

**Stormwater Planning Initiative Project –  
Stormwater Management Planning Guide and  
Landowner-friendly IMS website tool**

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Project Partners



This project was co-funded under the Coastal Zone Management Act, by NOAA's Office of Ocean and Coastal Resource Management, in cooperation with Minnesota's Lake Superior Coastal Program.

NRRI Technical Report NRRI/TR-2007/10

## **Introduction**

Individual landowners in rapidly growing areas of the North Shore Community are increasingly required to create stormwater management plans (SMPs) prior to building. Planning development with stormwater runoff in mind is particularly important on the North Shore of Lake Superior, characterized by shallow clay-rich soils over bedrock, steep slopes, and delicate wetland complexes. While numerous organizations exist with pieces of the information required to complete a SMP, the process of collecting expertise from multiple agencies is daunting for landowners. Duluth Township recognized the environmental importance of stormwater planning by passing new zoning ordinances mandating stormwater planning in some land use zones. However, they recognized the difficulty that landowners face in creating a SMP and are committed to finding solutions.

**The objective of this project was to connect Duluth Township landowners to tools and resources necessary to complete a Stormwater Management Plan for their property. This pilot project features development of a user friendly Internet Map Server (IMS) tool that allows landowners to easily generate working base maps of their property.** To date, IMS website tools have been largely developed by GIS professionals who are familiar with the GIS interface. When the general public tries to utilize these same tools, they typically become frustrated with the complexities of these programs, and cannot obtain the valuable information they need. This project was unique in that it was driven by extensive landowner input before, during, and after development to ensure that the tools developed achieved our objectives. Township administrators were also involved in development of the IMS tool and companion step-by-step guide so that the resulting landowner SMPs satisfied the regulatory and reporting requirements of the township.

With the user-friendly IMS interface, the landowner is able to easily obtain base maps of their property containing multiple layers of the best existing data, including aerial photographs, topography, and wetlands for developing the SMP's required by the Duluth Township zoning ordinance. While there are resolution limitations to the existing wetland data, the website guides landowners on how to elaborate on this base layer of data as they conduct a site evaluation of their property. For instance, the website illustrates how to identify a small unmapped wetland and add these features to the base map.

While the SMP Guide and IMS mapping tool was specifically designed and tested on Duluth Township, the project serves as a model template easily expanded to other townships along the North Shore.

This project had support from several partners organizations, who provide served as advisors on both the technical and public input components of this project. Collaborating organizations include:

- Minnesota’s Lake Superior Coastal Program, who provided monetary support through their STAR Program
- The Duluth Township Board, who represented the primary end users of the product and who provided review comments in all phases of the project
- Minnesota Sea Grant, particularly through the Non-point Education for Municipal Officials (NEMO) program
- The Regional Stormwater Protection Team (RSPT), who advised several aspects of the project

**Methods**

This project had two phases – the ‘listening’ sessions, in which the basic concepts and intermediate and final projects were described to the Duluth Township participants, and the site development process, in which technical work of delivering this information over the Internet Map Server was accomplished. UMD student John Geissler played a major role in conceptualizing the project as part of his thesis work, and in working with stakeholders. Gerry Sjerven and Terry Brown of the NRRI GIS laboratory were the predominant coders of the IMS tool. Drs. George Host, Richard Axler of NRRI, along with Cindy Hale, Director of the Boulder Lake Environmental Learning Center and Jesse Schoemberg of Minnesota Sea Grant served as advisors to various phases of the project.

A special emphasis was placed on ensuring that the product was usable for everyday landowners. To do this, the product was “tested” by actual Duluth Township landowners who attended educational training sessions in September and October.

Table 1. Presentations and Educational Training Sessions held primarily at North Shore Community School Computer Lab.

<b>Date of Presentation/Training</b>	<b>Audience</b>	<b>Attendance</b>
June 22, 2006	Duluth Township Planning Commission Meeting	9
September 21, 2006	Duluth Township Landowners	4
October 17, 2006	Duluth Township Landowners	17
October 25, 2006	Duluth Township Landowners	20
October 26, 2006	Duluth Township Planning Commission Meeting	8
October 30, 2006	Duluth Township Landowners	7
<b>Total</b>		<b>65</b>

Throughout the process of the training sessions, the project team observed and reacted to usability barriers that landowners encountered as they tried to use the website. Changes made from observations at the first training session were tested at the second session and so on. This process continued through six iterations which brought further and further refinement to the usability of the website. The following are major pieces of work completed to bring about the current working website

**Barrier 1.** Duluth Township did not provide any resources in the Land Use Application to assist landowners. For instance, how does one identify sensitive areas such as a wetland, steep slope, etc.

