BIOFILIA
CONSULTANTS EN
ENVIRONNEMENT

Erosion Control Measures

A Practical Guide

Prepared for :

The Town of Barkmere

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1. BACKGROUND

A watershed in its natural state has everything it needs to retain and filter water. However, the road network as a whole (roads, streets, ditches, culverts, etc.) forms channels that direct water straight toward streams and lakes without going through the full natural process of retention and filtration by means of vegetation and natural cavities.

This is why the Municipality of Barkmere, upon the recommendation of the Environmental Consultative Committee, adopted a new municipal bylaw on road system management. The new regulations will help optimize the environmental performance of road equipment, with a view to protecting bodies of water and streams more effectively.

The Municipality mandated the firm BIOFILIA to produce a technical guide on methods for controlling erosion and thereby enabling these regulations to be instituted. This document will help the public works department, developers and contractors working on municipal territory respect the environment and comply with the new regulations in force more effectively. Residents are also covered: the bylaw applies as well to private roads and culvert installation. The content of this guide is an integral part of the bylaw on construction standards for public or private roads and streets in Barkmere.

2. GOAL

The goal of this guide is to present the information needed to implement technical work and minimize the impact of the road network on soil erosion and sedimentation in bodies of water.

Sedimentation is the action through which mineral or organic particles are deposited at the bottom of a ditch, in a natural or man-made cavity, or on the bed of a body of water.

3. WHAT IS EROSION

Erosion is a mechanism through which soil particles are detached and moved from the point of origin. Soil becomes vulnerable to erosion when deprived of its natural protective layer formed by vegetation. Construction activities (roads, ditches, dwellings, etc.) Inevitably expose soil to this type of mechanism.

There exist various factors affecting soil erosion. These must be taken into account in conducting stabilization work. These factors are as follows:

- **Water** – Raindrops striking bare soil dislodge mineral and organic particles (humus and other plant or animal debris), with surface runoff then carrying these particles to sedimentation areas where the ground is flat or only slightly sloped. When organic matter is brought to bodies of water (streams, rivers and lakes) in runoff, it carries fertilizers there in the form of phosphates and nitrogen, contributing to the growth of aquatic plants.

- **Soil characteristics** – The porosity of soil affects rainwater infiltration through it. Soil compaction limits infiltration of water, and this has the effect of increasing surface runoff and erosion. Soil with low cohesive capacity (sandy or pebbly soil) is more vulnerable to erosion.

- **Land slope (topography)** – The speed of surface runoff is proportionate to the slope of the land. Erosive force and the capacity for carrying particles increases with the speed of water flow.

- **Plant cover** – Plant cover protects soil from the erosive action of precipitation and surface runoff. Vegetation is also useful in slowing water flow, maintaining the absorptive capacity of soil and retaining fine particles.

  Soil covered only with herbaceous plants, such as a lawn, has a weak ability to retain and filter runoff. Plant cover should thus include the three (3) strata of vegetation to be truly effective, with trees, shrubs and herbaceous plants playing complementary roles. Among other things, leaves from trees and shrubs slow the shock of raindrops on the ground, and tree roots can absorb very large quantities of water.

4. PRESENTATION OF THE GUIDE

The techniques presented below are useful in applying the general recommendations that follow. Since this guide is first and foremost a complement to the municipal bylaw on the building of public and private roads and streets, **the techniques described in it aim essentially for better control of the erosion caused by the ditches and culverts found throughout the road network.**

However, since the construction of dwellings is also a major cause of soil erosion, and since the immediate shorelines of bodies of water are often degraded by previous work, the guide also sets out indications on the application of certain techniques that are appropriate to these situations. This is why the techniques have been grouped as follows:

- Erosion control techniques in ditch management;
- Erosion control techniques in embankment and slope management;
- Erosion control techniques in bridge and culvert installation;
- Erosion control techniques in construction site management;
- Erosion control techniques in protecting degraded shores of lakes and streams.

5. GENERAL RECOMMENDATIONS

The following general recommendations should always be emphasized in work that could create erosion or sedimentation.

Plan development with site conditions taken into account

- Plan work so as to limit the excavation and perturbation of soil;
- Confine construction to less sensitive sectors;
- Consider not developing sensitive sectors (steep slopes, wetlands, woodlands).

