to quantify changes in walleye recruitment. Walleye recruitment declined by ~41% following zebra mussel invasion. Additionally, lakes with zebra mussels supported the highest walleye recruitment prior to invasion, suggesting that zebra mussels invade high quality walleye lakes. Next, we evaluated how zebra mussels influence food webs supporting walleye and yellow perch, and how food web changes influence mercury concentrations in fish tissue. Using stable isotope analysis, we found that walleye and yellow perch in zebra mussel invaded lakes use 36-50% more nearshore food resources compared to those in uninvaded lakes. Mercury concentrations in fish tissue were also influenced by zebra mussels; mercury in fish tissue was 66% higher for adult walleye and 91% higher for adult yellow perch in lakes containing zebra mussels compared to those in uninvaded lakes. On average, mercury concentrations in 16-inch walleye from lakes containing zebra mussels were 0.28 ppm, above the 0.2 ppm threshold triggering human consumption advisories by the Minnesota Department of Health. Zebra mussel-induced changes have important implications for walleye in Minnesota lakes. Lower walleye recruitment in invaded lakes may influence abundance at later life stages, which could influence harvest and stocking plans. Walleye were able to persist on nearshore food resources following zebra mussel invasions, but mercury concentrations were higher in these fish with important implications for human consumption. Given the significance of the impacts of zebra mussels documented in our study, preventing zebra mussel invasions into additional walleye lakes is critical.

PROJECT RESULTS USE AND DISSEMINATION

We have provided regular updates of our progress to scientists, managers, and the public via oral presentations and posters. PI Hansen and graduate student Kundel are members of the MN DNR Walleye-Zebra Mussel task force, and our research on the effects of zebra mussels on walleye recruitment has been critical for informing their approach to monitoring and managing for zebra mussel invasions. We have presented our results directly to MN DNR fisheries staff, at the MAISRC showcase, and at a national conference, as well as through several public virtual sessions. Progress on each objective was delayed due to the Covid-19 pandemic, and we are in the process of preparing

manuscripts describing our results for peer-reviewed publications.

Presentation Recordings

- 2020 MAISRC Research & Management Showcase Presentation
<https://z.umn.edu/2020ShowcaseZMWalleye>

Factsheets/Informational Documents

- Zebra mussel impacts on walleye populations and mercury concentrations: A collaborative project investigating the connections between zebra mussels, changes to lake food webs, and walleye success
<https://z.umn.edu/HansenWalleyeFactsheet>

Subproject 16.2 Completed: 12/31/2021

FINAL ABSTRACT

[Factsheet](#)

[Map](#)

[Visual](#)

Sub-Project 18.2: Genetics to Improve Hybrid and Eurasian Watermilfoil Management - \$236,423 TF

Raymond Newman

U of M - College of Food, Agriculture, and Natural Resource Sciences; Department of Fisheries, Wildlife, and Conservation Biology
135 Skok Hall
2008 Upper Buford Circle
Saint Paul, Minnesota 55108

Phone: (612) 625-5704

Email: RNewman@umn.edu

Web: <http://www.maisrc.umn.edu>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Invasive Eurasian and native northern watermilfoil can hybridize and we identified hybrid watermilfoil in 39 lakes across the state. Hybrid watermilfoil is genetically more diverse than Eurasian watermilfoil and has potential to be more invasive and resistant to herbicides; several potentially problematic genotypes have been identified for further study.

OVERALL PROJECT OUTCOME AND RESULTS

Invasive Eurasian and native northern watermilfoil can hybridize and some genotypes of hybrid watermilfoil have been shown to be more invasive or resistant to herbicidal control. Our aim was to determine the occurrence and distribution of hybrid watermilfoil in Minnesota, assess the response of different genotypes to herbicidal management, identify potentially problematic genotypes and assess the response of some of these genotypes to herbicide in controlled laboratory conditions. We assessed watermilfoil genetic composition in 81 waterbodies in Minnesota; 55 lakes had pure Eurasian, mostly one widespread genotype that was found in 52 lakes. Eight other Eurasian genotypes were found. We identified hybrid watermilfoil in 39 lakes across the state, mostly, but not entirely, in the Twin Cities

Metro. Hybrid watermilfoil is genetically more diverse than Eurasian watermilfoil and 82 genotypes were found. Most lakes have one unique genotype of hybrid but multiple genotypes were found in several lakes and 26 have been identified in Lake Minnetonka. One hybrid genotype has been found in 10 lakes. No clearly problematic genotypes have been identified in Minnesota but we did find changes in genotype frequency with management in an assessment of 5 managed waterbodies and 3 reference waterbodies over 3 years. Several hybrid genotypes have expanded while Eurasian decreased and two hybrids from Lake Minnetonka have persistently rebounded after control. We also identified one genotype of northern watermilfoil that may be less affected by herbicide treatment. We conducted laboratory performance and herbicide challenge tests with the widespread Eurasian genotype and 4 hybrid genotypes. Additional experiments are needed but preliminary results suggest that two hybrid genotypes may be more tolerant of 2,4-D than the widespread Eurasian and two other hybrid genotypes. Continued identification of hybrid genotypes and response to management will improve milfoil management by allowing manager to appropriate controls for their particular populations.

PROJECT RESULTS USE AND DISSEMINATION

We presented our insights and results and interacted with stakeholders at the MAISRC Showcase in 2019 and 2020 and held two in person and two virtual meetings with stakeholders to discuss observations and interest in genetic testing. We provided information to update the MAISRC website and hybrid watermilfoil fact sheet and developed a genotyping fact sheet for distribution by MAISRC and the DNR. We gave 8 presentations at regional and national scientific meetings and published three papers: Eltawely et al. 2020, Pashnick and Thum 2020, and Thum et al. 2020. In addition, two Masters projects, Eltawely 2019 and Gannon 2021 were completed.

We are in regular contact with the DNR, consultants and applicators about our results, which have been used to inform management actions.

Peer-reviewed publications:

Eltawely, J. A., R. M. Newman, and R. A. Thum. 2020. Factors Influencing the Distribution of Invasive Hybrid (*Myriophyllum Spicatum* x *M. Sibiricum*) Watermilfoil and Parental Taxa in Minnesota. *Diversity* 12(3):120. <https://doi.org/10.3390/d12030120>

Pashnick, J., and R. A. Thum. 2020. Comparison of molecular markers to distinguish genotypes of Eurasian watermilfoil, northern watermilfoil, and their hybrids. *Journal of Aquatic Plant Management* 58(1):61-71. <http://www.apms.org/wp/wp-content/uploads/japm-58-01-61-full.pdf>

Thum, R.A., Chorak, G.M., Newman, R.M., Eltawely, J.A., Latimore, J., Elgin, E., and Parks, S. 2020. Genetic diversity and differentiation in populations of invasive Eurasian (*Myriophyllum spicatum*) and hybrid (*Myriophyllum spicatum* x *Myriophyllum sibiricum*) watermilfoil. *Invasive Plant Science and Management* 13(2): 59-67. <https://doi.org/10.1017/inp.2020.12>

Masters' theses:

Eltawely, J. A. 2019. Distribution of Eurasian and hybrid watermilfoil in Minnesota. Water Resources Science Masters Plan B Paper, University of Minnesota, St. Paul, MN. <https://hdl.handle.net/11299/211341>

Gannon, K. A. 2021. Integrating DNA fingerprinting of invasive watermilfoil strains into aquatic

vegetation monitoring and assessment. Plant Sciences Masters of Science Thesis, Montana State University, Bozeman, MT.

Subproject 18.2 Completed: 06/30/2021

FINAL ABSTRACT

Graphic

Sub-Project 20: A Novel Technology for eDNA Collection and Concentration - ML2013 \$94,599 / ML2017 \$96,264 TF

Abdennour Abbas

U of M - College of Food Agriculture and Natural Resource Sciences/College of Science and Engineering;
Department of Bioproducts and Biosystems Engineering
2004 Folwell Ave
Saint Paul, Minnesota 55108

Phone: (612) 624-4292

Email: aabbas@umn.edu

Web: <http://abbaslab.com/>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The development of a novel filter capable of efficiently extracting Environmental DNA (eDNA) from water, and enabling rapid filtration of large volumes of samples at a reasonable cost, is expected to help convert the eDNA technology from a research curiosity into a routine tool for ecosystem protection and monitoring, and evidence-based management of invasive species.

OVERALL PROJECT OUTCOME AND RESULTS

Background/Context: Environmental DNA (eDNA) is the genetic material (genomic DNA) obtained directly from environmental samples such water. Collection and analysis of eDNA has the potential to provide actionable information on the presence and distribution of aquatic invasive species.

Challenge: The major challenge is that the results obtained from eDNA techniques currently do not always correlate with traditional netting data due to the size and quality of sampling. Unlocking the potential of eDNA requires disruption in sampling methods and tools.

Objectives: This project aimed to develop a novel aquatic eDNA collection and concentration technology for more efficient, reliable and cost-effective screening for not only invasive aquatic organisms and pathogens but also native and endangered species. The technology would significantly enable and empower aquatic ecosystem survey and management programs in Minnesota. Specifically, we aimed to 1) develop an eDNA nanofilter that specifically and rapidly captures nucleic acids (DNA, RNA) from water and enable the processing of large volumes of samples within a short period of time, 2) Verify increased eDNA sampling efficiency of the new nanofilter in field settings (proof-of-concept)

Results and Accomplishments: We have successfully developed a new eDNA filter that captures 50-100% of eDNA within 10 seconds. Commercial kits are incapable of capturing free eDNA. The loading capacity of the new filter is up to 5 mg/g, meaning that 1 g of filter can capture up to 5 mg of DNA. This is a

record-breaking capacity that enables the filtration of large volumes of water with one filter, knowing that surface water contains usually 10 ng/L of eDNA.

Following the COVID-19 pandemic, we have adapted the nonfilter to develop an RNA extraction kit for SARS-CoV-2. The new kit was evaluated by the University of Minnesota COVID-19 Diagnostic Laboratory on 80 patient samples, and it showed that our kit has a 100% specificity and 94% sensitivity, which is respectively 12.8% and 5.4% higher than the widely used Qiagen kits

Significance and Impact to Minnesota: Ecosystem conservation managers have been relatively reluctant to use eDNA as a routine tool for ecosystems monitoring. The results obtained here can have a significant impact on the widespread adoption of eDNA technology, which will help the State enhance the accuracy and quality of the data and improve decision making for the management of invasive species. This work has also led to starting a new company, which is expected to accelerate the transfer of the technology to the market, and enhance the industry capacity to respond to the State's need for AIS management.

PROJECT RESULTS USE AND DISSEMINATION

The results obtained in this project have been presented at three conferences and meetings and will be published through four scientific publications that are currently in process. The work has also been highlighted by the University of Minnesota news service and more media coverage is expected after manuscript publication. The work conducted in this project has also led to the foundation of a new technology company that is expected to take the eDNA filter technology to the market during 2021.

Presentations:

- Zarouri, A., A. Abbas. September 2019. Enhancing fish surveys: A novel technology for environmental DNA capture. MAISRC Research and Management Showcase. Saint Paul, MN.
- Quichen, D., A. Zarouri, A. Abbas. September 2019. A Novel Technology for Environmental DNA Collection and Concentration. American Fisheries Society and The Wildlife Society Conference. Reno, NV.
- Zarouri, A., Q. Dong, A. Abbas. October 2019. A Novel Technology for Environmental DNA Collection and Concentration. 2019 Department of Bioproducts and Biosystems Engineering Research Poster Session. Saint Paul, MN.

Media:

- Detection connections. CFANS News. 9 July 2020. <https://cfans.umn.edu/news/abbas-lab-covid-19-update>

Attachments:

- Photo of the eDNA nanofilter that was developed as a part of this project.

Subproject 20 Completed: 06/30/2020

FINAL ABSTRACT

Photo

Sub-Project 21.2: Field validation of multibeam sonar zebra mussel detection (Year 1) - \$14,247 TF**

Jessica Kozarek
U of M - St. Anthony Falls Laboratory
2 Southeast 3rd Ave
Minneapolis, MN 55414

Phone: (612) 624-4679
Email: jkozarek@umn.edu
Web: <http://www.safl.umn.edu/>

Subproject 21.2 Completed: 06/30/2020

Sub-Project 22: Copper-Based Control – Zebra Mussel Settlement and Non-Target Impacts - UMN ML2013 \$54,438 / ML2017 \$30,300 and USGS ML2013 \$12,428 / ML2017 \$121,790 TF

James Luoma
U.S. Geological Survey
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, WI 54603

Phone: (608) 781-6391
Email: jluoma@usgs.gov
Web: <https://www.usgs.gov/centers/umesc>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

A 10-day low-dose copper treatment of an enclosed bay in Lake Minnetonka (Minnesota) was highly effective at reducing the abundance of zebra mussel veligers and preventing zebra mussel settlement success. The treatment did cause some nontarget effects including, but not limited to, reductions in native zooplankton and benthic invertebrate abundance.

OVERALL PROJECT OUTCOME AND RESULTS

This study evaluated a low-dose copper treatment for zebra mussel (*Dreissena polymorpha* Pallas 1771) suppression by maintaining a mean copper concentration of 60 µg/L in waters above the thermocline for 10 consecutive days in St. Albans Bay (66.3-ha) of Lake Minnetonka, Minnesota. Robinson Bay (37.2-ha, Lake Minnetonka) was a control site. The volume of EarthTec QZ applied during five every-other-day applications was determined using copper concentrations measured in the field.

Treatment effects on zebra mussels lifestages were evaluated by analyzing changes in veliger abundance, juvenile settlement, benthic abundance, and adult survival. Treatment effects on nontargets were evaluated by analyzing changes in water chemistry properties, chlorophyll a, native fish (4 species) survival, native mussel (1 species) survival, native zooplankton abundance and richness, and native benthic invertebrate abundance and richness.

The copper concentration was maintained above 60 µg/L during the treatment period and returned to background levels between 60 and 90 days after treatment. The treatment adversely affected all life stages of zebra mussels throughout the study period. In the treated bay, veliger density was near zero

14 days after treatment, a strong reduction in juvenile settlement was observed, zebra mussel benthic density was sparse after treatment, and the odds of adult survival was substantially reduced. Detectable nontarget treatment-related effects included reductions in zooplankton abundance, chlorophyll a, and fathead minnow survival. Elevated copper residues in fish and mussel tissues were also observed. Decreases in benthic invertebrate abundance, secchi disk readings, and dissolved oxygen concentration were also observed after the treatment.

The data from this study can be used to assist in assessing if low-dose copper treatments are an appropriate zebra mussel management strategy for a waterbody. Any use of trade, firm, or product names in this report is for descriptive purposes only and does not imply endorsement by the U.S. Government.

PROJECT RESULTS USE AND DISSEMINATION

Publications:

- Luoma J.A., Barbour M.T., and Severson T.J. (2020). Data Release: Copper-based control: zebra mussel settlement and non-target impacts. U.S. Geological Survey. Data Release. <https://doi.org/10.5066/P9B9NUQM>.

Presentations:

- Barbour M.T., Luoma J.A., Severson T.J., Wise J.K., and Dahlberg A. (2019). Low-dose copper-based control: zebra mussel settlement and non-target impacts. MAISRC Research and Management Showcase, University of Minnesota Continuing Education and Conference Center, Saint Paul, Minnesota.
- Dahlberg A., Phelps N., Waller D., Luoma J., and Barbour M. (2020). Low-dose copper-based control: zebra mussel settlement and non-target impacts (webinar). AIS Detectors Program, August 26, 2020, <https://www.maisrc.umn.edu/ais-detectors/webinars>.
- Dahlberg A., Phelps N., Waller D., Luoma J., and Barbour M. (2020). Low-dose copper-based control: zebra mussel settlement and non-target impacts (webinar). Invasive Mussel Collaborative, August 27, 2020.

Media:

- UMN Driven to Discover video: Guardians of the Lake (2019). <https://twin-cities.umn.edu/discover/guardians-lake>
- Zebra mussels research project planned for Lake Minnetonka this summer. Melissa Turtinen, Southwest News Media. 23 April 2019. https://www.swnewsmedia.com/lakeshore_weekly/news/local/zebra-mussels-research-project-planned-for-lake-minnetonka-this-summer/article_750497a4-a492-5020-868b-6d752887fa0b.html
- St. Alban's, Robinson's bays will be site of zebra mussel research project. Sabina Badola, Sun Sailor. 16 April 2029. https://www.hometownsource.com/sun_sailor/free/st-alban-s-robinson-s-bays-will-be-site-of-zebra-musselresearch-project/article_fe8a1ea4-607c-11e9-aafc-63c0878d1728.html

Attachments:

- Zebra Mussel Control with Low-Dose Copper (handout)
- Photos from field work
- Effects Map

Subproject 22 Completed: 06/30/2020

FINAL ABSTRACT

Graphic

Sub-Project 23: Public Values of Aquatic Invasive Species Management - ML2013 \$131,845 / ML2017 \$110,245 TF

Amit Pradhananga

U of M - Center for Changing Landscapes, Department of Forest Resources
1530 Cleveland Avenue N
Saint Paul, Minnesota 55108

Phone: (612) 624-6726

Email: prad0047@umn.edu

Web: <https://www.maisrc.umn.edu/>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Minnesotans hold great value for Aquatic Invasive Species Management, both to lakes they visit and to waterbodies in the state as a whole and are willing to pay significantly for it. Minnesotans are concerned about AIS and are generally supportive of AIS management actions and policies.

OVERALL PROJECT OUTCOME AND RESULTS

Minnesota hosts a number of aquatic invasive species (AIS), which have far-reaching impacts on Minnesota's waterbodies, and subsequently its population. However, little was known about how Minnesotans value AIS, as well as costs associated with AIS management. To address this, we collected data on aquatic invasive species management and costs, public perceptions, values, knowledge, and willingness to pay for aquatic invasive species management via several surveys of different types spanning 2019 to 2021. Surveys of watershed districts and soil and water conservation districts provided data from 92 lakes across 12 counties, showing that carp management is a priority in Minnesota. We also were able to collect data on costs and types of management employed. On the individual side, an onsite survey of approximately 1000 people visiting lakes in the summer showed us visitors are willing to pay for AIS management at the lakes they are visiting and hold significant value for Minnesota's water resources, though individual AIS species present are not impactful for these social values. We also collected data through a mail survey of about 300 people, which confirmed Minnesotans' intrinsic value for water resources. Many residents are willing to pay for AIS management statewide, meaning they do not have to directly visit or use a lake to find value in it. This project is important as it provides data to support the viewpoint that Minnesotans do in fact have great value for AIS management and are willing to pay to expand management across the state.

PROJECT RESULTS USE AND DISSEMINATION

This project's findings have been disseminated through nine oral and poster presentations to researchers, resource professionals (e.g., Minnesota Department of Natural Resources), lake associations, policy makers, and the general public (e.g., lakeshore residents) at professional conferences (e.g., Minnesota Water Resources Conference), Minnesota Aquatic Invasive Species Research Center (MAISRC) Research & Management Showcase, and invited seminars (e.g., Minnesota DNR, AIS Detectors' Aquatic Invasive Species Webinar Series). We have published one open access article in a peer-reviewed journal (PLOS ONE). We have developed a fact sheet highlighting findings from the statewide survey conducted with Minnesota residents. In coordination with MAISRC, we developed a handout of findings from the survey conducted with recreationists at four Minnesota lakes. We plan to

continue to disseminate study findings through presentations and peer-reviewed journal articles. We have submitted two abstracts to the International Association for Society and Natural Resources Conference and Universities Council on Water Resources Annual Conference to be held in June, 2022 and are currently preparing three additional manuscripts for submission to peer-reviewed journals.

Peer-Reviewed Publications

- Levers, L., & Pradhananga, A. (2021). [Recreationist Willingness to Pay for Aquatic Invasive Species Management](#). PLOS ONE. <https://doi.org/10.1371/journal.pone.0246860>

Presentation Recordings/Videos

- 2021 MAISRC Research & Management Showcase Common Carp Panel
<https://z.umn.edu/2021ShowcaseCommonCarpPanel>
- AIS Detectors Webinar: Recreationists' Willingness to Pay for Aquatic Invasive Species Management
<https://z.umn.edu/DetectorsWebinarWillingnessToPay>
- MAISRC Video: Valuing Aquatic Invasive Species Management
<https://z.umn.edu/MAISRCValuingAISManagement>

Subproject 23 Completed: 12/31/2021

FINAL ABSTRACT

Factsheet

PLOS ONE Manuscript

Statewide Resident Survey Factsheet

Sub-Project 24: Genetic Method for Control of Invasive Fish Species - ML2013 \$110,112 / ML2017 \$140,004 TF

Michael Smanski

U of M - College of Biological Sciences; Department of Biochemistry, Molecular Biology, and Biophysics
1479 Gortner Ave, Room 140
Saint Paul, Minnesota 55108

Phone: (612) 624-9752

Email: smanski@umn.edu

Web: <http://www.bti.umn.edu/labs/smanski/>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

MAISRC has laid the groundwork to develop innovative genetic biocontrol approaches to be used in the fight against invasive carp.

OVERALL PROJECT OUTCOME AND RESULTS

Invasive fish species present an estimated \$5.4 billion burden on our domestic economy, and much of that extends to the lakes and rivers of Minnesota. For example, the foraging habits of the invasive common carp, *Cyprinus carpio*, diminishes water quality, reduces vegetative cover and waterfowl numbers, and reduce the ability of lakes to absorb nutrients that enter water systems through agricultural runoff. Current control methods have not been able to stem the tide of invasive carp and other fish species, so improved strategies are needed. The overall goal of this project is to demonstrate

a novel approach for controlling aquatic invasive species using invasive carp species as proof-of-concept. Success of this project would lead to its implementation in other aquatic invasive species (AIS), including Asian carp and zebra mussels.

Several major obstacles had to be overcome on this project to lay the foundation for genetic biocontrol of invasive carp. These included (i) Developing husbandry for year-round carp spawning in the MAISRC Containment Lab, (ii) Demonstrating transgenesis of *C. carpio*, (iii) Testing genetic reagents in a model laboratory fish that will be needed to engineer carp, and (iv) Performing a survey to gauge public perceptions of carp genetic biocontrol. We accomplished these project goals within a one-year no-cost extension to the project funding.

The impact of our results is that we are now primed to engineer carp genetic biocontrol agents in the lab during the next phase of this award, which will begin January 2022. There is still substantial work to be done before this will directly benefit Minnesotans. Specifically, we need to demonstrate a proof-of-concept carp biocontrol system in the laboratory; perform safety/efficacy testing; obtain permits for field trials; and eventually work with key stakeholders to use this new tool in the fight against invasive carp. The overall process is expected to take 10-15 years.

PROJECT RESULTS USE AND DISSEMINATION

Data generated from this subproject is expected to be included in three peer reviewed publications. These include results from the public survey (expected submission Summer 2021), results from the carp husbandry/transgenesis procedure (expected submission Winter 2021), and agent-based modeling results (waiting for accompanying wet-lab experimental confirmation).

In addition to these primary research reports, one book chapter that describes the techniques developed under this subproject has already been published:

Bajer P, Ghosal R, Maselko M, Smanski MJ, Lechelt JD, Hansen G, Kornis M (2019) Biological control of invasive fish and aquatic invertebrates: a brief review with case studies. Management of Biological Invasions. 10: 200-226.

Subproject 24 Completed: 06/30/2021

FINAL ABSTRACT

[**Graphic**](#)

Sub-Project 25: What's in Your Bucket? Quantifying AIS Introduction Risk - ML2013 \$111,642 / ML2017 \$84,094 TF

Nicholas Phelps

U of M - MAISRC - College of Food, Agriculture, and Natural Resource Sciences; Department of Fisheries, Wildlife, and Conservation Biology
135 Skok Hall
2008 Upper Buford Circle
Saint Paul, Minnesota 55108

Phone: (612) 624-7450

Email: phelp083@umn.edu

Web: <http://www.maisrc.umn.edu>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Live baitfish are popular among Minnesota anglers, but their illegal release is a known risk factor for spreading harmful diseases to wild fish populations. Our research identified high-risk pathogens in Minnesota, estimated the number of times anglers release an infected baitfish each year, and identified opportunities for strategic management intervention.

OVERALL PROJECT OUTCOME AND RESULTS

In Minnesota, the illegal release of live baitfish by anglers has been identified as a weak point in our efforts to prevent the spread of aquatic invasive species and pathogenic microbes, however the magnitude of the risk and evidence-based opportunities for intervention had not been well studied. The purpose of this project was to assess the risk of fish pathogen introduction via illegal release of live baitfish by Minnesota anglers to inform strategic management strategies to reduce that risk. First, we created a semi-quantitative framework to evaluate the threat of baitfish pathogens in Minnesota and used it to rank pathogens so managers can prioritize resources. We then conducted a statewide survey of anglers to quantify risky behaviors and used those data to parameterize a risk assessment model for high-risk pathogens to estimate the number of risky trips that occur in a given year under a variety of scenarios. Our results were variable, indicating a wide range of outcomes depending on current management strategies and pathogen prevalence. For example, with strong surveillance and controls in place for the viral hemorrhagic septicemia virus, the number of risky trips is limited in most scenarios. However, for high-risk pathogens (Ovipleistophora ovariae, Asian fish tapeworm) for which no controls are in place, the large number of anglers, frequency of illegal release, and the popularity of susceptible baitfish species, can result in hundreds of thousands of risky trips each year, even in low-prevalence scenarios. Ensuring a safe, pathogen-free bait supply and decreasing the percentage of anglers who release their baitfish can reduce pathogen introduction risk while preserving the important cultural and economic benefits of recreational angling. Our project provides evidence-based tools for prioritizing scarce resources and identifying weak points in our management strategies so we can improve them to protect our valuable fish and fishing resources.

PROJECT RESULTS USE AND DISSEMINATION

Throughout this process we have communicated and collaborated with technical experts, managers, and members of the public alike. In addition to the three manuscripts either published or in prep for this project, we have presented this material in a variety of settings. Results from this project have been shared via presentations to local (UMN Ecosystem Health Group, MAISRC Research Showcase, MNDNR AIS Working Group meetings, Minnesota Lakes and Rivers Advocates), statewide (MN Chapter of the American Fisheries Society, UMN Extension Webinars), regional (Upper Midwest Invasive Species Conference), and national (North American Invasive Species Management Association, American Fisheries Society Fish Health Seminar) audiences and hundreds of individual participants. We have also maintained close contact with DNR Fisheries and AIS staff who have periodically served as unfunded collaborators and advisers on the project, and we worked with a number of AIS Detector volunteers in implementing the survey portion of the project.

Subproject 25 Completed: 12/30/2020

FINAL ABSTRACT

Graphic

Sub-Project 28: Evaluating Innovative Coatings to Suppress Priority AIS - \$51,234 TF

Mikael Elias

U of M - College of Biological Sciences; Department of Biochemistry, Molecular Biology, and Biophysics – Biotechnology Institute
1479 Gortner Avenue
Saint Paul, Minnesota 55108

Phone: (612) 626-1915

Email: mhelias@umn.edu

Web: <https://www.eliaslab.org/>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Biofouling is a natural phenomenon that includes the adhesion of Zebra mussels to structures or boats and contribute to their spread in Minnesota waters. Current antifouling coatings are environmentally toxic. We demonstrate the efficacy of an eco-friendly coating technology that could help mitigate the spread of sessile invasive species, while minimizing non-target impacts.

OVERALL PROJECT OUTCOME AND RESULTS

Biofouling is a natural phenomenon that sticks on structures or boats. It is a vector for the spread of numerous invasive species in Minnesota waters. A current way of fighting biofouling involves using metals that are harmful to the environment. We successfully evaluated a new generation of coatings containing a non-toxic, antifouling, biological molecule, and demonstrate that it reduces the adhesion of invasive species. These coatings could help mitigate the spread of sessile invasive species not only in coastal and inland waterways but also on recreational and industrial equipment surfaces, while minimizing non-target impacts.

Problem: Replace current toxic antifouling coatings with coatings containing a non-toxic, antifouling, biological molecule to mitigate the spread of sessile invasive species while minimizing non-target impacts.

Methodology: We took advantage of our unique technical and scientific edges to evaluate the potential of this technology to replace toxic biocides currently used to limit biofouling. Coated samples were submerged in the field in three different sites in Minnesota, including infested sites, and samples were analyzed using microscopies, organisms were quantified and measured, and surface microbial communities determined.

Results and Significance: Biofouling is a main vector for the spread of aquatic invasive species. Current antifouling solutions are both partly effective and highly toxic to the environment. In this proof-of-concept project, we demonstrate that our non-toxic enzyme technology can prevent the adhesion of AIS on submerged surfaces. We show that in three different Minnesotan field sites that enzymatic coatings can outperform coatings containing biocides, and prevent Zebra mussels adhesion to polycarbonate surface over the course of two summer months. This enzyme-based coatings could help mitigate the spread of sessile invasive species in Minnesota and beyond. These results evidence that this novel technology has the potential to replace toxic antifouling coatings and help mitigate the spread of AIS in Minnesota and beyond.

PROJECT RESULTS USE AND DISSEMINATION

We have disseminated our findings to stakeholders to increase awareness of our technology and allow us to learn about market landscape and end-users needs. In particular, we discussed with lake owner associations leaders at and representative of the Legislature at the AIS Research and Management Showcase. We also have communicated via seminars and presentation with other stakeholders, including Dupont, the MN DNR, the Bureau of Reclamation, and presented our results at the iPrime meeting, an academic-industrial meeting where key stakeholders were present, including 3M, BASF, Evonik and Ecolab. We also used communication services at the Biotechnology Institute to disseminate our results to the public in the form of a blog article and we are preparing two research articles to communicate to the scientific community.

Presentations:

- Huang, Hicks, Elias. Suppressing Microbial Communication to Mitigate the Spread of AIS. 9/18/2019. MAISRC Research and Management Showcase.
- Elias. Interference in Microbial Signaling: a powerful way to control microbes and study their languages. 12/3/2019. Presentation to the Bureau of Reclamation.
- Elias. Interference in Microbial Signaling: a powerful way to control microbes and study their languages. 11/18/2019. Presentation to Dupont.
- Elias. New Advances in Controlling Microbial Behaviors by Interfering in Microbial Speech. 8/6/2020. iPrime national meeting.

Media:

- Enzyme-based coatings developed at the University of Minnesota help protect port infrastructure by disrupting the signals underwater bacteria use to communicate. Nick Minor and Kristal Leebrick, Gateway: Signal and Noise. 18 May 2020. <https://gateway.bti.umn.edu/2020/05/18/signal-and-noise/>

Attachments:

- Figure of results of coupons coated with paint containing control protein.

Subproject 28 Completed: 06/30/2021

FINAL ABSTRACT

Graphic

Sub-Project 30: Managing Midwestern Aquatic Invasions in a Changing Climate - UMN \$16,238 / IU \$22,762 TF

Nicholas Phelps

U of MN - MAISRC

135 Skok Hall, 2003 Upper Buford Circle

St. Paul, MN 55108

Phone: (612) 624-7450

Email: phelp083@umn.edu

Web: <http://www.maisrc.umn.edu/>

Ranjan Muthukrishnan

Indiana University - Environmental Resilience Institute

717 E. 8th St.
Bloomington, IN 47408

Phone: (812) 855-7039
Email: mrunj@iu.edu
Web: <https://integratedecology.weebly.com>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Managing AIS in Minnesota's water requires integrating ecological science to understand invaders' impacts and how they respond to different management strategies, climate science to understand changes under changing conditions, and social science to understand the preferences of communities and how they make decisions. This project helps us understand all three.

OVERALL PROJECT OUTCOME AND RESULTS

Nitellopsis obtusa (starry stonewort) is a freshwater alga that is a key emerging invader in Minnesota and the upper Midwest that displaces native aquatic plant communities and restructures lake ecosystems. We conducted an interdisciplinary project to evaluate how starry stonewort will respond to climate change and to understand community decision-making about management options incorporating both ecological and social factors. We did this by utilizing a latitudinal gradient in the range of starry stonewort, from Indiana to Minnesota, as well as inter-annual variability as proxies for potential climate change. Across the region we monitored invasions to evaluate community effects of starry stonewort and conducted interviews with stakeholders to evaluate perceptions of starry stonewort impacts and management preferences. We found that starry stonewort can expand rapidly, but invasion dynamics were highly variable and influenced by climatological conditions. In some particular circumstances expansion was very limited and, in some years, native species were able to recover in areas where starry stonewort abundances decreased. From stakeholder interviews we learned that current management strategies, perceptions about the importance of addressing invasive species, and stakeholders' goals differed between states and stakeholder types. We also found that there were two distinct sets of values that motivated stakeholders, where individuals either viewed lakes as a public good or an exclusive resource.

This information can help predictions of further spread of starry stonewort and of the potential impacts of starry stonewort invasions once established. Additionally, our results can help local stakeholders understand invasion dynamics and impacts to inform their decisions about management options. At the same time our social science efforts can help inform state and regional resource managers about how they can best assist stakeholders in their decisions and our ecological efforts can help develop standards (such as monitoring protocols) that should be included in permitting for treatments.

PROJECT RESULTS USE AND DISSEMINATION

We have presented results from this project in a number of academic, governmental, and public presentations including at the MAISRC Showcase, a MAISRC detectors webinar, the Indiana Invasive Species Council, the Indiana University Environmental Resilience Institute Symposium, Hoosier Flyfishers, Boston University, and the University of Buffalo. We are also currently drafting a policy brief based on our social science efforts (in coordination with a manuscript about to be submitted) that will be shared with MAISRC.

Presentation Recordings/Videos

- 2021 MAISRC Research & Management Showcase Presentation
<https://z.umn.edu/2020ShowcaseStarryClimate>
- AIS Detectors Webinar: Understanding Starry Stonewort Invasions in a Changing Climate
<https://z.umn.edu/DetectorsWebinarStarryClimate>

Subproject 30 Completed: 06/30/2022

FINAL ABSTRACT

Subd. 06b Emerald Ash Borer Biocontrol - Phase III - \$729,000 TF (FY2018)

Jonathan Osthus

Minnesota Department of Agriculture
625 Robert St N
St. Paul, MN 55155

Phone: (651) 201-6248

Email: jonathan.osthus@state.mn.us

Web: <http://www.mda.state.mn.us/plants/pestmanagement/eab/eabbiocontrol.aspx>

Appropriation Language

\$729,000 the first year is from the trust fund to the commissioner of agriculture in cooperation with the Board of Regents of the University of Minnesota to implement biocontrol of emerald ash borer using a newly approved parasitic wasp, assess the impact of the statewide program, and engage citizen volunteers. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Biological control has been effectively implemented, which has led to increasing recoveries of parasitoids over time. Cold tolerance testing of *Spathius galinae* resulted in a forecasting model of survival in North America. The *Buprestidae* of Minnesota guide was created and provides baseline data on jewel beetles present in Minnesota.

OVERALL PROJECT OUTCOME AND RESULTS

We have successfully completed all activities. We are pleased to report that the effective implementation of EAB biocontrol has led to increasing recoveries of the larval parasitoid *Tetrastichus planipennisi* and the egg parasitoid *Oobius agrili* through time based on data analysis in Activity 2. We produced several peer-reviewed scientific publications (with full credit to LCCMR) on Activities 3 and 4. For Activity 3, we evaluated the cold hardiness of the larval parasitoid *Spathius galinae* and published a study forecasting its survival in North America (Wittman, Aukema, Duan, and Venette (2021) Forecasting overwintering mortality of *Spathius galinae* in North America. *Biological Control*. 160: 104694). The insect will survive best in areas where winter temperatures remain above -20 Fahrenheit. For Activity 4, we published two journal articles detailing a checklist of buprestids found in Minnesota (Hallinen, Steffens, Schultz, Aukema (2021) The *Buprestidae* (Coleoptera) of Minnesota, with a discussion of the emerald ash borer, *Agrilus planipennis* Fairmaire. *The Coleopterists Bulletin* 75: 173-190) as well as a study on their habitat features (Hallinen, Wittman, Aukema (2020) Factors associated with diversity and

distribution of buprestid prey captured by foraging Cerceris fumipennis (Hymenoptera: Crabronidae) (Environmental Entomology 49: 1363-13763). These works provide critical information on what is here, now, so we have a basis of comparison for when a new invasive wood-boring beetle in the same family as emerald ash borer arrives in the future. We then published, from the scientific checklist, a free and accessible guide (The Buprestidae of Minnesota) that can be [downloaded from permalink](#). This latter guide contains not only specimen photos but also maps of the distribution record and dates of last collection by decade. All four publications are submitted with this final report.

PROJECT RESULTS USE AND DISSEMINATION

Throughout the duration of the project, results were disseminated through a variety of venues. A wide and diverse audience was reached through interviews with local press, informational webinars, outdoor training sessions held throughout the state, and at academic and natural resource professional conferences and meetings. Parasitoid release and recovery results from activity 1 and 2 can be viewed through an [interactive online map](#). Through the work on activity 3 of this project, models have been created and published forecasting the expected overwintering mortality of the introduced larval parasitoid Spathius galinae. This information is of vital importance to the successful implementation of EAB biological control throughout North America (Wittman, Aukema, Duan, and Venette (2021) Forecasting overwintering mortality of Spathius galinae in North America. Biological Control. 160: 104694). Activity 4 of this project produced tremendously valuable baseline data on the buprestids found in Minnesota. Two journal articles were published detailing a checklist of buprestids found in Minnesota (Hallinen, Steffens, Schultz, Aukema (2021) The Buprestidae (Coleoptera) of Minnesota, with a discussion of the emerald ash borer, Agrilus planipennis Fairmaire. The Coleopterists Bulletin 75: 173-190) as well as a study on their habitat features (Hallinen, Wittman, Aukema (2020) Factors associated with diversity and distribution of buprestid prey captured by foraging Cerceris fumipennis (Hymenoptera: Crabronidae) (Environmental Entomology 49: 1363-13763). A free and accessible guide was created from these publications called The Buprestidae of Minnesota and can be [downloaded from the permalink](#).

Project Completed: 6/30/2021

FINAL REPORT

Subd. 06c Invasive Bighead Carp and Silver Carp and Native Fish Evaluation - Phase II - \$500,000 TF (FY2018)

Brian Nerbonne

MN DNR
1200 Warner Rd
St. Paul, MN 55106

Phone: (651) 259-5789

Email: brian.nerbonne@state.mn.us

Web: <http://www.dnr.state.mn.us>

Appropriation Language

\$500,000 the first year is from the trust fund to the commissioner of natural resources to continue invasive bighead and silver carp monitoring in the Mississippi River and tributaries through advanced acoustic telemetry and assess food chains to determine how native species might prevent invasive bighead and silver carp establishment. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Over the past four years, this project tested new capture methods, learned locations where invasive carp are vulnerable to capture, and removed over 150 fish. Our goal in learning how best to remove invasive carp is to disrupt the potential for spawning that could lead to their establishment in Minnesota waters.

OVERALL PROJECT OUTCOME AND RESULTS

Invasive carp have caused severe ecological damage to the Illinois, Missouri, and lower Mississippi River ecosystems, and threaten to do the same if they become established in Minnesota. Increased monitoring by the Minnesota Department of Natural Resource (DNR), funded in part by ENRTF, has found invasive carp becoming more numerous and widespread in Minnesota in recent years. However, our mulit-year monitoring of larval fish has not documented any reproduction in Minnesota waters to date, indicating they are not yet established. ENRT funding has led to significant gains in our understanding of where, when and how to capture and remove these fish and disrupt their establishment.

An array of receivers used in tracking tagged fish has been instrumental in identifying movement patterns and season habitat preferences of invasive carp and native species. We are learning the seasonal use of invasive carp habitats, which has proven useful in removal and management efforts. Tracking of a radio-tagged invasive carp allowed us to know when and where to target removal efforts, and has directly led to the capture of six invasive carp. Applying what we have learned to places where we don't have tagged fish, ENTRF funded staff conducted 364 days of field sampling, including over 139,000 feet of gill net deployed, over 7,300 minutes of electrofishing and over 134 days of monitored/contracted commercial fishing. This resulted in the removal of over 150 invasive carp during the grant period.

Our tracking tagged native fish assessing their habitat use through stable isotope analysis will be useful in the future to learn what effect invasive carp have on the native species.

PROJECT RESULTS USE AND DISSEMINATION

MN DNR invasive carp staff have provided a yearly [Invasive Carp Sampling Report](#) in which all sampling data is shared for anyone to view. MN DNR invasive carp staff also shares data with other state and federal agencies as well as Universities. In addition, numerous news outlets have covered the work done by the invasive carp crew over the last four years. Those articles and news stories can be located by doing a quick google search of [Invasive carp in Minnesota](#).

Project Completed: 6/30/2021

FINAL REPORT

Subd. 07 Air Quality, Climate Change, and Renewable Energy

Subd. 07b Assessment of Urban Air Pollution - \$700,000 TF (FY2018)

Monika Vadali

Minnesota Pollution Control Agency
520 Lafayette Rd
St. Paul, MN 55155

Phone: (651) 757-2776

Email: monika.vadali@state.mn.us

Appropriation Language

\$700,000 the first year is from the trust fund to the commissioner of the Pollution Control Agency to set up and operate a network of 250 air pollution sensors at 50 sites to monitor fine particles, ozone, nitrogen oxides, sulfur dioxide, and carbon monoxide in each zip code for the cities of Minneapolis and St. Paul to assess variability of urban air pollution. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Air pollutant concentrations cannot be assumed to be the same across all zip codes in the cities of Minneapolis and St. Paul. There are local differences observed and these can influence quality of life where one lives. Monitor placement is very important in being able to detect these differences in neighborhoods.

OVERALL PROJECT OUTCOME AND RESULTS

Understanding small-scale differences in air pollution in urban areas is important for minimizing exposure to harmful air pollutants, particularly for vulnerable communities. This project is using new air-monitoring sensor technology to broaden our knowledge about air quality in Minneapolis and St. Paul. A total of 47 AQMESH air monitors were installed in the study area. 10 of these were co-located with existing MPCA regulatory monitors in order to more closely evaluate the use of sensor technology for accuracy. 14 monitors were located on parking lot light poles, in St. Paul public schools. 23 monitors were placed on Xcel light poles in Minneapolis in residential areas. Pollutants monitored were CO, NO, NO₂, SO₂, O₃, PM2.5 and PM10. Data was collected from June 2019 to June 2021. In addition to the overall goal of seeing small scale differences in urban neighborhoods, this project had 3 main goals:

- Are there significant differences in pollutant concentrations between ZIP codes in the urban core?
- Are there areas with unusually high pollutant concentrations?
- Is this technology suitable for measuring small differences in air quality?

To investigate the last question, data from collocated sensors was compared to the regulatory monitoring data and it was found that there is a reasonably moderate confidence in the sensor data as they compare to the regulatory grade monitors. A strong relationship was also found between the sensor pods themselves, indicating that these would be a good tool for highlighting the differences in pollutant concentrations across the study area.

To further investigate the first 2 questions, data collected from all the sensors for all zip codes was analyzed using R (v 1.4.1717). Data was divided by region into North Minneapolis, South Minneapolis and St. Paul, based on the sensor location. Basic data statistics were computed, pollutant level charts were plotted and a generalized additive model was applied to look for trends and differences across the entire study area.

The analysis showed that although minimal, there are indeed micro level differences that can be observed. A very clear seasonal pattern can be seen for CO and O₃ concentrations across all regions. Local events like the wide spread fires in May/June 2020 and July 4th fireworks tend to slightly increase the particulate counts for a short period. Sensor placement is very important as it affects the measurements.

Residents can use this data to be more cognizant about activities that happen around them in their neighborhoods, especially on days with bad AQI, which adds more particulates into the air making it unhealthy, and make appropriate changes for a healthier lifestyle. In St. Paul, monitoring was done in school parking lots, making these results suitable for education purposes and to understand how idling cars and buses effects short term air quality. Results specific to outdoor activities coinciding with drop off and pick up times can be useful. Extensive monitoring along roadways was not part of this project but some monitors along busy roads did show higher NO_x levels. Overall, the air quality in Minneapolis and St. Paul is good but depending on where you live and any preexisting health conditions, it may affect ones quality of life. This study can inform future monitoring projects, specific areas where traffic could be examined more closely and looking at other local neighborhood sources of pollution.

PROJECT RESULTS USE AND DISSEMINATION

Over the past two years, various efforts were made to communicate results as and when they were analyzed. A [project website](#) was developed which is available on the MPCA's website. A tableau workbook is available with all the monitoring sites and data for all the pollutants being monitored. These can be filtered by site, pollutant and dates if desired.

Six month quarterly updates were provided to the LCCMR. In fall of 2018, project presentations were made in Minneapolis and St. Paul to solicit feedback on monitor placement. In Fall/winter 2019-2020, one year study results were presented at several meetings in Minneapolis and St. Paul to give residents an overview of what the monitors were showing in their respective zip codes. These results were also presented to the Metropolitan Council and other stakeholders.

Presentations will be made to community groups, stakeholders and interested parties. Community concerns, comments and additional analysis done, will be incorporated in the final report and published on the MPCA project webpage.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 07c Generation, Storage, and Utilization of Solar Energy - \$500,000 TF (FY2018)

Bradley Heins

U of MN - West Central Research and Outreach Center in Morris

46352 State Hwy 329
Morris, MN 56267

Phone: (320) 589-1711
Email: hein0106@umn.edu
Web: <http://wcroc.cfans.umn.edu/research-programs/dairy>

Appropriation Language

\$500,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, West Central Research and Outreach Center, Morris, to develop and demonstrate an integrated facility to generate electricity, shade dairy cattle, and provide energy storage and utilization from solar technologies at the West Central Research and Outreach Center, Morris. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The project benefited lakes and streams through the development of novel methods to reduce energy usage on farm and integrate cattle grazing and solar systems. We evaluated technology that will reduce the carbon footprint through energy reduction from dairy farms in Minnesota that will improve environmental impact.

OVERALL PROJECT OUTCOME AND RESULTS

The work conducted at the University of Minnesota West Central Research and Outreach Center in Morris was to investigate electrical energy use on dairy farms located in west central Minnesota and to evaluate the effects of shade use by cattle from solar photovoltaic systems. Measurements of baseline fossil fuel consumption within dairy production systems are scarce. Therefore, there is a need to discern where and how fossil fuel-derived energy is being used within dairy production systems. Baseline energy use data collection is the first step in addressing the demand for a reduced carbon footprint within dairy production systems. Energy use on five Midwest dairy farms was evaluated from July 2018 to June 2021. Through in-depth monitoring of electricity-consuming processes, it was found that electricity use can differ quite drastically in different types of milking systems and farms. Electricity on an annual basis per cow ranged from 400 kWh/cow in a low-input and grazing farm to 1,145 kWh/cow in an automated milking farm. To reduce electrical energy consumption as well as reduce the effects of heat stress in pastured dairy cows, producers may investigate using an agrivoltaic system. Biological effects of internal body temperature, milk production, and respiration rates and behavioral effects of activity, rumination, fly avoidance behaviors, and standing and lying time of the solar shade were evaluated. Results of this agrivoltaic system suggested that grazing cattle that have access to shade had lower respiration rates and lower body temperatures compared to cattle that do not have access to shade. This project suggests that improvement in Minnesota waterways and environment may be achieved through reduced use of fossil energy through integrating livestock and solar energy production systems.

PROJECT RESULTS USE AND DISSEMINATION

We have provided tours of the agrivoltaic system at the WCROC to legislators, farmers, and industry representatives. We have also hosted dairy field days and the Midwest Farm Energy Conference at the WCROC that have shown the results and solar system to the public as well. Over 10,000 people have viewed the solar system and have responded with favorable interest in the system. A graduate student

on the project presented an abstract at the ADSA Meeting and Waste to Worth conference. So far, 3 peer reviewed papers have been published with more to follow. The WCROC website provides the results of the project and YouTube videos for promotion of the project. A presentation was made at the global Virtual AgriVoltaics conference in 2021. This applied dairy energy and agrivoltaics projects was the Master's thesis of Kirsten Sharpe in the Department of Animal Science at the University of Minnesota and she defended her thesis in 2020.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 07d District Heating with Renewable Biomass at Camp Ripley Training Center - \$1,000,000 TF (FY2018)

Jay Brezinka

Department of Military Affairs
15000 Highway 115
Little Falls, MN 56345

Phone: (320) 616-2618

Email: jay.a.brezinka.nfg@mail.mil

Appropriation Language

\$1,000,000 the first year is from the trust fund to the commissioner of military affairs to install a 5,000,000-BTU centralized biomass boiler system utilizing the forestry management at Camp Ripley. This appropriation must be matched by at least \$900,000 of nonstate money and must be committed by December 31, 2017. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The scope of this project was to install a biomass heating plant that would service 7 Buildings including mechanical and distribution systems. We received an architect estimate and the base cost for the project in total was \$7,122,035.

OVERALL PROJECT OUTCOME AND RESULTS

Due to these headwinds, Current Project estimates (Steel prices, metal prices in particular; (Piping), and lumber prices, etc), we lowered the scale of the project to just the biomass heating plant and underground piping and connections to just 2 facilities, and that bid estimate came in at \$4,407,008.

National Guard Bureau and DMA leadership requested that we reassess the Life Cycle Cost Analysis (LCCA's) numbers on this project. The Saving's to Investment Ratio (SIR) changed from 2.31 during the planning phase to .32 currently. Again, this is largely due to the current cost of construction and the reduction in buildings being included. Since we only have \$2.5 million available from federal sources and \$1 million in state LCCMR funds, we legally can no longer implement this project. We will be crossing budget thresholds. Only the design of the biomass facility has been completed.

PROJECT RESULTS USE AND DISSEMINATION

The funds spent for the Biomass project enabled the MNARNG to design a 5,000,000-BTU centralized biomass boiler system that was intended to heat 2 building on Camp Ripley. The design process started with 7 buildings but due to increase in material cost we had to decrease the scope to only 2 buildings.

The design is complete and on the shelf and available to others.

No information or the project design has been disseminated.

Project Completed: 12/31/2023

FINAL REPORT

Subd. 07e Geotargeted Distributed Clean Energy Initiative - \$800,000 TF (FY2018)

Jennifer Edwards

Center for Energy and Environment
212 Third Ave N, Ste 560
Minneapolis, MN 55401

Phone: (612) 335-5871

Email: jedwards@mncee.org

Web: <http://www.mncee.org>

Appropriation Language

\$800,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Center for Energy and Environment. Of this amount, \$600,000 is for analysis of community-distributed clean energy investments as alternatives to utility capital investments for transmission and distribution upgrades to meet forecasted electrical loads, and \$200,000 is to conduct pilot programs using energy efficiency and other distributed energy resources to achieve forecasted electric energy loads in communities. The appropriation for pilot programs is contingent on a \$200,000 match of an equal or greater amount of nonstate money. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project demonstrated that energy efficiency can be used to reliably offset utility infrastructure expansion, thereby saving money and decreasing the amount of air pollutants from Minnesota's electricity generation.