***Work Completed to address barrier 1.*** Created an electronic version of the application with an information column on the left side throughout the application with links to images, documents, and websites that would specifically help them fill out and elaborate on the data supplied for that section of the application (Refer to Appendix 4).

**Barrier 2.** Duluth Township officials complained that “Existing and Proposed Land Use Sketches” asked for in old application were often of poor quality and it was difficult for landowners to “capture” images from Internet map server and plug them into Land Use Application.

***Work Completed to address barrier 2.*** Developed scripts to generate a parcel specific Duluth Township Land Use application when landowners type in their parcel identification number. The scripts automatically inserted a watershed map (with parcel highlighted and links to more data on the watershed they are in), coarse soil data, and a close up aerial photo of the parcel with wetlands and streams overlaying the photo (See Section VI of the Application in Appendix 4).

**Barrier 3.** Data layers used in Internet Map Server were the best available but often did not have the resolution required for parcel level decisions. For instance the wetland layer did not accurately display all of the small wetlands that are present on the property. This was coarse data that required further refinement by the landowner.

***Work Completed to address barrier 3.*** Elaborated on left information column throughout the application and provided great detail through clear instructions and thumbnail image examples that illustrated how landowners should provide further detail to the “Site Planning Sketch” (See Appendix 4).

**Barrier 4.** Duluth Township Landowners were overwhelmed by the Internet Map Server having too many layers to choose from and the names of the layers were not intelligible.

***Work completed to address barrier 4.*** First, the project team worked with Duluth Township and NRRI to narrow down the list of layers available to landowner. Second, the project team made some layers automatically appear and disappear depending on the scale that was being viewed on the internet map server. Finally, the project team changed layer names to make more intuitive sense to landowners unfamiliar with GIS layer names. For example FSA, DOQ, and DRG were changed to Color aerial photo-2003, B&W aerial photo – 1990, and Topo Map respectively.

**Barrier 5.** Landowner had a difficult time using the tools to zoom to parcel quickly.

***Work completed to address barrier 6***

Created “zoom to” pull down feature with parcel identification numbers listed. This allowed landowners to quickly find their property. Also added a script to allow landowners to directly link to Internet Map Server session and zoom to their property from the “Options Page” of the website (See Appendix 2).

**Outcomes/Results**

This project created a model website called “Land Use/ Stormwater Planning Tools for Duluth Township Landowners” ([www.boulderlake.org/stormwaterims/default.html](http://www.boulderlake.org/stormwaterims/default.html)). The site removed several usability barriers to make technical land management information more easily accessible and useable to private landowners. This facilitates informed land use and stormwater planning. Further, the project presents the information in an educational manner so landowners understand why there is such a high value for the conservation of freshwater resources and what they can do to protect the quality of stormwater run-off in their watershed.

Duluth Township has adopted the project with the goals of

- Increasing awareness of stormwater management plan requirements and resources available to help landowners satisfy these requirements through the website and educational workshops.
- Increasing awareness of individual actions on water resources in particular stormwater runoff impacts and solutions
- Increasing collaboration among Duluth Township, Western Lake Superior Regional Stormwater Management Team (RSPT), U. of Minnesota (Sea Grant and Natural Resources Research Institute), and Boulder Lake ELC.
- Increasing preservation of wetlands, including small unmapped wetlands, and associated wildlife.

Several websites direct visitors to the website including the Duluth Township website ([DuluthTownship.org](http://DuluthTownship.org)), NRRI’s CoastalGIS site (<http://www.nrri.umn.edu/CoastalGIS>), and Lake Superior Streams ([www.LakeSuperiorStreams.org](http://www.LakeSuperiorStreams.org))

Beyond Duluth Township, the project generated widespread interest by other parties that may use part or the entire project as a template to expand to other areas of Minnesota. For example, NRRI is interested in expanding the scope of the project to other areas of the North Shore and the Arrowhead Regional Development Commission is hoping to bring similar services to communities on the Iron Range.

