

WORKING

Along the Shore

**A Professional's Guide to
Healthy Shoreline Management
for Lake Simcoe**



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Before Starting

Before undertaking any shoreline alteration work, it is important to ask the shoreline owner the following questions. If work must be done, consider using a habitat friendly approach. Landowner shoreline goals can be met while also improving water quality and providing good habitat for fish and wildlife species. A balance can be met. Keep human disturbances to a minimum.

Do you NEED to have work done on the shoreline?

Keep in mind that erosion is a natural shoreline process and if the erosion is not directly impacting the buildings and property, consider not doing any work or altering the shoreline.

What do you use the shoreline for?

Consider how what the shoreline is currently used for such as fishing, relaxation, wildlife viewing, swimming, boating, etc.

What are your priorities and goals for the shoreline?

Is a path to the lake required? A place to store equipment or the dock in the winter? A swimming or fishing area? More privacy and shade? Less lawn maintenance?



Shoreline Goals

Protect

Maintain and protect any intact shoreline remnants.

Restore

Restore the shoreline to a natural state wherever possible.

Plant

Re-establish native plant communities and shoreline buffer areas. Incorporate plantings into the shoreline stabilization design.



Focus of this Guide

It is recognized that a healthy shoreline is critical to the overall health of Lake Simcoe, and on a larger scale is important to foster a resilient, adaptable and sustainable watershed. The goal is to protect, restore and enhance the ecological integrity of the shoreline of Lake Simcoe through increased naturalization of altered shorelines and preservation of existing natural areas, which promotes biodiversity. This applies not only to the lake itself, but also along all of the streams and rivers feeding into it.

This guide contains detailed technical information on how to implement best management practices (BMP's) that are designed to protect shorelines from erosion. These BMP's also promote naturalization and reconnect the link between land and water, encouraging activities that benefit plant and wildlife species and the ecosystems they call home.

Lake Simcoe Legislation & History

Lake Simcoe and its watershed is an invaluable natural and recreational resource. It is the largest inland body of water in southern Ontario with 230 km of shoreline. With its quickly growing population and close proximity to urban areas, the lake has become a popular destination for recreational users while cottagers and permanent residents enjoy living along its shores.

Over the last 200 years, an increase in urban, rural, and recreational uses within the watershed has caused significant changes to the landscape of the basin. These changes have resulted in the alteration, degradation or complete loss of terrestrial natural heritage features and hydrological features; loss of species diversity; and the introduction of invasive species. These changes have resulted in impacts to water quality and quantity of the lake and its watershed.

In recognizing the changes needed to improve the health of the Lake Simcoe watershed, the *Lake Simcoe Protection Act* was passed in 2008 which provides the authority for the establishment of the Lake Simcoe Protection Plan (2009). The protection plan consists of targets, indicators and policies to support the Government of Ontario's overall strategy to protect and restore the ecological health of the Lake Simcoe watershed.

The shoreline has been identified as an area that has experienced considerable alteration, and the need for more naturalized shorelines has been clearly identified. It is recognized that an ecologically healthy shoreline and natural heritage system will improve water quality and better equip the watershed to endure ongoing and future challenges, including land use change and climate change.

A shoreline management strategy is being developed for Lake Simcoe that will provide strategic actions and recommendations to improve the state of the Lake Simcoe shoreline with associated benefits to the overall health of the lake and connected watershed.

Key Messages

Keep the Plants

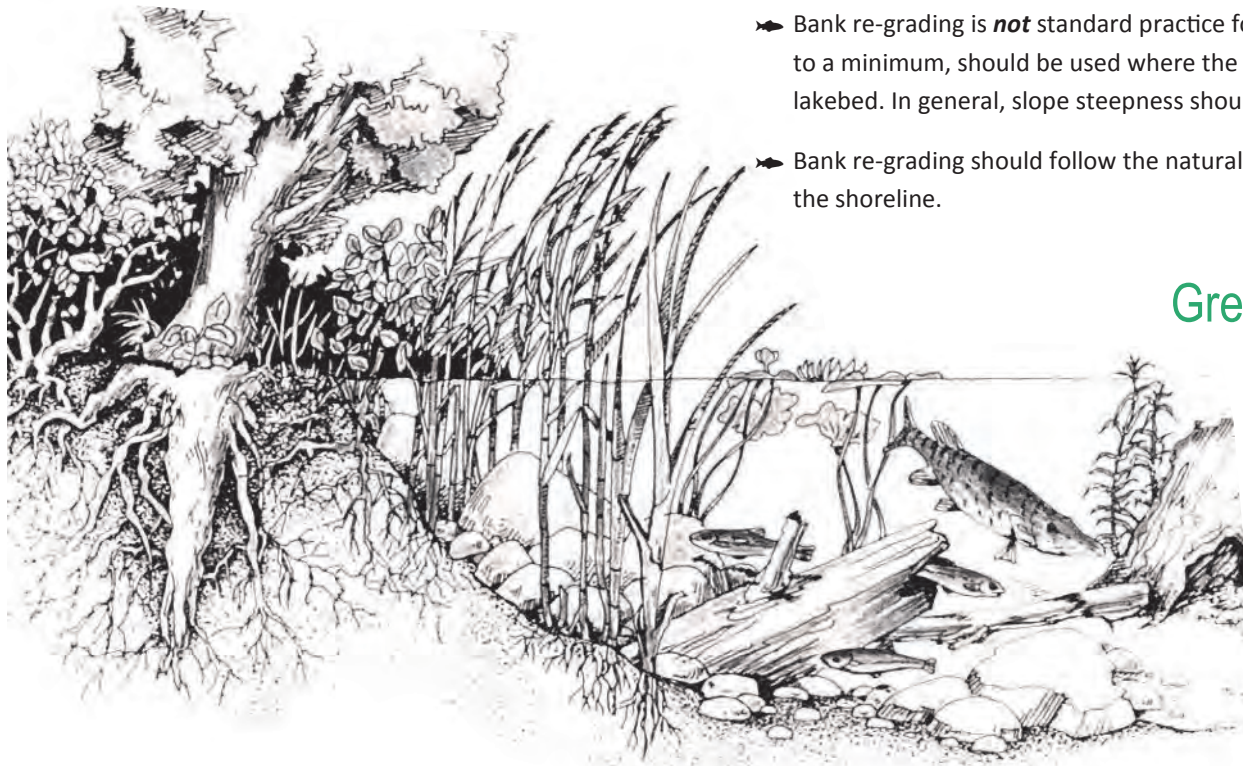
Shoreline modification by humans via hardening measures such as concrete, wood or steel walls and the removal of vegetation around lakes and stream banks negatively alter natural shoreline processes. Removal of vegetation decreases the stability of the bank and increases shoreline erosion.

Working on the Shoreline

- Stabilization works should not extend lakeward of the existing shoreline or attempt to reclaim eroded land. When replacing a seawall or stabilizing an eroding shoreline, the land-water interface should remain at the same location with bank re-grading occurring landward.
- Bank re-grading is **not** standard practice for shoreline projects. Any re-grading of the bank should be kept to a minimum, should be used where the slope has over-steepened and should not result in occupation of lakebed. In general, slope steepness should match the slope of the original shoreline.
- Bank re-grading should follow the natural contour of the original shoreline and not attempt to straighten the shoreline.

Green Marketing is Good for Business

Consider being *Lake Simcoe Shoreline Best Management Practice (BMP)* savvy as a good business practice. Knowledgeable landowners are looking for environmentally sustainable or “eco-friendly” practices from their contractors. Be proactive and progressive and use your knowledge of lake-friendly practices outlined in this guide to help set you apart from the competition. This ‘green marketing’ will benefit both you and the lake into the future.



Shoreline Type

Shoreline classification has been determined using GIS software analysis to outline topography and underlying geology information along the Lake Simcoe Shoreline. This information has been consolidated into 4 main categories:

Beach areas include dynamic beach areas with sand and gravel deposits (minimum 10 m wide and 100 m long).

Cohesive / Non-cohesive are primarily sedimentary materials. Cohesive shorelines have a high proportion of silts and clays, while non-cohesive shorelines are primarily sand and gravels.

Organic Deposit are wetland areas and areas with organic soils.

Bedrock shorelines include all shorelines where the nearshore area is primarily bedrock.

Next Pages

The flow charts on the next several pages (page 6-7), will assist in analyzing the shoreline in order to determine appropriate shoreline stabilization and protection techniques. Keep in mind that each site is unique and should be examined on a site-by-site basis.

Chart 1 (page 6) considers the proximity of existing structures to water's edge and the amount of erosive forces by wind, waves and water in order to determine what type of technique should be considered, such as naturalizing the shoreline if the structures are far back and there is minimal erosion occurring on site.

Chart 2 (page 7) assists in assessing the shoreline conditions using shoreline classifications outlined on the map to the right and site exposure to wave and wind energy, in order to direct you to the optimal approach for the shoreline.



STRUCTURE PROXIMITY

A Considerable Distance

There is considerable distance between the erosive shore and any structures, including septic system and well (approx. 30 m or more).

Fairly Close

Erosion is impacting the property and is close enough to have potential impact on the structures (including septic system).

Adjacent

The house or other structures (including septic system) are in danger of being compromised by the shoreline erosive forces.

EROSION

Minimal Erosion Little to no signs of exposed soils, bank undercutting etc. Vegetation is still intact at shoreline.

Moderate Erosion Bank is starting to wash away slowing over time. Some exposed soil. Some vegetation remains.

Severe Erosion bank is actively being washed away by erosive forces (wind, waves, etc.) could include steep slopes.

Minimal Erosion

Moderate Erosion

Severe Erosion

Minimal Erosion

Moderate Erosion

Severe Erosion

TECHNIQUE

Naturalize— consider letting the shore naturalize on its own, allow the natural erosion processes to take over. Consider adding native plants to the shoreline and property if possible.

Bioengineering — The techniques listed in the following pages of this guide may be most useful for you. You may still need to consult a qualified shoreline engineer before doing any construction. Appropriate technique will be dependant on shoreline type, and conditions outlined on following page.

Engineer — contact a qualified shoreline professional as more severe measures may need to be taken to protect the structures. Techniques outlined in this guide may be able to be incorporated into the design.

Page 12-16;
Next page

Pages 18-25;
Next page

Pages 23-27;
Next page

Last page

SHORELINE TYPE

NATURAL BEACH
(sand / fine gravel)

ORGANIC
(peat / wetland)

BEDROCK
(all or part solid rock)

COHESIVE
(silt / clay)

NON-COHESIVE
(sand / gravel)

Sheltered

Low Energy

Moderate /
Exposed

Sheltered

Low

Moderate

Exposed

SOME OPTIONS

Vegetative Plantings (Seed Mixes; pg. 13)
Live Siltation (pg. 22)

Vegetative Plantings (Live Staking; pg. 16)
Coir Logs (pg. 19)
Brush Mattresses (pg. 18)

Vegetative Plantings (Seed Mixes; pg. 13)
Fascines (pg. 20 & 21)

Fascines (pg. 20 & 21)
Vegetative Plantings (Live Staking; pg. 16)

Vegetative Plantings (Seed Mixes and Live Staking; pg. 13 & 16) - where soils allow

Vegetative Plantings (Seed Mixes and Live Staking; pg. 13 & 16)

Fieldstone Cobbles (pg. 25)
Brush Layering (pg. 24)
Vegetative Plantings (pg. 13-16)

Rock Revetment (pg. 25) with Vegetative Plantings (Live Staking, pg. 13-16)

Rock Revetment (Fieldstone revetments with boulders; pg. 25)
Root Wads (pg. 23)

Keep in mind that this is not prescriptive. Every site is unique and techniques should be considered that are most appropriate for that site. Contact a conservation professional for any clarification or to determine appropriate shoreline stabilization measures.

IT'S ALWAYS BUFFER TIME

No matter what shoreline treatment is chosen, even if the decision is made to not proceed with any erosion control activities, make sure the natural buffer area is retained, or enhanced with plantings or create a new vegetated buffer area. This can be done through seeding, live staking or direct planting.

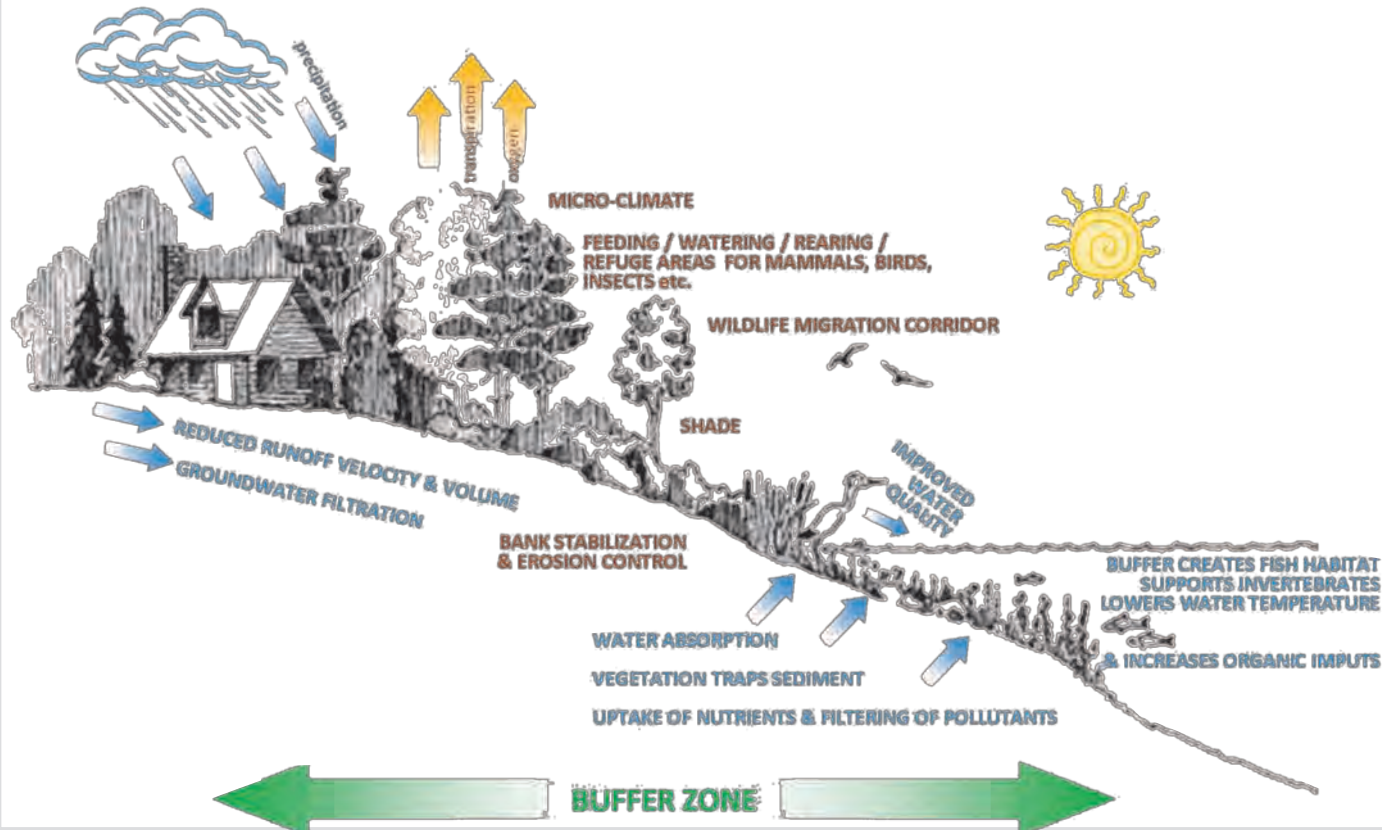
Always ensure appropriate permits and approvals are in place prior to commencing any work on the shoreline.

