

Reduce Rainwater Runoff... It Doesn't Go Away!

What is runoff?

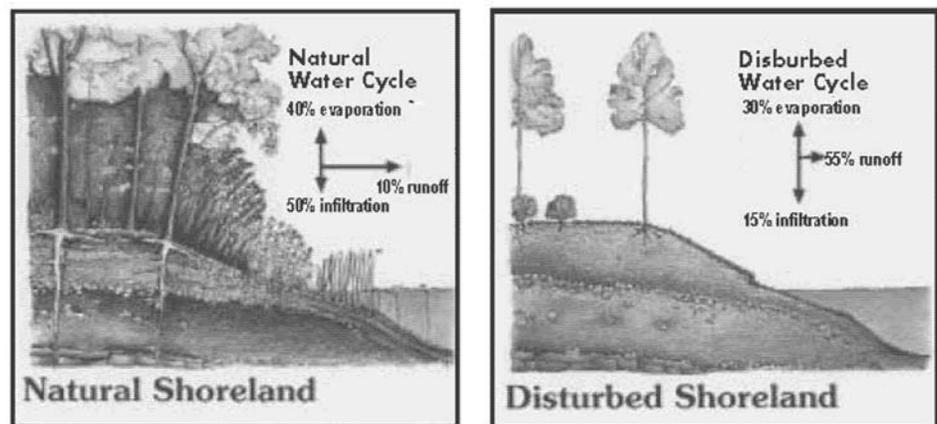
Rainwater or snowmelt that does not soak into the ground and instead runs off hard surfaces that don't absorb water (impervious surfaces) or washes off lawns and steep slopes is called *runoff*. Impervious surfaces include roofs, driveways, sidewalks, and compacted soils. When the runoff reaches the lake, it can carry with it nutrients, eroded soil sediments, toxic materials, bacteria and other pollutants that can cause reduced water clarity, increased aquatic plants and algae, and impact fish and wildlife habitat.

What was once an occasional cabin along a wild shore has become a ribbon of structures and paved areas circling the lakes. All this construction has added more rooftops, roads, walkways, decks, parking areas and driveways, increasing the amount of impervious surfaces, which act like funnels for runoff to reach lakes, rivers, and wetlands. Runoff from compacted soils and impervious surfaces also increases erosion and sedimentation.

Managing runoff on your property is the best way to reduce pollutants before they reach the lake. Increasing opportunities for water to soak into the ground (infiltrate) instead of running off is the best way to reduce runoff and filter out the pollutants before they reach the lake.

Learn From Mother Nature

With the natural water cycle, when there is precipitation, water will evaporate, run off the land, or soak (infiltrate) into the ground. The amount of vegetative cover on the ground will determine the amount of runoff and infiltration. Natural vegetation will hold back the runoff providing time for it to soak into the ground.



You Don't Have to Live on the Lake for Runoff to Impact Water Quality

If you live in town, the water running off your lawn and into the storm sewers has to go somewhere, and it eventually drains to the lake carrying with it nutrients, pollutants, and sediments that impact water quality. Whether you live on the lake or not, practice the principles in this guide for reducing the amount of runoff from residential and commercial properties to increase the amount of rainfall that infiltrates back into the ground.

Rainwater runoff is the #1 source of pollution to our lakes. Residential and urban runoff has been increasing in Otter Tail County in recent years while other sources of pollution have been declining.

How much of the rainfall runs off?

Woods	0.05%
Prairie	1%
Lawn	3%
Impervious surfaces	98%

Maintain Natural Vegetation

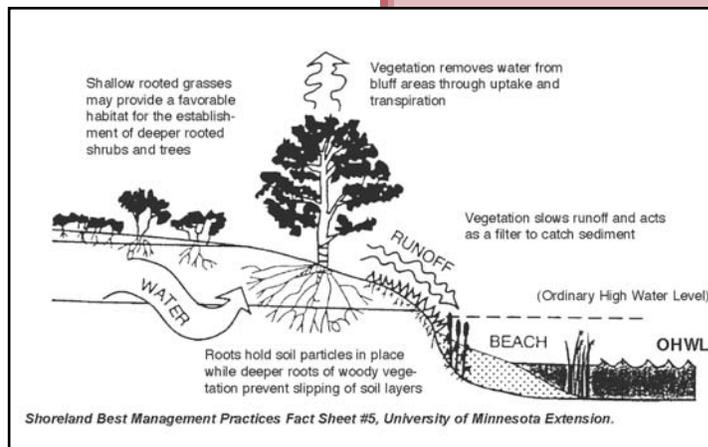
Natural vegetation will naturally reduce runoff by holding back the water to provide time for it to soak into the ground.