Set a work timeline that helps reduce risks of erosion

- Plan construction activities during periods of low precipitation;
- Stop work temporarily during periods of heavy precipitation;
- Plan work in successive phases to allow for the re-establishment of vegetation in sectors at risk;
- Plan work periods so as to allow for seeding and planting to take root before the end of the growing season.

Keep the existing vegetation

- Avoid deforestation in areas with sensitive soil;
- Demarcate clearly the boundaries of a construction site;
- Restrict access by vehicles and equipment, or arrange adequate roads and parking.

Protect denuded sectors and bare soil

- Cover temporary borrow pits (heaps of earth or sand) with geotextile cloths.

Divert water flow toward non-denuded areas

- Maintain natural drainage as much as possible.

Bring the quantity and speed of water flow down to a minimum

- Reduce the length and angle of slopes;
- Set up diversion channels to produce gentler slopes, and carpet them with geotextile membranes to limit their erosion.

Create stable and permanent structures

- Arrange ditches and other infrastructure using stable materials (above all, cornerstones of a size appropriate for the situation).

Keep sediments on the construction site and avoid dispersing them in the environment

- Use sediment barriers and other sediment collection structures;
- Set up sedimentation basins in critical spots.

Maintain road infrastructure

- Institute an infrastructure management plan, ensuring follow-up and maintenance.

Important notes:

- Applying the general recommendations and erosion control techniques set out below is especially important when the erosion situation to be prevented or corrected is near a body of water. The further it is from lakes and streams, the more the watershed, with its vegetation, can play its retention and filtration role. Special attention must be paid to the shoreline sector (a strip 300 metres wide for lakes and 100 metres wide for streams).

- Protecting creeks is as important as protecting rivers and lakes. It should be understood that the creeks feeding most lakes (called “tributaries”) carry a large portion of the sediments found in lakes.

- All work on banks and shorelines (of streams, lakes and wetlands) are subject to the municipal, provincial and federal laws and regulations in force.

6. RESPONSE TECHNIQUES

To facilitate the reading and understanding of the methods set out, Table 1 relates the methods described in this document to the places where they may be applied. The table of contents for each of the methods listed is found on the following page, while the technical descriptions are indicated in the following sections.

METHODS	WHERE APPLICABLE					
	Ditches with a slope > 5%	Ditches with a road Crossing a stream	Ditches avec a road developed near'a water course	Emban kments	Shores	Building Site
Rock-lined Ditch	X	X	X			X
Retention Dike	X	X	X			X
Sedimentary Basins	X	X	X			X
Drainage Channels	X	X	X			X
Filtration Ditches	X	X	X			
Inferior Third Techique	X	X	X			
Revegetalization	X	X		X	X	
Deviation Canal				X		X
Stabilization Vegetation				X	X	X
Culvert Development		X				
Bridge Development		X				
Sedimentary Barrier						X
Stabilization with Rocks				X	X	

6.1 Ditches

6.1.1 Ditches with stone added

Application
When the longitudinal slope of a ditch is 5% or more.