Buffers

Riparian buffers are strips of land near the water that are preserved in their natural state or enhanced with the addition of native vegetation.

- They reduce sediment and excess nutrients (fertilizer chemicals and pesticides, bacteria, and sediment) from entering lake.
- They protect the shore from wind, wave and ice action.
- They create cover, food and shade for plants and animals.

The various methods to establish vegetated buffer areas on the shoreline are outlined in detail on the following pages. They include leaving natural shorelines alone or enhancing with rooted plantings, seed mixes, aquatic plantings and live staking.



Best Buffer Tips

- ✓ Retain the natural shoreline vegetation already existing (especially mature vegetation).
- ✓ Plant the widest buffer possible (30m wide is ideal, but a minimum of 3m should be considered).
- ✓ Use deep-rooted native tree and shrub species.
- ✓ Densely planted buffers are best—plants should be placed close together.
- ✓ Dedicate at least 75% the length of the shoreline to naturalization, and concentrate use (swimming, boating etc) to other 25% area.
- ✓ Plant grasses and sedges near the waterline, and consider adding aquatic plantings.

Sample Buffer Planting Plan

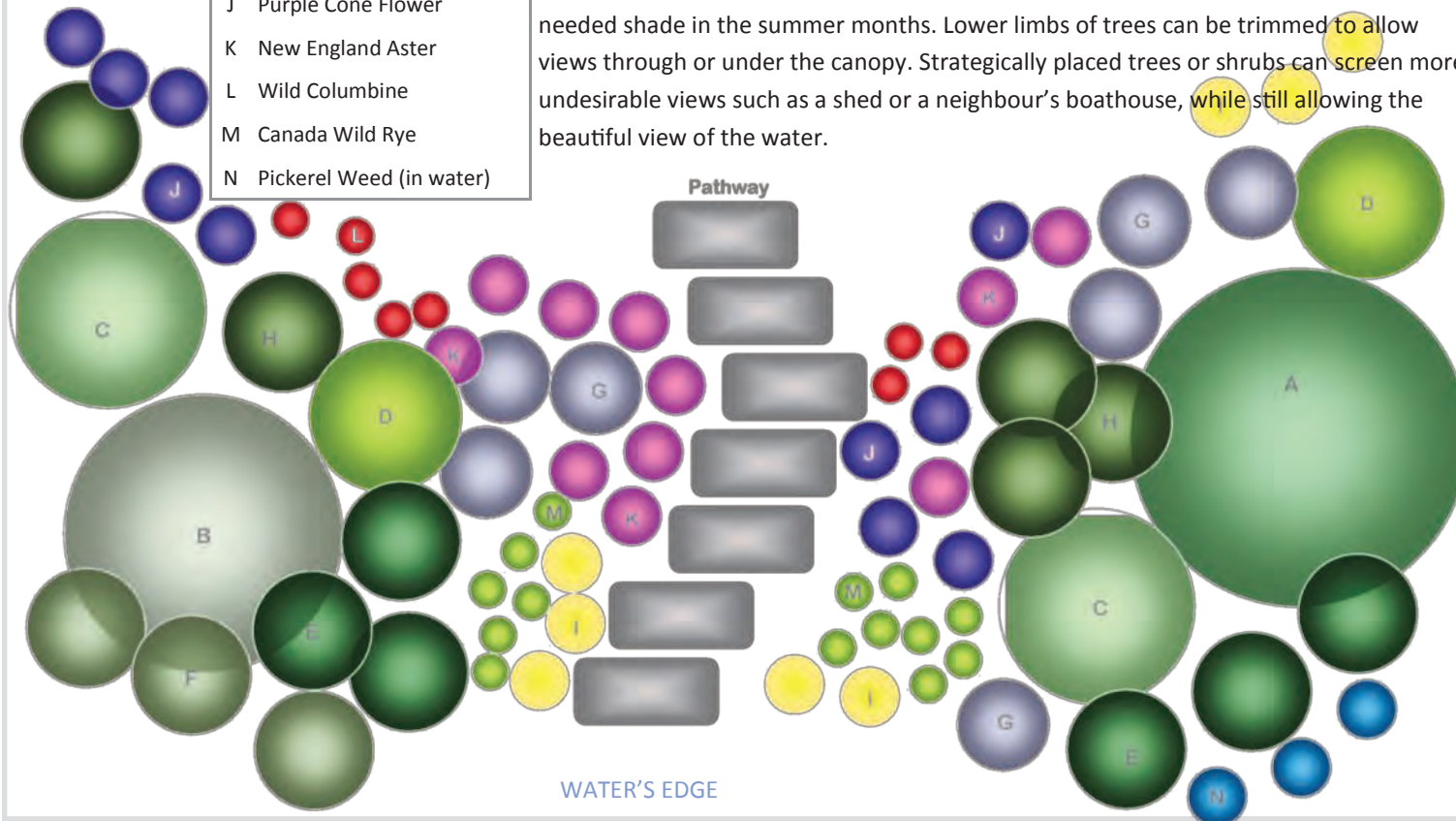
Keeping the View

- A Sugar Maple
- B White Birch
- C Eastern White Cedar
- D Elderberry
- E Red-Osier Dogwood
- F Heart-leaved Willow
- G Snowberry

- H Winterberry
- I Woodland Sunflower
- J Purple Cone Flower
- K New England Aster
- L Wild Columbine
- M Canada Wild Rye
- N Pickerel Weed (in water)

It is possible to naturalize the shoreline and retain a view of the lake! Diverse plantings can accent and even improve views. As with any project, identify which views the landowner wishes to keep and enhance, and which areas they wish to screen—then plant accordingly. As most houses and cottages are situated well above the water line, it is simple and easy to preserve and enhance the vistas while still reducing the impact on the environment.

Taller shrubs and trees can be placed at the edges of the property, with shorter shrubs, grasses and perennials in the middle, framing the view of the water, and providing much needed shade in the summer months. Lower limbs of trees can be trimmed to allow views through or under the canopy. Strategically placed trees or shrubs can screen more undesirable views such as a shed or a neighbour's boathouse, while still allowing the beautiful view of the water.



Working Together, Creating Layers

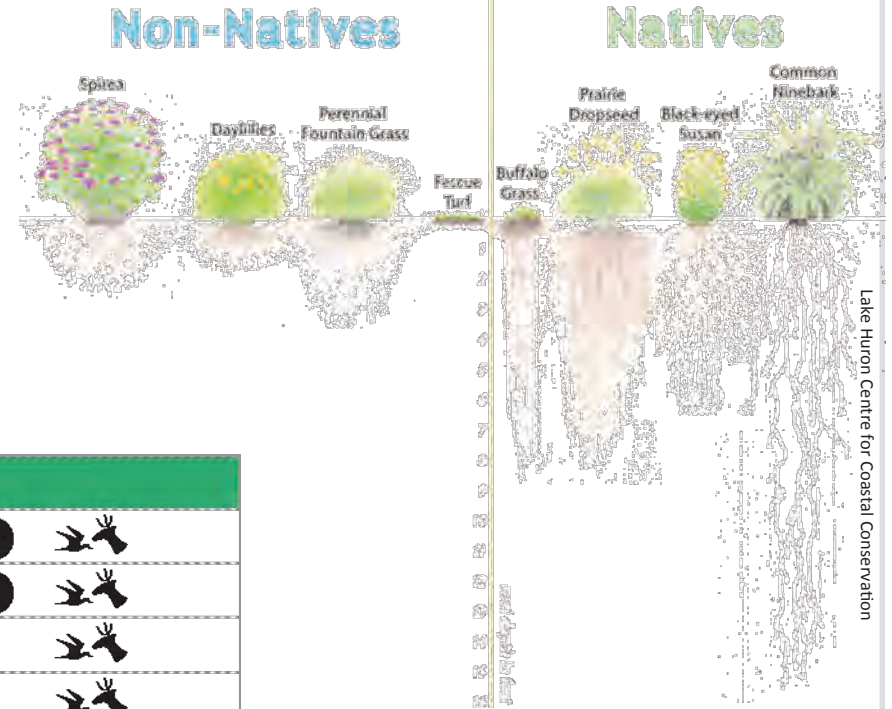
Select plants for the buffer area that work well together and are ecologically appropriate for the site. Each plant thrives in a certain range of sunlight, moisture, temperature, soil type and other conditions. Plants sharing similar requirements can generally be found together in natural 'plant communities'. By matching plant species that have similar requirements with each other you will be able to generally replicate natural conditions. Some plants are able to tolerate a broader range of site conditions and therefore will be able to be successfully grouped with a wider variety of different species depending on the site characteristics.

Instead of simply planting isolated species (such as a large tree or shrub alone in the middle of the lawn), try to group trees together and add shrubs, grasses and perennials to create layers of vegetation. These layers are essential to provide structure and variety to support a diversity of wildlife species for shelter, nesting or feeding. Take a look at a nearby naturalized or forest area. Note how it has different layers of vegetation, such as the tall trees (canopy), smaller trees and shrubs (understory), and then smaller plants and groundcover species making up the forest floor. Consider the species that grow near each other naturally and replicate these in the buffer area.

Native Plant List

Native species should be selected for shoreline projects. They are the species that are indigenous to the area, are hard-working, ecologically appropriate and adapted to local conditions. Native plants have deep root systems (see graphic), and hence require less irrigation, fertilizers and pesticides in order to thrive. Native plants provide habitat benefits for birds, butterflies, beneficial insects, and fish. Take note of the scientific names, as there may be non-native variations of the plant available commercially. Non-native ornamental plants can also be intermixed with native species to create the visual look desired, but ensure they are NOT invasive.

Take care to select plants from the appropriate hardiness zone—zone 5a* for most of the Lake Simcoe watershed (*Agriculture Canada).



| LEGEND | |
|-------------------------------|---|
| Full Sun | ○ |
| Sun / Shade | ◐ |
| Full Shade | ● |
| Large | 🌳 |
| Medium | 🌱 |
| Small | 🌿 |
| Grass / Flower (bloom colour) | 🌾 |
| Groundcover | 🌱 |
| Beneficial to: | |
| Butterflies / Insects | 🦋 |
| Birds | 🐦 |
| Fish | 🐟 |
| Wildlife | 🦎 |
| Reptiles / Amphibians | 🐸 |

















































| TREES | | | |
|--|---|---|-------|
| Balsam Poplar (<i>Populus balsamifera</i>) * | 🌳 | ◐ | 🐦 🦎 |
| Basswood (<i>Tilia americana</i>) | 🌳 | ◐ | 🐦 🦎 |
| Black Walnut (<i>Juglans nigra</i>) | 🌳 | ○ | 🐦 🦎 |
| Butternut (<i>Juglans cinerea</i>) | 🌳 | ○ | 🐦 🦎 |
| Common Hackberry (<i>Celtis occidentalis</i>) | 🌳 | ◐ | 🐦 🦎 |
| Eastern White Cedar (<i>Thuja occidentalis</i>) | 🌳 | ◐ | 🐦 🦎 |
| Green Ash (<i>Fraxinus pennsylvanica</i>) | 🌳 | ○ | 🐦 🦎 |
| Red Oak (<i>Quercus rubra</i>) | 🌳 | ○ | 🐦 🦎 🐸 |
| Silver Maple (<i>Acer saccharinum</i>) | 🌳 | ◐ | 🐦 🦎 |
| Sugar Maple (<i>Acer saccharum</i>) | 🌳 | ◐ | 🐦 🦎 |
| Tamarack (<i>Larix laricina</i>) | 🌳 | ○ | 🐦 🦎 |
| White Birch (<i>Betula papyrifera</i>) | 🌳 | ○ | 🐦 🦎 |
| White Oak (<i>Quercus alba</i>) | 🌳 | ○ | 🐦 🦎 |
| White Pine (<i>Pinus strobus</i>) | 🌳 | ◐ | 🐦 🦎 |

* denotes suitable species for bioengineering techniques












Plants for Bioengineering

Be sure to harvest materials for live staking and other bioengineering techniques when the parent plants are dormant - once the leaves have turned colour and fallen from the twig (usually after Oct 20th). Materials can be cut and used throughout the winter until spring (when the buds have begun to flush) and stored for as long as 10 weeks after harvesting. They should be stored at temperatures between 3-5° C with moderate to high humidity. Poplar species should not be used in places where beavers are a problem.

SHRUBS

| | | | |
|--|---|---|--|
| Alternate Leaved Dogwood (<i>Cornus alternifolia</i>)* |  |  |  |
| Beaked / Bebb Willow (<i>Salix bebbiana</i>)* |  |  |  |
| Chokecherry (<i>Prunus virginiana</i>) |  |  |  |
| Elderberry (<i>Sambucus canadensis</i>) |  |  |  |
| Grey Dogwood (<i>Cornus racemosa</i>) |  |  |  |
| Heart-leaved Willow (<i>Salix cordata</i>)* |  |  |  |
| Nannyberry (<i>Viburnum lentago</i>) |  |  |  |
| Pussy Willow (<i>Salix discolor</i>)* |  |  |  |
| Red-osier Dogwood (<i>Cornus stolonifera</i>)* |  |  |  |
| Sandbar / Slender Willow (<i>Salix exigua</i>) |  |  |  |
| Serviceberry (<i>Amelanchier spp.</i>) |  |  |  |
| Shining Willow (<i>Salix lucida</i>)* |  |  |  |
| Silky Dogwood (<i>Cornus amomum</i>)* |  |  |  |
| Snowberry (<i>Symphoricarpos albus</i>) |  |  |  |
| Staghorn Sumac (<i>Rhus typhina</i>) |  |  |  |
| Swamp Rose (<i>Rosa palustris</i>) |  |  |  |








































GROUNDCOVER

| | | | |
|--|---|---|--|
| Bearberry (<i>Arcostaphylos uva-ursi</i>) |  |  |  |
| Virginia Creeper (<i>Parthenocissus inserta</i>) |  |  | |
| Wild Ginger (<i>Asarum canadense</i>) |  |  |  |
| Wild Strawberry (<i>Fragaria virginiana</i>) |  |  |  |

GRASSES

| | | | |
|--|---|---|---|
| Big Bluestem (<i>Andropogon gerardii</i>) |  |  |  |
| Bottle-brush Grass (<i>Hystrix patula</i>) |  |  | |
| Canada Wild Rye (<i>Elmus canadensis</i>) |  |  |  |
| Indian Grass (<i>Sorghastrum nutans</i>) |  |  |  |

WILDFLOWERS

| | | | |
|--|---|---|---|
| Bee Balm (<i>Mondarda didyma</i>) |  |  |  |
| Blue Flag (<i>Iris versicolor</i>) |  |  |  |
| Butterfly Milkweed (<i>Asclepias tuberosa</i>) |  |  |  |
| Cardinal Flower (<i>Lobelia cardinalis</i>) |  |  |  |
| Dog Violet (<i>Viola conspersa</i>) |  |  |  |
| Foamflower (<i>Tiarella cordifolia</i>) |  |  |  |
| Joe Pye Weed (<i>Eupatorium spp.</i>) |  |  |  |
| New England Aster (<i>Aster novae-angliae</i>) |  |  |  |
| Pickrelweed (<i>Pontederia cordata</i>) |  |  |  |
| Purple Cone Flower (<i>Echinacea purpurea</i>) |  |  |  |
| Wild Columbine (<i>Aquilegia canadensis</i>) |  |  |  |
| Wild Geranium (<i>Geranium maculatum</i>) |  |  |  |
| Woodland Sunflower (<i>Helianthus divaricatus</i>) |  |  |  |

* denotes suitable species for bioengineering techniques

Naturalization

The first option that should be considered for the shoreline is to leave it alone. Alterations to the natural shoreline should only be considered when it is demonstrated that an engineered solution is absolutely necessary. Erosion is a natural shoreline process and if the erosion is not directly impacting the buildings and property, consider letting it be.