## Product Presentations

Date of Presentation	Audience	Attendance
August 10, 2006	St. Louis County Planning Department	4
November 7, 2006	NRRI Muffin Meeting	25
November 8, 2006	John Chell, Director of Arrowhead Regional Development Commission	1
November 16, 2006	UMD GIS day – Booth and presentation	28
TBA	Western Lake Superior Regional Stormwater Management Team (RSPT)	TBD
<b>Total</b>		54

## Summary and Future Directions

The principal benefit of this project was the tremendous strides it made in making the powerful utility of Internet Map Servers useable for landowners making land use decisions on their property. The project generated enthusiasm not only in Duluth Township officials and landowners but also in organizations that have expressed interest in building on this project and applying it to many other areas of Northeastern Minnesota.

Some of the issues that need to be addressed to take this project to the next stage are as follows.

- Not all communities have a parcel layer available. Is there a way to allow landowners to select a parcel through legal descriptions, drawing a polygon, entering an address, etc.?
- Many landowners would like to see more resolution in the aerial photographs, especially those with parcels less than 10 acres in size. One solution is to use higher resolution infrared photos once the IMS session zooms to a particular level. Will this dramatically reduce the speed of the IMS session and will the coloration of these photos confuse landowners?
- Participants complained that the frames of the IMS took up too much of the map viewing area, especially on smaller monitors. This could be corrected by allowing users to minimize the legend, layer options, and query window.
- Currently, landowners have to print out their Land Use application and then have to draw by hand existing impervious surface, proposed building sites, wetlands, steep slopes, etc. It would be nice if there was a tool on the website like “Google Sketch” that allowed landowners to easily draw and place these features to scale on the aerial image placed in the application.
- Developing the electronic land use application was a time consuming component of this project. In order to easily expand this to other townships it would be nice to have a base template that all townships agreed on.
- An advanced version of the website would automatically draw setbacks on the aerial photo, buffer zones around streams, steep slopes, and show the direction of water flow on a parcel, and other key information.

## **Appendices**

**Appendix 1. Opening page to website**

**Appendix 2. Option page of website**

**Appendix 3. Link from Duluth Township website**

**Appendix 4. One of several links on Lake Superior Streams**

**Appendix 5. Link from Coastal GIS “Decision Support Materials”**

**Appendix 6. Flyer sent out to all Duluth Township Landowners advertising Training Sessions**

**Appendix 1. Opening page to website**  
<http://www.boulderlake.org/stormwaterims/default.html>

**Duluth Township Land Use/ Stormwater Planning Resource Website - Microsoft Internet Explorer**

File Edit View Favorites Tools Help

Address <http://www.boulderlake.org/stormwaterims/default.html> Go Links >>


## Land Use/ Stormwater Planning Tools for Duluth Township Landowners

This pilot project features **two options** for landowners to gain access to working maps of their property in Duluth Township.

- The first option automatically generates a personalized copy of of the **Duluth Township Land Use Permit Application** complete with supplemental data and aerial photos specific to your property.
- The second option launches an Internet Map Server that allows you to zoom into your property and view a variety of Duluth Township maps including watersheds, soils, wetlands, topography, and aerial photos.
- **[More about this project](#)**

**[Start Here](#)**

This project was funded in part by the Coastal Zone Management Act, by NOAA's Office of Ocean and Coastal Resource Management, in cooperation with Minnesota's Lake Superior Coastal Program and the University of Minnesota Duluth Center for Community and Regional Research - University of Minnesota Duluth.





## Appendix 2. Option page of website

<http://www.boulderlake.org/stormwaterims/index.html>

Duluth Township Land Use/ Stormwater Planning Resource Website - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

Address <http://www.boulderlake.org/stormwaterims/index.html> Go Links

### Duluth Township Land Use/Stormwater Planning Resources

#### Step 1

*Before you start, you will need to know your Tax Parcel ID # 000-0000-0000*

[Click here to find your Tax Parcel ID #](#)

#### Step 2

<p><b>Option 1 - FAST and EASY</b> Enter your Parcel ID numbers below to automatically load a personalized copy of the <b>Duluth Township Land Use Permit Application</b></p> <p><a href="#">(See Example of Duluth Township Land Use Permit Application)</a></p> <p>(Parcel ID #'s have the form 123-1234-12345)</p> <p>*If you are not from Duluth Township but would like to try out the tool, you can use the tax parcel number 315-0020-02520.</p> <p>Parcel ID number (PIN): <input type="text"/></p>	<p><b>Option 2 - Explore your Property with the Internet Map Server</b></p> <p>This option allows you to zoom in and out on your property with different layers of data including topography, soils, watersheds, aerial photographs and more...</p> <p><a href="#">Launch Internet Map Server</a></p> <p><a href="#">Instructions on how to use Internet Map Servers</a></p>
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Internet