- When clearing your lot, minimize the removal of wooded areas, trees and low growing shrubs. Their removal causes more rain to fall to the ground instead of landing on leaves and branches.
- Grading large areas of land removes the natural depressions of land where water can pond and soak in.
- Carefully landscape your yard near roads, driveways, and along the shoreline to direct runoff away from the lake.

Practice Good Lawn Management

Maintain a Healthy Lawn to Absorb More Water

- Aerate your lawn to alleviate some of the compaction that turns many lawns into green concrete.
- Mow to a height of two to three inches; mow when dry to prevent clumping. Taller grass provides shade for better root growth, which helps with water absorption.
- Consider replacing some of the grass in your lawn area with clover, native grasses, or other groundcovers that don't need watering.
- If watering is necessary, water deeply, but infrequently, to encourage deep root growth. Water with lake water. (*Hint: use the nutrients in the lake to make a healthy lawn instead of frequent fertilizer applications.*) Water in the morning, not mid-day or evening.
- In hot weather, allow lawn grasses to go dormant so that they require less water and nutrient intake for survival. Water 1/4 to 1/2 inch every two or three weeks to keep crowns from dehydrating beyond the point of recovery.



If we love our lakes, we have to change our ideas about what is a good lawn for shoreland properties. Limit the amount of lawn and keep it as natural as possible to reduce maintenance and increase its ability to absorb runoff.

Identifying Lake Problems Caused by Runoff

Problem	Is the water near shore cloudy?
Possible Cause	<i>Excess sediment reaching the water.</i>
Problem	Is there an oily rainbow film on the water?
Possible Cause	<i>Possible petroleum contamination.</i>
Problem	Are there algal blooms, green scum, or abundant plant growth in the water?
Possible Cause	<i>Excess nutrients such as nitrate or phosphorus reaching the water.</i>
Problem	Are washouts, trenches, small piles of sediment, leaves, or debris found at the bottom of slopes?
Possible Cause	<i>Excessive water runoff across the property.</i>
Problem	Is your shoreline eroding?
Possible Cause	<i>Removal of natural vegetation for property development or creation of beaches, both on-shore and in the lake; dredging, filling, or construction on or near the shoreline; trampling of banks; inadequate protection against runoff from roofs, driveways, roads, or other developed areas.</i>

Building a home and establishing a lawn to the water's edge can cause seven times the amount of phosphorus and 18 times the amount of sediment to enter the water compared to a natural shoreline.¹

Allow Water to Settle Into the Soil— Not Run Off Into the Lake!



The fewer hard surfaces there are for rainwater to collect and runoff from the less likely there will be erosion and runoff into the lake. The key to solving this problem is to stop water from running off your property so it can soak into the ground. You can **capture** rainwater and allow it to be **cleansed** through natural soil processes.

The best way to do this is to: divert rainwater off roofs, driveways, walkways, and other hard surfaces into rain barrels or to the lawn, or create a rain garden designed to capture and cleanse the rainwater naturally.

Divert Rainwater off Roofs and Driveways

Paved driveways and roofs of buildings comprise most of the impervious surfaces on a lot. Redirect rainwater flow from downspouts, roof gutters, and driveways onto lawns or into a rain garden where it will have time to naturally infiltrate into the ground. Or, capture the water in a rain barrel, where it can be used later for watering.

Install a Rain Barrel

A rain barrel is any type of container used to catch water flowing from a downspout and store it for later use.

The rain barrel is placed underneath a shortened downspout diverting the roof runoff into the barrel. The rain barrel has a spigot to collect the stored water for use in watering flower gardens, house plants and lawns. Rainwater is naturally high in phosphorus it's a natural way to fertilize.

Humans and pets should not drink the stored water, nor should it be used on food products. A screen should be installed on the barrel to keep mosquitoes and debris from entering. Mosquitoes cannot breed if the barrel is drained weekly.

Rain barrels need to be drained regularly during spring and summer months to reduce algae growth. During winter months, take your barrel out of operation by simply turning it upside down at the same location or storing elsewhere. Rain barrels can be purchased at garden centers, ordered online from garden catalogs, or you can make your own. **(Send in the inserted postcard if you are interested in obtaining and installing a rain barrel.)**

How much rain do I need to fill a 50-gallon barrel? For every inch of rain that falls on one square foot of your roof, you can collect just over half a gallon of rainwater. Example: 100 square feet of roof could collect 60 gallons of rainwater during a 1-inch rain event.² Sixty-five (65) percent of all annual rain events are one inch or more.