Prevention is the Best Cure

The simplest and best shoreline treatment option is to prevent erosion before it starts. Keep development well back, leave the shoreline vegetation alone and do not mow right to the water's edge.

- SITE TYPE -
Can be easily incorporated into any shoreline type and approach .

Beware The Invasion

Invasive species negatively impact our natural ecosystems. They may out-compete native species, homogenize natural landscapes, introduce pests and diseases and hybridize with local populations. They are a threat to Ontario's biodiversity and can even change water or soil chemistry. Certain invasive species can be hazardous to human or animal health and can impair recreational activities.

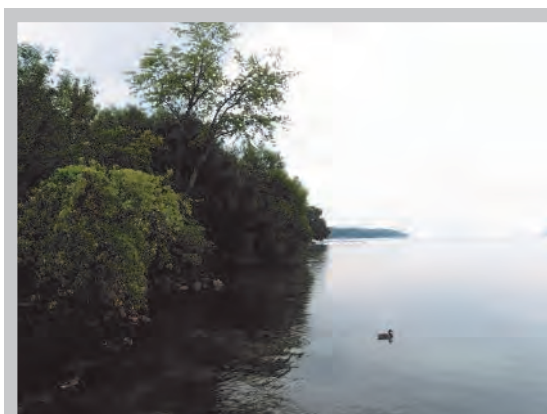
As they often do not have any natural predators in their introduced environments, invasive species can be difficult and costly to control and / or eradicate once they are established. Preventing their introduction is key to preventing long term environmental harm.

Be aware of what you are purchasing and planting. Do not plant it unless you are sure it is NOT INVASIVE.

A detailed guide is available with information regarding control methods for invasive species titled, "A Landowner's Guide to Managing and Controlling Invasive Plants" and can be found at www.invadingspecies.com.



The ideal situation is to leave natural areas untouched. If alterations are required, it is recommended that you utilize the technique with the lowest disturbance and greatest environmental benefit possible. These techniques are outlined in the remainder of this guide.



How It's Done

1. Assess shoreline to determine if shoreline is stable (3H:1V slope or flatter), and structures are at least 30 m from the shoreline.
2. Determine if shoreline habitat could be enhanced through addition of planting of native trees and shrubs (see page 10-11).
3. Plant and maintain (water) species as required.

For consistency, slopes are listed as H:V (referring to horizontal distance to vertical distance) in this document.

Pros

- Prevention is the best cure
- Lowest / no cost installation
- Little / no maintenance
- No permits required
- Good for the lake

Cons

- Simple naturalization may not be enough protection for some shorelines with severe erosion / exposure to wind and waves
- Longer amount of time to establish

Vegetated Plantings: Seed Mixtures

Both upland and shoreline areas can be enhanced with the simple addition of grasses and wildflowers in seed mixtures. Choose the appropriate species mix based on soil saturation and sunlight availability.

Seed mixes should be hand cast with a nurse crop (fast growing annual grasses) of annual rye to provide temporary cover and allow the native seed mix to establish.

Native wildflower seed mixes can be used to add colour to the riparian buffer and can attract pollinators, like butterflies as well as birds to the shoreline.

Some distributors provide specialized native seed mixtures adapted for shoreline and wetland areas, including specific Simcoe County mixes which may be appropriate for the property.



STABILIZE IT —Mulches & Geotextiles

It is important to stabilize any exposed soil on the shoreline to prevent it from washing into the lake after a heavy rain event.

Mulches, include those made of wood chips, or straw, can be applied to protect disturbed soil and seeds, and control weed growth in disturbed areas. Sloped areas that are covered by coir or jute cloth do not require mulching, but flat areas should be mulched with straw after construction is complete.

Coir and jute biodegradable geotextiles, made from coir (coconut husk) and jute plant fibres are commercially available erosion control fabrics. They can be used for slope stabilization on the upper slope, above the wave run-up limit, and in association with brush layering. These fabrics resist rot and can last for 3-5 years after installation. They provide immediate stabilization against soil erosion and helps germinate plant seeds by absorbing water and keeping the topsoil moist. These geotextiles should be secured to the ground with dead stakes.

Some manufacturers sell loosely-woven fabrics that come in a variety of material weights. Others produce a tightly woven textile which should be avoided because it does not allow the plant stems to penetrate the fabric.

How It's Done

1. Assess site to determine if conditions exist that could facilitate use of seed mixes.
2. Determine species to be used, and order appropriate amount for planting area from supplier.
3. Spread or 'cast' seeds by hand, using directions of density from seed mix distributor.
4. Monitor / water as required (or advise clients regarding appropriate watering practices).

- - SITE TYPE - -

Exposed soil
Stable / flat slopes
River or stream banks
Low exposure

Pros

- Low cost / minimal maintenance
- Can be used in conjunction with many other shoreline stabilization techniques

Cons

- Not instant stabilization; will take time for plants to become established
- Does not usually include tree / shrub seeds, these should be planted as rooted stock

Vegetated Plantings: Aquatic Plantings

Aquatic plants provide excellent fish habitat and erosion control, but due to high level of wave activity and exposure in some areas of Lake Simcoe, they may struggle to become established. Emergent plantings may work in sheltered bays. Certain species are sensitive to water depth, substrate, wave climate etc. It may be difficult to find ideal for conditions that do not already have existing

vegetation. Permits may be required for in-water work.

A list of some native plants appropriate for aquatic plantings are listed to the right.



Aquatic plantings can be planted by hand (photo on right), or seeds can be cast by hand from a boat (above).



Aquatic Species

FLOWERS

Blue Vervain (*Verbena hastata*)
Boneset (*Eupatorium perfoliatum*)
Nodding Bur Marigold (*Bidens ceruna*)
Spotted Joe Pye Weed (*Eupatorium maculatum*)

Square Stemmed Monkey Flower (*Mimulus*)
Swamp Milkweed (*Asclepias incarnata*)

SEDGES

Awl Sedge (*Carex stipata*)
Bebbs Sedge (*Carex bebbi*)
Blunt Broom Sedge (*Carex scoparia*)
Fox Sedge (*Carex vulpinoidea*)
Fringed Sedge (*Carex crinata*)
Lurid Sedge (*Carex lurida*)
Nodding Sedge (*Carex crinita*)
Tussock Sedge (*Carex stricta*)

GRASSES / RUSHES

Giant Bur Reed (*Sparganium eurycarpum*)
Green Bulrush (*Scirpus atrovirens*)
Hard Stem Bulrush (*Scirpus acutus*)
Rice Cutgrass (*Leersia oryoides*)
Soft Rush (*Juncus effusus*)
Sweet Flag (*Acorus americanus*)
Tall Manna Grass (*Glyceria grandis*)
Virginia Wild Rye (*Elymus virginicus*)
Wool Grass (*Scirpus cyperinus*)

EMERGENTS

Common Cattail (*Typha latifolia*)
Pickeral Weed (*Pontederia cordata*)
Common Arrowhead (*Sagittarie latifolia*)
Floating Leaved Pondweed (*Potamogeton natans*)
Blue Flag Iris (*Iris versicolor*)
Water Arum (*Calla palustris*)
Cardinal Flower (*Lobelia cardinalis*)

How It's Done

1. Assess site to determine if conditions exist that could facilitate use of seed mixes or aquatic plantings.
2. Determine species to be used.
3. Wade out into water (or use boat).
4. Ensure you select appropriate species for the site and conduct planting operations at the ideal time of year for that species to optimize success.
5. Dig hole and "plant" aquatic species just like you would on land or cast seeds by hand.
6. Monitor plantings and re-plant if necessary.

- - SITE TYPE - -

Best on sheltered site / bays with low wave energy and shallow water.

Pros

- Low cost
- Lots of benefit to water quality, fish and wildlife species

Cons

- Difficult to find appropriate site
- Work may be restricted to certain times of the year, dependent on ideal planting timing for certain species

Vegetated Plantings: Rooted Plantings

Rooted plantings is the preferred way to introduce new trees, shrubs and grasses to the shoreline area. Both bare-root and potted shrubs tend to be more expensive than live-staking or spreading seeds, but they establish quickly with roots and will instantly change the look of the shoreline. The higher survival rates allow them to be planted less densely than live-stakes.

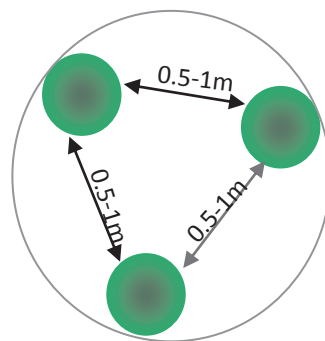
The best time to plant **is in the spring**, but potted shrubs can also be planted in the summer with high success. When you are planting, do not remove existing grass (unless it is an invasive species), rather simply dig holes and plant new species in existing conditions. This will ensure that soil is not exposed and will not wash into the lake during the next rain event.

-- SITE TYPE --

Works on any site.
Select appropriate species
for your site.

Species Selection Factors

- ✓ **Site Conditions**—soil moisture, type of soil, amount of sun, degree of slope etc
- ✓ **Plant Qualities**—height, bloom time, complimentary shapes, sizes and colours,
- ✓ **Be Goal Oriented**— if the goal is to attract birds, butterflies and wildlife, chose species with berries and flowers. If the goal is maintaining the view, chose low-lying shrubs, wildflowers and grasses.
- ✓ **Think Plant Communities**—chose plants that work well together (see page 12).



How It's Done

1. Determine which species will work best with the shoreline soil type, moisture level and amount of sun (see page 10-11).
2. Place trees and shrubs close together (0.5—1 m apart), in groupings of 3 or 5 for a natural looking approach.
3. Dig holes the same depth as the rootball, but 2-3 times wider to allow the roots to expand. If native material is compacted, edges should be scarified with trowel so roots can expand into native soil.
4. Remove plastic pots, burlap and other materials from rootball prior to planting.
5. Plant tree / shrub / grass / wildflower no deeper than root collar.
6. After planting, soil should be moderately compacted by foot to remove any air pockets.
7. Water plants as necessary , especially if planted in the summer months. (Or provide direction to client regarding suggested watering practices.)
8. Stabilize any exposed soil (see page 13 for more information).

Pros

- ✦ Potted stock can be planted in the spring, summer, or fall (bare root should be planted in the spring)
- ✦ Low cost
- ✦ Good for the lake

Cons

- ✦ May take time, patience and a little maintenance for the shoreline to establish and become a self-maintaining, natural system

Vegetated Plantings: Live Staking

Live staking is a simple and inexpensive method of controlling erosion and planting shrubs (usually dogwood or willow species) along shorelines. This technique includes inserting live branches or twigs directly into the ground, which will root, stabilize and grow on their own with regular watering.

Live staking can be used with many other re-vegetation and shore protection techniques, such as coir or jute fabric to provide immediate soil stabilization.

SITE TYPE

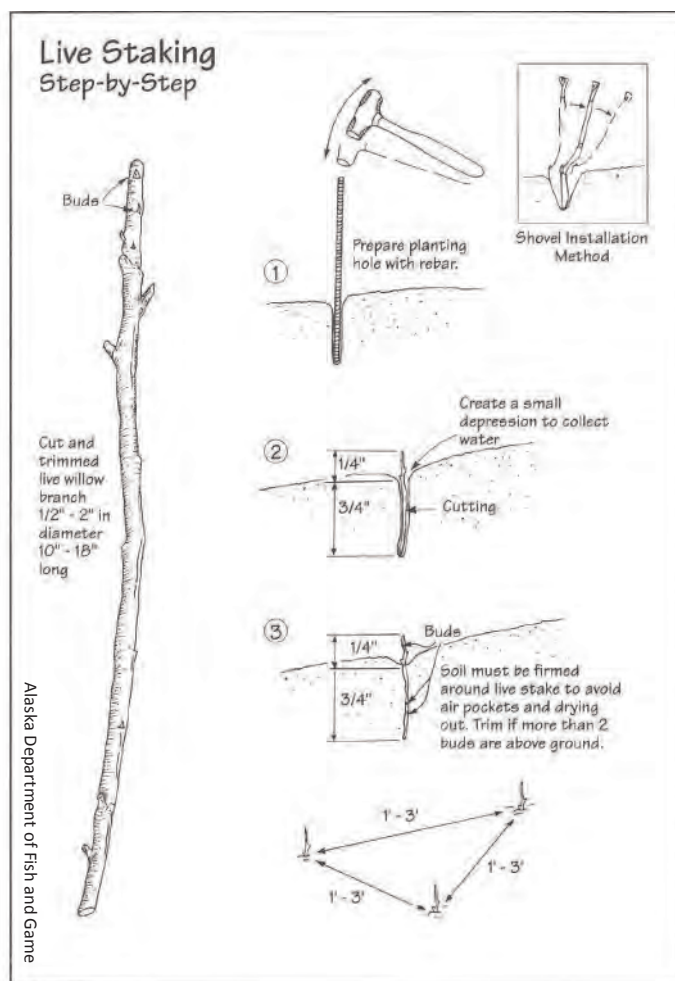
Work on any site with moist soils. (If moist soils are not present, extensive watering may be required).



Branch Cuttings

Branch cuttings are similar to live stakes but the side branches are retained when the cuttings are harvested. Branch cuttings can be used in applications such as brush layering, live siltation and fascines.

1. Cuttings are placed between layers of coir fabric which is filled with soil or in trenches that are backfilled after the cuttings are installed.
2. The basal end does not need to be cut at an angle unless the branches are to be inserted into the soil.



Alaska Department of Fish and Game

How It's Done

1. Cut from dormant shrubs in the fall or winter.
2. Live stakes should be 2-4 cm in diameter and 1.0-1.5 m long.
3. An angle cut should be made at the bottom of the stake (basal end) to differentiate it from the top and ensure that the stake is installed correctly.
4. Trim all side branches, leaving a single branch and taking care not to damage the bark.
5. Prior to installation, the cuttings should be soaked for 7-10 days to promote root development.
6. The stakes should be inserted approximately three-quarters of the stake into the ground (for the cutting to develop adequate roots). Use a deadblow hammer or rubber mallet which causes less damage to the cutting.
7. The stake is installed at a right angle to the slope, ensuring that the basal end is inserted into the soil.
8. Live stakes should be planted at a density of 2 stakes per square metre.
9. If the soil is compacted, a pilot hole should be made with a steel bar. If a pilot hole is used the soil should be repacked around the stake eliminating air pockets.

Pros

- 🐘 Inexpensive
- 🐘 Not labour intensive
- 🐘 Minimal equipment required, low tech
- 🐘 Can plant in high densities

Cons

- 🐘 May take a while to become established
- 🐘 Low survival compared to rooted plantings
- 🐘 May require watering the first few years
- 🐘 Ease of planting will depend on site conditions—e.g. difficult on hard or rocky soil



Please note: Planted live stake should be 10" - 18" long (not 1" as shown in steps 2-3).

Shore Protection Techniques —

Overview

Natural shore protection techniques, including “soil bioengineering” approach shoreline stabilization in a “soft” or “natural” way, incorporating native materials and native plants. These techniques are preferred since they are environmentally sound, aesthetically pleasing, and effective. With natural shore protection techniques, the desired result is to mimic natural conditions which are able to adapt to changing conditions, reduce surface runoff and erosion and create fish habitat, and contribute to biodiversity.

These techniques focus on using natural materials (logs, trees, twigs, biodegradable ground cover – coconut) and live plantings (including woody species). They provide shoreline stability as well as food and cover for wildlife, oxygen and moisture through transpiration. They incorporate woody species, such as trees and shrubs and consider the ability of the deep roots to bind the soil in place and prevent erosion. Some species like dogwood or willow grow especially well in shoreline conditions and can regenerate if they are damaged by waves or ice (refer to pages 10-13 for recommended species).