### Appendix 3. Link on Duluth Township website

<http://www.duluthtownship.org>

**Duluth Township Web Site - Microsoft Internet Explorer**

File Edit View Favorites Tools Help

Address <http://www.duluthtownship.org/>

**Contacts: [E-mail List](#) [Phone Numbers](#)**

# Duluth Township

Duluth Township located on the North Shore of Lake Superior, half way between Duluth and Two Harbors in southeastern St. Louis County, Minnesota. ([Map](#))

- [Calendar](#)
- [Newsletter](#)
- [Information](#)
- [Official Minutes](#)
- [Forms](#)
- [Documents](#)
- [Businesses](#)
- [Organizations](#)

### Community Links

[Community Education Classes](#) Fall 2006

[Results of the 2006 Resident Feedback Questionnaire](#)

[North Shore Community School](#)  
[Duluth/North Shore Sanitary District](#)

[Lakewood Township](#)  
[Normanna Township](#)  
[St. Louis County](#)  
[Duluth](#)

Web Design by: [Linda Hollinday](#)

**Deadline for the Jan. 2006 Newsletter** is Dec. 23. If you have an announcement of broad interest to Township residents, send it to the editor. ([e-mail](#))

### Upcoming Events and Issues

**Township Meeting Minutes and more...**  
[Read the Latest](#)

**Filing for Town Supervisor**  
Filing is open from Jan. 2 to 5pm on Jan. 16 at the Town Hall. Election is held March 13.

**Duluth Township Land Use/Stormwater Planning Resources**  
Aerial photos, topographic maps, watershed information, and more.  
[e-mail](#) [Website](#)

**South Recycling Shed Closed**  
**Due to McQuade Harbor Construction Work**  
New, extended hours at the North Recycle Shed:  
Tuesday, 9am to 11am and 2pm to 6pm  
Thursday, 9am to 7pm  
Saturday, 8am to 12 noon

**CrimeNet**  
The Duluth Township Police Department provides Safety Tips and the latest news about crime in our township. [Monthly Police Report.](#)

<http://www.boulderlake.org/stormwaterims/default.html>

**Appendix 4. One of several links on Lake Superior Streams**  
<http://www.duluthstreams.org/stormwater/toolkit/sitedesign.html>

Stormwater Management - Site Evaluation and Design - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://www.duluthstreams.org/stormwater/toolkit/sitedesign.html>

lake superior communities  
duluth streams.org understanding  
the streams  
citizens and schools stormwater

Stormwater Plan Inflow and Infiltration Regional Stormwater Protection Team Site Design Toolkit

**SITE DESIGN TOOLKIT**

**Site Evaluation and Design**

**A careful evaluation of how you design your site can actually minimize runoff and save money.**

This first step in managing stormwater is often forgotten, however. The following documents will help you to evaluate your site and determine what you can do to control stormwater runoff.

**Property Mapping**

Click [here](#) to see a prototype tool from a pilot project for Duluth Township to help landowners gain access to working maps of their property.