OVERALL PROJECT OUTCOME AND RESULTS

This pilot project demonstrated that energy efficiency and demand response are cost-effective tools to increase the use of clean electricity technologies while reliably deferring investments in grid expansion. While Minnesota has relatively low distribution grid expenditures today, peak demand is predicted to increase due to population growth, electrification of end uses like transportation and space heating, and warmer temperatures. This pilot demonstrated that adopting longer time horizons and multiple scenarios for planning forecasts will allow distribution planners to integrate non-wires alternatives, therefore saving money and advancing clean energy throughout the state.

This pilot successfully saved 576 kW of peak electricity across two small communities, higher than the pilot goal of 500 kW. This was the result of enhanced incentives, increased and geotargeted marketing, as well as a higher than average baseline participation in commercial lighting programs. Participation was also boosted by smart thermostat incentives which were available upon enrollment in a demand management program. The pilot cost (incentives + direct labor) came to \$163,000, within the estimated

value of a one-year deferral.

Minnesota has a modest technical potential for non-wires alternatives, but this is expected to increase. With current growth forecasts and distribution system expenditures, we calculated a low to modest potential for non-wires alternatives in Minnesota, estimated at between one and four million dollars per year. This will save between 4,000 and 17,000 tons of carbon per year, or the equivalent of the annual pollution caused by 800-6,000 passenger vehicles.

Additional information is included in the final technical report for this project on the [CEE website](#).

PROJECT RESULTS USE AND DISSEMINATION

This pilot is summarized in a technical report and project summary document that outlines the process, major findings, and recommendations for policymakers and stakeholders. Results have been included in policy processes at the Public Utilities Commission to help inform regulatory decisions. Pilot outcomes have been presented at multiple conferences of industry professionals and to Minnesota utilities.

Project Completed: 6/30/2021

[FINAL REPORT](#)

Subd. 08 Methods to Protect, Restore, and Enhance Land, Water, and Habitat

Subd. 08a Optimizing the Nutrition of Roadside Plants for Pollinators - \$815,000 TF (FY2018)

Emilie Snell-Rood

U of MN

1479 Gortner Ave, 140 Gortner Labs

St. Paul, MN 55108

Phone: (612) 624-7238

Email: emilies@umn.edu

Web: <http://cbs.umn.edu/snell-rood-lab/home>

Appropriation Language

\$815,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota in cooperation with the Departments of Agriculture, Natural Resources, and Transportation and the Board of Water and Soil Resources to produce site-specific recommendations for roadside plantings in Minnesota to maximize the nutritional health of native bees and monarch butterflies that rely on roadside habitat corridors. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This research shows that, from a nutritional perspective, Minnesota roadsides are promising habitat for native bees and monarchs. To minimize the negative effects of roadside pollutants on insect pollinators, managers should prioritize low- to moderate-traffic roads for restoration, mow a buffer strip, and support efforts to ban the pesticide chlorpyrifos.

OVERALL PROJECT OUTCOME AND RESULTS

Insect pollinators have suffered steep declines over the last two decades. Roadsides are a promising opportunity for pollinator conservation, potentially providing millions of acres of habitat, and acting as dispersal corridors. However, roadside habitat also contains pollutants such as heavy metals from car wear and past leaded gasoline use, sodium from road salt application, and pesticides from adjacent agriculture. In this research, we combined surveys of roadsides across Minnesota, with controlled lab and field experiments, to test how such roadside pollution impacts insect pollinators, and implications for restoring roadside habitat for monarch butterflies and native bees. Our results suggest that plants alongside the majority of Minnesota roadsides have sodium and metal content below which is worrisome to bees and monarchs. However, plants along very high traffic roads, especially those right next to the road, likely have negative effects on pollinator health. Our data also suggest that pesticides may be a significant concern for 5-10% of roadside plants. This research suggests roadside restoration efforts should focus on roads with low to moderate traffic volumes (<20K cars daily) and that mowing a buffer on the road edge should eliminate the most toxic plants. Recent national efforts to ban the pesticide chlorpyrifos would also be beneficial for Minnesota roadsides as this was the most commonly detected insecticide. Finally, this research suggests benefits to planting a diversity of roadside plants as species accumulate different toxins to different degrees, although on higher traffic roads, managers may want to avoid a handful of high accumulating species (e.g., yellow coneflower). Overall, from a nutritional perspective, Minnesota roadsides are promising habitat for insect pollinators, for instance, potentially producing 14M migratory monarchs annually. Future work should consider management methods that may minimize vehicle collisions, as currently pollinator mortality from collisions likely far exceeds that from plant toxicity.

PROJECT RESULTS USE AND DISSEMINATION

This project directly led to six publications in print and twelve in progress. Data are publically available on either [DRYAD](#) or [Mendeley](#). This work was presented in over 25 seminars, conference presentations, and webinars presented locally, nationally and internationally. The conclusions of the work are available in online talks, such as the Cedar Creek ["Lunch with a Scientist" series](#) and the Rights-of-Way working group [research series on pollinator habitat](#). This research will be featured in a popular science book on [road ecology](#) and resulting management recommendations shared as a brief report to relevant agencies later this year.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 08c Evaluating the Use of Bison to Restore and Preserve Savanna Habitat – Research Project - \$388,000 TF (FY2018)

Forest Isbell

U of MN - Cedar Creek Ecosystem Science Reserve
2660 Fawn Lake Drive NE
East Bethel, MN 55005

Phone: (612) 301-2601

Email: isbell@umn.edu

Web: <http://www.cedarcreek.umn.edu>

Appropriation Language

\$388,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Cedar Creek Ecosystem Science Reserve, to research combined bison grazing and fire management strategies to restore Minnesota's oak savanna ecosystems. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Oak savanna is Minnesota's most threatened ecosystem, but effective approaches for protecting and restoring savannas remain elusive. Our project reintroduced bison to one of Minnesota's largest remaining oak savannas. We found that bison grazing helped increase oak regeneration and stimulated plant productivity, providing a promising new strategy for savanna conservation.

OVERALL PROJECT OUTCOME AND RESULTS

Oak savanna is Minnesota's most threatened ecosystem, but effective approaches for protecting and restoring savannas remain elusive and prescribed fire, alone, is not maintaining oak savannas. Fire helps old oaks with thick bark that can survive its intense heat, in part by preventing other trees from growing and shading the oaks. However, fire also kills young oak seedlings, which prevents oak trees from regenerating. Thus, fire is a necessary, but insufficient strategy for maintaining oak savannas. We tested whether bison are essential for savanna preservation and restoration. Bison preferentially graze the most abundant native prairie grasses, which compete with young oaks and supply fuel for fires that kill them. Our project achieved the following outcomes: (1) discover better restoration and preservation practices for savanna remnants; (2) determine how these practices impact the full range of savanna biodiversity; and (3) educate Minnesotans about the ecological heritage of their state, including the roles that bison, fire and biodiversity play in the functioning of savannas and other Minnesota ecosystems. Specifically, we restored seasonal bison grazing to more than 200 acres of oak savanna, experimentally tested savanna restoration using bison grazing by establishing experimental plots and planting 660 oak seedlings, and disseminated results to more than 19,000 members of the public, in part by establishing a bison viewing gazebo. For many years to come, bison will continue to graze in these oak savannas, their impacts will continue to be assessed in experimental plots, and the public will continue to benefit from site access and programming. Our project has already attracted additional funding from the National Science Foundation's Long-Term Ecological Research Program, which will allow it to continue long after the initial support from the ENRTF. Our data are being disseminated through Cedar Creek's website and the National Science Foundation's Environmental Data Initiative.

PROJECT RESULTS USE AND DISSEMINATION

We have provided engagement opportunities for more than 19,000 visitors, including 2,172 K-12 students who attended field trips or online programs specifically about this research. The new bison gazebo has provided opportunities for a corps of 25 "bison naturalist" volunteers, spurred the creation of new educational resources including a savanna-themed feltboard and brochures, hosted open house events and tours, led to the design and construction of two new interpretive signs, and expanded the range of self-guided options for our community.

Project Completed: 6/30/2021

FINAL REPORT

Subd. 08d State Park Pollinator Habitat Restoration - \$672,000 TF (FY2018)

Edward Quinn

MN DNR, Division of Parks and Trails
500 Lafayette Rd, Box 39
St. Paul, MN 55155

Phone: (651) 259-5594

Email: edward.quinn@state.mn.us

Web: <http://www.dnr.state.mn.us/index.html>

Appropriation Language

\$672,000 the first year is from the trust fund to the commissioner of natural resources to restore at least 520 acres of monarch butterfly and other native pollinator habitats in at least seven state parks in the Minnesota Prairie Conservation Plan core areas and establish pollinator plantings and interpretive exhibits in at least ten state parks. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project restored approximately 520 acres of prairie/pollinator habitat in eight state parks where it will be permanently managed and protected. Additionally, educational pollinator plantings ranging in size from tenths of an acre to more than an acre were installed with engaging multi-sensory ADA-accessible interpretive exhibits at ten state parks.

OVERALL PROJECT OUTCOME AND RESULTS

Many species of pollinators are declining due primarily to habitat loss/degradation, diseases and parasites and pesticide exposure. This project focused on restoring 584 (520 originally planned) acres of prairie/pollinator habitat in eight state parks where it will be permanently managed and protected. Additionally, this project helped raise awareness about pollinators by establishing educational pollinator plantings from tenths of an acre to more than one acre in size with engaging multi-sensory ADA-accessible interpretive exhibits at 10 state parks.

Sites selected for habitat restorations were all within core areas identified in the Minnesota Prairie Conservation Plan. The sites themselves were former agricultural fields in state parks that contained non-native and invasive species. Site preparation included activities such as prescribed fire, control of invasive/problem species, woody stem removal, and disking. At Lake Bronson and Glacial Lakes State Parks, removal of encroached woody vegetation was the primary need to restore pollinator habitat through shearing/timber harvest. Following planting, sites were high mowed, spot treated for invasives and inter-seeded to ensure successful restorations. These sites will provide habitat for many species of pollinators such as bees, moths, and butterflies. For example, a recent study of prairie restorations at Glendalough State Park found more than 25 species of butterflies utilizing the restorations, including the Regal Fritillary, a Minnesota Special Concern Species. This project will also assist in meeting the goals of the Mid-America Monarch Conservation Strategy.

Educational pollinator plantings and exhibits were installed at 10 state parks within all but the Laurentian Mixed Forest Province. Interpretive exhibits were designed and constructed in cooperation with an exhibit contractor. Where needed educational plantings were established similar to the steps above albeit on a much smaller scale. Annual visitation at these 10 parks combined totals over three million visits annually.

PROJECT RESULTS USE AND DISSEMINATION

Educational pollinator plantings and exhibits provide an opportunity for millions of visitors annually to learn more about pollinators and the plant species which attract them. Attendance at these 10 parks combined is over three million visitors per year. The exhibits are regularly used by thousands of visitors per week based on park attendance and staff reports.

- The exhibit design was entered in the National Association of Interpretive Naturalists 2021 Media Awards competition and earned first place in the Outdoor Exhibits category. The award presentation was broadcast to over 800 interpretive professionals in December of 2021
- In summers of 2020 and 2021 this project was highlighted on the DNR Parks and Trails social media platforms as part of a monthly theme on butterflies. The 2021 campaign reached 33K Twitter followers and 151K Facebook followers.

Project Completed: 06/30/2022

FINAL REPORT

Subd. 08e Enhancing Spawning Habitat Restoration in Minnesota Lakes – Research Project - \$294,000 TF (FY2018)

William Herb

U of MN - St. Anthony Falls Laboratory
2 Third Ave SE
Minneapolis, MN 55414

Phone: (612) 624-5147

Email: herb0003@umn.edu

Web: <http://www.safl.umn.edu/>

Appropriation Language

\$294,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, St. Anthony Falls Laboratory, in cooperation with the Department of Natural Resources to enhance efforts to increase natural reproduction of fish in Minnesota lakes by assessing wave energy impacts on near-shore spawning habitat. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The main goal of this project was to create easily accessible information on wave energy to enable successful habitat restoration projects and increase natural fish reproduction in Minnesota lakes. We created maps, in GIS format, of wave height and energy statistics for 457 lakes in Minnesota.

OVERALL PROJECT OUTCOME AND RESULTS

There are many ways in which healthy near-shore habitat and water quality in lakes is linked to wind and wave energy. Examples include walleye spawning habitat on nearshore gravel substrates, the distribution of submersed aquatic plants, sediment resuspension by wave action, and shoreline erosion. Successful lake habitat restoration requires good information on wind and wave energy, and this

information is commonly not available. The main goal of this project was to create easily accessible information on lake wave energy to enable successful habitat restoration projects and increase natural fish reproduction in Minnesota lakes. The project partnered the University of Minnesota with the MN DNR and included field measurements of wind and wave height on four lakes ranging in size from 350 to 5000 acres, wave modeling work to map typical wave energy on the shorelines of 457 Minnesota lakes, and experimental work in a wave flume to better understand how nearshore sediment responds to wave energy in lakes. A major part of the project was to develop models for wave height and energy that consider wind sheltering by trees, so that wave height predictions could be made for smaller lakes with fetches of a kilometer or less. The wave maps created by this study can be used by state agencies and lake associations to plan lake shoreline management, including habitat restoration projects, aquatic plant management, and shoreline erosion control.

PROJECT RESULTS USE AND DISSEMINATION

Electronic maps of wave height and energy created in this project will be uploaded to the Data Repository for University of Minnesota (DRUM), and details of the project will be published in a St. Anthony Falls Lab project report to document the methodologies used. The project PI gave a talk on the project at a conference on Sentinel lakes in March 2019 in Alexandria, MN, and is giving a poster presentation at the 2021 Minnesota Water Resources Conference.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 08f Prescribed Fire Management for Roadside Prairies - \$345,000 TF (FY2018)

Nate Johnson

Minnesota Department of Transportation
395 John Ireland Blvd
St. Paul, MN 55155

Phone: (612) 723-4288

Email: nathan.d.johnson@state.mn.us

Appropriation Language

\$345,000 the first year is from the trust fund to the commissioner of transportation to enhance the prescribed-fire program to manage roadsides to protect and increase biodiversity and pollinator habitat. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

MnDOT's fire program has grown exponentially since this funding was secured. All fire crews have gained extensive experience and have gained a lot of confidence on how and when fire should safely be used. The number of areas and districts in which fire occurs on MnDOT property has increased throughout this project. Within the next 5 years MnDOT will be conducting prescribed fire in 6 of its 8 districts around the state.

OVERALL PROJECT OUTCOME AND RESULTS

MnDOT fire program took major steps forward with this funding and has secured a self-sustaining fire

program. Prior to this funding DOT completed less than 5 burns a year, in the 3 years of this program DOT completed 78 burns that totaled 142 miles of ROW burned totaling 1,600 acres of Mn and US highway ROW burned statewide. Even with one years of no burning allowed due to COVID 19, we surpassed our goals of this project and doubled our acres completed. DOT's current burn program has changed how native planting will be installed in the future, by being able to help maintain them for long lasting success. More Roadside Rest Areas around the state will be planted with native vegetation, to help increase pollinator habitat and reduce maintenance cost associated with turf grass. Six MnDOT staff have received fire training on becoming burn bosses, with one person finishing all training and task books required. With additional staff able to complete burns, MnDOT's fire program will continue to grow and expand.

PROJECT RESULTS USE AND DISSEMINATION

A Master Partnership Agreement was drafted, completed, and currently in place which allows MnDOT to assist the MnDNR on all aspects of wildfire suppression and prescribed fire operations, this agreement includes funding for direct payment between the two state agencies. With MnDOT assisting the DNR in wildfire suppression, it is our hope that we will reduce the number of resources needed from other state agencies and contractors.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 08g Minnesota Bee and Beneficial Species Habitat Restoration - \$732,000 TF (FY2018)

Sabin Adams

Pheasants Forever Inc.
1783 Buerkle Cir
St. Paul, MN 55110

Phone: (320) 250-6317

Email: sadams@pheasantsforever.org

Web: <http://www.pheasantsforever.org>

Appropriation Language

\$732,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Pheasants Forever in cooperation with the University of Minnesota and the Minnesota Honey Producers Association to restore approximately 800 acres of permanently protected land to enhance bee, butterfly, beneficial insect, and grassland bird habitats. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project's goal was to enhance and study 800 acres of permanently protected habitat by converting low diversity grassland areas to high diversity native grasses and wildflowers. The result of our efforts was the successful enhancement of 1,949.69 acres of habitat to benefit pollinators and other wildlife.

OVERALL PROJECT OUTCOME AND RESULTS

Grassland habitat loss and fragmentation continue to be the major factor in the decline of monarchs, other pollinators and grassland wildlife. While we have restored hundreds of thousands of acres of

grasslands, our early restorations rarely considered the needs of pollinators, the value of milkweed species to the monarch, or the vegetative structural and species diversity required by many species.

This project sought to address the loss of habitat essential to pollinators by enhancing 800 acres of low diversity grasslands on permanently protected lands. These enhancements were monitored in collaboration with the University of Minnesota (UofM) to, inform practitioners of best practices and provide a path to future habitat enhancements for native pollinators.

Enhancement projects were solicited by Pheasants Forever (PF) and project partners through a sign-up period via an RFP sent to SWCD's and other private land partners in the agricultural region of Minnesota. Application were ranked and funded based on potential benefit to the program. Private contractors were hired by PF to complete enhancement work on 1949.69 acres. After enhancement work was completed researchers from the UofM monitored the sites to measure usage by pollinator species as well as measure native plant growth.

Pollinators are extremely important to the production of foods and other products that Minnesotans utilize, as well as other ecosystem services. Whether through funding or policy, the decline of pollinators suggests the need to put a greater emphasis on the protection, restoration, and management of their habitats. Once results are analyzed, the research conducted by the UofM will help improve our best management practices in pollinator habitat restoration and enhancement.

PROJECT RESULTS USE AND DISSEMINATION

The enhancement activities completed by this project did not result in the creation of any new tools or documents. Projects were occasionally highlighted in field tours, or via social media posts. The field research conducted by the UofM is now complete, but data analysis and results have yet to be finalized or published. Once complete, this data will be available to the public and should inform practitioners about improved methods for restoring and enhancing pollinator habitat.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 08h Mississippi and Vermillion River Restoration of Prairie, Savanna, and Forest Habitat – Phase Ten - \$213,000 TF (FY2018)

Lisa Mueller

Friends of the Mississippi River
101 Est 5th Street, Suite 2000
St. Paul, MN 55101

Phone: (651) 222-2193 x12

Email: lmueller@fmr.org

Web: <http://www.fmr.org>

Appropriation Language

\$213,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Friends of the Mississippi River for continued implementation of the Metro Conservation Corridors partnership by improving at least 80 acres of habitat at approximately seven sites along the Mississippi

River and Vermillion River corridors. Expenditures are limited to the identified project corridor areas as defined in the work plan. A list of proposed restoration sites must be provided as part of the required work plan. Plant and seed materials must follow the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Friends of the Mississippi River increased and improved 133 acres of habitat at 6 sites along the Mississippi and Vermillion River corridors, linking existing nodes of high biodiversity. The project restored and enhanced prairie, savanna and forest habitat along the river corridors with a focus on increasing habitat for pollinators.

OVERALL PROJECT OUTCOME AND RESULTS

Through this project, Friends of the Mississippi River will increase and improve 82 acres of habitat at 7 sites along the Mississippi and Vermillion River corridors. Habitat fragmentation and degradation from non-native species, diseases and other causes threaten Minnesota's rich natural heritage. This situation will be exacerbated as the state's climate continues to change. A system of interconnected natural areas can help to lessen these impacts by providing both habitat and the ability for native species to move on the landscape in response to these changes. This is the goal of the Metro Conservation Corridors partnership and of this proposal. The projects on our list are all along the Mississippi and Vermillion Rivers, natural corridors that link the existing nodes of high biodiversity.

The overarching goal for this project is to restore and enhance prairie, savanna, and forest habitat along these river corridors. While these projects will improve habitat for a variety of species, FMR will specifically focus on increasing habitat for our diminishing pollinators. We will seed and install a diversity of host and nectar plants. The restoration activities, presented in existing natural resource management plans, include exotic invasive plant removal, soil preparation, spraying, seeding, mowing, plant installation and burning. To help reduce costs and to increase the educational outcomes, FMR will organize volunteer stewardship events to accomplish some of the restoration activities at some of these sites. These restoration activities will have multiple benefits. An important outcome will be to improve or increase habitat for native pollinators by increasing host and nectar plants. Seed mixes will exceed the Minnesota Board of Soil and Water guidelines, with many additional pollinator plant blooms in all seasons. Restoration activities at these sites will provide water quality benefits by installing deep-rooted prairie/savanna plants that help reduce erosion and sediment & chemicals from entering the rivers. Being within the Metro area, these sites provide examples of diverse native habitat for area residents to enjoy and learn about. A final goal of this project is to work with Metro Conservation Corridors partners to develop a more uniform restoration monitoring and evaluation protocol that also allows the data to be shared. Each of the specific sites in this project is in public ownership and have natural resource management plans in place to guide the habitat restoration and management activities and are on file at FMR. The Conservation Corps of Minnesota is on our contractor contact list and receive notice for all restoration Request for Proposals that we prepare and distribute.

FMR will conduct an evaluation for each of site upon completion of these grant-funded restoration activities and three years later. These evaluations will analyze how the activities achieved the goals for the project, present any unforeseen issues that impacted the achievement of those goals and lessons learned from the project.

PROJECT RESULTS USE AND DISSEMINATION

FMR promoted and disseminated information about this project through earned media, FMR's website (www.FMR.org), electronic & printed newsletters, and volunteer stewardship events. FMR has acknowledged ENRTF in all publications and events that refer to these projects. FMR will work with landowners to erect signage where ENRTF grant funds were spent.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 08i Community Stewardship to Restore Urban Natural Resources - Phase Ten - \$524,000 TF (FY2018)

Wiley Buck

Great River Greening
35 Water St W, Ste 201
St. Paul, MN 55107

Phone: (651) 665-9500

Email: wbuck@greatrivergreening.org

Web: <http://www.greatrivergreening.org>

Appropriation Language

\$524,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Great River Greening to work with volunteers for continued implementation of the Metro Conservation Corridors partnership to restore approximately 250 acres of forest, prairie, woodland, wetland, and shoreline throughout the greater Twin Cities metropolitan area. Expenditures are limited to the identified project corridor areas as defined in the work plan. A list of proposed restoration sites and evaluations must be provided as part of the required work plan. Plant and seed materials must follow the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

To protect Minnesota's natural heritage, Greening restored and enhanced 310 ecologically significant acres in priority metro areas and engaged volunteers in a suite of activities to address the need for long-term management of projects. Greening disseminated results for the layperson through electronic channels and to professionals through a published paper.

OVERALL PROJECT OUTCOME AND RESULTS

We reached 123% of our acreage goals, restoring and enhancing 310 acres of significant ecological habitat, compared to the 252 acres anticipated. The 12 restoration and enhancement sites were selected based on ecological significance and potential for improvement. Restoration and enhancement improvements were made on prairie, forest, and wetland communities including habitat for rare species, within the mapped Metro Conservation Corridors.

We successfully engaged 468 volunteers in hands-on restoration, and 5 known observers via iNaturalist

app for a combined total of 473 contacts. Reaching this number was a challenge we met, as during the second half of this appropriation, we had to significantly and rapidly modify our community outreach and event models in response to the COVID-19 pandemic to safely engage our volunteers throughout 2020 and 2021. We were successful in our community engagement events with staggered start time, multi-shift days with smaller pods of volunteers, and strict safety guidelines in place. Furthermore, we also piloted independent volunteer outings utilizing the iNaturalist platform, allowing volunteers to explore project parcels and record their observations independently. These observations provided very useful data (e.g. benchmarking progress and identifying patches of exotic species) while engaging volunteers in a novel way.

To help address the need for innovative methods for long term maintenance, we also offered two additional levels of volunteer engagement beyond field volunteer and started using a digitized restoration evaluation for more standard, shareable data. The 'site monitor' level of engagement was successful, but the 'site steward' level of engagement was challenging due to a combination of the pandemic, and the effort needed to get landowners, GRG, and volunteers comfortable with making independent enhancement decisions.

PROJECT RESULTS USE AND DISSEMINATION

Greening highlighted projects over a suite of social media (twitter, Facebook), website, and external media. Examples from the final months of the appropriation include: May 2021 feature on our work at Inspiration easement; Oheyawahe/Pilot Knob Hill site highlighted during a March 2021 segment on KARE 11, then shared in Greening channels; the Blaine Wetland Sanctuary enhancement featured in our June 2021 Greening channels.

A peer-reviewed paper on the pollinator response to conservation haying and burning treatments at Six Mile Marsh authored by members of each stakeholder organization has recently been accepted for publication in 2021.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 08j Economic Assessment of Precision Conservation and Agriculture - \$400,000 TF (FY2018)

Tanner Bruse
Pheasants Forever Inc.
1783 Buerkle Circle
St. Paul, MN 55110

Phone: (507) 337-9789
Email: tbruse@pheasantsforever.org

Appropriation Language

\$400,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Pheasants Forever to demonstrate a new approach to promote conservation practices utilizing return-on-investment analysis and identifying revenue-negative acres on agricultural land to assist farmers in implementing conservation practices that will provide environmental and economic benefits.

This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project showcased opportunities available for farmers and landowners to implement profitable conservation practices on lands otherwise providing a negative return. Through this new approach to conservation delivery, we were able to put 1,216 acres of conservation on the landscape, providing multiple benefits to Minnesota's natural resources and economy.

OVERALL PROJECT OUTCOME AND RESULTS

With recent advancements of real-time yield monitoring, it has been demonstrated that, on many farms, 3-15% of cropped acres cost money to farm (revenue negative acres). By applying the current cutting-edge precision technology and focusing on return on investment (ROI) to deliver conservation, we worked with farmers to identify areas that make sense for them to apply conservation practices in a practical and profitable way. This new approach to conservation delivery, focused on revenue negative acres, provided insight to the consideration of profitable conservation practices, reasons for conservation adoption, and the delivery of conservation acres that otherwise would've continued to be in traditional crop production. In addition, this project demonstrated a high level of cooperation and coordination between agriculture and conservation.

By looking at the entire operation, at the enterprise level, current technology allows for acre-by-acre analysis to develop conservation solutions on acres that otherwise yield a negative return. This project worked directly with 72 farmers to analyze 45,214 acres and look for conservation solutions on 5,382 acres that are low yielding in comparison to the rest of the field or operation. Our findings show that of the analyzed acres, 12% of the acres fell below break-even yield, which is in the range of 3-15% revenue negative acres demonstrated by [previous research](#) (E Brand et al 2016). With the analysis and available program opportunities this project was able to meet farmer objectives while increasing profitability through conservation on 1,216 acres. These are acres that otherwise didn't receive consideration for conservation practices. While not all identified acres received immediate change, the overall conversation and influence of this project, opened the door for continued conservation consideration and future conservation adoption. The practices implemented provide direct benefit to Minnesotans through increased soil health, water quality, carbon sequestration, wildlife habitat, and other natural resources.

PROJECT RESULTS USE AND DISSEMINATION

This project resulted in the [hiring](#) of a precision ag & conservation specialist to work with farmers, landowners, [trusted advisors](#) and demonstrate the use of precision agriculture technology to deliver conservation on the landscape. This project helped launch the addition of [multiple staff in additional states](#) to both implement and influence conservation on the landscape. This project hosted or was a part of 66 different outreach event impacting 3,608 attendees. Outreach consisted of [online webinars](#), attendance at tradeshows (such as the MN Ag Expo and FarmFest) along with varying presentations and meetings geared towards ag professionals, conservation professionals, and farmers/landowners.

Project Completed: 06/30/2022

FINAL REPORT

Subd. 09 Land Acquisition, Habitat and Recreation

Subd. 09a Metropolitan Regional Parks System Land Acquisition - \$1,500,000 TF (FY2018)

Jessica Lee
Metropolitan Council
390 Robert St N
St. Paul, MN 55101

Phone: (651) 602-1621
Email: jessica.lee@metc.state.mn.us
Web: <http://www.metrocouncil.org/parks/index.htm>

Appropriation Language

\$1,500,000 the first year is from the trust fund to the Metropolitan Council for grants to acquire approximately 197 acres of land within the approved park boundaries of the metropolitan regional park system. This appropriation may not be used to purchase habitable residential structures. A list of proposed fee title acquisitions must be provided as part of the required work plan. This appropriation must be matched by at least 40 percent of nonstate money that must be committed by December 31, 2017. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Metropolitan Council along with Washington County and Carver County acquired 12 parcels to increase recreational opportunities for the Regional Parks System. These critical acquisitions protected over three miles of Minnesota River and St. Croix River shoreline and 192 acres of high-quality natural resource land in Washington and Carver Counties.

OVERALL PROJECT OUTCOME AND RESULTS

The Metropolitan Council works with the Regional Park Implementing Agencies to protect critical lands and provide recreational opportunities for the Regional Parks System. This \$1,436,000 ENRTF project was matched with \$1.7 million in Council funds and Agency funds to purchase 14 parcels for the Regional Parks System.

Washington County acquired a 102-acre property for St. Croix Bluffs Regional Park with funding from this and a previous appropriation. The property contains critical habitats including hardwoods, mixed forest, open meadow, and 3,800 feet of St. Croix River shoreline. With the addition of this 102-acre parcel, the park now protects 5,000 contiguous feet of shoreline. Carver County acquired 13 parcels for the Minnesota River Bluffs Regional Trail, protecting 90 acres of natural resources and 3 miles of regional trail, much of it along the Minnesota River corridor.

Acquiring these properties permanently protects critical natural resources while providing additional recreational opportunities for the region. All properties funded are inholdings or parcels that are included in master plan-approved park boundaries. The Regional Park Implementing Agencies work only with willing landowners when acquiring lands with ENRTF, and they focus on acquiring lands with high natural resources and habitat value that are at risk of being developed.

PROJECT RESULTS USE AND DISSEMINATION

Articles were released both after the grant was awarded and after the Rowe parcel was purchased for

Washington County's St. Croix Bluffs Regional Park, including an article in the Pioneer Press on June 11, 2019. Carver County celebrated the opening of their rebuilt portion of the Minnesota River Bluffs Regional Trail on July 13, 2021 with a public celebration. Several news releases were published, including the SW News Media and on Carver County's website. The Council also issued news releases after each grant was awarded. The Agencies include the ENRTF sign when they install visitor signs. In addition, the Metropolitan Council and the Agencies acknowledge ENRTF for any media releases about the acquisitions.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 09b Scientific and Natural Areas Acquisition, Restoration, Citizen Science and Engagement - \$2,500,000 TF (FY2018)

Molly Roske

MN DNR, Division of Ecological & Water Resources
500 Lafayette Rd, Box 25
St. Paul, MN 55155

Phone: (651) 259-5094

Email: molly.roske@state.mn.us

Web: <http://www.dnr.state.mn.us/snats/index.html>

Appropriation Language

\$2,500,000 the first year is from the trust fund to the commissioner of natural resources to acquire at least 250 acres of land with high-quality native plant communities and rare features to be established as scientific and natural areas as provided in Minnesota Statutes, section 86A.05, subdivision 5, restore and improve at least 1,000 acres of scientific and natural areas, and provide technical assistance and outreach, including site steward events. At least one-third of the appropriation must be spent on restoration activities. A list of proposed acquisitions and restorations must be provided as part of the required work plan. Land acquired with this appropriation must be sufficiently improved to meet at least minimum management standards, as determined by the commissioner of natural resources. When feasible, consideration must be given to accommodate trails on lands acquired. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Volunteers, staff, and contractors with Minnesota DNR completed enhancement and improvement activities on almost two-thousand acres of quality habitat on 75 of Minnesota's SNAs. A 10-acre wetland acquisition was added to Hastings SNA. Many thousands more people learned about, visited, or helped steward an SNA thanks to this funding.

OVERALL PROJECT OUTCOME AND RESULTS

Minnesota's Scientific and Natural Areas (SNAs) are public lands representing the state's best hope for protecting rare features and averting biodiversity loss. This appropriation strengthened the "science" in

SNA through monitoring-based habitat enhancement, citizen-science action and outreach, and strategic acquisition to protect additional high-quality natural lands. Over 1,930 acres across 75 SNAs were treated for terrestrial invasive species, received much-needed prescribed disturbance (e.g., prescribed fire, haying, etc.) or received other site improvement work, to maintain the overall quality of natural habitats for the rare and unique species that call these lands home. Such habitat work was guided by monitoring and site-assessment efforts taken on by staff as well as by volunteers: at least 190 SNA stewardship or interpretive events were held with an estimated attendance of nearly 6,000 participant volunteers donating thousands of hours to the educational, citizen-science, and stewardship aims of the SNA Program, led in part by the network of long-term volunteer Site Stewards serving at almost all SNAs by caring for the land and reporting observations. Online users observed upgrades to each SNA's webpage with improved interpretive narrative and consistent, unified themes; likewise, enhanced SNA social media presence and content have dramatically ramped up followers, subscribers, and forum membership numbers since this funding began, extending the reach and audience of the SNA Program on a variety of platforms to enhance public support for conservation. The project permanently protected a new tract consisting of 10 acres of high-quality wetland as an addition to Hastings SNA near the confluence of the Vermillion and Mississippi Rivers, important for water quality and for many special-concern and migratory bird species in the Mississippi flyway. Through this appropriation's support for programmatic acquisition work, around ten other SNA acquisition projects were recruited and developed, though several of these have proceeded instead on alternative funding.

PROJECT RESULTS USE AND DISSEMINATION

The SNA website is updated regularly, e.g., with improved species lists from monitoring efforts or for new or expanded SNAs, and with a frequently updated [events calendar](#) now also appearing in the "LCCMR Updates" e-newsletters. The 46th (Summer 2022) issue of the SNA [Nature Notes e-newsletter](#) was delivered to 10,790 subscribers (more than double since this appropriation began). The [SNA Facebook channel](#) now has ~9.1K followers, and the SNA Program contributes twice-monthly content to the [DNR Instagram channel](#). The [Minnesota SNAs Flickr group](#) has 108 members currently sharing over 1,500 high-quality photos of the beauty and diversity of Minnesota's SNAs.

Project Completed: 06/30/2022

FINAL REPORT

Subd. 09d Minnesota State Trails Acquisition, Development and Enhancement - \$1,038,000 TF (FY2017 - \$999,000 / FY2018 - \$39,000)

Kent Skaar

MN DNR, Division of Parks and Trails
500 Lafayette Rd, Box 25
St. Paul, MN 55155

Phone: (651) 259-5636
Email: Kent.skaar@state.mn.us
Web: <http://www.mndnr.gov>

Appropriation Language

\$999,000 in fiscal year 2017 and \$39,000 the first year are from the trust fund to the commissioner of natural resources for state trail acquisition, development, and enhancement in southern Minnesota. A proposed list of trail projects on authorized state trails must be provided as part of the required work plan. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project focused on expanding recreational opportunities and enhancing user safety on Minnesota's State Trails through the development of two new State Trail Segments, (1) the Casey Jones State Trail – Woodstock Segment, Pipestone County and (2) the Mill Towns State Trail – Cannon River Bridge and Trail Connection, Rice County.

OVERALL PROJECT OUTCOME AND RESULTS

As of June 30, 2020 the Minnesota Department of Natural Resources had completed the development of the two proposed new State Trail Segments, the Woodstock Segment of the Casey Jones State Trail near the community of Woodstock, Pipestone County and the new Mill Towns State Trail - Cannon River Trail Bridge and Trail in the City of Faribault, Rice County. Department of Natural Resources Engineering Staff completed all engineering and design required for the development of the two discrete trail segments and administered the associated construction contracts. All of the new State Trail infrastructure has been designed to meet the applicable requirements of the Americans with Disabilities Act (ADA) as well as trail design guidelines developed by Minnesota Department of Natural Resources and the Minnesota Department of Transportation. Although the Casey Jones State Trail Segment as originally proposed was to include the upgrading and bituminous surfacing of approximately 5 miles of the existing State Trail corridor, the project had to be revised when realized construction costs substantially exceeded the pre-design cost estimates. As revised, the Casey Jones State Trail Project consisted of the upgrading and improvement of the entire 5 miles of the existing State owned former railroad grade as originally proposed, however, the bituminous trail surfacing was limited to approximately 3 miles. The development of the new Mill Towns State Trail Cannon River Bridge and Trail has provided both the intended connection between the Mill Towns State Trail, the Sakatah-Singing Hills State Trail and the local trail system and a significant improvement in user safety realized through the elimination of the previously required "at-grade" crossing of TH21 at the Cannon River. Both of the new State Trail segments were substantially complete in 2019 and immediately opened to public use. Final project closeout was complete for both projects in late 2020.

PROJECT RESULTS USE AND DISSEMINATION

The Project's two Minnesota State Trail improvement and enhancement projects , the Casey Jones State Trail – Woodstock Segment and the Mill Towns State Trail – Faribault Canon River Bridge Crossing were completed through the collaborative and cooperative efforts of the Communities of Woodstock and Faribault, Pipestone County, the Friends of the Casey Jones Trail Association and the Mill Towns Trail Association. The Minnesota Department of Transportation's direct participation was also critical in the project's success. The project plans and specifications for each project were subject to review and approval by all project partners prior to implementation. Each of the project partners played a critical role in disseminating project information during both the design and construction phases of the projects. Following substantial completion of the Mill Towns State Trail – Cannon River Bridge and Trail Segment in Late 2019, the City of Faribault hosted a "Grand Opening and Ribbon Cutting". This event was held at the adjacent White Sands Trailhead, a municipally developed facility, and was well attended by members of the public and local dignitaries. Each of the communities and trail groups involved in

these projects remain active in advocating for further expansion and improvement of both the Casey Jones and Mill Towns State Trails. Each of the State Trail Maps published by the DNR have been updated to reflect the completed projects. The Environment and Natural Resources Trust Fund is acknowledged as a Project Partner on the Casey Jones Trailhead Sign in Pipestone and will be acknowledged with a sign that is to be affixed to the Mill Towns State Trail - Cannon River Bridge.

Project Completed: 06/30/2020

FINAL REPORT

Subd. 09e Native Prairie Stewardship and Prairie Bank Easement Acquisition - \$2,675,000 TF (FY2018)

Judy Schulte

MN DNR - SNA Program

1241 Bridge St E

Redwood Falls, MN 56283

Phone: (507) 637-6016

Email: judy.schulte@state.mn.us

Web: <http://www.dnr.state.mn.us/snus/index.html>

Appropriation Language

\$2,675,000 the first year is from the trust fund to the commissioner of natural resources to acquire native prairie bank easements in accordance with Minnesota Statutes, section 84.96, on approximately 335 acres, prepare baseline property assessments, restore and enhance at least 570 acres of native prairie sites, and provide technical assistance to landowners. Of this amount, up to \$132,000 may be deposited in a conservation easement stewardship account. Deposits into the conservation easement stewardship account must be made upon closing on conservation easements or at a time otherwise approved in the work plan. A list of proposed easement acquisitions must be provided as part of the required work plan. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Permanently protected 287 acres of high-quality historically undisturbed native prairie, which house state threatened and special concerns species, Species in Greatest Conservation Need and a wide variety of pollinators. Prairie enhancement (1,227 acres), outreach, monitoring and research activities were implemented across the state to improve prairie habitat.

OVERALL PROJECT OUTCOME AND RESULTS

Through this appropriation, 287 acres of high-quality native prairie, which house state threatened and special concerns species, Species in Greatest Conservation Need and a wide variety of pollinators, were permanently protected through 5 Native Prairie Bank conservation easements (see attached parcel list). Protection efforts, through this appropriation and others, preserve some of the best remaining native prairie in the state for current and future Minnesota Citizens benefit. These remaining native prairies function at a significantly higher level and provide habitat to more species of insects, birds, reptiles, and mammals than restored prairie. Additionally, 21 Baseline Property Reports and 53 monitoring events

were completed and stewardship funds for the 5 closed Native Prairie Bank easements were enrolled into the Conservation Easement Stewardship Account.

A total of 705 acres of invasive species control and 522 acres of prescribed disturbance were completed to improve prairie quality throughout the prairie region of the state. Adaptive Management Monitoring was completed on 50 Native Prairie Banks. Knowledge gained through this monitoring and research will help landowners, DNR land managers and partner agencies improve the management of native prairie and wetlands.

DNR Prairie Specialists participated in 8 outreach events and engaged over 215 different priority prairie landowners on prairie protection, restoration, and enhancement. Prairie Stewardship Plans were completed for 14 landowners providing site specific management recommendations. The “Prairies of Minnesota Landowner Handbook” was published in June of 2021. To-date 3,500 copies of the book have been distributed to landowners and conservation professionals. A [digital version of the book](#) can be found on the DNR website.

Throughout this appropriation many challenges were encountered. A decrease in payment rates caused a higher decline rate, more time needed by landowners to decide on enrollment and the need for increased staffing to accomplish acquisition goals. This did allow for the acquisition of more acres for less and the return of a significant amount of money to the Commission for use on other great conservation projects. A pandemic froze or limited the ability to do many tasks, but staff got creative and looked for alternative approaches to get the work done.

PROJECT RESULTS USE AND DISSEMINATION

Fourteen Prairie Stewardship Plans were provided to native prairie landowners. These plans will guide the landowner’s enhancement activities for well over a decade. The “Prairies of Minnesota Landowner Handbook” was published in June of 2021. To-date 3,500 copies of the book have been distributed to landowners and conservation professionals (who will continue to give the book to landowners managing prairies for years to come). A digital version of the book can be found here: <https://files.dnr.state.mn.us/assistance/backyard/prairierestoration/prairie-handbook.pdf>

All outreach materials produced through this appropriation followed ENRTF acknowledgement guidelines. Special thanks was given to ENRTF in the back cover of the book.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 09f Leech Lake Acquisition - \$1,500,000 TF (FY2018)

Joseph Fowler

Leech Lake Division of Resource Management
190 Sail Star Dr NE
Cass Lake, MN 56633

Phone: (218) 335-7400

Email: Joseph.fowler@llojibwe.org

Web: <http://www.llojibwe.org/drm/index.html>

Appropriation Language

\$1,500,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Leech Lake Band of Ojibwe to acquire approximately 45 acres, including 0.67 miles of shoreline of high-quality aquatic and wildlife habitat at the historic meeting place between Henry Schoolcraft and the Anishinabe people. The land must be open to public use including hunting and fishing. The band must provide a commitment that land will not be put in a federal trust through the Bureau of Indian Affairs.

Project Completed: 08/30/2018

FINAL REPORT

Subd. 09g Mesabi Trail Development - \$2,269,000 TF (FY2018)**Bob Manzoline**

St. Louis & Lake Counties Regional Railroad Authority
111 Station 44 Rd
Eveleth, MN 55734

Phone: (218) 744-2653

Email: bamnzoline@rrauth.com

Appropriation Language

\$2,269,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for engineering and constructing segments of the Mesabi Trail. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

Project due to be completed: 12/31/2022

FINAL REPORT

**4. M.L. 2016 Projects Completed
January 15, 2021 – January 15, 2023**

MN Laws 2016, Chapter 186, Section 2

M.L. 2016 Projects

[MN Laws 2016, Chapter 186](#), Section 2 (beginning July 1, 2016)

Visit [the LCCMR website](#) for the most up-to-date project information and reports

Subd. 04 Water Resources

Subd. 04s Agricultural and Urban Runoff Water Quality Treatment Analysis - Phase II - \$110,000 TF

Craig Austinson

Blue Earth County Drainage Authority
204 Fifth St S
Mankato, MN 56001

Phone: (507) 304-4253

Email: Craig.Austinson@blueearthcountymn.gov

Web: <http://www.co.blue-earth.mn.us>

Appropriation Language

\$110,000 the second year is from the trust fund to the Board of Water and Soil Resources for an agreement with the Blue Earth County Drainage Authority to continue monitoring a model demonstration for storage and treatment options in drainage systems designed to improve agricultural and urban water quality by reducing soil erosion, peak water flows, and nutrient loading. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The results will be used to implement the most cost effective BMPs and guide future maintenance to maximize the benefits and lifespan of the associated BMPs implemented on public drainage systems. The data can be used to inform larger watershed plans to meet local and state water quality goals.

OVERALL PROJECT OUTCOME AND RESULTS

Phase I Agricultural and Urban Water Quality Treatment Analysis data shows how combining agricultural best management practices (BMPs) on a public drainage system can significantly improve water quality in an agricultural landscape. Upon the completion of the Phase I report and analysis, the need for continued, and more detailed, monitoring was identified as well as a gap in available information on maintenance recommendations for the BMPs and associated costs.

Phase II analysis refined methodology and findings from targeted site location including Klein Pond, the two-stage ditch, and rate control weir. Monitoring samples were collected during 2016-2017 by graduate students at Minnesota State University – Mankato (MSU) and added to previously collected data in Phase I to develop long-term trends.

A formal report compiled the findings from Phase II. The report outlined the long-term effectiveness of BMPs, maintenance recommendations to ensure functionality and effectiveness of BMPs, and review of

BMPs lifetime costs to determine the most cost-effective water quality practices for drainage systems.

The report was published on the ISG website [here](#). The findings were presented at multiple virtual conferences reaching over 125 people. In addition, the report was sent in an email blast to 650+ individuals and was posted to social media to engage a larger audience and direct them to the website for more detailed information on findings.

The long-term study on CD 57 collected 10-years of monitoring data that provides decision makers and professionals with data to make informed decisions on having the greatest success with implementing and maintaining BMPs. Particularly in south-central Minnesota where drained agricultural lands dominate the landscape, a watershed approach to utilizing multi-purpose drainage management will play an integral role in meeting water quality goals. CD 57 can be used as a model for drainage systems and watersheds for implementing multiple BMPs with collaborative efforts from landowners, drainage authorities, county staff, and agencies. This project highlights the importance of long-term sustainable funding for water quality and resiliency programs targeting implementation of practices on agricultural lands.

PROJECT RESULTS USE AND DISSEMINATION

A formal report was developed supplementing the finding created in the Phase I report which summarized the monitoring data, long-term maintenance recommendation, and lifetime cost analysis. The report is posted to the ISG website [here](#). The findings were presented in workshops, conferences, virtual water storage tours, email blasts, posts to ISG's website, and social media threads for drainage staff, county commissioners, watershed district managers, watershed management organizations, landowners, agency staff, non-profit organizations, academics, water resources engineers, and others from Minnesota and Iowa.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 06 Aquatic and Terrestrial Invasive Species

Sub-Project 01: Fungi in Ash Trees: Towards Protecting Trees from Emerald Ash - \$500,000 TF

Robert Blanchette

U of M - Minnesota - MITPPC
1991 Upper Buford Circle
495 Borlaug Hall
St Paul, Minnesota 55108

Phone: (612) 625-0202

Email: robertb@umn.edu

Web: <http://forestpathology.cfans.umn.edu>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Important new findings have been obtained about the fungi associated with the emerald ash borer (EAB). This knowledge helps better understand the biology and ecology of EAB invasion and provides new biological control agents that can be used to help manage this invasive pest.

OVERALL PROJECT OUTCOME AND RESULTS

The emerald ash borer (EAB) is an exotic beetle that has been introduced into the United States and is currently causing serious losses of ash trees in Minnesota. To effectively manage this pest, it is essential to understand the biology and ecology of the beetle and associated microorganisms. Our research has identified the diverse fungi that are associated with EAB. These include 1) canker causing fungi that work along with EAB to kill trees, 2) aggressive pioneer decay fungi that enter EAB wounds and cause hazardous conditions in ash trees attacked by the beetle and 3) fungi that can kill EAB with potential use as biological control agents. Laboratory and field studies have been done to test the pathogenicity of selected fungi on eggs, larvae and adult EAB. These studies have shown that fungi can kill EAB, and several species have been evaluated and are now available for field trials. This method of control for EAB provides an additional tool that natural resource managers will be able to use to control the pest. Methods of spraying and injecting trees have also been tested. Other fungi obtained from EAB galleries produce lesions and pathogenicity studies show that several of these canker causing fungi work in concert with EAB to kill trees. We also have a better understanding of the pioneer species of decay fungi that come into wounds made by EAB. These fungi cause extensive decay and strength losses early in the colonization process resulting in affected ash to become hazardous. These results, which are especially important in the urban landscape, indicate that timely tree removal is needed to avoid hazards produced by EAB associated wood decay fungi. Our research results provide important new findings for integrated pest management that will benefit Minnesotans long into the future.

PROJECT RESULTS USE AND DISSEMINATION

Results have been disseminated in scientific publications, presentations, and news releases. This includes journal articles on the diverse fungi associated with the emerald ash borer and fungi from EAB that produce cankers in ash trees, as well as presentations on the ovicidal effects of fungi on EAB and other aspects of biological control and management of EAB. Numerous news releases on fungi attacking EAB, protecting Minnesota's ash trees and others have taken place.

Subproject 01 Completed: 06/30/2022

FINAL ABSTRACT

Sub-Project 02: Understanding the Benefits and Limitations of using Goats for Invasive Plant Control - \$445,533 TF

Tiffany Wolf

U of M - Minnesota - MITPPC
495L Animal Science/Veterinary Medicine
1988 Fitch Ave
St Paul, Minnesota 55108

Phone: (612) 625-0492

Email: wolfx305@umn.edu

Web: <https://www.vetmed.umn.edu/bio/veterinary-population-medicine/tiffany-wolf>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Targeted grazing by goats demonstrates some benefits for the control of invasive *Rhamnus cathartica* and the enhancement of native plant communities. While *P. tenuis* transmission to goats remains a

concern during invasive plant management, co-grazing goats with waterfowl may mitigate this seasonal disease risk.

OVERALL PROJECT OUTCOME AND RESULTS

The use of goats for invasive plant control is increasing, yet few data exist on the effects of goat browsing on invasive species populations or native plant community composition. The cost of this management strategy is also elevated in some regions due to mortality caused by a parasite of white-tailed deer, *Parelaphostrongylus tenuis*, that goats may be exposed to when browsing in areas where infected deer defecate. To address these issues, we used *Rhamnus cathartica* as a target species to quantify the short- and long-term effects of goat browsing for invasive plant control and non-target impacts on associated native plant communities. We found that goats provide temporary suppression of *R. cathartica* abundance but this invasive shrub rebounds following grazing cessation. Native vegetation was similarly temporarily suppressed, but in some cases native plant diversity reached higher levels following grazing treatments. A broader synthesis and meta-analysis of the targeted grazing literature revealed similar patterns for the effects of goats and other livestock used for targeted grazing of invasive or undesired plant populations. Importantly, consumption by goats kills the seed of *R. cathartica*, and other invasive plants with larger seeds, indicating that goats are unlikely to exacerbate invasions by spreading them to new areas. Finally, in evaluating the *P. tenuis* risk to goats, we conducted a retrospective study of *P. tenuis*-associated mortalities of small ruminants in Minnesota over a 19-year period, as well as examined whether co-grazing goats with waterfowl could reduce transmission risk through waterfowl consumption of the gastropod intermediate hosts that harbor this parasite. Overall, we determined that the *P. tenuis*-associated mortality rate of goats is low (<1%), though it is unclear how browsing for invasive plant control might affect this level. Through our co-grazing experiments, we found more gastropods in habitats after goats had browsed alone; however, we did not observe these increases when goats were co-grazed with waterfowl. In addition, waterfowl did not negatively affect overall gastropod abundance or diversity. Thus, waterfowl could reduce *P. tenuis* risk to goats without harming gastropod communities.