There are many different methods and types of natural shore protection techniques, each with own advantages in different conditions, and these are outlined on the following pages. Many can be used together to customize the approach the shoreline requires. The chosen technique may also depend on materials available, cost to implement, and the shoreline type.



Is Geotextile Fabric Required under Rocks and Boulders?

YES: If there is a high groundwater table on the property and water seeps out from the property towards the lake. In this case you may need to use a non-woven geotextile fabric placed under the large boulders, but not extending below the high water level. This will ensure that the soil does not get washed out through the boulders.

NO: If there is a lower groundwater table, and it does not interfere with the shoreline, a geotextile fabric is NOT required.

Concrete vs. Natural

The strongest moment in the life of a concrete wall is the minute it gets built. After this, it only gets weaker and weaker with age.

Alternatively, with bioengineered structures, the weakest point is the moment they are installed, and they only grow stronger with time.

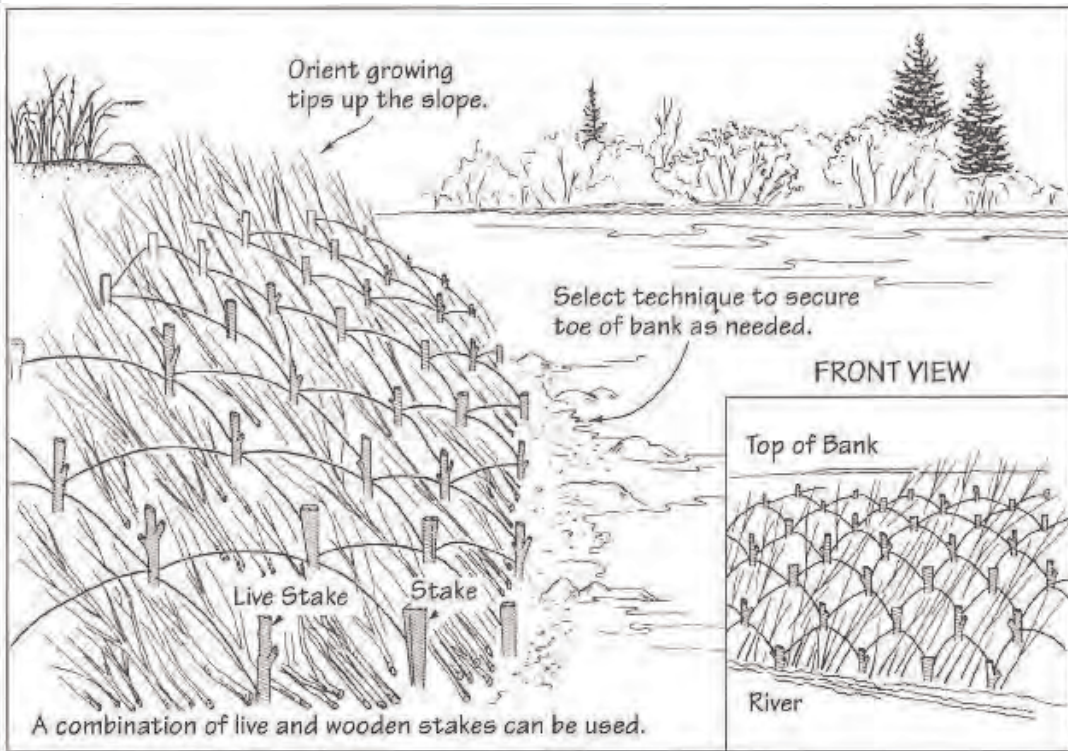
Brush Mattresses

Brush mats or “mattresses” are protective mats of cuttings placed on the bank of a lake or stream, and staked sufficiently to hold them in place until they are able to become established. They are layers of fresh (dormant) branches placed on the slope with alternating layers of soil, which is then staked down with a grid pattern of twine to hold it in place.

A brush matt is preferred over traditional ‘erosion control blankets’ since it provides immediate erosion control for exposed soil and fish and wildlife habitat, and eventually grows, naturalizes and stabilizes the shoreline. The brush matt will trap sediment from running off the slope into the lake, as well as native seeds which can then germinate and grow on the slope. The toe of slope may need to be stabilized by other means.

- SITE TYPE -

Organic sheltered shorelines
 Moderate slope (no steeper than 1H:2.5V)
 Low wave exposure



Alaska Department of Fish and Game

How It's Done

1. Collect dormant plant material (see page 10).
2. Place branches flat on the bank, perpendicular to the water line with tops of branches facing up the bank. Place branches in a criss-cross pattern. Brush mattresses can be placed over other existing plants or roots.
3. Alternate layers of branches with layers of soil until the desired thickness of the brush mattress is reached. Compressed mattress should be 3-4 inches thick.
4. Stake the mat in place with live stakes or thin wooden untreated stakes. Stakes should be spaced approx. 1 m apart. Attach twine around each stake to form a grid pattern between the stakes. Then drive the stakes further into the ground to secure the mattress.
5. Water lightly.
6. Toe of slope should be stabilized by other means (if required) such as live fascines, coir logs, root wad etc.



Ontario Streams

Pros

- Provides immediate erosion control for slope & good soil stability
- Weakest when installed, strengthens over time
- No unnatural material (geotextile or metal stakes) left on bank
- Good plant coverage

Cons

- Labour intensive
- Lots of live dormant material required
- Can take time to establish
- Needs a site with soil and sunlight available
- Sites with high exposure and extreme water levels and waves should be avoided
- Restricted to certain times of year

Coir Logs

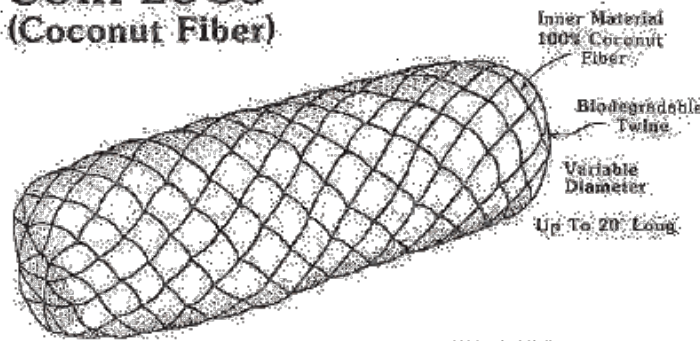
Coir logs are commercially available products made of biodegradable coconut fibres bound together with biodegradable netting / twine and can be used like fascines to help stabilize banks. They come in various lengths and diameters.

They can provide temporary physical protection (from boat wakes, waves etc.) to a site while aquatic or shoreline vegetation becomes established.

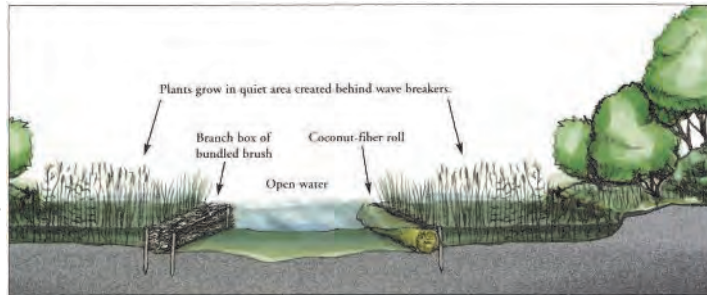
Protecting, enhancing or restoring wetland shoreline areas will result in numerous benefits for the lake.

- - SITE TYPE - -
 Sheltered shorelines
 Low to moderate slope
 Wetland / organic shorelines

COIR LOGS (Coconut Fiber)



Minnesota Department of Natural Resources / Baird & Associates



How It's Done

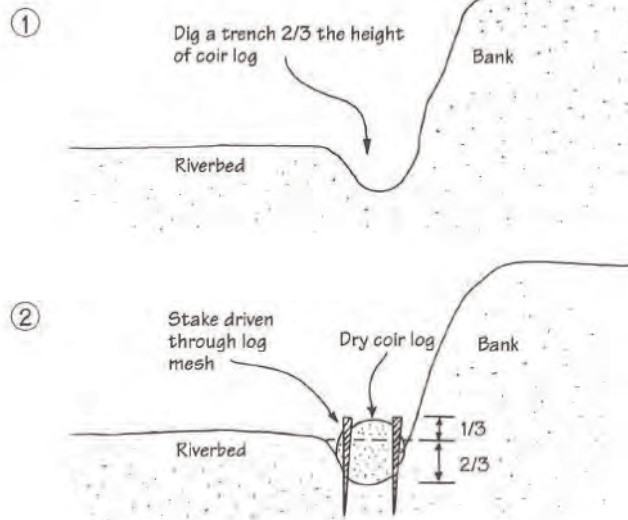
1. Assess site to determine applicability.
2. Ensure both ends of the coir logs are 'tied-in' to adjacent properties to reduce wash-out potential.
3. Install coir log in the dry (see page 32 for timing).
4. Insure that the log is in contact with the soil along the entire length. If possible, dig a small trench so the log can be 2/3 buried in it.
5. Stake logs in place with untreated wooden stakes or live stakes on both sides, approx. every foot. Consider using twine (woven between stakes, and through coir log mesh) to further secure the coir log.
6. Tie adjacent logs together with twine.
7. Compact soil around logs.
8. You can use coir logs in conjunction with other techniques.

Pros

- Fully biodegradable
- Easy installation with minimal training required
- Immediate toe-of slope protection
- Encourages sediment accumulation and encourages plant growth

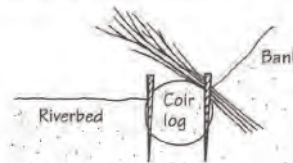
Cons

- Moderately expensive
- Only recommended in low exposure / velocity situations
- Least effective bioengineered toe protection technique

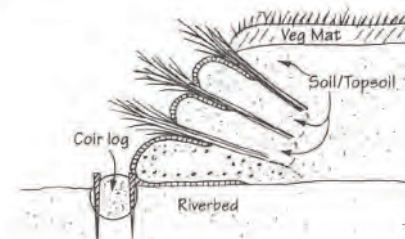


③ Alternatives using coir logs for securing toe of slope depending upon site:

a) Crisscross layers of dormant cuttings 15 stems per linear foot (See live siltation)



b) Brush Layering



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Fascines / Bundled Branches

Fascines are rope shaped bundles of live (dormant) cuttings lashed together to create a long, log-like structure. Once established, their root systems work well to vegetate slopes, secure soils and hold fascine in place. They can be used in conjunction with other methods, such as protecting the toe of brush mattresses. They can be used to 'soften' existing riprap, gabion baskets or concrete blocks by placing them along the top edge of the stone, or if possible along the water's edge. As well, they can be used across the slope to reduce runoff or trap sediment, as well as encouraging native plant seed collection and subsequent growth.

They are simple, effective and can be installed with minimal site disturbance.

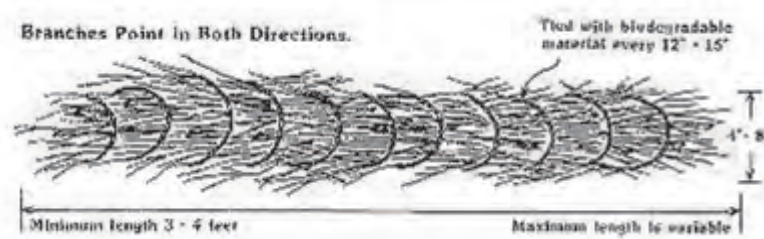
Below are images of fascines immediately after construction (L) and a few months later (R). These were constructed on a river system but the same technique can be applied to lake shoreline properties.



Doug Forder



Doug Forder



Alaska Department of Fish and Game

BUILDING FASCINES

1. Harvest an assortment (various species, lengths etc.) of live, dormant cuttings. Ideally use slim, unbranched cuttings, and if side branches need to be cut off, be sure to use them too.
2. Lay cuttings in bundle with growing tips all facing the same direction, with the cut ends staggered throughout.
3. Tightly tie fascines together using biodegradable rope or twine. Place the ties close enough together that you can carry, bend and not be able to pull the fascine apart. They can be constructed in varying lengths and diameters.

How It's Done

1. Ensure toe of slope is stabilized by other means.
2. Re-grade the existing slope to a 2 horizontal to 1 vertical or flatter where feasible.
3. Construct fascines following detailed directions outlined to the left.
4. Install first fascine at bottom of slope (see page 21).
5. Move upslope placing more fascines using recommended spacing.

- - SITE TYPE - -

- Organic sheltered shorelines
- Moderate slope
- Low wave exposure
- Can be used with high exposure sites if toe of slope stabilized by other means

Pros

- 🐾 Good density of root material and vegetation
- 🐾 Simple to install and construct
- 🐾 Can be cost effective
- 🐾 Provides fish and wildlife habitat
- 🐾 Breaks up slope length

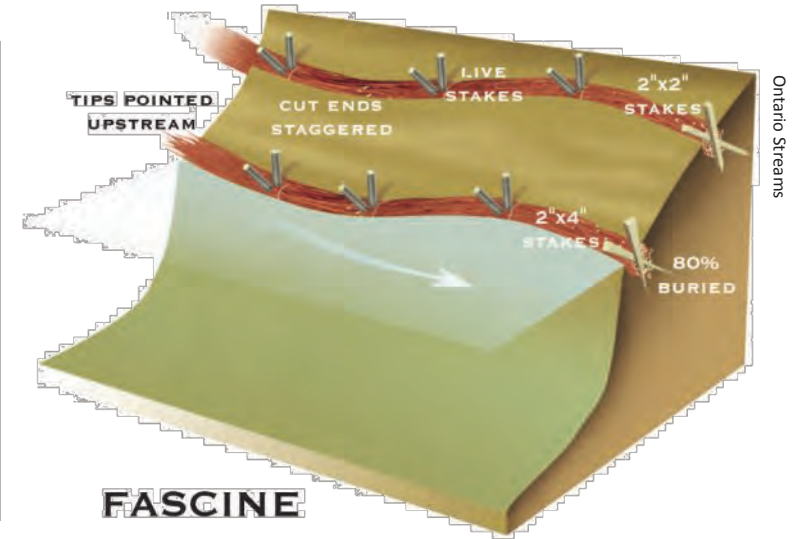
Cons

- 🐾 Requires a significant amount of dormant material (e.g. dogwood / willow)
- 🐾 May require use of other techniques for toe of slope stabilization in high-energy locations

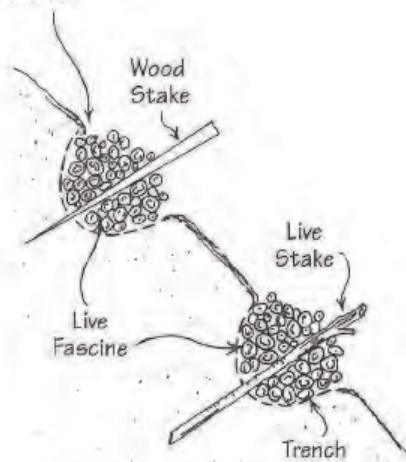
Fascines continued

FASCINE INSTALLATION

1. Dig a shallow trench (use a shovel or pick axe) slightly less wide and deep than the diameter of the fascine. (it should be 20% exposed when installed).
2. Place fascine in trench and stake it into place (using ideally live stakes, untreated 2"x2" stakes, or 2"x4"s cut on a diagonal), place stake every 1-1.5m (you should not be able to lift the fascine out after it is staked).
3. Ensure ends of fascines are 'returned' or 'anchored' to the streambank. Tuck the upstream end in the bank and stake it securely so the current cannot dislodge it.
4. Bury most of the fascine by placing soil around and on top of it, tamping gently into place, leaving 20% exposed.



EXAMPLE 1.
Trench is filled with soil until bundle is partially covered.



