

Shoreline Stabilization Techniques

Soft vs. Hard Armoring

The shoreline is a valuable and important area to land owners, recreation users and wildlife. It provides a rich habitat for fish and other animals, filters water runoff before it enters the water body and provides us with a nice place to fish, walk and enjoy nature. Naturally occurring vegetation found on the shoreline dampens wave energy and can protect against erosion from water, ice, and wind. When riparian vegetation, rocks or logs are removed below the high water mark, the risk of erosion increases because these elements provide a very strong natural line of defence. Once they are removed, the land is exposed and becomes more vulnerable to becoming an erosion zone. Changing the natural process of erosion affects our natural resources, water quality, ecosystems' health and can result in major property loss.

“Soft”
Armoring



“Hard”
Armoring

“Soft” Armoring

Erosion experts are learning that the most successful and least costly approaches to dealing with erosion problems involves **mimicking nature's own design** and using native vegetation as much as possible. Soft shore techniques help to maintain wildlife habitat, reduce sediment erosion, filter runoff, and protect water quality. Re-vegetation in the case of bare lawns and shorelines is an effective method to prevent against low to moderate erosion. The planting of trees and shrubs helps to remove water from slopes through the uptake and transpiration of water. Shallow roots hold soil in place to allow the establishment of deeper rooted shrubs and trees. These deeper roots prevent soil slippage by taking up water that is deep in the soil. Grasses are useful to slow, filter, and take up excess runoff water. They also protect the soil from the erosive forces of rain. Aquatic plants provide fish with spawning

habitat and dissipate the energy of waves against the shoreline. By planting native species along your shoreline, you are creating a “living barrier” of protection that blends into the surroundings and creates a natural look. In steeper locations, consider using live palisades, living fences of thick stakes planted deep into the ground in combination with rocks and logs for practical and aesthetic purposes. Many of the materials needed for soft shore techniques can be obtained locally and installed with light weight equipment, saving you money and the potential damage caused by heavy machinery. Soft shore armoring is a successful long-term method of addressing the erosion concerns that led to shoreline armoring while at the same time restoring degraded habitat.

Choose a Native Species

Trees, shrubs and perennials that are adapted for the climate and growing conditions in the area are essential for making soft shore protection work. Native plants root easier, grow well, require little maintenance and won't outcompete the other vegetation in the area like an invasive species might. You can obtain plants by rescuing them from sites under development, starting them from seed or buying them at a local native plant nursery. Choose healthy plants that are at least two years old, native to your area and elevation and of species appropriate for your site or purpose. The best time to plant is during the spring because the plant material is still dormant. Consult your local nursery or conservation group to find out other recommendations.

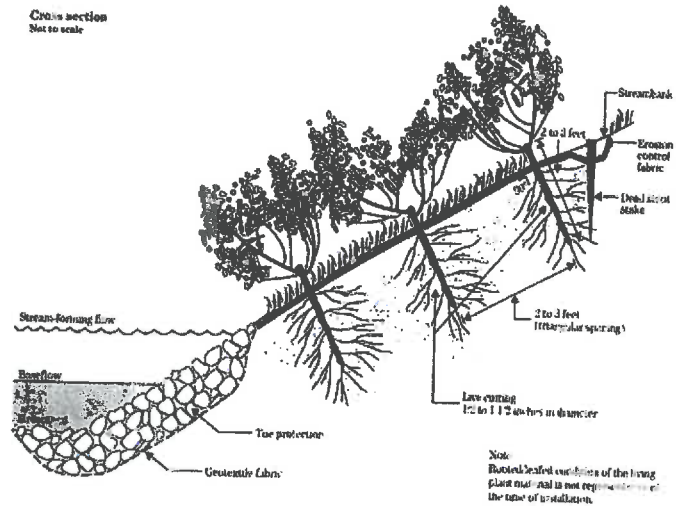
Using Logs and Rocks

Rocks and logs are an integral part of soft armoring that is really about following Mother Nature's example. When trees fall onto a bank or into the water, it acts as a nursery for many plants and wildlife species as it decays. It also helps to stabilize the shoreline and bank by obstructing the movement of runoff and the action of waves on the shore. By placing logs in strategic locations we too can protect the shoreline and make it look natural. Specifically placing rocks in certain locations can help to save banks at drainage outfalls or gullies, break the force of waves and provide shelter for fish and other wildlife. Rocks and logs help anchor plantings and speed up the naturalization of your shoreline.