PROJECT RESULTS USE AND DISSEMINATION

Research highlights were regularly disseminated throughout the duration of our project. Over the course of our research, our project was featured in eight popular press articles within the midwest region, one Minnesota radio station and PBS's Prairie Lawn and Garden show. Our project team leveraged our research in 11 education events targeting primary, secondary, higher education-level students, and community members, and seven presentations to university, local, regional, and national scientific, natural resource management, and public audiences. We've also had four manuscripts published in peer-reviewed scientific journals, with a fifth nearing submission. Project highlights have also been shared on [Twitter](#).

Subproject 02 Completed: 06/30/2022

FINAL ABSTRACT

Sub-Project 03: Genetic Control of Invasive Insect Species: Phase I - \$296,655 TF

Michael Smanski

U of M - College of Biological Sciences

334A Gortner Lab

1479 Gortner Ave

St Paul, MN 55108

Phone: (612) 624-9752
Email: smanski@umn.edu
Web: www.mitppc.umn.edu

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

We have demonstrated (in lab cages) a powerful new approach to combat invasive insect pests. Genetically engineered male insects would be released to mate with wild females, who would not have offspring. This can crash a wild population, and it is applicable to any sexually reproducing insect.

OVERALL PROJECT OUTCOME AND RESULTS

With the overall goal of demonstrating our innovative genetic biocontrol approach in the pest insect Spotted Wing Drosophila, we had three specific objectives on this project: (i) demonstrate a proof-of-concept in the model laboratory insect and close cousin to SWD, *Drosophila melanogaster*, (ii) translate what we learned from *D. melanogaster* into the SWD species, and (iii) study the genome sequence of wild SWD so we can precisely design our engineered biocontrol agents to effectively suppress wild SWD populations in Minnesota.

Our outcomes and results for the first objective exceeded project expectations. We succeeded in making the proof-of-concept in *D. melanogaster*, and the engineered insects were 100% incompatible with wild-type flies. We made over a dozen versions. We also added additional genetic control elements to automatically sort the males from females, making the technology more economical to deploy for pest control.

We did not meet our objective two milestones (completing the engineering of SWD), however, we made good progress in that direction. Near the end of the award, we succeeded in making our first transgenic SWD flies, so we should be able to move quickly now in finishing the engineering process.

Our results from the third objective exceeded expectations. While we initially planned to sequence the genome of 20 wild-caught flies, we instead invented a new approach that allowed us to sequence the relevant genes from over 10,000 wild flies. We are using this data in our current engineering efforts with SWD.

This was a high-risk/high-reward project. We were able to overcome a tremendous amount of technical risk on the project so far, and the approach is looking very promising. We plan to continue to make progress towards Objective 2 in our second Phase of this project.

PROJECT RESULTS USE AND DISSEMINATION

We have disseminated our results through the normal channels available to academic labs (regional, national, and international conferences and workshops; peer-reviewed publications; patents; etc.). We are most proud of two high-impact publications from this work. The first was published in [Nature Communications](#) in 2020, and the [second](#) is currently undergoing peer review at a top-ranked journal. We will have at least two additional papers submitted in the next year that stem from this project.

Subproject 03 Completed: 02/28/2021

FINAL ABSTRACT

Sub-Project 04: Dwarf Mistletoe Detection and Management in Minnesota - \$433,250 TF

Marcella Windmuller-Campione

U of M - Department of Forest Resources
330G Green Hall
1530 Cleveland Ave N
St Paul, Minnesota 55108

Phone: (612) 624-3699

Email: mwind@umn.edu

Web: <https://forestecology.cfans.umn.edu>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

We were able to identify key considerations for the early detection of the invasive American dwarf mistletoe on jack pine, including different detection methods and the need for field-level biology and identification education for foresters and loggers.

OVERALL PROJECT OUTCOME AND RESULTS

American dwarf mistletoe is an invasive species that infects and kills jack pine, a native tree species of Minnesota. American dwarf mistletoe is not currently present in Minnesota but has been detected in neighboring Canadian provinces. The goal of our project was to utilize Minnesota's native dwarf mistletoe, eastern spruce dwarf mistletoe (ESDM), to explore options for detection and management. Just like American dwarf mistletoe, ESDM results in mortality for its host tree, black spruce. We tested different types of detection methods. Google Earth was able to detect mortality, but we were unable to determine if mortality was caused by ESDM. Winter sampling resulted in higher potential false positives due to snow cover on tree. Summer sampling provided a clear view of the trees but movement within the stands were more difficult. Summer sampling was also used to explore impact of ESDM on forest ecosystems. ESDM is not a binary variable; lower levels of ESDM in black spruce stand resulted in higher tree species diversity and did not negatively impact regeneration.

With this new insight we explored different methods for predicting ESDM at the individual tree level and at the stand level using multiple different datasets. At the landscape level, we identified areas that have greater potential for impact from ESDM and linked those with stand and environmental variables which can provide foresters and natural resource management tools to prioritize management.

An additional part of our project was conducting focus groups and surveys with foresters and loggers within northern Minnesota. We found variable opinions regarding management and knowledge about ESDM and foresters and loggers identified the need for additional information about mistletoe and more data on results of management. We identified the need for training as a key component when considering early detection for the invasive American dwarf mistletoe.

PROJECT RESULTS USE AND DISSEMINATION

Results have been shared through talks at local, regional, and national meetings. We shared results through a special symposium: [Lake States Lowland, Wet, and Floodplain Forests](#). Published papers include:

- [Influence of eastern spruce dwarf mistletoe on stand structure and composition in northern](#)

Minnesota,

- [The Difficulty of Predicting Eastern Spruce Dwarf Mistletoe in Lowland Black Spruce](#),
- [Results of a Qualitative Assessment of Northern Minnesota Loggers' and Foresters' Perspectives and Experiences with Dwarf Mistletoe in Black Spruce Stands](#), and
- [Results of a Survey of Minnesota Foresters Regarding Knowledge of and Treatment Practices for Dwarf Mistletoe in Black Spruce Stands in Northern Minnesota](#).

Subproject 04 Completed: 11/30/2021

FINAL ABSTRACT

Sub-Project 05: Developing Spatially Explicit Bio-economic Dispersal Model to Aid with the Management of Brown Marmorated Stink Bug - \$329,354 TF

Senait Senay

U of M - Department of Plant Pathology
248D Ruttan Hall
1994 Buford Avenue 248 Ruttan Hall
St Paul, Minnesota 55108

Phone: (612) 625-5249

Email: ssenay@umn.edu

Web: www.mitppc.umn.edu

Subproject 05 Completed: 07/18/2021

Effects of Starvation, Age, and Mating Status on Flight Capacity of Laboratory-Reared Brown Marmorated Stink Bug (Hemiptera: Pentatomidae)

Sub-Project 07: Building Mechanistic and Process based Species Distribution Models for Common Tansy and Leafy Spurge: from Landscapes to Genomes - \$351,188 TF

David Moller and Ryan Briscoe Runquist

U of M - Minnesota - MITPPC
410 Biological Sciences
1445 Gortner Ave
St Paul, Minnesota 55108

Phone: (612) 624-1037 - David Moeller

Email: moeller@umn.edu - David Moeller

rbriscoe@umn.edu - Ryan Briscoe Runquist

Web: www.mitppc.umn.edu

Subproject 07 Completed: 07/18/2021

FINAL ABSTRACT

Sub-Project 09: Genetic control of invasive insects, Phase 2 - \$60,000 TF

Michael Smanski
U of M - College of Biological Sciences
334A Gortner Lab
1479 Gortner Ave
St Paul, MN 55108

Phone: (612) 624-9752
Email: smanski@umn.edu
Web: www.mitppc.umn.edu

Subproject 09 Completed: 12/31/2022

FINAL ABSTRACT

Subd. 06c Advancing Microbial Invasive Species Monitoring from Ballast Discharge - \$368,000 TF

Research Project

Randall Hicks
U of MN - Duluth
1035 Kirby Dr, SSB 207
Duluth, MN 55812

Phone: (218) 726-8438
Email: rhicks@d.umn.edu

Appropriation Language

\$368,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to identify bacteria in ship ballast water and St. Louis River estuary sediments, assess the risks posed by invasive bacteria, and evaluate treatment techniques for effectiveness at removing the bacteria from ballast water. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Bacterial communities and pathogen-containing bacterial genera were characterized in ship ballast water, throughout the St. Louis River estuary including commercial dock areas and muskellunge habitats to better understand the risk of discharging ballast water from commercial ships into this estuary.

OVERALL PROJECT OUTCOME AND RESULTS

While culture-based methods to detect indicator bacteria reduce the cost and complexity to monitor ballast and harbor waters, caution should be used when monitoring based on these indicators alone because their fates are not necessarily representative of bacterial cells in some pathogen-containing genera. Both UV-treatment and chlorination resulted in >99% removal of culturable indicator bacteria, however, each indicator responded differently with no regrowth of Enterococcus, moderate regrowth of E. coli for chlorine treated samples, and major regrowth of total bacteria after treatment. There were shifts in overall bacterial community composition after treatment including regrowth of cells from

genera that harbor pathogens (particularly *Acinetobacter*, *Flavobacterium*, and *Pseudomonas*). Initially, *P. salmonis* DNA appeared to be present in the surface water of the St. Louis River estuary, but this result proved to be incorrect. This finding was confirmed by sequencing bacterial DNA at various sites in 2017 and 2019, which did not detect the presence of *Piscirickettsia* DNA. Bacterial communities and the pathogen-containing bacterial genera (PCGs) subset in water and sediments at four commercial docks in the Duluth-Superior harbor were different from other sites in the St. Louis River estuary. Higher relative abundances of PCGs were found in commercial dock sediments compared to the rest of the estuary. While there were only minor differences in the relative abundance of PCGs in surface water throughout the estuary, DNA from the *Flavobacterium* genus was more abundant at docks than other areas. Discharge of ballast water may affect the prevalence of PCGs in the Duluth-Superior harbor. Treatment of ballast water prior to discharge may reduce any human and wildlife pathogen load. In addition, care should be taken when dredging dock areas because disturbing sediment may temporarily increase the chances of exposing recreational users to pathogenic bacterial strains.

PROJECT RESULTS USE AND DISSEMINATION

In total during this project, three graduate students were trained, two M.S. degrees will be completed, four poster and four oral presentations were made at regional and national scientific conferences and venues, and project results were disseminated to collaborators and colleagues at the U.S. EPA Mid-Continent Ecology Division and the Duluth Seaway Port Authority in Duluth, MN. One M.S. thesis will be appended to this project final report and the other will be forwarded when it is completed.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 08 Methods to Protect, Restore, and Enhance Land, Water, and Habitat

Subd. 08a Bee Pollinator Habitat Enhancement - Phase II - \$387,000 TF

Marla Spivak

U of MN
1980 Folwell Ave, 219 Hodson Hall
St. Paul, MN 55108

Phone: (612) 624-4798

Email: spiva001@umn.edu

Web: <http://www1.umn.edu>

Appropriation Language

\$387,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to continue assessment of the potential to supplement traditional turf grass by providing critical floral plant resources to enhance bee pollinator habitat. Plant materials and seeds must follow the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Florally enhanced fine fescue lawns provide forage for diverse bee pollinators, maintain recreational and

aesthetic value, and reduce the need for irrigation, pesticides, fertilizers, and mowing. In response to demand, many local retailers now sell bee lawn seed mixes, a trend that will likely grow in Minnesota and nationally.

OVERALL PROJECT OUTCOME AND RESULTS

Our research demonstrates how small changes to a landscape can have meaningful conservation impacts on pollinators. Within Minneapolis parks, florally enhanced lawns (containing Dutch white clover, self-heal, and creeping thyme) had more diverse and distinct bee communities than lawns containing just Dutch white clover. Fifty-five species of wild bees were found foraging on Dutch white clover, and the vast majority were native species; however, *Apis mellifera*, the European honey bee, was the most common species. Seven bee species were found only on self-heal and not observed on Dutch white clover. The addition of flowers allows lawns to maintain their recreational and aesthetic value while still providing high-quality forage for pollinators. Park visitors supported bee lawns (95%) for their aesthetics and bee conservation, and city land managers emphasized need for education on the multiple benefits of bee lawns. Flowering lawns are highly sustainable, utilizing low-input fine fescues that reduce the need for irrigation, fertilizer applications, and mowing. Bee lawns encourage residents to view lawn flowers as food for bees rather than as a nuisance, reducing the perceived need to apply herbicides to the landscape. In addition, Bee lawns have become increasingly popular throughout the state of Minnesota as a result of this work; many local home and garden retailers in Minnesota now sell bee lawn mixes, which include both flower seeds and fine fescues. The Lawns to Legumes (L2L) program strives to make pollinator friendly lawns a trend nationwide. A newly funded grant will support bee lawn research integrated with other urban ecosystems questions: National Science Foundation: The Changing Nature of Cities: Ecological and Social Dynamics in the Minneapolis-St. Paul Urban Ecosystem. We see this as an excellent extension and expansion of the LCCMR project that will build future collaborations with Minnesota State agencies, Twin Cities municipalities, non-government organizations and businesses.

PROJECT RESULTS USE AND DISSEMINATION

There has been an amazing amount of interest by the general public about bee lawns. We have published four peer-reviewed research articles, have given dozens of talks, workshops, podcasts, field days, classroom lectures, and scientific conference presentations on bee lawns. Bee lawn materials are accessible on three different UMN websites geared toward different audiences (the general public on the UMN Extension site which gets hundreds of thousands of visits every year, turfgrass audiences on the Turfgrass Science website and entomology audiences on the Bee Lab website). Our continued outreach on bee lawns will reach many thousands of Minnesotans.

Project due to be completed: 06/30/2021

FINAL REPORT

Flowering Lawns in Minneapolis Parks - 1 pg

Bee Lawns - Turf Grass with Flowering Plants - 2 pgs

Bee Lawns: Installing - 2 pgs

Testing the Establishment of Eight Forbs in Mowed Lawns of Hard Fescue (*Festuca brevipila*) for Use in Pollinator Conservation - 7 pgs

Turfgrass Species Affect the Establishment and Bloom of Kura Clover (*Trifolium ambiguum*) in Lawns - 6 pgs

FLOWERING BEE LAWNS - A TOOLKIT FOR LAND MANAGERS - 14 pgs

Exploring park visitor perceptions of 'flowering bee lawns' in neighborhood parks in Minneapolis, MN, US - 12 pgs

Applying 'action situation' concepts to public land managers' perceptions of flowering bee lawns in urban parks - 10 pgs

Subd. 08b Measuring Pollen and Seed Dispersal for Prairie Fragment Connectivity – Research Project - \$556,000 TF

Lauren Sullivan

U of MN

1987 Upper Buford Cir, 100 Ecology Bldg
St. Paul, MN 55108

Phone: (612) 301-1056

Email: lsulliva@umn.edu

Appropriation Language

\$556,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to determine habitat connectivity between prairie fragments by measuring plant movement by dispersal of pollen and seeds to improve prairie restoration implementation. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project determined habitat connectivity between prairie fragments by measuring plant movement of 6 species by dispersal of pollen and seeds to improve prairie restoration implementation. New modeling approaches indicated that spillover from established/remnant prairies is a more complicated process than previous thought and requires different land management.

OVERALL PROJECT OUTCOME AND RESULTS

When restored prairies are adjacent to remnant prairies, rare species will move into and establish in these remnant prairies. This is a process we call spillover. Species that move into remnants tend to be dispersed by wind or animals. Over 1200 hectares of restored prairies benefit from spillover from remnant prairies in Minnesota.

We created an interactive map for managers in Minnesota to use to determine how landscape connectivity would change when they either 1) removed a remnant prairie, or 2) added a prairie to a location via restoration.

We learned that in Minnesota grasslands, if we model connectivity of our existing habitat fragments by incorporating an actual dispersal kernel, we get very different estimates of connectivity than when we use traditional approaches. This work demonstrates the importance of using dispersal kernels for measuring connectivity.

PROJECT RESULTS USE AND DISSEMINATION

This project has been presented at the Ecological Society of America conference in 2018 to an invited session on the role of space for coexistence as well as in 2019. Additionally, our team presented findings at the Botany Society meetings in 2019, 2020, and 2021 and various intuitional research talks in 2019 and 2020. The list of published papers associated with this project can be found in our Overall Project Outcomes.

One of the main outreach foci of this project was to provide conservation agencies and the MPCP with tools that they can use to determine the degree of habitat connectivity and the necessary size of corridors, to promote the spread of desirable species. To that end, we created and an app to the Nature Conservancy, and the MN DNR in March 2019. This app can be found at MN Connectivity.

Project Completed: 06/30/2020

FINAL REPORT

Apps can help bridge restoration science and restoration practice

Species diversity and dispersal traits alter biodiversity spillover in reconstructed grasslands

Consequences of ignoring dispersal variation in network models for landscape connectivity

Subd. 08d Evaluate Prescribed Burning Techniques to Improve Habitat Management for Brushland Species – Research Project - \$267,000 TF

Rebecca Montgomery

U of MN

1530 Cleveland Ave N

St. Paul, MN 55108

Phone: (612) 624-7249

Email: rebeccam@umn.edu

Appropriation Language

\$267,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to compare the effects on brushland habitat of conducting prescribed burning in spring, summer, and fall to provide improved management guidelines for wildlife habitat. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Lowland brush ecosystems provide critical habitat for a variety of wildlife. Lack of fire degrades habitat value. Our project suggests that prescribed burning in different seasons (e.g., spring, summer, fall) can be a tool to support a variety of outcomes, maintaining a diverse habitat that supports a diverse bird community.

OVERALL PROJECT OUTCOME AND RESULTS

Lowland brush ecosystems provide critical habitat for a variety of wildlife including over 80 Species of Greatest Conservation Need. These ecosystems depend on fire. Without fire, shrubs become dominant, reduce herbs, and reduce the quality of habitat for wildlife. Managers use prescribed burning as a tool in these ecosystems, conducting most burns in spring. We know that in other systems, summer and fall fires increase habitat value by creating patchiness in the vegetation. This patchiness supports greater plant and animal diversity. The objective of our project was to evaluate the effects of burn season on fire severity, woody and herbaceous plant communities, and breeding bird communities. Our goal was to understand whether burning in different seasons might improve brushland habitat to meet the needs of diverse wildlife and plants.

Four study sites were each broken into four 100-acre burn units including spring, summer, fall, and a control. At eight points per unit, we collected pre- and post-burn plant and breeding bird data. We

found similar levels of loss of aboveground shrub stems in all seasons in patches that burned. However, we found that spring burns burned more area than fall or summer. Overall, spring burns were the most successful at reducing woody stem density one year after burn. However, spring burns created a uniform layer of resprouting shrubs. This could reduce habitat quality. We found that when there was a greater variety of stem heights, we found more bird species. Thus, burning in just one season could homogenize brushlands reducing their value to wildlife. Overall, our project suggest that managers should view fire season as a tool to support a variety of outcomes and maintain a diverse habitat that supports a diverse bird community. Our data will be used to develop best management practices for brushland habitats.

PROJECT RESULTS USE AND DISSEMINATION

Our project results were presented at numerous regional meetings of natural resource managers, including several workshops focused specifically on the use of fire in management. In addition, two M.S. theses were completed ([Lori Knosalla](#) and [Annie Hawkinson](#)) with peer-reviewed publications in progress.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 08f - Forest Management for Mississippi River Drinking Water Protection - \$300,000 TF

Melissa Barrick

Crow Wing SWCD
322 Laurel St, Ste 13
Brainerd, MN 56401

Phone: (218) 828-6197

Email: melissa.barrick@crowwingswcd.org

Web: <http://crowwingswcd.org/>

Appropriation Language

\$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Crow Wing Soil and Water Conservation District to pilot a water protection approach for the watershed through development of forest stewardship plans and targeted riparian forest restoration projects. Any expenditures from this appropriation spent on forest management plans or restoration must be for lands with a long-term contract commitment for forest conservation, and the restoration must follow the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Keeping forests alive and surrounding our communities is vital for water protection, provides safe drinking water to residents, and benefits wildlife populations into the future. Landowners within the Camp Ripley Sentinel Landscape completed 76 forest stewardship plans totaling 13,104 acres and 38 water quality practices in their woodlands.

OVERALL PROJECT OUTCOME AND RESULTS

Forests provide vital functions including water protection, providing critical habitat for wildlife, and contributing resources which communities rely on. The conversion of land within the Camp Ripley Sentinel landscape is happening at an alarming rate. Upland forest lands within LSP have declined by 28 percent (200,000 acres). These riparian forest areas are threatened by rapid urban and rural residential development within the City of Baxter, Crow Wing, Cass, Morrison, and Todd Counties (MN 2010 Census Data). This project aimed to work with private residents and certified forest plan writers to engage landowners into completing a forest stewardship plan and implement a best Management Practice on their woodlands. These plans provide important information about their forest resources and make it easier to enroll into forest protection programs like the Sustainable Forest Incentive Act or 2c. Parcels were targeted based on modeling, MPCA watershed Restoration and Protection Plan goals, and the county water plan. Landowners were reached through mailings or talking with their local foresters or certified plan writers in the region. In total, 76 forest stewardship plans (13,104 Acres) were written by SWCD technicians or certified forest plan writers. All landowners were then enrolled into some form of forest protection program like a conservation easement, SFIA, or 2c. In addition, 38 water quality projects were implemented on those properties to benefit drinking water as well as improve wildlife habitat and forest resiliency. Minnesotans will directly benefit from this work because 1.7 million people draw their drinking water from the Mississippi River. Forests are natural filters which traps pollutants and treat stormwater before it enters a water body.

PROJECT RESULTS USE AND DISSEMINATION

Mailers and in-person meetings were the two main modes of communication with landowners in the LCCMR boundary. The SWCD produced countless materials that were sent to prioritized landowners about forest plans and water quality BMP's. The best success with outreach came from in-person meetings with landowners and certified forest stewardship plan writers. The plan writers already had a great working relationship with the community and could disseminate materials quickly and have those 1 on 1 conversations. The Crow Wing SWCD is developing a story map to present the successes to landowners and constituents. It will be an interactive map with resources for landowners.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 09 Land Acquisition, Habitat and Recreation

Subd. 09b Minnesota Point Pine Forest Scientific and Natural Area Acquisition - \$500,000 TF

Molly Roske

MN DNR

500 Lafayette Rd, Box 25

St. Paul, MN 55155

Phone: (651) 259-5094

Email: molly.roske@state.mn.us

Web: <http://www.dnr.state.mn.us/snus/index.html>

Appropriation Language

\$500,000 the second year is from the trust fund to the commissioner of natural resources in cooperation

with the Duluth Airport Authority to acquire approximately ten acres as an addition to the designated Minnesota Point Pine Forest Scientific and Natural Area located along the shores of Lake Superior in Duluth.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The effort to acquire 10 acres of high-quality old growth forest and beach dune habitat from the Duluth Airport Authority as a new addition to Minnesota Point Pine Forest SNA was unfortunately unsuccessful during this appropriation's time-frame. However, opportunities to bring these parcels under protection may yet exist.

OVERALL PROJECT OUTCOME AND RESULTS

This appropriation came about due to a Duluth Airport Authority (DAA) ENRTF proposal in 2015 for funds to transfer about 10 acres of outstanding biodiversity significance to the DNR to create a new addition to (and contiguous ownership and management of) the existing Minnesota Point Pine Forest Scientific and Natural Area (SNA). The appropriation was awarded in ML16 (FY17) to DNR's SNA Program instead, to purchase the parcels from DAA / the City of Duluth following a more typical acquisition project model. DNR worked with DAA to write their application for a public waters permit to build out into the St. Louis Estuary to realign the Sky Harbor airport's runway, and thereby release the flight-path airspace into which the old-growth pines have been vertically growing. DAA/FAA (Federal Aviation Administration) release of that designated airspace once the runway realignment was complete, and subsequent sale of those acres to the SNA Program, was included in DAA's application for the public waters permit, since several rare features and critical habitat would be thereby placed under permanent SNA protections. However, after at least two appraisals and several appropriation extensions, the City/DAA did not respond to the DNR's February 2021 offer at certified Fair Market Value, which has led to DNR's inability to complete this project with the appropriated funds on time. The City of Duluth was not successful in an attempt to amend the original appropriation language to allow for the remainder of these funds to be granted to the Duluth Airport for the runway re-alignment instead of as compensation for a sale of the land. Rather than returning unused funds at the end of the award to the ENRTF corpus, funds were reallocated by the Legislature to other projects on June 30, 2021. This effort involved years of collaboration and negotiation between the DNR and the City of Duluth / DAA, among other stakeholders involved including the Minnesota Legislature, the Duluth City Council, the FAA and LCCMR. While ultimately unsuccessful on this appropriation, opportunities for protecting these acres may yet exist.

PROJECT RESULTS USE AND DISSEMINATION

This project has had no results to disseminate to date. Because of this project's inability to progress into the latter stages of acquisition and designation, none of the work completed thus far (largely professional services for acquisition e.g. appraisals, and staff hours devoted to the project) was deemed appropriate for public dissemination.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 09g Otter Tail River Recreational Trail Acquisition - \$600,000 TF

Andrew Bremseth
City of Fergus Falls

112 Washington Ave W
Fergus Falls, MN 56537

Phone: (218) 332-5403
Email: andrew.bremseth@ci.fergus-falls.mn.us
Web: <http://www.ci.fergus-falls.mn.us>

Appropriation Language

\$600,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Fergus Falls to acquire approximately 16 acres along the Otter Tail River for a recreational trail and park. This appropriation is contingent on at least a \$400,000 match of nonstate money. Prior to the acquisition, a phase 1 environmental assessment must be completed and the city must not accept any liability for previous contamination of lands acquired with this appropriation.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The City of Fergus Falls proposed, but was unable, to acquire 3,476 lineal feet of frontage on the Otter Tail River.

OVERALL PROJECT OUTCOME AND RESULTS

The City of Fergus Falls proposed to acquire 3,476 lineal feet of frontage on the Otter Tail River. The former Mid-American Dairy property, a 28.9 acre industrial site fronting on the Otter Tail River in downtown Fergus Falls, is currently owned by the Fergus Falls Port Authority. In preparation for the acquisition by the City of Fergus Falls and with the guidance of a work plan approved by the MPCA, the site has been carefully returned to a green field site from its former industrial use and subdivided into two parcels, with 11.57 acres identified as the location of a multi-use non-motorized trail.

By obtaining 11.57 acres from the Port Authority, the City would ensure in perpetuity the protection of 3,476 lineal feet of river frontage and foster recreational activities led by trail development. The acquisition would provide public access to river frontage that was previously inaccessible as well as create a trail link that would provide a major point of future connectivity between the Central Lakes Trail and north bound Pelican to Perham Trail, with eventual connection to the Heartland Trail. The Dairy trail segment factored into trail master plans initiated and approved by the City of Fergus Falls and Otter Tail County and recognized as regionally significant by the Greater Minnesota Parks and Trails Commission.

Unfortunately, the City of Fergus Falls was unable to secure the approval of the DNR's Appraisal Management Unit for acquisition of the property, rendering the aforementioned project outcomes incomplete. It is therefore not clear that Minnesotans will benefit from the protection of and recreational access to the Otter Tail River in this location. The failure of this project suggests a rigidity of policy by State agencies that counteracts the will of the Legislature.

DNR comment:

The DNR's Attachment E process, which requires the review that Fergus Falls mentions, is designed to ensure that the will of the legislature regarding acquisitions with ENRTF funds is followed. ENRTF session law requires that we pay no more than 100% of appraised value, and Office of Grants Management Policy 08-11 states that we have a duty to monitor pass-through grants to the same standards applied to other state grants.

Accordingly, we apply to ENRTF pass-through grants the same appraisal quality standards that we apply to our own land acquisitions and those of competitive grants the DNR awards. We are tasked with conducting valuations in a way that is independent and unbiased for the protection of the funding sources and taxpayers of the State of Minnesota. Technical reviews are designed to ensure that the appraiser complied with USPAP and DNR Supplemental Guidelines on completing appraisals.

Fergus Falls submitted two appraisal reports, reviewed under two different qualified reviewers. In both cases the reviewer determined the appraisal met neither USPAP standards nor DNR Supplemental Guidelines. To reimburse using an appraisal determined to be inadequate would not have been consistent with the expectations set in appropriation law or OGM policy for the administration of these grants.

PROJECT RESULTS USE AND DISSEMINATION

This project has been closely monitored by both the City of Fergus Falls' City Council and the Fergus Falls Port Authority by in-person updates from the project manager.

Project Completed: 06/30/2022

FINAL REPORT

**5. M.L. 2015 Projects Completed
January 15, 2021 – January 15, 2023**

MN Laws 2015, Chapter 76, Section 2

M.L. 2015 Projects

[MN Laws 2015, Chapter 76](#), Section 2 (beginning July 1, 2015)

Visit [the LCCMR website](#) for the most up-to-date project information and reports

Subd. 03 Foundational Natural Resource Data and Information

Subd. 03g Minnesota Native Bee Atlas - \$790,000 TF

Robert Blair

U of MN

1980 Folwell Ave, #200

St Paul, MN 55108

Phone: (651) 644-1591

Email: blairrB@umn.edu

Web: <http://www.minnesotamasternaturalist.org>

Appropriation Language

\$790,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to supplement and enhance existing bee survey efforts by engaging citizens in helping to document the distribution and phenology of wild Minnesota bees and integrating data from all related bee survey efforts into a single publicly accessible, online tool and repository. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

The Minnesota Bee Atlas relied on volunteers to collect data on native bee distribution and diversity as well as previously unstudied nesting phenology. This data supplements existing information from the Minnesota DNR and UMN Insect Collection and can inform land management and policy decisions.

OVERALL PROJECT OUTCOME AND RESULTS

Although the plight of bees and other pollinators has been highlighted recently, the question of how bees are doing is complicated. There is still much to be known about which bees live where in Minnesota and their population status. From 2015 through 2019, volunteers documented over 25,000 bees in Minnesota as a part of the Minnesota Bee Atlas. They did this by submitting photos of bees to iNaturalist, adopting roadside survey routes to capture, identify and release bumble bees, and monitoring nesting blocks for stem-nesting bees.

Through this work, five species were documented that had previously not been recorded in Minnesota. While it's difficult to know if they are new arrivals or just newly documented, Minnesota is at the northern end of the range for 3 of those species and could be evidence of shifting ranges.

Non-lethal bumble bee sampling led to documentation of additional populations of the federally endangered rusty patched bumble bee (*Bombus affinis*). This data informs the US Fish and Wildlife Service species recovery plan.

The Bee Atlas documented nest structures and nest activity for stem-nesting bees that had not

previously been recorded. This information may inform management decisions that would impact the amount of forage or nesting habitat available for bees as changes could be made at times when bees are less active.

Finally, the Bee Atlas engaged members of the public beyond volunteer participants when volunteers became active in their own communities. Volunteers shared their knowledge of bees and pollinator conservation with youth scout groups, 4-H youth, Master Gardeners, Master Naturalists, and countless friends and neighbors.

PROJECT RESULTS USE AND DISSEMINATION

All records from the Bee Atlas can be found in publicly accessible databases, namely iNaturalist.org and the [Minnesota Biodiversity Atlas](#). Additionally, species-specific information such as seasonality, floral associations, and identification for bumble bees and stem-nesting bees can be accessed through the [University of Minnesota Extension](#). All volunteer training documents are also found on this page.

Publications relating to this work have been published in the [Journal of Melittology](#) and [The Great Lakes Entomologist](#).

Project Completed: 06/30/2021

FINAL REPORT

[Record of Anthophora \(Clisodon\) terminalis in a wooden trap-nesting block and comparison to available nesting information \(Hymenoptera: Apidae\) by Colleen Satyshur](#)
[Minnesota State Records for Osmia georgica, Megachile inimica, and Megachile frugalis \(Hymenoptera, Megachilidae\), Including a New Nest Description for Megachile frugalis Compared with Other Species in the Subgenus Sayapis by Colleen Satyshur](#)

Subd. 06 Aquatic and Terrestrial Invasive Species

Sub-Project 01: Garlic Mustard Biocontrol: Ecological Host Range of Biocontrol Agents - \$570,173 TF

Roger Becker

U of M - Department of Agronomy and Genetics
411 Borlaug Hall, 1991 Upper Buford Circle
St Paul, Minnesota 55108

Phone: (612) 625-5753

Email: becke003@umn.edu

Web: <http://appliedweeds.cfans.umn.edu/personnel>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

We were integral in the release of *Ceutorhynchus scrobicollis* in Canada, the first biological control agent for garlic mustard in North America. We moved closer to federal regulatory approval to release *C. scrobicollis* and *C. constrictus* in the United States. When achieved, these will offer the first viable control of garlic mustard in Minnesota woodlands.

OVERALL PROJECT OUTCOME AND RESULTS

Garlic mustard poses significant threats to our forest ecosystem. Research supported by this grant develops effective biological control of garlic mustard in Minnesota, the United States, and Canada, offering the first viable control option for this troublesome invasive plant. We gained a recommendation that *Ceutorhynchus scrobicollis* be considered for a release in the U.S. from the APHIS PPQ Technical Advisory Group. In follow-up consultation between USDA-APHIS-PPQ and USFWS, questions were generated that were intended to expedite writing the Biological Assessment for *C. scrobicollis*. Funding from this grant enabled us to address those questions with specific research on three federally listed species. COVID-19 altered our timeline, yet we will be submitting the third edition of the response in August 2021. This funding supported Entomology PhD candidate Mary Marek-Spartz analyze predictive tools used to determine the expected range of biological control insects introduced to a new region, define specific biological thresholds of *C. scrobicollis*, and develop a novel biennial stage-structured plant-herbivore population model. She improved the accuracy of this model through data generated in our monitoring efforts funded from this grant. Also supported on this grant, Project Scientist Dr. Katovich further defined the vernalization requirements for a garlic mustard which will greatly improve the accuracy of the projected range of garlic mustard in the US, a key factor in determining the risk of introducing specific biological control insects to North America. Additionally, she completed host specificity testing for *C. scrobicollis* and made significant progress towards completing the registration package for *C. constrictus*. We have a draft of the petition for the release of *C. constrictus* for biological control of garlic mustard. Due to technical difficulties in rearing threatened and endangered species out of their normal habitats, we will complete the few species needed at CABI, Delémont CH.

PROJECT RESULTS USE AND DISSEMINATION

Knowledge gains have been distributed widely through professional and land manager meetings. Additionally, we presented our findings to our colleagues at the triennial International Symposium on the Biological Control of Weeds, hosted in 2018 by our cooperators from CABI, CH. Generations.py is a software program publicly available with a novel biennial component enabling modelers to improve predictions of the dynamics and biology of biennial organisms. We played a key role in the first release of a biological control insect for garlic mustard in North America. Additionally, four to six papers will be published in professional journals. A petition for the release of *C. constrictus* will be submitted to USDA APHIS PPQ TAG this fall or early next spring.

Subproject 01 completed: 06/30/2021

FINAL ABSTRACT

Sub-Project 02: Mountain Pine Beetle, Phase II: Protecting Minnesota - \$445,347 TF

Dr. Brian Aukema

U of M - Minnesota - MITPPC
432A Hodson Hall, 1980 Folwell Ave
St Paul, MN 55108

Phone: (612) 624-1847

Email: baukema@umn.edu

Web: <https://www.entomology.umn.edu/faculty-staff/brian-aukema>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Repeated surveys did not find mountain pine beetle in Minnesota. Scant few individuals were captured dispersing far from active infestations in western states. We found that local bark beetles and predators do not optimally recognize the insect's chemical signals, however, suggesting that such components of invasion resistance might be low.

OVERALL PROJECT OUTCOME AND RESULTS

Surveys over the course of this project did not detect any mountain pine beetle in Minnesota. Although absence data cannot rule out inappropriate lure choices, testing of a new lure within the Black Hills of South Dakota where mountain pine beetle is endemic found that the conventional lure worked well. No improvements were noted when testing a new formulation. Long distance dispersal transects revealed that mountain pine beetles can be captured up to 30 miles away from active tree-killing outbreaks, but these singletons represented a fraction of a fraction of the population. Dispersal pressure was much lower in the last year of the project when beetles returned to endemic levels, which is the norm in western forests for decades at a time. Thus, we expect that the risk of mountain pine beetle reaching Minnesota by blowing from infestations in the Black Hills of South Dakota, which is approximately 500 miles away from the nearest mature pine forests in Minnesota, is extremely low. If mountain pine beetle was to arrive in Minnesota, it would have to establish into an environment with new flora (species of pines) and fauna (other species of bark beetles as well as their predators) to which it had never been exposed. The only species of pine common to the Black Hills and Minnesota is Scots pine; exposures to the fungus that mountain pine beetle carries revealed strong localized responses of Scots pine to the inoculation sites with defensive chemicals known as monoterpenes. Surveys of Minnesota's community of bark beetles, competitors, and predators responding to lures of mountain pine beetle in comparison to similar in the Black Hills revealed nuanced, regional variations in responses, but overall strong fidelity to cures of predators associated with local prey. Thus, we expect that predators or competitors in Minnesota would not optimally recognize the aggregation pheromone of mountain pine beetle. In one case with direct comparative tests in the Black Hills, we noted that one of the most common bark beetles that would potentially compete with mountain pine beetle in Minnesota, *Ips grandicollis*, avoids the lure of mountain pine beetle. We did note a few mountain pine beetles in traps baited with the aggregation pheromone of *Ips grandicollis* when the traps were placed far from active infestations of mountain pine beetle. This finding suggests that mountain pine beetle could respond to such pheromones as a "last-ditch" effort to find habitat during endemic periods where there are insufficient numbers to mass-attack, colonize, and kill large trees. If true, mountain pine beetle could find an endemic niche in Minnesota's pine forests. Because we still lack knowledge about how mountain pine beetles persist in endemic states, and whether colonization densities might actually be lower in other species of Minnesota's pines if they have lower defensive responses, continued vigilance against mountain pine beetle as a threat to Minnesota's pine forests is warranted.

PROJECT RESULTS USE AND DISSEMINATION

We have published one scientific paper from this work, with four more moving toward publication with peer-reviewed journal targets. We gave numerous regional, national, and even presentations as venues such as the Entomological Society of America, the IUFRO Conference on Biological Invasions in Forests, the North American Forest Insect Work Conference, North Central Forest Pest Workshop, Western Forest Insect Work Conference, Upper Midwest Invasive Species Conference, the Sustainable Forest Education Cooperative, State Forest Health Cooperators, Northern Advanced Silviculture Program, Minnesota Forest Industries, and MN Department of Natural Resources Forestry Team.

Subproject 02 completed: 12/31/2021

FINAL ABSTRACT

Colonization and reproduction of potential competitors with mountain pine beetle

Sub-Project 03: Biological control of the soybean aphid by *Aphelinus certus* - \$479,859 TF

George Heimpel

U of M - Department of Entomology
1980 Folwell Ave
St Paul, MN 55108

Phone: (612) 624-3480

Email: heimp001@umn.edu

Web: <https://www.entomology.umn.edu/faculty-staff/george-heimpel>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Results of this study indicate that the parasitoid *Aphelinus certus* provides sufficient mortality of soybean aphids to substantially decrease the need to apply insecticides against this pest.

OVERALL PROJECT OUTCOME AND RESULTS

Prior to the year 2000, the approximately seven million acres of soybeans in Minnesota suffered very little insect damage and were seldom subjected to insecticide applications. This changed with the arrival of the soybean aphid from Asia during that year. This aphid rapidly became the most important insect pest of soybeans due to its ability to substantially lower soybean yield when present at high densities on plants. This led to a 'new normal' that included widespread insecticide use in soybeans in Minnesota, with areas in excess of one million acres sprayed in bad aphid years. While predatory insects were capable of suppressing populations in some years, this level of control was not consistent. We noted the arrival of a new natural enemy of soybean aphid in Minnesota in 2011, however – the parasitoid *Aphelinus certus* – that appeared to have the potential to be a game changer. This insect lays its eggs into soybean aphids, and the developing larvae kill the aphids from within. Our main objective was to determine the extent to which this parasitoid could control populations of soybean aphids below the level that necessitates insecticide use. We also hoped to elucidate agronomic strategies that could lead to increased control by this parasitoid. Based upon a combination of laboratory, field and theoretical studies, we were able to show that *A. certus* is indeed capable for suppressing soybean aphid densities below the threshold levels that farmers use to initiate insecticide use. Our theoretical simulations suggested that such control occurs in approximately 10% of fields during a given year. These studies also pointed to overwintering success of the parasitoids as a critical factor determining the strength of aphid suppression. It therefore stands to reason that any agronomic factors that increase overwintering success improve the parasitoid's capability of suppressing soybean aphid.

PROJECT RESULTS USE AND DISSEMINATION

This research led to new analytical tools to analyze the ability of the parasitoid *Aphelinus certus* to control populations of the soybean aphid. It also provided novel information on the primary overwintering site of the parasitoid (within soybean fields) and aspects of its overwintering and diapausing strategy. This information can be used to predict when *A. certus* adults will emerge in a given field season. Lastly, the research quantified the extent of control provided by this parasitoid and generated novel hypotheses for how control can be improved.

We generated an analytical tool using a stage-based matrix modeling approach and published it in an open access Journal. This model can be modified based on environmental and life-history characteristics for this or similar host-parasitoid systems and the underlying R code is available upon request from the authors.

Subproject 03 completed: 09/30/2021

FINAL ABSTRACT

A matrix model describing host-parasitoid population dynamics: The case of Aphelinus certus and soybean aphid

Sub-Project 04: Decreasing Environmental Impacts of Soybean Aphid Management - \$570,000
TF

Dr. Robert Koch

U of M
1980 Folwell Ave
St Paul, MN 55108

Phone: (612) 624-6771

Email: koch0125@umn.edu

Web: <https://www.entomology.umn.edu/faculty-staff/robert-koch>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Management of soybean aphid relies on applications of broad-spectrum insecticides. This work aimed to decrease insecticide use and ameliorate associated environmental impacts through development of aphid-resistant soybean and advancement of remote scouting.

OVERALL PROJECT OUTCOME AND RESULTS

The invasion of US soybean by the soybean aphid resulted in dramatic increases in insecticide use, which has increased production costs for farmers and environmental and human-health risks. This proposal takes a two-pronged approach (preventative and therapeutic) to improve management of the soybean aphid through decreased insecticide input, which will result in increased environmental and economic sustainability of soybean production. Integration of preventative and therapeutic pest management tactics is fundamental to integrated pest management (IPM). For preventative management, we advanced the development and availability of aphid-resistant soybean. This included advancement of numerous resistant soybean lines already in the soybean breeding pipeline, including commercial release of one line. Furthermore, numerous crosses were made to incorporate different combinations of aphid-resistance genes into soybean lines, and to test and advance them through the pipeline. Novel research was also performed to examine the variability in susceptibility of aphid populations to these aphid resistant lines. For therapeutic management, we advanced the ability to use remote sensing for soybean aphid through a series of field experiments and technological advancements. Through caged experiments and open-field experiments, we documented that aphid-induced stress to soybean can be detected from drone-based sensors. In addition, through additional caged experiments we found that typical levels of defoliation (<5%) from another insect, the Japanese beetle, is unlikely to affect the ability to scout for soybean aphid; however, higher levels of defoliation (>33%) could impact scouting for

soybean aphid. In addition, we built hardware to host new algorithms for autopilots used to guide small drones for accurate and safe pest management missions. We have tested the algorithm in simulation and by post-processing data collected from flight tests. These advancements will help farmers prevent soybean aphid outbreaks through the use of aphid-resistant soybean and to more effectively respond to outbreaks through efficient drone-based scouting.

PROJECT RESULTS USE AND DISSEMINATION

An aphid-resistant variety stemming from the work has become commercially available. Results of this project have been actively disseminated to stakeholders and the scientific community. Project results were shared in extension presentations to farmers and agricultural professionals throughout the life of this project and a [video was created for stakeholders](#). A publication for stakeholders [listed available resistant soybean varieties](#). Updates on this work were also shared at several scientific conferences. This work has led to scientific publications on remote sensing [applications](#) and technology [\(2019, 2020, 2021\)](#), and [aphid-resistant soybean](#), and led to detection of a [new soybean pest](#).

Subproject 04 completed: 12/31/2021

FINAL ABSTRACT

Observability and Performance Analysis of a Model-Free Synthetic Air Data Estimator

Two-Stage Batch Algorithm for Nonlinear Static Parameter Estimation

Variation in Soybean Aphid (Hemiptera: Aphididae) Biotypes Within Fields

First Reports of Macrosaccus morrisella (Lepidoptera: Gracillariidae) Feeding on Soybean, Glycine max (Fabales: Fabaceae)

Detection of Stress Induced by Soybean Aphid (Hemiptera: Aphididae) Using Multispectral Imagery from Unmanned Aerial Vehicles

Air data fault detection and isolation for small UAS using integritymonitoring framework

Sub-Project 05: Optimizing Tree Injections against Emerald Ash Borer - \$320,000 TF

Brian Aukema

U of M - Department of Entomology
1980 Folwell Ave
St Paul, MN 55108

Phone: (612) 624-1847

Email: BrianAukema@umn.edu

Web: <https://www.forest-insects.umn.edu>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Emerald ash borer continues to spread and devastate Minnesota's urban forests, but deploying the right types of insecticides to ash trees in the right ways can offer tree conservation and protection with minimal risk to non-target organisms such as bees that visit flowers and worms that decompose leaves.

OVERALL PROJECT OUTCOME AND RESULTS

Emerald ash borer is an invasive insect that kills mature ash trees and has been spreading within Minnesota since its detection in 2009. Ash is a major component of many of Minnesota's urban forests. Injections of insecticides into ash trees can preserve trees indefinitely, but raises concerns for non-target

organisms in the environment such as bees and earthworms. For this study, we injected subsets of 1200 trees located in eight different cities in Minnesota with two different insecticides. We specifically tested products that were not neonicotinoids that have presented past risks to pollinators. Insecticides were injected into the trunks in summer of 2017, with periodic reapplications until 2020 while we measured crown health of each tree each summer until 2021. The original site selections were in cities with low pressure from emerald ash borer. We found over the four years of the study that injecting only half of the trees in a given site gave good protection to all trees. We were unable to determine, however, whether this associational protection (i.e., preservation of canopy in an untreated tree when proximate to a treated tree), winter mortality to EAB, or some combination of both was responsible for the site-wide excellent conditions that persisted five years after EAB was present in these communities. Measurements of tree phenology such as leaf out and leaf drop showed that insecticides did not alter the timing of such events. One of the insecticides, emamectin benzoate, showed excellent protection of ash seeds against seed weevils by the third year of the study, without affecting seed viability. We also canvassed the insect communities that visited the trees and harvested leaves for feeding trials with nontarget organisms, and measured chemical concentrations in the leaves. We found that insects communities were similar between treated versus untreated trees across seasons, that bees preferred visiting synchronously flowering plants such as flowering crab apples and rhododendrons versus ash trees, that trunk-injected chemicals were not reliably detected in all plant parts after injection, and that invertebrates such as worms showed no reduction in reproduction or feeding on treated leaves. As such, we concluded that detrimental effects of the insecticides tested on non-target organisms are not likely to be ubiquitous or widespread. In summary, when homeowners or communities are selecting a product to preserve urban ash trees, we recommend emamectin benzoate as a suitable and effective alternative to neonicotinoid-based products.

PROJECT RESULTS USE AND DISSEMINATION

This work has been submitted for publication at two peer-reviewed journals, with two more submissions planned. The work has been presented at regional, national, and international venues including workshops and conferences such as the Shade Tree Short Course, the Entomological Societies of Canada and America, the IUFRO Conference on Biological Invasions of Forests, the North American Forest Insect Work Conference, the Upper Midwest Invasive Species Conference, the USDA Interagency Annual Forum, and the North Central Forest Pest Workshop. A number of presentations were also given to local community forestry and resource manager groups throughout the project, and we enjoyed a high number of interactions with members of the public while working in their communities.

Subproject 05 completed: 12/31/2021

FINAL ABSTRACT

Effects of systemic insecticides against emerald ash borer on ash seed resources

Sub-Project 06: Distribution and Traits of the Fungal Pathogen *Fusarium Virguliforme* that Influence Current and Future Risk to Soybean and Other Legumes in Minnesota - \$383,581 TF

Dean Malvick and Kathryn Bushley

U of M - Department of Plant Pathology
1991 Upper Buford Circle
St Paul, MN 55108

Phone: 612-625-5282

Email: dmalvick@umn.edu

Web: <https://plpa.cfans.umn.edu/people/faculty/dean-malvick>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project has discovered factors that influence the ability of the fungus *Fusarium virguliforme* to become established as a destructive pathogen on crops in new areas of Minnesota. The results are foundational to understanding this pathogen and contribute to managing the diseases it causes on soybean and other crops.

OVERALL PROJECT OUTCOME AND RESULTS

The fungal pathogen *Fusarium virguliforme*, which causes sudden death syndrome (SDS) on soybean and root rot of other legumes, is an expanding problem for crop producers in Minnesota. Our research team has made discoveries regarding the pathogen's ability to spread and cause disease. First, a survey has confirmed the spread of the pathogen for the first time into seven counties in central and western MN. Second, studies of nutrient use suggest that *F. virguliforme* grows on a larger number of carbon and nitrogen sources than many other fungi in crop fields, likely giving it a competitive advantage. Analysis of competition between *F. virguliforme* and other fungi from crop fields revealed that while several fungi can inhibit its growth, multiple others are overcome by the pathogen, indicating it is a good competitor in soil and roots. Third, we determined it can survive to -40°C and thus its spread is not likely limited by cold temperatures. Fourth, in field and greenhouse experiments investigating host range, multiple crop species (black bean, pinto bean, kidney bean, and pea) showed symptoms of disease, and multiple other plant species were infected asymptotically. Fifth, we completed a study and a publication on genetic and pathogenic variation among *F. virguliforme* populations in Minnesota and the Midwest. While genetic groups did not correspond to aggressiveness, three genetic clusters were identified, with two clusters likely contributing most to spread of this fungus. Sixth, we completed initial analysis of genomes from 35 isolates to investigate genes involved in pathogenicity and abilities to invade new environments. The projected trained one M.S. level and one postdoctoral level scientist, expanding expertise for addressing invasive plant pathogens. This project significantly advances fundamental and applied knowledge of *F. virguliforme* that can be harnessed for disease management and risk analysis by scientists, agricultural professionals, and crop producers.