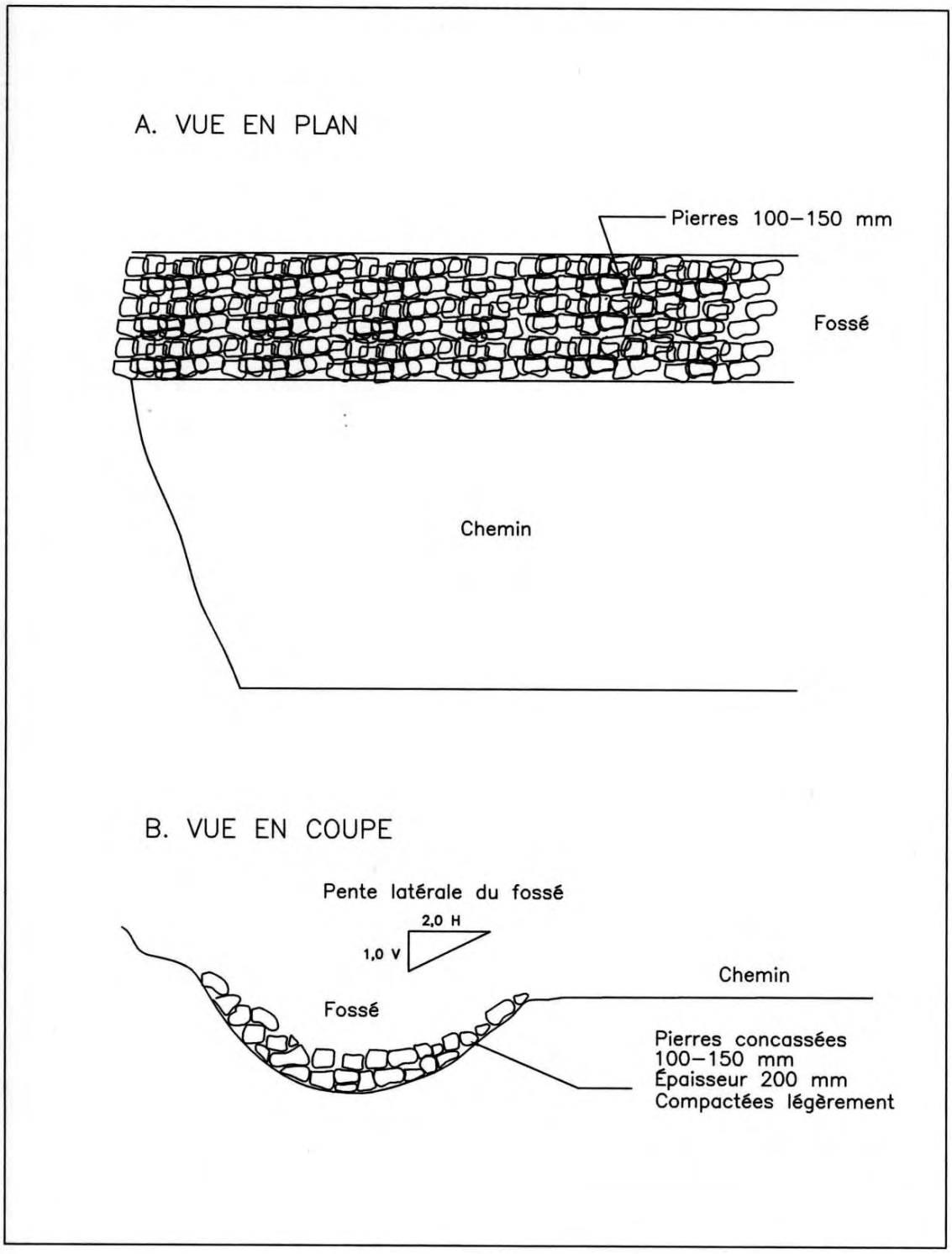
Description
Placing of crushed stone on the bottom and ledge of a ditch to create a stable covering.

Goal
- To limit the erosion of ditches;
- To reduce the speed of water flow in ditches and to allow for sedimentation of particles through the interstices.

Materials required
- Crushed stone, 100 to 150 mm (4 to 6 inches)
- Power shovel or backhoe (may be done manually on a slope or a space narrower than 20 metres)

Construction note
Place the crushed stone in the ditch to cover the bottom and sides, obtaining a thickness of 200 to 250 mm (8 to 10 inches). Compact the stone lightly with the back of the shovel without forcing the stone into the ground. Cover the entire length of the ditch with stone where the slope exceeds 5%.

Maintenance
None.



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	Conception : Vincent Clément	Dessin : Daniel Laramée	Date : 2 septembre 2004


STOP

6.1.2 Retention dikes

Application
When the longitudinal slope of ditches exceeds 10%, the addition of stone to ditches and the building of dikes should be done jointly.

Description
Creation of small stone dikes set up across the ditch to block the water flow and reduce its speed, thereby allowing the sediments to settle.