Live Staking

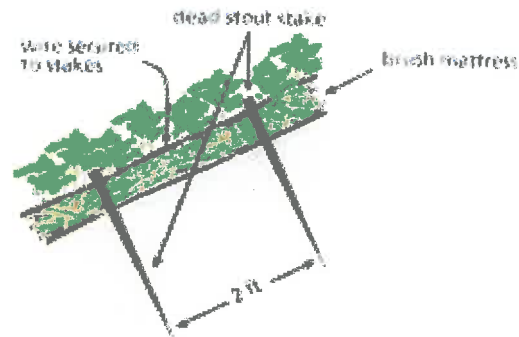
Slopes with light erosion can be used in conjunction with other methods for areas with heavier erosion. Normally live staking can be installed to anchor wattles (bundled live fascine) to provide deep root vegetation with the potential of favorable moisture retention. Wattles are also useful for the capture of sediment, organic matter and seed that is carried by the runoff. This method can be done by taking woody plants that are native to the area and driving them into the dirt or substrate of the eroded area so they can sprout roots and grow. Live staking is

relatively low cost and can be easily done by the landowner.



Brush Mattress

A brush mattress consists of a thick (15 to 30cm) blanket of living cuttings and soil fill that is placed on a stream bank or lake shore to simultaneously re-vegetate and armour the bank. This method works well on badly eroded slopes because the dense layer of brush increases roughness, reduces velocities at the bank face and protects the bank from scour. As the live branches root and grow, they provide cover and reinforcement for the soil underneath. If these mats are used on stream banks, they trap sediments during high water and eventual plant growth will enhance aquatic habitat. This method is relatively cost effective but can be quite labour intensive depending on the area.



Vegetated Rip-Rap

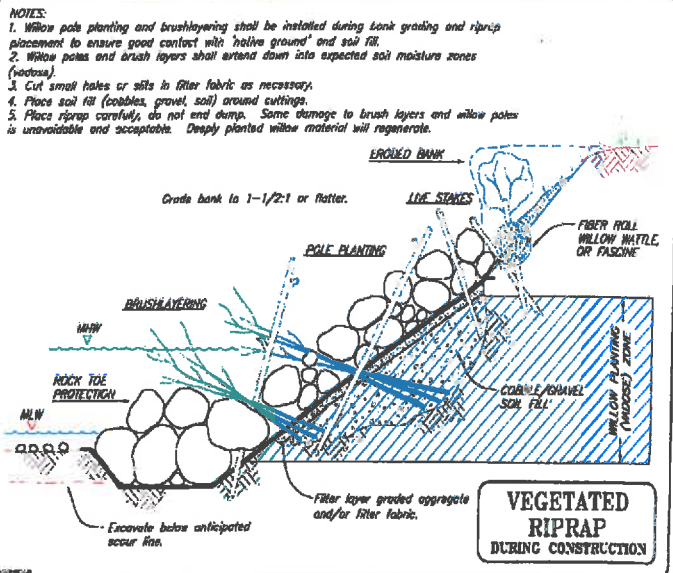
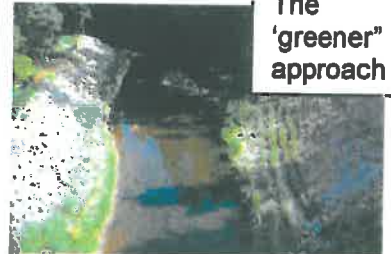
Vegetated Rip-Rap combines the rock revetment techniques with vegetative techniques. It consists of a layer of stone or boulder armoring that is vegetated using pole planting, brushlayering and live staking. This technique works best for waterways or inland lakes where continuous and resistive bank protection measures are needed. Plants incorporated into the riprap will create a more natural look to the shoreline as well as create habitat for aquatic and terrestrial wildlife. Although an expensive and sometimes difficult method to implement depending on the land, this option offers an opportunity for the land owner to attain the immediate and long-term protection afforded by riprap with the habitat benefits inherent with the establishment of a healthy riparian buffer.

problem alone. This technique is often more expensive than soft shore techniques and requires the use of heavy equipment which is more likely to cause damage to the surrounding area. It is also more difficult to obtain approvals for these types of solutions. Consult with the Association of Professional Engineers, Geologists and Geophysicists of Alberta for suitable advice and techniques available. New techniques such as "green gabions" are available to mix a hard approach with live plants and may be useful for updating already existing retaining walls or other forms of hardened shoreline modifications.

BEFORE



AFTER:
The
'greener'
approach



Revetments

Shorelines can be protected against erosive wave action by placing rocks or other inert material against the bank. This type of protection is called a revetment. Flexible revetment structures include riprap and Gabions. Rip-rap consists of large washed stones or gravel placed on a slope or artificially graded shore and usually placed to protect underlying soil from erosion due to flowing water. Although this method is relatively easy to install for smaller areas, it can be expensive, may require the use of heavy equipment and doesn't have the same ability as plant roots to keep soil firmly in place. Gabions are rectangular wire mesh baskets filled with large washed rocks. Gabions are best for areas without much foot traffic and when an area to be protected is usually already severely eroded or you want to direct the force of a flow of water around a vulnerable structure.