PROJECT RESULTS USE AND DISSEMINATION

This project has discovered multiple factors that influence the ability of *F. virguliforme* to spread and become established as a destructive pathogen on crops in new areas. Results have been presented via University of Minnesota Extension programs to key agricultural professionals and crop producers across Minnesota that contribute to managing this pathogen and the crop diseases it causes. Results have also been presented at scientific conferences and are being published in scientific journals.

Subproject 06 completed: 06/30/2021

FINAL ABSTRACT

Sub-Project 07: Tools to Distinguish Native from Exotic Reed Canary Grass - \$263,273 TF

Neil O. Anderson

U of M - Department of Horticultural Science
286 Alderman Hall

1970 Folwell Avenue
St Paul, MN 55108

Phone: (612) 624-6701
Email: ander044@umn.edu

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project used genetic techniques to find that most reed canarygrass in Minnesota is native to the state and not from Europe. Plant DNA was extracted from samples of reed canarygrass across the state. Due to this outcome, Tribal and State managers may choose to manage or preserve this species differently.

OVERALL PROJECT OUTCOME AND RESULTS

The goal of this project was to use molecular markers to determine native vs. exotic reed canary grass status in various locations across Minnesota growing along rivers (Des Moines, Minnesota, Mississippi, Red, Roseau, St. Croix), in fields, as commercially-grown cultivars (forage, ornamental), and preserved historic specimens in herbaria (<1940, presumed native) and a corollary set of samples from rivers in the Czech Republic as exotic comparisons (Activity 1); along Minnesota transportation corridors (highways) existing during the 1920s-1930s (Dust Bowl era) and Minnesota lakes (Bush, Cedar, Como, Phalen, Mille Lacs, Minnetonka, Square, White Bear) and Central Park (Activity 2). Due to Covid-19 travel restrictions, we were unable to get permission to collect along additional lakes. The number of plants analyzed totaled 3,430 (Activities 1,2). Plant DNA was extracted from each sample to determine genomic markers of short DNA sequences (2,889 highly differentiated single nucleotide polymorphisms, SNPs, out of 16,902 total markers) to distinguish native vs. exotic status. Genetic analysis of reed canarygrass showed that river populations are native Minnesota or North American types. Herbarium samples as well those from a native, unplowed field (Roseau, MN) were genetically similar to wild collections from five Minnesota rivers; forage cultivars in commercial fields (Roseau, MN) and along the Roseau River formed a separate group. The exotic central European populations were distinctly different from all native MN groups. Most variation is within (98.8%), rather than among (1.2%), populations, suggesting little divergence and a high level of shared genetic markers. Across the state, Minnesota rivers had 2-32 genetic variants present, some of which were shared among rivers. Thus, the majority of Minnesota reed canarygrass, while invasive, is native in origin and not exotic (European). Thus, based on this study, all of MN reed canarygrass is native; Tribal and State managers may choose to preserve this species.

PROJECT RESULTS USE AND DISSEMINATION

Dissemination of native vs. exotic status of all Phalaris results from Activity 1 has been reported on the Department of Horticultural Science website (<http://horticulture.umn.edu>), that of the PIs (<http://horticulture.umn.edu/directory/faculty/neil-oanderson>), as well as in all PIs/co-PIs Experts at umn.edu links (<https://experts.umn.edu/>). As many as 11 abstracts were published in national and international meetings, along with corollary public posters sessions or seminar talks to varied audiences of academics, land managers, students, and/or the public-at-large. We have kept State and Tribal Land Managers informed on the native status of MN reed canarygrass and have initiated discussions on approaches to managing this native species yet invasive. The investment by the state on control measures for this invasive grass warrant careful consideration of best management approaches to maintaining the native genetic diversity yet not encouraging the invasive spread of this grass into managed areas. Results were also communicated to the scientific community in peer-reviewed journal articles.

Subproject 07 completed: 06/30/2020

FINAL ABSTRACT

Sub-Project #8. Accurate detection and integrated treatment of oak wilt (*Bretziella fagacearum*) in Minnesota - \$356,382 TF

Jeannine Cavender-Bares

U of M - Department of Ecology, Evolution and Behavior, College of Biological Sciences
1475 Gortner Avenue
St Paul, MN 55108

Phone: (612) 624-6337

Email: cavender@umn.edu

Web: <http://cbs.umn.edu/cavender-bares-lab/home>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project developed methods and approaches for better detection of oak wilt using spectroscopic technology and documented best practices to prevent spread of the disease.

OVERALL PROJECT OUTCOME AND RESULTS

Our team has made substantial progress on the development of methods and approaches for accurate detection of oak wilt in Minnesota forest using spectroscopic technology. We have also documented best practices for management efforts to prevent spread of the disease. Specifically, we have completed physiological experiments demonstrating the disease can be differentiated from other stress factors under controlled conditions (Activity 1). A manuscript on the greenhouse seedling experiment using leaf and whole plant spectroscopic data to differentiate oak wilt from bur oak blight and drought has been published in *Tree Physiology*. We have advanced analyses and ground-truthing of AVIRIS NG airborne imagery including model development and spectral index development for stress physiology in response to the oak wilt disease (Activity 2). In an outdoor field experiment using naturally growing oak saplings at the Cedar Creek Ecosystem Science Reserve, oak saplings were inoculated with oak wilt and compared to healthy saplings using leaf and canopy spectroscopy. Results indicate that physiological disease symptoms can be readily detected using spectral sensors at both leaf and canopy scales using statistical models and simple indices from spectral features linked to physiological stress. Lastly, treatments were completed at 20 oak wilt sites with a new “double plow line” to prevent spread of the disease through root grafts. Initial assessments indicate the approach is highly effective, but a final determination will be made 5 years after treatment, beyond the life of this project (funding secured from USDA Forest Service). Two postdoctoral scientists, a technical scientist, a first-year graduate student and two undergraduate research assistants received training and mentoring during the project.

PROJECT RESULTS USE AND DISSEMINATION

Our team has disseminated new knowledge from this project to local, regional, national and international audiences. A significant peer-reviewed publication has already come from this project (Beth Fallon, Anna Yang, Cathleen Lapadat, Isabella Armour, Jennifer Juzwik, Rebecca A Montgomery, Jeannine Cavender-Bares. 2020. Spectral differentiation of oak wilt from foliar fungal disease and drought is correlated with physiological changes. *Tree Physiology* 40(3): 377–390, <https://doi.org/10.1093/treephys/tpaa005>). Others are in development. The team delivered 11 talks,

three posters, and one field tour to professional audiences. In addition, the project was featured in The Minnesota Daily and Market Science (scientific engagement at farmers' markets).

Subproject 08 completed: 06/30/2020

FINAL ABSTRACT

Sub-Project 10: Management Strategies for the Invasive Spotted Wing Drosophila - \$478,876
TF

Mary Rogers

U of M - Department of Horticultural Science
1970 Folwell Ave
St Paul, MN 55108

Phone: (612) 624-8871

Email: roge0168@umn.edu

Web: <http://fruit.cfans.umn.edu>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Our project developed new cost-effective methods to help growers manage damage and reduce yield loss caused by the invasive Spotted-wing drosophila in small fruit while reducing pesticide use. Additionally, we have gained basic knowledge on the behavior and flight capabilities of this pest that will contribute to future management strategies.

OVERALL PROJECT OUTCOME AND RESULTS

Spotted wing drosophila (*Drosophila suzukii*, SWD) is an invasive fly that lays eggs in intact, ripening fruit such as blueberries, strawberries, and raspberries. This pest has caused considerable economic losses for small fruit growers. First detected in MN in 2012, SWD threatens 750 acres of raspberries, strawberries, grapes, and blueberries, in addition to its 5,000 high tunnel operations statewide. At the start of our project, current control tactics were limited to repeat applications of broad-spectrum insecticides that failed to adequately protect fruit from infestation, in addition to posing risks to the environment. Additionally, we faced gaps in understanding the basic biology ad behavior of SWD, such as migration and overwintering in Minnesota, which hindered our ability to recommend appropriate management strategies. To address this, we proposed three goals: 1) develop SWD forecasting tool using local migration and overwintering data; 2) investigate efficacy of alternative management techniques; and 3) research economic impact and develop decision making tools. As a result of our work, we have indirect evidence showing that SWD may be overwintering and little evidence that the SWD has the flight capabilities for long-distance movement. We learned that physical exclusion can effectively reduce SWD damage and is cost-effective for small farms and reduces the need for insecticide sprays. Our work on biopesticides and novel repellants shows promising results in the lab but is less consistent in the field, warranting new methods to increase field efficacy. Economically, we found that SWD is responsible for at least \$2 million in losses annually to raspberry growers alone, establishing the need for management for the statewide fruit industry, and growers can benefit from adopting physical exclusion and biological based pesticides. Our science-based management recommendations for this best improves overall sustainability of small fruit production in Minnesota.

PROJECT RESULTS USE AND DISSEMINATION

Our project has resulted in six peer-reviewed publications in scientific journals, eight academic presentations, over thirty talks to grower audiences and dozens of online newsletters, articles, and blog submissions, and a [grower decision making tool](#). Grower recommendations are available on the [FruitEdge website](#) and archives on the [UMN Extension Fruit and Vegetable News](#). Through this work, we have leveraged an additional \$750,000 in federal funds to further develop sustainable production and pest management techniques for small fruit in Minnesota.

Subproject 10 completed: 08/31/2021

FINAL ABSTRACT

Sub-Project 11: Will Future Weather Favor Minnesota's Woody Invaders? - \$514,325 TF

Peter Reich

U of M - Department of Forestry
220F Green Hall
1530 Cleveland Avenue North
St Paul, Minnesota 55108

Phone: (612) 624-4270

Email: preich@umn.edu

Web: <https://www.forestecology.cfans.umn.edu>

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Our findings tell the story of how exotic honeysuckle and buckthorn have invaded Minnesota forests, how and why new areas are likely to be invaded in the future, and how we may be able to mitigate invasion using native tree species.

OVERALL PROJECT OUTCOME AND RESULTS

Glossy buckthorn, common buckthorn, tatarian honeysuckle, and morrow's honeysuckle are woody species that have been introduced to Minnesota forests from other continents. All four species frequently dominate forests and exclude native plant species. Warming temperatures and continued dispersal of these species are likely to significantly increase their abundance throughout Minnesota, especially in northern Minnesota. However, most effort by researchers and managers alike has been given to reactive measures against invasion instead of increased understanding of invasion processes and/or preventative measures. This project evaluated the climate sensitivity of these four invasive species in a way that provides for more accurate threat assessment of each throughout the state and provides tools for Minnesotans to potentially slow invasion into new areas and protect Minnesota's forests. We analyzed growth rings of 274 trees to determine how quickly invasive species spread and characterize how native and invasive species have responded to past growing conditions. We found that growth rates of invasive buckthorn and honeysuckle are most similar to native cherries and ashes in southern Minnesota, but that the invasive species already are growing much faster than those native species in northern Minnesota. Within a forest, we found that buckthorn tended first to invade hilltops and subsequently spread to low-lying areas at a rate of 3-4m yr-1 (slower than honeysuckle, which spread at 6 m yr-1). We experimentally assessed 10 native species in addition to the four invaders to determine which are favored by changing temperature and rainfall patterns (i.e. their responses to future climate). We found invasive and more southern native species to be favored by warming

conditions in terms of their growth and survival, whereas more northern native species were often strongly disfavored. We established programs to detect current invasion at fine-scale spatial resolution and predict future invasion based on the findings above, and set up long-term experiments to test the ability of tree plantings to slow invasion into new areas.

PROJECT RESULTS USE AND DISSEMINATION

Results from this project were disseminated through multiple avenues, including conference presentations, journal articles, and popular media. Principally, dissemination efforts focused on academic journals. We have submitted one manuscript detailing results from Activity 2 for peer review. Three other manuscripts related to the project are in preparation and will be submitted during the spring of 2022. We are also collaborating with National Geographic for a feature on work supported by this grant, primarily results associated with Activity 2.

Subproject 11 completed: 12/31/2021

FINAL ABSTRACT

Subd. 08 Methods to Protect, Restore, and Enhance Land, Water, and Habitat

Subd. 08b Propagating Native Plants and Restoring Diverse Habitats - \$495,000 TF

Ashley Brenke

Martin County Soil and Water Conservation District
923 N State St, Ste 110
Fairmont, MN 56031

Phone: (507) 235-6680

Email: ashley.martinswcd@gmail.com

Web: <http://www.martinswcd.net>

Appropriation Language

\$495,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Martin County Soil and Water Conservation District for a cooperative 13-county effort by Blue Earth, Brown, Cottonwood, Crow Wing, Faribault, Freeborn, Jackson, Lake, Le Sueur, Martin, Nicollet, Waseca, and Watonwan Counties to protect and expand native forest and prairie habitat for species in greatest conservation need in four regions of the state through collection and propagation of local ecotype native plants, habitat restoration efforts, and educational outreach. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This project enhanced the number and variety of native plant species on sites across the state of Minnesota. By working with a variety of partners, we were able to reach citizens from the border of Iowa up to Lake Superior, and teach many people about the importance of native habitats.

OVERALL PROJECT OUTCOME AND RESULTS

Minnesota is blessed to have a variety of habitats all across the state. The Thirteen Counties project focused on improving those diverse habitats by restoring uncommon native plant species. This had a secondary benefit of also providing habitat for other at-risk species. Local sourced species were chosen for planting that matched the growing conditions on the restoration site. Species selection was made depending on local

species availability and the characteristics of the sites.

Plant materials were collected locally from species that have little or no presence in restorations. Over 50,000 plants were propagated of 50 different species. Prior to establishing new native plant species on site, invasive species sometimes had to be removed. Restorations occurred on over 15 different sites across the state. Funds were directly used on sites in 4 different counties and technical assistance was provided to projects in 2 additional counties. While projects did not occur in 7 of the counties, project participants still heard updates about grant progress at regional meetings in southcentral Minnesota. The degree of invasive species removal varied from site to site. Some of the invasive species removed during this project were Common Tansy and Japanese Barberry. Resilient native species, such as Grass Leaved Goldenrod, were planted in place of the invasive species with the goal of being able to out-compete the invasive species long term. In Cottonwood County, for example, invasive buckthorn was removed and replaced with local dogwood shrubs.

Martin SWCD and project partners reached over 700 people (volunteers, students, etc.) through direct interaction at planting events and workshops. Thousands more were reached through social media, newsletters, radio, and local newspapers. Over 20 workshops and trainings were held as well. Some of the workshops were hands-on activities in the field, where others were more general topics in a classroom that focused on the difference between native and invasive species. Martin SWCD staff was able to share the knowledge they have gained about plant propagation from previous projects with other Southern Minnesota counties and with project partners at Crow Wing and Lake County SWCDs. The education transferred from experienced SWCD staff to new SWCD staff will be invaluable for years to come.

The most important achievement of this project is the number of people who learned more about habitats native to their region of the state. Individuals will take this knowledge and work on promoting and protecting native species in their own backyard, and pass it on for future generations to learn.

PROJECT RESULTS USE AND DISSEMINATION

Activities under this project were disseminated using a variety of different methods. Restoration sites were shown on Facebook as well as in videos on YouTube. Project information was also shared with numerous school classes, local elected Boards, volunteer organizations (Rotary Club, etc.), conservation clubs and at County Fairs. This project work was also covered in local newsletters and websites of the partner Soil and Water Conservation Districts. Over the years of the project, there were also a number of media outlets covering project work.

Project Completed: 06/30/2021

FINAL REPORT

Subd. 09 Land Acquisition for Habitat and Recreation

Subd. 09i Mesabi Trail Development Soudan to Ely - Phase II - \$1,000,000 TF

Bob Manzoline

St. Louis and Lake Counties Regional Railroad Authority
111 Station Rd
Eveleth, MN 55734

Phone: (218) 744-2653
Email: bmanzoline@rrauth.com

Appropriation Language

\$1,000,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for the right-of-way acquisition, design, and construction of segments of the Mesabi Trail, totaling approximately seven miles between Soudan and Ely. This appropriation is available until June 30, 2018, by which time the project must be completed and final products delivered.

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

This segment, approximately 3 miles, of the Mesabi Trail starting from Highway 169 underpass to County Road 88 has been completed. We were able to construct the trail on portions of the former railroad grade, however, we ran into many road blocks from landowners that wouldn't allow for the trail to be on their property. Several alternative routes were considered. Right-of-way, environmental permitting, trail design, engineering and construction were completed with the best available route for this paved segment of the Mesabi Trail. We also came across old culverts needing replacement and were able to complete the project within our budget.

OVERALL PROJECT OUTCOME AND RESULTS

Completing the Mesabi Trail segment from the Highway 169 underpass to County Road 88 required the following analysis criteria and steps: route alternatives analysis; historic/cultural resource; social, economic and environmental effects; agency coordination; reports, notices and hearings; wetland delineation and mitigation; and final outcome. Four alternative routes were considered and evaluated, with the best final route determined by the above analysis. There were many delays encountered after selecting the route, namely right-of-way acquisitions. Originally, we were looking to use the abandoned railroad grade for the majority of this trail segment. However, many landowners owned parcels along the grade not allowing for easements. We again needed to adjust our trail route and moved approximately 1.0 mile to be along the Highway 169 right-of-way. This in turn, needed further environmental wetland, impact evaluations and engineering. In the end, approximately 18 acres through 22 parcels were acquired with easements, fee title, lands that the Regional Railroad Authority purchased and Limited Use Permits required to be alongside the highway right-of-way. All were purchased with non-ENRTF funds. Other items not anticipated were two culverts needing replacement as they were deteriorating and required adequate water flow away from the trail and other landowner's properties. Construction of the trail, COVID and personnel were other setbacks on completing this segment. With these unanticipated events, we were able to complete this trail project under budget. This segment of the Mesabi Trail near Ely, MN will be enjoyed by outdoor recreationalists for many years to come and are another segment closer to completing the continuous path of the Mesabi Trail from Grand Rapids to Ely.

PROJECT RESULTS USE AND DISSEMINATION

This trail segment was discussed at a public meeting held for another segment of trail, known as "Camp Lake Road to Highway 1/169 Underpass," and received recognition in the Ely Echo News. This trail segment has also been presented at local gatherings such as Ely Rotary, Ely City Council, Morse Township Board of Commissioners, Ely Chamber of Commerce, Ely Economic Development Authority and Visit Ely Convention & Visitors Bureau. Mesabi Trail news and updates are provided through a variety of media, marketing and publications. Web site is: Mesabitrail.com.

Project Completed: 12/31/2022

FINAL REPORT

**6. M.L. 2014 Projects Completed
January 15, 2021 – January 15, 2023**

MN Laws 2014, Chapter 226, Section 2

M.L. 2014 Projects

[MN Laws 2014, Chapter 226](#), Section 2 (beginning July 1, 2014)

[MN Laws 2014, Chapter 312](#), Article 12, Section 8 (beginning July 1, 2014)

Visit [the LCCMR website](#) for the most up-to-date project information and reports

Sec. 08 Invasive Terrestrial Plants and Pests Center

Sec. 08 Invasive Terrestrial Plants and Pests Center - Research Project - \$1,460,000 TF

Rob Vennette

U of M - Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC)
1992 Folwell Avenue
St Paul, Minnesota 55108

Phone: (612) 301-1405

Email: venet001@umn.edu

Web: <http://www.mitppc.umn.edu/>

Appropriation Language

\$490,000 in 2015 is from the environment and natural resources trust fund for the Invasive Terrestrial Plants and Pests Center requested under this act, including a director, graduate students, and necessary supplies. This is a onetime appropriation and is available until June 30, 2022.

\$970,000 from the environment and natural resources trust fund appropriated in Laws 2011, First Special Session chapter 2, article 3, section 2, subdivision 9, paragraph (d), Reinvest in Minnesota Wetlands Reserve Acquisition and Restoration Program Partnership, is transferred to the Board of Regents of the University of Minnesota for the Invasive Terrestrial Plants and Pests Center requested under this act, including a director, graduate students, and necessary supplies and is available until June 30, 2022.

Project Overview

Terrestrial invasive species are species that are not native to a location and that pose critical ecological and economic challenges once they become established in that location. They come in the form of plants, animals, insects, pathogens, and microbes that can cause harm to natural habitat, urban landscapes, and agricultural systems. The problems posed by terrestrial invasive species continue to grow as existing infestations expand and new exotic species arrive, many of which are poorly understood. New ideas and approaches are needed to develop solutions and to stay on top of emerging threats. The University of Minnesota is using this appropriation to help launch a new interdisciplinary Terrestrial Invasive Species Research Center charged with using scientific findings to support policy-making, application, and resource management practices that address the terrestrial invasive species affecting Minnesota. The center will coordinate initiatives focused on prevention of establishment, early detection and rapid response, development of new control methods and technology, integrated pest management, and minimizing non-target impacts of control. Proven tools and techniques developed at the center are intended to be implemented statewide as applicable.

Sub-Projects M.L. 2014, Sec. 08:

- [01](#): *Novel Diagnostic Tools for Rapid and Early Detection of Oak Wilt* - \$271,911
- [02](#): *Early Detection, Forecasting and Management for Halyomorpha halys* - \$616,081
- [03](#): *Climate Change and Range Expansion of Invasive Plants* - \$206,335
- [04](#): *Cover It Up! Using Plant to Control Buckthorn* - \$327,000
- [05](#): *Terrestrial Invasive Species Prioritization* - \$32,000

SOUND BITE OF PROJECT OUTCOMES AND RESULTS

Funding enabled the establishment of the Minnesota Invasive Terrestrial Plants & Pests Center (MITPPC). MITPPC now drives discoveries to prevent or reduce threats posed by priority invasive species to Minnesota lands. We bring University-of-Minnesota researchers together with partners from around the state, taking a programmatic approach to make thoughtful research investments and solve complex problems.

OVERALL PROJECT OUTCOME AND RESULTS

MITPPC, established by the Minnesota Legislature in 2014, has become a national leader in research to protect Minnesota's forests, prairies, wetlands, and agricultural lands from invasive species. Under this first appropriation, MITPPC set up its internal operations; established an advisory board, comprised of representative stakeholders from agriculture and natural resource sectors; developed a prioritization process and document upon which the RFP was based; made five research awards; and worked with LCCMR staff to appropriately document an ENRTF appropriation of this scope. Significant accomplishments include:

- Sub-project #1: Dr. Abdennour Abbas and his team developed novel detection and diagnostic tools for the oak wilt pathogen, generating patents and significant publications with spin-off applications for other invasive pathogens. These new technologies will reduce the time necessary to confirm the pathogen.
- Sub-project #2: Dr. William Hutchison and his team greatly improved our understanding of the biodynamics of the brown marmorated stinkbug, *Halyomorpha halys*. A stinkbug app ("The Midwest Stinkbug Assistant") and climate suitability models by Drs Twine and Snyder were important contributions for early detection and management of this pest.
- Sub-project #3: Drs. David Moeller and Ryan Runquist completed a deep dive into climate and range maps for 10 current and emerging invasive plants, including Palmer amaranth. Their maps can guide management decisions about surveillance and eradication efforts for these species.
- Sub-project #4: Dr. Peter Reich and colleagues have demonstrated the utility of planting native plants to help manage common buckthorn. Their findings suggest managers can simultaneously increase forest health, inhibit invasion, and reduce the need for investment in future buckthorn removals.
- Sub-project #5: Dr. Amy Morey provided critical on-going research into terrestrial invasive species (TIS) prioritization. A research publication summarizes MITPPC's unique approach to the process that has been applied to more than 200 TIS and drives its requests for research proposals.

PROJECT RESULTS USE AND DISSEMINATION

The MITPPC's impact can be measured by the dissemination of its applied results. In-person interviews and engagements (108 presentations around the state) and peer-reviewed publications (e.g., 12 papers in high profile journals as *Restoration Ecology*, the *Journal of Economic Entomology*, and the *Journal of Biogeography*) provide initial outlets to share progress of the Center. MITPPC amplifies these messages

and engages broader, diverse audiences through social media and on-line content, such as [MITPPC's website](#), [Twitter account](#), and [YouTube channel](#) and these messages are further amplified through other outlets (e.g., local press, newsletters, etc.).

Project Completed: 06/30/2022

FINAL REPORT - 64 pgs

Managing Invasive Buckthorn - 14 pgs

A participatory method for prioritizing invasive species: Ranking threats to Minnesota's terrestrial ecosystems - 10 pgs

- **Spreadsheet of all research projects completed between January 1, 2021 and December 31, 2022.**

Environment and Natural Resources Trust Fund (ENRTF)
 Research Projects completed between January 1, 2021 and December 31, 2022
 Full abstracts are included in Section III. Completed Research Projects

Year	Subd.	Title	Organization	Project Manager	Funding Amount
2014	Sec 8	Minnesota Invasive Terrestrial Plants and Pests Center	U of MN - MITPPC	Robert Venette	\$ 1,460,000
2015	06a-01	Sub-Project 01: Garlic Mustard Biocontrol: Ecological Host Range of Biocontrol Agents	U of MN - MITPPC	Roger Becker	\$ 600,000
2015	06a-02	Subproject #2: Mountain pine beetle, Phase III: Protecting Minnesota	U of MN - MITPPC	Brian Aukema	\$ 444,982
2015	06a-03	Subproject #3: Biological control of the soybean aphid by Aphelinus certus	U of MN - MITPPC	George Heimpel	\$ 479,859
2015	06a-04	Subproject #4: Decreasing environmental impacts of soybean aphid management	U of MN - MITPPC	Robert Koch	\$ 570,000
2015	06a-05	Subproject #5: Optimizing tree injections against emerald ash borer	U of MN - MITPPC	Brian Aukema	\$ 318,927
2015	06a-06	Subproject #6: Distribution and Traits of the Fungal Pathogen Fusarium Virguliforme that Influence Current and Future Risk to Soybean and Other Legumes in Minnesota	U of MN - MITPPC	Dean Malwick	\$ 383,651
2015	06a-07	Sub-Project 07: Tools to Distinguish Native from Exotic Reed Canary Grass	U of MN - MITPPC	Mary Rogers	\$ 263,273
2015	06a-08	Sub-Project #8. Accurate detection and integrated treatment of oak wilt (<i>Bretziella fagacearum</i>) in Minnesota	U of MN - MITPPC	Jeannine Cavender-Bares	\$ 356,382
2015	06a-10	Subproject #10: Overwintering, Migration and Development of Cost-Effective Practical	U of MN - MITPPC	Mary Rogers	\$ 477,541
2015	06a-11	Subproject #11: Will Future Weather Favor Minnesota's Woody Invaders?	U of MN - MITPPC	Peter Reich	\$ 526,000
2016	06a-01	MITPPC - Phase III - Fungi in Ash Trees: Towards Protecting Trees from Emerald Ash Borer and New Diseases	U of MN	Robert Blanchette	\$ 500,000

Environment and Natural Resources Trust Fund (ENRTF)
 Research Projects completed between January 1, 2021 and December 31, 2022
 Full abstracts are included in Section III. Completed Research Projects

Year	Subd.	Title	Organization	Project Manager	Funding Amount
2016	06a-02	MITPPC - Phase III - Understanding the Benefits and Limitations of Using Goats for Invasive Plant Control	U of MN	Tiffany Wolf	\$ 445,533
2016	06a-03	Sub-Project 03: Genetic Control of Invasive Insect Species: Phase I	U of MN	Michael Smanski	\$ 296,655
2016	06a-04	Sub-Project 04: Dwarf Mistletoe Detection and Management in Minnesota	U of MN	Marcella Windmuller-Campione	\$ 433,250
2016	06a-05	Sub-Project 05: Developing Spatially Explicit Bio-economic Dispersal Model to Aid with the Management of Brown Marmorated Stink Bug	U of MN	Senait Senay	\$ 329,354
2016	06a-07	Sub-Project 07: Building Mechanistic and Process based Species Distribution Models for Common Tansy and Leafy Spurge: from Landscapes to Genomes	U of MN	David Moller and Ryan Briscoe Runquist	\$ 351,188
2016	06a-09	Sub-Project 09: Genetic control of invasive insects, Phase 2	U of MN	Michael Smanski	\$ 60,000
2016	06c	Advancing Microbial Invasive Species Monitoring from Ballast Discharge	U of MN - Duluth	Randall Hicks	\$ 368,000
2016	08b	Measuring Pollen and Seed Dispersal for Prairie Fragment Connectivity	U of MN	Lauren Sullivan	\$ 556,000
2016	08d	Evaluate Prescribed Burning Techniques to Improve Habitat Management for Brushland Species	U of MN	Rebecca Montgomery	\$ 267,000
2017	03c	Preserving Minnesota Prairie Plant Diversity – Phase II	U of MN	Ruth Shaw	\$ 900,000
2017	03f	Assessment of Microbes for Improving Wild Rice Restoration	U of MN - Duluth NRRI	Chan Lan Chun	\$ 334,000
2017	03k	Cedar Creek Natural Area Wolf Recolonization Assessment	U of MN	Forest Isbell	\$ 398,000
2017	03l	Effects of Wolf Predation on Beaver, Moose, and Deer	Voyageurs National Park	Steve Windels	\$ 293,000

Environment and Natural Resources Trust Fund (ENRTF)
 Research Projects completed between January 1, 2021 and December 31, 2022
 Full abstracts are included in Section III. Completed Research Projects

Year	Subd.	Title	Organization	Project Manager	Funding Amount
2017	03m	Mapping Taxonomy and Environmental Toxicology of Minnesota Freshwater Sponges	U of MN	Anthony Schroeder	\$ 258,000
2017	04b	Wastewater Nitrogen Removal Technology to Protect Water Quality	U of MN	Paige Novak	\$ 450,000
2017	04e	Reassessing Toxicity of Petroleum Spills on Groundwater and Surface Water	St. Thomas University	Dalma Martinovic-Weigelt	\$ 300,000
2017	06a	Aquatic Invasive Species Research Center - Phase II	U of MN - MAISRC	Nicholas Phelps	\$ 2,700,000
2017	06a-04.3	Social Learning and Carp Removal	U of MN - MAISRC	Przemek Bajer	\$ 189,475
2017	06a-08.2	Impacts of Invader Removal on Native Vegetation Recovery	U of MN - MAISRC	Daniel Larkin	\$ 119,034
2017	06a-12.2	Historical Analyses of Spiny Water Flea Invasion Patterns	U of MN - MAISRC	Donn Branstrator	\$ 53,795
2017	06a-15	Determining Highest Risk Vectors of Spiny Water Flea Spread	U of MN - MAISRC	Valerie Brady	\$ 26,581
2017	06a-16.2	AIS Impacts on Walleye Populations and Mercury Concentrations	U of MN - MAISRC	Gretchen Hansen	\$ 199,862
2017	06a-18.2	Genetics to Improve Hybrid and Eurasian Watermilfoil Management	U of MN - MAISRC	Raymond Newman	\$ 236,423
2017	06a-20	A Novel Technology for eDNA Collection and Concentration	U of MN - MAISRC	Abdenour Abbas	\$ 96,264
2017	06a-21.2	Field validation of multibeam sonar zebra mussel detection (Year 1)	U of MN - MAISRC	Jessica Kozarek	\$ 14,247
2017	06a-22	Copper-Based Control – Zebra Mussel Settlement and Non-Target Impacts	U of MN - MAISRC	James Luoma	\$ 152,090
2017	06a-23	AIS Management: An Eco-economic Analysis of Ecosystem Services	U of MN - MAISRC	Amit Pradhananga	\$ 110,245
2017	06a-24	Genetic Method for Control of Invasive Fish Species	U of MN - MAISRC	Michael Smanski	\$ 140,004
2017	06a-25	What's in Your Bucket? Quantifying AIS Introduction Risk	U of MN - MAISRC	Nicholas Phelps	\$ 84,094

Environment and Natural Resources Trust Fund (ENRTF)
 Research Projects completed between January 1, 2021 and December 31, 2022
 Full abstracts are included in Section III. Completed Research Projects

Year	Subd.	Title	Organization	Project Manager	Funding Amount
2017	06a-28	Evaluating Innovative Coatings to Suppress Priority AIS	U of MN - MAISRC	Mikael Elias	\$ 51,234
2017	06a-30	Managing Midwestern Aquatic Invasions in a Changing Climate	U of MN - MAISRC	Ranjan Muthukrishnan	\$ 39,000
2017	07a	Extraction of Solar Thermal Energy in Minnesota	U of MN	Lian Shen	\$ 250,000
2017	08c	Evaluating the Use of Bison to Restore and Preserve Savanna Habitat	U of MN	Forest Isbell	\$ 388,000
2017	08e	Enhancing Spawning Habitat Restoration in Minnesota Lakes	U of MN - St. Anthony Falls Laboratory	William Herb	\$ 294,000
2018	03e	Assessing Natural Resource Benefits Provided by Lichens and Mosses	U of MN	Daniel Stanton	\$ 213,000
2018	03g	Conserving Minnesota's Forest Birds of Management Concern	U of MN - Duluth NRRI	Alexis Grinde	\$ 500,000
2018	03h	Mapping Avian Movement in Minnesota	U of MN - Duluth NRRI	Alexis Grinde	\$ 200,000
2018	03j	Develop Sonar Data Mapping on Three Rivers to Assess Suitability for Native Mussel Habitat	National Park Service	Nancy Duncan	\$ 200,000
2018	03k	Conserving Minnesota's Nine Species of Freshwater Turtles	Minnesota Zoo	Seth Stapleton	\$ 300,000
2018	04f	Evaluate Emerging Pathogens in Lakes, Rivers, and Tap Water to Keep Drinking Water Safe	U of MN	Timothy LaPara	\$ 325,000
2018	04h	Mapping Antibiotic Resistance in Minnesota to Help Protect Environmental, Animal, and Human Health	U of MN	Randall Singer	\$ 750,000
2018	06c	Evaluate Control Methods for Invasive Hybrid Cattails	Voyageurs National Park	Steve Windels	\$ 131,000
2018	06f	Determining Risk of a Toxic Alga in Minnesota Lakes	Science Museum of Minnesota - St. Croix	Adam Heathcote	\$ 200,000
2018	08f	Develop Strategies for Timber Harvest to Minimize Soil Impacts to Maintain Healthy and Diverse Forests	U of MN	Charles Blinn	\$ 200,000

Environment and Natural Resources Trust Fund (ENRTF)
 Research Projects completed between January 1, 2021 and December 31, 2022
 Full abstracts are included in Section III. Completed Research Projects

Year	Subd.	Title	Organization	Project Manager	Funding Amount
2018	08g	Restoring Wetland Invertebrates to Revive Wildlife Habitat	MN DNR	Megan Fitzpatrick	\$ 400,000
2018	10a	Subproject 01 - State-Wide Reconnaissance of SARS-CoV-2 in Drinking Water Supplies	U of MN	Timothy LaPara	\$ 59,297
2019	03c	Quantifying Exposure of Minnesota's Raptors to Mercury and PFAS	Hawk Ridge Bird Observatory	Matthew Etterson	\$ 250,000
2019	03g	Mapping Habitat Use and Disease of Urban Carnivores	U of MN	Nicholas McCann	\$ 500,000
2019	03i	Den Boxes for Fishers and other Nesting Wildlife	U of MN - Duluth NRRI	Michael Joyce	\$ 190,000
2019	03j	Red-headed Woodpeckers as Indicators of Oak Savanna Health	U of MN	David Andersen	\$ 171,000
2019	03q	Forest and Bioeconomy Research	U of MN - Duluth NRRI	Rolf Weberg	\$ 2,200,000
2019	03r	Minerals and Water Research	U of MN - Duluth NRRI	Rolf Weberg	\$ 883,000
2019	04d	Quantifying Microplastics in Minnesota's Inland Lakes	U of MN - Duluth	Kathryn Schreiner	\$ 200,000
2019	04i	Extracting Deicing Salt from Roadside Soils with Plants	U of MN	Bo Hu	\$ 360,000
2019	04m	Setting Realistic Nitrate Reduction Goals in Southeast Minnesota	U of MN	John Nieber	\$ 350,000
2019	04n	Mapping Unprofitable Cropland for Water and Wildlife	Science Museum of Minnesota - St. Croix	Jason Ulrich	\$ 100,000
2019	04o	Evaluating Locally Sourced Materials for Road Salt Reduction	U of MN - Duluth NRRI	Chan Lan Chun	\$ 162,000
2019	07a	Development of Clean Energy Storage Systems for Farms	U of MN - WCROC	William Northrop	\$ 650,000

IV. Agency Implementation

“recommendations to implement successful projects and programs into a state agency’s standard operations;”

No recommendations are being advanced at this time.

V. Recommendations

“to the extent known by the commission, descriptions of the projects anticipated to be supported by the trust fund during the next biennium;”

There is \$79,644,000 available for expenditure in each year of the FY24-25 biennium from the ENRTF (for a biennial total of \$159,288,000). The amount available for expenditure is determined by the Minnesota Constitution, which states: “The amount appropriated each year of a biennium....may be up to 5.5% of the market value of the fund on June 30 one year before the start of the biennium”. The value of the ENRTF on June 30, 2022 was \$1,448,074,000.

The LCCMR is making a funding recommendation to the 2023 Legislature totaling \$79,833,000 (FY24) which includes \$79,644,000 from the ENRTF and \$189,000 from the Great Lakes Protection Account (GLPA). \$79,644,000 (FY25) would be available for recommendation by the LCCMR to the 2024 Legislature. As stated in M.S. 116P, the LCCMR may make an annual or a biennial funding recommendation.

The list of FY24 recommended appropriations totaling \$79,833,000 from the ENRTF and GLPA is provided in “Section V. Recommendations.” The projects and funding levels were adopted by the LCCMR on August 30, 2022. The proposed legislative bill language is pending review by LCCMR at our upcoming meeting in January.

M.L. 2023 Environment and Natural Resources Trust Fund (ENRTF)
Summary of LCCMR Recommendations for FY 2024

Process for M.L. 2023

For FY 2024 (July 1, 2023 -June 30, 2024), approximately \$79 million is available for funding from the Environment and Natural Resources Trust Fund (ENRTF) and approximately \$189,000 is available from the Great Lakes Protection Account (GLPA).

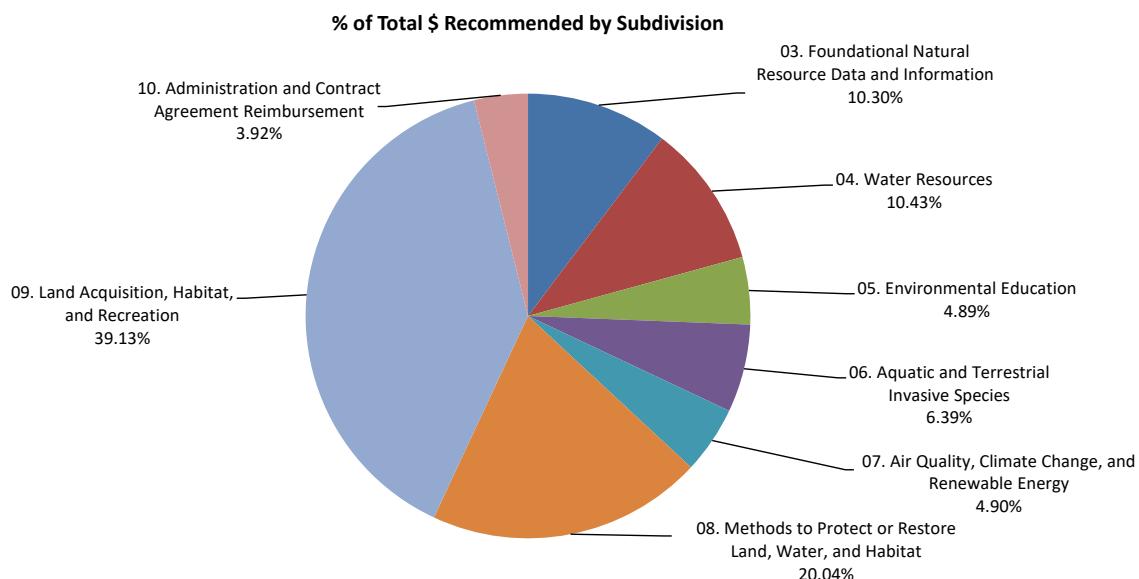
As of August 30, 2022, the Legislative-Citizen Commission on Minnesota Resources (LCCMR) has selected 85 projects totaling \$79,833,000 to recommend to the 2023 Minnesota Legislature for funding from the ENRTF and the GLPA. The recommendations are a result of the LCCMR's 2023 Request for Proposal (RFP) process in which 174 proposals requesting a total of approximately \$164 million were received and considered through a competitive, multi-stage evaluation. The recommendations range from funding the full proposal and dollar amount requested to partial funding for specific proposal elements.

Check the LCCMR schedule for the most up-to-date information and important process dates.

March 25, 2022	RFP Issued
May 26, 2022	RFP Proposal Deadline (174 proposals received totaling ~\$164 million)
July 25, 2022	Selection of Proposals for Further Consideration and Presentations
August 8-10 & 16-17, 2022	Proposal Presentations
August 30, 2022	Allocation and Recommendations
September - November, 2022	Recommended Projects Undergo Work Plan Development; Research Projects Undergo Peer Review
December 8 & 20, 2022	Appropriation Language Review and Adoption

Summary of Recommendations by Subdivision

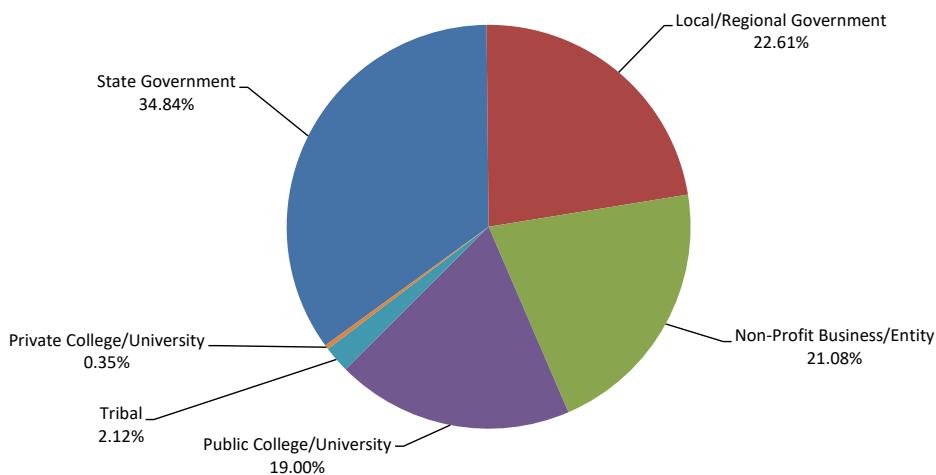
Subdivision	\$ Recommended	\$ Percent	# Recommended	# Percent
03. Foundational Natural Resource Data and Information	\$8,219,000	10.30%	19	22.35%
04. Water Resources	\$8,328,000	10.43%	13	15.29%
05. Environmental Education	\$3,905,000	4.89%	8	9.41%
06. Aquatic and Terrestrial Invasive Species	\$5,104,000	6.39%	2	2.35%
07. Air Quality, Climate Change, and Renewable Energy	\$3,913,000	4.90%	6	7.06%
08. Methods to Protect or Restore Land, Water, and Habitat	\$15,997,000	20.04%	18	21.18%
09. Land Acquisition, Habitat, and Recreation	\$31,241,000	39.13%	15	17.65%
10. Administration and Contract Agreement Reimbursement	\$3,126,000	3.92%	4	4.71%
Total	\$79,833,000	100.00%	85	100.00%



Summary of Recommendations by Proposer Affiliation

Affiliation Type	\$ Recommended	\$ Percent	# Recommended	# Percent
State Government	\$27,813,000	34.84%	21	24.71%
Local/Regional Government	\$18,050,000	22.61%	17	20.00%
Non-Profit Business/Entity	\$16,832,000	21.08%	21	24.71%
Public College/University	\$15,166,000	19.00%	24	28.24%
Tribal	\$1,693,000	2.12%	1	1.18%
Private College/University	\$279,000	0.35%	1	1.18%
Total	\$79,833,000	100.00%	85	100.00%

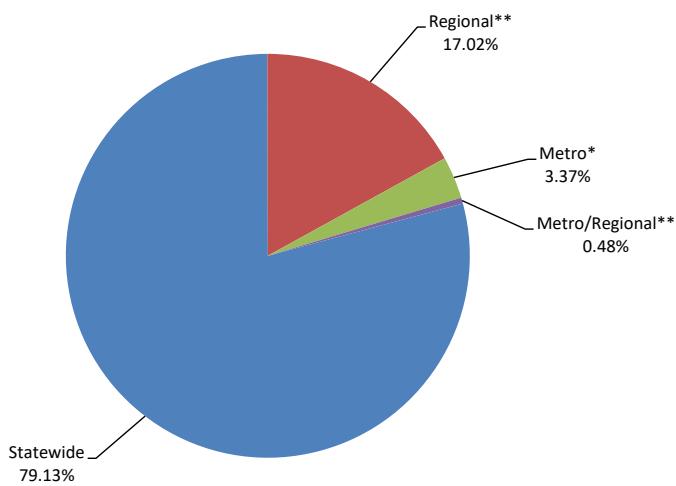
% of Total \$ Recommendations by Proposer Affiliation



Summary of Recommendations by Area of Impact

Areas of Impact	\$ Recommended	\$ Percent	# Recommended	# Percent
Statewide	\$63,170,000	79.13%	62	72.94%
Regional**	\$13,587,000	17.02%	16	18.82%
Metro*	\$2,692,000	3.37%	5	5.88%
Metro/Regional**	\$384,000	0.48%	2	2.35%
Total	\$79,833,000	100.00%	85	100.00%

% of Total \$ Recommended by Area of Impact



* "Metro" region includes the 11 counties of Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, and Wright.

** "Regional" means area of impact is less than "Statewide" but includes one or more regions of the state ("Northwest", Northeast", "Central", "Southwest", or "Southeast") other than the 11-county "Metro" region.

M.L. 2023 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Recommendations for FY 2024

For FY 2024 (July 1, 2023 -June 30, 2024), approximately \$79 million is available for funding from the Environment and Natural Resources Trust Fund (ENRTF) and approximately \$189,000 is available from the Great Lakes Protection Account (GLPA). As of August 30, 2022, the Legislative-Citizen Commission on Minnesota Resources (LCCMR) has selected 85 projects totaling \$79,833,000 to recommend to the 2023 Minnesota Legislature for funding from the ENRTF and the GLPA. The recommendations are a result of the LCCMR's 2023 Request for Proposal (RFP) process in which 174 proposals requesting a total of approximately \$164 million were received and considered through a competitive, multi-stage evaluation. The recommendations range from funding the full proposal and dollar amount requested to partial funding for specific proposal elements.