Plant a Rain Garden

A rain garden is just what it sounds like, a garden to soak up rain water. It is a recessed planting bed, shaped like a saucer or shallow bowl, and is designed to collect runoff from driveways, roofs, other hard surfaces or sheet flow of rain from lawns. The collected water is then infiltrated into the ground instead of running off to the lake.

Rain gardens are planted with hardy, water-loving native perennial plants that have deep roots, which along with the soil, work to provide a filter system to catch pollutants such as phosphorus, oil, mercury and other heavy metals in rainwater that run into the garden area. Rain gardens allow sediments that are carried with runoff to settle so plants can absorb the nutrients. During a rainfall, the highest concentration of pollutants is during the first inch, or first flush of a storm, which is retained in the rain garden. Rain gardens are designed so that collected water will infiltrate into the ground within a few hours of the rainfall ending.

To be effective, rain gardens must be properly designed for the right shape and size to accommodate the amount of roof, driveway, and other hard surfaces on your property as well as your soil conditions. For proper design, it is recommended to consult resources to help you determine the proper plants and dimensions. Remember to always call the Digger Hotline (800-242-8511) before digging to prevent cutting into an electrical line or cable.



Use Pervious Pavement and Pavers

Pervious pavement and pavers are made of special materials that allow the water to flow through and infiltrate into the ground. They can be used for driveways, sidewalks, walkways, and patios. Pavers are quite attractive and some have a 5-year life span. A 1,000 square foot pervious driveway can infiltrate over 12,000 gallons of water per year. Runoff from rooftops and lawns can be diverted to pervious areas for additional water treatment.

Note: In Otter Tail County, pervious pavers are considered impervious and count as part of the 25% impervious surface limit per parcel.

Additional Resources for Rain Barrels and Gardens:

Constructing a Rain Barrel:

<http://home.comcast.net/~leavesdance/rainbarrels/construction.html>

Designing a Rain Garden:

http://www.lowimpactdevelopment.org/raingarden_design/how2designraingarden.htm

<http://bluethumb.org/raingardens/>

Rain Garden Tips:

- Don't worry about mosquitoes. Most rain gardens should not hold water long enough for mosquitoes to reproduce.
- When first planted, hand weed biweekly until native plants are established.
- Don't fertilize near the rain garden, it will stimulate weed competition without benefiting the native plants.

Source: Taylor Creek Restoration Nurseries



Buffer the Lake from Runoff

Benefits of a Shoreland Buffer

- 1. Enhances water quality.** A good buffer protects your lake, stream, or wetland by slowing runoff and allowing it to soak into the ground.
- 2. Stabilizes shorelines.** Buffers prevent fluctuating water levels, moving ice, flooding, surface runoff and wave action from eroding your shoreline.
- 3. Provides fish and wildlife habitat.** The shoreline buffer provides habitat for fish and cover for birds, butterflies, turtles, and other wildlife.
- 4. Enhances aesthetics.** Natural buffers beautify your yard with a variety of colorful wildflowers, create a natural screen for privacy, and enhance that “Up North” feeling.
- 5. Increases property value.** A high quality buffer is an asset that can add resale value.
- 6. Limits nuisance bugs and wildlife.** A native plant buffer creates a natural barrier to Canada geese.

Scientific research shows that the way we treat our shorelines affects lake water quality and fish and wildlife habitat. **To protect and improve our lakes, we need to improve our shorelines.** The best way we can do that is by adding or keeping a buffer strip of natural vegetation along the shore. Buffer strips of native wildflowers, grasses, trees, and shrubs protect water quality and provide habitat for fish and wildlife.

If you have lawn to the water's edge, lawn behind rip-rap, steep slopes, or little vegetation near the shore, consider a natural shoreland landscaping project to restore the native vegetation by creating a shoreland buffer zone—an area of native vegetation along the water's edge.

Rethinking How our Shorelands Should Look

Creating and maintaining a natural buffer zone along your shore does not mean your property has to look messy, but it may mean you have to re-think what your shoreland should look like. Lawn-to-lake shorelines are no longer ecologically smart.

Creating or keeping a native shoreline buffer reduces the amount of nutrients entering the lake along with providing better wildlife habitat. For example, a 20-foot buffer strip along the lake can trap about 80% of the phosphorus runoff and about 90% of the sediment pollutants.