Hard" Armoring

In certain situations, soft armoring techniques may not be enough. These "harder" solutions are only approved in situations where erosion risk is very high. The use of human-made structures alone, such as solid concrete or rocks in cages, use to be the control method of choice. Experience has shown that these methods are difficult to implement successfully and if improperly designed or installed may be worse off than just leaving the

Bulkheads and retaining walls

A naturally occurring slope is usually gradual and will absorb the energy of the waves but when bulkheads and retaining walls are installed, they cause waves around it to crash into shore. A lot of the energy from these waves

is sent downwards into the base of the wall causing the substrate to slowly be dug out from under the wall's foundation eventually leading to it tumbling into the water. Furthermore, water draining from upland will build up behind the wall and push on it from behind which can be a problem especially during freeze-thaw cycles. The construction of bulkheads or retaining walls can also pose problems to neighbours' properties as it increases erosion rates on either side of it. From an environmental standpoint, retaining walls are by far the **most destructive method** of stabilization because natural vegetation that provides feeding grounds and

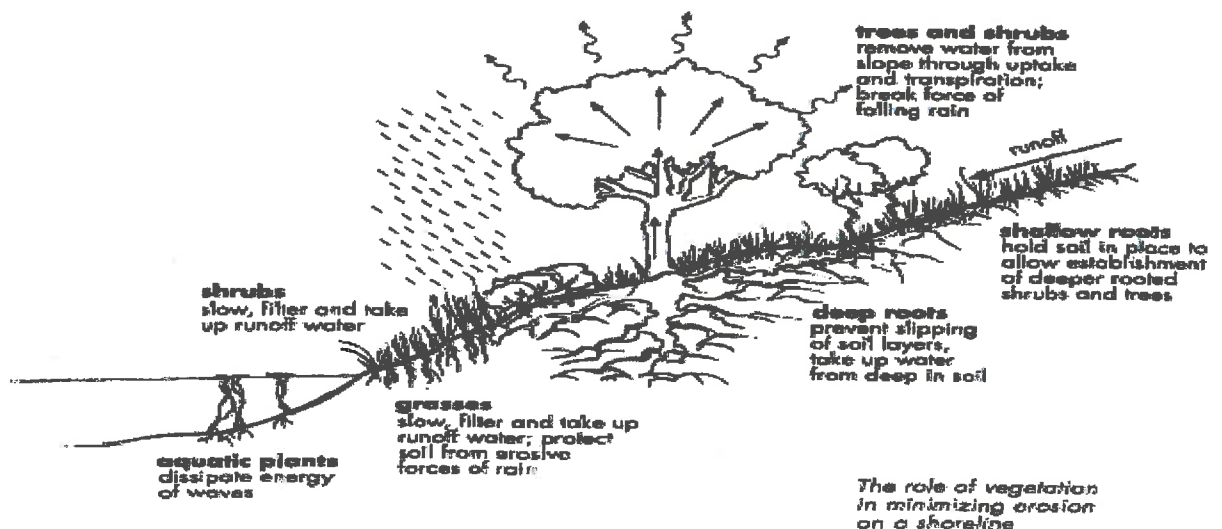
shelter for Wildlife is cleared and built over. Retaining walls are also the most expensive and troublesome because they require constant maintenance and only provide a quick fix for a short period of time. **Rigid structures, such as retaining walls are not recommended by Alberta Environment and Parks except in public uses areas such as marinas.** You must obtain a permit for your erosion control project and it should include advice for designing and installing revetments where needed.

Recommended Shoreline Protection Methods

For the best chance of protecting your shoreline now and in the future we recommend the use of "softer" approaches over "harder" ones. These methods are not only more cost efficient for both install and maintenance but also more durable, aesthetically pleasing and environmentally friendly. These methods will help create a healthy riparian zone on your land and allow the shoreline to blend in with its natural surroundings. Plants and trees provide the best natural protection for the long run and by planting them early or leaving already existing ones alone you avoid potential costly and unfixable property loss. The most favorable soft approaches, such as the ones listed above, as well as others including: erosion control fabrics, hydroseeding, mulching and topsoiling are only just some of the ways you can help keep your shoreline as natural as possible and protect it from erosion.