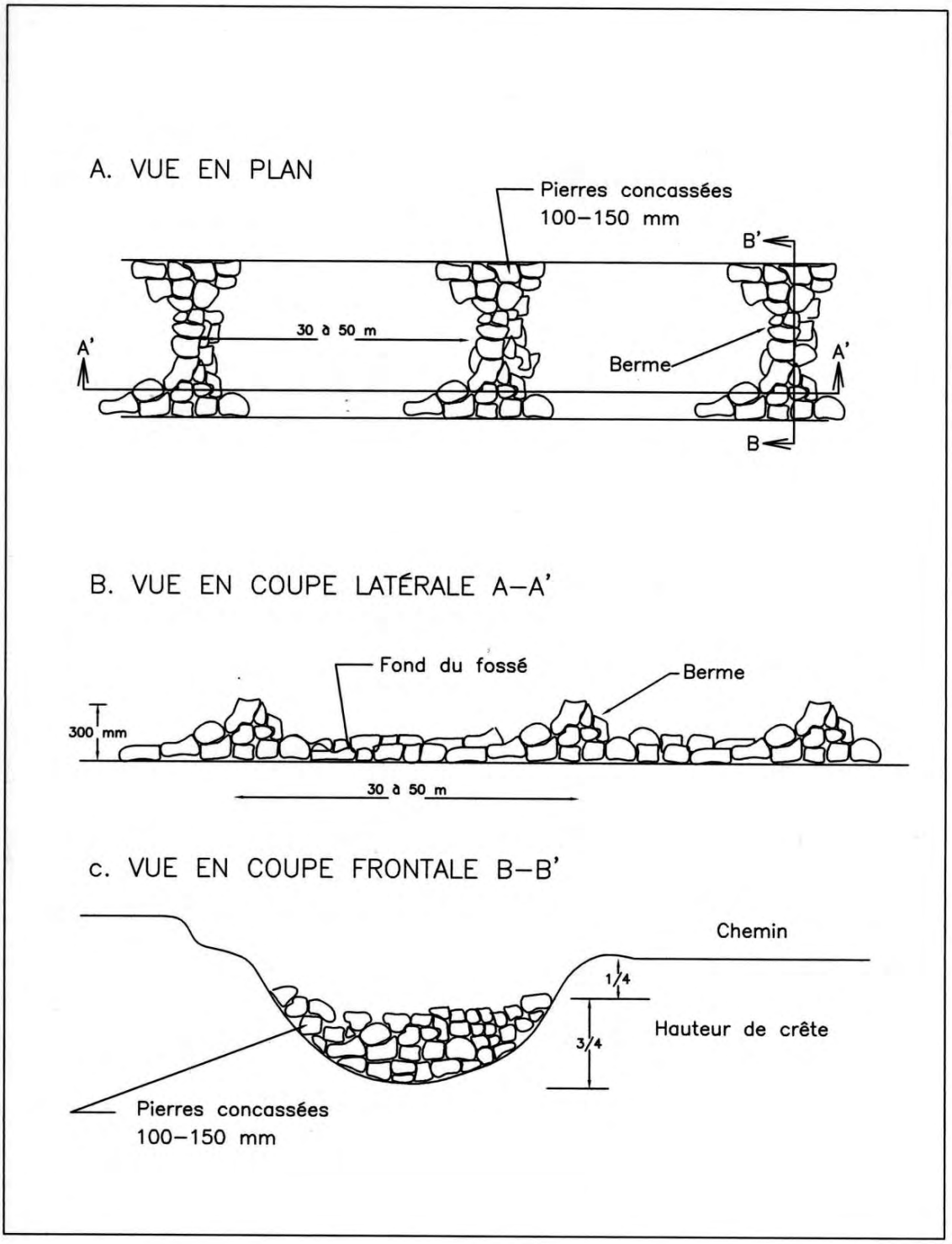
Goal
- To limit the erosion of ditches;
- To reduce the speed of water flow and allow for the sedimentation of particles upstream from the dike.

Materials required
- Crushed stone, 100 to 150 mm (4 to 6 inches);
- Power shovel or backhoe.

Construction note
Create the dike using stones set across the ditch. The dike's upstream portion (the side the water comes from) must be more pronounced than the downstream portion (where the water flows to). The sides of the dike should be raised slightly in relation to the centre to allow for the water to flow there. The height of the crest should not exceed three-quarters of the ditch's depth. Put in dikes at intervals of 30 to 50 metres according to the slope of the ditch.

Dikes can also be set up in places where erosion of the ditch is pronounced, even if the ditch is not covered with stone.