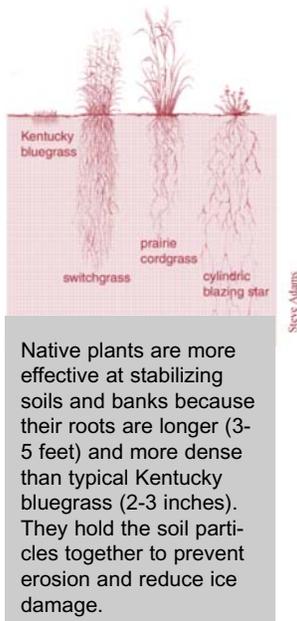


This lawn is labor-intensive and expensive to maintain. Fertilizer and grass clippings add nutrients to the lake leading to weed and algae growth. A shallow-rooted lawn (turfgrass) has a minimal ability to filter nutrients and sediment entering from rain-water runoff and is ineffective at allowing infiltration of water into the soil. The shallow roots leave subsurface runoff untreated while native plant roots intercept and withdraw the nutrients and water.

This shoreland buffer of native vegetation protects the shoreline, maintains the natural landscape, and filters out boat noise. Many plants are suitable that are low growing and won't impede your view of the lake. Using ornamental grasses, perennials and smaller woody plants will significantly reduce and filter runoff while restoring the natural beauty to the shore, and they are less work—more time to recreate.



One of the greatest benefits of establishing native vegetation is their deep root systems that stabilize the shore from erosion and ice damage, and they loosen the soil allowing the rain to soak into the ground instead of running off to the lake.



What is a shoreland buffer?

A shoreland buffer is an unmowed strip of native vegetation that extends both lakeward and landward from the water's edge. A buffer zone of native plants that extends 25-50 feet landward from the shore is preferable, but even adding a buffer as narrow as 10-15 feet can restore many functions critical to the health of the lake that may have been eliminated previously by sod, hard structures, or mowing. **When it comes to shoreland buffers, wider is better for more benefits.**

A shoreland buffer consists of:

- The shallow **aquatic zone** of the emergent, submerged, and floating leaf aquatic plants that provide food and shelter for ducks, songbirds, frogs and other amphibians, and fish. The taller plants, like bulrush, sedges, and cattails can reduce the energy of wave action to minimize erosion and help maintain water quality.
- The **wetland transition zone** of more water-loving plants that bind the lake bed to the upland soils.
- The **upland zone** of native trees, shrubs, grasses, and wildflowers slows rainwater running over-land, making sediment drop out, absorbing water and nutrients, and breaking down pollutants.

Getting Started Creating a Shoreland Buffer

There are a number of ways to create a shoreland buffer depending on the characteristics of the shoreland and the desires of the property owner. Some decisions in creating a buffer are easy, such as: How tall do you want the plants to be? Others, are more complicated, like: What is your soil type and moisture?

Otter Tail County has a program to assist you in designing and installing a shoreland buffer. For personal assistance, fill out and mail the inserted postcard or contact the Otter Tail County Shoreland Specialist:

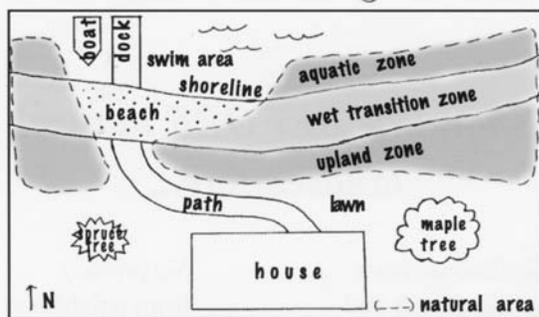
801 Jenny Ave SW Suite 2
 Perham, MN 56573
 218-346-4260 ext.3
 Email: steve.henry@mn.nacdnet.net



Native Shoreland Buffer

Resource professionals recommend that you maintain a shoreland buffer along 75% of the shoreline frontage.

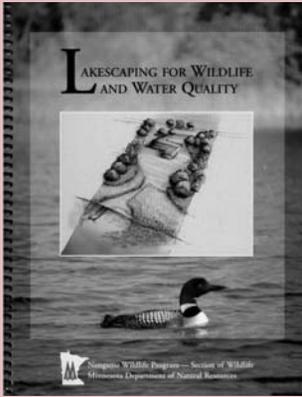
Plan a natural area along the shore.



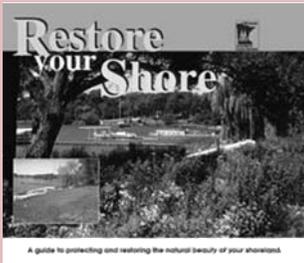
Source: University of Minnesota Extension Service, 2005; Item #08308

Here are some options to help you decide how you want to establish a shoreland buffer.