Topic Area	\$ Recommended	Percentage of Total Recommendation
Subd. 03 Foundational Natural Resource Data and Information 19 Recommendations	\$8,219,000	10.30%
Subd. 04 Water Resources 13 Recommendations	\$8,328,000	10.43%
Subd. 05 Environmental Education 8 Recommendations	\$3,905,000	4.89%
Subd. 06 Aquatic and Terrestrial Invasive Species 2 Recommendations	\$5,104,000	6.39%
Subd. 07 Air Quality, Climate Change, and Renewable Energy 6 Recommendations	\$3,913,000	4.90%
Subd. 08 Methods to Protect or Restore Land, Water, and Habitat 18 Recommendations	\$15,997,000	20.04%
Subd. 09 Land Acquisition, Habitat, and Recreation 15 Recommendations	\$31,241,000	39.13%
Subd. 10 Administration, Emerging Issues, and Contract Agreement Reimbursement 4 Recommendations	\$3,126,000	3.92%
Total Recommendations	\$79,833,000	100.00%

Fund Source	\$ Amount
FY 2024 - Environment and Natural Resources Trust Fund (ENRTF)	\$79,644,000
Great Lakes Protection Account (GLPA)	\$189,000
Total \$	\$79,833,000

M.L. 2023 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Recommendations for FY 2024

Subd.	Proposal ID	Title	LCCMR Total Recommended Amount (FY24)	Organization	Project Manager	Region*
Subd. 03 Foundational Natural Resource Data and Information (19 Recommendations = \$8,219,000)						
03a	2023-044	Assessing Restorations for Rusty-Patched and Other Bumblebee Habitat	\$75,000	Friends of the Mississippi River	Alex Roth	Metro
03b	2023-066	Removing Barriers to Carbon Market Entry	\$482,000	U of MN, College of Food, Agricultural and Natural Resource Sciences	John Zobel	Statewide
03c	2023-072	Mapping Migratory Bird Pitstops in Minnesota	\$340,000	Audubon Minnesota	Dale Gentry	Statewide
03d	2023-086	Enhancing Knowledge of Minnesota River Fish Ecology	\$199,000	MN DNR, Fish and Wildlife Division	Anthony Sindt	Metro, SE, SW
03e	2023-090	Changing Distribution of Flying Squirrel Species in Minnesota	\$186,000	U of MN, Duluth - NRRI	Michael Joyce	Statewide
03f	2023-092	Statewide Forest Carbon Inventory and Change Mapping	\$987,000	MN DNR, Forestry Division	David Wilson	Statewide
03g	2023-120	Predicting the Future of Aquatic Species by Understanding the Past	\$170,000	U of MN, College of Food, Agricultural and Natural Resource Sciences	Lynn Waterhouse	Statewide
03h	2023-139	Assessing Status of Common Tern Populations in Minnesota	\$199,000	U of MN, Duluth - NRRI	Annie Bracey	Statewide
03i	2023-146	Salvaged Wildlife to Inform Environmental Health, Ecology, and Education	\$486,000	U of MN, Bell Museum of Natural History	Sushma Reddy	Statewide
03j	2023-154	Developing Conservation Priorities for Rare and Specialist Bees	\$619,000	U of MN, College of Food, Agricultural and Natural Resource Sciences	Daniel Cariveau	Statewide
03k	2023-169	Efficacy of Urban Archery Hunting to Manage Deer	\$393,000	Minnesota State Colleges and Universities, Bemidji State University	Jacob Haus	NW
03l	2023-183	Mapping the Ecology of Urban and Rural Canids	\$601,000	U of MN, College of Food, Agricultural and Natural Resource Sciences	James Forester	Central, Metro
03m	2023-186	Maximizing Lowland Conifer Ecosystem Services - Phase II	\$482,000	U of MN, College of Food, Agricultural and Natural Resource Sciences	Marcella Windmuller-Campione	Central, NE, NW
03n	2023-209	Modernizing Minnesota's Wildlife (and Plant!) Action Plan	\$889,000	MN DNR, Ecological and Water Resources Division	Kristin Hall	Statewide
03o	2023-217	Linking Breeding and Migratory Bird Populations in Minnesota	\$199,000	Hawk Ridge Bird Observatory	Emily Pavlovic	Statewide

M.L. 2023 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Recommendations for FY 2024

Subd.	Proposal ID	Title	LCCMR Total Recommended Amount (FY24)	Organization	Project Manager	Region*
03p	2023-218	Old Growth Forest Monitoring	\$441,000	MN DNR, Ecological and Water Resources Division	Emily Peters	Statewide
03q	2023-222	Integrating Remotely Sensed Data with Traditional Forest Inventory	\$191,000	U of MN, Duluth - NRRI	John Du Plissis	NE
03r	2023-232	Community Response Monitoring for Adaptive Management in Southeast Minnesota	\$483,000	The Nature Conservancy	David Ruff	SE
03s	2023-248	Minnesota Biodiversity Atlas - Phase III	\$797,000	U of MN, Bell Museum of Natural History	George Weiblen	Statewide
		Subtotal =	\$8,219,000			
Subd. 04 Water Resources (13 Recommendations = \$8,328,000)						
04a	2023-004	Ditching Delinquent Ditches: Optimizing Wetland Restoration	\$199,000	U of MN, College of Science and Engineering	Andrew Wickert	Statewide
04b	2023-022	Assessment of Red River Basin Project Outcomes	\$920,000	Red River Basin Flood Damage Reduction Work Group	Andrew Graham	NW
04c	2023-026	Wind Wave and Boating Impacts on Inland Lakes	\$415,000	U of MN, St. Anthony Falls Laboratory	Jeffrey Marr	Statewide
04d	2023-063	Finding, Capturing, and Destroying PFAS in Minnesota Waters	\$478,000	U of MN, College of Science and Engineering	William Arnold	Statewide
04e	2023-074	Sinking and Suspended Microplastic Particles in Lake Superior	\$412,000	U of MN, Duluth - Large Lakes Observatory	Elizabeth Minor	NE
04f	2023-107	Ecotoxicological Impacts of Quinone Outside Inhibitor (QoI) Fungicides	\$279,000	University of St. Thomas	Kristine Wammer	Statewide
04g	2023-129	Brightsdale Dam Channel Restoration	\$1,004,000	Fillmore County Soil and Water Conservation District	Mindy Williamson	SE
04h	2023-134	Mapping Aquifer Recharge Potential	\$391,000	U of MN, St. Anthony Falls Laboratory	Peter Kang	Statewide
04i	2023-137	ALASD's Chloride Source Reduction Pilot Program	\$764,000	Alexandria Lake Area Sanitary District (ALASD)	Scott Gilbertson	Central
04j	2023-215	Removing CECs from Stormwater with Biofiltration	\$641,000	U of MN, St. Anthony Falls Laboratory	Andy Erickson	Metro

M.L. 2023 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Recommendations for FY 2024

Subd.	Proposal ID	Title	LCCMR Total Recommended Amount (FY24)	Organization	Project Manager	Region*
04k	2023-237	Didymo II – The North Shore Threat Continues	\$394,000	Science Museum of Minnesota, St. Croix Watershed Research Station	Mark Edlund	NE
04l	2023-238	Leveraging Data Analytics Innovations for Watershed District Planning	\$738,000	Minnehaha Creek Watershed District	Brian Beck	Statewide
04m	2023-247	Protecting Water in the Central Sands Region of the Mississippi River Headwaters	\$1,693,000	White Earth Band of Minnesota Chippewa Indians	Jamie Konopacky	Central
		Subtotal =	\$8,328,000			
Subd. 05 Environmental Education (8 Recommendations = \$3,905,000)						
05a	2023-008	Fostering Conservation by Connecting Students to the BWCA	\$1,080,000	Friends of the Boundary Waters Wilderness	Alison Nyenhuis	Statewide
05b	2023-051	Statewide Environmental Education via PBS Outdoor Series	\$391,000	Pioneer PBS	Cindy Dorn	Statewide
05c	2023-062	Increasing Diversity in Environmental Careers	\$763,000	MN DNR, Operational Services Division (OSD)	Mimi Daniel	Statewide
05d	2023-167	Reducing Biophobia and Fostering Environmental Stewardship in Underserved Schools	\$180,000	U of MN, Raptor Center	Victoria Hall	Statewide
05e	2023-185	Sharing Minnesota's Biggest Environmental Investment	\$628,000	Science Museum of Minnesota	Joy Hobbs	Statewide
05f	2023-201	North Shore Private Forestry Outreach and Implementation	\$375,000	Sugarloaf The North Shore Stewardship Association	Molly Thompson	NE
05g	2023-223	Teaching Students about Watersheds through Outdoor Science	\$290,000	Minnesota Trout Unlimited	John Lenczewski	Statewide
05h	2023-229	Bioblitz Urban Parks: Engaging Communities in Scientific Efforts	\$198,000	Minneapolis Park and Recreation Board	MaryLynn Pulscher	Metro
		Subtotal =	\$3,905,000			
Subd. 06 Aquatic and Terrestrial Invasive Species (2 Recommendations = \$5,104,000)						
06a	2023-153	Northward Expansion of Ecologically Damaging Amphibians and Reptiles	\$163,000	U of MN, College of Food, Agricultural and Natural Resource Sciences	Kenneth Kozak	Statewide
06b	2023-176	Developing Research-Based Solutions to Minnesota's AIS Problems	\$4,941,000	U of MN, MAISRC	Cori Mattke	Statewide
		Subtotal =	\$5,104,000			

M.L. 2023 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Recommendations for FY 2024

Subd.	Proposal ID	Title	LCCMR Total Recommended Amount (FY24)	Organization	Project Manager	Region*
Subd. 07 Air Quality, Climate Change, and Renewable Energy (6 Recommendations = \$3,913,000)						
07a	2023-013	Community Forestry AmeriCorps	\$1,500,000	ServeMinnesota	Sharon Delcambre	Statewide
07b	2023-043	Biochar Implementation in Habitat Restoration: A Pilot	\$185,000	Great River Greening	Todd Rexine	Central, Metro, SE
07c	2023-101	Completing Installment of the Minnesota Ecological Monitoring Network	\$1,094,000	MN DNR, Ecological and Water Resources Division	Holly Bernado	Statewide
07d	2023-152	Lichens as Low-Cost Air Quality Monitors in Minnesota	\$341,000	U of MN, College of Biological Sciences	Natalia Mossmann Koch	Statewide
07e	2023-171	Environment-Friendly Decarbonizing of Steel Production with Hydrogen Plasma	\$739,000	U of MN, College of Science and Engineering	Uwe Kortshagen	Statewide
07f	2023-240	Economic Analysis Guide for Minnesota Climate Investments	\$54,000	Minnesota Pollution Control Agency	David Bael	Statewide
		Subtotal =	\$3,913,000			
Subd. 08 Methods to Protect or Restore Land, Water, and Habitat (18 Recommendations = \$15,997,000)						
08a	2023-006	Minnesota Bee and Beneficial Species Habitat Enhancement II	\$876,000	Pheasants Forever Inc	Sabin Adams	Statewide
08b	2023-010	Karner Blue Butterfly Insurance Population Establishment in Minnesota	\$405,000	Three Rivers Park District	John Moriarty	Metro
08c	2023-025	Root River Habitat Restoration at Eagle Bluff	\$866,000	Eagle Bluff Environmental Learning Center	Colleen Foehrenbacher	SE
08d	2023-060	Restoring Mussels in Streams and Lakes - Continuation	\$825,000	MN DNR, Ecological and Water Resources Division	Madeline Pletta	Statewide
08e	2023-061	Minnesota Million: Seedlings for Reforestation and CO2 Sequestration	\$906,000	U of MN, Duluth	Julie Etterson	Statewide
08f	2023-080	Panoway on Wayzata Bay Shoreline Restoration Project	\$200,000	City of Wayzata	Nick Kieser	Metro
08g	2023-105	Pollinator Central III: Habitat Improvement with Community Monitoring	\$190,000	Great River Greening	Rebecca Tucker	Metro
08h	2023-117	Restoring Forests and Savannas Using Silvopasture - Phase II	\$674,000	Great River Greening	Brad Gordon	Statewide

M.L. 2023 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Recommendations for FY 2024

Subd.	Proposal ID	Title	LCCMR Total Recommended Amount (FY24)	Organization	Project Manager	Region*
08i	2023-135	Minnesota Community Schoolyards	\$1,433,000	The Trust for Public Land	Eric Weiss	Statewide
08j	2023-136	Pollinator Enhancement and Mississippi River Shoreline Restoration	\$187,000	Department of Military Affairs	Josh Pennington	Central
08k	2023-142	Conservation Cooperative for Working Lands	\$2,611,000	Pheasants Forever Inc	Tanner Bruse	Statewide
08l	2023-177	Quantifying Environmental Benefits of Peatland Restoration in Minnesota	\$754,000	U of MN, College of Food, Agricultural and Natural Resource Sciences	Christian Lenhart	NE, NW
08m	2023-181	Renewing Access to an Iconic North Shore Vista	\$197,000	Superior Hiking Trail Association	Lisa Luokkala	NE
08n	2023-189	Addressing Erosion Along High Use River Loops	\$368,000	Superior Hiking Trail Association	Lisa Luokkala	NE
08o	2023-211	Pollinator Habitat Creation at Minnesota Closed Landfills	\$1,508,000	Minnesota Pollution Control Agency	Eric Pederson	Statewide
08p	2023-212	Enhancing Habitat Connectivity within the Urban Mississippi Flyway	\$190,000	Minneapolis Park and Recreation Board	Adam Arvidson	Metro
08q	2023-219	Statewide Diversion of Furniture and Mattress Waste Pilots	\$2,833,000	EMERGE Community Development	Shawn Dolan	Statewide
08r	2023-250	Phelps Mill Wetland and Prairie Restoration	\$974,000	Otter Tail County	Nicholas Leonard	Central
		Subtotal =	\$15,997,000			
Subd. 09 Land Acquisition, Habitat, and Recreation (15 Recommendations = \$31,241,000)						
09a	2023-028	SNA Stewardship, Outreach, and Biodiversity Protection	\$1,919,000	MN DNR, Ecological and Water Resources Division	Judy Schulte	Statewide
09b	2023-032	Wannigan Regional Park Land Acquisition	\$727,000	City of Frazee	Stephanie Poegel	NW
09c	2023-039	Local Parks, Trails, and Natural Areas Grant Programs	\$3,802,000	MN DNR, Grants Unit	Audrey Mularie	Statewide
09d	2023-064	Outreach and Stewardship Through the Native Prairie Bank Program	\$620,000	MN DNR, Ecological and Water Resources Division	Judy Schulte	Central, NW, SW
09e	2023-081	Minnesota State Trails Development	\$4,952,000	MN DNR, State Parks and Trails Division	Kent Skaar	Statewide

M.L. 2023 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Recommendations for FY 2024

Subd.	Proposal ID	Title	LCCMR Total Recommended Amount (FY24)	Organization	Project Manager	Region*
09f	2023-091	Construction of East Park	\$700,000	City of St. Joseph	Nate Keller	Central
09g	2023-110	Scandia Gateway Trail to William O'Brien State Park	\$2,689,000	City of Scandia	Kenneth Cammilleri	Metro
09h	2023-147	Grand Marais Mountain Bike Trail Rehabilitation - Phase II	\$200,000	Superior Cycling Association	Paul Nordlund	NE
09i	2023-148	Acquisition of State Parks and Trails Inholdings	\$5,425,000	MN DNR, State Parks and Trails Division	Kent Skaar	Statewide
09j	2023-172	St. Louis River Re-Connect - Phase II	\$1,375,000	City of Duluth	Cliff Knettel	NE
09k	2023-207	City of Biwabik Recreation	\$1,306,000	City of Biwabik	Jeff Jacobson	NE
09l	2023-210	Silver Bay Multimodal Trailhead Project	\$1,970,000	City of Silver Bay	Lana Fralich	NE
09m	2023-213	Above the Falls Regional Park Restoration Planning and Acquisition	\$1,376,000	Minneapolis Park and Recreation Board	Adam Arvidson	Metro
09n	2023-231	Redhead Mountain Bike Park	\$1,666,000	Minnesota Discovery Center	Donna Johnson	NE
09o	2023-249	Maplewood State Park Trail Segment of the Perham to Pelican Rapids Regional Trail	\$2,514,000	Otter Tail County	Nicholas Leonard	Central
		Subtotal =	\$31,241,000			

Subd. 10 Administration, Emerging Issues, and Contract Agreement Reimbursement (4 Recommendations = \$3,126,000)

10a	2023-001	LCCMR Administrative Budget	\$2,000,000	Legislative-Citizen Commission on Minnesota Resources	Becca Nash	Statewide
10b	2023-002	Emerging Issues	\$900,000	Legislative-Citizen Commission on Minnesota Resources	Becca Nash	Statewide
10c	2023-073	Contract Agreement Reimbursement	\$224,000	MN DNR, Grants Unit	Katherine Sherman-Hoehn	Statewide
10d	2023-255	Legislative Coordinating Commission Legacy Website	\$2,000	Legislative Coordinating Commission	Sally Olson	Statewide
		Subtotal =	\$3,126,000			
		Total =	\$79,833,000			

M.L. 2023 Environment and Natural Resources Trust Fund (ENRTF)
LCCMR Recommendations for FY 2024

Subd.	Proposal ID	Title	LCCMR Total Recommended Amount (FY24)	Organization	Project Manager	Region*
-------	-------------	-------	---------------------------------------	--------------	-----------------	---------

* Metro region includes the 11 counties of Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, and Wright.

**Appropriation
Language -FY24**

Pending

VI. Revenues and Distributions

“the source and amount of all revenues collected and distributed by the commission, including all administrative and other expenses;”

Documents include, for appropriation years 1991-2022:

- Dollars appropriated and available from ENRTF
- Revenue sources of appropriations
- Appropriations for LCMR and LCCMR administration expenses

DOLLARS AVAILABLE FROM THE ENVIRONMENT AND NATURAL RESOURCES TRUST FUND (ENRTF)

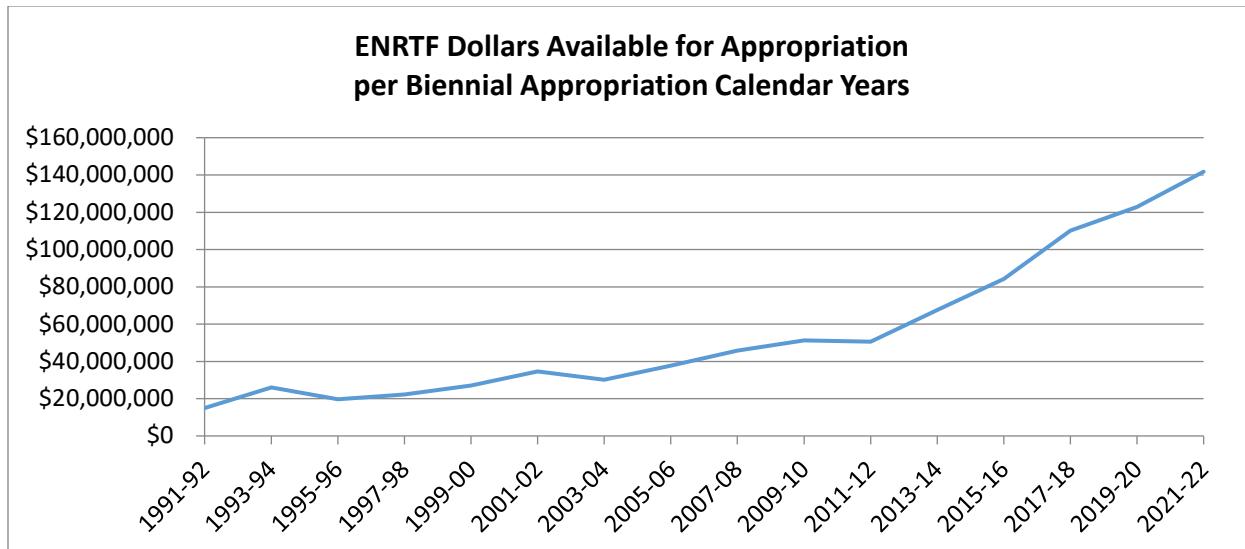
Total ENRTF Dollars Available for FY 22-23 Recommendations: up to \$141,762,000

Basis

The Minnesota Constitution provides that up to 5.5% of the market value of the Environment and Natural Resources Trust Fund can be used for projects each year. This 5.5% value is determined for both years of each fiscal biennium based on the market value of the Trust Fund on June 30 one year prior to the start of the next fiscal biennium. Thus, the dollars available for appropriation during fiscal years 2022 (beginning July 1, 2021) and 2022 (beginning July 1, 2021) was determined on June 30, 2020.

Value of the Environment and Natural Resources Trust Fund on June 30, 2020 =	\$1,288,757,980.88
5.5% of value on June 30, 2020 =	\$70,881,688.95
Dollar Amount to be used for FY 2022-2023 LCCMR recommendations (rounded down to nearest thousandth) =	\$70,881,000/year
Total Dollars available for recommendation during fiscal 2022-2023 biennium =	\$141,762,000

Total ENRTF Dollars Available Historically



Biennial Appropriation Calendar Years	Dollars Available for Appropriation
1991-92	\$14,960,000
1993-94	\$25,946,000
1995-96	\$19,649,000
1997-98	\$22,270,000
1999-00	\$27,001,000
2001-02	\$34,620,000
2003-04	\$30,100,000
2005-06	\$37,657,000
2007-08	\$45,732,000
2009-10	\$51,244,000
2011-12	\$50,656,000
2013-14	\$67,620,000
2015-16	\$84,292,000
2017-18	\$110,078,000
2019-20	\$122,774,000
2021-22	\$141,763,000
TOTAL	\$886,362,000

Revenue Sources For Appropriations

Appropriation Year	Environment and Natural Resources Trust Fund	Future Resources Fund	Oil Overcharge Money	Land & Water Conservation (LAWCON)	Great Lakes Protection Account	Totals
LEGISLATIVE COMMISSION ON MINNESOTA RESOURCES (LCMR) - Biennial funding cycle						
1991						
Ch 254 Art. 1 Sec.14	14,960,000	16,534,000	3,500,000		0	34,994,000
1993						
Ch 172 Sec. 14	24,600,000	14,662,000	2,012,000		0	41,274,000
1994						
Ch 632 Art. 2 Sec. 6	1,346,000	1,404,000	0		0	2,750,000
1995						
Ch 220 Sec. 19, 20, 21	17,844,000	15,083,000	2,055,000		130,000	35,112,000
1st. Sp.Ses., Ch. 2, Sec. 5	175,000					175,000
1996						
Ch 407 Sec. 8	1,630,000	3,258,000	0		0	4,888,000
1997						
Ch 216 Sec. 15	22,270,000	14,668,000	150,000		120,000	37,208,000
Ch 246, Sec. 32		150,000				150,000
1999						
Ch 231, Sec. 16	(1) 25,460,000	14,840,000	0		200,000	40,500,000
Ch 231, Sec. 17	991,000					991,000
2001						
1st. Sp.Ses., Ch. 2, Sec. 14	(2) 34,165,000	(2) 15,110,000	180,000		87,000	49,542,000
2002						
Ch. 220, Art. 8, Sec. 1 & 8	316,000	0	0		0	316,000
2003						
Ch. 128, Art. 1, Sec. 9	30,100,000	(3)	519,000	2,000,000	56,000	32,675,000
2005						
1st. Sp.Ses., Ch. 1, Art. 2, Sec. 11	(5) 33,560,000	0	0	1,600,000	(5) 0	35,160,000
2006						
Ch. 243, Sec. 19 & 20	4,097,000	0	0	0	28,000	4,125,000
LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES (LCCMR) - Annual funding cycle						
2007						
Ch. 30, Sec. 2	22,866,000	0	0	500,000	0	23,366,000
2008						
Ch.367, Sec. 2	22,866,000	0	0	0	86,000	22,952,000
2009						
Ch.143, Sec. 2	(6) 25,204,000	0	0	400,000	66,000	25,670,000
2010						
Ch.362, Sec. 2	(7) 25,897,000	0	0	0	0	25,897,000
2011 (Biennial)						
1st. Sp.Ses., Ch. 2, Art. 3, Sec. 2	50,656,000	0	0	750,000	0	51,406,000
2013						
Chp. 52, Sec. 2	(8) 38,160,000	0	0	0	0	38,160,000
2014						
Chp. 226, Sec. 2	28,970,000	0	0	0	0	28,970,000
Chp. 312, Art. 12, Sec. 8	(9) 490,000	0	0	0	0	490,000
2015						
Chp. 76, Sec. 2	46,324,000	0	0	0	59,000	46,383,000
2016						
Chp. 186, Sec. 2	(10) 37,909,000	0	0	0	0	37,909,000
2017						
Chp. 96, Sec. 2	64,250,000	0	0	0	0	64,250,000
2018						
Chp. 214, Art. 4, Sec. 2	42,888,000	0	0	0	0	42,888,000
	(11)					
Chp. 214, Art. 6, Sec. 4	(12) 0	0	0	0	0	0
2019						
1st Sp. Ses., Chp. 4, Art. 2	64,327,000	0	0	0	0	64,327,000
2020						
	0	0	0	0	0	0
2021						
1st Sp. Ses., Chp. 6, Art. 5	(13) 61,387,000	0	0	0	0	61,387,000
1st Sp. Ses., Chp. 6, Art 6	(14) 70,881,000	0	0	0	0	70,881,000
2022						
Chp. 94	(15) 70,881,000	0	0	0	0	70,881,000
	885,470,000	95,709,000	8,416,000	5,250,000	832,000	995,677,000

NOTES:

(1) In 1999, the following amounts were vetoed and have been subtracted from totals above:

350,000 TF
200,000 TF
<hr/>
1,200,000 FRF
<hr/>
1,750,000

(2) In 2001, the following amounts were vetoed and have been subtracted from the totals above:

275,000 FRF
455,000 TF
<hr/>
730,000

(3) In 2003, Future Resource Fund was redirected to the General Fund, not to be recommended by the LCMR per ML 2003, Ch. 128, Art. 1, Sec. 146 & Sec. 155. The unencumbered balance was transferred to the account in the natural resources fund. It is believed this was \$17,870,000.

(4) Previous to 2003, the LAWCON money was included in the Future Resource Fund appropriation for purposes of this chart.

(5) In 2005, the following amounts were vetoed and have been subtracted from the totals above:

4,098,000 TF
28,000 GLPA
<hr/>
4,126,000

(6) In 2009, the following amounts were vetoed and have been subtracted from the totals above:

275,000	TF
143,000	TF
<hr/>	
418,000	

(7) In 2010, the following amounts were vetoed and have been subtracted from the totals above:

143,000 TF

(8) In 2013, in addition to the appropriations noted above, \$200,000 ENRTF was transferred from FY10 (ML09) to a new project

(9) In 2014, in addition to the appropriations noted above, \$970,000 ENRTF was transferred from FY11 to a new project

(10) In 2016, the following amounts were vetoed and have been subtracted from the totals above:

8,428,000 TF (7 Appropriations)

(11) This appropriation was for debt service of FY18 \$2,940,000 and FY20-FY39 \$7,860,000/year for \$98,000,000 in special appropriation bonds

(12) In 2019, this law was repealed and the debt service in the following amount has been subtracted from the totals above:

2,940,000 TF

(13) RA 7/6/21 In 2021, in addition to the appropriations noted above, \$100,000 ENRTF from FY16, \$430,000 ENRTF from FY17, \$94,000 ENRTF from FY18, \$540,000 ENRTF from FY19, and \$2,768,000 ENRTF from FY20 was transferred to new projects.

(14) RA 7/6/21 In 2021, in addition to the appropriations noted above, \$270,000 ENRTF from FY18, \$350,000 ENRTF from FY19, \$220,000 ENRTF from FY20 was transferred to new projects.

(15) In 2022, in addition to the appropriations noted above, \$2,463,000 ENRTF from the following fiscal years was transferred to new projects: \$78k from FY20; \$550k from FY19, \$1,835k from FY19

Appropriations for LCMR and LCCMR Administrative Expenses

Statutory reference MS 116P

The amounts shown here are part of the total appropriation

Appropriation Year	Environment & Natural Resources Trust Fund	\$ of Total Appropriations	% of Total Appropriations	Carryforward	Future Resources Fund	Biennium Total
LCMR 1991	0	14,960,000	0.00%		850,000	850,000
LCMR 1993	270,000	25,946,000	1.04%		425,000	695,000
LCMR 1995	394,000	19,649,000	2.01%		308,000	702,000
LCMR 1997	472,000	22,270,000	2.12%		304,000	776,000
LCMR 1999	567,000	27,001,000	2.10%		333,000	900,000
LCMR 2001	738,000	34,620,000	2.13%		389,000	1,127,000
LCMR 2003	672,000	30,100,000	2.23%	172,000 *	0 **	672,000
LCMR 2005 (annual)	449,000	18,828,000	2.38%		0	449,000 ***
LCCMR 2006 (annual)	550,000	18,828,000	2.92%	63,000 ****	0	550,000
LCCMR 2007	1,278,000	45,732,000	2.79%		0	1,278,000
LCCMR 2009	1,254,000	50,636,000	2.48%		0	1,254,000
LCCMR 2011	946,000	50,656,000	1.87%		0	946,000
LCCMR 2013	990,000	67,620,000	1.46%		0	990,000
LCCMR 2015	1,072,000	92,674,000	1.16%		0	1,072,000
LCCMR 2017	1,200,000	110,078,000	1.09%		0	1,200,000
LCCMR 2019	1,400,000	122,774,000	1.14%		0	1,400,000
LCCMR 2021	1,750,000	141,763,000	1.23%		0	1,750,000
LCCMR 2023 (proposed)	2,170,000	159,288,000	1.36%		0	2,170,000
Total	16,172,000	1,053,423,000	1.54%	235,000	2,609,000	18,781,000

NOTES:

All appropriations are biennial unless noted

The administrative budget from the Trust Fund is capped at 4% of the Trust Fund available each year, M.S. 116P, Subd. 5

* Carryforward from administrative budget appropriation 02-03 (Trust Fund)

** Future Resources Fund was redirected to the General Budget, not to be recommended by the LCMR per ML 2003, Ch. 128, Art. 1, Sec. 146 & Sec. 155.

*** This amount reflects only first year funding. The governor vetoed the second half of the biennium funding of the administrative budget (\$450,000).

**** Carryforward from 2005 administrative appropriation for LCMR and the "Citizen Advisory Committee for the Trust Fund"

VII. Assets & Liabilities

“a description of the assets and liabilities of the trust fund;”

The following documents include:

- Historical market value of the Environment and Natural Resources Trust Fund (1992 – June 30, 2022)
- State Board of Investment 2020 Annual Report
- State Board of Investment 2021 Annual Report
- State Board of Investment 2022 Annual Report

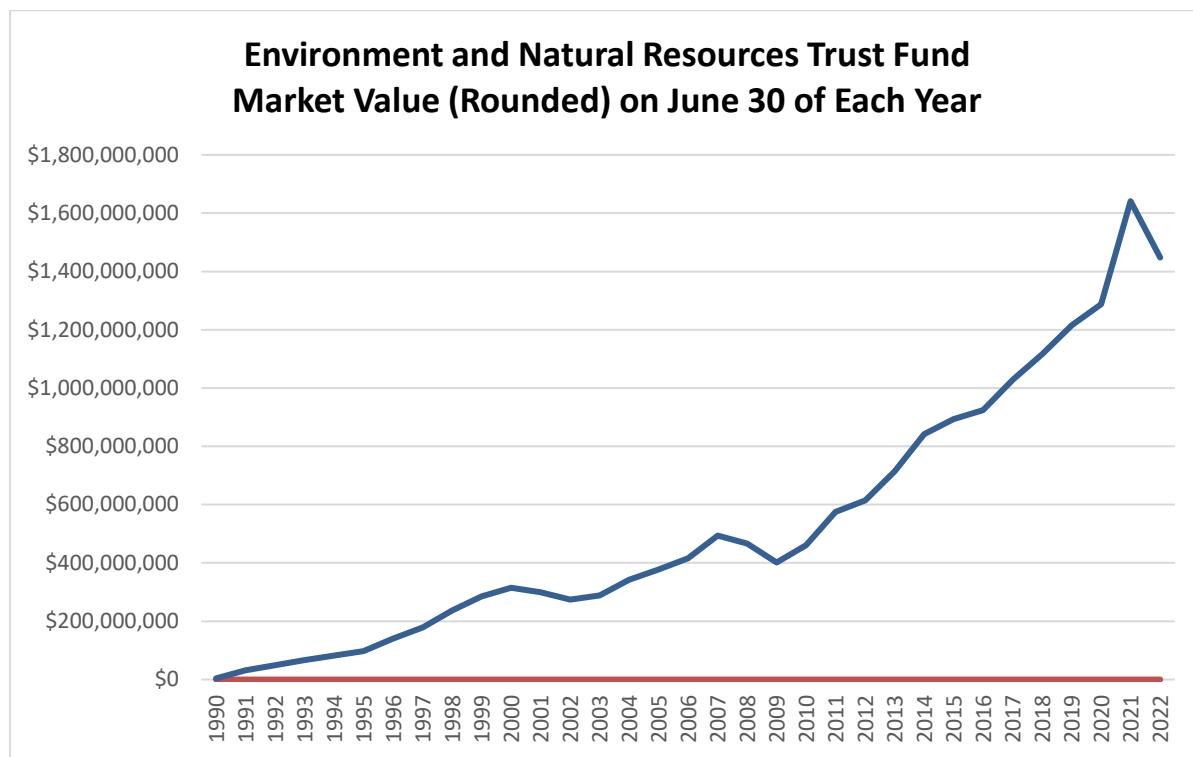
HISTORICAL MARKET VALUE OF THE ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Background

The assets in the Environment and Natural Resources Trust Fund (ENRTF) originate from a combination of contributions and investment income. Forty percent of the net proceeds from the Minnesota State Lottery, or more than six cents of every dollar spent on playing the lottery, are contributed to the ENRTF each year; this source of contribution is guaranteed by the Minnesota Constitution through December 31, 2024. The ENRTF may also receive contributions from other sources, such as private donations. Once deposited into the ENRTF, contributions become part of the principal balance and are invested in a combination of stocks and bonds by the Minnesota State Board of Investment. The income generated from those investments is reinvested back into the ENRTF.

For FY 1992-1999, investment earnings of the ENRTF and up to 25% of the Minnesota Lottery's annual contributions to the ENRTF were available for appropriation each year. A constitutional amendment in 1998 altered this rule so that beginning in FY 2000, through the present, up to 5.5% of the ENRTF's market value (determined by the market value of the ENRTF on June 30 one year before the start of a biennium) is available for appropriation each year.

History



Year	June 30 Value
1990	\$4,000,000
1991	\$32,000,000
1992	\$49,000,000
1993	\$67,000,000
1994	\$82,000,000
1995	\$98,000,000
1996	\$140,000,000
1997	\$179,000,000
1998	\$237,000,000
1999	\$285,000,000

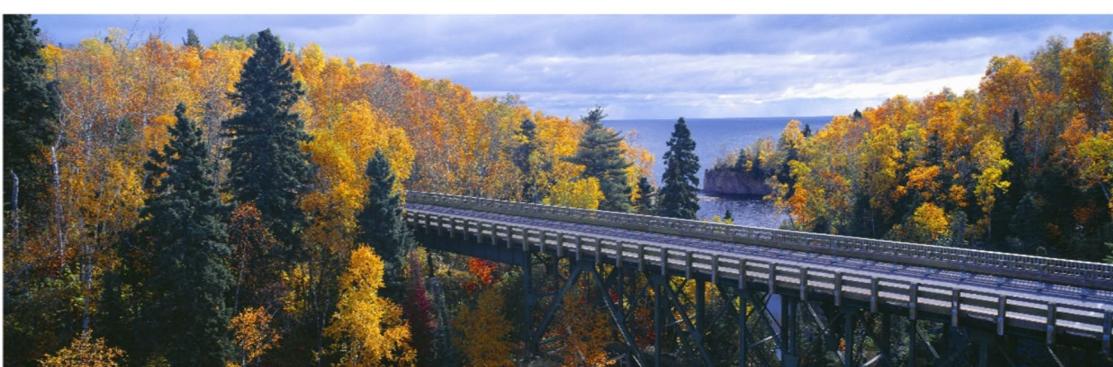
Year	June 30 Value
2000	\$315,000,000
2001	\$300,000,000
2002	\$274,000,000
2003	\$289,000,000
2004	\$342,000,000
2005	\$377,000,000
2006	\$416,000,000
2007	\$494,000,000
2008	\$466,000,000
2009	\$402,000,000

Year	June 30 Value
2010	\$461,000,000
2011	\$575,000,000
2012	\$615,000,000
2013	\$714,000,000
2014	\$842,000,000
2015	\$893,000,000
2016	\$924,000,000
2017	\$1,028,000,000
2018	\$1,116,000,000
2019	\$1,215,000,000

Year	June 30 Value
2020	\$1,288,000,000
2021	\$1,641,000,000
2022	\$1,448,000,000

MINNESOTA STATE BOARD OF INVESTMENT

2020 Annual Report



60 Empire Drive | Suite 355 | St. Paul, MN 55103 | E-mail: minn.sbi@state.mn.us | Website: <https://mn.gov/sbi/>

Non-Retirement Account Environmental Trust Fund

The SBI invests the assets of the Environmental Trust Fund in the Non-Retirement Equity Fund, Bond Fund, and Money Market Fund. On June 30, 2020, the market value of the Fund was \$1.3 billion.

Environmental Trust Fund

Overview

The Environmental Trust Fund was established in 1988 by the Minnesota Legislature to provide a long-term, consistent and stable source of funding for activities that protect and enhance the environment. By statute, the State Board of Investment invests the assets of the Environmental Trust Fund. The Minnesota Legislature funds environmental projects from a portion of the market value of the Fund.

Investment Objective

The Environmental Trust Fund's investment objective is long-term growth in order to produce a growing level of funding within the constraints of maintaining adequate portfolio liquidity.

A constitutional amendment passed in November 1998 continues the mandate that 40% of the net proceeds from the state lottery be credited to the Fund through 2025.

The amendment provides for spending 5.5% of the Fund's market value annually. The amendment eliminated certain accounting restrictions on capital gains and losses as well as the provision that the principal must remain inviolate.

Asset Allocation

After the constitutional amendment was adopted in November 1998, SBI staff worked with the Legislative

Citizen Commission on Minnesota Resources to establish an asset allocation policy that is consistent with the Commission's goals for spending and growth of the Fund. The allocation positions the Fund for an appropriate long-term growth potential to meet the Fund's objective to produce a growing level of funding.

The current long-term asset allocation targets for the Fund are:

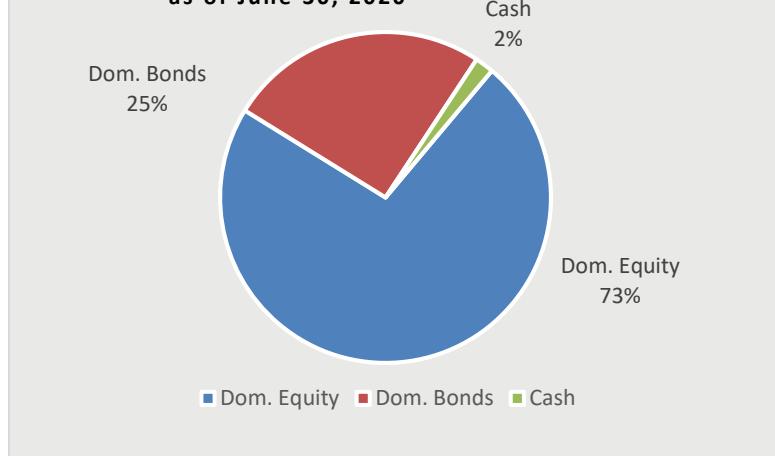
Domestic Equity	70%
Domestic Bonds	28%
Cash	2%

Figure 65 presents the actual asset mix of the Fund at the end of fiscal year 2020.

Investment Management

The Environmental Trust Fund is invested in the Non-Retirement Equity, Bond and Money Market Funds. Fund Summaries are provided on pages B105-B107.

Figure 65. Environmental Trust Fund Asset Mix as of June 30, 2020



Non-Retirement Account Environmental Trust Fund

Investment Performance

During the fiscal year, the *equity* segment matched its benchmark, the S&P 500, for the fiscal year.

The *bond* segment underperformed its benchmark, the Bloomberg Barclays U.S. Aggregate Index, by 0.5 percentage point during the fiscal year.

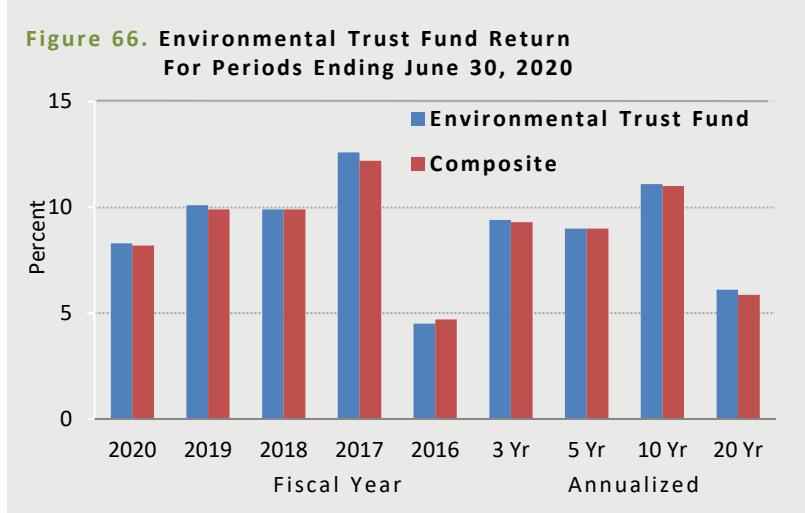
The *cash* segment outperformed its benchmark, the iMoneyNet All Taxable Money Fund Average by 0.4 percentage point during the fiscal year.

Overall, the Environmental Trust Fund provided a return of 8.3% for fiscal year 2020, which outperformed its composite index by 0.1 percentage point during the fiscal year. Results for a longer time-periods, show the Fund outperforming its composite index over the ten and twenty-year time periods ending June 30, 2020.

Historical performance results for the total Fund and each of the asset class segments are presented in Figure 66.

Spendable income generated by the Fund over the last five fiscal years is shown below:

Fiscal Year	Millions
2016	\$46
2017	\$46
2018	\$51
2019	\$51
2020	\$61



	Fiscal Year End Return (%)				
	2020	2019	2018	2017	2016
Environmental Trust Fund	8.3	10.1	9.9	12.6	4.5
Composite ¹	8.2	9.9	9.9	12.2	4.7
Equity Segment	7.5	10.4	14.3	17.9	4.0
S&P 500	7.5	10.4	14.4	17.9	4.0
Bond Segment	8.2	8.4	-0.3	0.8	5.7
BB Barclays Agg	8.7	7.9	-0.4	-0.3	6.0
Cash Segment	1.5	2.4	1.4	0.6	0.2
iMoney Net All Taxable Fund	1.1	1.9	1.0	0.3	0.1

	Annualized Returns (%) as of June 30, 2020			
	3 Yr.	5 Yr.	10 Yr.	20 Yr.
Environmental Trust Fund	9.4	9.0	11.1	6.1
Composite ¹	9.3	9.0	11.0	5.9
Equity Segment	10.7	10.7	14.0	6.0
S&P 500	10.7	10.7	14.0	5.9
Bond Segment	5.3	4.5	4.2	5.6
BB Barclays Agg	5.3	4.3	3.8	5.1
Cash Segment	1.8	1.2	0.7	1.8
iMoney Net All Taxable Fund	1.3	0.9	0.4	1.4

¹ Represents the aggregate returns of the target allocation: S&P 500 70%, Bloomberg Barclays U.S. Aggregate 28%, and iMoney Net All Taxable Money Fund Avg 2%.

Minnesota
State Board of Investment



2021 ANNUAL REPORT

Non-Retirement Account Environmental Trust Fund

The SBI invests the assets of the Environmental Trust Fund in the Non-Retirement Equity Fund, Bond Fund, and Money Market Fund. On June 30, 2021, the market value of the Fund was \$1.6 billion.

Environmental Trust Fund

Overview

The Environmental Trust Fund was established in 1988 by the Minnesota Legislature to provide a long-term, consistent and stable source of funding for activities that protect and enhance the environment. By statute, the SBI invests the assets of the Environmental Trust Fund. The Minnesota Legislature funds environmental projects from a portion of the market value of the Fund.

Investment Objective

The Environmental Trust Fund's investment objective is long-term growth in order to produce a growing level of funding within the constraints of maintaining adequate portfolio liquidity.

A constitutional amendment passed in November 1998 continues the mandate that 40% of the net proceeds from the state lottery be credited to the Fund through 2025.

The amendment provides for spending 5.5% of the Fund's market value annually. The amendment eliminated certain accounting restrictions on capital gains and losses as well as the provision that the principal must remain inviolate.

Asset Allocation

After the constitutional amendment was adopted in November 1998, SBI staff worked with the Legislative

Citizen Commission on Minnesota Resources to establish an asset allocation policy that is consistent with the Commission's goals for spending and growth of the Fund. The Fund allocation is positioned for an appropriate long-term growth potential to meet the Fund's objective to produce a growing level of funding.

The current long-term asset allocation targets for the Fund are:

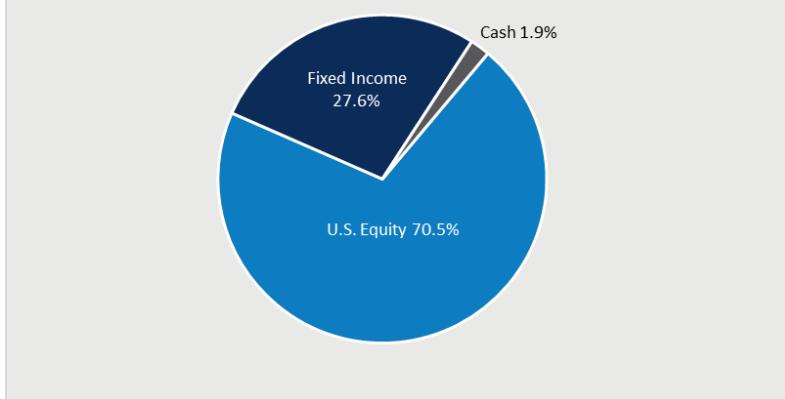
Domestic Equity	70%
Domestic Bonds	28%
Cash	2%

Figure 78 presents the actual asset mix of the Fund at the end of fiscal year 2021.

Investment Management

The Environmental Trust Fund is invested in the Non-Retirement Equity, Bond and Money Market Funds. Fund Summaries are provided on pages B117-B119.

Figure 78. Environmental Trust Fund Asset Mix as of June 30, 2021



Non-Retirement Account Environmental Trust Fund

Investment Performance

During the fiscal year, the **equity** segment matched its benchmark, the S&P 500, for the fiscal year.

The **bond** segment outperformed its benchmark, the Bloomberg Barclays U.S. Aggregate Index, by 1.5 percentage points during the fiscal year.

The **cash** segment outperformed its benchmark, the iMoneyNet All Taxable Money Fund Average by 0.1 percentage point during the fiscal year.

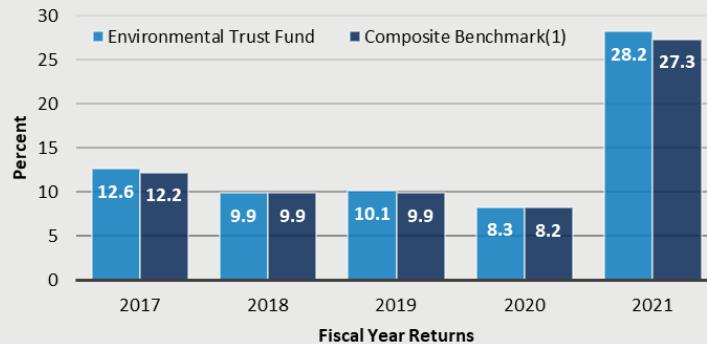
Overall, the Environmental Trust Fund provided a return of 28.2% for fiscal year 2021, which outperformed its composite index by 0.9 percentage point during the fiscal year. Results for a longer time-periods, show the Fund outperforming its composite index over the ten and twenty year time periods ending June 30, 2021.

Historical performance results for the total Fund and each of the asset class segments are presented in Figures 79A and 79B.

Spendable income generated by the Fund over the last five fiscal years is shown below:

Fiscal Year	Millions
2017	\$46
2018	\$51
2019	\$51
2020	\$61
2021	\$61

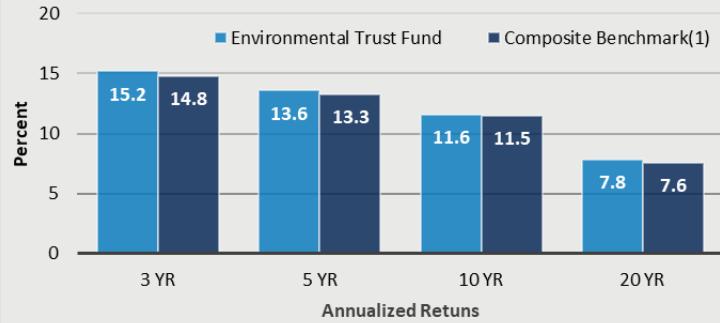
Figure 79A. Environmental Trust Fund Fiscal Year Returns For Periods Ending June 30



	Fiscal Year End Return (%)				
	2017	2018	2019	2020	2021
Environmental Trust Fund Total	12.6	9.9	10.1	8.3	28.2
Composite Benchmark ¹	12.2	9.9	9.9	8.2	27.3
Equity Segment	17.9	14.3	10.4	7.5	40.8
S&P 500	17.9	14.4	10.4	7.5	40.8
Bond Segment	0.8	-0.3	8.4	8.2	1.2
BB Barclays Agg	-0.3	-0.4	7.9	8.7	-0.3
Cash Segment	0.6	1.4	2.4	1.5	0.1
iMoney Net All Taxable Fund	0.3	1.0	1.9	1.1	0.0

¹ Represents the aggregate returns of the target allocation: S&P 500 70%, Bloomberg Barclays U.S. Aggregate 28%, and iMoney Net All Taxable Money Fund Avg 2%.

Figure 79B. Environmental Trust Fund Annualized Returns For Periods Ending June 30, 2021



	Annualized Returns (%) as of June 30, 2021			
	3 Yr.	5 Yr.	10 Yr.	20 Yr.
Environmental Trust Fund Total	15.2	13.6	11.6	7.8
Composite Benchmark ¹	14.8	13.3	11.5	7.6
Equity Segment	18.7	17.6	14.8	8.7
S&P 500	18.7	17.6	14.8	8.6
Bond Segment	5.9	3.6	3.9	5.1
BB Barclays Agg	5.3	3.0	3.4	4.6
Cash Segment	1.3	1.2	0.7	1.5
iMoney Net All Taxable Fund	1.0	0.9	0.4	NA

¹ Represents the aggregate returns of the target allocation: S&P 500 70%, Bloomberg Barclays U.S. Aggregate 28%, and iMoney Net All Taxable Money Fund Avg 2%.

**State Board of Investment
2022 Annual Report**

Pending

VIII. Findings

“any findings or recommendations that are deemed proper to assist the legislature in formulating legislation;”

Capital Projects Funded from the Environment and Natural Resources Trust Fund (ENRTF); Report to the Legislature

As required by Sec. 4 of M.L. 2022, Chapter 94

Adopted August 30, 2022

Capital Projects Funded from the Environment and Natural Resources Trust Fund (ENRTF)

Report to the Legislature

As Required by Sec. 4 of M.L. 2022, Chapter 94.

Adopted August 30, 2022

Prepared by:

Legislative-Citizen Commission on Minnesota Resources
100 Rev. Dr. Martin Luther King Jr. Blvd.
State Office Building, Room 65
St. Paul, MN 55155

E-mail: lccmr@lccmr.mn.gov
Phone: 651-296-2406





LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES

100 REV. DR. MARTIN LUTHER KING JR. BLVD.
ROOM 65 STATE OFFICE BUILDING
ST. PAUL, MINNESOTA 55155-1201

Phone: (651) 296-2406
Email: lccmr@lccmr.mn.gov
Web: www.lccmr.mn.gov

Becca Nash, Director

October 13, 2022

The Honorable Bill Ingebrigtsen
Chair
Environment and Natural Resources Finance
Minnesota Senate
3207 Minnesota Senate Bldg.
St. Paul, MN 55155

The Honorable Rick Hansen
Chair
Environment and Natural Resources Finance and Policy
Minnesota House of Representatives
407 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, MN 55155

The Honorable Patricia Torres Ray
Ranking Minority Member
Environment and Natural Resources Finance
Minnesota Senate
2225 Minnesota Senate Bldg.
St. Paul, MN 55155

The Honorable Josh Heintzman
Ranking Minority Member
Environment and Natural Resources Finance and Policy
Minnesota House of Representatives
353 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, MN 55155

To the Honorable Chairs:

In June 2022, the Legislature adopted M.L. 2022, Chapter 94, Sec. 4 directing the Legislative-Citizen Commission on Minnesota Resources (LCCMR) to “consider whether statutorily requiring additional information to accompany proposals for capital projects would help the commission better evaluate those proposals.” The LCCMR was directed to submit a report and recommendations, along with any proposed statutory changes, to the chairs and ranking minority members of the house of representatives and senate committees and divisions with jurisdiction over environment and natural resources by October 15, 2022.

This report is transmitted in fulfillment of this requirement and contains recommendations for statutory changes that the LCCMR believes will help the commission better evaluate proposals and provide appropriate safeguards to help ensure the successful use of state dollars and completion of capital construction projects using Environment and Natural Resources Trust Fund (ENRTF) dollars. In making these recommendations, the commission worked to balance the need for additional information and safeguards with the potential burden on applicants and recipients of ENRTF dollars.

Please let me know if you have questions or would like additional discussion.

Sincerely,

Becca Nash, Director
On behalf of the LCCMR

Table of Contents

Executive Summary.....	1
Background.....	1
Process.....	2
Recommendations to the Legislature.....	3
Match.....	4
Full Funding.....	4
Sustainable Building Guidelines.....	4
Sale and Alteration of Use.....	5
Public Access.....	8
References to Existing Requirements.....	8
Applicability.....	9
Effective Date.....	9

Appendix A: Compiled Proposed Statutory Changes

Appendix B: Requirements for Bond and Other State-Funded Capital Projects

Appendix C: ENRTF-Funded Activities to Acquire or Improve Land or Buildings (Capital Projects)

Appendix D: About the LCCMR and ENRTF

Appendix E: LCCMR Members

Appendix F: LCCMR Subcommittee on Capital Projects Members

Executive Summary

M.L. 2022, Chapter 94, Sec. 4 directed the Legislative-Citizen Commission on Minnesota Resources (LCCMR) to submit a report and recommendations to the Legislature on additional information that should be required to accompany proposals to the LCCMR for capital project funding. The legislative charge relates to ongoing discussions within the LCCMR regarding capital projects and the increasing number and size of projects seeking funding for these types of projects from the Environment and Natural Resources Trust Fund (ENRTF). The LCCMR appointed a subcommittee to discuss and make recommendations to the full commission. The subcommittee met multiple times during the summer of 2022 to develop recommendations for inclusion in this report, which were later adopted by the full commission. In making these recommendations, the commission worked to balance the need for appropriate safeguards to ensure successful completion of funded projects with the additional burden those safeguards may place on applicants and recipients of ENRTF dollars.

