Environment and Natural Resources Trust Fund
2018 Request for Proposals (RFP)

Project Title: **ENRTF ID: 092-B**

Geospatial Airborne Sensor Survey to Manage Water Resources

Category: B. Water Resources

Total Project Budget: $ 999,768

Proposed Project Time Period for the Funding Requested: 2 Years, July 2018 to June 2020

Summary:

This project seizes immediate opportunities to employ aerial sensors and other GIS technology through the use of drones to capture high resolution…real time…3-dimentional data for active management of watershed challenges.

Name: Anton Bergee

Sponsoring Organization: Northland Community and Technical College

Address: 1101 Hwy 1 East

Thief River Falls MN 56701

Telephone Number: (218) 683-8621

Email Anton.bergee@northlandcollege.edu

Web Address www.northlandcollege.edu

Location

Region: Northwest

County Name: Beltrami, Clearwater, Itasca, Kittson, Koochiching, Lake of the Woods, Mahnomen, Marshall, Pennington, Polk, Red Lake, Roseau

City / Township:

Alternate Text for Visual:

The image shows the the five partner logos with a map of their locations in NW MN. The image also show some different types of data that the sensors can collect depending on each partners individual needs.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

I. PROJECT STATEMENT

The real time capture of geospatial sensor data using small unmanned aircraft systems (sUAS or *drone*) will result in the ability to efficiently target and prioritize resources in management activities to restore and protect water quality in the State of Minnesota. The expected outcome of employing drones is an increase in efficiency of management practices, which are required to protect the quality of water resources; as well as a model for statewide implementation of sUAS in water conservation applications.

There is an immediate opportunity to employ aerial sensors and other geospatial information systems (GIS) technology to capture high resolution…real time…3-dimentional data for active management of watershed challenges. Repeated collection of GIS data will also be used to quantify erosion along a reach of a river. As an example, drones will be used to document erosion along reaches of the rivers and ditches that are relatively inaccessible to watercraft due to a limited frequency of access points. Drone work will be done from roadsides without trespassing or traversing steep banks. Many smaller streams aren't navigable due to shallow depths, wood debris, beaver dams, rocks, etc. Aerial surveys of streams and ditches will help target projects that reduce erosion, find barriers to fish passage and alter water flow.

Full motion video, LIDAR, and photogrammetrically accurate imagery are examples of tools which can be used to collect data on waterways. The information provided will result in accurate assessments which are needed to engineer grade stabilization projects and properly assess progress or possible issues. The data collected by sUAS GIS advanced technologies will be used to monitor the success of ditch improvement projects, application of two stage ditch design, erosion control projects, and overall management of the ditch and waterways system. sUAS aerial surveys will assist geomorphic assessments and facilitate shorter intervals between assessments of erosion rates. Getting erosion rates sooner than the anticipated 10-year interval should help local staff target and address problems faster. Geomorphic surveys are labor intensive, which limits the number of streams that can be assessed each year. The use of drones will be an innovative method of improving the efficiency of geomorphic assessments. Data collected with drones will not replace ground work and survey work, but it will save a significant amount of time by focusing efforts and reducing the amount of manual survey work that is needed.

At the completion of the project, the development and implementation of new technologies for the enhancement of water resources will provide a road map for statewide implementation of sUAS technology. During this project, pre/post-project monitoring and evaluation will be conducted to be accountable to the taxpayers by documenting the effectiveness of the project.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1 / Year 1: Project Setup and Initialization **Budget: $589,884.48**

The first year of the project will include activities related to initial setup of operations and teams. It will include all activities for establishing routine business practices and fiscal controls. Initial flights of unmanned aircraft will be conducted to calibrate sensors and software. The expected outcome will be the capture of baseline data that will be used for implementation of overall project outcomes.

Outcome	Completion Date
1. Procurement and Hiring	*October 1, 2018*
2. Operational Protocols and Calibration Flights	*January 1, 2019*
3. Capture of Baseline Data/ Formulation of Corrective Action Plans	*June 30, 2019*

Activity 2 / Year 2: Data Capture, Assessment, Dissemination and Corrective Action Plan **Budget: $409,884.48**

The second year of the project will primarily encompass flight operations and data capture directly related to action and management plans. Data collected during the 2nd year will be compared to baseline data to calculate changes in channel geometry that may indicate erosion, sedimentation, or blockages. This data will be used to plan the implementation of a corrective action plan and engineered changes. Data capture will continue along with qualitative assessments of the data. Determinations will be made as to the overall success of ditch improvements regarding enhancements to water

quality and benefits to water resources. Finally, the project will "package" results for the purposes of dissemination to third parties such as watersheds and the Minnesota Department of Natural Resources. Educational programs for training geospatial graduates will be finalized.

