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Promoting Soft Engineering Along Detroit River Shorelines

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The Detroit River was honored to become one of the 14 American Heritage Rivers designated by the President of the United States in 1998. Specifically, this program helps communities restore and revitalize their rivers and waterfronts. The heart of the American Heritage River Initiative is locally driven and designed solutions for environmental stewardship, historical/cultural preservation, and economic development. In 2001, the Detroit River received a Canadian Heritage River designation, making it the first international heritage river system in North America.

Historically, many river shorelines were stabilized and hardened with concrete and steel to protect developments from flooding, stop erosion, or accommodate commercial navigation or industry. Quite typically shorelines were developed for a single purpose. Today, there is growing support for development of shorelines for multiple purposes so that additional benefits can be accrued.

Eroded Lake Muscoday shoreline near a heavily traveled road on Detroit's 980-acre island park called Belle Isle, September 2000 (photo credit: Mark Breederland, Michigan Sea Grant).

Up and down our Detroit River, efforts are underway to reshape the riverfront from being concealed in our back yard to being the focal point of our attention. In Detroit, General Motors Corporation has switched the front door of GM's Global Headquarters at the Renaissance Center from Jefferson Avenue to the Detroit River with the building of a four-season, five-story, glass "Wintergarden" in 2001. The Promenade stretching east from the Renaissance Center further showcases our river for businesses and residents. Across from Detroit in Windsor, Ontario, Canada, another 3 miles of continuous riverfront greenway were opened in 1999 to promote the river and help create an exciting venue for people to work, play, and socialize downtown. In Wyandotte, Michigan, along the lower end of the Detroit River, the building of a golf course, a rowing club, and greenways have directed attention to our river and have resulted in considerable spin-off benefits. People want to increase access to our river, incorporate trails and walkways to it, improve the aesthetic appearance of the shoreline, and reap recreational, ecological, and economic benefits from it.

One of the first things that was done under the Greater Detroit American Heritage River Initiative was to convene a major conference to look at options on how to reshape the Detroit River shoreline using techniques of soft engineering. Hard engineering of shorelines is generally defined as use of concrete breakwalls or steel sheet piling to stabilize shorelines and achieve safety. There are many places along our working river where hard engineering is required for navigational or industrial purposes. As most people who live near the Detroit River know, much of the river shoreline is already hardened. However, there is growing interest in using soft engineering of shorelines in appropriate locations. Soft engineering is use of ecological principles and practices to achieve stabilization of shorelines and safety, while enhancing habitat, improving aesthetics, and saving money. Soft engineering is achieved by using native plants and other materials to soften the land-water interface, thereby improving ecological features without compromising the engineered integrity of the shoreline.

Hard engineering, in the form of concrete structures and steel sheet piling, typically has no habitat value for fish or wildlife. According to the U.S. Geological Survey-Great Lakes Science Center, approximately 97% of the coastal wetland habitats that existed in 1815 have been lost to urban and industrial development. Soft engineering incorporates habitat for fish and wildlife. This is important because the Detroit River is one of the most biologically diverse areas in the Great Lakes Basin. In 1998 the U.S.-Canada State of the Lakes Ecosystem Conference identified the Detroit River-Lake St. Clair ecosystem as one of 20 biodiversity investment areas in the entire Great Lakes Basin Ecosystem with an exceptional diversity of plants, fish, and birds, and the required habitats to support them. The State of the Lakes Ecosystem Conference went on to call for special efforts to protect these unique ecological features. The Canada-United States North American Waterfowl Management Plan has also identified the Detroit River as part of one of 34 Waterfowl Habitat Areas of Major Concern in the United States and Canada (i.e., Lower Great Lakes-St. Lawrence Basin). In addition, the Western Hemispheric Shorebird Reserve Network has declared marshes along the Lower Detroit River part of a Regional Shorebird Reserve.

Most local people who appreciate the outdoors know that the Detroit River supports a nationally renowned urban sport fishery. For example, the City of Trenton, located on the Trenton Channel at the lower end of the Detroit River, hosts a major walleye fishing tournament called "Walleye Week." "Walleye Week" attracts people from all over North America to compete in the In-Fisherman Professional Walleye Tournament, the Team Walleye Tournament, and the Michigan Walleye Tournament offering $240,000 in prize money. It is significant that during 2001 the largest walleye ever caught in a Professional Walleye Trail ProAm Tournament was caught in the Detroit River. It weighed 13.2 pounds. It is estimated that walleye fishing alone brings in $1 million to the economy of communities along the lower Detroit River each spring. Hunting, wildlife viewing and photography, and other recreational uses bring in many millions of dollars more. Soft engineering not only helps protect biodiversity, but it helps sustain an important recreational economy.

Another reason why soft engineering practices are being encouraged is because it is well recognized that there is limited public access to the Detroit River, particularly on the United States side. Use of multiple objective soft engineering of shorelines will increase public access to the river.

There are also other economic benefits associated with use of soft engineering. In general, soft engineering of shorelines is typically less expensive than hard engineering of shorelines. Additionally, long-term maintenance costs of soft engineering are generally lower because soft engineering uses living structures which tend to mature and stabilize with time.