The LCCMR recommends that the Legislature enact statutory changes that will allow the commission to better evaluate capital project proposals, make funding recommendations to the Legislature, and improve the likelihood of the successful spending of state dollars and the timely completion of projects. To this end, the commission is making specific recommendations related to matching funds, full funding, sustainable building guidelines, sale and alteration of use of the capital improvement, and public access. The commission recommends that these new requirements be limited to capital construction projects and include a de minimis exception. The commission also recommends that the Legislature provide additional clarification for existing statutory requirements for capital projects that may apply to certain ENRTF-funded projects.

Background

The Environment and Natural Resources Trust Fund (ENRTF) has funded a variety of capital projects related to its constitutional purpose of protecting, conserving, preserving, and enhancing the state's air, water, land, fish, wildlife, and other natural resources. From 2013 to 2021, 163 projects have included some sort of capital activity, and roughly \$169.5 million has gone toward those activities. The following list describes some of the types of capital activities that have been funded through the ENRTF during that period:

Building Design and/or Construction – The design and construction of large buildings and facilities.
Examples: visitor centers, learning centers.

Conservation Easements – Acquisition of easements on private land for conservation.

Educational Exhibits – The design and installation of educational exhibits. Examples: kiosks, displays.

Land Acquisition – Fee title acquisition of land for recreation, conservation, or other purposes related to natural resources and the environment. Examples: scientific and natural areas, parks.

Recreational Facilities – The design and construction of recreational facilities and supporting infrastructure. Examples: campgrounds (and at times associated offices), restrooms, shower facilities, docks, canoe landings, picnic areas, boat wash stations, parking lots, access roads.

Renewable Energy – The design and construction of renewable energy systems. Examples: solar gardens, biomass boiler systems.

Research and Demonstration – The design and construction of research facilities, installation of long-term monitoring equipment, and evaluation and demonstration of innovative technologies. Examples: AIS deterrents, wastewater treatment, renewable energy systems.

Restoration (Large-Scale) – Restoration involving large-scale earth-moving and placement of materials. Examples: shoreline stabilization, grading, stream restoration.

Stormwater – The design and construction of stormwater infrastructure to improve water quality or habitat. Examples: retention basins, rain gardens.

Trails – The engineering, design, and construction of trails.

The Legislative-Citizen Commission on Minnesota Resources (LCCMR) has received an increasing number of proposals for funding capital projects in the last decade. The number of projects funded each year that include a capital activity increased from 24% of projects to 36% of projects from 2013 to 2021, and the proportion of ENRTF dollars directed towards capital activities each year has increased from 22% of ENRTF funding to 48% of ENRTF funding (See Appendix C). This rise has primarily been driven by increased funding to construct recreational facilities and trails. In addition, two projects in the last four years have been appropriated approximately \$6.7 million from the ENRTF to design and construct buildings.

With the increasing number, size, and complexity of capital projects, the LCCMR wanted to ensure that it is receiving sufficient information with proposals to make informed funding recommendations to the Legislature, and that, once funded, conditions and requirements are in place that will lead to successful completion of the project. To this end, the LCCMR directed its staff to review and report on the conditions and requirements applied to capital projects funded through general obligation bond proceeds. The LCCMR had some initial discussions on this issue in December 2021.

In June 2022, the Legislature directed the LCCMR to consider whether statutorily requiring additional information to accompany proposals for capital projects would help the commission better evaluate those proposals (M.L. 2022, Chapter 94, Sec. 4). The LCCMR was directed to submit a report, recommendations, and any proposed statutory changes to the Legislature by October 15, 2022.

Process

The LCCMR appointed a subcommittee to discuss capital projects and make recommendations to the full commission. The LCCMR Subcommittee on Capital Projects met on July 25, August 8, August 16, and August 17. At its first meeting, the subcommittee decided not to limit its recommendations only to additional information to accompany proposals. Therefore, it also considered additional requirements that would need to be met by applicants and recipients as a condition of receiving funding from ENRTF. The subcommittee narrowed its focus to capital construction projects rather than all capital projects and activities, although it still wished to include any land acquisitions associated with construction.

The subcommittee followed an iterative process to develop a list of recommendations. The subcommittee reviewed background information on capital projects compiled by LCCMR staff during the previous year. This information included a list of requirements and conditions for bonding and other state-funded capital projects culled by staff from Minnesota Management & Budget (MMB) operating policies, orders, memos, and other documents, which allowed the subcommittee to consider items related to eligibility, assurances, and consultation and review (See Appendix B). After that meeting, each subcommittee member independently chose requirements and conditions that it wished to assess, either as a requirement for more information to be provided by applicants or as a requirement that must be met before or after funding is awarded. Staff compiled the results, and only requirements and conditions selected by a majority of members moved forward.

The subcommittee then considered the selected conditions and requirements, along with sample language of how that condition or requirement might look as a requirement for ENRTF funding. During its discussions, the subcommittee chose to split its recommendations into two sections: (1) recommendations for new statutory language to be submitted as part of the report to the Legislature, and (2) recommendations for the commission to incorporate into its current business practices that do not require further legislative action. After this meeting, House and Senate nonpartisan counsel assisted LCCMR staff with drafting proposed statutory language for the first set of recommendations.

The subcommittee discussed the proposed recommendations, considered final questions presented by staff and additional recommendations proposed by members, and voted on each recommendation to be made to the Legislature and the commission. The subcommittee tasked LCCMR staff with drafting the legislative report for individual comment by the subcommittee members and submittal to the full commission.

LCCMR staff reached out to officials with the MMB, the Department of Administration, the Department of Natural Resources, the State Historic Preservation Office, and the University of Minnesota's Center for Sustainable Building Research (CSBR) for comment on the subcommittee recommendations. Based on feedback, slight modifications were made to the subcommittee's recommended statutory changes. The LCCMR adopted this legislative report at its August 30, 2022 meeting.

Recommendations to the Legislature

The LCCMR makes the following recommendations for statutory changes. The LCCMR believes the adoption and implementation of these recommendations will provide appropriate safeguards to help ensure the successful use of state dollars and completion of capital construction projects funded from the ENRTF that support the protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, other natural resources, and outdoor recreation.

The commission was sensitive to not recommend requirements that would create an undue burden on applicants and recipients of trust fund dollars. In particular, the ENRTF is a valuable source of funding for smaller local communities and organization that may be more limited in their resources. It is the hope of the commission that these recommendations, if enacted, will help these smaller communities and organizations and all other recipients of ENRTF dollars achieve greater success and meet their goals and the goals of the ENRTF.

Match

The LCCMR recommends that the Legislature require any entity requesting money from the ENRTF for a capital construction project to provide a 50% match from non-ENRTF sources to ensure the applicant's commitment and readiness to complete the project.

The following amendatory language to MS 116P.08 is offered to implement this recommendation:

116P.08 TRUST FUND EXPENDITURES.

...Subd. 8. A recipient of money appropriated from the trust fund for a capital construction project must provide a cash or in-kind match from non-trust fund sources of at least 50 percent of the total eligible project costs.

Full Funding

The LCCMR recommends that the Legislature require that all funds needed to complete a capital construction project or project phase be committed and secured prior to ENRTF funds being available. This requirement would be similar to current requirements applied to capital projects funded from state general obligation bond proceeds under MS 16A.502. The commission believes adopting this type of requirement for ENRTF-funded projects would avoid scenarios where construction may begin using ENRTF funds but cannot be completed or construction would be significantly delayed because funds originally expected to be available from other sources did not materialize.

The commission recommends the following new section be added to Chapter 116P:

116P.XX [FULL FUNDING REQUIRED]

(a) If an appropriation from the trust fund for a capital construction project or project phase is not sufficient, by itself, to complete the project or project phase, and thus requires a commitment from sources other than the trust fund:

(1) the commitment must be in an amount that, when added to the appropriation, is sufficient to complete the project or project phase; and

(2) the agency administering the appropriation shall not distribute the funds until the commitment is determined to be sufficient. In determining the sufficiency of a commitment under this paragraph, the agency shall apply the standards and principles applied by the commissioner of management and budget under section 16A.502.

Sustainable Building Guidelines

The LCCMR recommends that the Legislature require that capital construction projects for new buildings or major renovations funded in whole or in part from the ENRTF comply with sustainable building guidelines. For over a decade, appropriation rider language that has accompanied appropriations from the ENRTF has included a provision that a recipient of funding for a capital improvement project "must ensure that the project complies with the applicable energy conservation and sustainable building guidelines and standards contained in law..." The commission believes incorporating the sustainable building guideline requirement into the LCCMR implementing statute will provide greater clarity for entities seeking funding from the trust fund. The proposed requirement would also parallel current

requirements for capital projects funded from state general obligation bond proceeds under MS 16B.325, subd. 3.

To implement this recommendation, the commission recommends the following new section be added to Chapter 116P:

116P.XX [SUSTAINABLE BUILDING GUIDELINES]

The sustainable building guidelines established under sections 16B.325 and 216B.241, subdivision 9, apply to new buildings and major renovations receiving funding from the environment and natural resources trust fund. A recipient of money appropriated from the trust fund for a new building or major renovation must ensure that the project complies with the guidelines.

Sale and Alteration of Use

The LCCMR recommends that the Legislature create protections to ensure that buildings or other capital assets constructed in whole or in part with ENRTF funds continue to be used for their intended purpose. Specifically, the LCCMR recommends:

- Any alteration in use or conveyance, such as a sale, of an interest in the capital asset should require LCCMR approval and notification of the legislative committees with jurisdiction over the trust fund.
- The following conditions must be met for LCCMR approval: a sale price of at least fair market value and repayment to the trust fund proportional to the funds originally contributed to the construction project.
- The approval conditions be waived if recommended by the LCCMR and approved by the Legislature to account for potential situations where the capital asset may be conveyed but the use maintained, the proposed altered use may be different than the original intended purpose but still consistent with the purposes of the trust fund, or some other mitigating circumstance.
- The alteration of use restrictions remain in place for 25 years.

In addition, to help maintain awareness and tracking of the associated restrictions, the LCCMR recommends the inclusion of requirements for (1) recording a notice of funding restrictions in the appropriate local government office and (2) annual reporting to the LCCMR certifying the property status and its continued use for its intended purpose. These recommendations parallel current statutory restrictions for land acquired using ENRTF dollars and are similar to requirements for capital projects funded using state general obligation bond proceeds.

To implement this recommendation, the commission recommends the following amendatory language for MS 116P.15 and MS 116P.16:

116P.15 CAPITAL CONSTRUCTION AND LAND ACQUISITION; RESTRICTIONS.

Subdivision 1. Scope. A recipient of an appropriation from the trust fund or the Minnesota future resources fund who uses any portion of the appropriation for a capital construction project must comply with subdivision 3 of this section. A recipient of an appropriation from the trust fund or the Minnesota future resources fund who acquires any other interest in real property with the appropriation must comply with subdivision 2 of this

section. For the purposes of this section, "interest in real property" includes, but is not limited to, an easement or fee title to property.

Subd. 2. **Restrictions; modification procedure** Land acquisitions. (a) An easement, fee title, or other interest in real property acquired with an appropriation from the trust fund or the Minnesota future resources fund must be used in perpetuity or for the specific term of an easement interest for the purpose for which the appropriation was made. The ownership of the interest in real property transfers to the state if:

- (1) the holder of the interest in real property fails to comply with the terms and conditions of the grant agreement or work plan; or
- (2) restrictions are placed on the land that preclude its use for the intended purpose as specified in the appropriation.

(b) A recipient of funding who acquires an interest in real property subject to this section may not alter the intended use of the interest in real property or convey any interest in the real property acquired with the appropriation without the prior review and approval of the commission or its successor. The commission shall notify the chairs and ranking minority members of the legislative committees and divisions with jurisdiction over the trust fund or Minnesota future resources fund at least 15 business days before approval under this paragraph. The commission shall establish procedures to review requests from recipients to alter the use of or convey an interest in real property. These procedures shall allow for the replacement of the interest in real property with another interest in real property meeting the following criteria:

- (1) the interest must be at least equal in fair market value, as certified by the commissioner of natural resources, to the interest being replaced; and
- (2) the interest must be in a reasonably equivalent location, and have a reasonably equivalent useful conservation purpose compared to the interest being replaced, taking into consideration all effects from fragmentation of the whole habitat.
- (3) A recipient of funding who acquires an interest in real property under paragraph (a) must separately record a notice of funding restrictions in the appropriate local government office where the conveyance of the interest in real property is filed. The notice of funding agreement must contain:
 - (1) a legal description of the interest in real property covered by the funding agreement;
 - (2) a reference to the underlying funding agreement;
 - (3) a reference to this section; and
 - (4) the following statement:

"This interest in real property shall be administered in accordance with the terms, conditions, and purposes of the grant agreement controlling the acquisition of the property. The interest in real property, or any portion of the interest in real property, shall not be sold, transferred, pledged, or otherwise disposed of or further encumbered without obtaining the prior written approval of the Legislative-Citizen Commission on Minnesota Resources or its successor. The ownership of the interest in real property transfers to the state if: (1) the holder of the interest in real property fails to comply with the terms and conditions of the grant agreement or work

plan; or (2) restrictions are placed on the land that preclude its use for the intended purpose as specified in the appropriation.

Subd. 3. Capital Construction. (a) A recipient of an appropriation from the trust fund who uses the appropriation to wholly or partially construct a building, trail, campground, or other capital asset may not alter the intended use of the capital asset or convey any interest in the capital asset for 25 years from the date of project completion without the prior review and approval of the commission or its successor. The commission shall notify the chairs and ranking minority members of the legislative committees and divisions with jurisdiction over the trust fund at least 15 business days before approval under this paragraph. The commission shall establish procedures to review requests from recipients to alter the use of or convey an interest in a capital asset under this paragraph. These procedures must require that:

(1) the sale price must be at least fair market value; and

(2) the trust fund must be repaid a proportion of the sale price equal to the percentage of the total funding provided by the fund for constructing the capital asset.

(b) Requirements under clause (1) and (2) above may be waived by the commission or its successor through recommendation to the legislature if the transfer allows for a continued use of the asset in a manner consistent with the original appropriation purpose or with the purposes of the trust fund.

(c) If both a capital asset and the real property on which it sits were wholly or partially purchased with an appropriation from the trust fund and the commission approves a request to alter the use of or convey an interest in the real property under subdivision 2, a separate approval under this subdivision to alter the use of the capital asset is not required.

(d) A recipient of an appropriation from the trust fund who uses the appropriation to wholly or partially construct a building, trail, campground, or other capital asset must separately record a notice of funding restrictions in the appropriate local government office. The notice of funding restrictions must contain:

(1) a legal description of the interest in real property covered by the funding agreement;

(2) a reference to the underlying funding agreement;

(3) a reference to this subdivision; and

(4) the following statement:

"This interest in real property shall be administered in accordance with the terms, conditions, and purposes of the grant agreement controlling the improvement of the property. The interest in real property, or any portion of the interest in real property, shall not be altered from its intended use or be sold, transferred, pledged, or otherwise disposed of or further encumbered without obtaining the prior written approval of the Legislative-Citizen Commission on Minnesota Resources or its successor."

116P.16 REAL PROPERTY INTERESTS; REPORT.

(a) By December 1 each year, a recipient of an appropriation from the trust fund, that is used for the acquisition of an interest in real property, including, but not limited to, an easement or fee title, or for the construction of a building, trail, campground, or other capital asset must submit annual reports on the status of the real property to the Legislative-Citizen Commission on Minnesota Resources or its successor in a form determined by the commission. The responsibility for reporting under this section may be transferred by the recipient of the appropriation to another person who holds the interest in the real property. To complete the transfer of reporting responsibility, the recipient of the appropriation must:

- (1) inform the person to whom the responsibility is transferred of that person's reporting responsibility;
- (2) inform the person to whom the responsibility is transferred of the property restrictions under section 116P.15; and
- (3) provide written notice to the commission of the transfer of reporting responsibility, including contact information for the person to whom the responsibility is transferred.

(b) After the transfer, the person who holds the interest in the real property is responsible for reporting requirements under this section.

Public Access

The LCCMR recommends that the Legislature consider a requirement for appropriate public access to capital improvements constructed using ENRTF dollars, but it is not proposing any specific statutory language for adoption by the Legislature. The LCCMR believes the public should have access to capital improvements constructed in whole or in part with public dollars. However, the ENRTF has funded a wide variety of projects that support the protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, other natural resources, and outdoor recreation. The LCCMR can envision scenarios where capital construction projects funded by the ENRTF may have public benefit but public access may not be appropriate, whether due to incompatibility (e.g., small building constructed to support research or a demonstration project for a new renewable energy system), public safety concerns (e.g., a water control structure), or another reason. Restrictions on all public access or allowing public access to be limited by time of day, number of people, fees, or other means may be appropriate under different circumstances.

References to Existing Requirements

The LCCMR recommends adding references to existing statutory requirements related to predesign, historic and archaeological review, accommodations for hard-of-hearing, energy conservation standards, energy use, geothermal and solar heating and cooling systems, competitive bids, targeted group purchasing, responsible contractors, and prevailing wage into Chapter 116P. The LCCMR's intent is not to create new requirements for projects with this recommendation but to provide greater clarity for LCCMR staff and ENRTF applicants that certain existing statutory requirements apply to ENRTF-funded projects. Many of these requirements are currently outlined in ENRTF appropriation rider language or grant agreements for pass-through ENRTF appropriations.

The following amendatory language is offered to implement this recommendation:

116P.XX [ADDITIONAL REQUIREMENTS FOR CAPITAL PROJECTS]

The following statutes apply to recipients of appropriations from the trust fund:

MS 16B.32; MS 16B.326; MS 16B.335, subd. 3 and subd. 4; MS 16C.16, MS 16C.28 and MS 471.345; MS 16C.054; MS 16C.285; MS 138.40, 138.665, and 138.666; and MS 177.41 to 177.44.

Applicability

The LCCMR recommends that capital construction projects of less than \$10,000 be excluded from any new ENRTF-specific statutory requirements for capital construction, but that land acquisition associated with construction be considered part of the capital construction project.

The following amendatory language is offered to implement this recommendation:

116P.XX [APPLICABILITY]

(a) Sections/Subdivisions X [match], Y [full funding], Z [sustainable building guidelines], XX [sale and alteration of use], and YY [public access] do not apply to:

- (1) a capital construction project with a total cost of less than \$10,000; or
- (2) a land acquisition project.

(b) If land is acquired with environment and natural resources trust fund money for the purpose of capital construction, the land acquisition is not exempted under this subdivision/section paragraph (a)(2).

Effective Date

The LCCMR recommends that any enacted statutory changes take effect July 1, 2023, and apply to proposals for capital construction projects received after that date to ensure applicants have sufficient notice and time to account for any new requirements.

Appendix A. Compiled Proposed Statutory Changes to Chapter 116P

116P.08 TRUST FUND EXPENDITURES.

...

Subd. 8. A recipient of money appropriated from the trust fund for a capital construction project must provide a cash or in-kind match from non-trust fund sources of at least 50 percent of the total eligible project costs.

116P.XX [FULL FUNDING REQUIRED]

(a) If an appropriation from the trust fund for a capital construction project or project phase is not sufficient, by itself, to complete the project or project phase, and thus requires a commitment from sources other than the trust fund:

(1) the commitment must be in an amount that, when added to the appropriation, is sufficient to complete the project or project phase; and

(2) the agency administering the appropriation shall not distribute the funds until the commitment is determined to be sufficient. In determining the sufficiency of a commitment under this paragraph, the agency shall apply the standards and principles applied by the commissioner of management and budget under section 16A.502.

116P.XX [SUSTAINABLE BUILDING GUIDELINES]

The sustainable building guidelines established under sections 16B.325 and 216B.241, subdivision 9, apply to new buildings and major renovations receiving funding from the environment and natural resources trust fund. A recipient of money appropriated from the trust fund for a new building or major renovation must ensure that the project complies with the guidelines.

116P.XX [ADDITIONAL REQUIREMENTS FOR CAPITAL PROJECTS]

The following statutes apply to recipients of appropriations from the trust fund:

MS 16B.32; MS 16B.326; MS 16B.335, subd. 3 and subd. 4; MS 16C.16, MS 16C.28 and MS 471.345; MS 16C.054; MS 16C.285; MS 138.40, 138.665, and 138.666; and MS 177.41 to 177.44.

116P.15 CAPITAL CONSTRUCTION AND LAND ACQUISITION; RESTRICTIONS.

Subdivision 1. Scope. A recipient of an appropriation from the trust fund or the Minnesota future resources fund who uses any portion of the appropriation for a capital construction project must comply with subdivision 3 of this section. A recipient of an appropriation from the trust fund or the Minnesota future resources fund who acquires any other interest in real property with the appropriation must comply with subdivision 2 of this section. For the purposes of this section, "interest in real property" includes, but is not limited to, an easement or fee title to property.

Subd. 2. **Restrictions; modification procedure** **Land acquisitions.** (a) An easement, fee title, or other interest in real property acquired with an appropriation from the trust fund or the Minnesota future resources fund must be used in perpetuity or for the specific term of an easement interest for the purpose for which the appropriation was made. The ownership of the interest in real property transfers to the state if:

(1) the holder of the interest in real property fails to comply with the terms and conditions of the grant agreement or work plan; or

(2) restrictions are placed on the land that preclude its use for the intended purpose as specified in the appropriation.

(b) A recipient of funding who acquires an interest in real property subject to this section may not alter the intended use of the interest in real property or convey any interest in the real property acquired with the appropriation without the prior review and approval of the commission or its successor. The commission shall notify the chairs and ranking minority members of the legislative committees and divisions with jurisdiction over the trust fund or Minnesota future resources fund at least 15 business days before approval under this paragraph. The commission shall establish procedures to review requests from recipients to alter the use of or convey an interest in real property. These procedures shall allow for the replacement of the interest in real property with another interest in real property meeting the following criteria:

(1) the interest must be at least equal in fair market value, as certified by the commissioner of natural resources, to the interest being replaced; and

(2) the interest must be in a reasonably equivalent location, and have a reasonably equivalent useful conservation purpose compared to the interest being replaced, taking into consideration all effects from fragmentation of the whole habitat.

(c) A recipient of funding who acquires an interest in real property under paragraph (a) must separately record a notice of funding restrictions in the appropriate local government office where the conveyance of the interest in real property is filed. The notice of funding agreement must contain:

(1) a legal description of the interest in real property covered by the funding agreement;

(2) a reference to the underlying funding agreement;

(3) a reference to this section; and

(4) the following statement:

"This interest in real property shall be administered in accordance with the terms, conditions, and purposes of the grant agreement controlling the acquisition of the property. The interest in real property, or any portion of the interest in real property, shall not be sold, transferred, pledged, or otherwise disposed of or further encumbered without obtaining the prior written approval of the Legislative-Citizen Commission on Minnesota Resources or its successor. The ownership of the interest in real property transfers to the state if: (1) the holder of the interest in real property fails to comply with the terms and conditions of the grant agreement or work plan; or (2) restrictions are placed on the land that preclude its use for the intended purpose as specified in the appropriation."

Subd. 3. **Capital Construction.** (a) A recipient of an appropriation from the trust fund who uses the appropriation to wholly or partially construct a building, trail, campground, or other capital asset may not alter the intended use of the capital asset or convey any interest in the capital asset for 25

years from the date of project completion without the prior review and approval of the commission or its successor. The commission shall notify the chairs and ranking minority members of the legislative committees and divisions with jurisdiction over the trust fund at least 15 business days before approval under this paragraph. The commission shall establish procedures to review requests from recipients to alter the use of or convey an interest in a capital asset under this paragraph. These procedures must require that:

(1) the sale price must be at least fair market value; and

(2) the trust fund must be repaid a proportion of the sale price equal to the percentage of the total funding provided by the fund for constructing the capital asset.

(b) Requirements under clause (1) and (2) above may be waived by the commission or its successor through recommendation to the legislature if the transfer allows for a continued use of the asset in a manner consistent with the original appropriation purpose or with the purposes of the trust fund.

(c) If both a capital asset and the real property on which it sits were wholly or partially purchased with an appropriation from the trust fund and the commission approves a request to alter the use of or convey an interest in the real property under subdivision 2, a separate approval under this subdivision to alter the use of the capital asset is not required.

(d) A recipient of an appropriation from the trust fund who uses the appropriation to wholly or partially construct a building, trail, campground, or other capital asset must separately record a notice of funding restrictions in the appropriate local government office. The notice of funding restrictions must contain:

(1) a legal description of the interest in real property covered by the funding agreement;

(2) a reference to the underlying funding agreement;

(3) a reference to this subdivision; and

(4) the following statement:

"This interest in real property shall be administered in accordance with the terms, conditions, and purposes of the grant agreement controlling the improvement of the property. The interest in real property, or any portion of the interest in real property, shall not be altered from its intended use or be sold, transferred, pledged, or otherwise disposed of or further encumbered without obtaining the prior written approval of the Legislative-Citizen Commission on Minnesota Resources or its successor."

116P.16 REAL PROPERTY INTERESTS; REPORT.

(a) By December 1 each year, a recipient of an appropriation from the trust fund, that is used for the acquisition of an interest in real property, including, but not limited to, an easement or fee title, or for the construction of a building, trail, campground, or other capital asset must submit annual reports on the status of the real property to the Legislative-Citizen Commission on Minnesota Resources or its successor in a form determined by the commission. The responsibility for reporting under this section may be transferred by the recipient of the appropriation to another person who holds the interest in the real property. To complete the transfer of reporting responsibility, the recipient of the appropriation must:

- (1) inform the person to whom the responsibility is transferred of that person's reporting responsibility;
- (2) inform the person to whom the responsibility is transferred of the property restrictions under section 116P.15; and
- (3) provide written notice to the commission of the transfer of reporting responsibility, including contact information for the person to whom the responsibility is transferred.

(b) After the transfer, the person who holds the interest in the real property is responsible for reporting requirements under this section.

116P.XX [APPLICABILITY]

(a) Sections/Subdivisions X [match], Y [full funding], Z [sustainable building guidelines], XX [sale and alteration of use], and YY [public access] do not apply to:

- (1) a capital construction project with a total cost of less than \$10,000; or
- (2) a land acquisition project.

(b) If land is acquired with environment and natural resources trust fund money for the purpose of capital construction, the land acquisition is not exempted under this section paragraph (a)(2).

Appendix B

Legislative-Citizen Commission on Minnesota Resources

MEMO Agenda Item 4d

DATE: December 15, 2021

SUBJECT: Requirements for Bond and Other State-Funded Capital Projects

Executive Summary

In response to a request from Legislative-Citizen Commission on Minnesota Resources (LCCMR) members, staff researched state bond-funding requirements of capital projects. Given the number of variables we discovered, staff narrowed its focus for purposes of this memo to a certain type of capital project: large construction projects for buildings over a certain cost threshold. We provide a summary of these state-funded project requirements below and attached. Some of these requirements are already incorporated in 116P or in the Environment and Natural Resources Trust Fund (ENRTF) standard bill rider language. Others are not but may still apply to ENRTF as the laws may refer to any state-funded capital project. Communications to ENRTF recipients by LCCMR about these requirements, as well as systems to facilitate the requirements being followed, are not currently consistent across requirements. These are noted as such in the “current ENRTF conditions” column on the attached table.

Background

Capital projects encompass a wide range of activities to acquire or better land or buildings in whole or in part. Minnesota statutes pertaining to capital projects (notably, those statutes found in [Ch. 16A](#) and [Ch. 16B](#)) address projects funded by general obligation (GO) bonds, which are the most common funding source for state-funded capital projects, as well as other sources of state funds. The statutes apply different requirements to a project depending on the type of project, the type of entity receiving the funding, and the funding source. For example, different requirements may apply to local projects versus projects conducted by state agencies. Some requirements only apply if the project is over a certain dollar threshold. Some requirements may apply to capital projects funded by GO bonds; others appear to apply for any state source of funding - even ENRTF.

Given the complexity in the variables described above and given this request from members for information appears to have been prompted by several recent requests from non-state entities to use ENRTF monies to construct buildings, LCCMR staff is providing a list and overview of requirements that most likely apply to **large-scale projects involving the design, construction, renovation, or repair of buildings**. Several of these requirements only apply if a project is over a certain threshold, for example at least \$1.5 million for local government projects or \$750,000 for state government or state university and college projects.

While we can provide information for other types of capital projects and expand the discussion, the requirements provided in this memo **do not necessarily apply (or apply uniformly)** to the following types of capital projects (unless they are part of a larger project meeting the criteria above):

- Acquisition of land for protection, restoration, or enhancement of air, land, water, fish, and wildlife
- Campgrounds
- Trails & paths
- Parking lots
- Boat ramps & docks
- Dams
- Design, construction, renovation, or repair of buildings by private entities

Legislative-Citizen Commission on Minnesota Resources

Existing LCCMR Requirements for Capital Projects

The constitution, MS 116P, LCCMR's strategic plan, and the annual request for proposals all touch on various types of capital projects that may or may not be eligible for ENRTF funding and that may or may not be prioritized for ENRTF funding. This memo does not address these authorizations, restrictions, or emphases.

There are some standard conditions on ENRTF funding, however, that are consistent with some of the requirements for GO bond and other state-funded capital projects. For example, for more than a decade, the following conditions have been included in LCCMR's standard appropriation rider language and would apply to the type of capital project addressed in this memo:

- Applicable energy conservation and sustainable building guidelines
- Americans with Disability Act (ADA) accessibility guidelines¹

In addition, pass-through grant agreements to recipients of ENRTF money require compliance with the following conditions related to contracting, purchasing, and wages, and therefore, these conditions would apply to the type of capital project addressed in this memo:

- Competitive Bidding
- Responsible Contractor
- Targeted Group Purchasing
- Prevailing Wage

In the attached list of likely requirements for GO bond and other state funded **large-scale projects involving the design, construction, renovation, or repair of buildings**, we have noted which may already apply to ENRTF-funded projects as well as the status of LCCMR operationalizing the requirement.

Bonding and Other State-Funded Capital Project Requirements

The attached table provides a list of GO bond and other state funding requirements for large-scale building construction projects. We also provide a brief description and link to the relevant statutory citation. Below is additional discussion of some of these requirements, the general process of vetting bond-funded requests, and acknowledgement that systems of oversight exist for most of these requirements.

Eligibility

Unlike ENRTF-funded projects, GO bond-funded capital projects must be publicly owned (a long-term lease may qualify) and used to operate a governmental program or activity. Private use is restricted, although a private entity may be contracted to operate the governmental program.

Requirements

Numerous additional requirements apply to both the review and the implementation of state-funded capital projects. For example, funding recipients may need to:

- Demonstrate fiscal capacity both to complete a project and fund ongoing operations of its state-funded purpose.
- Provide 50% match for local projects.
- Incorporate or consider incorporating certain elements into their project design, such as geothermal and solar thermal heating and cooling systems or accommodations for the hard-of-hearing.
- Have their project design and budget reviewed for compliance with various requirements and approved by different state agencies or legislative committees.
- Comply with certain contracting, purchasing, and labor requirements.
- Commit to restrictions on property use and sale that ensure the improved property continues to be used for the state-funded purpose.
- Provide assurances, in some cases through a construction bond, that the project will be completed as approved.

Legislative-Citizen Commission on Minnesota Resources

Process

GO bond funding requests, and most other requests for state funding of capital projects, are submitted in odd-numbered years to Minnesota Management and Budget (MMB) through the online Capital Budget System. The MMB reviews and ranks the projects based on need, eligibility, availability of alternative funding sources, capacity, and other criteria. The Department of Administration also reviews projects that require a state pre-design review prior to design or construction. The Governor recommends projects and incorporates them into a capital budget that is submitted for consideration by the Legislature in January of even-numbered years.

The requirements discussed here and provided on the attached table apply whether a project is funded through the standard process or added by the Legislature.

Once funded, systems exist within the various state agencies for review and monitoring of projects to ensure consistency with the funding requirements.

Attachments

- Requirements and Conditions Associated with State-Funded Capital Projects (table) dated 12/14/21

Action

This information is being provided for purposes of future discussion. No action is needed at this time.

ⁱ See [M.L. 2021, First Special Session, Chapter 6](#), Article 6, Subdivision 16 and 17

Requirements and Conditions Associated with State-Funded Capital Projects

This table provides an overview of various conditions and requirements that may apply to state-funded capital projects, such as building construction over a certain dollar threshold. The table also provides notes if any conditions are current conditions of Environment and Natural Resources Trust Fund (ENRTF) funding. This information was gathered from various documents related to general obligation bond funding from the Minnesota Management & Budget (MMB). It is not meant to be a comprehensive review of every possible requirement that might apply to a state-funded capital project.

		Description	Citation	Current ENRTF Condition
Eligibility				
1	Government Program	The capital improvement will be used to operate a governmental program or activity.	M.S. 16A.695, subd. 8	No
2	Public Ownership	Ownership by state agency or political subdivision of the capital asset being acquired or improved. ¹	M.S. 16A.695	No
3	Coordinated Facility Planning	Coordinated planning for consolidation or construction by the MDH, MDA, DNR, MPCA, and BWSR of facilities located outside of the metropolitan area.	M.S. 16B.241	No
Assurances				
4	Full Funding	Committed or legally binding demonstration that all funds to complete project are secured before project starts.	M.S. 16A.502; M.S. 16B.31, subd. 2	No ²
5	Match	Commitment of money to match state contribution.	M.S. 16A.86, subd. 4; M.S. 16A.695, subd. 6;	No
6	Resolution	Resolution in support of the project from the governing body if the applicant is part of a local unit of government.	M.S. 16A.86, subd. 3a	Yes
7	Grant Agreement	Agreement between state and non-state entity receiving funding.	M.S. 16A.695, subd. 9	Yes
8	Construction Assurances	Assurances in place that construction will be completed as designed.		No
9	Confirmation of Satisfactory Completion	Final reimbursement contingent on demonstrated work completion based on inspection, certificate of occupancy, or other methods.		No
10	Insurance	Appropriate insurance in place for improved property, such as builders risk insurance and fire and extended coverage.		No
Consultation and Review				
11	Predesign	Review and recommendation of predesign plan defining the purpose, scope, cost, and schedule of the project by the Department of Administration. ³	M.S. 16B.335	No ²

¹ Fee simple or long-term lease or easement qualifies as ownership.

² The LCCMR has not fully operationalized this requirement.

³ Exemptions for local government projects with total construction costs less than \$1.5 million, state government or state university/college projects less than \$750,000, campgrounds, trails, parking lots, pathways, dams, park buildings owned by a local government unit in the metropolitan area, and others.

Requirements and Conditions Associated with State-Funded Capital Projects

		Description	Citation	Current ENRTF Condition
12	Legislative Design Review and Notification	Presentation of program plan and cost estimates and advisory recommendation by Senate Finance and House Ways and Means committees prior to preparing final plans and specifications and notice to House and Senate capital investment committees. ⁴	M.S. 16B.335	No
13	Historic and Archaeological	Consult with State Historic Preservation Office and the Office of the State Archaeologist.	M.S. 138.40, subd. 3 ; M.S. 138.665, subd. 2 ; M.S. 138.666	No ⁵
14	Information Technology	Review and approve the information technology portion of construction and major remodeling program plan. ⁶	M.S. 16B.335, subd. 5 and 6	No
15	Asset Preservation	Report of projects funded through asset preservation appropriation to various executive and legislative entities.	M.S. 16B.307 ; M.S. 16A.632 ; M.S. 84.946	No
Energy Conservation and Sustainable Building Guidelines				
16	Sustainable Building Guidelines	Apply sustainable building guidelines.	M.S. 16B.325 ; M.S. 216B.241	Yes ⁵
17	Energy Conservation Standards	Comply with applicable energy conservation standards contained in law.	M.S. 16B.335, subd. 4 ; M.S. 216C.19 ; M.S. 216C.20	Yes ⁵
18	Geothermal and Solar Heating and Cooling System	Consider providing Geothermal & Solar Energy Heating & Cooling Systems on new or replacement HVAC systems.	M.S. 16B.326	No
19	Energy Use	Consider and plan for use of renewable energy sources and make energy efficiency improvements.	M.S. 16B.32	No
20	Solar Energy	Limit costs for solar energy systems to 5% of appropriation.	M.S. 16B.323	No
21	Recycling of Construction and Demolition Waste	Recycle certain percentage of nonhazardous construction and demolition waste.	M.S. 16B.327	Yes ⁵
Accessibility				
22	Accommodation for Hard-of-Hearing	Provide accommodations for hard-of-hearing when a public gathering space for gatherings of more than 15 people is constructed or improved.	M.S. 16C.054	No ⁵
Contracting, Purchasing, and Wages				
23	State Designer Selection Board	Selection or recommendation of a primary designer by the State Designer Selection Board. ⁷	M.S. 16B.33	No
24	Competitive Bid	Follow state requirements for competitively bidding contracts.	M.S. 16C.28 ; M.S. 471.345	Yes

⁴ Exemptions for local government projects with total construction costs less than \$1.5 million; state government or state university/college projects with total construction costs less than \$750,000; and campgrounds, trails, parking lots, pathways, dams, and other types of projects.

⁵ The LCCMR has not fully operationalized this requirement.

⁶ Limited to state agency projects.

⁷ Limited to state agencies and state universities and colleges. Only applies to projects for more than \$2 million or planning projects with fees more than \$200,000.

Requirements and Conditions Associated with State-Funded Capital Projects

		Description	Citation	Current ENRTF Condition
25	Responsible Contractor	Award competitively bid contracts of more than \$50,000 to contractors meeting minimum criteria as a responsible contractor.	M.S. 16C.285	Yes
26	MINNCOR Products	Consider the use of MINNCOR products.	M.S. 16B.335, subd. 3(c)	No ⁸
27	Prevailing Wage	Prevailing wage for laborers and workers for construction work of \$25,000 or more.	M.S. 177.42 to 177.44	Yes
28	Targeted Group Purchasing	Promote the use of targeted group businesses in purchasing. ⁹	M.S. 16C.16, subd. 13	Yes
29	Workforce Certificate of Compliance	Contract with businesses holding a workforce certificate of compliance, confirming an affirmative action plan, from the Department of Human Rights. ¹⁰	M.S. 363A.36	No
30	Equal Pay Certificate of Compliance	Contract with businesses holding an equal pay certificate of compliance from the Department of Human Rights. ¹⁰	M.S. 363A.44	No
Expenditures				
31	Art	Allocate up to 1% of total appropriation for artwork in public areas if appropriation for \$500,000 or more.	M.S. 16B.35	No
Ongoing Operations and Maintenance				
32	Operational Funding	Ability and plan to fund the program intended for the facility.	M.S. 16A.695, subd. 5;	No
33	State Operating Budget Impact	Identification of additional state funds for operations that upon completion, will be needed or requested related to the project.	M.S. 16A.695, subd. 5; M.S. 16A.86, subd. 3a	No
34	Ongoing Public Program Operation	Ongoing oversight by the state granting agency to ensure that the intended public program contained in the facility or operated on the property exists.	M.S. 16A.695, subd. 9	No
35	Recording Property Restriction	Recorded use restriction against property that is purchased or improved.		No ¹¹
36	Maintenance and Upkeep	Duty to maintain and upkeep improved property and avoid actions that decrease value.		No
37	Sale	Sale of property subject to certain conditions and state approval.	M.S. 16A.695	No ¹²

⁸ The LCCMR has not fully operationalized this requirement.

⁹ Targeted group businesses include businesses majority owned and operated by women, persons with a substantial physical disability, or minorities.

¹⁰ Applies to contracts above a certain threshold and businesses of a certain size.

¹¹ ENRTF projects are subject to use restrictions on land acquired using ENRTF funds ([M.S. 116P.15](#)), but those restrictions do not apply to construction or improvements independent of acquisition.

¹² ENRTF projects are subject to limitations on the sale of land acquired using ENRTF funds ([M.S. 116P.15](#)), but those limitations do not apply to projects that construct or improve facilities on land acquired using other funds.

Appendix C

Legislative-Citizen Commission on Minnesota Resources

MEMO

DATE: March 14, 2022

SUBJECT: ENRTF-Funded Activities to Acquire or Improve Land or Buildings (Capital Projects)

In response to a request from Legislative-Citizen Commission on Minnesota Resources (LCCMR) members, staff compiled a list of Environment and Natural Resources Trust Fund (ENRTF)-funded capital projects since 2013. Projects were added to the list of capital projects if they fit the broad definition of capital, i.e., projects that included some activity to acquire or improve land or buildings. Projects were grouped into 11 more narrow categories (as defined below) based on the dominant capital activity planned. The approximate amount of the project budget allocated to capital activities is also shown on the list.

We also examined trends in the number and funding level of capital projects from 2013 to 2021, and the results of this analysis are presented in the attached figure and tables. For the purpose of this analysis, we only counted a project once according to its dominant capital activity. However, projects may have included spending for capital activities in more than one category, such as land acquisition and development of recreational facilities. In these cases, the dollar amounts were split into the appropriate categories.

In all the above calculations, we used the amounts shown in the initial approved work plan budget, and non-capital costs of the projects were, to the best of our ability, not included. In some cases, this means funds may have ultimately been spent differently than shown in this analysis.

Highlights

- There are different kinds of capital projects; we have identified at least 11 categories.
- 163 ENRTF-funded projects from 2013 to 2021 included activities to acquire or improve land or buildings, with approximately \$169.5 million allocated toward these activities.
- The amount of ENRTF dollars directed towards capital projects has increased from 22% of ENRTF funding to 48% of ENRTF funding from 2013 to 2021.
- The increase has primarily been driven by increased funding for projects to construct recreational facilities and trails.
- The ENRTF has been used to fund two large-scale (>\$1.5 million for a local project) building projects since 2013. These projects were funded in the last 3 years.

Capital Project Categories

Building Design and/or Construction – The design and construction of large buildings and facilities.
Examples: visitor centers, learning centers

Conservation Easements – Acquisition of easements on private land for conservation.

Educational Exhibits – The design and installation of educational exhibits. Examples: kiosks, displays

Legislative-Citizen Commission on Minnesota Resources

Land Acquisition – Fee title acquisition of land for recreation, conservation, or other purposes related to natural resources and the environment. Examples: scientific and natural areas, parks

Recreational Facilities – The design and construction of recreational facilities and supporting infrastructure. Examples: campgrounds, restrooms, shower facilities, offices, docks, canoe landings, picnic areas, boat wash stations, parking lots, access roads

Renewable Energy – The design and construction of renewable energy systems. Examples: solar gardens, biomass boiler systems

Research and Demonstration – The design and construction of research facilities, installation of long-term monitoring equipment, and evaluation and demonstration of innovative technologies. Examples: AIS deterrents, wastewater treatment, renewable energy systems

Restoration (Large-Scale) – Restoration involving large-scale earth-moving and placement of materials. Examples: shoreline stabilization, grading, stream restoration. Traditional land restoration (plantings, prescribed burns, etc.) was not included.

Stormwater – The design and construction of stormwater infrastructure to improve water quality or habitat. Examples: retention basins, rain gardens

Trails – The engineering, design, and construction of trails.