Side view of multiple live bundles in a bank. Live bundles are partially covered with soil. Slope of bank can vary.

Alaska Department of Fish and Game

RECOMMENDED SPACING

Space fascines on bank, following the contour of the bank. They can be planted in single or multiple rows (and can be "terraced"). Fascines can also be placed in a "smile" configuration, with ends of the fascine placed slightly higher than the middle. Consider these recommendations for fascine spacing:

The steeper the slope, the closer (vertically) together the fascines should be placed. Sample spacing is below.

1h:1v slope - 1m apart

2h:1v—1.5m apart,

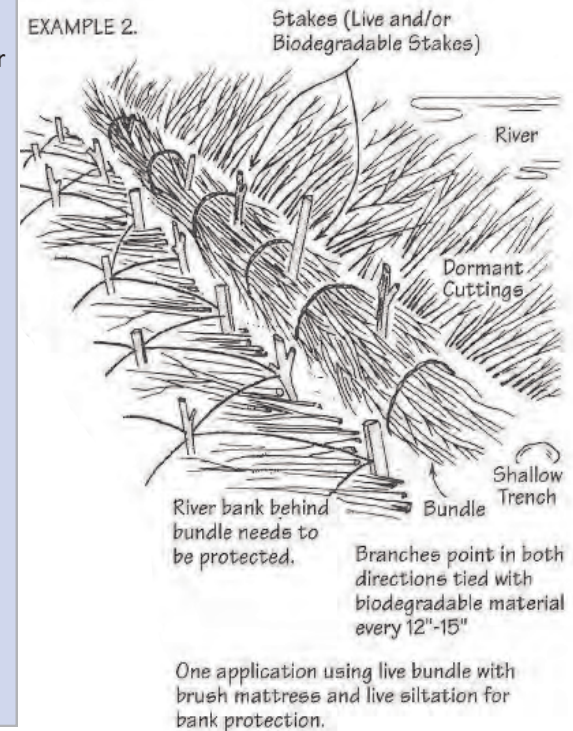
3h:1v—2m spacing

On dry slopes—place fascines on level or on contour

Wet slopes—place fascines on slight angles to facilitate drainage of runoff

Flat slopes (1v—5h or greater)

Steep slopes—use in conjunction with erosion control fabric (anchored by putting leading edge into trench and staking fabric on top)



Alaska Department of Fish and Game

Live Siltation

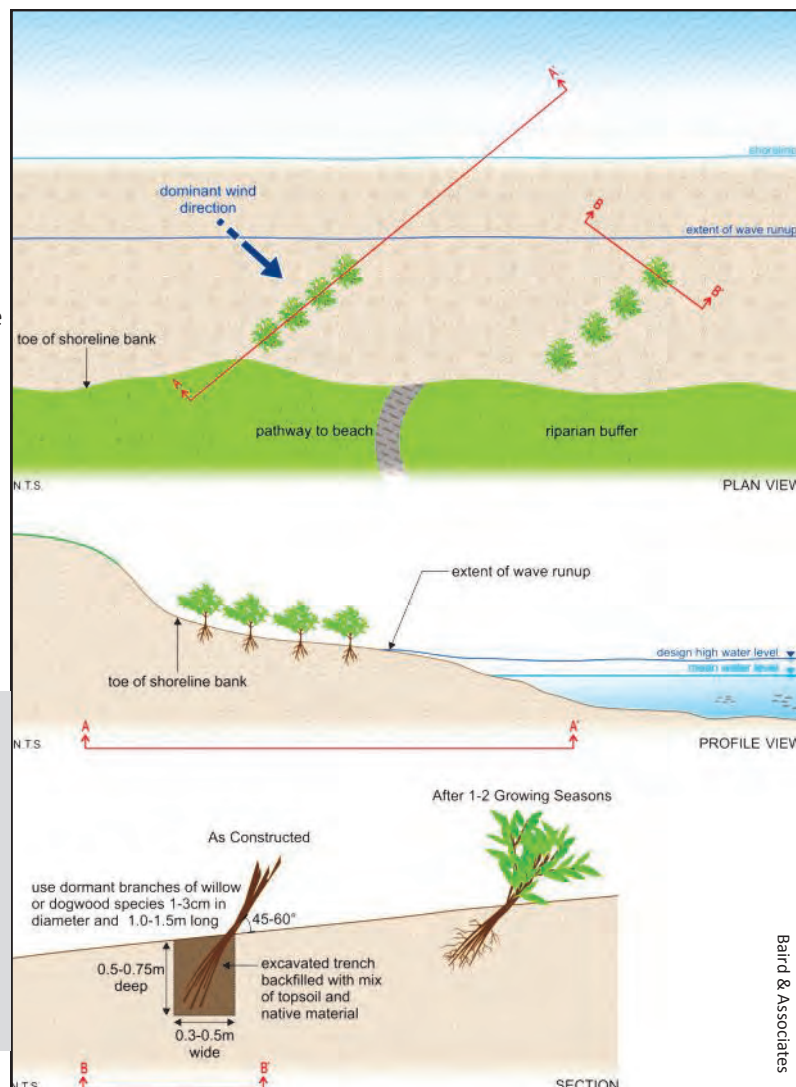
Lake Simcoe has two main types of beaches— one consisting of sand, and the other a mixture of cobbles, gravel and sand material. Both types of beaches are dynamic and respond to water level changes, conditions and sediment supply. Hard structures (such as revetments and seawalls) should be avoided, as they restrict this natural process, and often result in increased wave reflection and a loss of beach materials.

Live siltation is a simple treatment that can be used on beaches. It aims to build up beach material by encouraging wind blown sediment and detritus to deposit in the lee of the vegetation. It also reduces wind erosion, and promotes the germination of wind-blown seeds which lead to the natural colonization of the upland areas of the beach. This technique is highly valuable as it provides immediate cover and fish habitat while the plantings become established.

United States Department of Agriculture



- - SITE TYPE - -
 Natural Beach Areas (sand, gravel, fine cobble)
 Sheltered shorelines
 Low to moderate slope



Baird & Associates

How It's Done

1. Chose cuttings of live dogwood and willow species to use (1-3cm in diameter and 1-1.5m long). The side branches should be left intact on the upper third of the branch cuttings.
2. Construct a “v” shaped trench above the ordinary high water level. The trench should be approx. 60cm (2’) deep and perpendicular to dominant wind direction.
3. Place a thick layer of branches in the trench with the branches angled towards the lake and 1/3 of branches exposed.
4. Branches should be installed above the high water line at an angle of 45—60 ° to the trench.
5. Backfill over the branches (bottom 2/3 only) with washed gravel and/or bundles.
6. Rows should be parallel and 2-3 m apart depending on site conditions (windy sites require closer spacing between rows).
7. Backfill trench with mix of topsoil and native material.

Pros

- Provides immediate cover and fish habitat
- Good bank stability in sheltered / low exposure sites
- Good riparian vegetation

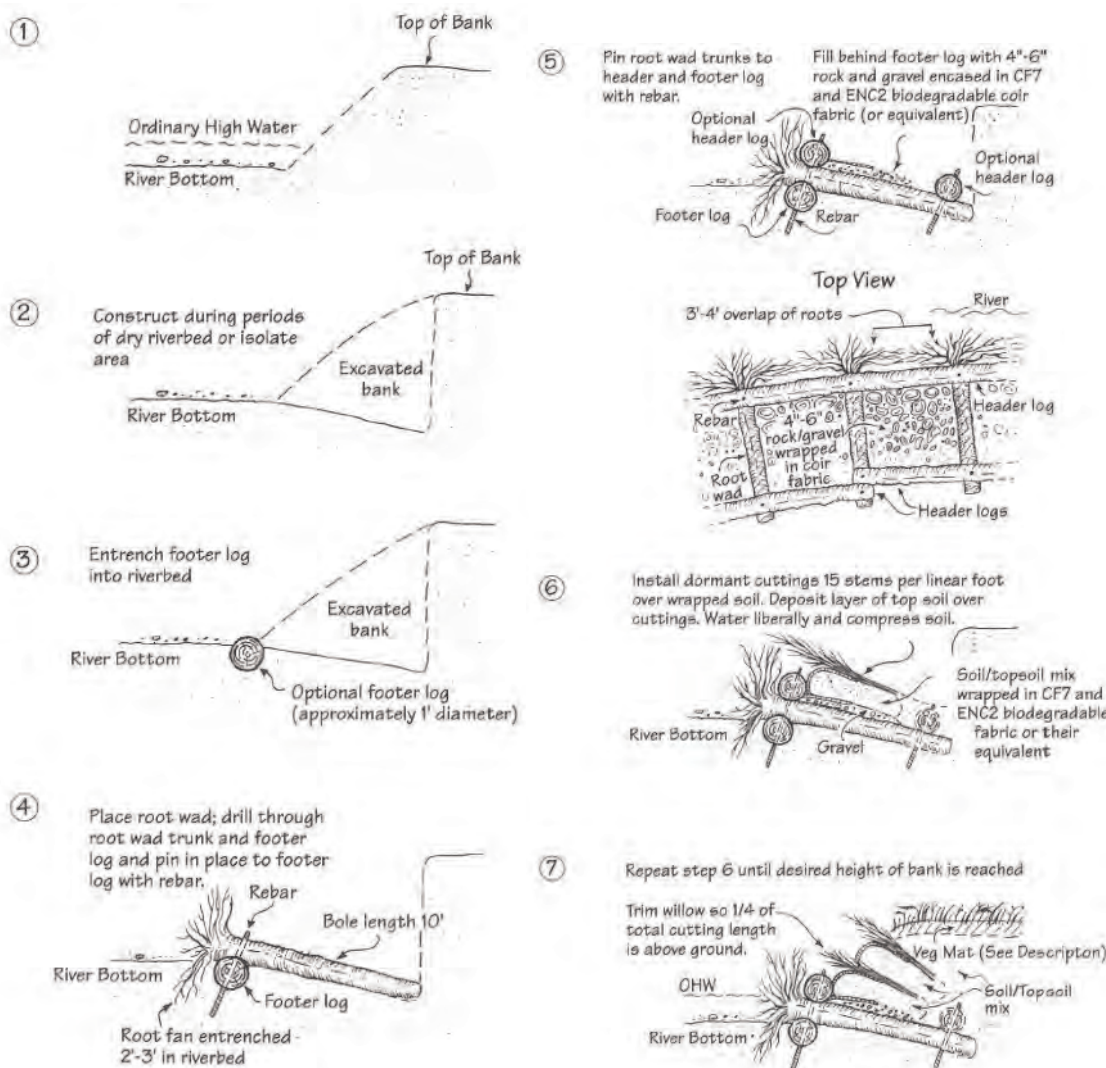
Cons

- Plants will take time to establish
- Requires shallow water and low slope, with minimal exposure.
- Some monitoring / maintenance may be required

Root Wads

Root wads are an excellent shoreline protection and stabilization technique. They provide erosion protection and toe of slope protection, as well as excellent fish habitat. This technique can be utilized at the toe of the slope, with other bank stabilization techniques further up slope. It usually requires heavy equipment and extensive excavation of the bank.

SITE TYPE
Can be used in high exposure site with moderate slopes



Alaska Department of Fish and Game

How It's Done

1. Source appropriate softwood trees with appropriate permission. Push trees out of ground (when ground is not frozen) to retain roots. Trees tops should be removed, and the bole (trunk) of the tree should be a min 12" diameter and 10' long and the root fans should be 5-6' in diameter.
2. Do work in the dry, or isolate work site to work in the dry (see page 32 for timing tips).
3. Ensure you 'tie in' work to properties on either side of work area.
4. Follow *Step By Step* instructions (see image on left).
5. Can use alternative methods to stabilize the remainder of the bank (i.e. brush layering as seen in diagram).

Pros

- ✘ Provides immediate cover and fish habitat
- ✘ Can be used in steeper slopes and more exposed sites
- ✘ Most stable bioengineered toe-of-slope protection technique

Cons

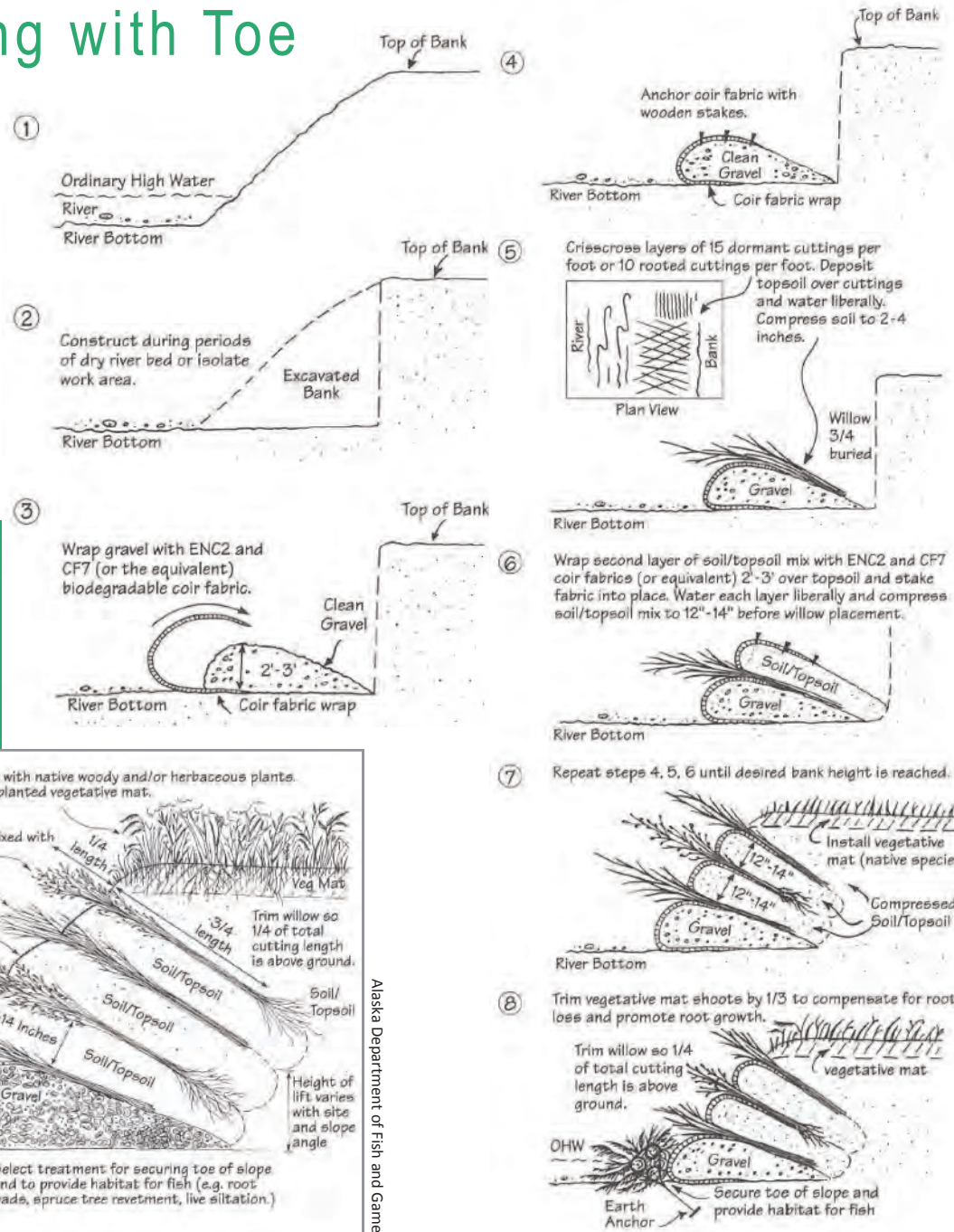
- ✘ Restricts access to water— may need dock / grated walkway / stairs to access the water
- ✘ Expensive
- ✘ Labour intensive
- ✘ Heavy equipment required

Brush Layering with Toe Protection

Brush layering is a revegetation technique that assists in stabilizing an exposed or eroding slope by installing layers of cuttings and rooted plants which are arranged perpendicular to the slope, and horizontally placed.