Maintenance
Medium. Check the stability of the structures once every two years.



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6.1.3 Sedimentation

Application
Sedimentation basins are needed when ditches empty directly into the water environment (streams, lakes, marshes) and/or the quantity of sediments carried is very high.

Description
Excavation of a cavity intended to hold the water flowing from ditches for a brief time to collect the sediments and cause them to settle.

Goal
- To collect sediments and have them settle before reaching the water environment;
- To remove the sediments from the environment and allow for their reuse.

Materials required
- Crushed stone, 100 to 150 mm (4 to 6 inches);
- Power shovel or backhoe.

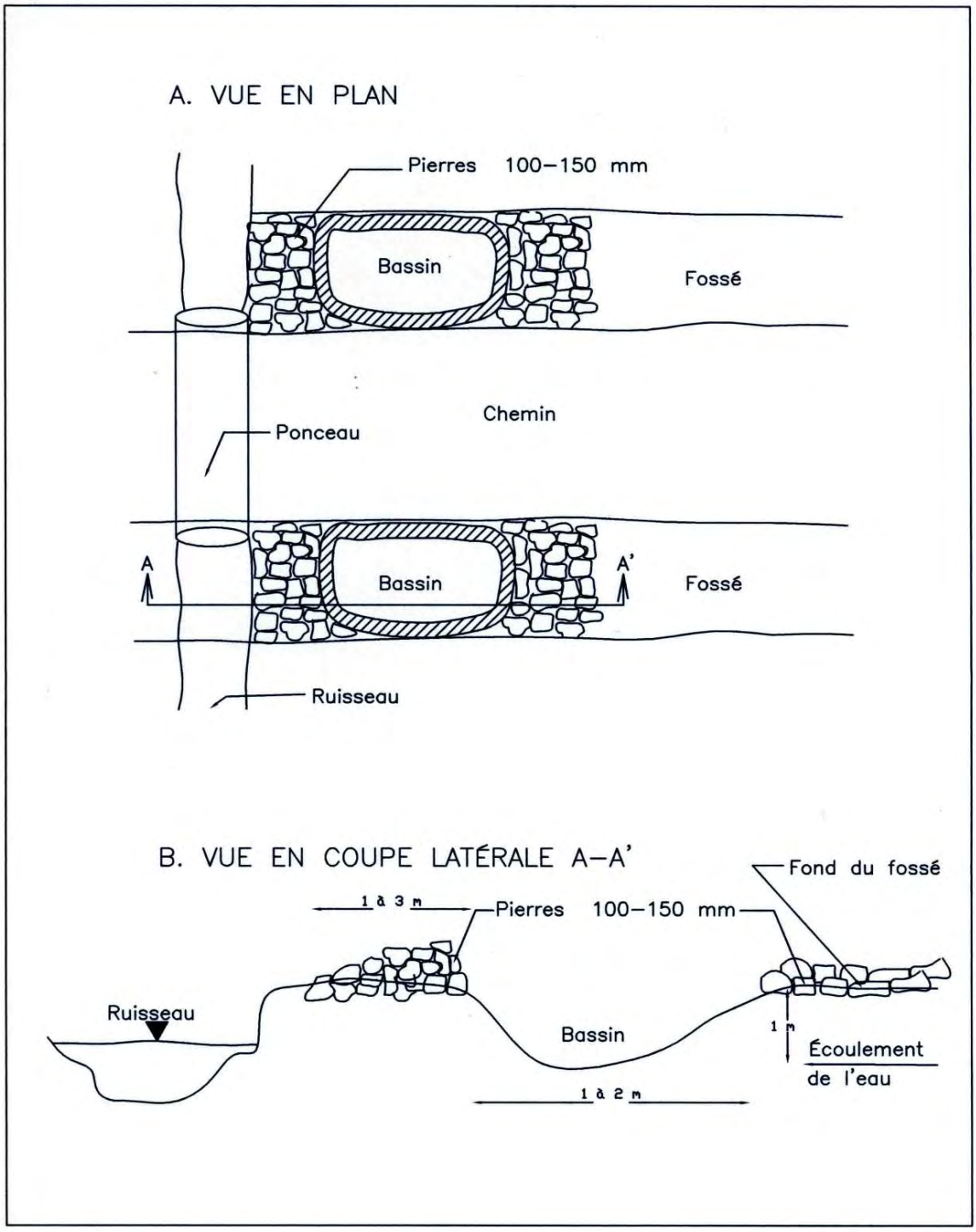
Construction note
Dig cavities (basins) in ditches. A basin's dimensions are proportionate to those of the ditch, but the containment volumes should vary between 0.5 and 1.5 m^3.