Don't Mow, Let It Grow A simple, no-cost way to get started in restoring your shoreland is to stop mowing for the width of the desired buffer strip. Turf grasses will grow 12-24 inches before going to seed, after which seeds in the soil will germinate and valuable native plants will begin to appear. You can note the types of native plants and wildflowers growing on natural shorelands around lake to get an idea of what is likely to appear or will be suitable for growing in your area. While the buffer is getting established, you may need to weed out nuisance species or add native plants for diversity, but not mowing will get you started. Perennial native plants will take three to five years to become apparent.



The book *Lakescaping for Wildlife and Water Quality* and the DNR CD *Restore Your Shore* are two highly recommended resources to get you started. They are available in bookstores and online through the Minnesota Bookstore at www.mnbookstore.com



The *Restore Your Shore* CD is also online at www.dnr.state.mn.us/restoreyourshore/index.html

Check local Otter Tail County libraries for copies of both resources.

Restore Your Shoreline

Local nurseries and garden centers are starting to carry more native plant stock and can recommend the best plants for your site. Plants used should be indigenous to this region of Minnesota—don't buy plants from a mail order catalog grown in another part of the country and expect them to grow. The DNR website has a list of native plant suppliers and landscapers. Consult with University of Minnesota Shoreland Specialists, DNR Shoreland Restoration Specialists, or the Otter Tail County Soil and Water Conservation Districts for resources and fact sheets on designing your project, selecting plants, preparing the site, and planting. Take one of the many classes, tours, and open houses offered throughout the summer on the basics of shoreland restoration. Professionals teaching the classes will help you design your own project and may later be available for further consultation. Many classes include an opportunity to participate in the planting of a restoration project to give you experience for planting your own project. Check with the Otter Tail Shoreline Specialist for possible cost-share assistance.



Hire a Professional

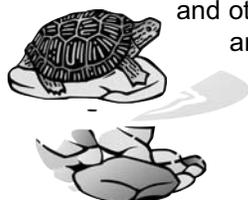
Shoreland restoration is a rapidly growing field among landscape professionals; consult the yellow pages or watch for promotions. Ask for recommendations from other property owners who have completed re-vegetation projects. If your site has a steep slope or other unusual characteristics, getting professional assistance will be very important to the success of your project.

Maintaining Your Restored Shoreland

A shoreland restored with native vegetation should maintain itself once it is established. Apply mulch to new planting beds to prevent soil erosion, hold moisture in the soil, and control weeds. You may need to water and weed the first season, but once the plants are established, they will be able to out-compete most weeds. Native species should never be fertilized because they are adapted to the nutrient levels found in local soils, and fertilizers and pesticides applied to areas near shore can be a threat to aquatic life and water quality. Plants left standing in fall and winter provide seeds and shelter for wildlife, protect the soil from wind erosion, and capture windblown leaves and debris.

Leave Fallen Trees and Branches Alone

Unless they are interfering with your recreational access, leave trees and branches that have fallen into the water alone. They form critical habitat for aquatic organisms that fish and other aquatic life feed on, provide cover from predators for small fish, and they serve as a dock for turtles, kingfishers and other interesting wildlife.



Protect the Aquatic Zone

The aquatic zone is a vital part of the shoreland buffer. Emergent vegetation, such as soft stem bulrush, wild rice, and cattails, help purify the lake by removing contaminants and calming the water, which allows suspended soil particles to settle to the lake bottom. They provide food, shelter and spawning areas for fish and other wildlife and add oxygen back into the water. If submerged aquatic plants are interfering with swimming, clear by hand only what is needed to provide a small swimming area and access to the water. Leave other submerged plants in place. Remember, aquatic plants are protected and any disturbance may require a DNR Fisheries permit (218-739-7576) to remove or treat with chemicals.



Requirements When Working in the Shoreland District

All counties and municipalities with shorelands within their jurisdiction are required to have and enforce a Shoreland Ordinance that regulates activities done in the shoreland district. The shoreland district is established as 1,000 feet from a lake or 300 feet from a river or floodplain. The local government ordinance must meet or exceed the Minnesota State Shoreland Rules.