This technique works effectively on both river and lake shorelines.

- - SITE TYPE - -
 Moderate exposure
 Gradual to moderate slope (2H:1V or flatter)
 Recommend to be used with toe protection done by other means.



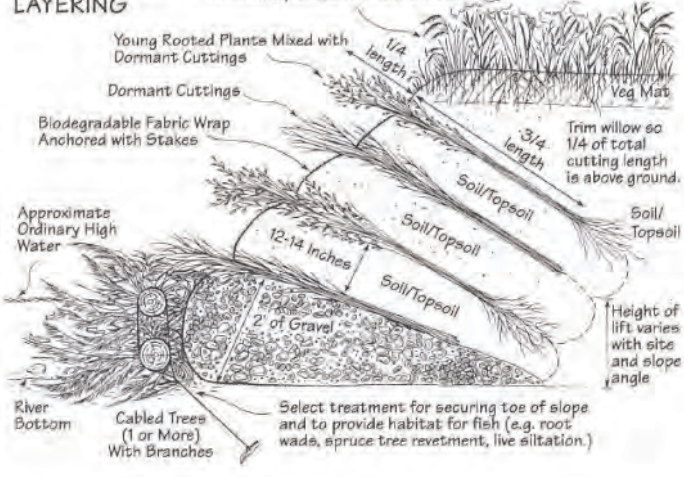
Alaska Department of Fish and Game

How It's Done

1. Toe of slope should be stabilized by other means (if required) such as live fascines, coir logs, root wad etc.
2. Install brush layers on an angled bench that follows the contour of the slope with approx. 75% buried in the bank with remainder 25% exposed (follow step by step diagram on left).
3. The areas between the brush layers should be mulched and seeded (erosion control fabric can also be used).

HEDGE BRUSH LAYERING

Revegetate with native woody and/or herbaceous plants. Trim newly planted vegetative mat.



Alaska Department of Fish and Game

Pros

- 🌿 Effective erosion control and bank stabilization technique
- 🌿 Provides native vegetation (healthy riparian functions)
- 🌿 Provides benefits for fish and wildlife
- 🌿 High success rate

Cons

- 🌿 Mechanically intensive and technically challenging
- 🌿 Can be expensive
- 🌿 Requires isolated work areas (in the dry)
- 🌿 Depends on other successful slope toe stabilization technique—not recommended for sites where severe erosion is occurring

Rock Revetments

Vegetative Stone

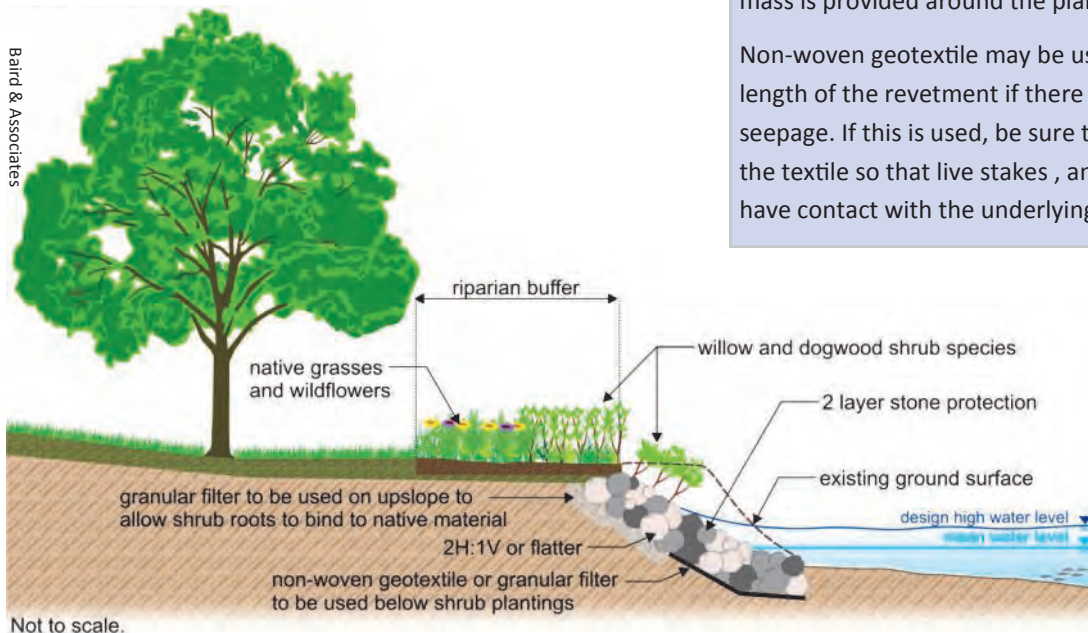
This technique offers the same structural benefits of a conventional revetment but aims to lessen the impact of the structure on the lake environment. The final product allows the wave energy to be dissipated, and wave run-up to be reduced.

This is achieved by using a gentler slope, and planting rooted shrubs or live stakes between the stones above the level of wave run-up.

The gentler slope allows for use of smaller and less angular material.

-- SITE TYPE --

Severe wind/ wave exposure
Moderate slope



This drawing is for illustrative processes only. Works may not be permitted to extend below water level.

Fieldstone Cobble & Boulder

May be used in situations where protection is required. For areas subject to severe waves, larger boulders will be required, and it may be necessary to use a milder slope.

In these situations, plantings may not be suitable within the revetment slope. However, trees and shrubs should still be planted at the top of the slope to stabilize the shore and prevent loss of soil through armour stone layer.

A granular filter and non woven geotextile should be placed under boulders to prevent piping of material through armour stone layer.

For shrubs to survive, it is imperative that an adequate soil mass is provided around the plant material.

Non-woven geotextile may be used under the entire length of the revetment if there are concerns about water seepage. If this is used, be sure to carefully cut or puncture the textile so that live stakes, and eventually plant roots have contact with the underlying native material.

How It's Done

1. Re-grade to a 2h:1v or flatter where feasible.
2. Place granular filter under area where fieldstone and plantings are to be placed (allowing for root penetration).
3. A non-woven geotextile may be used below the high water mark.
4. Place 2 layers of stone protection above granular filter and/ or geotextile.
5. Plant rooted shrubs or live stakes between the stones.
6. Plant shrubs along the top of the revetment to tie it in with the shoreline.
7. Seed any disturbed area landward of the structure with a native shoreline seed mix (including grasses and wildflowers).



Pros

- ✦ Opportunities to incorporate other techniques
- ✦ Best for severely exposed / eroded sites

Cons

- ✦ Expensive
- ✦ Fewest ecological benefits
- ✦ Often 'over engineered' for site

Retaining Wall Removal

Retaining walls, also referred to as sea walls, steel wall, concrete etc., are frequently found around Lake Simcoe. They are the least environmentally considerate shore protection technique. A hardened shoreline restricts the movement of life along the waterfront by eliminating the interaction between the natural aquatic (water) and terrestrial (land) environments.

Additionally, these hardened shorelines are just a temporary fix and are generally constructed in combination with the removal of hard-working vegetation. These walls do not dissipate wave energy as natural shorelines do, but rather reflect it, causing erosion elsewhere. As waves slam against the wall, the wave energy is deflected upwards, downwards, and outwards. This action causes the walls to be undermined, especially in storm events, and many landowners experience erosion behind the wall and at its base, leading to its eventual undermining and collapse. Therefore, retaining walls do not provide effective shoreline protection.

Removing a retaining wall results in a beneficial “softening” of the shoreline. This also provides an opportunity to restore or plant deep rooted vegetation along the top of the retaining wall to help buffer surface water and reduce erosion, as well as plant overhanging native shrubs to improve water quality and fish habitat. It is important to work with a coastal engineer when considering the removal of a sea wall to ensure long-term, shoreline protection.

You may be able to create aquatic habitat at the base of the retaining wall (if approvals are in place). This could include installation of anchor logs or boulder toe protection.

- - SITE TYPE - -
Any site with existing retaining wall. Consider removing retaining wall and stabilizing / protecting the shore with other technique found in this guide.

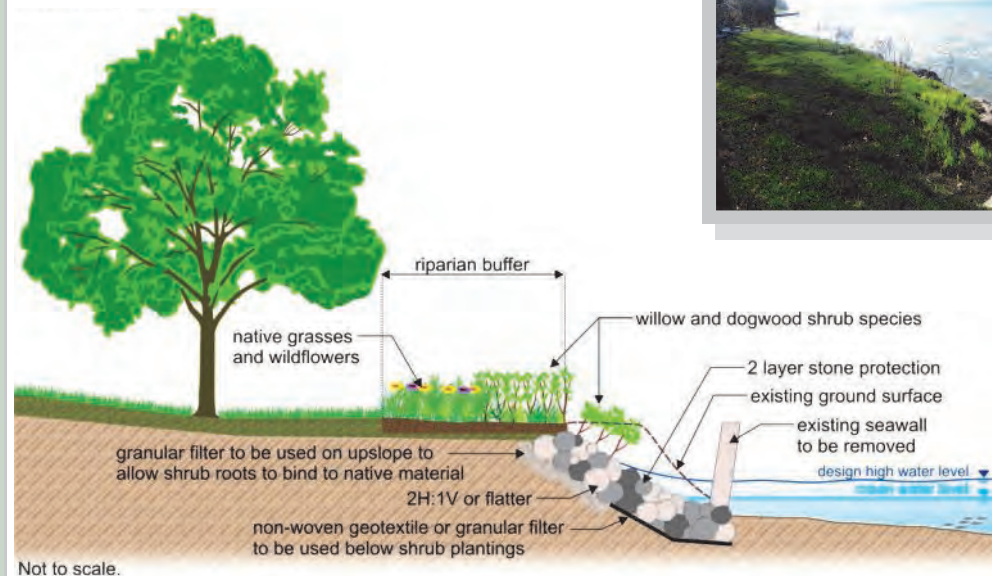


How It's Done

1. Install effective sediment and erosion control measures.
2. Remove wall and re-grade slope to stable slope: 2h:1v or flatter.
3. It is generally okay to start rock placement at or behind footprint of existing wall, and move landward.
4. Determine appropriate slope and/or toe stabilization methods for site and install (e.g. rock protection, brush layering, etc).
5. Plant shrubs / live stake among rocks.
6. Plant shrubs / trees along top of rock.
7. Stabilize any exposed soil.

NEGATIVE IMPACTS of RETAINING WALLS

- ◆ interfere with natural sediment movement along the shore
- ◆ increasing erosion in other areas
- ◆ do not dissipate energy, but rather reflect it—often resulting in scouring at toe
- ◆ often will erode behind the wall
- ◆ cut off the link from land—water, and hence are barriers for amphibians, reptiles and young waterfowl
- ◆ minimal ecological benefits
- ◆ provide no habitat for fish
- ◆ can promote nuisance species like Canada Geese



Pros

- 🌀 Improve lake habitat (water quality, fish habitat, amphibian access etc.)
- 🌀 Favourably looked upon by permitting agencies
- 🌀 Dissipate wave energy

Cons

- 🌀 Can be expensive
- 🌀 Heavy equipment required

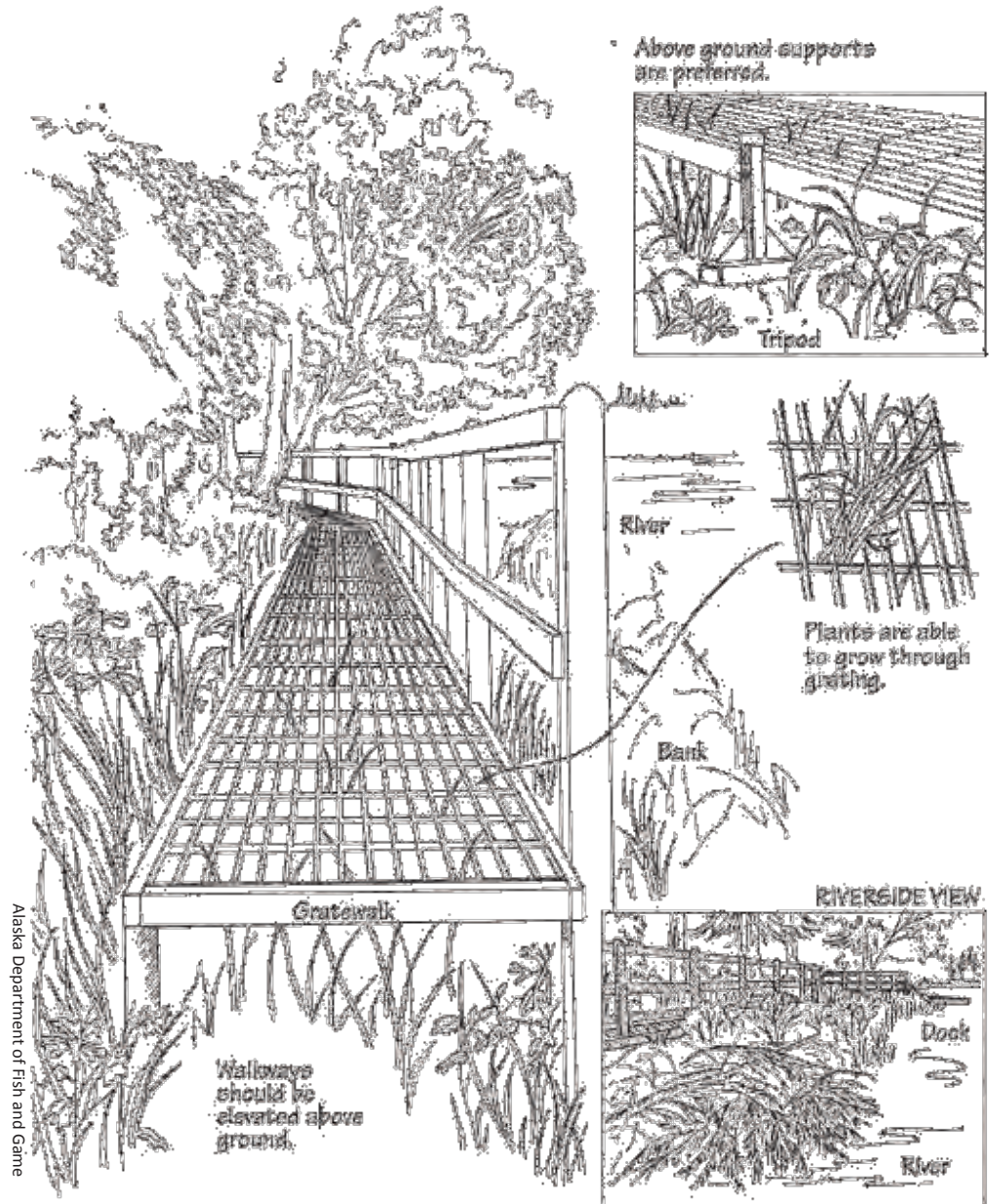
Docks and Walkways

- ✦ Dock area should be as small as possible while still allowing for dock activities.
- ✦ The ideal dock width is a maximum of 6' (1.8m) wide, allowing for maximum light penetration from the sun, thus optimizing production capacity of aquatic species.
- ✦ Use grated deck with openings that allow maximum light penetration, thus maximizing production capacity for aquatic species.
- ✦ Do not use vertical planking or 'skirts' along the sides of the dock that extend to the water, this reduces the amount of light that is able to reach the nearshore area.
- ✦ Use untreated wood, or be very selective about the preservatives used on any lumber that will have contact with the water. For decking material consider metal, fiberglass or plastic grating, or naturally rot-resistant wood. Some options include Douglas Fir wood or galvanized steel piles.
- ✦ Recognize that any chemical applied to the dock may end up in the lake, no matter how careful you are.
- ✦ Ensure that disturbance is minimized and any potential spills are prevented during the construction process. Do the work at a time of the year that is not destructive to fish species. Many in-water activities are prohibited at certain times of year. In-water work construction timing windows are determined by the Ministry of Natural Resources.
- ✦ Ensure all permits are in place prior to starting work.
- ✦ Build the least destructive option that will suit the shoreline landowner's needs

Walkways & Paths

Choose a meandering trail to access the dock (and the water) that angles across the property instead of a straight path. Cover the trail with bark chips or pea gravel instead of concrete to allow rainwater to infiltrate the soil instead of running off. This type of trail will also look more natural.

