

MODULE 10: EROSION AND BANK PROTECTION TIER REVIEW APPROACH

TIER 1 (5-day review)

- Placing biotechnical products/vegetation along eroding bank
- Placing rip-rap/armor stone along eroding bank

TIER 3 (requires a standard WAWA permit)

- Any alterations resulting in a permanent wetland impact greater than 100 sq. m
- Any alterations in and within 30 m of a provincially significant wetland (PSW)
- Any alterations within a designated [watershed](#) or [wellfield](#) used as a source for public water supply
- Placing erosion protection products along the banks of a watercourse where an aquatic species (or habitat) at risk has been identified under the [Species at Risk Act](#) (habitat for the Inner Bay of Fundy Salmon and Lake Utopia Rainbow Smelt)
- Any other activity not approved under Tier 1 or exceeding the guidelines

10.0 EROSION AND BANK PROTECTION

10.1 DEFINITION

Erosion protection products (*i.e.* structures or vegetation) are used to stabilize and protect the banks of a watercourse from the scouring and erosive action of water, ice, or floating debris within the stream flow or surface runoff from the land bordering the watercourse.

10.2 OBJECTIVES

- To prevent loss of material from the banks of the watercourse and property adjacent to the banks of the watercourse
- To control channel meander and prevent the undermining of structures
- To prevent sedimentation of the watercourse

10.3 PLANNING CONSIDERATIONS

Natural flowing watercourses meander (*i.e.* have bends – they are not straight). The process of erosion and deposits of materials, such as gravel/sand bars and islands, is a natural process in the evolution of a watercourse. It is natural for bends, riffles, pools, and other features of a watercourse to change in size and location.

The rate and extent of erosion is influenced by the magnitude of the erosive forces from within the watercourse, soil characteristics, topography, and ground cover. The erosion protection products must be designed to modify at least one of these variables.

Taking this information into consideration, it is important to only apply erosion protection products at the appropriate location and to the appropriate degree. Otherwise, the effects can have a significant impact on the system. They may create/accelerate erosion issues to neighboring properties by distributing the energy of the water to a new location.

The inside of a bend is where the channel is shallower, and the flow is slower. This is where deposits (*i.e.* gravel/sand bars) are more likely to form. Unless the watercourse has been artificially disturbed, there is no erosion at this location. Applying erosion protection products at the inside of a bend will significantly disturb the natural flow of the watercourse and could cause additional problems downstream, creating a domino effect. Erosion naturally occurs on the outside bend of a flowing watercourse. This is also where the flow is fastest, and the channel is deepest, creating pools for fish to rest and cool down.

Note: The installation and placement of erosion protection products on the bank of a watercourse is only permitted if there is erosion present on the bank that could

compromise existing infrastructure or the loss of land. If there is no erosion, the application will be refused.

Erosion and bank protection projects where there is an aquatic species at risk under the [Species at Risk Act](#) that is subject to the DFO Critical Habitat Order require a standard WAWA permit. These areas include the habitat for the Inner Bay of Fundy Salmon and Lake Utopia Rainbow Smelt. For these instances, an application for a standard watercourse and wetland alteration permit must be made using the [online application program](#).

10.4 COMMON PRODUCTS USED FOR EROSION PROTECTION

10.4.1 Vegetation

Can be in the form of grasses, shrubs, trees, vines, and live cuttings. It can also include live fascine (wattles), live stakes, and brush mattresses. A combination of a rock toe with vegetation above this layer is also an option.

10.4.2 Structural Products

Rip-rap/armor stone

The placement of a layer of boulders, cobbles, or rock fragments placed over an exposed slope.

Retaining walls

They are constructed out of wire baskets or cages filled with rock or timber crib, steel, or concrete. **Note:** Although mentioned here as a structural product, the construction of retaining walls is not permitted under the permitting system within the Watercourse Alteration Certification Program. A standard WAWA permit is required for all retaining walls.

10.4.3 Choosing an Erosion Protection Product

The method used depends on the magnitude of the erosive forces and economic feasibility. Vegetation and rip-rap are the least expensive alternatives. However, they may not be applicable if the banks are excessively steep or the wave/ice action is excessive or if the soils, such as sand or heavy clay, do not allow vegetation to become established.