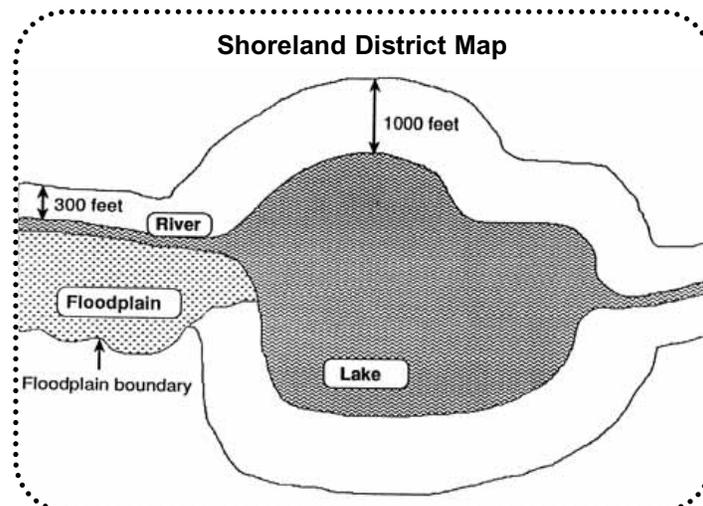
The Otter Tail County Shoreland Management Ordinance is not a building code. It addresses the setbacks and the location of structures on a shoreland lot and defines restrictions on the types of activities that can take place within the shoreland zone. It also regulates the setback and construction of septic systems. It does not address the type of structure that may be built or anything regarding the interior of the structure.

The requirements in the shoreland management ordinance are based on the established classification of the lake on which the work is to be done. Lakes in Otter Tail County are classified by the Minnesota DNR as one of the following types:

1. General Development (GD)
2. Recreational Development (RD)
3. Natural Environment (NE)

Most of the more populated, well-developed lakes are designated as general development (GD), while many of the less developed lakes are natural environment (NE). Because each type of lake has unique characteristics, each has different shoreland development standards to provide adequate protection of water quality and fish and wildlife habitat. Natural environment lakes generally have the most restrictive standards while general development lakes have less restrictive standards. To find the classification of your lake, see the DNR Lake Finder at www.dnr.state.mn.us or Waters of Otter Tail County on the home page of the Otter Tail Land & Resource Management web page.

The Otter Tail Shoreland Ordinance is periodically revised to insure that it is fair and yet protective of the environment. **Before doing any work in the shoreland district, contact the Otter Tail Land & Resource Management Office to see if permits are required or there are other requirements.** See pages 23 and 24 for some requirements in the Otter Tail Shoreland Management Ordinance.



Otter Tail Land & Resource Management
Government Services Center
540 West Fir
Fergus Falls, MN 56537
218-998-8095
<http://www.co.ottertail.mn.us>;

Business Hours:
8 a.m. - 4:30 p.m.
Monday-Friday
No applications processed
after 4 p.m.

The Otter Tail Shoreland Ordinance is located at:
www.co.ottertail.mn.us
Under Departments
choose Land & Resource
Management.

Don't Let Your Shoreline Slip Away—Curb Erosion

Curbing the erosion of soil into the lake will reduce pollutants reaching the lake.

A survey of Otter Tail County shoreland owners found that over 25% of shoreline stabilization projects were not performing as landowner's expected.

Success Rates Reported

Rip-Rap	74%
Native Plants	68%
Retaining Wall	50%
Sandbags	15%
Aerator	8%
Concrete Blocks	7%

Rainwater runoff or waves lapping at the banks of your shore can erode the shoreline, silt up the water, and wash away sand blankets and impair fish spawning areas. When soil washes into the lake, it carries with it phosphorus, the desired nutrient for aquatic plant and algae growth. It causes sediment to build up in the lake; increases turbidity after rain events, which interferes with normal lake functions; and impacts fish and wildlife habitat. Degradation to water quality is the result. **Curbing the erosion of soil into the lake will reduce pollutants reaching the lake.**

Shorelines can erode through many processes. Natural causes of erosion include currents, waves, ice, and rain. Many human activities may significantly increase the rate of erosion. Some common causes of erosion include:

- removal of natural vegetation for property development or creation of beaches, both on shore and in the lake.
- improper installation of erosion control structures, such as retaining walls.
- increased wave action from watercraft traveling close to the shore.
- dredging, filling, or construction on or near the shoreline.
- trampling of banks by human, animal, or vehicle traffic.
- inadequate protection against stormwater runoff from roofs, driveways, streets, and other paved or hard surfaces.

Signs of a Serious Problem

- A large area of bare soil on a steep, high shoreline bank.
- A noticeable recession of the shoreline over a period of time.
- Large patches of muddy water near a lakeshore, or unusually muddy streams during periods of high water or following a rain-storm.
- Excessive deposits of sand or other sediments on the stream bed, or very wide, shallow areas in a stream.



Erosion may be accelerated by activities such as boat wakes or high waves during storms. Each year erosion causes the loss of valuable shorefront property.

How can shoreline erosion be controlled?

If your shoreland is eroding away, stabilizing the shoreland will be necessary to reduce erosion.

Each shoreland situation is different. You are encouraged to consult with shoreland landscaping professionals, the DNR Area Hydrologist, University of Minnesota Shoreland Specialists, or an Otter Tail County Soil and Water Conservation District to determine the best solution for your shoreline erosion situation.