Other – Projects that don't fall under any other category. Examples: green schoolyards, bison holding facilities

Attachments

- Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021
- Tables 2 to 4 and Figure 1. Summary Tables and Figure.
- LCCMR Memo: Requirements for Bond and Other State-Funded Capital Projects, From December 15, 2021 LCCMR Meeting

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
Building Design and/or Construction						
2021	9n	Crane Lake Voyageurs National Park Visitor Center - Continuation	\$2,700,000	\$2,700,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Crane Lake to design and construct an approximate 4,500 to 7,000 square-foot visitor center building to serve as an access point to Voyageurs National Park. A fiscal agent or fiscal management plan must be approved in the work plan before any trust fund money is spent. A copy of a resolution or other documentation of the city's commitment to fund operations of the visitor center must be included in the work plan submitted to the Legislative-Citizen Commission on Minnesota Resources.	Local Unit of Government	
2020 (ML 2021)	9u	Sportsmen's Training and Development Learning Center	\$85,000	\$85,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Minnesota Forest Zone Trappers Association to complete a site evaluation and master plan for the Sportsmen's Training and Developmental Learning Center near Hibbing...	Private	
2019	9e	National Loon Center	\$4,000,000	\$4,000,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the National Loon Center Foundation, in partnership with a fiscal agent to be approved by the Legislative-Citizen Commission on Minnesota Resources, to construct an approximately 15,000-square-foot National Loon Center in Cross Lake dedicated to loon survival, loon habitat protection and research, and recreation. Of this amount, up to \$1,449,000 is for planning, design, and construction of approximately six outdoor demonstration learning kiosks, interpretive trails, boardwalks and boat docks, a fishing dock, and native landscaping along approximately 3,100 feet of shoreline. Any remaining funds are for planning, engineering, and constructing the building and indoor exhibits. A land lease commitment of at least 25 years and fiscal sponsorship must be secured before any trust fund money is spent. This project requires a match of at least \$6,000,000. At least \$2,000,000 of this match must come from nonstate sources. If naming rights will be conveyed, the National Loon Center Foundation must include a plan for this in the work plan. All matching funds must be legally committed before any trust fund money may be spent on planning activities for or construction of the building and indoor exhibits. Net income generated from admissions, naming rights, and memberships to the National Loon Center as a result of trust fund contributions may be reinvested in the center's long-term loon conservation efforts as described in the work plan approved by the Legislative-Citizen Commission on Minnesota Resources according to Minnesota Statutes, section 116P.10.	Private	
Conservation Easements						
2021	9h	Native Prairie Stewardship and Prairie Bank Easement Acquisition	\$476,406	\$1,341,000 the first year is from the trust fund to the commissioner of natural resources to provide technical stewardship assistance to private landowners, restore and enhance native prairie protected by easements in the native prairie bank, and acquire easements for the native prairie bank in accordance with Minnesota Statutes, section 84.96, including preparing initial baseline property assessments...	State	
2020 (ML 2021)	9b	Private Native Prairie Conservation through Native Prairie Bank	\$642,935	\$2,000,000 the second year is from the trust fund to the commissioner of natural resources to provide technical stewardship assistance to private landowners, restore and enhance native prairie protected by easements in the native prairie bank, and acquire easements for the native prairie bank in accordance with Minnesota Statutes, section 84.96, including preparing initial baseline property assessments...	State	
2019	9j	Preserving the Avon Hills with Reverse-Bidding Easements	\$1,192,000	\$1,600,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Saint John's University in cooperation with Minnesota Land Trust to restore and enhance protected lands, provide public outreach, and prepare management plans for and use a reverse-bid ranking system to secure permanent conservation easements on high-quality natural habitat in the Avon Hills area of Stearns County...	College or University	
2018	9h	Protecting North-Central Minnesota Lakes	\$635,500	\$750,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Crow Wing County Soil and Water Conservation District to increase watershed protection to maintain and improve water quality in lakes and rivers in Aitkin and Crow Wing Counties with about ten permanent RIM conservation easements and 12 forest stewardship plans and by implementing six best management practices...	Local Unit of Government	
2018	9i	Easement Program for Native Prairie Bank	\$1,070,702	\$2,000,000 the second year is from the trust fund to the commissioner of natural resources to provide technical stewardship assistance to private landowners, restore and enhance about 270 acres of native prairie protected by easements in the native prairie bank, and acquire easements for the native prairie bank in accordance with Minnesota Statutes, section 84.96, on about 275 acres, including preparing initial baseline property assessments...	State	
2017	8l	Conservation Reserve Enhancement Program (CREP)	\$9,086,500	\$2,729,000 in fiscal year 2017 and \$5,771,000 the first year and \$5,000,000 the second year are from the trust fund to the Board of Water and Soil Resources to acquire permanent conservation easements and restore land under Minnesota Statutes, section 103F.515. This work may be done in cooperation with the federal Conservation Reserve Enhancement Program...	State	

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2017	9e	Native Prairie Stewardship and Prairie Bank Easement Acquisition	\$1,852,160	\$2,675,000 the first year is from the trust fund to the commissioner of natural resources to acquire native prairie bank easements in accordance with Minnesota Statutes, section 84.96, on approximately 335 acres, prepare baseline property assessments, restore and enhance at least 570 acres of native prairie sites, and provide technical assistance to landowners...	State	
2016	9c	Conservation Easements in the Avon Hills - Phase III	\$1,272,000	\$1,300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Saint John's University in cooperation with Minnesota Land Trust to secure permanent conservation easements on approximately 500 acres of high-quality habitat in Stearns County, prepare conservation management plans, and provide public outreach...	College or University	
2015	9d	Native Prairie Stewardship and Prairie Bank Easement Acquisition	\$2,560,761	\$3,325,000 the first year is from the trust fund to the commissioner of natural resources to acquire native prairie bank easements on at least 675 acres, prepare baseline property assessments, restore and enhance at least 1,000 acres of native prairie sites, and provide technical assistance to landowners...	State	
2015	9e	Metro Conservation Corridors Phase VIII - Coordination and Mapping and Conservation Easements	\$485,000	\$515,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Minnesota Land Trust for Phase VIII of the Metro Conservation Corridors partnership to provide coordination and mapping for the partnership and to acquire permanent conservation easements on at least 120 acres of strategic ecological landscapes to protect priority natural areas in the metropolitan area, as defined under Minnesota Statutes, section 473.121, subdivision 2, and portions of the surrounding counties...	Private	
2015	9j	Multi-Benefit Watershed Scale Conservation on North Central Lakes	\$950,000	\$950,000 the first year is from the trust fund to the Board of Water and Soil Resources to secure permanent conservation easements on at least 480 acres of high-quality habitat in Crow Wing and Cass Counties...	State	
2013	4c	Native Prairie Stewardship and Prairie Bank Easement Acquisition	\$529,570	\$750,000 the first year is from the trust fund to the commissioner of natural resources to acquire native prairie bank easements, prepare baseline property assessments, restore and enhance native prairie sites, and provide technical assistance to landowners...	State	
2013	4j	Preserving the Avon Hills Landscape - Phase II	\$743,500	\$772,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Saint John's University in cooperation with the Minnesota Land Trust to secure permanent conservation easements on high quality habitat in Stearns County, prepare conservation management plans, and provide public outreach...	College or University	
Educational Exhibits						
2018	5g	Morris Prairie Pollinator Demonstration Area and Education	\$105,000	\$550,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center at Morris to restore 17 acres of native prairie for pollinators and to construct wayside shelters and kiosks along an existing trail to provide information to visitors on the importance of pollinators and native prairie ecosystems...	College or University	
2018	5i	Update International Wolf Center Exhibits	\$1,000,000	\$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the International Wolf Center to design, construct, and install new interactive educational exhibits to help Minnesotans understand coexistence with the state's wolf populations and ongoing wolf management efforts.	Private	
2017	8d	State Park Pollinator Habitat Restoration	\$155,254	\$672,000 the first year is from the trust fund to the commissioner of natural resources to restore at least 520 acres of monarch butterfly and other native pollinator habitats in at least seven state parks in the Minnesota Prairie Conservation Plan core areas and establish pollinator plantings and interpretive exhibits in at least ten state parks...	State	
2014	9f	Pollinator Education Center at the Minnesota Landscape Arboretum	\$615,000	\$615,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop exhibits for an educational center that will offer hands-on learning experience about the role of pollinators and importance of pollinator habitat...	College or University	
Land Acquisition						
2021	9e	Metropolitan Regional Parks System Land Acquisition - Phase VII	\$2,250,000	\$2,250,000 the first year is from the trust fund to the Metropolitan Council for grants to acquire land within the approved park boundaries of the metropolitan regional park system...	Local Unit of Government	
2021	9j	SNA Acquisition, Restoration, Citizen-Science and Outreach	\$1,418,911	\$3,336,000 the first year is from the trust fund to the commissioner of natural resources for the scientific and natural areas (SNA) program to restore, improve, and enhance wildlife habitat on SNAs; increase public involvement and outreach; and strategically acquire lands that meet criteria for SNAs under Minnesota Statutes, section 86A.05, from willing sellers.	State	Also funded recreational facilities
2021	9q	Above the Falls Regional Park Acquisition	\$950,000	\$950,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Minneapolis Parks and Recreation Board to develop a restoration plan and acquire approximately 3.25 acres of industrial land for public access and habitat connectivity along the Mississippi River as part of Above the Falls Regional Park.	Local Unit of Government	
2021	9u	State Parks and State Trails Inholdings	\$2,560,000	\$2,560,000 the first year is from the trust fund to the commissioner of natural resources to acquire high-priority inholdings from willing sellers within the legislatively authorized boundaries of state parks, recreation areas, and trails to protect Minnesota's natural heritage, enhance outdoor recreation, and improve the efficiency of public land management.	State	

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2020 (ML 2021)	9a	DNR Scientific and Natural Areas	\$1,750,629	\$3,000,000 the second year is from the trust fund to the commissioner of natural resources for the scientific and natural area (SNA) program to restore, improve, and enhance wildlife habitat on SNAs; increase public involvement and outreach; and strategically acquire high-quality lands that meet criteria for SNAs under Minnesota Statutes, section 86A.05, from willing sellers.	State	Also funded recreational facilities
2020 (ML 2021)	9c	Minnesota State Parks and State Trails Inholdings	\$3,500,000	\$3,500,000 the second year is from the trust fund to the commissioner of natural resources to acquire high-priority inholdings from willing sellers within the legislatively authorized boundaries of state parks, recreation areas, and trails to protect Minnesota's natural heritage, enhance outdoor recreation, and promote tourism.	State	
2020 (ML 2021)	9g	Turning Back to Rivers: Environmental and Recreational Protection	\$1,000,000	\$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with The Trust for Public Land to help local communities acquire priority land along the Mississippi, St. Croix, and Minnesota Rivers and their tributaries to protect natural resources, provide buffers for flooding, and improve access for recreation.	Private	
2020 (ML 2021)	9h	Metropolitan Regional Parks System Land Acquisition	\$1,000,000	\$1,000,000 the second year is from the trust fund to the Metropolitan Council for grants to acquire land within the approved park boundaries of the metropolitan regional park system...	Local Unit of Government	
2020 (ML 2021)	9m	Whiskey Creek and Mississippi River Water Quality, Habitat, and Recreation	\$500,000	\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Mississippi Headwaters Board to acquire and transfer approximately 13 acres of land to the city of Baxter for future construction of water quality, habitat, and recreational improvements to protect the Mississippi River.	Local Unit of Government	
2020 (ML 2021)	9o	Crow Wing County Community Natural Area Acquisition	\$400,000	\$400,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Crow Wing County to acquire approximately 65 acres of land adjacent to the historic fire tower property to allow for diverse recreational opportunities while protecting wildlife habitat and preventing forest fragmentation...	Local Unit of Government	
2020 (ML 2021)	9t	Chippewa County Acquisition, Recreation, and Education	\$160,000	\$160,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Chippewa County to acquire wetland and floodplain forest and abandoned gravel pits along the Minnesota River to provide water filtration, education, and recreational opportunities.	Local Unit of Government	
2019	9a	Minnesota Scientific and Natural Areas	\$1,970,821	\$3,500,000 the first year is from the trust fund to the commissioner of natural resources for the scientific and natural areas (SNA) program to restore and enhance wildlife habitat on SNAs, increase public involvement and outreach, and strategically acquire high-quality lands that meet criteria for SNAs under Minnesota Statutes, section 86A.05, from willing sellers...	State	Also funded recreational facilities
2019	9c	Minnesota Parks and State Trails In-Holdings	\$2,000,000	\$2,000,000 the first year is from the trust fund to the commissioner of natural resources to acquire high-priority in-holdings from willing sellers within the legislatively authorized boundaries of state parks and trails to protect Minnesota's natural heritage, enhance outdoor recreational opportunities, and improve the efficiency of public land management...	State	
2018	9c	Harmony State Trail Extension	\$235,000	\$235,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Harmony to acquire fee title of about 16 parcels to allow for the approximate six-mile extension of the legislatively authorized state trail from Harmony south to the Iowa state border with a spur to Niagara Cave...	Local Unit of Government	
2018	9g	Protecting Mississippi River Headwaters Lands through Local, State, and Federal Partnership	\$700,000	\$700,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Baxter, in cooperation with Brainerd Public Schools and the Camp Ripley Sentinel Landscape Program, to acquire about 200 acres of forested land on the upper Mississippi River adjacent to Mississippi River Overlook Park for multiple public benefits, including being an outdoor classroom for local schools...	Local Unit of Government	
2018	9k	Minnesota State Parks and State Trails	\$2,500,000	\$2,500,000 the second year is from the trust fund to the commissioner of natural resources to acquire about 163 acres of high-priority in holdings from willing sellers within the legislatively authorized boundaries of state parks and trails in order to protect Minnesota's natural heritage, enhance outdoor recreational opportunities, and improve the efficiency of public land management...	State	
2018	9l	Scientific and Natural Areas Program	\$1,313,500	\$3,250,000 the second year is from the trust fund to the commissioner of natural resources for the scientific and natural areas program. Of this amount, \$1,500,000 is for habitat restoration activities, \$500,000 is for scientific and natural areas public engagement and outreach, and \$1,250,000 is to acquire strategic high-quality lands that meet criteria for scientific and natural areas under Minnesota Statutes, section 86A.05, from willing sellers...	State	
2017	9a	Metropolitan Regional Parks System Land Acquisition	\$1,500,000	\$1,500,000 the first year is from the trust fund to the Metropolitan Council for grants to acquire approximately 197 acres of land within the approved park boundaries of the metropolitan regional park system...	Local Unit of Government	
2017	9b	Scientific and Natural Areas Acquisition, Restoration, Citizen Science and Engagement	\$1,095,780	\$2,500,000 the first year is from the trust fund to the commissioner of natural resources to acquire at least 250 acres of land with high-quality native plant communities and rare features to be established as scientific and natural areas as provided in Minnesota Statutes, section 86A.05, subdivision 5, restore and improve at least 1,000 acres of scientific and natural areas, and provide technical assistance and outreach, including site steward events...	State	Also funded recreational facilities

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2017	9c	Minnesota State Parks and State Trails Land Acquisition	\$1,500,000	\$1,500,000 the first year is from the trust fund to the commissioner of natural resources to acquire approximately 373 acres from willing sellers for authorized state trails and critical parcels within the statutory boundaries of state parks...	State	
2017	9f	Leech Lake Acquisition	\$1,500,000	\$1,500,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Leech Lake Band of Ojibwe to acquire approximately 45 acres, including 0.67 miles of shoreline of high-quality aquatic and wildlife habitat at the historic meeting place between Henry Schoolcraft and the Anishinabe people...	Tribal	
2017	9i	Land Acquisition for Voyageurs National Park Crane Lake Visitors Center	\$950,000	\$950,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the town of Crane Lake, in partnership with Voyageurs National Park and the Department of Natural Resources, to acquire approximately 30 acres to be used for a visitor center and campground...	Local Unit of Government	
2016	9b	Minnesota Point Pine Forest Scientific and Natural Area Acquisition	\$500,000	\$500,000 the second year is from the trust fund to the commissioner of natural resources in cooperation with the Duluth Airport Authority to acquire approximately ten acres as an addition to the designated Minnesota Point Pine Forest Scientific and Natural Area located along the shores of Lake Superior in Duluth.	State	
2016	9d	Lincoln Pipestone Rural Water System Acquisition for Wellhead Protection	\$1,426,000	\$1,500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Lincoln Pipestone Rural Water to acquire and restore lands designated under an approved wellhead protection plan...	Private	
2016	9g	Otter Tail River Recreational Trail Acquisition	\$600,000	\$600,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Fergus Falls to acquire approximately 16 acres along the Otter Tail River for a recreational trail and park...	Local Unit of Government	
2015	9a	State Parks and State Trails Land Acquisitions	\$1,500,000	\$1,500,000 the first year is from the trust fund to the commissioner of natural resources to acquire at least 335 acres for authorized state trails and critical parcels within the statutory boundaries of state parks...	State	
2015	9b	Metropolitan Regional Parks System Land Acquisition Phase 4	\$1,000,000	\$1,000,000 the first year is from the trust fund to the Metropolitan Council for grants to acquire at least 133 acres of lands within the approved park unit boundaries of the metropolitan regional park system...	Local Unit of Government	
2015	9c	SNA Acquisition, Restoration, Enhancement and Public Engagement	\$2,533,068	\$4,000,000 the first year is from the trust fund to the commissioner of natural resources to acquire at least 350 acres of lands with high-quality native plant communities and rare features to be established as scientific and natural areas as provided in Minnesota Statutes, section 86A.05, subdivision 5, restore and improve at least 550 acres of scientific and natural areas, and provide technical assistance and outreach...	State	Also funded recreational facilities
2015	9f	Metropolitan Conservation Corridors Phase VIII - Strategic Lands Protection	\$750,000	\$750,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with The Trust for Public Land for Phase VIII of the Metro Conservation Corridors partnership to acquire in fee at least 35 acres of high-quality priority state and local natural areas in the metropolitan area, as defined under Minnesota Statutes, section 473.121, subdivision 2, and portions of the surrounding counties...	Private	
2015	9g	Metro Conservation Corridors Phase VIII - Priority Expansion of Minnesota Valley National Wildlife Refuge	\$500,000	\$500,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Minnesota Valley National Wildlife Refuge Trust, Inc. for Phase VIII of the Metro Conservation Corridors partnership to acquire in fee at least 100 acres of priority habitat for the Minnesota Valley National Wildlife Refuge in the metropolitan area, as defined under Minnesota Statutes, section 473.121, subdivision 2, and portions of the surrounding counties...	Private	
2015	9h	Metro Conservation Corridors Phase VIII - Wildlife Management Area Acquisition	\$400,000	\$400,000 the first year is from the trust fund to the commissioner of natural resources for Phase VIII of the Metro Conservation Corridors partnership to acquire in fee at least 82 acres along the lower reaches of the Vermillion River in Dakota County within the Gores Pool Wildlife Management Area...	State	
2014	7a	Scientific and Natural Area Acquisition, Restoration, Improvement and Citizen Engagement	\$1,424,140	\$2,540,000 the second year is from the trust fund to the commissioner of natural resources to acquire lands with high-quality native plant communities and rare features to be established as scientific and natural areas as provided in Minnesota Statutes, section 86A.05, subdivision 5, restore and improve parts of scientific and natural areas, and provide technical assistance and outreach...	State	Also funded recreational facilities
2014	7b	Metropolitan Regional Park System Acquisition	\$1,500,000	\$1,500,000 the second year is from the trust fund to the Metropolitan Council for grants for the acquisition of lands within the approved park unit boundaries of the metropolitan regional park system...	Local Unit of Government	
2014	7d	Shoreland Acquisition on St. Croix River	\$1,250,000	\$1,250,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Washington County to purchase 15 acres, encompassing 3,500 feet of St. Croix shoreland paralleling Brown's Creek State Trail in the city of Stillwater...	Local Unit of Government	

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2014	7e	Martin County Park and Natural Area Acquisition	\$430,000	\$435,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Fox Lake Conservation League, Inc. and Martin County to acquire approximately 40 acres in Martin County, including a ten-acre prairie remnant to be owned and managed by Martin County as part of its park system...	Private	Also funded recreational facilities
2013	4a	State Parks and State Trails Land Acquisitions	\$1,000,000	\$1,000,000 the first year is from the trust fund to the commissioner of natural resources to acquire authorized state trails and critical parcels within the statutory boundaries of state parks...	State	
2013	4d	Metropolitan Conservation Corridors Phase VII	\$1,284,550	\$2,000,000 the first year is from the trust fund for the acceleration of agency programs and cooperative agreements. Of this appropriation, \$10,000 is to the commissioner of natural resources for agency programs and \$1,990,000 is to the commissioner of natural resources for agreements as follows: \$304,000 with Friends of the Mississippi River; \$368,000 with Dakota County; \$208,000 with Great River Greening; \$310,000 with Minnesota Land Trust; \$400,000 with Minnesota Valley National Wildlife Refuge Trust, Inc.; and \$400,000 with the Trust for Public Land for planning, restoring, and protecting priority natural areas in the metropolitan area, as defined under Minnesota Statutes, section 473.121, subdivision 2, and portions of the surrounding counties, through contracted services, technical assistance, conservation easements, and fee title acquisition...	Private	
2013	4e	Landscape Arboretum Acquisition Lake Tamarack	\$2,000,000	\$2,000,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to acquire land surrounding Lake Tamarack in Carver County as part of the acquisition of approximately 80 acres...	College or University	
2013	4k	Frogtown Farm and Park Acquisition	\$1,500,000	\$1,500,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Trust for Public Land to acquire a portion of 12 acres for Frogtown Farm and Park to be established as a St. Paul city park.	Private	
Recreational Facilities						
2021	6g	Stop Starry Invasion with Community Invasive Species Containment	\$1,000,000	\$1,000,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Minnesota Lakes and Rivers Advocates to work with civic leaders to purchase, install, and operate waterless cleaning stations for watercraft; conduct aquatic invasive species education; and implement education upgrades at public accesses to prevent invasive starry stonewort spread beyond the 16 lakes already infested...	Private	
2021	8o	Shoreline Stabilization, Fishing, and ADA Improvements at Silverwood Park	\$200,000	\$200,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Three Rivers Park District to provide water quality improvements through shoreline stabilization, shoreline fishing improvements, and shoreline ADA access on the island in Silver Lake within Silverwood Park.	Local Unit of Government	
2021	9d	Local Parks, Trails, and Natural Areas Grant Programs	\$2,250,000	\$2,250,000 the first year is from the trust fund to the commissioner of natural resources to solicit and rank applications for and fund competitive matching grants for local parks, trail connections, and natural and scenic areas under Minnesota Statutes, section 85.019...	State	Also funded trails and land acquisition
2021	9f	Sauk Rapids Lions Park Riverfront Improvements	\$463,000	\$463,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Sauk Rapids to design and construct a second phase of upgrades to Lions and Southside Parks including trails, lighting, riverbank restoration, and a canoe and kayak launch to enhance access to the Mississippi River.	Local Unit of Government	
2021	9g	City of Brainerd - Mississippi Landing Trailhead	\$2,850,000	\$2,850,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Brainerd to design and construct Mississippi Landing Trailhead Park to help connect residents and visitors to the Mississippi River through recreation, education, and restoration.	Local Unit of Government	
2021	9m	Veterans on the Lake	\$553,000	\$553,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Lake County for Veterans on the Lake to conduct accessibility upgrades to Veterans on the Lake's existing trails, roadway, and buildings to improve access to the wilderness and outdoor recreation for disabled American veterans.	Local Unit of Government	
2021	9o	Brookston Campground, Boat Launch, and Outdoor Recreation Facility Planning	\$425,000	\$425,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Brookston to design a campground, boat launch, and outdoor recreation area on the banks of the St. Louis River in northeastern Minnesota...	Local Unit of Government	
2021	9v	Accessible Fishing Piers and Shore Fishing Areas	\$340,000	\$340,000 the first year is from the trust fund to the commissioner of natural resources to provide accessible fishing piers and develop shore fishing sites to serve new angling communities, underserved populations, and anglers with disabilities.	State	
2020 (ML 2021)	9d	Grants for Local Parks, Trails, and Natural Areas	\$2,400,000	\$2,400,000 the second year is from the trust fund to the commissioner of natural resources to solicit, rank, and fund competitive matching grants for local parks, trail connections, and natural and scenic areas under Minnesota Statutes, section 85.019. This appropriation is for local nature-based recreation, connections to regional and state natural areas, and recreation facilities and may not be used for athletic facilities such as sport fields, courts, and playgrounds.	State	Also funded trails and land acquisition

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2020 (ML 2021)	9l	Upper St. Anthony Falls Enhancements	\$2,700,000	\$2,800,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Friends of the Lock and Dam in partnership with the city of Minneapolis to design and install green infrastructure, public access, and habitat restorations on riverfront land at Upper St. Anthony Falls for water protection, recreation, and environmental education purposes...	Local Unit of Government	
2020 (ML 2021)	9r	Ranier Safe Harbor and Transient Dock on Rainy Lake	\$762,000	\$762,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Ranier to construct a dock that accommodates boats 26 feet or longer with the goal of increasing public access for boat recreation on Rainy Lake...	Local Unit of Government	
2020 (ML 2021)	9s	Crane Lake Voyageurs National Park Campground and Visitor Center	\$3,100,000	\$3,100,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the town of Crane Lake to design and construct a new campground and to plan and preliminarily prepare a site for constructing a new Voyageurs National Park visitor center on land acquired for these purposes in Crane Lake...	Local Unit of Government	
2020 (ML 2021)	9v	Birch Lake Recreation Area	\$350,000	\$350,000 the second year is from the trust fund to the commissioner of natural resources for a grant to the city of Babbitt to expand the Birch Lake Recreation Area by adding a new campground to include new campsites, restrooms, and other facilities...	Local Unit of Government	
2019	9b	Grants for Local Parks, Trails, and Natural Areas	\$3,000,000	\$3,000,000 the first year is from the trust fund to the commissioner of natural resources to solicit, rank, and fund competitive matching grants for local parks, trail connections, and natural and scenic areas under Minnesota Statutes, section 85.019. The appropriation is for local nature-based recreation, connections to regional and state natural areas, and recreation facilities and not for athletic facilities such as sport fields, courts, and playgrounds.	State	Also funded trails and land acquisition
2019	9f	Accessible Fishing Piers	\$320,000	\$320,000 the first year is from the trust fund to the commissioner of natural resources to provide accessible fishing piers in locations that have a high potential to serve new angling communities, underserved populations, and anglers with physical disabilities...	State	
2019	9h	Birch Lake Recreation Area Campground	\$350,000	\$350,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Babbitt to expand Birch Lake Recreation Area by adding a new campground for recreational vehicles and tent campers...	Local Unit of Government	
2019	9k	Bailey Lake Trail and Fishing Pier	\$550,000	\$550,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Virginia to reconstruct the existing Bailey Lake Trail and construct a new fishing pier on Bailey Lake that is accessible from the trail.	Local Unit of Government	
2019	9p	Rainy Lake Recreational Access and Boat Wash Station	\$200,000	\$200,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Ranier to enhance and increase public access to Rainy Lake by constructing an Americans with Disabilities Act (ADA)-compliant recreational parking lot, an ADA-compliant public restroom, and an aquatic invasive species boat wash station.	Local Unit of Government	
2019	9q	Historic Bruce Mine Park and Mesabi Trailhead	\$1,000,000	\$1,000,000 the first year is from the trust fund to the commissioner of natural resources for a grant to the St. Louis and Lake Counties Regional Railroad Authority to engineer, design, renovate, and construct the Historic Bruce Mine Park and Mesabi Trailhead and access in the city of Chisholm...	Local Unit of Government	
2018	9a	Grants for Local Parks, Trails, and Natural Areas	\$2,000,000	\$2,000,000 the second year is from the trust fund to the commissioner of natural resources to solicit, rank, and fund competitive matching grants for local parks, trail connections, and natural and scenic areas under Minnesota Statutes, section 85.019. The appropriation is for local nature-based recreation and connections to regional and state natural areas and recreation facilities and does not include athletic facilities such as sport fields, courts, and playgrounds...	State	Also funded trails and land acquisition
2017	9h	Tower Trailhead Boat Landing and Habitat Improvement - Phase II	\$600,000	\$600,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Tower to construct a trailhead and boat landing and restore vegetative habitat on city-owned property...	Local Unit of Government	Also funded restoration (large-scale)
2016	9a	Scientific and Natural Area Restoration	\$63,300	\$1,386,000 the second year is from the trust fund to the commissioner of natural resources to restore and improve approximately 750 acres of scientific and natural areas...	State	
2015	5c	Zumbro River Watershed Recreational Learning Stewardship Sites	\$300,000	\$300,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Zumbro Watershed Partnership to develop at least six recreational and educational sites on the Zumbro River with water quality demonstration elements and interpretive signage designed to encourage adoption of water protection practices...	Private	
2015	5a	Trap Shooting Sports Facility Grants	\$132,000	\$132,000 the first year is from the trust fund to the commissioner of natural resources for trap shooting sports facility grants under Minnesota Statutes, section 87A.10.	State	
2014	7f	Minnesota River Water Trailhead and Landing in Morton	\$198,000	\$198,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Morton to transform a municipal parcel from a compost site into a Minnesota River water trailhead and landing and to design and build interpretive trails around the landing complex...	Local Unit of Government	

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2013	4b	Scientific and Natural Areas Restoration, Enhancement and Citizen Engagement	\$242,440	\$1,500,000 the first year is from the trust fund to the commissioner of natural resources to conserve sites of biodiversity significance by restoring and enhancing lands established as scientific and natural areas as provided in Minnesota Statutes, section 86A.05, subdivision 5, and providing volunteer engagement and outreach...	State	
Renewable Energy						
2019	7b	White Earth Nation Community Solar for Economic Resilience	\$500,000	\$500,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Rural Renewable Energy Alliance to install a 200-kW White Earth community-owned solar garden to reduce greenhouse gas emissions, increase economic development through environmental education and solar workforce training, and improve energy resilience.	Private	
2017	7d	District Heating with Renewable Biomass at Camp Ripley Training Center	\$1,000,000	\$1,000,000 the first year is from the trust fund to the commissioner of military affairs to install a 5,000,000-BTU centralized biomass boiler system utilizing the forestry management at Camp Ripley...	State	
2016	7a	Community Solar Garden Installation	\$479,000	\$490,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Rural Renewable Energy Alliance to install a 200-kilowatt community solar garden to provide for electrical distribution in Cass, Beltrami, Hubbard, and Itasca Counties, to assist households in the Minnesota low-income housing energy assistance program in meeting electrical energy needs and serve as a model for low-income energy assistance elsewhere in the state...	Private	
2014	8h	Solar Photovoltaic Installation at Residential Environmental Learning Centers	\$150,000	\$150,000 the second year is from the trust fund to the commissioner of natural resources for agreements with Deep Portage Learning Center to coordinate with Audubon Center of the North Woods; Eagle Bluff Environmental Learning Center; Laurentian Environmental Learning Center; Long Lake Conservation Center; and Wolf Ridge Environmental Learning Center the installation of at least five kilowatt institutional solar arrays at each of the six residential environmental learning centers as a teaching tool...	Private	
2014	8i	Itasca Community College Woody Biomass Utilization Project Design	\$112,000	\$112,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Itasca Community College to develop a final design for installation of a boiler heating system using woody biomass...	College or University	
Research and Demonstration						
2021	4b	Novel Nutrient Recovery Process from Wastewater Treatment Plants	\$98,695	\$200,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to conduct lab- and pilot-scale tests of a new process to promote nutrient removal and recovery at rural municipal and industrial wastewater treatment plants for water protection and renewable energy production.	College or University	
2021	7b	Storing Renewable Energy in Flow Battery for Grid Use	\$2,198,000	\$2,408,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Morris, to implement a rural, community-scale project that demonstrates how a large flow battery connected to solar and wind generation improves grid stability and enhances use of renewable energy.	College or University	
2021	7c	Agrivoltaics to Improve the Environment and Farm Resiliency	\$391,000	\$646,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, West Central Research and Outreach Center, Morris, to model and evaluate alternative solar energy system designs to maximize energy production while providing other benefits to cattle and farmers.	College or University	
2020 (ML 2021)	10	Wastewater Renewable Energy Demonstration Grants	\$1,095,000	\$1,095,000 the second year is from the trust fund to an emerging issues account authorized in Minnesota Statutes, section 116P.08, subdivision 4, paragraph (d). Money appropriated under this subdivision must be used for grants in consultation with the Public Facilities Authority for renewable energy demonstration projects at wastewater treatment facilities.	State	
2020 (ML 2021)	3d	Foundational Hydrology Data for Wetland Protection and Restoration	\$350,000	\$400,000 the second year is from the trust fund to the commissioner of natural resources to improve wetland protection, management, and restoration in Minnesota by completing the partially established long-term Wetland Hydrology Monitoring Network that will provide critical knowledge of wetland hydrology dynamics...	State	
2020 (ML 2021)	3f	Expanding Restoration and Promoting Awareness of Native Mussels	\$29,680	\$489,000 the second year is from the trust fund to the Minnesota Zoological Garden to promote mussel conservation by rearing juvenile mussels for reintroduction, researching methods to improve growth and survival in captivity, and encouraging public action to benefit water quality...	Private	
2020 (ML 2021)	4f	Innovative Solution for Protecting Minnesota from PFAS Contamination	\$250,000	\$250,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Dem-Con Companies to demonstrate a new technology for protecting the state's drinking water and natural resources by eliminating per- and polyfluoroalkyl substances (PFAS) from point source discharges...	Private	
2019	4r	Spring Biological Nitrate Removal to Protect Drinking Water	\$141,000	\$175,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Fairmont to build and demonstrate the effectiveness of an experimental passive biological treatment system to reduce nitrates that enter the city's springtime water supply source.	Local Unit of Government	

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2019	7a	Development of Clean Energy Storage Systems for Farms	\$244,494	\$650,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center at Morris to develop and test novel clean energy storage systems for farms using wind-generated ammonia to displace fossil fuels and reduce greenhouse gas emissions...	College or University	
2018	3h	Mapping Avian Movement in Minnesota	\$33,500	\$200,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to pilot the establishment of a network of automated radio-telemetry stations to monitor bird migration and local movements and to develop strategic plans for using the infrastructure long term to monitor animal movement for conservation...	College or University	
2018	6e	Install and Evaluate an Invasive Carp Deterrent for Mississippi River Locks and Dams	\$889,750	\$998,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota in cooperation with the United States Army Corps of Engineers and the United States Fish and Wildlife Service to install, evaluate, and optimize a system in Mississippi River locks and dams to deter passage of invasive carp without negatively impacting native fish and to evaluate the ability of predator fish in the pools above the locks and dams to consume young carp...	College or University	
2018	7b	Demonstration for Community-Scale Storage System for Renewable Energy	\$414,350	\$550,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to install, demonstrate, and evaluate three community-scale storage systems for renewable energy and develop a guidebook on storing renewable energy for statewide use...	College or University	
2017	4c	Rearing Native Mussels for Reintroduction and Expanding Water Quality Awareness	\$183,000	\$591,000 the first year is from the trust fund to the Minnesota Zoological Garden in cooperation with the Department of Natural Resources to accelerate the reintroduction of native mussels into Minnesota rivers and streams through expanded mussel rearing, research, and statewide educational activities promoting mussel conservation and water quality...	Private	
2017	4d	Water Quality Monitoring in Southeastern Minnesota Trout Streams	\$361,750	\$500,000 the first year is from the trust fund to the Board of Trustees of Minnesota State Colleges and Universities, Winona State University, to develop a system of biological monitoring for water quality protection of trout streams in southeastern Minnesota...	College or University	
2017	7c	Generation, Storage, and Utilization of Solar Energy	\$160,000	\$500,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, West Central Research and Outreach Center, Morris, to develop and demonstrate an integrated facility to generate electricity, shade dairy cattle, and provide energy storage and utilization from solar technologies at the West Central Research and Outreach Center, Morris...	College or University	
2017	8c	Evaluating the Use of Bison to Restore and Preserve Savanna Habitat	\$135,000	\$388,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Cedar Creek Ecosystem Science Reserve, to research combined bison grazing and fire management strategies to restore Minnesota's oak savanna ecosystems...	College or University	
2016	4t	Surface Water Bacterial Treatment System Pilot Project	\$422,900	\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Vadnais Lake Area Water Management Organization to reduce bacteria and nutrient loads to Vadnais Lake, a drinking water supply reservoir, through implementation and evaluation of a subsurface constructed wetland as a best management practice for potential statewide use. The Vadnais Lake Area Water Management Organization must consider contracting with the University of Minnesota Department of Civil, Environmental, and Geo-Engineering to evaluate the effectiveness of the pilot treatment system so that it maximizes benefits and can be replicated elsewhere...	Local Unit of Government	
2016	7e	Solar Energy Utilization for Minnesota Swine Farms - Phase II	\$412,294	\$475,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center in Morris to continue to develop and evaluate the utilization of solar photovoltaic systems at swine facilities to improve energy and economic performance, reduce fossil fuel usage and emissions, and optimize water usage...	College or University	
2015	4b	A Novel Biofilm Technology for Water Nutrient Removal	\$100,703	\$281,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to develop a simulated lichen biofilm system that can be used to remove pollutants and recycle nutrients from storm water runoff and polluted lakes, ponds, and lagoons...	College or University	
2015	4g	Using Hydroacoustics to Monitor Sediment in Minnesota Rivers	\$50,190	\$455,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the United States Geological Survey to install hydroacoustic equipment on the lower Minnesota and Mississippi Rivers to improve measurement and monitoring accuracy for suspended sediment and enhance ongoing sediment reduction efforts by state, federal, and local agencies...	Federal	
2015	7b	Reducing Emissions from Open Burning through Biomass Gasification	\$45,620	\$268,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota in cooperation with the Department of Natural Resources to characterize and promote distributed biomass gasification of wood waste as a means for producing renewable and sustainable energy in rural areas through a demonstration at the Department of Natural Resources regional office facility in New Ulm.	College or University	

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2014	3l	Rainwater and Reuse and Valuation Investigation	\$100,000	\$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to design, install, and monitor a rainwater reuse system for use in evaporative chiller systems and identify other potential applications for rainwater reuse systems.	College or University	
2014	4a	Blocking Bighead, Silver, and Other Invasive Carp by Optimizing Lock and Dams	\$42,950	\$854,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to collaborate with the United States Army Corps of Engineers to develop ways, including new technologies, to modify the operations of Lock and Dam Numbers 2 to 8 to optimize their ability to impede invasive carp movement into the Minnesota, St. Croix, and Mississippi Rivers...	College or University	
2014	8d	Transitioning Minnesota Farms to Local Energy	\$175,145	\$500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center in Morris to develop clean energy strategies for Minnesota farms in order to reduce fossil fuel energy use and increase local energy production. Any installation of infrastructure or improvements must be at the University of Minnesota West Central Research and Outreach Center...	College or University	
Restoration (Large-Scale)						
2021	8r	Elm Creek Habitat Restoration Final Phase	\$521,000	\$521,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Champlin to conduct habitat and stream restoration in Elm Creek upstream of Mill Ponds.	Local Unit of Government	
2021	9k	Precision Acquisition for Restoration, Groundwater Recharge, and Habitat	\$467,000	\$467,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Shell Rock River Watershed District to acquire and restore to wetland a key parcel of land to reduce downstream flooding while providing water storage, groundwater recharge, nutrient reduction, and pollinator and wildlife habitat.	Local Unit of Government	Also funded land acquisition
2020 (ML 2021)	9e	Mississippi River Aquatic Habitat Restoration and Mussel Reintroduction	\$1,800,000	\$1,800,000 the second year is from the trust fund. Of this amount, \$1,549,000 is to the commissioner of natural resources for an agreement with the Minneapolis Park and Recreation Board and \$251,000 is to the commissioner of natural resources to restore lost habitat and reintroduce mussels in the Mississippi River above St. Anthony Falls. This work includes creating habitat and species restoration plans, implementing the restoration plans, and monitoring effectiveness of the restoration for multiple years after implementation...	Local Unit of Government	
2020 (ML 2021)	9j	Elm Creek Restoration - Phase IV	\$500,000	\$500,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Champlin to conduct habitat and stream restoration of approximately 0.7 miles of Elm Creek shoreline above Mill Pond Lake and through the Elm Creek Protection Area.	Local Unit of Government	
2019	8c	Sauk River Dam Removal and Rock Rapids Replacement	\$2,768,000	\$2,768,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Melrose to remove an existing fixed-elevation dam, construct a rock arch rapids, and conduct in-stream and shoreline habitat restoration to improve water quality and native fish passage in the Sauk River...	Local Unit of Government	
2016	8i	Champlin Mill Pond Shoreland Restoration	\$2,000,000	\$2,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Champlin to restore the Champlin Mill Pond shoreline and adjacent habitat...	Local Unit of Government	
2015	8i	Flood Recovery on Sargent Creek Duluth Habitat Restoration	\$300,000	\$300,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Duluth to re-establish stable and natural streambanks with riparian and aquatic habitat restoration on at least 5,400 linear feet of Sargent Creek in Duluth destroyed during the flood of 2012.	Local Unit of Government	
2014	6d	Northeast Minnesota White Cedar Restoration - Phase 2	\$185,000	\$335,000 the second year is from the trust fund to the Board of Water and Soil Resources to continue an assessment of the decline of northern white cedar plant communities in northeast Minnesota, demonstrate restoration techniques, and provide cedar restoration training to local units of government...	State	
Stormwater						
2021	9t	Highbanks Ravine Bat Habernaculum Project	\$825,000	\$825,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of St. Cloud to reroute and upgrade an existing stormwater system in the Highbanks Ravine area to improve an existing bat hibernaculum, reduce erosion, and create additional green space for wildlife habitat.	Local Unit of Government	
2013	5c	Heron Lake Sediment and Phosphorus Reduction Implementation Projects	\$93,000	\$122,000 the first year is from the trust fund to the Board of Water and Soil Resources for an agreement with the Heron Lake Watershed District for public outreach and installation and monitoring of water quality improvement projects...	State	
2013	5d	Southern Minnesota Lakes Restoration	\$463,000	\$463,000 the first year is from the trust fund to the Board of Water and Soil Resources for an agreement with Le Sueur County to install shoreland and agricultural best management practices to improve water quality for up to 14 lakes in a tri-county area in southern Minnesota...	State	
Trails						
2021	8h	Plumbing the Muddy Depths of Superior Hiking Trail	\$187,000	\$187,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Superior Hiking Trail Association to install and implement water management practices to prevent erosion and improve access to the Superior Hiking Trail.	Private	

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2021	8k	Woodcrest Trail Expansion	\$16,000	\$16,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Foundation for Health Care Continuum, doing business as Country Manor Campus, LLC, to construct a trail for public recreational use on land owned by the senior living facility in central Minnesota.	Private	
2021	9a	Perham to Pelican Rapids Regional Trail (McDonald Segment)	\$2,245,000	\$2,245,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Otter Tail County to construct the McDonald Segment of the Perham to Pelican Rapids Regional Trail to connect the cities of Perham and Pelican Rapids to Maplewood State Park.	Local Unit of Government	
2021	9b	Mesabi Trail CSAH 88 to Ely	\$1,650,000	\$1,650,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority to acquire, engineer, and construct a segment of the Mesabi Trail beginning at the intersection of County State-Aid Highway 88 toward Ely.	Local Unit of Government	Also funded land acquisition
2021	9c	Southwest Minnesota Single-Track Trail	\$190,000	\$190,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Jackson County to create a single-track mountain bike trail and expand an associated parking lot in Belmont County Park to address a lack of opportunity for this kind of outdoor recreation in southwest Minnesota.	Local Unit of Government	Also funded recreational facilities
2021	9i	Moose Lake - Trunk Highway 73 Trail	\$330,000	\$330,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Moose Lake to design and construct a nonmotorized recreational trail in an off-street pedestrian corridor along Highway 73 to connect to several existing regional trails in the Moose Lake area.	Local Unit of Government	
2021	9l	Lake Brophy Single-Track Trail Expansion	\$100,000	\$100,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Douglas County in partnership with the Big Ole Bike Club to design and build new expert single-track segments and an asphalt pump track for the existing trail system at Lake Brophy Park to improve outdoor recreation experiences in west-central Minnesota.	Local Unit of Government	
2021	9p	Moose and Seven Beaver Multiuse Trails Upgrade	\$900,000	\$900,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Hoyt Lakes, in partnership with the Ranger Snowmobile and ATV Club, to design and construct upgrades and extensions to the Moose and Seven Beaver multiuse trails to enhance access for recreation use and connect to regional trails.	Local Unit of Government	
2021	9r	Silver Lake Trail Improvement Project	\$1,071,000	\$1,071,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Virginia to reconstruct and renovate the walking trail around Silver Lake to allow safe multimodal transportation between schools, parks, community recreation facilities, and other community activity centers in downtown Virginia.	Local Unit of Government	
2021	9s	Minnesota State Trails Development	\$4,266,000	\$4,266,000 the first year is from the trust fund to the commissioner of natural resources to expand recreational opportunities on Minnesota state trails by rehabilitating and enhancing existing state trails and replacing or repairing existing state trail bridges...	State	
2020 (ML 2021)	9f	Minnesota Hunter Walking Trails: Public Land Recreational Access	\$260,000	\$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Ruffed Grouse Society to improve Minnesota's hunter walking trail system by restoring or upgrading trailheads and trails, developing new walking trails, and compiling enhanced maps for use by managers and the public.	Private	
2020 (ML 2021)	9i	Minnesota State Trails Development	\$994,000	\$994,000 the second year is from the trust fund to the commissioner of natural resources to expand high-priority recreational opportunities on Minnesota's state trails by rehabilitating, improving, and enhancing existing state trails...	State	
2020 (ML 2021)	9k	Superior Hiking Trail as Environmental Showcase	\$450,000	\$450,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Superior Hiking Trail Association to rebuild damaged and dangerous segments and create a new trail segment of the Superior Hiking Trail to minimize environmental impacts, make the trail safer for users, and make the trail more resilient for future use and conditions.	Private	
2020 (ML 2021)	9n	Perham to Pelican Rapids Regional Trail (West Segment)	\$2,600,000	\$2,600,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Otter Tail County to construct the west segment of the 32-mile Perham to Pelican Rapids Regional Trail that will connect the city of Pelican Rapids to Maplewood State Park.	Local Unit of Government	
2020 (ML 2021)	9p	Rocori Trail - Phase III	\$1,200,000	\$1,200,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Rocori Trail Construction Board to design and construct Phase III of the Rocori Trail along the old Burlington Northern Santa Fe rail corridor between the cities of Cold Spring and Rockville.	Local Unit of Government	
2020 (ML 2021)	9q	Mesabi Trail: New Trail and Additional Funding	\$1,000,000	\$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for constructing the Mesabi Trail beginning at the intersection of County Road 20 and Minnesota State Highway 135 and terminating at 1st Avenue North and 1st Street North in the city of Biwabik in St. Louis County...	Local Unit of Government	
2019	9d	Minnesota State Trails Development	\$5,000,000	\$5,000,000 the first year is from the trust fund to the commissioner of natural resources to expand high-priority recreational opportunities on Minnesota's state trails by developing new trail segments and rehabilitating, improving, and enhancing existing state trails...	State	

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2019	9g	Mesabi Trail Extension	\$3,000,000	\$3,000,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for environmental assessment, permitting, right-of-way easements or other acquisition as needed, and engineering for and construction of four trail segments beginning and ending at the following approximate locations: Darwin Meyers Wildlife Management Area to County Road 21, Embarrass to Kugler, County Road 128 to the Eagles Nest Town Hall, and Wolf Creek to the Highway 169 underpass.	Local Unit of Government	
2019	9i	Britton Peak to Lutsen Mountain Bike Trail	\$350,000	\$350,000 the first year are from the trust fund to the commissioner of natural resources for an agreement with the Superior Cycling Association to create a sustainably designed single-track mountain bike trail connecting trail clusters and trailheads between Britton Peak in Tofte and Lutsen Mountains as part of northeast Minnesota's effort to become a national recreation destination...	Private	
2019	9l	Vergas Long Lake Trail	\$290,000	\$290,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Vergas to construct a bicycle and pedestrian bridge, trail, and floating boardwalk along Long Lake including shoreline restoration and stabilization with native plants..	Local Unit of Government	
2019	9m	Glacial Edge Trail and Downtown Pedestrian Bridge	\$600,000	\$600,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the city of Fergus Falls to acquire easements for and construct a trail along the Otter Tail River in downtown Fergus Falls and a bicycle and pedestrian bridge crossing the river...	Local Unit of Government	Also funded conservation easements
2019	9n	Crane Lake to Vermilion Falls Trail	\$400,000	\$400,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with St. Louis County in cooperation with Voyageur Country ATV Club to designate and improve a wooded trail from Crane Lake to Vermilion Falls to accommodate all-terrain vehicle and snowmobile users...	Local Unit of Government	
2019	9o	Restoring Five Sections of the Superior Hiking Trail	\$191,000	\$191,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Superior Hiking Trail Association to restore and repair the most damaged parts of five sections of the Superior Hiking Trail and restore an abandoned route to a natural footpath for hikers.	Private	
2018	9b	Develop Mesabi Trail Segment from County Road 88 to Ely	\$600,000	\$600,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for environmental assessment, permitting, right-of-way easements or other acquisition as needed, engineering, and construction of an approximately three-mile-long bituminous surface section of the Mesabi Trail between Ely and the intersection of Highway 169 and County Road 88...	Local Unit of Government	Also funded land acquisition
2018	9d	Mississippi Blufflands State Trail - Red Wing Barn Bluff to Colvill Park Segment	\$550,000	\$550,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Red Wing to be used with other funds to construct an approximate three-quarter-mile-long hard-surfaced segment of the Mississippi Blufflands State Trail along Red Wing's Mississippi River riverfront from Barn Bluff Regional Park to Colvill Park...	Local Unit of Government	
2018	9e	Swedish Immigrant Regional Trail Segment with Interstate State Park	\$2,254,000	\$2,254,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Chisago County Environmental Services to construct an approximate one-half-mile regional county trail segment within Interstate State Park from the end point of the existing trail at the park boundary to City hall including a trail bridge over the ravine and parking and trailhead improvements and to conduct a natural and cultural review to determine the feasibility and route of a future section of the trail through the park...	Local Unit of Government	
2018	9f	Enhancement Plan for Superior Hiking Trail	\$100,000	\$100,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Superior Hiking Trail Association to evaluate improvements to the 310-mile-long Superior Hiking Trail including routing, safety, water management, maintenance, and other environmental, recreational, and design issues and to develop an interactive trail-management system to capture efficiencies and best management practices.	Private	
2018	9j	Minnesota State Trails Development	\$2,500,000	\$2,500,000 the second year is from the trust fund to the commissioner of natural resources to expand high-priority recreational opportunities on Minnesota's state trails by developing new trail segments and rehabilitating, improving, and enhancing existing state trails...	State	
2017	9d	Minnesota State Trails Acquisition, Development and Enhancement	\$1,038,000	\$999,000 in fiscal year 2017 and \$39,000 the first year are from the trust fund to the commissioner of natural resources for state trail acquisition, development, and enhancement in southern Minnesota...	State	
2017	9g	Mesabi Trail Development	\$2,269,000	\$2,269,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for engineering and constructing segments of the Mesabi Trail...	Local Unit of Government	
2016	9e	Mesabi Trail Segment from Highway 135 to Town of Embarrass	\$1,200,000	\$1,200,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for engineering and construction of segments of the Mesabi Trail, totaling approximately six miles between Highway 135 and the town of Embarrass...	Local Unit of Government	Also funded land acquisition
2016	9f	Tower Historic Harbor Trail Connections	\$679,000	\$679,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Tower to construct recreational trails along the harbor in Tower and to connect to the Mesabi Trail...	Local Unit of Government	

Table 1. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Subdivision	Project Title	Approximate Capital Allocation	Appropriation Language	Entity	Notes
2015	9i	Mesabi Trail Development Soudan to Ely - Phase II	\$1,000,000	\$1,000,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the St. Louis and Lake Counties Regional Railroad Authority for the right-of-way acquisition, design, and construction of segments of the Mesabi Trail, totaling approximately seven miles between Soudan and Ely...	Local Unit of Government	Also funded land acquisition
2014	7c	Mesabi Trail Development - Soudan to Ely Segment	\$1,000,000	\$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with St. Louis and Lake Counties Regional Rail Authority for the right-of-way acquisition, design, and construction of segments of the Mesabi Trail totaling approximately 11 miles east of Soudan towards Ely...	Local Unit of Government	
Other						
2021	8g	Minnesota Green Schoolyards	\$221,000	\$250,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with The Trust for Public Land to assess, promote, and demonstrate how schoolyards can be adapted to improve water, air, and habitat quality and to foster next-generation environmental stewards while improving health, education, and community outcomes.	Private	
2021	8q	Reintroducing Bison to Spring Lake Park Reserve	\$560,000	\$560,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Dakota County, in partnership with the Minnesota Bison Conservation Herd, to establish the holding facilities and infrastructure needed to reintroduce American plains bison (Bison bison) to improve the resiliency and biodiversity of the prairie at Spring Lake Park Reserve.	Local Unit of Government	
2015	3h	Reintroduction and Interpretation of Bison in Minnesota State Parks	\$417,311	\$600,000 the first year is from the trust fund to the commissioner of natural resources to preserve American bison by reintroducing bison to Minneopa State Park and provide interpretive learning opportunities at Blue Mounds and Minneopa State Parks...	State	
2013	4i	Conservation Grazing to Improve Wildlife Habitat on Wildlife Management Areas	\$523,628	\$600,000 the first year is from the trust fund to the commissioner of natural resources to develop grazing plans and provide infrastructure to support conservation grazing on approximately 10,000 acres of targeted wildlife management areas in partnership with local livestock producers...	State	

Tables 2 to 4 and Figure 1. Summary Tables and Figure.

Table 2. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021, by Year

Year	Number of Projects			Dollar Amount		
	Capital Projects	All ENRTF Funded Projects	Capital Percentage	Capital Projects	All ENRTF Funded Projects	Capital Percentage
2013	10	41	24%	\$8,379,688	\$38,360,000	22%
2014	13	72	18%	\$7,182,235	\$30,430,000	24%
2015	17	65	26%	\$13,024,653	\$46,383,000	28%
2016	11	79	14%	\$9,054,494	\$37,909,000	24%
2017	16	65	25%	\$23,386,444	\$64,250,000	36%
2018	17	67	25%	\$16,901,302	\$45,828,000	37%
2019	21	82	26%	\$28,067,315	\$64,476,000	44%
2020	26	85	31%	\$28,879,244	\$65,319,000	44%
2021	32	89	36%	\$34,673,012	\$71,721,000	48%
Total	163	645		\$169,548,387	\$464,676,000	

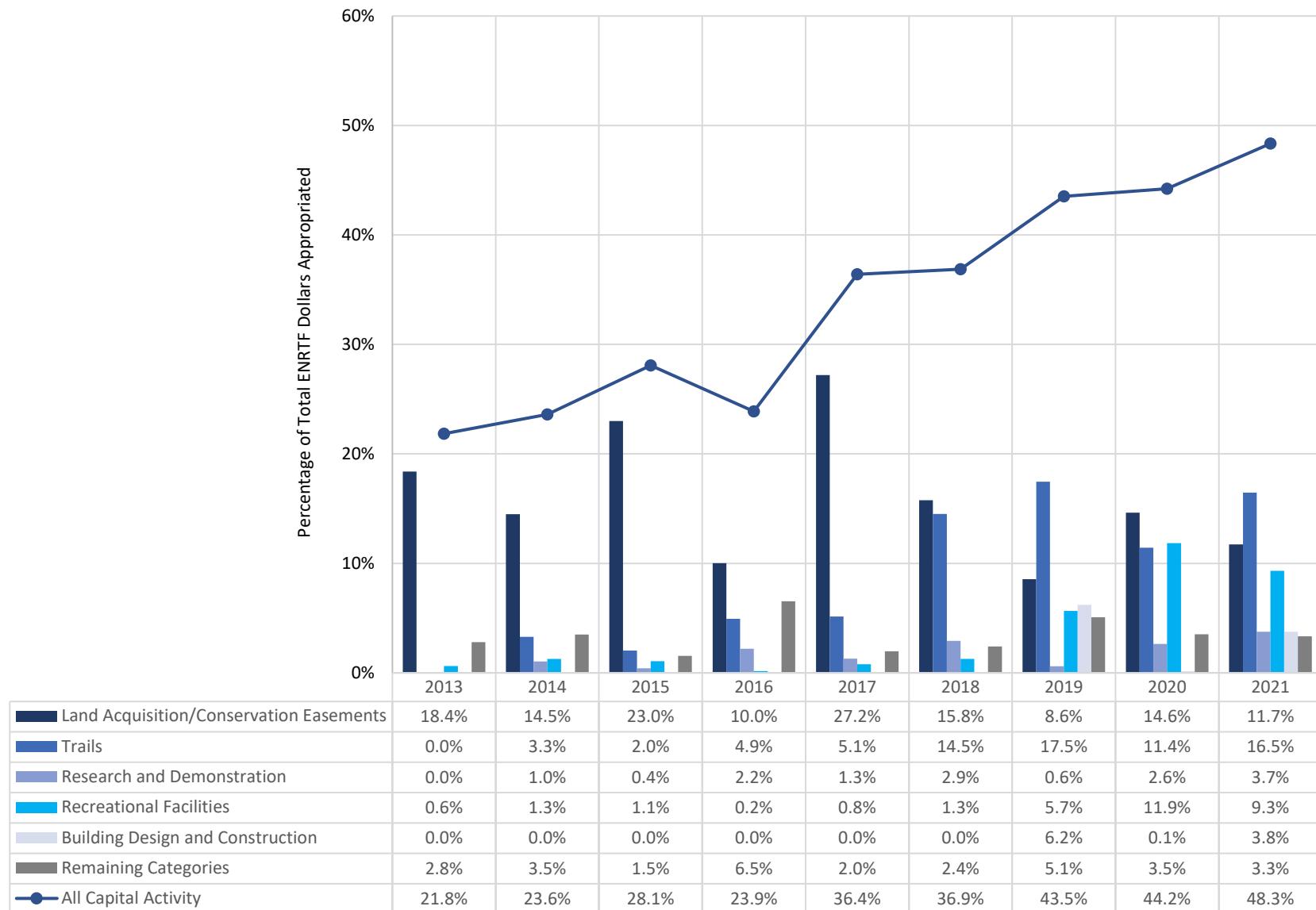
Table 3. Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021, by Category

Category	Capital Projects		Dollars		
	Number	Percentage	Amount	Percentage	Average
Building Design and/or Construction	3	1.8%	\$6,785,000	4.0%	\$2,261,667
Conservation Easement	13	8.0%	\$21,517,884	12.7%	\$1,655,222
Educational Exhibit	4	2.5%	\$1,875,254	1.1%	\$468,814
Land Acquisition	39	23.9%	\$52,604,007	31.0%	\$1,348,821
Recreational Facilities	26	16.0%	\$20,347,107	12.0%	\$782,581
Renewable Energy	5	3.1%	\$2,241,000	1.3%	\$448,200
Research and Demonstration	24	14.7%	\$8,325,021	4.9%	\$346,876
Restoration (Large-Scale)	8	4.9%	\$8,441,800	5.0%	\$1,055,225
Stormwater	3	1.8%	\$1,381,000	0.8%	\$460,333
Trail	34	20.9%	\$44,308,375	26.1%	\$1,303,188
Other	4	2.5%	\$1,721,939	1.0%	\$430,485
Total	163	100%	\$169,548,387	100%	-

Table 4. Number of Projects Appropriated ENRTF Funds for Activities to Acquire or Better Land or Buildings (Capital Projects), 2013 to 2021

Year	Building Design and/or Construction	Conservation Easements	Educational Exhibits	Land Acquisition	Recreational Facilities	Renewable Energy	Research and Demonstration	Restoration (Large-Scale)	Stormwater	Trails	Other
2013	0	2	0	4	1	0	0	0	2	0	1
2014	0	0	1	4	1	2	3	1	0	1	0
2015	0	3	0	6	2	0	3	1	0	1	1
2016	0	1	0	3	1	1	2	1	0	2	0
2017	0	2	1	5	1	1	4	0	0	2	0
2018	0	2	2	4	1	0	3	0	0	5	0
2019	1	1	0	2	6	1	2	1	0	7	0
2020	1	1	0	7	5	0	4	2	0	6	0
2021	1	1	0	4	8	0	3	2	1	10	2

Figure 1. ENRTF Dollars Allocated to Capital Activities to Acquire or Better Land or Buildings, 2013 to 2021



Appendix D. About the LCCMR and ENRTF

About the LCCMR

The Legislative-Citizen Commission on Minnesota Resources (LCCMR) is a commission of legislators and citizens whose primary function is to make funding recommendations to the Minnesota Legislature for special environmental and natural resources protection and enhancement projects, primarily from the Environment and Natural Resources Trust Fund (ENRTF). Additionally, the LCCMR tracks all projects funded through its proposal process to ensure outcome achievement. Since 1963, approximately \$1.0 billion from multiple funding sources has been awarded to more than 2,400 projects recommended to the legislature by the commission.