Other types of erosion protection products should be avoided if vegetation can be used, or they should be used in combination with vegetation wherever possible. The shade provided by the vegetation helps prevent rip-rap, and the stones used in the rock-filled wire baskets from heating up, which in turn helps reduce thermal pollution of the water.

Vegetation also provides food and cover for aquatic animals and wildlife. Mulch, consisting of plant residue or synthetic materials, is often used to temporarily protect the work site from erosive forces of rainfall and to aid in the germination and growth of vegetation until the vegetation becomes well established or the site is permanently stabilized by another means. It can be used in combination with vegetation providing temporary protection to denuded slopes during the early phases of plant growth or can be used alone during the non-growing season where plant growth is impossible. Mulch improves water infiltration, reduces rainfall impact, and reduces surface runoff. Materials commonly used as mulch include straw, hay, corn stalks, wood or bark chips, soil binders, nets, and mats. Chemical mulches, consisting of emulsions of vinyl compounds, rubber or other substances, are mixed with water and then sprayed on the exposed soil.

All techniques require that the upstream and downstream limits of the erosion protection product be keyed into the bank to prevent scouring around either end.

10.5 BIOTECHNICAL/VEGETATION

10.5.1 Definition

The placement of biotechnical products, along with trees, shrubs, vines, grasses, cuttings, or other plants used to stabilize and protect the banks of a watercourse from the erosive action of the stream flow, waves, ice, and debris within the watercourse.

It also includes live fascine (wattles), live stakes, and brush mattresses. A combination of a rock toe with vegetation above this layer is also an option. See Figure 10.1.

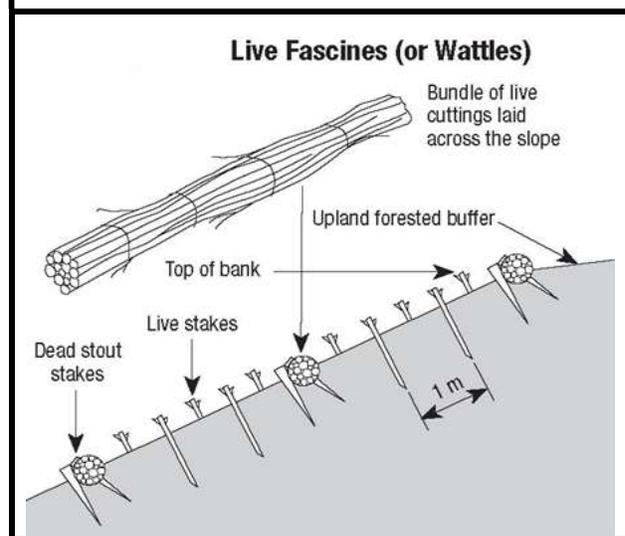
When erosion is occurring, vegetation should be the first option to consider while easing the steepness of the bank and creating a vegetated floodplain to disseminate the water flow and its energy. Instead of trying to stop the water from entering the land, the focus should be shifted to allowing the water to flow to its natural path while protecting existing infrastructure.

10.5.2 Objectives

To protect the banks of a watercourse while providing and promoting habitat for fish and wildlife.

To minimize the thermal pollution of the water.

Figure 10-1 Live fascine (wattles), live stakes, and brush mattresses



10.5.3 Planning Considerations

If the banks are made up of soil which can sustain plant growth and have slopes of 2:1 or flatter, vegetation provides excellent protection against soil erosion. It also promotes animal habitat along the banks of the watercourse and in the water by providing shade and by depositing leaf litter and insects into the water, which act as food sources for fish and aquatic insects.

The degree of erosion protection offered by vegetation and vegetative products increases as the plants and root systems grow and spread. Advantages of using vegetation as an erosion protection product include the following:

- Vegetation shields the soil from raindrop impact and slows the velocity of runoff, thereby protecting the watercourse from sedimentation
- The root systems hold soil particles in place and maintain the soil's capacity to absorb water
- It is less costly than other product and requires little or no maintenance
- Vegetation is more compatible with the natural watercourse characteristics
- It helps maintain a lower water temperature and provides cover for the fish in the water and wildlife on the shoreline

10.5.4 Guidelines

Plants chosen for erosion protection should require little maintenance and be suited for the climate and soils at the site. Conditions throughout the province vary greatly and plans for vegetative stabilization must be adapted on a site-specific basis. In general, the plants should have fibrous roots and be capable of attaining dense growth, thereby providing a complete soil cover. The selected species should be easy to plant, fast-growing, requiring little or no irrigation, fertilizer, or mowing. Examples of plants used for vegetative stabilization include alders, willows, poplars, shrub willow, shrub dogwood, lupine, clover, timothy, and trefoil. A local nursery can be consulted for species of plants that are adapted to specific conditions.