Outcome	Completion Date
1. Application of sUAS techniques and enhancements to water conservation	*August 2019*
2. Monitoring and cataloging of new activities and baseline data or outcomes	*November 2019*
3. Assessment of the success of erosion control/flow data and outcomes	*January 2020*
4. Comparisons of quality of data/relevance of data and relative collection techniques and efficiencies of unmanned and manned versus traditional methods	*June 2020*
5. Dissemination of "packaged" materials including techniques, protocols, procedures and outcomes to third parties for educational and informational purposes	*June 2020*

III. PROJECT STRATEGY

A. Project Team/Partners

4 watershed districts and a soil and watershed conservation district have partnered on this project. The water conservation team is partnered with Northland Aerospace[1] to provide the subject matter expertise needed in sUAS and imagery analysis. Middle-Snake-Tamarac Rivers[2], Red Lake[3], Roseau River[4] and Two Rivers[5] Watershed Districts are all adding unmanned systems resources to their daily operations as a part of this project. Pennington Soil and Water Conservation District[6] (PSWCD) is also partnered on this project as a leader in applying the technology. PSWCD received a grant for $332,749 from the Minnesota Board of Water and Soil Resources[7] (MNBWSR) which will support this project by establishing basic concepts of operations and give this project a head start in accomplishing grant outcomes. $83,187.25 in additional resources were awarded from Enbridge[8] in 2017 to match resources awarded from MNBWSR. Northland Aerospace has invested over $5 million[9] in resources throughout the past 5 years focused on developing sUAS GIS technology. Industry experience earned through implementation of surveying with sUAS technology will also be leveraged. HDR Inc.[10] and Houston Engineering Inc.[11] have experience using drones for surveying work. Some of their findings have already been implemented in water conservation applications, and they have agreed to partner with the team to share lessons learned.

B. Project Impact and Long-Term Strategy

It is expected that the data captured, processed and applied to ditch management and stream bed pollution because of the project, will provide a new path forward in the long-term effort to improve water quality in the State of Minnesota. The establishment of data baselines and the timely capture of relevant geospatial data will provide solid scientific basis for focused solutions to the management of water resources. It is further expected that the information generated will be shared with all water resource stake holders for use in future efforts to make relevant and timely decisions in water resources management.

C. Timeline Requirements

The project will require two years to complete. During the performance period, we will; capture baseline data, apply data to identified conservation strategies, evaluate outcomes and then disseminate grant project findings. In addition, it is expected that the dissemination of "lessons learned" to external partners or water resource stakeholders will continue past the evaluation period of the grant.

[1] Northland Aerospace – www.northlandaerospace.com, [2]Middle-Snake-Tamarac Rivers - http://mstrwd.org/, [3]Red Lake - http://www.redlakewatershed.org/, [4]Roseau River - http://www.roseauriverwd.com/, [5]Two Rivers - http://www.tworiverswd.com/, [6]Pennington Soil and Water Conservation District - http://www.penningtonswcd.org/, [7]Mn BWSR Grant - http://www.bwsr.state.mn.us/cleanwaterfund/fy2017/awards/FY17_AIG.pdf, [8]Enbridge Grant - http://www.enbridge.com/~/media/Enb/Documents/Projects/Line%203/ENBEcoGrantAwardhandoutAPR2016L01B.pdf, [9]Northland Aerospace Grants - http://www.northlandcollege.edu/aerospace//dronetech/NCTC-DroneTECH-Project-TAACCCT.pdf, [10]HDR Inc. - http://www.hdrinc.com/, [11]Houston Engineering Inc. - http://www.houstoneng.com/