The LCCMR is composed of 17 members: five senators, five representatives, five citizens appointed by the governor, one citizen appointed by the Senate, and one citizen appointed by the House. Legislative members are appointed by legislative leadership and must include representation from both majority and minority parties. The citizen members appointed to the LCCMR must have experience or expertise in the science, policy, or practice of the protection, conservation, preservation, and enhancement of the state's environment and natural resources.

LCCMR developed from a program initiated in 1963 to preserve, develop, and maintain the natural resources of Minnesota. The name and funding sources have changed over the years, with the most recent change in 2006, when the commission was restructured into its current form, the Legislative-Citizen Commission on Minnesota Resources, with the addition of non-legislative citizen members in order to include citizen input more directly in the decision-making process.

About the ENRTF

The Environment and Natural Resources Trust Fund (ENRTF) is a permanent fund in the Minnesota state treasury dedicated to funding activities that protect, conserve, preserve, and enhance the state's air, water, land, fish, wildlife, and other natural resources. The ENRTF was created in 1988 when 77% of Minnesota voters approved an amendment to the Minnesota Constitution (Art. XI, Sec.14). The ENRTF provides a long-term, consistent, and stable source of funding for Minnesota's environment and natural resources for the benefit of current and future generations.

Money in the ENRTF originates from a combination of contributions and investment income. Forty percent of the net proceeds from the Minnesota State Lottery, or approximately seven cents of every dollar spent on playing the lottery, goes into the ENRTF, which is then managed and invested for continued growth by the State Board of Investment. Up to 5.5% of the market value of the ENRTF is available to spend on projects each year. The LCCMR makes annual project funding recommendations to the Minnesota Legislature based on a competitive, multi-step proposal and selection process.

Appendix E. Legislative-Citizen Commission on Minnesota Resources Members



Rep. Patty Acomb
593 State Office Bldg.
St. Paul, MN 55155

Minnetonka, MN
rep.patty.acomb@house.mn



Rita Albrecht – Gov. Appt.
1911 Norton Ave NW
Bemidji, MN 56601

Term ends – 12/31/2024
Appointed by Governor on 04/05/2021
rita.c.albrecht@gmail.com



Sen. Gary Dahms
*2111 Minnesota Senate Bldg.
St. Paul, MN 55155

P.O. Box 158
Redwood Falls, MN 56283
sen.gary.dahms@senate.mn



Sen. Kari Dziedzic
*2203 Minnesota Senate Bldg.
St. Paul, MN 55155

514 3rd Avenue NE
Minneapolis, MN 55413
sen.kari.dziedzic@senate.mn



****William Faber – Co-Vice Chair - Gov. Appt.**
7427 Cottonwood Road
Cushing, MN 56443

Term ends – 12/31/2025
Appointed by Governor on 03/07/2022
wfaber@clc.mn.edu



****Nancy Gibson – Co-Chair – Gov. Appt.**
2712 Glenhurst Ave
St. Louis Park, MN 55416

Term ends – 12/31/2023
Appointed by Governor on 04/05/2021
nangibson@comcast.net



****Rep. Rick Hansen – Co-Chair**
*407 State Office Building
St. Paul, MN 55155

1007 – 15th Ave. N.
South St. Paul, MN 55075
rep.rick.hansen@house.mn



Sen. Foung Hawj
*2201 Minnesota Senate Bldg.
St. Paul, MN 55155

St. Paul, MN
sen.foung.hawj@senate.mn



****Sen. Bill Ingebrigtsen – Co-Chair**
*3207 Minnesota Senate Bldg.
St. Paul, MN 55155

6968 Sunset Strip NW
Alexandria, MN 56308
sen.bill.ingebrigtsen@senate.mn



Shona Langseth – House Appt.
500 Preston St. NW
Preston, MN 55965

Term ends – 12/31/2025
Appointed by the House on 12/22/2021
shonagi17@gmail.com



Rep. Dale Lueck
371 State Office Bldg.
St. Paul, MN 55155

Aitkin, MN 56431
rep.dale.lueck@house.mn



Seth Moore – Gov. Appt.
27 Store Rd
Grand Portage, MN 55605

Term ends – 12/31/2025
Appointed by Governor on 03/07/2022
samoore@boreal.org



Rep. Kelly Morrison
507 State Office Bldg.
St. Paul, MN 55155

Deephaven, MN
rep.kelly.morrison@house.mn



Jeremy Peichel – Gov. Appt.
2071 Rosewood Ln S
Roseville, MN 55113

Term ends – 12/31/2024
Appointed by the Governor on 04/19/2021
jpeichel@gmail.com



Michael Reese
26566 – 375th Ave
Hancock, MN 56244

Term ends – 12/31/2021
Appointed by the Senate on 05/24/2018
reesem@umn.edu



****Rep. Tama Theis – Co-Vice Chair**
*201 State Office Building
St. Paul, MN 55155

St. Cloud, MN 56302
rep.tama.theis@house.mn



Sen. Torrey Westrom
*3201 Minnesota Senate Bldg.
St. Paul, MN 55155

4951 W Lake Mary Drive SW
Alexandria, MN 56308
sen.torrey.westrom@senate.mn

* Address for preferred interim mail address
** Executive Committee Members

Appendix F. LCCMR Subcommittee on Capital Projects Members

Rita Albrecht, Chair

Jeremy Peichel, Vice Chair

Sen. Kari Dziedzic

Rep. Rick Hansen

Rep. Dale Lueck

Michael Reese

Sen. Torrey Westrom

IX. Gifts and Donations

“a list of all gifts and donations with a value over \$1,000;”

No gifts or donations were received.

X. Environmental Spending Comparisons

“a comparison of the amounts spent by the state for environment and natural resources activities through the most recent fiscal year;”

The following document “All Funds Biennial Spending by Agency and Fund”, was prepared by the Minnesota State Senate Office of Senate Counsel, Research, and Fiscal Analysis.

Environmental Spending
All Funds Biennial Spending by Agency & Fund*

<u>Agency/Fund</u>	<i>(dollars in thousands)</i>	FY 2020-21 Spending	Current FY 2022- 23 Budget	Change
ENVIRONMENT & AGRICULTURE AGENCIES				
Pollution Control Agency				
General Fund	13,916	17,665	3,749	
State Govt Special Revenue Fund	153	153	-	
Special Revenue Fund	68,605	80,205	11,600	
Environmental Fund	168,649	178,315	9,666	
Remediation Fund	115,358	160,238	44,880	
Closed Landfill Investment Fund	1,821	6,456	4,635	
Gift Fund	13,856	21,384	7,528	
Federal Funds	41,865	50,526	8,661	
Expenses in Multiple Funds	<u>(57,424)</u>	<u>(59,825)</u>	<u>(2,401)</u>	
Subtotal Pollution Control Agency:	366,799	455,117	88,318	
<i>Dedicated/Constitutional Funds</i>				
Environment & Natural Resources Trust Fund	921	6,138	5,216	
Clean Water Fund	<u>41,008</u>	<u>51,941</u>	<u>10,933</u>	
Subtotal Dedicated/Constitutional Funds:	41,929	58,079	16,150	
Total Pollution Control Agency:	408,728	513,196	104,468	
Department of Natural Resources				
General Fund	248,080	292,368	44,288	
Natural Resources Fund	207,540	241,398	33,857	
Game & Fish Fund	225,851	254,351	28,500	
Special Revenue Fund	313,099	319,136	6,037	
Remediation Fund	5,746	1,379	(4,368)	
Gift Fund	3,938	4,696	758	
Permanent School Fund	786	2,095	1,309	
Federal Funds	<u>37,942</u>	<u>74,677</u>	<u>36,736</u>	
Coronavirus Relief (Federal)	348	-	(348)	
ARP-State Fiscal Recovery (Federal)	-	2,083	2,083	
Expenses in Multiple Funds	<u>(216,283)</u>	<u>(228,339)</u>	<u>(12,056)</u>	
Subtotal Department of Natural Resources:	827,046	963,843	136,796	
<i>Dedicated/Constitutional Funds</i>				
Environment & Natural Resources Trust Fund	43,463	146,853	103,390	
Outdoor Heritage Fund	220,847	304,617	83,770	
Parks & Trails Fund	60,917	95,914	34,997	
Clean Water Fund	<u>18,262</u>	<u>21,109</u>	<u>2,846</u>	
Subtotal Dedicated/Constitutional Funds:	343,489	568,493	225,004	
Total Department of Natural Resources:	1,170,535	1,532,336	361,800	

Environmental Spending
All Funds Biennial Spending by Agency & Fund*

(dollars in thousands)

<u>Agency/Fund</u>	<u>FY 2020-21 Spending</u>	<u>Current FY 2022- 23 Budget</u>	<u>Change</u>
Board of Water and Soil Resources			
General Fund	29,824	35,072	5,248
Special Revenue Fund	18,862	22,584	3,722
Federal Funds	<u>5,369</u>	<u>6,073</u>	<u>703</u>
Subtotal Board of Water and Soil Resources:	54,056	63,729	9,673
<i>Dedicated/Constitutional Funds</i>			
Environment & Natural Resources Trust Fund	11,274	9,631	(1,643)
Outdoor Heritage Fund	38,070	60,192	22,122
Clean Water Fund	<u>160,831</u>	<u>174,973</u>	<u>14,142</u>
Subtotal Dedicated/Constitutional Funds:	210,175	244,796	34,621
Total Board of Water and Soil Resources:	264,231	308,526	44,294
Minnesota Conservation Corps			
General Fund	910	910	-
Natural Resources Fund	<u>980</u>	<u>980</u>	<u>-</u>
Total MN Conservation Corps:	1,890	1,890	-
Metropolitan Council Parks			
General Fund	5,222	5,080	(142)
Natural Resources Fund	<u>13,200</u>	<u>14,900</u>	<u>1,700</u>
Subtotal Metropolitan Council Parks:	18,422	19,980	1,558
<i>Dedicated/Constitutional Funds</i>			
Environment & Natural Resources Trust Fund	2,657	3,250	593
Parks & Trails Fund	40,096	43,861	3,765
Clean Water Fund	<u>2,750</u>	<u>3,088</u>	<u>338</u>
Subtotal Dedicated/Constitutional Funds:	45,503	50,199	4,696
Total Metropolitan Council Parks:	63,925	70,179	6,254
Minnesota Zoological Board			
General Fund	19,474	19,618	144
Natural Resources Fund	380	520	140
Special Revenue Fund	16,935	42,931	25,996
Gift Fund	6,374	15,724	9,350
Coronavirus Relief (Federal)	6,000	-	(6,000)
ARP-State Fiscal Recovery (Federal)	-	11,495	11,495
Federal Funds	<u>153</u>	<u>7,480</u>	<u>7,327</u>
Expenses in Multiple Funds	<u>-</u>	<u>(92)</u>	<u>(92)</u>
Subtotal Minnesota Zoological Board:	49,316	97,676	48,361

Environmental Spending
All Funds Biennial Spending by Agency & Fund*

(dollars in thousands)

<u>Agency/Fund</u>	<u>FY 2020-21 Spending</u>	<u>Current FY 2022- 23 Budget</u>	<u>Change</u>
<i>Dedicated/Constitutional Funds</i>			
Environment & Natural Resources Trust Fund	888	851	(37)
Arts & Cultural Heritage Fund	4,216	4,033	(184)
Subtotal Dedicated/Constitutional Funds:	5,104	4,884	(220)
Total Minnesota Zoological Board:	54,420	102,560	48,140
Science Museum			
General Fund	2,158	2,158	-
<i>Dedicated/Constitutional Funds</i>			
Environment & Natural Resources Trust Fund	288	2,254	1,966
Total Science Museum:	2,446	4,412	1,966
Transfer to Metropolitan Landfill Contingency Action Trust Account			
General Fund	-	200	200
Department of Agriculture			
General Fund	112,219	139,085	26,866
Agricultural Fund	82,538	86,127	3,588
Special Revenue Fund	15,100	16,199	1,098
Remediation Fund	3,536	4,636	1,100
Gift Fund	21	1,308	1,287
COVID 19 MN (from General Fund)	1,249	-	(1,249)
Federal Funds	19,904	30,401	10,497
Coronavirus Relief (Federal)	12,533	-	(12,533)
ARP-State Fiscal Recovery (Federal)	-	6,000	6,000
Expenses in Multiple Funds	(12,765)	(13,358)	(593)
Subtotal Dept. of Agriculture:	234,335	270,397	36,062
<i>Dedicated/Constitutional Funds</i>			
Environment & Natural Resources Trust Fund	2,342	1,812	(529)
Arts & Cultural Heritage Fund	724	938	214
Clean Water Fund	26,535	29,704	3,169
Subtotal Dedicated/Constitutional Funds:	29,601	32,454	2,853
Total Dept. of Agriculture:	263,936	302,851	38,915
Animal Health Board			
General Fund	11,293	12,097	804
Special Revenue Fund	307	421	114
Federal Funds	1,377	3,342	1,965
Total Animal Health Board:	12,977	15,860	2,883

Environmental Spending
All Funds Biennial Spending by Agency & Fund*

<u>Agency/Fund</u>	<u>FY 2020-21 Spending</u>	<u>Current FY 2022- 23 Budget</u>	<u>Change</u>
Agriculture Utilization Research Inst.			
General Fund	7,786	8,586	800
<i>Dedicated/Constitutional Funds</i>			
Environment & Natural Resources Trust Fund	-	200	200
Total AURI:	7,786	8,786	1,000
Totals by Fund			
General Fund	450,882	532,839	81,957
State Govt Special Revenue Fund	153	153	-
Special Revenue Fund	432,909	481,477	48,568
Environmental Fund	168,649	178,315	9,666
Remediation Fund	124,640	166,253	41,612
Natural Resources Fund	222,100	257,798	35,697
Game & Fish Fund	225,851	254,351	28,500
Closed Landfill Investment Fund	1,821	6,456	4,635
Permanent School Fund	786	2,095	1,309
Agricultural Fund	82,538	86,127	3,588
Gift Fund	24,188	43,112	18,924
COVID 19 MN (from General Fund)	7,249	-	(7,249)
Federal Funds	106,609	172,499	65,889
Coronavirus Relief (Federal)	12,881	-	(12,881)
ARP-State Fiscal Recovery (Federal)	-	19,578	19,578
Expenses in Multiple Funds	(286,472)	(301,614)	(15,142)
Subtotal Non-dedicated Funds:	1,574,784	1,899,436	324,651
<i>Dedicated/Constitutional Funds</i>			
Environment & Natural Resources Trust Fund	61,833	170,989	109,156
Outdoor Heritage Fund	258,917	364,809	105,892
Clean Water Fund	249,387	280,815	31,429
Parks & Trails Fund	101,013	139,775	38,762
Arts & Cultural Heritage Fund	4,940	4,970	30
Subtotal Dedicated/Constitutional Funds:	676,089	961,359	285,270
Total for Environment & Agriculture Agencies	2,250,874	2,860,795	609,921
STATE TOTAL ALL BUDGET AREAS, ALL FUNDS	89,438,621	109,129,616	9,793,048
Environment and Agriculture Agencies as percentage of Grand Total	2.5%	2.6%	
* Data from November 2022 Forecast			

XI. Compliance Audit

“a copy of the most recent compliance audit.”

No audits were conducted in the 2021-2022 Biennium.

The most recent compliance audit was released by the Office of the Legislative Auditor on February 11, 2016.

Appendix A

Funding Source Reference:

Environment and Natural Resources Trust Fund

- MN Constitution – Amendment Article 11, Sec. 14
- M.S. 116P

Great Lakes Protection Account

- M.S. 116Q.02

Oil Overcharge Money

- M.S. 4.071

Minnesota Constitution – Article XI, Section 14

Sec. 14. ENVIRONMENT AND NATURAL RESOURCES FUND. A permanent environment and natural resources trust fund is established in the state treasury. Loans may be made of up to five percent of the principal of the fund for water system improvements as provided by law. The assets of the fund shall be appropriated by law for the public purpose of protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources. The amount appropriated each year of a biennium, commencing on July 1 in each odd-numbered year and ending on and including June 30 in the next odd-numbered year, may be up to 5-1/2 percent of the market value of the fund on June 30 one year before the start of the biennium. Not less than 40 percent of the net proceeds from any state-operated lottery must be credited to the fund until the year 2025. [Adopted, November 8, 1988; Amended, November 6, 1990; November 3, 1998]

CHAPTER 116P

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

116P.01	FINDINGS.	116P.11	AVAILABILITY OF FUNDS FOR DISBURSEMENT.
116P.02	DEFINITIONS.	116P.12	WATER SYSTEM IMPROVEMENT; LOAN PROGRAM.
116P.03	TRUST FUND NOT TO SUPPLANT EXISTING FUNDING; APPROPRIATIONS.	116P.15	LAND ACQUISITION; RESTRICTIONS.
116P.04	TRUST FUND ACCOUNT.	116P.16	REAL PROPERTY INTERESTS; REPORT.
116P.05	LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES.	116P.17	ACQUIRING LANDS OR INTEREST IN LANDS; COMMISSIONER APPROVAL.
116P.07	INFORMATION GATHERING.	116P.18	LANDS IN PUBLIC DOMAIN.
116P.08	TRUST FUND EXPENDITURES.	116P.19	DONATIONS.
116P.09	ADMINISTRATION.	116P.20	EASEMENTS; MONITORING AND ENFORCEMENT REQUIREMENTS.
116P.10	ROYALTIES, COPYRIGHTS, PATENTS, AND SALE OF PRODUCTS AND ASSETS.		

116P.01 FINDINGS.

The legislature finds that all Minnesotans share the responsibility to ensure wise stewardship of the state's environment and natural resources for the benefit of current citizens and future generations. Proper management of the state's environment and natural resources includes and requires foresight, planning, and long-term activities that allow the state to preserve its high quality environment and provides for wise use of its natural resources. The legislature also finds that to undertake such activities properly, a long-term, consistent, and stable source of funding must be provided.

History: 1988 c 690 art 1 s 5

116P.02 DEFINITIONS.

Subdivision 1. **Applicability.** The definitions in this section apply to this chapter.

Subd. 2. [Repealed, 2006 c 243 s 22]

Subd. 3. **Board.** "Board" means the State Board of Investment.

Subd. 4. **Commission.** "Commission" means the Legislative-Citizen Commission on Minnesota Resources.

Subd. 5. **Natural resources.** "Natural resources" includes the outdoor recreation system under section 86A.04 and regional recreation open space systems as defined under section 473.351, subdivision 1.

Subd. 6. **Trust fund.** "Trust fund" means the Minnesota environment and natural resources trust fund established under Minnesota Constitution, article XI, section 14.

History: 1988 c 690 art 1 s 6; 1989 c 335 art 1 s 269; 2003 c 128 art 1 s 146; 2006 c 243 s 2

116P.03 TRUST FUND NOT TO SUPPLANT EXISTING FUNDING; APPROPRIATIONS.

(a) The trust fund may not be used as a substitute for traditional sources of funding environmental and natural resources activities, but the trust fund shall supplement the traditional sources, including those sources used to support the criteria in section 116P.08, subdivision 1. The trust fund must be used primarily to support activities whose benefits become available only over an extended period of time.

(b) The commission must determine the amount of the state budget spent from traditional sources to fund environmental and natural resources activities before and after the trust fund is established and include a comparison of the amount in the report under section 116P.09, subdivision 7.

(c) For the fiscal year beginning July 1, 2007, and each year thereafter, the amount of the environment and natural resources trust fund that is available for appropriation under the terms of the Minnesota Constitution, article XI, section 14, shall be appropriated by law.

(d) The amount appropriated from the environment and natural resources trust fund may be spent only for the public purpose of protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources. Recommendations made by the commission under this chapter must be consistent with the Minnesota Constitution, article XI, section 14; this chapter; and the strategic plan adopted under section 116P.08, subdivision 3, and must demonstrate a direct benefit to the state's environment and natural resources.

History: 1988 c 690 art 1 s 7; 2006 c 243 s 3

116P.04 TRUST FUND ACCOUNT.

Subdivision 1. Establishment; investment. A Minnesota environment and natural resources trust fund, under article XI, section 14, of the Minnesota Constitution, is established as an account in the state treasury. The commissioner of management and budget shall credit to the trust fund the amounts authorized under this section and section 116P.10. The State Board of Investment shall ensure that trust fund money is invested under section 11A.24. All money earned by the trust fund must be credited to the trust fund. The principal of the trust fund and any unexpended earnings must be invested and reinvested by the State Board of Investment.

Subd. 2. [Repealed, 1990 c 610 art 1 s 59]

Subd. 3. **Revenue.** Nothing in sections 116P.01 to 116P.12 limits the source of contributions to the trust fund.

Subd. 4. **Gifts and donations.** Gifts and donations, including land or interests in land, may be made to the trust fund. Noncash gifts and donations must be disposed of for cash as soon as the board prudently can maximize the value of the gift or donation. Gifts and donations of marketable securities may be held or be disposed of for cash at the option of the board. The cash receipts of gifts and donations of cash or capital assets and marketable securities disposed of for cash must be credited immediately to the principal of the trust fund. The value of marketable securities at the time the gift or donation is made must be credited to the principal of the trust fund and any earnings from the marketable securities are earnings of the trust fund.

Subd. 5. **Audits required.** The legislative auditor shall audit trust fund expenditures to ensure that the money is spent for the purposes for which the money was appropriated.

History: 1988 c 690 art 1 s 8; 1990 c 610 art 1 s 44; 1991 c 343 s 1; 2006 c 243 s 4; 2009 c 101 art 2 s 109

116P.05 LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES.

Subdivision 1. Membership. (a) A Legislative-Citizen Commission on Minnesota Resources of 17 members is created in the legislative branch, consisting of the chairs of the house of representatives and senate committees on environment and natural resources finance or designees appointed for the terms of the

chairs, four members of the senate appointed by the Subcommittee on Committees of the Committee on Rules and Administration, and four members of the house of representatives appointed by the speaker.

(b) At least two members from the senate and two members from the house of representatives must be from the minority caucus. Members are entitled to reimbursement for per diem expenses plus travel expenses incurred in the services of the commission.

(c) Seven citizens are members of the commission, five appointed by the governor, one appointed by the Senate Subcommittee on Committees of the Committee on Rules and Administration, and one appointed by the speaker of the house. The citizen members are selected and recommended to the appointing authorities according to subdivision 1a and must:

(1) have experience or expertise in the science, policy, or practice of the protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources;

(2) have strong knowledge in the state's environment and natural resource issues around the state; and

(3) have demonstrated ability to work in a collaborative environment.

(d) Members shall develop procedures to elect a chair that rotates between legislative and citizen members each meeting. A citizen member, a senate member, and a house of representatives member shall serve as chairs. The citizen members, senate members, and house of representatives members must select their respective chairs. The chair shall preside and convene meetings as often as necessary to conduct duties prescribed by this chapter.

(e) Appointed legislative members shall serve on the commission for two-year terms, beginning in January of each odd-numbered year and continuing through the end of December of the next even-numbered year. Appointed citizen members shall serve four-year terms, beginning in January of the first year and continuing through the end of December of the final year. Citizen and legislative members continue to serve until their successors are appointed.

(f) A citizen member may be removed by an appointing authority for cause. Vacancies occurring on the commission shall not affect the authority of the remaining members of the commission to carry out their duties, and vacancies shall be filled for the remainder of the term in the same manner under paragraphs (a) to (c).

(g) Citizen members are entitled to per diem and reimbursement for expenses incurred in the services of the commission, as provided in section 15.059, subdivision 3.

(h) The governor's appointments are subject to the advice and consent of the senate.

Subd. 1a. Citizen selection committee. (a) The governor shall appoint a Trust Fund Citizen Selection Committee of five members who come from different regions of the state and who have knowledge and experience of state environment and natural resource issues.

(b) The duties of the Trust Fund Citizen Selection Committee shall be to:

(1) identify citizen candidates to be members of the commission as part of the open appointments process under section 15.0597;

(2) request and review citizen candidate applications to be members of the commission; and

(3) interview the citizen candidates and recommend an adequate pool of candidates to be selected for commission membership by the governor, the senate, and the house of representatives.

(c) Members are entitled to travel expenses incurred to fulfill their duties under this subdivision as provided in section 15.059, subdivision 6.

Subd. 2. Duties. (a) The commission shall recommend an annual or biennial legislative bill for appropriations from the environment and natural resources trust fund and shall adopt a strategic plan as provided in section 116P.08. Approval of the recommended legislative bill requires an affirmative vote of at least 12 members of the commission.

(b) It is a condition of acceptance of the appropriations made from the Minnesota environment and natural resources trust fund, and oil overcharge money under section 4.071, subdivision 2, that the agency or entity receiving the appropriation must submit a work plan and annual or semiannual progress reports in the form determined by the Legislative-Citizen Commission on Minnesota Resources, and comply with applicable reporting requirements under section 116P.16. None of the money provided may be spent unless the commission has approved the pertinent work plan. Modifications to the approved work plan and budget expenditures shall be made through the amendment process established by the commission. The commission shall ensure that the expenditures and outcomes described in the work plan for appropriations funded by the environment and natural resources trust fund are met.

(c) The peer review procedures created under section 116P.08 must also be used to review, comment, and report to the commission on research proposals applying for an appropriation from the oil overcharge money under section 4.071, subdivision 2.

(d) The commission may adopt operating procedures to fulfill its duties under this chapter.

(e) As part of the operating procedures, the commission shall:

(1) ensure that members' expectations are to participate in all meetings related to funding decision recommendations;

(2) recommend adequate funding for increased citizen outreach and communications for trust fund expenditure planning;

(3) allow administrative expenses as part of individual project expenditures based on need;

(4) provide for project outcome evaluation;

(5) keep the grant application, administration, and review process as simple as possible; and

(6) define and emphasize the leveraging of additional sources of money that project proposers should consider when making trust fund proposals.

Subd. 3. [Repealed, 2014 c 226 s 4]

History: 1988 c 690 art 1 s 9; 1989 c 335 art 1 s 269; 1990 c 594 art 1 s 56; 1991 c 254 art 2 s 39; 1991 c 343 s 2; 1993 c 4 s 15; 1994 c 580 s 1; 1997 c 202 art 2 s 36; 2003 c 128 art 1 s 147; 1Sp2005 c 1 art 2 s 135; 2006 c 243 s 5; 2009 c 143 s 3; 1Sp2011 c 2 art 4 s 23; 2013 c 52 s 3,4; 2015 c 76 s 3; 2016 c 186 s 3; 2017 c 96 s 3

116P.06 [Repealed, 2006 c 243 s 22]

116P.07 INFORMATION GATHERING.

The commission may convene public forums or employ other methods to gather information for establishing priorities for funding.

History: 1988 c 690 art 1 s 11; 1991 c 254 art 2 s 41; 1991 c 343 s 4; 2002 c 225 s 2; 2006 c 243 s 6

116P.08 TRUST FUND EXPENDITURES.

Subdivision 1. **Expenditures.** (a) Money in the trust fund may be spent only for:

- (1) the reinvest in Minnesota program as provided in section 84.95, subdivision 2;
- (2) research that contributes to increasing the effectiveness of protecting or managing the state's environment or natural resources;
- (3) collection and analysis of information that assists in developing the state's environmental and natural resources policies;
- (4) enhancement of public education, awareness, and understanding necessary for the protection, conservation, restoration, and enhancement of air, land, water, forests, fish, wildlife, and other natural resources;
- (5) capital projects for the preservation and protection of unique natural resources;
- (6) activities that preserve or enhance fish, wildlife, land, air, water, and other natural resources that otherwise may be substantially impaired or destroyed in any area of the state;
- (7) administrative and investment expenses incurred by the State Board of Investment in investing deposits to the trust fund; and
- (8) administrative expenses subject to the limits in section 116P.09.

(b) In making recommendations for expenditures from the trust fund, the commission shall give priority to funding programs and projects under paragraph (a), clauses (1) and (6). Any requests for proposals issued by the commission shall clearly indicate these priorities.

Subd. 2. **Exceptions.** Money from the trust fund may not be spent for:

- (1) purposes of environmental compensation and liability under chapter 115B and response actions under chapter 115C;
- (2) purposes of municipal water pollution control in municipalities with a population of 5,000 or more under the authority of chapters 115 and 116;
- (3) costs associated with the decommissioning of nuclear power plants;
- (4) hazardous waste disposal facilities;
- (5) solid waste disposal facilities;
- (6) projects or purposes inconsistent with the strategic plan; or
- (7) acquiring property by eminent domain, unless the owner requests that the owner's property be acquired by eminent domain.

Subd. 3. Strategic plan required. (a) The commission shall adopt a strategic plan for making expenditures from the trust fund, including identifying the priority areas for funding for the next six years. The strategic plan must be reviewed every two years. The strategic plan must have clearly stated short- and long-term goals and strategies for trust fund expenditures, must provide measurable outcomes for expenditures, and must determine areas of emphasis for funding.

(b) The commission shall consider the long-term strategic plans of agencies with environment and natural resource programs and responsibilities and plans of conservation and environmental organizations during the development and review of the strategic plan.

Subd. 4. Legislative recommendations. (a) Funding may be provided only for those projects that meet the categories established in subdivision 1.

(b) The commission must recommend an annual or biennial legislative bill to make appropriations from the trust fund for the purposes provided in subdivision 1. The recommendations must be submitted to the governor for inclusion in the biennial budget and supplemental budget submitted to the legislature.

(c) The commission may recommend regional block grants for a portion of trust fund expenditures to partner with existing regional organizations that have strong citizen involvement, to address unique local needs and capacity, and to leverage all available funding sources for projects.

(d) The commission may recommend the establishment of an emerging issues account in its legislative bill for funding emerging issues, which come up unexpectedly, but which still adhere to the commission's strategic plan, to be approved by the governor after initiation and recommendation by the commission.

(e) Money in the trust fund may not be spent except under an appropriation by law.

Subd. 5. Public meetings. (a) Meetings of the commission, committees or subcommittees of the commission, technical advisory committees, and peer reviewers must be open to the public and are subject to chapter 13D. The commission shall attempt to meet throughout various regions of the state during each biennium. For purposes of this subdivision, a meeting occurs when a quorum is present and action is taken regarding a matter within the jurisdiction of the commission, a committee or subcommittee of the commission, a technical advisory committee, or peer reviewers.

(b) For legislative members of the commission, enforcement of this subdivision is governed by section 3.055, subdivision 2. For nonlegislative members of the commission, enforcement of this subdivision is governed by section 13D.06, subdivisions 1 and 2.

Subd. 6. Peer review. (a) Research proposals must include a stated purpose directly connected to the trust fund's constitutional mandate, this chapter, and the adopted strategic plan under subdivision 3, a timeline, potential outcomes, and an explanation of the need for the research. All research proposals must be peer reviewed before receiving an appropriation.

(b) In conducting research proposal reviews, the peer reviewers shall:

(1) comment on the methodology proposed and whether it can be expected to yield appropriate and useful information and data; and

(2) comment on the need for the research and about similar existing information available, if any.

(c) Peer reviewers' comments under paragraph (b) must be reported to the commission.

(d) The peer reviewers may review completed research proposals that have received an appropriation and comment and report upon whether the project reached the intended goals.

Subd. 7. Peer reviewers. (a) The peer reviewers must be knowledgeable in general research methods in the areas of environment and natural resources.

(b) Compensation of peer reviewers is governed by section 15.059, subdivision 3.

History: 1988 c 690 art 1 s 12; 1989 c 335 art 1 s 178; 1991 c 254 art 2 s 42,43; 1991 c 343 s 5,6; 1994 c 580 s 2,3; 2001 c 7 s 31; 2004 c 284 art 2 s 14; 2006 c 243 s 7-10; 2007 c 30 s 3; 2009 c 143 s 4; 2015 c 76 s 4-6; 2016 c 186 s 4; 2017 c 96 s 4; 2018 c 214 art 4 s 3; art 6 s 2; 2019 c 2 art 1 s 10; 2022 c 94 s 3

116P.09 ADMINISTRATION.

Subdivision 1. Administrative authority. The commission may appoint legal and other personnel and consultants necessary to carry out functions and duties of the commission. Permanent employees shall be in the unclassified service. In addition, the commission may request staff assistance and data from any other agency of state government as needed for the execution of the responsibilities of the commission and an agency must promptly furnish it.

Subd. 2. Liaison officers. The commission may request each department or agency head of all state agencies with a direct interest and responsibility in any phase of environment and natural resources to appoint, and the latter shall appoint for the agency, a liaison officer who shall work closely with the commission and its staff.

Subd. 3. Appraisal and evaluation. The commission shall obtain and appraise information available through private organizations and groups, utilizing to the fullest extent possible studies, data, and reports previously prepared or currently in progress by public agencies, private organizations, groups, and others, concerning future trends in the protection, conservation, preservation, and enhancement of the state's air, water, land, forests, fish, wildlife, native vegetation, and other natural resources. Any data compiled by the commission shall be made available to any standing or interim committee of the legislature upon the request of the chair of the respective committee.

Subd. 4. Personnel. Persons who are employed by a state agency to work on a project and are paid by an appropriation from the trust fund are in the unclassified civil service, and their continued employment is contingent upon the availability of money from the appropriation. When the appropriation has been spent, their positions must be canceled and the approved complement of the agency reduced accordingly. Part-time employment of persons for a project is authorized. The use of classified employees is authorized when approved as part of the work program required by section 116P.05, subdivision 2, paragraph (b).

Subd. 5. Administrative expense. The prorated expenses related to commission administration of the trust fund may not exceed an amount equal to four percent of the amount available for appropriation of the trust fund for the biennium.

Subd. 6. Conflict of interest. A commission member, a technical advisory committee member, a peer reviewer, or an employee of the commission may not participate in or vote on a decision of the commission, advisory committee, or peer review relating to an organization in which the member, peer reviewer, or employee has either a direct or indirect personal financial interest. While serving on the commission or technical advisory committee or as a peer reviewer or while an employee of the commission, a person shall avoid any potential conflict of interest.

Subd. 7. Report required. The commission shall, by January 15 of each odd-numbered year, submit a report to the governor, the chairs of the house of representatives appropriations and senate finance committees, and the chairs of the house of representatives and senate committees on environment and natural resources. Copies of the report must be available to the public. The report must include:

- (1) a copy of the current strategic plan;
- (2) a description of each project receiving money from the trust fund during the preceding biennium;
- (3) a summary of any research project completed in the preceding biennium;
- (4) recommendations to implement successful projects and programs into a state agency's standard operations;
- (5) to the extent known by the commission, descriptions of the projects anticipated to be supported by the trust fund during the next biennium;
- (6) the source and amount of all revenues collected and distributed by the commission, including all administrative and other expenses;
- (7) a description of the assets and liabilities of the trust fund;
- (8) any findings or recommendations that are deemed proper to assist the legislature in formulating legislation;
- (9) a list of all gifts and donations with a value over \$1,000;
- (10) a comparison of the amounts spent by the state for environment and natural resources activities through the most recent fiscal year; and
- (11) a copy of the most recent compliance audit.

Subd. 8. Technical advisory committees. The commission shall make use of available public and private expertise on environment and natural resource issues and may appoint necessary technical advisory committees to review funding proposals and evaluate project outcomes. Compensation for technical advisory committee members is governed by section 15.059, subdivision 6.

History: 1988 c 690 art 1 s 13; 1991 c 254 art 2 s 44-46; 1991 c 343 s 7-10; 1994 c 580 s 4; 2003 c 128 art 1 s 148-150; 2006 c 243 s 11-13; 2013 c 52 s 5; 2015 c 76 s 7,8; 2018 c 182 art 1 s 12

116P.10 ROYALTIES, COPYRIGHTS, PATENTS, AND SALE OF PRODUCTS AND ASSETS.

- (a) This section applies to projects supported by the trust fund and the oil overcharge money referred to in section 4.071, subdivision 2, each of which is referred to in this section as a "fund."
- (b) The fund owns and shall take title to the percentage of a royalty, copyright, or patent resulting from a project supported by the fund equal to the percentage of the project's total funding provided by the fund. Cash receipts resulting from a royalty, copyright, or patent, or the sale of the fund's rights to a royalty, copyright, or patent, must be credited immediately to the principal of the fund. Receipts from Minnesota future resources fund projects must be credited to the trust fund. The commission may include in its legislative bill a recommendation to relinquish the ownership or rights to a royalty, copyright, or patent resulting from a project supported by the fund to the project's proposer when the amount of the original grant or loan, plus interest, has been repaid to the fund.

(c) If a project supported by the fund results in net income from the sale of products or assets developed or acquired by an appropriation from the fund, the appropriation must be repaid to the fund in an amount equal to the percentage of the project's total funding provided by the fund. The commission may include in its legislative bill a recommendation to relinquish the income if a plan is approved for reinvestment of the income in the project or when the amount of the original grant or loan, plus interest, has been repaid to the fund.

History: 1988 c 690 art 1 s 14; 1993 c 172 s 79; 2003 c 128 art 1 s 151; 2008 c 367 s 3; 2009 c 143 s 5

116P.11 AVAILABILITY OF FUNDS FOR DISBURSEMENT.

(a) The amount annually available from the trust fund for the legislative bill developed by the commission is as defined in the Minnesota Constitution, article XI, section 14.

(b) Any appropriated funds not encumbered in the biennium in which they are appropriated cancel and must be credited to the principal of the trust fund.

History: 1988 c 690 art 1 s 15; 1990 c 594 art 1 s 57; 1990 c 612 s 14; 1992 c 513 art 2 s 27; 1992 c 539 s 10; 1993 c 300 s 10; 1994 c 580 s 5; 1995 c 220 s III; 2002 c 225 s 3; 2006 c 243 s 14

116P.12 WATER SYSTEM IMPROVEMENT; LOAN PROGRAM.

Subdivision 1. Loans authorized. (a) If the principal of the trust fund equals or exceeds \$200,000,000, the commission may vote to set aside up to five percent of the principal of the trust fund for water system improvement loans. The purpose of water system improvement loans is to offer below market rate interest loans to local units of government for the purposes of water system improvements.

(b) The interest on a loan shall be calculated on the declining balance at a rate that is the greater of one percent or 50 percent of the secondary market yield of one-year United States Treasury bills calculated according to section 549.09, subdivision 1, paragraph (c).

(c) An eligible project must prove that existing federal or state loans or grants have not been adequate.

(d) Payments on the principal and interest of loans under this section must be credited to the trust fund.

(e) Repayment of loans made under this section must be completed within 20 years.

(f) The Minnesota Public Facilities Authority must report to the commission each year on any loans made to the authority under this section.

Subd. 2. Application and administration. (a) The commission must adopt a procedure for the issuance of the water system improvement loans by the Public Facilities Authority.

(b) The commission also must ensure that the loans are administered according to its fiduciary standards and requirements.

History: 1988 c 690 art 1 s 16; 2018 c 214 art 4 s 4

116P.13 [Repealed, 2016 c 189 art 3 s 53]

116P.14 [Repealed, 1Sp2011 c 2 art 4 s 36]

116P.15 LAND ACQUISITION; RESTRICTIONS.

Subdivision 1. Scope. A recipient of an appropriation from the trust fund or the Minnesota future resources fund who acquires an interest in real property with the appropriation must comply with this section. For the purposes of this section, "interest in real property" includes, but is not limited to, an easement or fee title to property.

Subd. 2. Restrictions; modification procedure. (a) An interest in real property acquired with an appropriation from the trust fund or the Minnesota future resources fund must be used in perpetuity or for the specific term of an easement interest for the purpose for which the appropriation was made. The ownership of the interest in real property transfers to the state if: (1) the holder of the interest in real property fails to comply with the terms and conditions of the grant agreement or work plan; or (2) restrictions are placed on the land that preclude its use for the intended purpose as specified in the appropriation.

(b) A recipient of funding who acquires an interest in real property subject to this section may not alter the intended use of the interest in real property or convey any interest in the real property acquired with the appropriation without the prior review and approval of the commission or its successor. The commission shall notify the chairs and ranking minority members of the legislative committees and divisions with jurisdiction over the trust fund or Minnesota future resources fund at least 15 business days before approval under this paragraph. The commission shall establish procedures to review requests from recipients to alter the use of or convey an interest in real property. These procedures shall allow for the replacement of the interest in real property with another interest in real property meeting the following criteria:

(1) the interest must be at least equal in fair market value, as certified by the commissioner of natural resources, to the interest being replaced; and

(2) the interest must be in a reasonably equivalent location, and have a reasonably equivalent useful conservation purpose compared to the interest being replaced, taking into consideration all effects from fragmentation of the whole habitat.

(c) A recipient of funding who acquires an interest in real property under paragraph (a) must separately record a notice of funding restrictions in the appropriate local government office where the conveyance of the interest in real property is filed. The notice of funding agreement must contain:

(1) a legal description of the interest in real property covered by the funding agreement;

(2) a reference to the underlying funding agreement;

(3) a reference to this section; and

(4) the following statement:

"This interest in real property shall be administered in accordance with the terms, conditions, and purposes of the grant agreement controlling the acquisition of the property. The interest in real property, or any portion of the interest in real property, shall not be sold, transferred, pledged, or otherwise disposed of or further encumbered without obtaining the prior written approval of the Legislative-Citizen Commission on Minnesota Resources or its successor. The ownership of the interest in real property transfers to the state if: (1) the holder of the interest in real property fails to comply with the terms and conditions of the grant agreement or work plan; or (2) restrictions are placed on the land that preclude its use for the intended purpose as specified in the appropriation."

History: *1Sp2001 c 2 s 141; 2002 c 225 s 4; 2006 c 243 s 21; 2013 c 52 s 6*

116P.16 REAL PROPERTY INTERESTS; REPORT.

(a) By December 1 each year, a recipient of an appropriation from the trust fund, that is used for the acquisition of an interest in real property, including, but not limited to, an easement or fee title, must submit annual reports on the status of the real property to the Legislative-Citizen Commission on Minnesota Resources or its successor in a form determined by the commission. The responsibility for reporting under this section may be transferred by the recipient of the appropriation to another person who holds the interest in the real property. To complete the transfer of reporting responsibility, the recipient of the appropriation must:

- (1) inform the person to whom the responsibility is transferred of that person's reporting responsibility;
- (2) inform the person to whom the responsibility is transferred of the property restrictions under section 116P.15; and
- (3) provide written notice to the commission of the transfer of reporting responsibility, including contact information for the person to whom the responsibility is transferred.

(b) After the transfer, the person who holds the interest in the real property is responsible for reporting requirements under this section.

History: *1Sp2005 c 1 art 2 s 136; 2006 c 243 s 21; 2013 c 52 s 7*

116P.17 ACQUIRING LANDS OR INTEREST IN LANDS; COMMISSIONER APPROVAL.

Subdivision 1. Commissioner approval. (a) A recipient of an appropriation from the trust fund who acquires an interest in real property must receive written approval from the commissioner of natural resources prior to the acquisition, if the interest is acquired in whole or in part with the appropriation. A recipient must request the commissioner's approval at least ten business days before the proposed acquisition. When a recipient requests approval under this subdivision, the recipient must simultaneously submit the same information to the commission. Conservation easements to be held by the Board of Water and Soil Resources, acquisitions of land in the metropolitan regional recreation open space systems as defined under section 473.351, subdivision 1, with appropriations to the Metropolitan Council, and acquisitions specifically identified in appropriation laws are not subject to commissioner approval under this section.

(b) The commissioner shall approve acquisitions under this section only when the interest in real property:

- (1) is identified as a high priority by the commissioner and meets the objectives and criteria identified in the applicable acquisition plan for the intended management status of the property; or
- (2) is otherwise identified by the commissioner as a priority for state financing.

Subd. 2. Value assessment. At least ten business days prior to acquiring an interest in real property with an appropriation from the trust fund, a recipient of an appropriation must submit the most recent tax assessed value and most recent tax statement of the real property and the amount the recipient plans to offer for the interest in real property to the commission and the commissioner of natural resources. Conservation easements to be held by the Board of Water and Soil Resources are not subject to the requirements of this section. The board shall keep a record of the tax assessed value of the real property at the time of acquisition and the most recent tax statement.

History: *2010 c 362 s 3; 2013 c 52 s 8; 2014 c 226 s 3; 2017 c 96 s 5*

116P.18 LANDS IN PUBLIC DOMAIN.

Money appropriated from the trust fund must not be used to purchase any land in fee title or a permanent conservation easement if the land in question is fully or partially owned by the state or a political subdivision of the state or was acquired fully or partially with state money, unless:

- (1) the purchase creates additional direct benefit to the protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources; and
- (2) the purchase is approved, prior to the acquisition, by an affirmative vote of at least 12 members of the commission.

History: 2013 c 52 s 9

116P.19 DONATIONS.

A recipient of money from the trust fund must not accept a monetary donation or payment from an owner of land that is acquired in fee in whole or in part with an appropriation from the trust fund that exceeds the documented expenses that are directly related to and necessary for activities specified in the work plan approved by the commission, unless expressly approved by the commission in the work plan. This section does not apply to:

- (1) donations that are not connected with the acquisition transaction; or
- (2) bargain sales, as defined by Code of Federal Regulations, title 26, section 1.1011-2, provided that the purchase price reimbursed by the state does not exceed the purchase price paid by the recipient.

History: 2016 c 186 s 5

116P.20 EASEMENTS; MONITORING AND ENFORCEMENT REQUIREMENTS.

A recipient of money appropriated from the trust fund for easement monitoring and enforcement may spend the money only on activities included in an easement monitoring and enforcement plan contained within the work plan. Money received for monitoring and enforcement, including earnings on the money received, must be kept in a monitoring and enforcement fund held by the recipient and dedicated to monitoring and enforcing conservation easements in Minnesota. A recipient of an appropriation for easement monitoring and enforcement must, within 120 days after the close of the recipient's fiscal year, provide an annual financial report to the commission or the commission's successor on the easement monitoring and enforcement fund as specified in the work plan. Money appropriated from the trust fund for monitoring and enforcement of easements and earnings on the money appropriated revert to the state if:

- (1) the easement transfers to the state;
- (2) the recipient fails to file an annual financial report and then fails to cure the default within 30 days of notification of the default by the state; or
- (3) the recipient fails to comply with the terms of the monitoring and enforcement plan contained within the work plan and fails to cure the default within 90 days of notification of the default by the state.

History: 2016 c 186 s 6

116Q.02 STATE RECEIPTS FROM FUND.

Subdivision 1. **Great Lakes protection account.** Any money received by the state from the Great Lakes protection fund, whether in the form of annual earnings or otherwise, must be deposited in the state treasury and credited to a special Great Lakes protection account. Money in the account must be spent only as specifically appropriated by law for protecting water quality in the Great Lakes. Approved purposes include, but are not limited to, supplementing in a stable and predictable manner state and federal commitments to Great Lakes water quality programs by providing grants to finance projects that advance the goals of the regional Great Lakes toxic substances control agreement and the binational Great Lakes water quality agreement.

Subd. 2. **LCCMR review.** The legislature intends not to appropriate money from the Great Lakes protection account until projects have been reviewed and recommended by the Legislative-Citizen Commission on Minnesota Resources. A work plan must be prepared for each project for review by the commission. The commission must recommend specific projects to the legislature.

History: 1990 c 594 art 1 s 59; 2006 c 243 s 21

4.071 OIL OVERCHARGE MONEY.

Subdivision 1. **Appropriation required.** "Oil overcharge money" means money received by the state as a result of litigation or settlements of alleged violations of federal petroleum pricing regulations. Oil overcharge money may not be spent until it is specifically appropriated by law.

Subd. 2. **Minnesota resources projects.** The legislature intends to appropriate one-half of the oil overcharge money for projects that have been reviewed and recommended by the Legislative-Citizen Commission on Minnesota Resources. A work plan must be prepared for each proposed project for review by the commission. The commission must recommend specific projects to the legislature.

Subd. 3. [Repealed, 1998 c 273 s 15]

History: 1988 c 686 art 1 s 36; 1988 c 690 s 1; 1989 c 335 art 1 s 269; 1990 c 568 art 2 s 1; 1994 c 483 s 1; 2006 c 243 s 21