Many types of plants are used for vegetative stabilization in New Brunswick. Species of grasses, legumes, vines, shrubs, or trees are used depending on slope stability, soil type, and moisture conditions. Only non-invasive plant species native to New Brunswick are to be used for stabilization purposes.

A variety of species should be planted rather than a single species of plant. The vegetation should be checked and maintained on a regular basis until growth is established. The plants may have to be watered and fertilized to promote growth initially.

The portion of the bank of the watercourse where biotechnical products are to be placed shall be uniformly graded to a slope no steeper than 2 horizontal to 1 vertical. Clean, well-graded borrow may be added if required to obtain a uniform slope. The reshaping

of the eroding bank to a stable slope and any placement of material to create a uniform slope must be carried out in isolation from the remainder of the watercourse.

The height of the erosion protection material must not be any greater than the existing grade of the top of the bank as it exists immediately upstream and downstream of the project area. In other words, the grade of the property cannot be raised as a result of the project, and the addition of the material must not create a berm.

The placement of the biotechnical products shall start at the upstream end of the eroding section of the bank and progress in the downstream direction. The upstream and downstream limits of the products shall be keyed into the bank to prevent scouring around either end.

Biotechnical products placed for the protection of agricultural land shall include establishing and maintaining a buffer of undisturbed vegetation at least 5 metres (16.4 ft) wide along the upland edge of the stabilized bank.

Note: If the proposed project does not meet these guidelines, an application for a standard watercourse and wetland alteration permit must be made using the [online application program](#). During the permit application review process, DELG may require that the project be designed (signed and stamped) by a professional engineer licensed to practice in the province of New Brunswick.

10.6 RIP-RAP

10.6.1 Definition

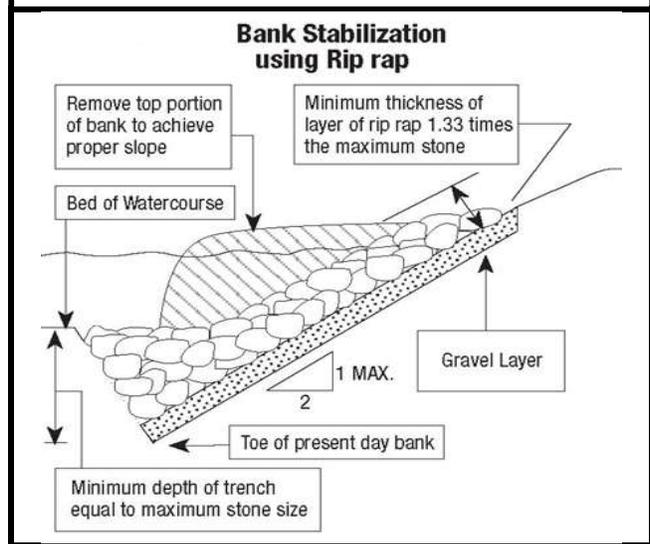
Rip-rap is heavy broken rock, cobbles, or boulders placed over a denuded or exposed soil, providing a permanent, erosion-resistant cover. See Figure 10-2. Rip-rap is used to armor the banks of watercourses for the following reasons:

- To protect the banks and adjacent upland areas from the erosive action of the stream flow, waves, ice, or floating debris
- To control channel meander thereby protecting downstream or adjacent facilities or resources
- To protect the banks near a bridge or culvert where erosion could undermine the structure
- Existing infrastructure may be too close to the bank of the watercourse, therefore creating a vegetated floodplain may not be a suitable option

10.6.2 Planning Considerations

Rip-rap can be used to prevent erosion on the bank of a watercourse if it is no steeper than 2:1 and if the velocity of the flowing water prevents the use of vegetation. Rip-rap depends on the soil beneath it for support; therefore, it must be founded on solid ground. If the banks are unstable, crumbling, excessively steep or vertical, rock-filled wire baskets or retaining walls may need to be used to maintain the property bordering the watercourse. Otherwise, the top of the bank may be cut-back/contoured to achieve the slope prescribed above.