Controlling shoreline erosion and doing work in and around a water body will generally requires at least two provincial approvals (Public Lands Act, Water Act), and possibly approval from Fisheries and Oceans Canada (federal Fisheries Act or Navigable Waters Protection Act). **Check to make sure you have all the required approvals and plans before you start doing any work on your shoreline!** For more information please check out our website:

<http://aep.alberta.ca/land/shorelands/approvals-regulatory-requirements.aspx>



Public Lands Act and Water Act: Shoreline/Water Body Modifications Facts at Your Fingertips

This fact sheet provides information on the requirements under the *Public Lands Act* and *Water Act* prior to undertaking shoreline modifications.

- [Public Lands Act](#)
- [Water Act](#)

Legislative Requirements

Several legislative requirements apply to making changes to the bed and/or shore of any water body, or an area below the high water mark, of natural water bodies. A disposition under the *Public Lands Act* along with a *Water Act* approval is generally required prior to commencing any work within the bed and shore or within a water body.

Activities that require a disposition under the *Public Lands Act* and approval under the *Water Act* include, but are not limited to:

- Beach construction and maintenance
- Erosion protection or bank stabilization
- Permanent boat launches and marinas

A joint application for a shoreline modification project is required to be submitted electronically through Electronic Disposition System (EDS) in order to obtain authorization under both the *Water Act* and *Public Lands Act*. Applicants are required to submit their joint application electronically through the EDS.

- [Electronic Disposition System](#)

Work in or near water bodies may also require authorization or consideration of:

- Conservation and reclamation under the:
 - [Environmental Protection and Enhancement Act](#)
- The local municipality under the:
 - [Municipal Government Act](#)
- Federal legislation, including:
 - [Fisheries Act](#)
 - [Migratory Birds Convention Act](#)
 - [Navigation Protection Act](#)

Modifications to shorelines can result in the direct or indirect loss of valuable fish and wildlife habitat. They also have the potential to prevent public access along a shoreline. Poorly designed or constructed modifications can contribute to shoreline erosion problems.

Water Act Exemptions

Activities that are exempt under the Water (Ministerial) Regulations from the requirement for approval under the *Water Act* include:

- Seasonal piers and seasonal docks
- Fences
- Portable pump and supply line

Recommendations

Alberta Environment and Parks (AEP) recommends using "softer" approaches for your shoreline protection. These methods can be more cost efficient (having lower maintenance costs), are more durable and resilient,

aesthetically pleasing, and environmentally friendly to the commonly used "hard" or structural methods. Prior to submitting an application, proposed preventive measures may be discussed with regional department staff to determine what authorizations are required.

To learn more about the preservation and restoration of the natural state of Alberta's lakes and shore lands, visit our website:

- [Lakeshores](#)

Application Requirements

To be considered complete, an application must include the following information requirements:

- (a) A sketch plan of the proposed activity that meets the Content requirements for Disposition Plans.
 - [Survey/Sketch Plans](#)
- (b) A location plan must show:
 - (i) Proposed works in relation to property lines
 - (ii) If applicable, any municipal reserve lands between the applicants property and the water body
 - (iii) Location of proposed works and the present, highest, and lowest known water levels
 - (iv) If applicable, dimensions of the site (e.g. outer boundary of the area required to enclose the installation)
 - (v) Minimum plan size 21.5 cm x 28 cm
- (c) Cross sections must show:
 - (i) Existing conditions and proposed modifications
 - (ii) Relevant measurements
 - (iii) Minimum plan size 21.5 cm x 28 cm
- (d) A letter stating:
 - (i) What the proposal is
 - (ii) Why it needs to be done
- (e) If available, a photograph, or copy of a photograph, showing the existing shoreline

Note: A development permit may be required from the local authority where the proposed activity may involve the use of Municipal Reserve lands.

For more complex proposals (i.e. erosion protection works) we may request a report to address engineering details. Issues outlined in the Administrative Guide for Approvals to Protect Surface Water Bodies under the *Water Act* must also be addressed.

- [Administrative Guide for Approvals to Protect Surface Water Bodies Under the Water Act](#)

Application for proposals that involve high environmental risks may require a detail study of the environmental impacts resulting from the proposed project. The report, depending on the nature of the environmental issues, must be prepared and signed off by a subject matter expert(s) in that area of concern.

A public notice of the application will likely be required and the concerns of people affected by the project must be addressed.

Enforcement

Under the *Water Act*, anyone who conducts an activity in a water body without an AEP approval, or diverts water without a licence, may face enforcement action with a fine up to \$50,000 for an individual, and \$500,000 for a company or organization.

Enforcement actions under the *Public Lands Act* can also result in financial penalties. Administrative penalties range from \$250 to \$5,000 for a contravention (and each day the contravention continues). Penalties for offences under the Act can result in fines ranging from \$25,000 - \$100,000 for an individual, and \$100,000 - \$1,000,000 for a corporation.

