

**Environment and Natural Resources Trust Fund
2011-2012 Request for Proposals (RFP)**

LCCMR ID: 163-F3+4

Project Title: WARF Greenhouse: Renewable, Sustainable Energy & Food System

Category: F3+4. Renewable Energy

Total Project Budget: \$ \$450,000

Proposed Project Time Period for the Funding Requested: .5 yr, July 2011 - Oct 2011

Other Non-State Funds: \$ 0

Summary:

Construction of a greenhouse for the integrated production of algal bio-diesel, produce and fish using local renewable energy sources, rooftop rainwater collection and nutrients from Silver Bays Water treatment facility.

Name: Bruce Carman

Sponsoring Organization: City of Silver Bay

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Silver Bay MN 55614

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Location

Region: NE

Ecological Section: Northern Superior Uplands (212L)

County Name: Lake

City / Township: Silver Bay

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

2011-2012 MAIN PROPOSAL

PROJECT TITLE: WARF Greenhouse: Renewable, Sustainable Energy & Food System (WARF = wind-algal-rain-food)

I. PROJECT STATEMENT

Silver Bay has been developing an Eco-industrial Park to stimulate sustainable regional economic development and diversify its local economy. The eco-industrial concept means businesses are selected so that the waste from one tenant serves as the raw material for another. This effort has been funded by several grants (IRR, MPCA, UMD) aimed at park design, business recruitment/integration and on-site renewable energy production. From these efforts our concept has emerged, and recently was awarded \$298,870 in seed funding. We are proposing to construct a 10,000 ft² two-story greenhouse/processing facility to demonstrate the combined production of bio-diesel from algae, produce and fish. Our research has shown that none of these production activities are economically viable on their own, but an integration of the three, as illustrated in Figure 1, has the promise of sustainable energy and food production as well as creating numerous high-quality jobs. The facility would be used to demonstrate the concept, maximize production/design efficiencies, serve as an educational tool for regional schools, vocational programs, universities and environmental learning centers and as a model for communities throughout MN interested in duplicating our efforts.

The project is designed to achieve specific production goals (30,000 gallons of bio-diesel, 50,000 lbs of fish, 3,000lbs of tomatoes and 5600 heads of Bibb Lettuce) and waste minimization using only on-site renewable energy (wind, solar and bio-diesel) sources, water collected from rooftops and nutrients from Silver Bay's adjacent Waste-Water Treatment Facility. A final goal is the creation of 10-15 sustainable full-time and numerous part-time jobs. Production levels, as well as system inputs and outputs will be carefully monitored to track progress towards these goals. Specific measurable outcomes include the elimination of waste, production of clean energy (from wind, solar and bio-diesel) and water from rooftop collection system, healthy fish and produce for regional consumption as well as job creation and all the associated project economics. In addition, system design, construction and on-going experimentation will serve to increase production efficiencies and eliminate wastes. Finally, all aspects of the proposed project will be used as an educational tool.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Construction (wind funnel and solar panels)

Budget: \$125,000

The project begins with construction of the 10,000 ft² greenhouse/processing facility, the rainwater collection/filtration system and the renewable energy systems. The greenhouse will be used for growing bio-diesel, fish and produce. The processing facility will be used for produce and fish cleaning/packaging as well as the conversion of algal oil to bio-diesel. The renewable energy system will consist of a hybrid solar/wind unit and a backup bio-diesel generator. The greenhouse and processing facility will be oriented in a manner to maximize the wind tunneling effect between them. The wind will be captured by helical wind turbines integrated into the building design. Solar panels will be mounted on the roof of the processing facility. The rooftop rainwater collection system will consist of gutter filters, gutters, storage tanks and carbon/ultraviolet filters to ensure potable, but non-chlorinated water for the algal/fish cultures. Land within the Eco-industrial Park will be provided by the City of Silver Bay.

Outcomes:

1. Construction of Greenhouse/Processing Facility
2. Construction of Rainwater Collection System
3. Construction of Renewable Energy Production Systems

Completion Date:

October 2011
October 2011
October 2011

Activity 2: Algal Bio-diesel Production System

Budget: \$150,000

This system will consist of liquid nutrient storage containers connected to large cylindrical, vertical algal production cultures. Algal material is concentrated (buoyancy driven) and harvested (intermittent

siphoning) into large storage containers. The algal material is then dried and pressed to release oil. The pressed material is then placed into settling tanks allowing the solid cellular material, water and oil layers to separate. The water and cellular material is used in the fish production system, and the oil is converted (transesterification) to bio-diesel. Nutrients will come from the adjacent waste water treatment plant and CO2 from nearby biomass combined heat and power facility. Water will come from the rainwater collection system. Experimentation and monitoring will take place in this and all remaining project activities in an ongoing attempt to maximize system efficiencies and production.

Outcomes:

1. Construction of Algal Bio-diesel Production System
2. Algal Production, Economic and Experimentation Data Report

Completion Date:

Oct. 2011
July 2013

Activity 3: Plant Production System

Budget: \$75,000

The plant production system will consist of table-top soil beds. Soil will come from composted algal, plant and fish materials. Water will come from the fish tanks, and will then return to the fish tanks once the nutrients have been removed by the plants. The choice of specific plant species will be determined based on regional produce demand. Produce will be grown year-round, harvested and processed in the adjacent processing facility.