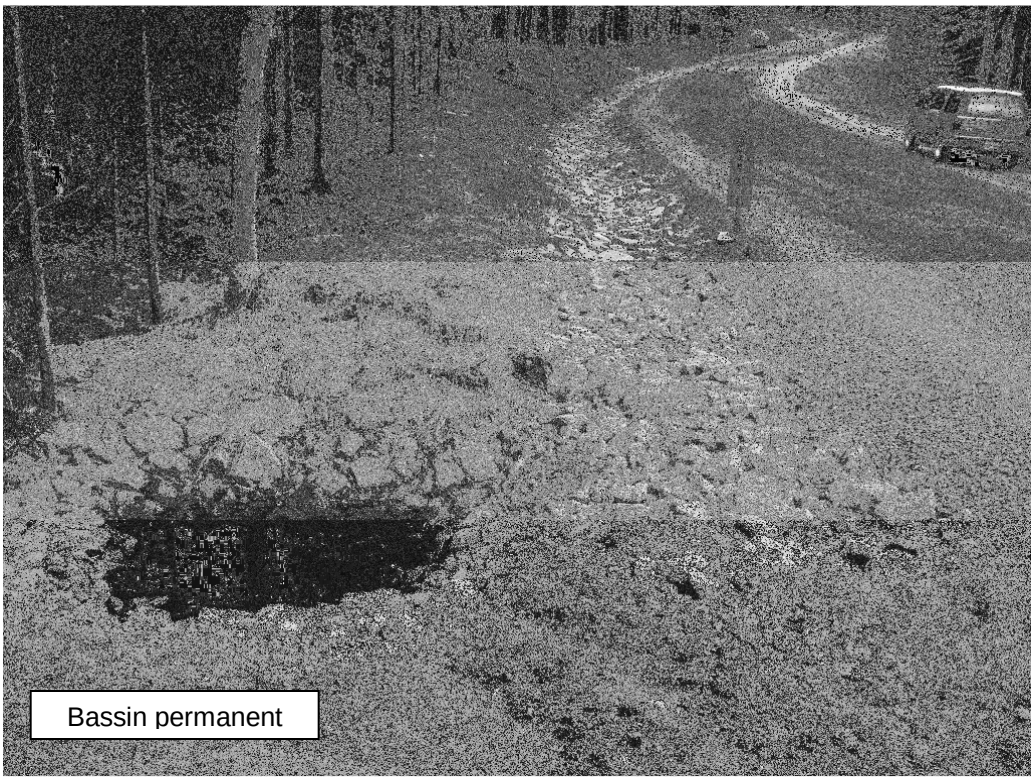
Stabilize the basin entrance by putting stone in the ditch over a length of about two metres. Set up a stone dike at the basin exit to allow for slow percolation of the water through the interstices. Drain the basin as required using a backhoe and storing the removed material in appropriate places.

Basins may be temporary facilities during construction work. Following the end of work, the basins may be filled in.

Basins may be permanent facilities when they are set up in ditches of a road crossing a stream. As such, basins must be set up on both sides of the stream, both upstream and downstream from it and from the targeted crossing (bridge or culvert).

Maintenance
Medium. Drain as required, when the basin is filled to three-quarters of its volume. Deactivate temporary basins when work is completed.


A. VUE EN PLAN
Pierres 100–150 mm
Bassin
Fossé
Chemin
Ponceau
A
A'
Bassin
Fossé
Ruisseau
B. VUE EN COUPE LATÉRALE A–A'
Fond du fossé
1 à 3 m
Pierres 100–150 mm
Ruisseau
Bassin
1 m
Écoulement
de l'eau
1 à 2 m



Bassin permanent

Bassin temporaire

6.1.4 Drainage channels for ditches and roads

Application
Drainage channels for roads may be developed on roads with no ditches to limit their surface runoff over long distances.