Part II – Supporting Information to Accompany Application Form

Note: Applicants are encouraged to review documentation referenced below. Applications that do not meet the information requirements may be returned.

Authorizations issued under the Water Act are available here on the department Authorization Viewer on our website: <http://aep.alberta.ca/land/land-industrial/programs-and-services/authorization-viewer.aspx>

1. Is this a new application? Yes No
2. If no, is this an update or resubmission? Update Resubmission

Application Resubmission	Date Issued	Expiry Date
Previous Water Act #		
Previous TFA #		

3. Provide a general description of the project and the work involved:
4. Do you own the land next the water body where the activity will occur? Yes No
5. If no, has the registered landowner/disposition holder provided written access consent? Yes (if yes, attach a copy) No
Note: Applications without written consent from the landowner/disposition holder will not be accepted.
6. Will you be crossing or accessing a Municipal Reserve or Environmental Reserve to access the water body?
 Municipal Reserve Environmental Reserve Both
7. Describe the siltation and erosion prevention measures you propose to use in order to minimize adverse impacts to the water body, fish and the aquatic environment (i.e. silt fences, diversion structure, isolation):
8. Describe your plans for soil management and reclamation during construction (topsoil stripping, salvage, handling and stockpiling):
9. Describe your post construction reclamation plan:
10. Describe what equipment will be used, what land or properties it will cross, and if it will be entering the water body:

Debris Removal

1. Describe the material to be removed. Identify any of the following (i.e. trees, rock, building materials, silt muds, potentially hazardous materials such as fuel slip tanks, propane tanks, vehicles):
2. Method of removal (explain how works will be conducted, including equipment to be used):
3. Will sand, rock or gravel material removed from the water body remain on site (reconstituted)? Yes No
4. Will the sand, rock or gravel material be removed from the site? Yes No
5. Disposal site destination (where will you dispose of the debris):
6. Estimate the volume of material to be removed in cubic metres:

Erosion And Bank Protection

1. Construction Design Details (i.e. construction technique, construction footprint, area of crown bed and shore to be occupied (per site plan), erosion/siltation mitigation, slopes, etc.):

Note: An additional detailed plan, including cross-section, should be included for activities such as erosion protection works.

Fisheries

The questions in this section are intended to guide applicants through a critical review of the design elements of the proposed project which may affect fish and fish habitat. The intent of these questions is to ensure that no further impacts to fisheries resources and habitat occur as a result of proposed repair work. Your answers to these questions should clearly demonstrate how the required design elements are incorporated into your plans, or clearly describes a design alternative that adequately addresses impacts to fish and fish habitat.

AEP considers applications to be 'high risk' to fish and fish habitat when the application for a proposed activity suggests that:

- There is a moderate or high probability of causing increased harm or mortality of fish as a result of the activity;
- There is a moderate or high probability of long-term or permanent damage to fish habitat as a result of the activity.

Confirmation of Submission to Department of Fisheries And Oceans Canada

Have you conducted a self-assessment on the DFO website in relation to this project? Yes No

If a review was required, date submitted to DFO:

What was the result of the submission?

- Unknown. No response from the DFO at this time.
- DFO provided a letter of advice, or comment, for the project (attach letter with application).
- An authorization under the *Fisheries Act* is required. Specify:

- Other. Specify:

Erosion And Bank Protection Design

Basic Design Requirements: Plans for erosion and bank protection works should be generated by a qualified individual and employ fundamental best practices for working in or near a water body.

Provide a description or submit plans to address the following questions:

1. How will repaired slopes be tied-in to existing bank elevations and profiles?

2. What measures will be used to ensure riprap treatments are adequately stabilized with underlain filter material (i.e. geotextile fabric, granular material, etc.)?

3. How will the slope be embedded or 'keyed-in' appropriately?

4. How will slope "toes" be designed to ensure future toe-scour is addressed (i.e. appropriate launching apron, toe berm, etc.)?

5. Have you considered using an undulating or scalloped shoreline in your plan design? Yes No
If no, please describe why:

Note: An undulating or 'scalloped' shoreline may more closely emulate natural conditions with benefits to the aquatic environment and fisheries. A scalloped shoreline should be considered where practical and technically feasible.

Materials for use in Bank Stabilization

Basic Riprap Requirements: Riprap should be sized sufficiently to resist displacement during seasonal high water events. The preferred shape for riprap is blocky angular rock, which will also help keep the rock in-place.

