



Working with Engineers and Contractors on Shore Protection Projects

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Issues

- Eliminating shoreline retreat
- Protecting the shore from the damaging action of waves and ice
- Stabilizing coastal slopes
- Developing recreational amenities, such as beaches
- Minimizing damage and protecting or enhancing environmental habitat

Background

Great Lakes shorelines are evolving, and many of them have been retreating for thousands of years. As the shoreline has retreated, there has been a corresponding erosion (or down-cutting) of the lake bed in many places. Stopping these natural processes is complex because of the consequences to other sections of the shoreline, because of the variability in shoreline soils and geometry and because of the complexity of the processes that erode the shoreline. Natural processes (including the freezing and thawing of water) undermine and shorten the lives of shore protection structures.

Shore protection as a do-it-yourself project is often done as a series of short-term experiments in a vain and costly search for a long-term solution.

Experienced professionals can favorably influence the success of a shoreline project, including the permitting process, public and neighbors' responses

to the planned project, construction and maintenance costs, and the performance and life of the project. They can monitor the project following completion and plan any modifications or repairs needed after major storms. An investment in the services of experienced professionals is the best way to ensure the long-term success of a coastal protection project and minimize costs during the period of ownership.

The steps of typical shore protection projects that go beyond surface water control and re-vegetation of slopes are shown in the following box.

Typical Steps of a Shore Protection Project

- **Selecting technical advisors or consultants**
- **Conducting field investigations**
- **Analyzing and designing by consultants (detailed below)**
- **Preparing and submitting permit applications to regulatory agencies**
- **Modifying the designs (if needed) and securing permit approvals**
- **Soliciting bids and selecting a contractor**
- **Observing construction**
- **Monitoring the shore protection at least annually and after major storms**
- **Repairing and replacing the shore protection as needed**

For shoreline projects, we recommend retaining a professional person with experience undertaking similar projects. A professional person experienced in coastal slope stability and erosion control may be registered as a professional geologist, geoscientist or engineer. A professional experienced in the design of coastal shore protection structures is likely to be a coastal engineer registered as a professional engineer (P.E.). Request and contact references provided by prospective consultants, clients for whom similar work was done.

What a Shore Protection Professional Can Do for You

Professionals can describe how the shoreline has been naturally changing, including the rate of shoreline retreat and the presence (or absence) and significance of lakebed erosion. They can describe the long-term and short-term consequences of halting that retreat at particular locations. They can also estimate the wave conditions approaching the shore, the probable future variations in water levels, and the action of ice. A coastal slope stability expert provides technical guidance on intercepting groundwater, controlling surface water, and stabilizing lakeshore slopes. An engineer experienced in shore protection structures understands the advantages and disadvantages of each protection option, the features important to achieving the desired performance, specifications adequate for the wave, current and water level exposure, and the risks and reliability inherent in making each design decision. These professionals are experienced in working out solutions acceptable to, and understood by, their clients. The initial work generally consists of the steps shown in the following box.

Initial Work of a Shore Protection Consultant

- Making site visits, surveying, and collecting data
- Reviewing information about the site (including shoreline and nearshore shapes and slope properties and conditions) and obtaining any essential missing information
- Determining site exposure to waves, currents and water levels
- Preparing a technical study and evaluation of alternatives related to site features, conditions and exposures
- Designing slope changes and structures
- Preparing plans, specifications and bid documents

Once the owner has decided, with professional advice, which slope stabilization measures to use, and what shore protection structures to build, bids can be solicited from contractors, with the assistance of the engineer. Nearly all decisions that affect the final cost of the solution will be made with the engineer, before the structure is built. These decisions will affect initial cost, maintenance costs and the expected life of the slope stabilization and shore protection system. During construction, the engineer can assist the owner by evaluating the contractor's bid, representing the owner through administration of the construction contract and monitoring the contractor's work.

Basic Information to Expect in a Shore and Slope Protection Design

- Storm conditions, water levels, surface water, ground water and ice conditions for which the project is designed
- Basic shapes, slopes, conditions, and properties of the coastal slope, and nearshore lakebed
- Regulatory and environmental impact issues involved in the design and measures to minimize adverse impacts
- Probable adverse impacts of the design on neighboring properties
- Probable adverse impacts of neighbors' actions on the design
- Steps to be taken to maintain the desired quality of construction
- What needs to be done to monitor the condition of the completed work and to take steps to repair/replace damaged elements

Elements of a Typical Shore Protection Structure Design

A designer of shore protection structures should provide the following information and features in a structure design:

- A stated specific life expectancy (design life) based on the owner's needs.
- A statement of specific extreme combinations of storm water levels and storm wave conditions to be met by the designed structure.
- A statement of the probability (or percentage chance) that excessive damage will occur over the expected period of ownership based upon the owner's understanding and acceptance of that risk.
- A design based on a prior determination and statement that lakebed erosion does or does not significantly occur lakeward of the owner's property.
- Plans that avoid overtopping by storm waves or accommodate it in a way that minimizes damage.
- A design that provides flank protection (if required) at both ends of the structure.
- A design that provides toe protection from wave scour and lakebed erosion (if present).
- Plans that show proper preparation of the structure foundation to prevent future settling of the structure and loss of soil behind the structure.
- Plans that include dimensions of the structure referenced to a local or national datum.

What Coastal Contractors Can Do for You

The contractor and subcontractors should be experienced in working on shoreline projects. This is expected whether that work is in vegetation selection and planting, groundwater control, or slope stabilization and construction of shore protection structures such as armor stone revetments or concrete seawalls. The contractor is responsible for taking the design prepared by the engineer and building the solution at the project site in conformance with the plans and specifications. A typical contractor will perform the steps listed in the box below.