2018 Detailed Project Budget

Project Title: Geospatial Airborne Sensor Survey to Manage Water Quality

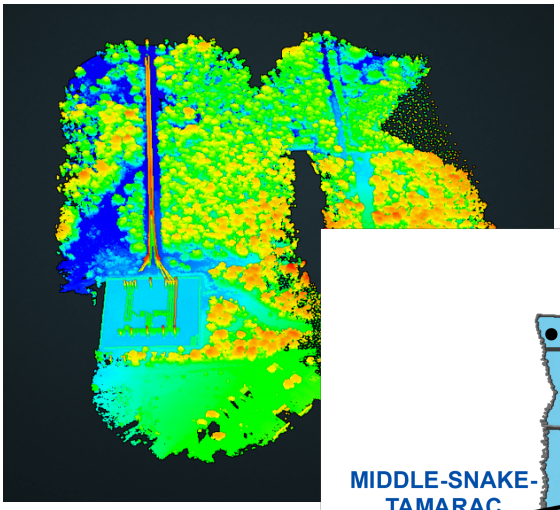
IV. TOTAL ENRTF REQUEST BUDGET 2 years

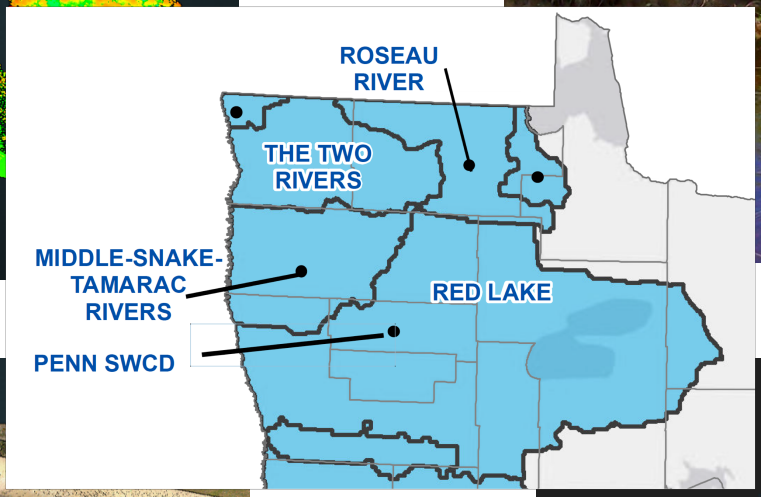
BUDGET ITEM	AMOUNT
Personnel: Formula = "Per Hour Rate" x "39% Fringe Rate" x "2080 Hours Per Year" x "FTE" x "2	**2 Yr Project**
Project Manager will oversee the implementation of project activities, including required reporting of grant activities, scheduling, contract management, data collection, budgeting, and day-to-day management of grant activities. (.5 FTE - 1Person) @ $62,000 / yr	$173,472.00
Water Quality Coordinator - In charge of planning and implementing the district's water quality related activities, including water quality sampling, continuous water quality monitoring, flow measurements and continuous stage/flow monitoring. (.3 FTE - 4 Personnel)	$222,044.16
requirements. Responsible for operational planning, safety, flight reporting, compliance with Federal Aviaiton Administration, and site selection based on environmental conditions. (.25 FTE - 3 Personnel)	$130,104.00
Geospatial Intelligence Analyst - Provide analytical skills sufficient to review and compare data, remote sensing software, Arc Map/GIS for photo interpretation, digitizing, manage electronic spreadsheets to compile lists or track projects and activities, correspondence and presentations showcasing project results. (.25 FTE - 3 Personnel)	$130,104.00
Imagery Analysis Interns - Must have completed one year imagery analysis certificate and will directly support the Geospatial Intelligence Analyst (.2 FTE - 5 Personnel) (Reduced Fridge Calculated - 15%)	$57,408.00
Project Data Coordinator - Responsible for data collection and management for both grant project activitees as well as grant reporting. Reporting requirements include fiscal, compliance, and activity reporting as required by the granting organization. (.25 FTE - 1 Person)	$40,476.80
Professional/Technical/Service Contracts:	
External Evaulation - Grant Compliance	$15,000.00
Industry Subject Matter Expertise, Engineering Partners and Training	$18,000.00
Equipment/Tools/Supplies:	
Small Unmanned Aerial System w/LiDar x 2 Systems	$119,600.00
Small Unmanned Aerial System w/Near IR, Survey Sensors x 2 Systems	$58,400.00
Software Purchase and Integration- ArcGIS x 2 years	$23,060.00
Generators for Field Systems x 2	$2,000.00
Misc Supplies; field work consumables, fuel for generators	$500.00
Travel:	
Flight Teams - 25 Trips per year / 4 Partners / 100 Trips Total per year / 2 Years / $48.00 per Trip	$9,600.00
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	**$999,768.96**