An **elevated light-penetrating walkway** is another great option for the shoreline. Design it so the spaces between the wood slats or grates are large enough to allow rain and sunlight to penetrate below. This will protect the vegetation on the slope and provide a sheltered area for frogs, toads, etc. Also, to ensure the walkway does not encourage erosion, install it on posts instead of cut into the slope.



Construction Best Management Practices (BMPs)

Materials

- Avoid the use of non-natural materials such as concrete, broken concrete, metals, plastics, etc.
- Use only un-treated timber. In areas prone to wetting and drying use cedar, hemlock, or spruce timber which are more resistant to rotting.
- Existing beach or lakebed substrate (e.g. rock, cobble, gravel or sand), should not be used as fill and/or backfill for the proposed works. Excess fill (soil) BMP's are available from the Ministry of Environment. Removal of substrate or woody debris may cause damage to fish habitat, which is protected under the federal Fisheries Act.
- Stockpiled materials should be stored and stabilized away from the water in designated areas outside the floodplain.



Re-grading the Slope

- Stone protection for the toe of bank may be permitted lakeward if there is a demonstrated need while consideration should be made to whether the materials provide suitable fish habitat.
- Works should improve or maintain wildlife access to the lakeshore. A sloping shoreline allows amphibians and reptiles to move between the lake and upland areas.
- Final grading should ensure positive drainage towards the lake with no depressions that may result in fish stranding.



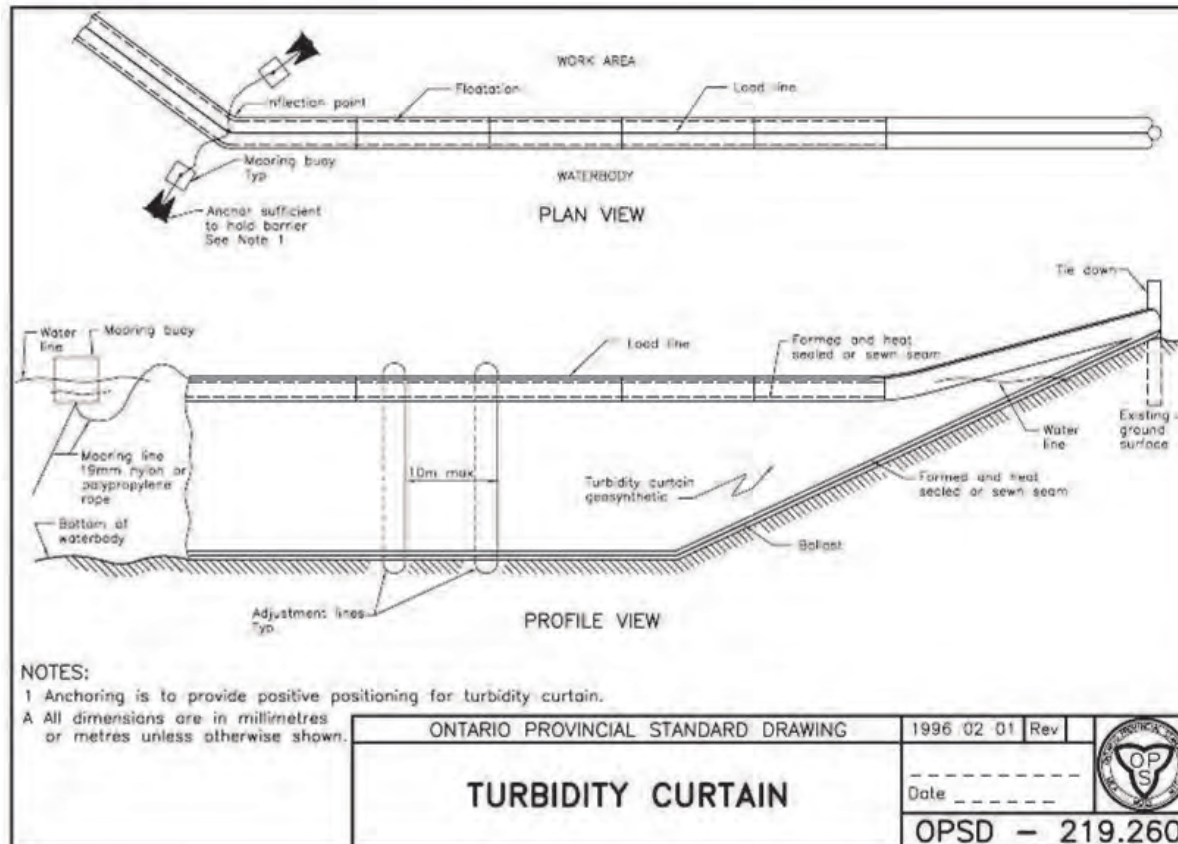
Ontario Streams

Equipment

- Any part of approved equipment entering the water should be free of fine particulate matter and free of fluid leaks and externally cleaned and degreased to prevent any deleterious substance from entering the water.
- No equipment refuelling or servicing should be undertaken within 25 metres of any watercourse or surface water drainage. Vehicle and equipment re-fuelling and maintenance should be conducted 25 metres away from the water in a controlled manner to prevent fuel spillage.
- All equipment operating near the water should be equipped with a spill kit.
- In the event of a spill, contain and clean up the spill and notify the Ontario Ministry of Environment Spills Action Centre at 1-800-268-6060.
- No vehicle should enter the bed of the lake.
- All materials and equipment used should be operated and stored in a manner that prevents any deleterious substance (silt, fuel, etc.) from entering the water.

Sediment & Erosion Control

- Minimize the area of disturbance by delineating the work area with erosion and sediment control measures and snow fencing or similar barriers.
- Sediment and erosion control measures (silt fencing, floating turbidity curtains, etc.) should be installed prior to the commencement of work and maintained during the work phase to prevent entry of sediment into the water.
- After construction is completed, it is recommended to mulch with straw to minimize soil erosion and limit the potential for weeds and invasive plants to establish.



- Develop an erosion and sediment control plan to limit erosion of disturbed soils and prevent transmission of sediment into the lake. Measures may include silt fencing, straw bales and floating turbidity curtains. Refer to the Ontario Provincial Standards Drawings for more information (available online):
 - ⇒ OPSD 219.100 Light-duty straw bale barrier
 - ⇒ OPSD 219.110 Light-duty silt fence barrier
 - ⇒ OPSD 219.130 Heavy-duty silt fence barrier (shown on page 30)
 - ⇒ OPSD 219.260 Turbidity curtain (shown on this page)
 - ⇒ OPSD 219.261 Turbidity curtain, seam detail
- All sediment and erosion control devices must be removed after completion of the works and upon natural stabilization.
- Refer to references for a link to detailed installation instructions.



Turbidity curtain must ensure sediment does not leave work area.

Jurisdictions

AGENCY JURISDICTIONS

SRCA—Regulated Areas

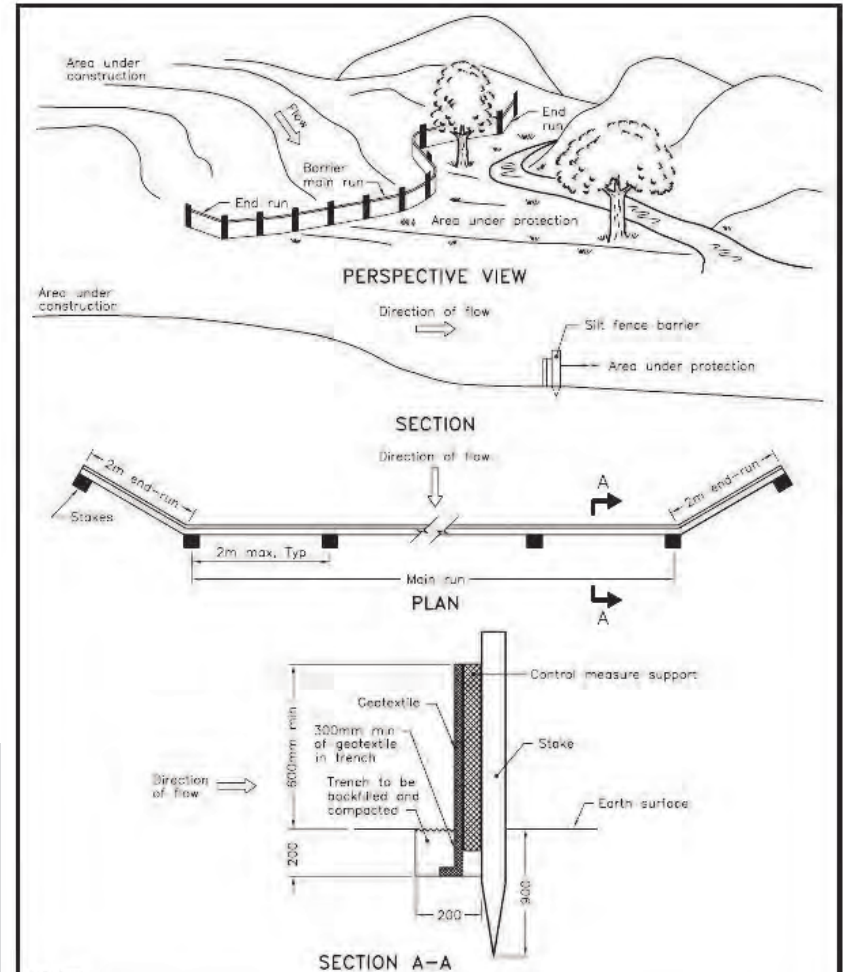
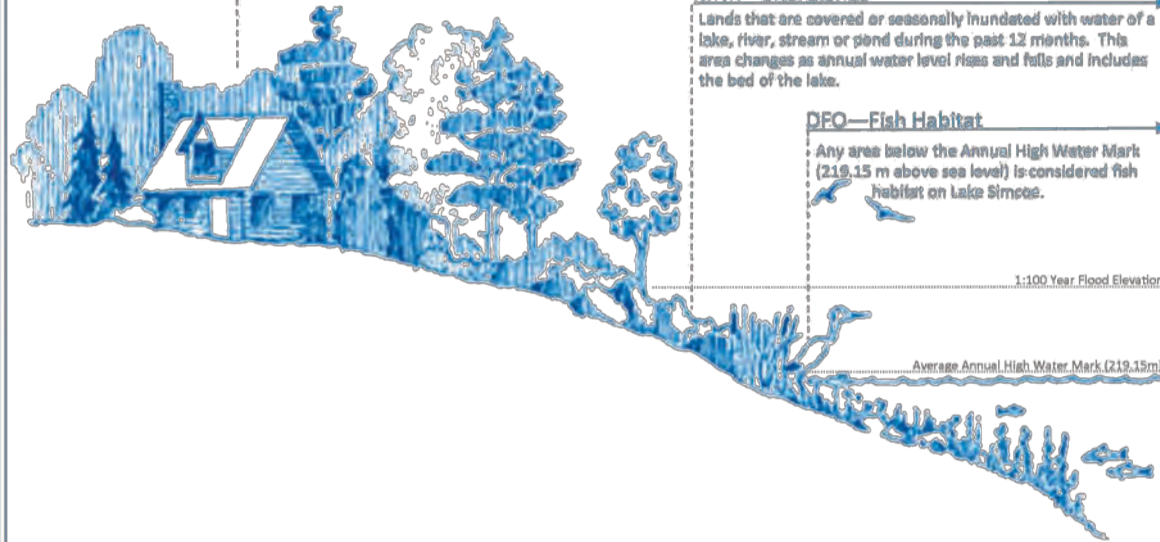
Regulated areas are lands adjacent or close to the shorelines of Lake Simcoe and its tributaries that could be affected by flooding, erosion or dynamic beaches.

MNR—Shorelands

Lands that are covered or seasonally inundated with water of a lake, river, stream or pond during the past 12 months. This area changes as annual water level rises and falls and includes the bed of the lake.

DFO—Fish Habitat

Any area below the Annual High Water Mark (219.15 m above sea level) is considered fish habitat on Lake Simcoe.



NOTE:

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2006 Rev 1

HEAVY-DUTY
SILT FENCE BARRIER

OPSD 219.130



IT IS YOUR RESPONSIBILITY TO MAKE SURE NOTHING GETS INTO THE LAKE. Install appropriate sediment and erosion controls and continuously monitor to ensure effectiveness.



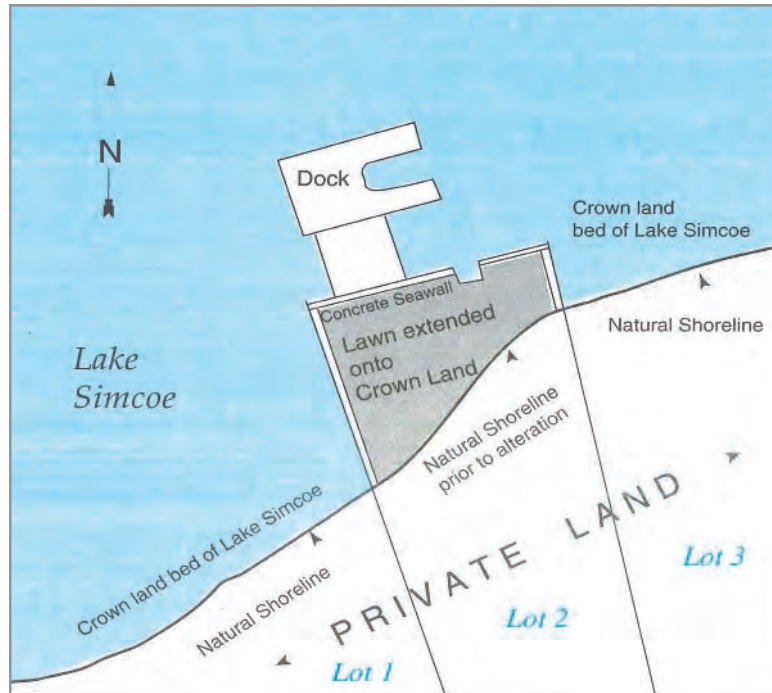
Shoreline Land Ownership

Who Owns the Shoreline?

Be aware of the fundamentals of shoreline ownership, as you conduct a project. Generally, most properties are deeded to the naturally occurring “water’s edge” of a lake, stream or river which may fluctuate seasonally and over time.

In most cases, land under water is provincial Crown land which is managed by the Ministry of Natural Resources. There are a few exceptions which include harbours managed by the federal government or a municipality, navigational channels and canals (e.g. Trent-Severn Waterway), private water lots, and canals dredged onto private land.

It is necessary to refer to both the property survey and deed to determine the extent of a property. In some cases there may be land located between the present water’s edge and the water’s edge as shown on the survey or a registered plan.



A section of this natural shoreline has been extended into the Crown land bed of Lake Simcoe.

Natural Accretion vs. Filling

It is possible that land has been filled onto the bed of Lake Simcoe or may have accreted to the lot. Accretion, if it were built up slowly and imperceptibly over a long period of time would become part of the adjoining lot. Land that has been created by filling on the lakebed may be filled Crown land. In order to determine the location of the Crown/ Private land boundary, a Reference Plan of Survey would have to be prepared by an Ontario Land Surveyor.