Figure 10-2 Bank stabilization using rip-rap



Rip-rap is often placed as a rock apron on the bed/bank of the watercourse at the discharge of an outfall pipe, around bridge abutments and piers to prevent scour, and around the ends of a culvert to help prevent erosion of the foreslopes.

10.6.3 Environmental Considerations

Rocks used as rip-rap can heat up from the sun, which may result in an increase in water temperature, and consequently, a decrease in dissolved oxygen required for fish.

10.6.4 Construction

The sequence for construction includes uniformly grading the surface of the banks, followed by placement of the rip-rap. In standing water environments, placement of a filter layer, such as geotechnical fabric and/or a layer of clean gravel, may be used.

10.6.5 Guidelines

Rip-rap/armor stone must be clean, durable, non-ore bearing, and non-toxic rock, and must not be obtained from a watercourse nor from within 30 metres (100 ft) of a watercourse/wetland.

Rocks used to stabilize the bank of the watercourse must be irregular in shape, with at least 70% of the material having a smallest dimension of not less than 15 centimetres (6 in).

The minimum thickness of the layer of rip-rap/armor stone must be 1.33 times the maximum rock size used.

The full thickness of the rip-rap/armor stone must be deposited as a dense mass of

various sized rock with minimal voids. It shall not be placed in layers.

The rip-rap/armor stone must not be dumped or pushed over the shoulder of the bank but either lowered in place with machinery capable of controlling the dropping of the rock or placed into position using machinery stationed on a barge.

Trees and other woody vegetation removed must be limited to the minimum required to facilitate the stabilization of the bank of the watercourse. Any vegetation destroyed, including trees removed, to fulfill the project must be replaced with non-invasive perennial vegetation native to the area. The species and density of woody vegetation planted shall be similar to that which existed in the area before the project took place.

The height of the erosion protection material must not be any greater than the existing grade of the top of the bank as it exists immediately upstream and downstream of the project area. In other words, the grade of the property cannot be raised as a result of the project, and the addition of the rip-rap/armor stone must not create a berm.

The base of the rip-rap/armor stone must follow the alignment and be entrenched at the toe of the present-day bank of the watercourse created by the effects of the erosion.

While carrying out maintenance work to the existing rip-rap/armor stone, the existing base of the rock wall must be entrenched at the toe of the present-day bank of the watercourse created by the effects of the erosion if it is not currently entrenched. Furthermore, additional rip-rap/armor stone must not be placed any closer to the watercourse than the present-day bank.

The portion of the bank where rip-rap/armor stone is to be placed must be uniformly graded to a slope no steeper than 2 horizontal to 1 vertical. Clean, well-graded borrow may be added where needed and compacted to prepare a uniform base for the rip-rap/armor stone. The reshaping of the eroding bank to a stable slope and any placement of material to create a uniform slope must be carried out in isolation from the remainder of the watercourse.

A layer of clean, coarse gravel must be placed under the rip-rap/armor stone. If geotextile fabric is used, it must be pulled flat to eliminate wrinkles and folds which create voids.

The placement of the rip-rap/armor stone must start at the upstream end of the eroding section of the bank and progress in a downstream direction. The upstream and downstream limits of the products must be keyed into the bank to prevent scouring around either end.

Once the rip-rap/armor stone is installed, it requires minimal maintenance. Still, it should be checked periodically to ensure that any movement of the stones does not result in exposing the slope, increasing the risk of failure.

Rip-rap/armor stone placed for the protection of agricultural land must include establishing and maintaining a buffer of undisturbed vegetation at least 5 metres (16.4 ft) wide along the upland edge of the stabilized bank.

Note: If the proposed project does not meet these guidelines, an application for a standard watercourse and wetland alteration permit must be made using the [online application program](#). During the standard permit application, DELG may require that the project be designed (signed and stamped) by a professional engineer licensed to practice in the province of New Brunswick.

10.7 TIMING OF INSTALLATION

All erosion and bank protection projects must be carried out between June 1st and September 30th of the same year, preferably during low water conditions. Construction should proceed diligently to help minimize any unnecessary environmental problems and minimize impacts to fish.

Work and project extensions outside of this window will not be approved through the Watercourse Alteration Certification Program. If there are unforeseen issues that prevent the project from being completed prior to the September 30th deadline, DELG should be contacted as soon as possible to discuss next steps.