Outcomes:

1. Construction of Plant Production/Processing System
3. Plant Production, Economic and Experimentation Data Report

Completion Date:

Oct. 2011
July 2013

Activity 4: Fish Production System

Budget: \$100,000

The fish production system will consist of 2 large tanks. Each tank will contain water at a different temperature corresponding to the optimal growth rates for a variety of fish species. Clean input water will come from the algal cultures (filtered) and runoff from the plant soil beds. Output water will be used for plant irrigation. Fish food will come from algal cellular protein, and non-market fish remains will be composted or sold as fertilizer. The choice of specific fish species will be determined based on regional demand, intrinsic growth rates and water temperature preferences. Fish will be grown year-round, harvested and processed in the adjacent processing facility.

Outcomes:

1. Construction of Fish Production System
2. Fish Production, Economic and Experimentation Data Report

Completion Date:

Oct. 2011
July 2013

III. Project Strategy

A. Project Team: (members are NOT funded by the Environment and Natural Resources Trust Fund)

Our project team consists of: Ms Lana Fralich: City Administrator for the City of Silver Bay; Mr Wade LeBlanc: Chairperson for the Silver Bay EDA; Mr Bruce Carman: Project Coordinator for the Silver Bay Eco-Park; Dr. Mike Mageau: Wind and Algal Bio-Diesel: U of MN – Duluth; Dr. Andrew Klemer: Algal Bio-Diesel: U of MN – Duluth; Mr David Stark: Water Capture Systems and Purification: U of MN – Duluth and Mr. Abazs: Greenhouse Agriculture and Aquaculture: Round River Farms

B. Timeline Requirements

Currently, with seed money funding, design, engineering, specifications and equipment selection has started with bids being let 7/01/10. Construction starts 9/01/10 with substantial completion 09/01/11. Final completion, occupancy and systems start-up is projected to be 10/31/11.

C. Long-Term Strategy and Future Funding Needs:

The WARF Greenhouse Project is an advancement of an MPCA Grant for “Sustainable Industrial Development” received by the City of Silver Bay, June 2009. The project recently received \$298,870 in seed money from the State. The City of Silver Bay is seeking funding from Iron Range Resources, the LCCMR and the USDA to advance the initial grant as well as complete the proposed project we have received seed money for.

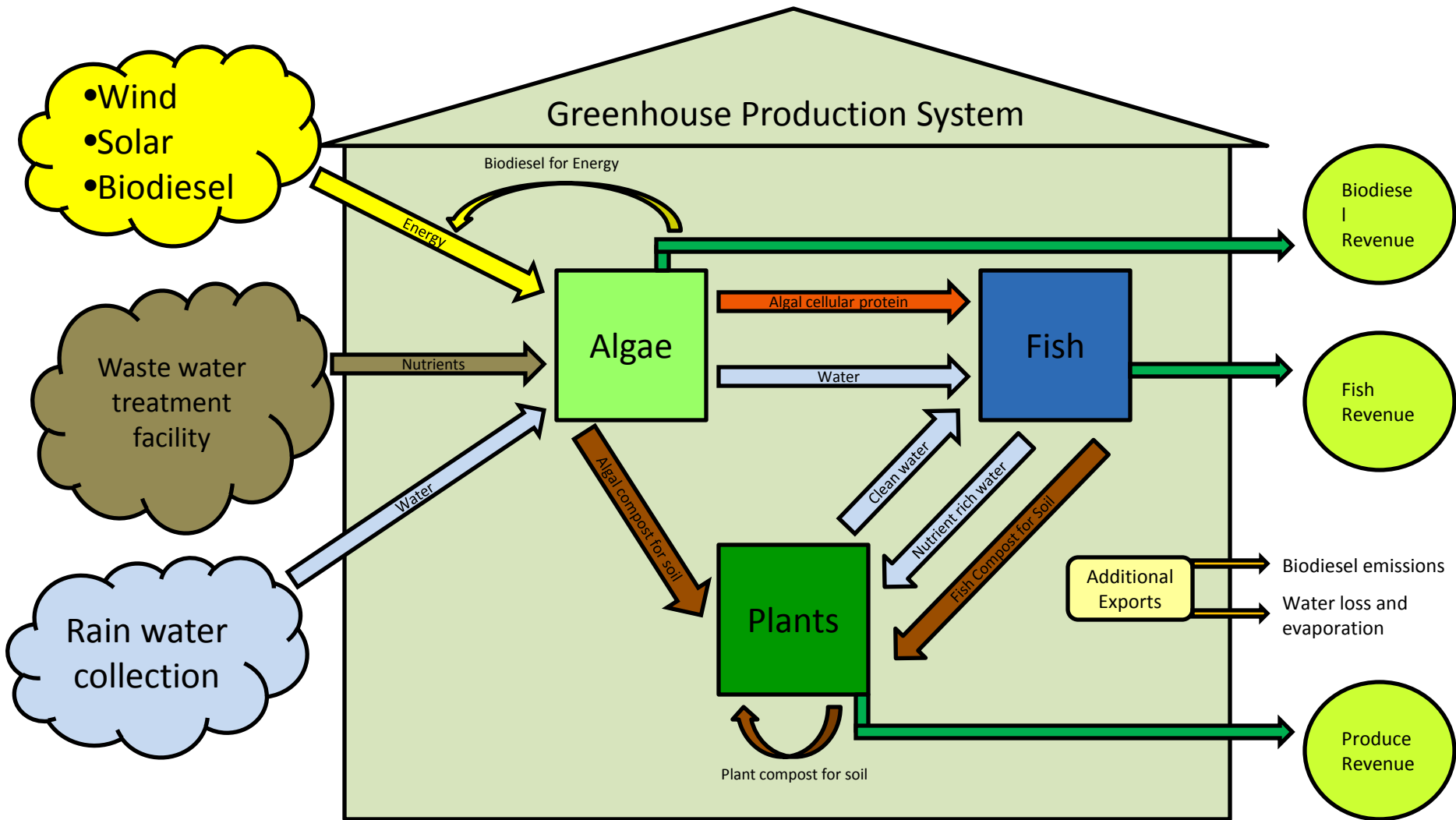
2011-2012 Detailed Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET .5 year(s)

