

## **Great Lakes Research Center Vision & Goals** (draft 11-19-08)

**Vision:** Create an internationally recognized interdisciplinary center and state-of-the-art laboratory for investigation and monitoring of the upper Great Lakes, for education of K12 students and teachers, the public, and university community about Great Lakes issues, and for the promotion and development of sustainable policies related to the Great Lakes. The building will house not only MTU faculty, staff, and students, but also visiting scientists and representatives from government agencies involved in Upper Great Lakes research. Scientific studies will include field and laboratory studies, experiments, remote sensing, and modeling. Educational activities will include K12 teacher training and undergraduate and graduate laboratory instruction. To achieve this vision, the Lab will contain laboratories, berthing areas for research vessels, classrooms, offices, and advanced computational facilities. The Lab will be designed to minimize the environmental footprint of the building, including LEED certification. Activities in the Center will build upon and coalesce ongoing educational and research activities regarding the upper Great Lakes at MTU and other institutions.

### **Program Goals:**

**1) Develop and implement an ecosystem monitoring program for Lake Superior** and integrate this into national and international monitoring programs (e.g., GLOS, NEON, WATERS, GLEON, IADN). Research will focus on Great Lakes food chain, global climate change, carbon cycling, hydrodynamics, and emerging contaminant issues. An important component of this monitoring will be the use of real-time and historical satellite data to extend surface monitoring stations and to generate climatologies of derived geophysical products such as surface water temperature, wind speed, wave state, ice cover, chlorophyll, suspended matter, and dissolved organic carbon for Lake Superior. (Remote Sensing Lab; Computation Lab; MTRI).

A portion of the monitoring data will be provided to the Great Lakes Observing System (GLOS) and to the NOAA Great Lakes Environmental Research Laboratory (GLERL). Monitoring will be coupled with development and testing of high resolution coupled hydrodynamic and biogeochemical models. (Open/Coastal Waters: Computational Lab; Atmospheric Lab; Sediment and Resurrection Ecology Lab)

**2) Investigate watershed and coastal/groundwater interfaces relative to human activities, fisheries populations, biota and biogeochemical inputs.** Research efforts will characterize and monitor the flora and fauna of the Lake Superior region and other northern lakes. River watershed studies will focus on fisheries and riparian restoration projects, inputs of allochthonous carbon, and development and implementation of watershed management plans. Coastal, river, and lake studies will include sampling for invasive species and public education programs. It will also include modeling ground water recharge into streams and shoreline portions for the region. Investigation of coastal physical, chemical and biotic processes will focus on the impacts of lake level changes due to climate change and other human activities. (Watershed Component: Fisheries Restoration Lab; Invasive Species Lab)

**3) Develop and conduct education/outreach programs and resources for K-12 students, teachers, and communities and policy-makers that focus on water resources and the Great Lakes.** Educational outreach programs will utilize classroom, auditorium, limnology lab, and open space/display areas. Operations will provide safe and convenient boarding of MTU and EPA/NOAA/CCIW research vessels (e.g. Agassiz, R/V Guardian, Ranger III) for scientific cruises on the Portage Waterway and Lake Superior. Shoreline docking that extends over the water near the lab will allow convenient aquatic sampling of the near shore lake environment ---sediment, plankton, clarity, etc. and mooring for small boats. The K-12 classroom will be utilized during the summer for teacher institutes in limnology, navigation, Great Lakes ecology, and other topics, as well as “Great Lakes Academies” for middle/high school students and summer camps for elementary students to stimulate their interest in research and marine sciences. (Outreach/Education, CSEO, WUPCSMEE, GEM Ctr).

The lab will support interagency collaboration and communication by providing office space for state/federal agencies (NOAA GLERL, SeaGrant, DEQ, Army Corps) and visiting scientists (from LLO, WHOI, MTRI) that will allow MTU to promote and showcase contributions to Great Lakes research. The CWS will host workshops, seminars and conferences here to facilitate discussion among policy-makers and Great Lakes stakeholders.

**4) The building and grounds will be a demonstration area to showcase low impact building and landscape design.** The lab/outreach center will integrate energy efficiency, storm water management, and shoreline ecosystem protection practices. Construction should aim towards LEED certification. The building and adjacent area should include instrumented low-impact development (LID) features such as a green roof and rain garden or bio-retention area, along with permeable asphalt in the parking lot and native plants along the water. These features will be used to develop design criteria appropriate for northern latitudes as well as to teach university students and the public about sustainable water quality protection and management techniques.

**Key Elements of GLRC:**

State-of-the-art building with dock facilities that accommodate a variety of research boats (internal bay for MTU R/V Agassiz, Polar; upgraded shoreline facilities for larger Lake Superior research vessels (e.g. R/V Guardian, R/V Blue Heron, R/V Limnos; small-craft storage and summer mooring adjacent to building). Improvements include moorage, lighting, gangplank boarding & loading.

An array of research vessels capable of operating in Lake Superior coastal waters, rivers, and lakes. An endowment will be established for GLH that can be used on a yearly basis to offset vessel costs and upgrade laboratory equipment.

State-of-the-art analytical equipment for chemical and biological analysis. This includes a common-use aquatic/atmospheric cluster that includes an ICP-Mass Spec, a Stable Isotope Mass Spec, and an LTU Orbitrap.

Multiple laboratories for coastal, watershed, and atmospheric studies. Wet lab equipment for physical, chemical, and biological experiments.

Dedicated computation facility for modeling, data storage, data retrieval and scientific visualization. High speed Internet for satellite data analysis and display. Geo-wall for visualization of products and outreach.

Seminar room/auditorium/lab/classroom for teaching and outreach activities. Two display areas for posters. Offices for outreach/education extension activities.

Specialized instruments (2 moorings with associated instrumentation, glider, sequential sediment traps) for deployment in coastal waters. Placement of instrumentation on Ranger III. Deployment of atmospheric monitoring instrumentation on a coastal or mid-lake lighthouse as well as at the building location. Construction of heated, storage area that can accommodate small craft, large instruments, and arrays.

As a part of its mission, the laboratory will 1) develop, fabricate, and test new aquatic and biota sensors and sampling instrumentation for northern studies, and 2) train students in collection of aquatic data, biological and sediment sampling.

#### Acronyms

CCIW	Canada Center for Inland Waters
CWS	Michigan Tech Center for Water & Society
DEQ	Michigan Department of Environmental Quality
EPA	U. S. Environmental Protection Agency
GEM Ctr).	GEM Center for Science and Environmental Outreach at Michigan Tech
GLEON	Global Lakes Ecological Observatory Network
GLERL	Great Lakes Environmental Research Laboratory
GLOS	Great Lakes Observing System
ICP-Mass Spec	Inductively Coupled Plasma Mass Spectrophotometer
LID	Low Impact Development
LLO	Large Lakes Observatory University of Minnesota Duluth
LTQ Orbitrap.	LTQ Orbitrap Mass Spectrophotometer
MTRI.	Michigan Tech Research Institute
MTU	Michigan Technological University
NEON	National Ecological Observatory Network
NOAA	National Oceanic and Atmospheric Administration
WHOI	Woods Hole Oceanographic Institute