Working with a Contractor

Typically, the contractor will:

- Submit a bid to do the work as designed and execute a construction contract.
- Mobilize material and equipment on site.
- Provide people to manage and carry out the construction.
- Meet on a regular basis with the owner and engineer to review progress and resolve problems as they arise.
- Demonstrate that the work is being performed in accordance with the specifications.

The importance of obtaining a competent contractor to build the engineer's solution cannot be overstated. Do not assume that the contractor with the lowest bid should be awarded the construction contract. A low bid may reflect inexperience in construction of coastal works. If the construction quality is poor, the structure will require a high degree of maintenance (or early replacement), resulting in long-term costs that may be higher than the overall costs of an adequate structure. Coastal construction on the land/water boundary of the Great Lakes is a specialty. Review works already completed by the contractor.

Selecting Engineering Consultants and Contractors

Registration and licensing alone provide no assurance that a person is qualified and experienced as a professional consultant or contractor in designing and building slope stabilization, erosion control and shore protection structures. A good way to select a consultant is to use a Qualification Based Selection (QBS) procedure that is a recognized and tested method for selecting consulting engineers. The procedure has eight commonsense steps shown in the following box. It can be used on large and small projects, done simply, or in substantial detail. The procedure can also be used to develop a list of prequalified construction contractors.

A Qualification Based Selection Procedure

1. Read or review QBS materials and make a list of engineers and contractors to contact. (See the section titled "Sources of Information.")
2. Write out a brief statement of project goals and create a project description, a list of project needs, an approximate budget, and a timetable.
3. Send a request for statement of qualifications with a copy of your project goals, description, needs, budget selection criteria and timetable to the engineers and contractors on the list. The engineers and contractors should respond with a statement of qualifications that includes lists of similar projects and references for these projects.
4. Evaluate responses to your request, and contact references. Statements from prospective consultants may indicate preferred contractors.
5. Interview the two or three consultants and the two or three contractors who seem to best fit your needs, and plan visits to selected sites where projects have been completed.
6. Select the most-qualified consultant and negotiate a contract, including scope of service and compensation to be provided.
7. Notify firms not selected and thank them for their interest.
8. Once designs have been completed, solicit bids from the list of prequalified construction contractors with the aid of your consultant.



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The main purpose of using a QBS process is to decide if there are adequate indications that applicants can meet your goals. Note that experience of the on-site supervisor(s) is not necessarily the same as the applying firm. Look for:

- experience in the type of work needed.
- performance on past projects, including the ability to complete projects on time, within estimated cost, and with good quality of construction.

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- experience of the on-site construction supervisor(s). Contact references about their work.
 - a history of defaulting on projects, and the ability of the contractor to obtain a bond.
 - forms of payment the contractor accepts.
 - the contractor's procedure by which post-construction issues will be raised, monitored, and resolved.
 - the type of guarantee that is being offered.
- A competent and confident contractor should have no concerns about offering a one-year guarantee on all material and workmanship.



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Sources of Information

Learning more about coastal processes, slope stabilization and shore protection structures

Living with the Lakes. 1999. A 39-page booklet to help understand and adapt to Great Lakes water level changes. U.S. Army Corps of Engineers and the Great Lakes Commission. Copies are available from the Great Lakes Commission, Eisenhower Corporate Park, 2805 S. Industrial Highway, Suite 100, Ann Arbor, MI 48104-6791.

Living on the Coast. Publication anticipated in 2003. A 50-page booklet to help people protect investments in shore property on the Great Lakes.

U.S. Army Corps of Engineers-Detroit District and the University of Wisconsin Aquatic Sciences Center. A companion booklet to *Living with the Lakes*. Copies will be available from the U.S. Army Corps of Engineers and the University of Wisconsin-Madison's Aquatic Sciences Center.

Understanding Natural Hazards. 2001. Ontario Ministry of Natural Resources. A 40-page booklet about the natural hazards of the Great Lakes-St. Lawrence River and large inland lakes, river and stream systems and a CD-ROM providing technical guidelines on the subject. Copies are available from The Watershed Science Centre, Trent University, Peterborough, Ontario, Canada.

Finding Qualified Consultants and Contractors

For the Qualification Based Selection (QBS) procedure for selecting a consultant, contact the

Wisconsin Association of Consulting Engineers, Madison, Wisconsin. A free QBS manual can be read or downloaded from the Internet. Do a web search for "ACECWI."

Consulting engineers in Ontario. Contact the Consulting Engineers of Ontario (Phone: 416-620-1400) to find firms with capabilities in coastal engineering. Check with Professional Engineers Ontario to determine if particular consultants are members in good standing.

Consulting engineers and geologists in the United States. In the yellow pages of phone books, look under marine engineers, consulting engineers, civil engineers, environmental engineers, coastal engineers, geologists or geoscientists. Contact state and provincial associations of these professionals. One such association is the American Institute of Professional Geologists (AIPG). The association has a Web page with links to various state sections of the association.

For contractors experienced in working along the coasts of the Great Lakes, consult the yellow pages of phone directories for coastal cities and look under marine contractor. Many marine contractors are also dredging contractors and may be listed in the International Dredging Review's annual Directory of Dredge Owners and Operators/ Dredging Industry Buyer's Guide. Some contractors specialize in erosion control, slope stabilization, or biotechnical and soil bioengineering stabilization of slopes that may include experience with coastal slopes. They may also be listed in yellow pages of phone directories.