Rip-rap, stone, retaining walls, or turf grass might seem like good solutions for stabilizing erosion, but they are not usually the best choice. Rip-rap reflects wave energy back towards the lake causing previously sandy areas to erode to gravel or cobblestones. Water can undercut retaining walls and turf grasses. Rip-rap and non-native grasses don't reduce chemical runoff polluting the water and causing unsightly algal blooms. These choices can negatively impact the lake by creating an unnatural barrier between upland areas and the shoreland environment that destroys vegetative transition areas and eliminates critical habitat for many species.

Retaining walls deflect wave energy back to the lake instead of diffusing it, which can undercut the base of the wall and cause increased erosion at the ends making the water more turbid. And, neither rip-rap or retaining walls will prevent ice ridges from forming because rock cannot withstand the up to 30,000 pounds of ice pressure per square foot.

Preventing Erosion

Some basic preventive actions include:

- Preserve existing rock and vegetation that naturally occur along the shoreline.
- Stop mowing a strip of land near the shoreline or restore a shoreland buffer of native vegetation.
- Prevent impervious surface (i.e. roofs, driveways, etc.) runoff from flowing to the shoreline, steep slopes and bluff areas.
- Avoid construction within 100 feet of the shoreline, steep slopes or bluffs.
- Protect berms pushed up by ice action along lakeshores. They prevent excessive surface runoff and trap sand which "nourishes" the beach.
- Limit the amount of foot traffic and other recreational activities in erosion prone areas. Regardless of preventive measures, the right combination of conditions, such as high water level, violent windstorms, drastic ice movement, and certain shoreline configurations, may result in serious shoreline erosion.

Preventing Erosion on Steep Slopes and Bluff Areas

The erosion potential on steep slopes and bluffs can be reduced by:

- Diverting water away from steep slopes by rerouting drainpipes and gutters. If diverting water away from the bluff is impractical, it should be routed through a non-perforated plastic drain pipe that outlets at the very bottom of the bluff into rock drainage.
- If you need a walkway to the shore, follow the natural contours of the slope to go across or around the slope, or use steps when a walkway must go directly up and down a slope, but minimize destruction of natural vegetation during construction.
- Keep the moisture- and nutrient-absorbing natural vegetation on steep slopes by limiting clearing and grading.
- Replant vegetation on barren slopes.
- Create a view corridor through the trees with selective pruning for an excellent view while maintaining the natural trees and shrubs.



On steep bluffs, selectively prune trees to create a view corridor of the lake. Keep the vegetative undergrowth to stabilize the soil on the bluff.

Neither rip-rap or retaining walls will prevent ice ridges from forming because rock cannot withstand the up to 30,000 pounds of ice pressure per square foot.

Naturalizing your shoreline or maintaining the natural shoreland vegetation is the most important way to reduce shoreland erosion.

Ice ridges provide a natural form of shoreline protection and have many benefits to the lake.

Reduce Erosion By Slowing Down the Boat

Boat wakes can cause tremendous shoreland erosion, so slow the boat down. In shallow areas (less than 15 feet), motor at slow-no-wake speeds (5 mph or less) to reduce the boat wake and the consequent wave action that can erode your shoreline and the shoreline of others around the lake. Observe all posted no-wake and low-speed zones. For personal watercraft, running at slow, no-wake speed within 150 feet of the shore is the law.

Boating slowly makes less wake, less noise, reduces pollution and is less disruptive to bottom sediments, wildlife and other people. When running at higher speeds, keep the motor properly trimmed to reduce noise and the boat wake.

Make Friends with the Ice Ridge

Ice ridges are formed by the pushing action of the lake's winter ice sheet against the shore. Cracks form in the ice because of different contraction rates at the top and bottom of the ice sheet, and it is especially pronounced in years when there is little insulating snow cover. Ice cracks also develop because the edges of the ice sheet are sometimes firmly attached to the shore. Then, as the water rises in cracks and freezes, the ice sheets expands slightly and exerts thrust against the shore.

Unless the ice ridge is impeding your use of the lake or access to your dock area, consider making friends with the ice ridge and leave it alone. Historical ice ridges are a feature of many lakes and are protected by state law as a valuable resource to prevent runoff into the lake.

Otter Tail County Ice Damage Repair Policy

Alteration of a permanent ice ridge must be authorized by a Conditional Use Permit approved by the Otter Tail County Planning Commission. Permit applications can be obtained from the Otter Tail Land & Resource Management Office.