Provide a description or submit plans to address the following questions:

1. How are you proposing to use riprap (i.e. slope stabilization, isolation berm, etc.)?
2. What size riprap are you planning to use?
3. What measures have you taken to ensure that the riprap size, shape, and composition are suitable for the location, potential river flows and proposed use?
4. What is the source, shape and composition of the riprap? Is it mostly angular? If not, please describe the rationale for the use of different shaped rock.
5. Will you be using bioengineering* as a potential alternative to riprap? Yes No If yes, please describe project scope, vegetation type, and source:

*** Note:** Bioengineering is an approach to stabilizing exposed soil that uses natural materials (logs, rocks, live stakes, live bush bundles, etc.) in combination with native vegetation. These techniques can be better for the aquatic environment and can provide for fish habitat. Bioengineered solutions should be considered as a potential alternative to riprap where practical and technically feasible.

Spoil Management

1. Describe your plans for spoil management. Your plans should consider measures for stabilization of stockpiled spoil (i.e. covering with biodegradable mats, planting with native vegetation, etc.).

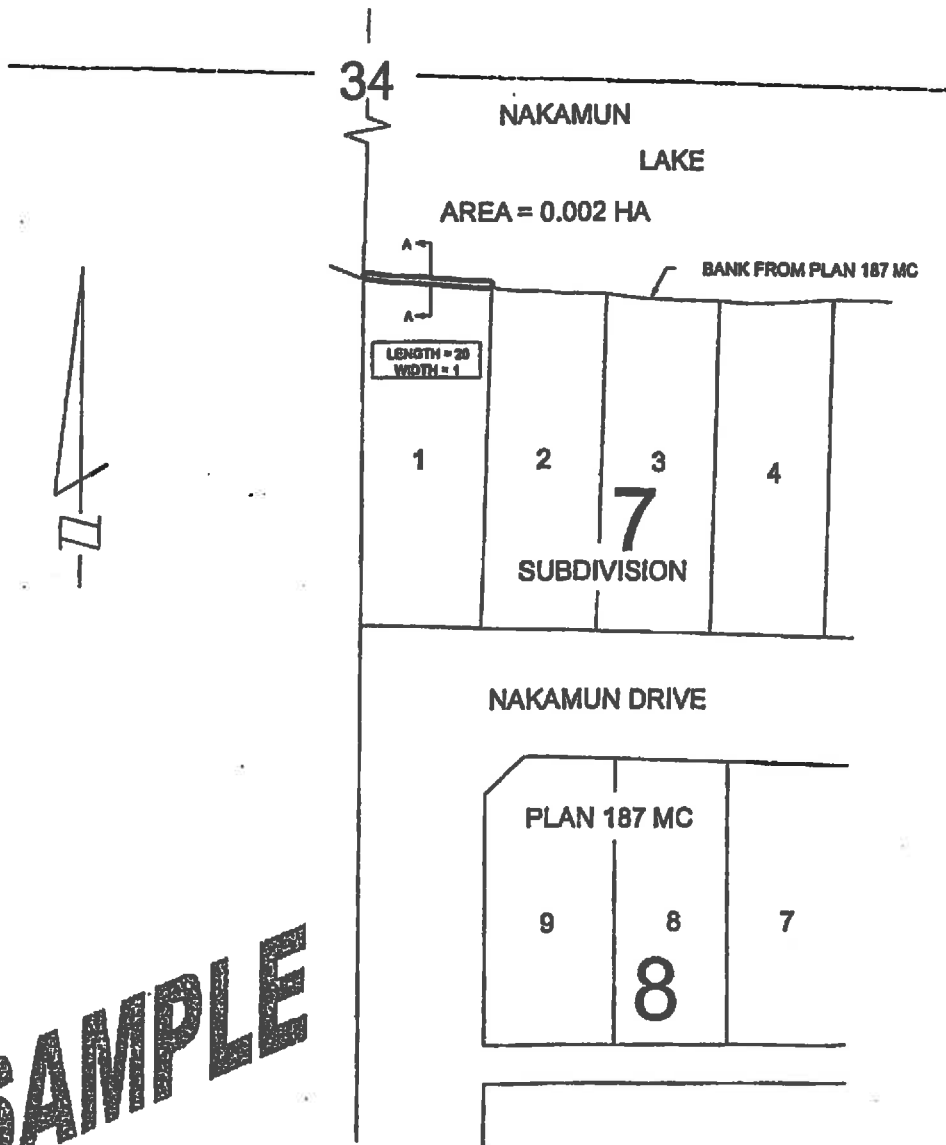
Vegetation Management

1. Describe your plans to minimize vegetation removal from the construction site. Your plans should consider the topping or pruning of vegetation where practical and technically feasible.
2. Describe your plans for revegetation of disturbed areas (i.e. planting of native vegetation, mulching, hydro-seeding, etc.).