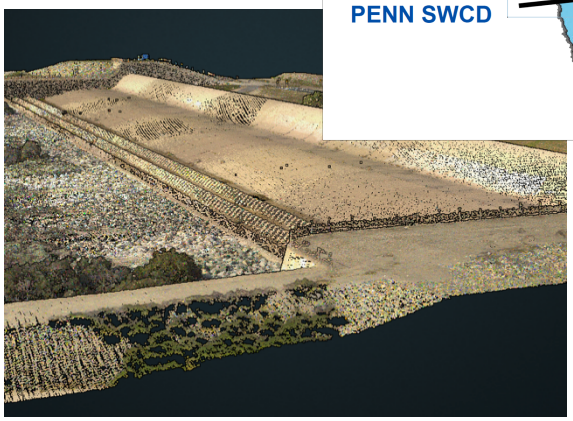
V. OTHER FUNDS

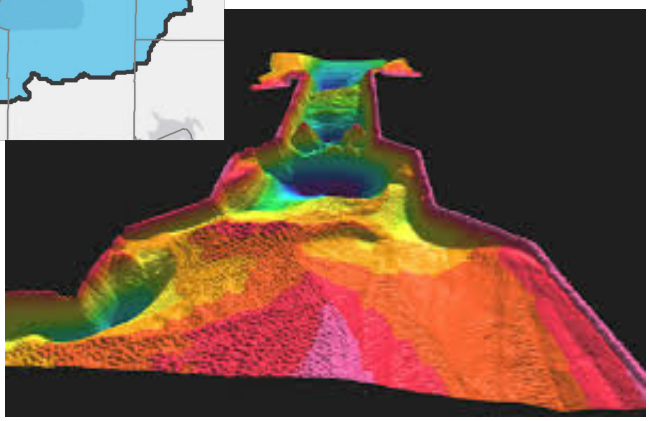
SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:		
National Science Foundation	$ 599,975.79	Pending
Enbridge Ecofootprint	$ 83,187.25	Secured
Other State $ To Be Applied To Project During Project Period:		
MN Board of Water and Soil Resources	$ 332,749.00	Secured
In-kind Services To Be Applied To Project During Project Period:	n/a	n/a
Past and Current ENRTF Appropriation:		
MN DNR- Enhancing Forest Inventory Using Multiple Remote Sensing Technnologies	$ 1,053,638.00	Unspent
Other Funding History:	n/a	n/a

NORTHLAND
COMMUNITY & TECHNICAL COLLEGE









Roseau River Watershed District

Two Rivers Watershed District
In Kittson, Roseau, & Marshall Counties, MN

Red Lake Watershed District • Dedicated to Water Management •

MSRWD

NORTHLAND AEROSPACE

PENNINGTON SOIL & WATER CONSERVATION DISTRICT

Project Manager:
Anton Bergee, Grant Support Officer, Northland Community and Technical College (NCTC)

Qualifications:
Education – B.S. in Business Administration from Bemidji State University with an emphasis in Management

Professional Prep – Basic and Advanced International Traffic in Arms Regulations (ITARs) compliance training, small Unmanned Aerial Systems (sUAS) Familiarization Certificate, University of MN Professional Grant Development Training, Federal Publications Seminar-Federal Grant Compliance

Experience – Anton Bergee has a proven track record in managing successfully completed projects including fifteen years of project management experience in both private and public sectors. The last five years have been spent with Northland Community and Technical College managing over 15 million dollars in grant funded projects. These projects include private sector, state, and federal funding. Previous topics of project focus include; unmanned aircraft systems technology, imagery analysis and geospatial intelligence training, precision agriculture applications and advanced technologies in manufacturing. These projects cover a variety of technologies in advanced robotics and autonomous technologies which are grounded in environmental conservation applications. The experience earned through the management of past projects will assist in ensuring this project will attain targeted outcomes.

When performing duties as the Grant Support Officer for NCTC, Anton has driven timelines and outcomes for projects from initial inception to completion. Daily responsibilities included grant seeking and development, grant tracking – both budget and project outcomes, and finally grant compliance including assistance with final audits.

Project Responsibilities:
As project manager, Anton's responsibilities will include:

- Monitoring project timelines and budget
- Managing project work plan and scope
- Coordinating project team communication strategies and tasks with internal and external stakeholders
- Coordinating/Completing progress updates and financial reports
- Providing guidance in state and federal regulatory compliance considerations

Organization Description:
NCTC is a comprehensive college with campuses in Thief River Falls, MN and East Grand Forks, MN. Northland Aerospace also has an aviation site in Thief River Falls, MN and a satellite site in Roseau, MN. NCTC offers 110 certificates, diplomas, transfer courses, and two-year AAS degrees in more than 60 areas of study, workforce training and education programs. NCTC is a member of Minnesota State, a system of 30 colleges, 7 universities and 54 campuses throughout Minnesota communities.

Mission Statement- *Northland Community & Technical College is dedicated to creating a quality learning environment for all learners through partnerships with students, communities, businesses, and other educational institutions.*

Vision Statement- *Northland Community & Technical College will be widely recognized as a progressive leader in community and technical college education, responsive to the needs of our learners through the use of partnerships, innovation, and technology. Learn about our Institutional Learner Outcomes.*