For ice ridges formed during the immediate past winter, a conditional use or grade and fill permit will not be required for earthmoving to repair ice damaged shoreline provided:

- The property owner's name, address, lake name and number are placed on the County's ice damage repair list.
- The repair is limited to damage from the immediate past winter and repair is completed between May 15 and September 1 of the current year.
- Not more than 200 feet of shoreline is affected.
- The ice ridge is leveled and flattened in place, when possible. If conditions do not allow that, it may be pulled landward from the lake on upland areas or removed from the site. No ice ridge material can be pushed towards the lake.
- No additional excavation or replacement fill material occurs on the site.
- All disturbed areas are appropriately stabilized within 10 days of completion of the repair.

Before doing any repair work on an ice ridge, contact Otter Tail Land & Resource Management for the current requirements.



Natural shoreline vegetation and other preventive actions are the best protection from both wave erosion and ice heaves, and it's less expensive and longer lasting.

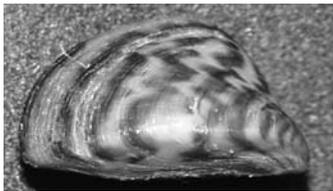
Be a Careful Boater

Stop the Spread of Aquatic Invasive Species (AIS)

Aquatic Invasive Species (AIS) are plants and animals released either accidentally or intentionally into areas where they are not native. Such introductions usually occur through human activities and often are spread through boating activity.

Common AIS in Minnesota lakes include:

- Eurasian watermilfoil, now in over 246 lakes, rivers, and streams statewide. There are no infested lakes in Otter Tail County yet; let's keep it that way.
- Curlyleaf pondweed, found in 18 lakes in Otter Tail County.
- Zebra mussels, now in 7 lakes and streams in Otter Tail County.
- Flowering Rush, not yet in Otter Tail County but it is found in 7 lakes in neighboring Becker County and in the Pelican River.



AIS, such as Eurasian watermilfoil and Curlyleaf pondweed, cause problems by replacing native plants important for fish and wildlife habitat and form thick mats that make boating difficult. When Curlyleaf pondweed dies back in mid-summer it releases phosphorus that can fuel noxious algal blooms. Zebra mussels attach to hard surfaces and interrupt the food chain eventually impacting fish populations. Flowering rush outcompetes native shoreland vegetation impeding access to the lake and interrupting shoreland ecological functions.

To stop the spread of AIS, careful boaters:

- Inspect boat, trailer, and boating equipment (anchors, centerboards, rollers, axles) before entering a lake or leaving a lake, and remove any plants and animals that are visible.
- Drain water from the motor, livewell, bilge, and transom wells while on land before leaving any waterbody; it is the law.
- Dispose of unwanted bait in the trash. Never release live bait into a waterbody. When cleaning off fishing lines, collect plant fragments in a bucket and dispose of onshore away from the lake.
- Wash then dry your boat, tackle, downriggers, trailer, and other boating equipment to kill harmful species that were not visible at the boat launch.
- Know what waters are infested; check lake accesses for DNR infested waters signs.

Jet skis can carry AIS, too, so clean out all water intakes and other parts before transporting jet skis.

Other Boating Cautions

- Do not dump wastewater from toilets, porta-potties, sinks, or showers into or near the lake. All waste must be held on board and disposed of properly onshore.
- Avoid boating in very shallow areas, where motors can churn up the bottom and increase the amount of damaging, nutrient-rich sediment in the water.
- Make sure boat engines do not leak oil, gas or other contaminants. Be extra careful when filling fuel tanks and be sure to clean up any spills.
- Keep unsightly litter out of the lake. Take it ashore and place in recyclable trash containers.
- Be safe: wear a Coast Guard approved life vest when boating. Stay 100 feet away from swimmers, paddle boats, and other small objects in the water. Remember who has the right away on the lake.

In Minnesota it is against the law to transport any aquatic plants and invasive species.

The law requires boaters to remove the drain plug and drain all water from the boat. The plug must remain out while the boat is transported.

AIS Infested Lakes in Otter Tail County:

Zebra Mussels: Bass, Crystal, Fish, Little Pelican, Lizzie, Pelican, Prairie & the Pelican River from Fish Lake downstream to Prairie Lake.

Curlyleaf Pondweed:

West Battle, Clitheral, Deer, Hoot, Jolly Ann, East Leaf, Leek/Trowbridge, North & South Lida, Lizzie, Orwell, Otter Tail, Big Pelican, Big & Little Pine, Rush, Swan, & North Turtle.

Lakes in neighboring Becker County infested with Flowering Rush:

Buck, Detroit Lake, Curfman, Melissa, Mill, Muskrat, & Sallie plus the Pelican River from Detroit Lake to Muskrat Lake.