Lake Muscoday shoreline three months after implementing soft engineering techniques, July 2001 (photo credit: Mark Breederland, Michigan Sea Grant).

We have learned that it is important to redevelop and redesign our shorelines for multiple objectives. Shorelines can be stabilized and achieve safety, while increasing public access, enhancing habitat, improving aesthetics, and saving money. Hard engineering of shorelines, in the form of steel sheet piling, can be as much as $1,400 or more per linear foot. We cannot afford to use hard engineering along the entire length of the Detroit River shoreline, nor do we want fully hard engineered shorelines because they have no habitat value and will not support the diversity of fish and wildlife that our river has blessed us with. We have also learned that hard and soft engineering are not mutually exclusive. There are places where attributes of hard and soft engineering can be used together. This makes sense in a high flow river like the Detroit River through which the entire upper Great Lakes pass.

It is critically important that the right people get involved up-front in redevelopment projects to be able to incorporate principles of soft engineering into future waterfront designs. The design process must identify opportunities and establish partnerships early in the process that achieve integrated ecological, economic, and societal objectives. It is the hope of the Greater Detroit American Heritage River Initiative that the advantages of soft engineering practices be recognized and incorporated into many shoreline projects along the Detroit River as the development standard into the future.

Soft engineering demonstration projects have already been implemented at 10 locations along the Detroit River. One good example of a recent demonstration project is on Belle Isle, a 980-acre island park located in the Detroit River. Belle Isle has 8 million annual visitors and is the largest island park in the United States. Lake Muskoday is located on the northeastern end of Belle Isle, within 20 feet of a road. The closeness of the road, combined with the high degree of erosion, presented a unique engineering challenge.

The purpose of this project was to demonstrate innovative soil erosion and sediment control practices using soft engineering techniques along an eroded section of Lake Muskoday. Many organizations contributed to this project, including:

•City of Detroit Recreation Department;
•Detroit/Wayne County Port Authority;
•Greater Detroit American Heritage River Initiative;
•Michigan Sea Grant College Program;
•Michigan State University Extension;
•U.S. Department of Agriculture - Natural Resources Conservation Service;
•U.S. Army Corps of Engineers;
•Michigan Department of Environmental Quality;
•Friends of Belle Isle;
•The Friends of the Detroit River; and
•NTH Consultants, Ltd.

The Natural Resources Conservation Service's Michigan based Soil Bioengineering Team provided the technical support for design of the shoreline, including the selection of soft engineering practices. Design work began in fall 2000. The stream bank was analyzed for many factors, including slope, stability, vegetation, shoreline meander, water level, ordinary and high water flows, man-made conditions, and the natural conditions found along the shoreline. Implementation occurred on April 3-5, 2001. It began with a workshop to train key Belle Isle Park staff and other users on how to implement and maintain best management practices for shorelines. Over 40 volunteers participated. Following the workshop training, soil erosion and sedimentation control measures were put in place. Next, an operator cut back the eroded banks with a small backhoe and excavated for the installation of a rock toe. A geotextile fabric was placed in the excavation and then stone was placed from below the bottom of the lakebed to the bankfull level. Often vegetation will not grow up to the bankfull elevation due to the rise and fall of water levels, and that elevation is critical in the design of any soil bioengineering system.

After the rock toe was installed, vegetative plantings were used to stabilize the stream bank in the area above the rock toe. Soft engineering techniques such as live fascines, brush mattresses, and vegetative geogrids were constructed using dormant plant material. The dormant plant material was cut off-site and included native willow and dogwood cuttings. Native plant species completed the vegetative buffer sections adjacent to the lakeshore. Monitoring is now underway to track effectiveness. Addressing the regulatory requirements for the permits in a timely fashion was challenging. It is advised to involve early on representatives of the permitting agencies to gain their support and ensure timely follow-through.

This project was funded by a $25,000 Soil Erosion and Sediment Control Grant from the Great Lakes Basin Program (administered by the Great Lakes Commission) to the Detroit/Wayne County Port Authority. Other partners also provided over $10,000 of in-kind support.

All feedback on the project has been very positive. The project was intentionally chosen in a highly visible location to showcase the benefits.

Key lessons and advice from experiences with soft engineering along Detroit River shorelines include:

•Establish multiple objectives for shoreline development;
•Start with demonstration projects;
•Involve habitat experts up-front in planning;
•Ensure sound multidisciplinary technical support throughout the project (e.g., the Natural Resources Conservation Service's Soil Bioengineering Team);
•Involve volunteers;
•Measure benefits and communicate successes; and
•Promote education and outreach.

Volunteers implementing soft engineering techniques along the Lake Muscoday shoreline, April 2001 (photo credit: Mark Breederland, Michigan Sea Grant).

In summary, the time is right to incorporate soft engineering practices into efforts to redevelop and improve urban shorelines, and into municipal operating manuals and day-to-day operations. In addition, soft engineering projects lend themselves to volunteers. We need to work together to showcase the use of multiple objective soft engineering practices along urban shorelines like the Detroit River and help put the river back into riverfronts.

More information on the Greater Detroit American Heritage River Initiative is available online at: www.tellusnews.com/ahr. More information on best management practices for soft engineering of shorelines is available online at: www.tellusnews.com/ahr/report_cover.html.