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel	N/A
Contracts: Sub-contractor: Rain Water Capture & Filter System (50,000), Sub-Contractor: Solar Panel System (25,000), Sub-Contractor: Wind Turbine System (50,000), Sub-Contractor: Algal-Biodiesel System (150,000), Sub-Contractor: Fish Tank Filtration System (100,000).	\$ 375,000
Equipment/Tools/Supplies: Produce Planting: Equipment, Tools, Supplies and Lighting	\$ 75,000
Acquisition (Fee Title or Permanent Easements):	N/A
Travel:	N/A
Additional Budget Items:	N/A
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND \$ REQUEST	\$ 450,000

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period: USDA funding Rural Renewable Energy, Agriculture and Aquaculture.	\$ 300,000	Pending
Other State \$ Being Applied to Project During Project Period: Seed money from MN Legislature (\$298,870 Secured). Iron Range Resources: Renewable Energy Grant (\$250,000 Pending)	\$ 548,870	Secured and Pending
In-kind Services During Project Period: City of Silver Bay Staff (Administrative and Public Works \$49,130) and Eco-Park Land Lot 9, Block 4 (\$7000)	\$ 56,130	Secured
Remaining \$ from Current ENRTF Appropriation (if applicable):	N/A	
Funding History: Seed money from MN Legislature (\$298,870 Secured) for Phase I and II (see project Timetable). The development of more Funding History before July 2011 is to be on-going.	\$298,870	



Project Manager Qualifications and Organizational Description

Project Manager Qualifications:

Bruce Carman

Bruce has over 30 years experience in design, construction and project management. Bruce is current President of Cedar Tree Enterprises, Inc. a Design and Consulting firm. Bruce has lived on the north shore of Lake Superior since 1991 and is very familiar with the unique climate and geographical characteristics of the Silver Bay area, surrounding forests and shoreline. Bruce conceptualized the initial MPCA Grant: Silver Bay: Eco-Industrial Opportunities and is the Project Coordinator on behalf of the City of Silver Bay and The Silver Bay Economic Development Authority (EDA) to facilitate the development of the Silver Bay Business Park into an eco-industrial park. Bruce also has a purchase agreement with the City of Silver Bay and the EDA to purchase a 1.5+ acre lot within the park and volunteers much time with the City's youth ice hockey program.

Project Experience

Designer, Contractor and Project Manager for residential and light commercial projects, most of them in excess \$500, 000 in construction costs. Owner/Contractor Liaison for Cook County on behalf of the Board of Commissioners for their \$7 million construction and renovation projects for their Court House and Law Enforcement Center. Facilitated communication, construction inspections and budget management between Cook County the general contractor and the sub-contractors. Currently Bruce is serving as Project Coordinator for Silver Bay Eco-Industrial Business Park as a consultant.

Formal Education

Bachelor of Arts in Architecture with an emphasis in Construction Engineering, Iowa State University, Ames, IA, 1983.

Organizational Description:

In October 2008, an inter-disciplinary Project Team of local stakeholders and regional renewable energy experts began discussing the possibility of transforming the Silver Bay Business Park into an Eco-Industrial Business Park. Industrial ecology is achieved by designing clusters of businesses and industries to network with each so that one industry's waste becomes another nearby industry's feedstock. The goal of the park is to be self sustainable, i.e., off the grid and powered by renewable energy production systems that are locally owned. It is strongly believed that the park is an ideal location for integrating three types of renewable energy (wind, biomass, biodiesel). Businesses will be attracted to locate within the park as they will benefit from predictable renewable, sustainable energy costs. In addition, the need for fossil fuel consumption will be eliminated, which ultimately results in reductions in greenhouse gas emission, reductions in carbon footprint and reductions in waste.