Additional Fact Sheets and Information Requirements

- [Application Information Requirements Information Sheet](#) - Jun 10, 2016 (7 pages, <1 MB)
- [Approval Amendment Fact Sheet](#) - Apr 2016 (2 pages, <1 MB)
- [Aquatic Environment Fact Sheet](#) - Apr 2016 (3 pages, <1 MB)
- [Authorizations Under the Public Lands Act For Work Within the Bed and Shore of Water Bodies](#) - Jun 2016 (1 page, <1 MB)
- [Debris Removal Fact Sheet](#) - Jun 2016 (1 page, <1 MB)
- [Restricted Activity Period Fact Sheet](#) - Apr 2016 (3 pages, <1 MB)

TOWNSHIP 56, RANGE 2 WEST 5



PLAN SHOWING LOCATION
OF
BANK STABILIZATION

PLAN PREPARED FOR :
PLAN PREPARED BY :
FILE #:

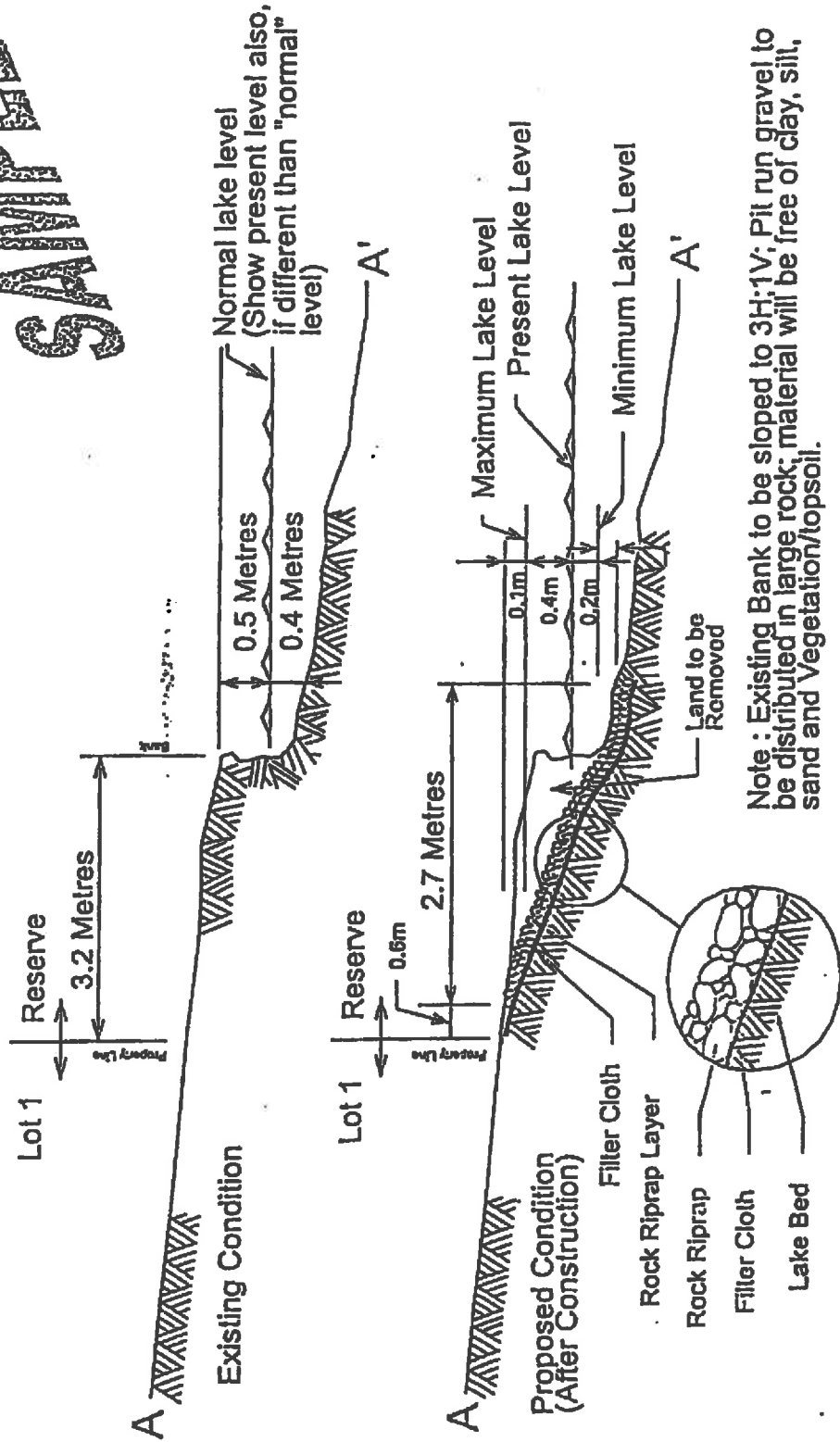
SCALE: 1:1000
DISTANCES IN METRES

SAMPLE OF PLAN REFERENCING BASE "D"