**The information below is reproduced directly from the Minnesota Stormwater Manual 2005.**

[PDF icon] = pdf file; it will be opened in a new window

**BETTER SITE DESIGN**

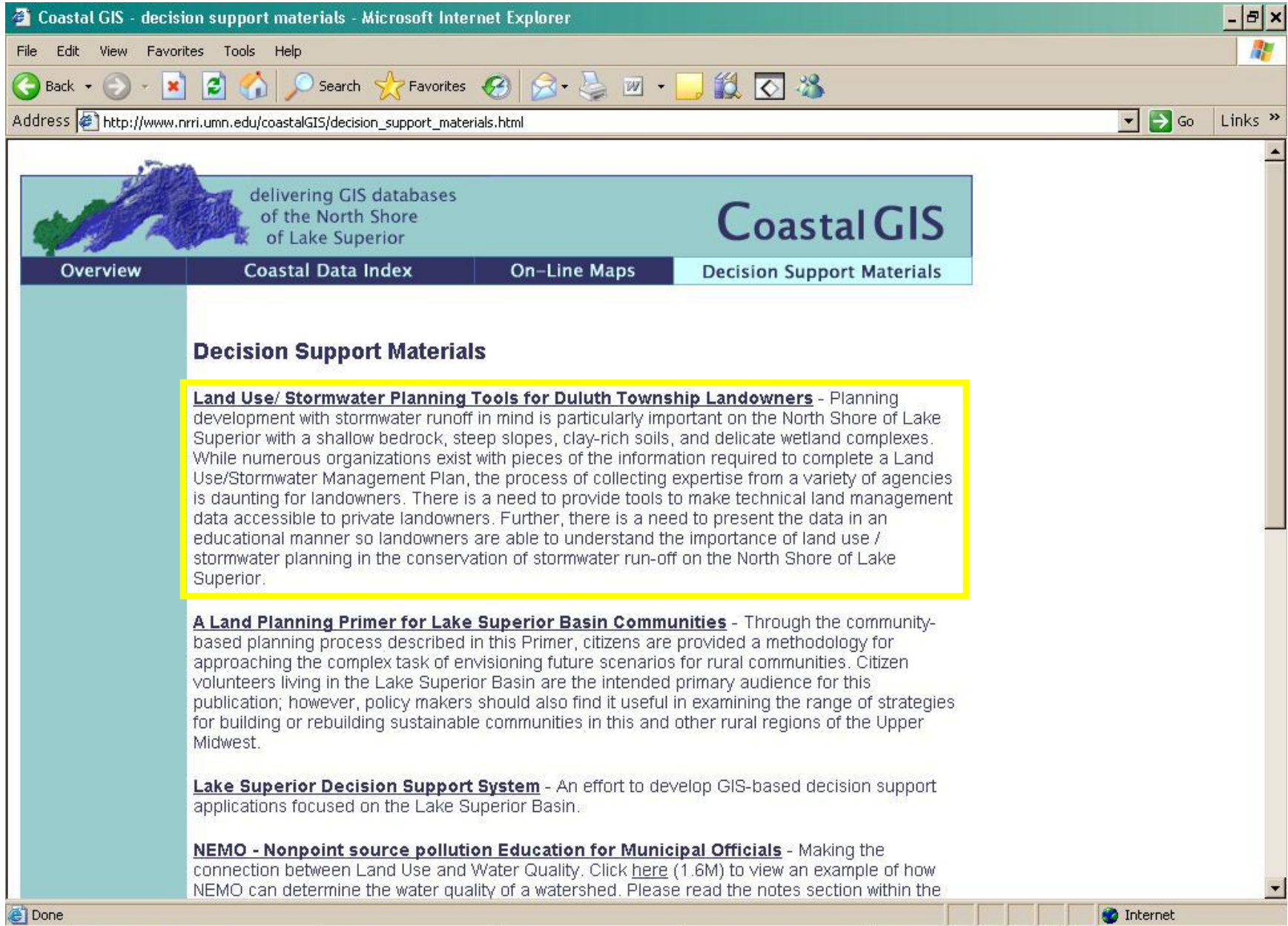
**Better Site Design Fact Sheet - Ch. 12-02** [PDF icon] 1.0 MB

A 10 page fact sheet on Better Site Design,

<http://www.duluthstreams.org/index.html> Internet




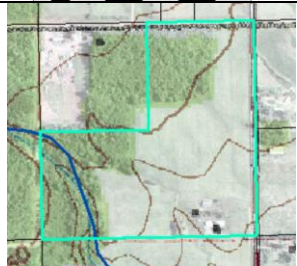
**Appendix 7. Link from Coastal GIS “Decision Support Materials”**  
[http://www.nrri.umn.edu/coastalGIS/decision\\_support\\_materials.html](http://www.nrri.umn.edu/coastalGIS/decision_support_materials.html)



# TRAINING for Duluth Township Landowners

The University of Minnesota Duluth and Boulder Lake Environmental Learning Center have teamed up with Duluth Township to pilot an internet map server project specific to the North Shore that helps landowners gain information about their property.

Learn in one hour how to get.....

	<ul style="list-style-type: none"><li>• aerial photos of your land</li><li>• soil and watershed information</li></ul>
	<ul style="list-style-type: none"><li>• topographical maps</li><li>• and much more free from the internet.</li></ul>

Where: North Shore Community School Computer Lab

When: Pick the date that works best for you....

Tuesday, October 17<sup>th</sup> 7-8:00 p.m.

Wednesday, October 25<sup>th</sup> 7-8:00 p.m.

Monday, October 30<sup>th</sup> 7- 8:00 p.m.

**Cost: Free! but there is limited space...please register by contacting John Geissler at 721-3731 or [geiss020@d.umn.edu](mailto:geiss020@d.umn.edu)**

This project was funded in part by the Coastal Zone Management Act, by NOAA's Office of Ocean and Coastal Resource Management, in cooperation with Minnesota's Lake Superior Coastal Program and the University of Minnesota Duluth Center for Community and Regional Research.