The Geese

Identify potential nesting and rearing sites as soon as they arrive (can be as early as February). Once the birds have begun moulting their flight feathers (early June), they can be extremely reluctant to change locations. Habitat modification may be necessary along with seasonal deterrents to discourage the geese over time.



Modify the Yard – Geese prefer areas that have good visibility, easy access to water, and short grass to eat. This makes a manicured lawn leading up to the water’s edge an ideal location for geese. Leave an unmowed buffer of trees, shrubs, grasses and wildflowers along the water’s edge to make the property less appealing to the geese.

Obstruct Access – Obstruct the access to the lawn by constructing barriers along the shoreline. Natural barriers could include densely spaced bushes, trees, or shrubbery. Placing low fences marked with highly visible material such as shiny Mylar tape at both goose and gosling levels can repel geese.

Use Scare Tactics – Deter the birds from settling on the property by disturbing them as soon as they arrive by using noisemakers, recorded distress calls, strobe lights or trained dogs. Landowners must make sure they vary the sequence and techniques so the birds do not adapt.

Keep in mind it is illegal to disturb, damage or destroy the nest or eggs of Canada Geese.

Permits & Approvals

Timing Tips

There are periods during the year when in-water works pose a reduced risk to fish communities dependent on their thermal requirements (i.e. coldwater and warmwater fish communities) and the Ontario Ministry of Natural Resources can provide guidelines for in-water works timing, depending on the nature and location of the work. Recent changes to both the Federal Fisheries Act and the Provincial Public Lands Act put greater responsibility on the proponent planning the in-water work. However, it is recommended and encouraged that any questions regarding the timing of in-water works be directed to the appropriate MNR district.

Please note: It is the responsibility of the applicant to contact all applicable regulatory agencies and comply with all existing laws and regulatory requirements. Applicants need to be aware that approvals may also be required from other agencies as well, such as municipal building permits, conservation authority permits and Department of Fisheries and Oceans approvals related to fisheries habitat. Approval from one agency does not guarantee approval from another agency.

Construction should occur during low water and good weather conditions (low winds and low rainfall) and be completed as quickly as possible.



Step ONE Design Project

- Make sure to design all work on the property and do not interfere with the neighbour's use and enjoyment of their waterfront. Better still, include the neighbour in the discussions.
- Consider shoreline type and alternatives (relocate, redesign, mitigate) that will result in the least impact to the physical and natural processes.

Step TWO Contact Agency Staff

- Contact Conservation Authority (CA) and/or Ministry of Natural Resources (MNR) staff to obtain advice on how to proceed before designing the project and submitting the application.
- This should be done well in advance of the planned start date as some sites will have specific timing windows for construction (refer to bottom of page).

Step THREE Complete & Submit Application if required

- If permit is required, provide project details and supplementary information to appropriate agency.
- Complete appropriate application(s) or online registration (if applicable) and provide contact information, location and project description.
- Proponents are required to self-assess whether their projects require a review by the Department of Fisheries and Oceans (DFO) for any Fisheries Act requirements. In this regard, further information can be obtained at DFO's website <http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>, or by phone (1-855-852-8320) or by email fisheriesprotection@dfo-mpo.gc.ca.
- Prepare site plan and location map.
- Submit complete application with copy of deed or latest tax bill.
- Prepare the site for a visit by staking the location and perimeter of all proposed works so it can be easily located and reviewed.

Step FOUR Agency Review if required

- The application is reviewed by the CA and/or by MNR staff (if applicable) and field inspections may need to be conducted when there is no snow and ice cover.
- If the project is approved, a permit will be issued with conditions to be followed.
- Review the permit and work within the time line allowed and keep a copy of the permit on site during construction.

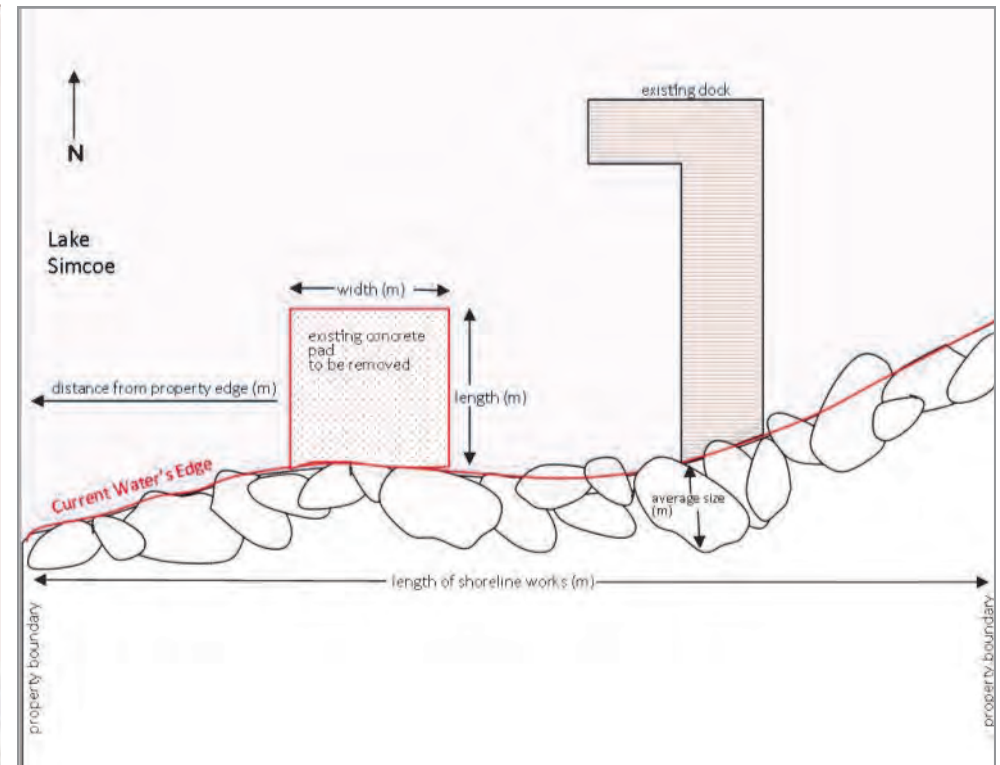
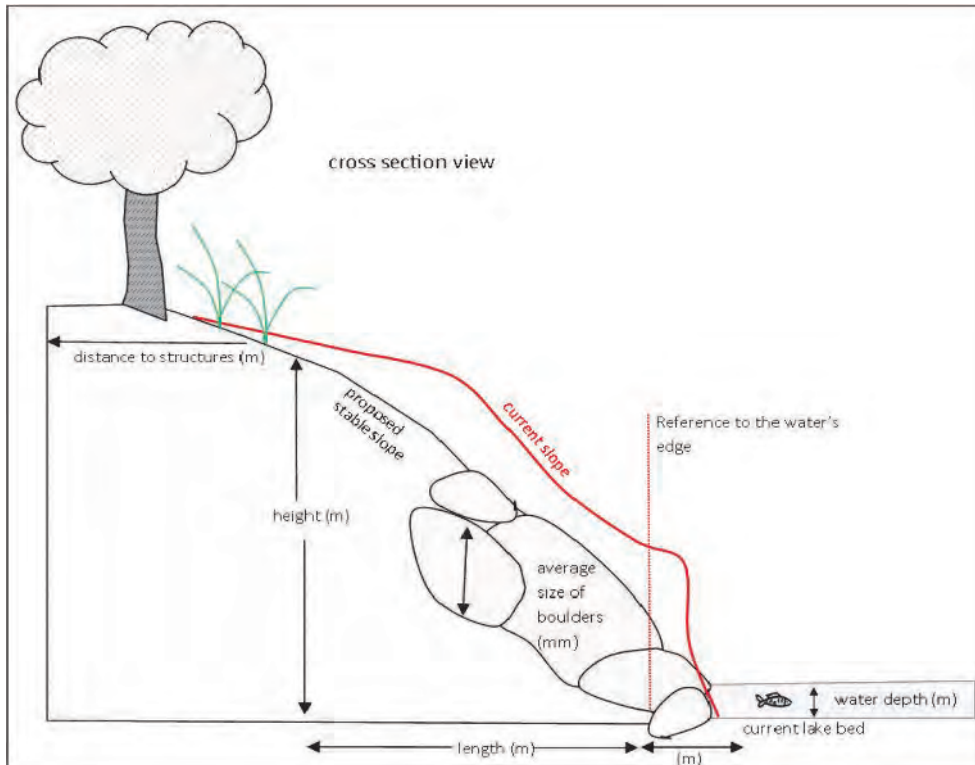
Step FIVE Mitigation & Construction

- Install construction mitigation measures and apply other permit conditions.
- Make sure to construct all work according to the plan and applicable permit conditions.

Tips for Getting Permits & Approvals

- These rules and regulations change over time to reflect changes to the environment and government policy. Therefore, consulting the experts on the following list (page 34) for information, advice and direction is time well spent.
- Before starting a project, ask whether work is absolutely necessary, what alternatives are available and if it's better to do nothing or just keep it natural. It's best to not undertake changes to the shoreline unless you are attempting to restore the shore.
- **Contact staff from the approval agencies as early as possible in the planning stage of the project to determine project feasibility, if permits are required, and the approximate timeline for permit issuance.**
- Submit everything at once, and make sure the application is complete and accurate
- Include photographs when submitting the application
- Most agencies have application packages that outline what items must be submitted with a completed application form. Taking time to read these carefully, and being aware of what will be required from each agency for the project may save time and unnecessary frustration. Additionally, submitting a complete application will allow the application to be processed as efficiently and quickly as possible. Submission of incomplete or inaccurate applications is one of the main reasons approval processes may take longer than expected.
- **Apply for permits well in advance of when you wish to do the work. The permit processes from various agencies can take time, and may involve site inspections or further consultation.**
- Although staff will help ensure a coordinated review by letting you know which other agencies you will need to apply to and circulating approvals, keep in mind that the landowner is ultimately responsible to ensure all permits are in place prior to conducting work.

Sample permit drawings—cross section (side) shown on left, and plan (top) view on right.



Contact Information



| | |
|---|--|
| Fisheries and Oceans Canada (DFO) www.dfo-mpo.gc.ca | Fisheries Protection Program, 867 Lakeshore Road, P.O. Box 5050, Burlington, ON, L7R 4A6, Phone: 1.855.852.8320, Fax: 905.336.6285 |
| Ontario Ministry of Natural Resources (OMNR) www.mnr.gov.on.ca | Aurora District - 50 Bloomington Road, Aurora, ON L4G 0L8, Phone: 905.713.7400, Fax 905.713.7361 |
| | Bancroft District - 106 Monck StPO Box 500, Bancroft, ON, K0L 1C0, Phone: 613-332-3940 Fax: 613-332-0608 |
| | Midhurst District- 2284 Nursery Road, Midhurst, ON L0L 1X0 Phone: 705.725.7500 Fax: 705.725.7584 |
| | Peterborough District - 300 Water Street, South Tower, Floor 1, Peterborough, ON K9J 8M5 Phone: 705-755-2001 Fax: 705-755-3125 |
| Lake Simcoe Region Conservation Authority (LSRCA) www.lsrca.on.ca | 120 Bayview Parkway, Box 282 Newmarket, ON L3Y 4X1 Phone: 905.895.1281 or 1.800.465.0437 Fax: 905.853.5881 |
| Transport Canada / Marine Safety | 28 Waubeek Street, Parry Sound, ON P2A 2X4 Phone: 705.774.9095 |
| Local Regional Government | Contact the local municipality |

*For areas outside of Conservation Authority jurisdiction, contact the local MNR Office.

Resources

A Landowner's Guide to Managing and Controlling Invasive Plants (Ontario Invasive Plant Council)
<http://www.invadingspecies.com/resources/landowners-guide-managing-controlling-invasive-plants/>

Agriculture and Agri-Food Canada. Plant Hardiness Zones in Canada. <http://sis.agr.gc.ca/cansis/nsdb/climate/hardiness/index.html>

Along the Shore—A Landowner's Guide to Healthy Shoreline Management for Lake Simcoe (Ministry of Natural Resources)
http://www.ourlakesimcoe.com/pdf/shoreline_publication.pdf

Canada Geese in Southern Ontario: Seasonal deterrent techniques for lakeside home and cottage owners (Environment Canada)
www.on.gc.ca/wildlife

Fisheries and Oceans Canada (DFO) Resources www.dfo-mpo.gc.ca/
The Shore Primer <http://Library/337924.pdf>
The Dock Primer <http://www.dfo-mpo.gc.ca/Library/337919.pdf>
Fish Habitat Fact Sheets (Building a Beach, Boathouses and Boat Launches, and Bioengineering)
<http://www.dfo-mpo.gc.ca/regions/central/pub/factsheets-feuilletsinfos-on/index-eng.htm>

Green Shorelines: Bulkhead Alternatives for a Healthier Lake Washington (City of Seattle, Department of Planning and Development)
<http://www.govlink.org/watersheds/8/action/greenshorelines/default.aspx>

Growing Native Plants Selection Guide (York Region)
<http://www.waterfortomorrow.ca/en/athome/landscapedesign.asp>

Lake Simcoe Stewardship Guide: Self-assessment for your environmental performance as a property owner (University of Guelph & Ontario Ministry of Natural Resources)
http://www.ontariostewardship.org/councils/lakesimcoe/files/Lake_Simcoe_Guide_PRINT_COPY_May_20_2010.pdf

Lake Simcoe and Lake Couchiching—Mary Byers (1999)

Management of Excess Soil - A Guide for Best Management Practices (Ministry of Environment)
http://soiil.com/news/files/STDPROD_110253.pdf

Ministry of Transportation Resources—erosion and sediment control: <https://www.raqsa.mto.gov.on.ca/techpubs/ops.nsf/wv?OpenView&Start=1&Count=1000&Expand=3&RestrictToCategory=Volume%203#3>

Native Plants for Wildlife Habitat and Conservation Landscaping—Chesapeake Bay Watershed (U.S. Fish and Wildlife Service).

Ontario Invasive Species Strategic Plan (Ontario Ministry of Natural Resources) http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@biodiversity/documents/document/stdprod_097634.pdf

Ontario Streams Rehabilitation Manual (Ontario Streams)
http://www.ontariostreams.on.ca/rehabilitation%20_manual.html
On the Living Edge: Your Handbook for Waterfront Living (Sara Kipp & Clive Callaway)
<http://www.livingbywater.ca/prodservices.html>

Restore Your Shore (Minnesota Department of Natural Resources)
www.dnr.state.mn.us/restoreyourshore/index.html

State of the Shoreline (Ministry of Natural Resources) : <http://www.mnr.gov.on.ca/en/Business/LIO/index.html>—search for “Lake Simcoe Shoreline Inventory 2008/2009 “

Streambank Revegetation and Protection—A Guide for Alaska—Alaska Department of Fish and Game
<http://www.adfg.alaska.gov/index.cfm?adfg=streambankprotection.main>

The Green Book for the Buffer—An illustrated guidebook for planting at the shoreline—Adkins Arboretum and the Critical Area Commission for the Chesapeake and Atlantic Coastal Bays

The Identification of Best Management Practices for the Naturalization of the Lake Simcoe Shoreline (W.F. Baird & Associates Coastal Engineering Ltd.)

Understanding, Living With & Controlling Shoreline Erosion, Third Edition (Tip of the Mitt Watershed Council)
<http://www.watershedcouncil.org/resources%20and%20publications/>

“... [No other place]... will stand in comparison with the smiling beauty of the waters,
shores and bays of Lake Simcoe...”

Stephen Leacock
(Lake Simcoe and Lake Couchiching)