BANK STABILIZATION CROSS SECTION A-A

Subdivision Plan 187 MC Block 7 Lot 1
(TOWNSHIP 56, RANGE 2, WEST 5 MERIDIAN)
(South east Quarter of Section 34)

SAMPLE

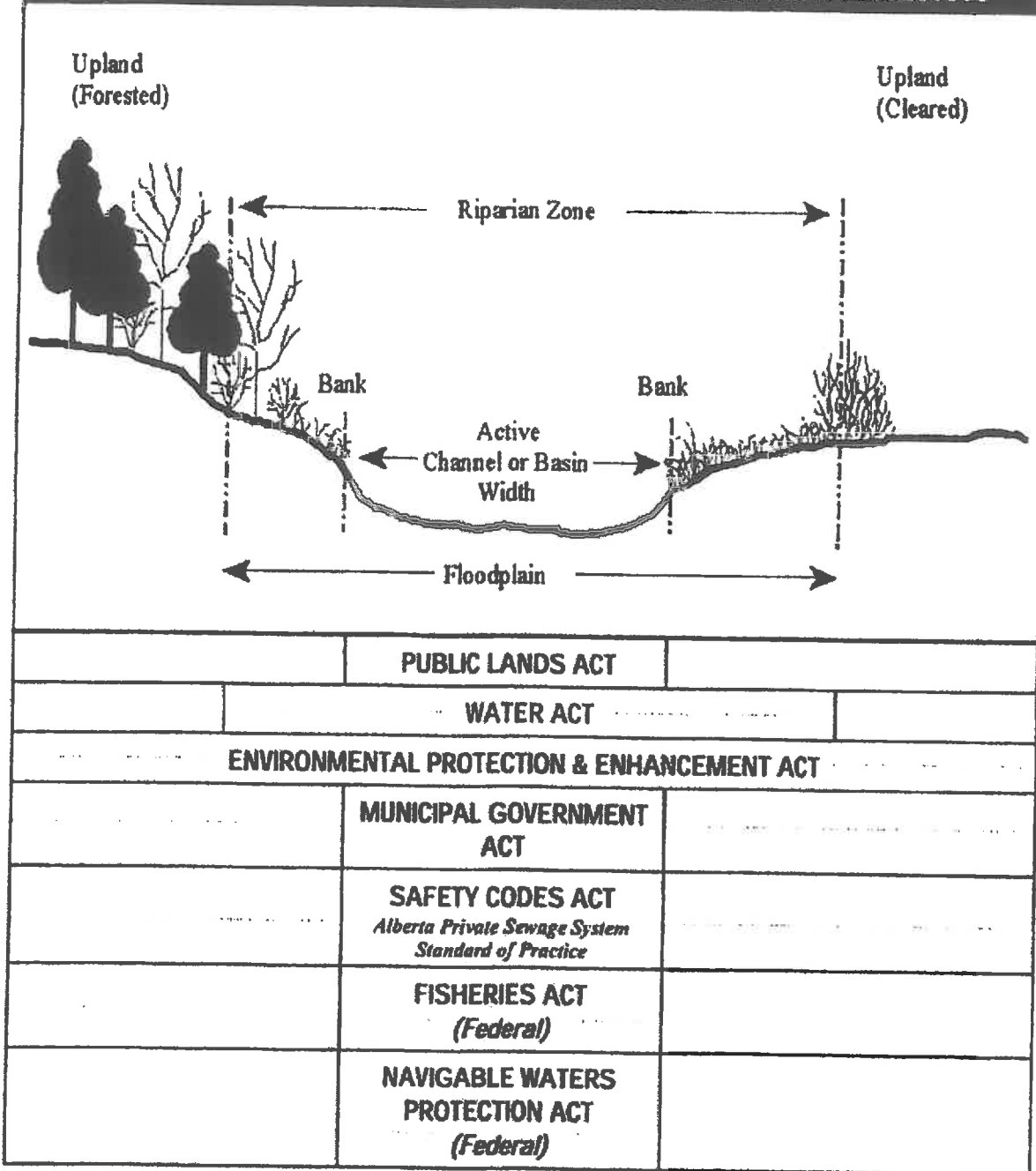


Note : Existing Bank to be sloped to 3H:1V; Pit run gravel to be distributed in large rock; material will be free of clay, silt, sand and Vegetation/topsoil.

PLAN PREPARED FOR :
PLAN PREPARED BY :
FILE #:

DISTANCES IN METRES

LEGISLATION AFFECTING WATER BODIES IN ALBERTA*



* Not all applicable legislation is depicted in the table, only the most commonly encountered.

Respect Our Lakes