Drainage channels for ditches are developed when the ditch has a pronounced slope over a great distance or when the flow of water mobilized in the ditch is substantial and could cause impacts at the end of its course.

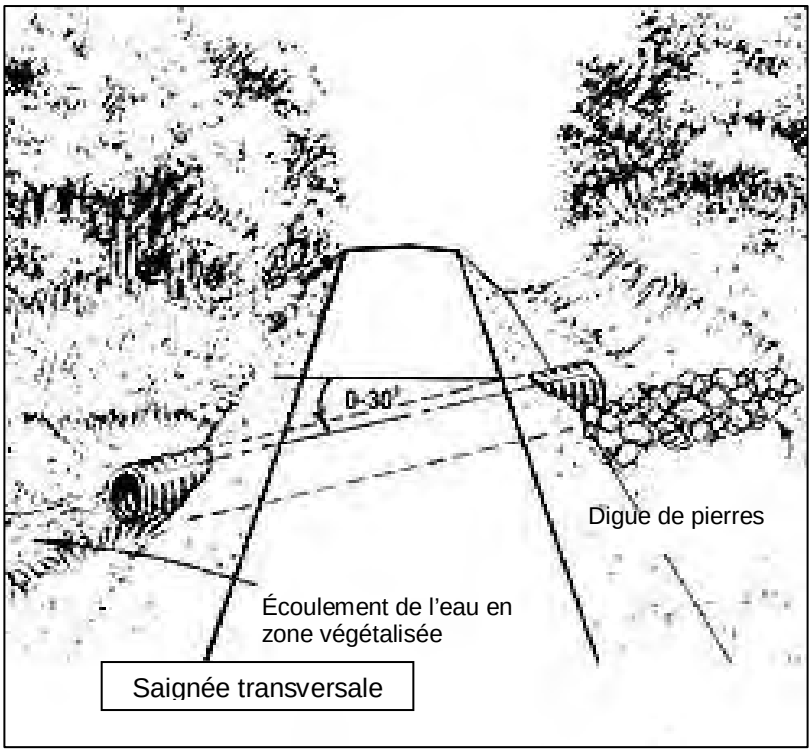
Description
Creating a diversion channel for ditch water in a stable and vegetated spot.

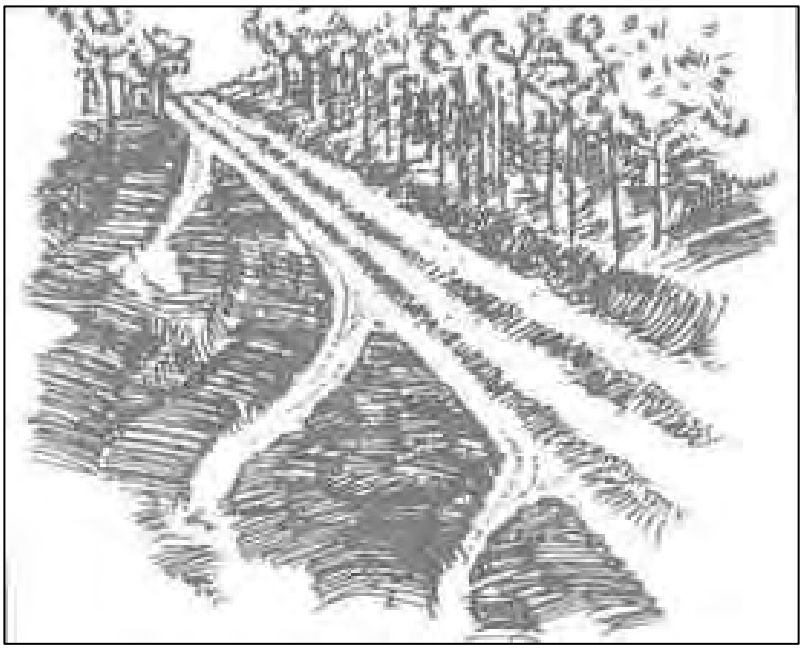
Goal
- To reduce the water's erosive force by reducing the distances over which water flows in ditches.

Materials required
- A small-gauge power shovel or backhoe.

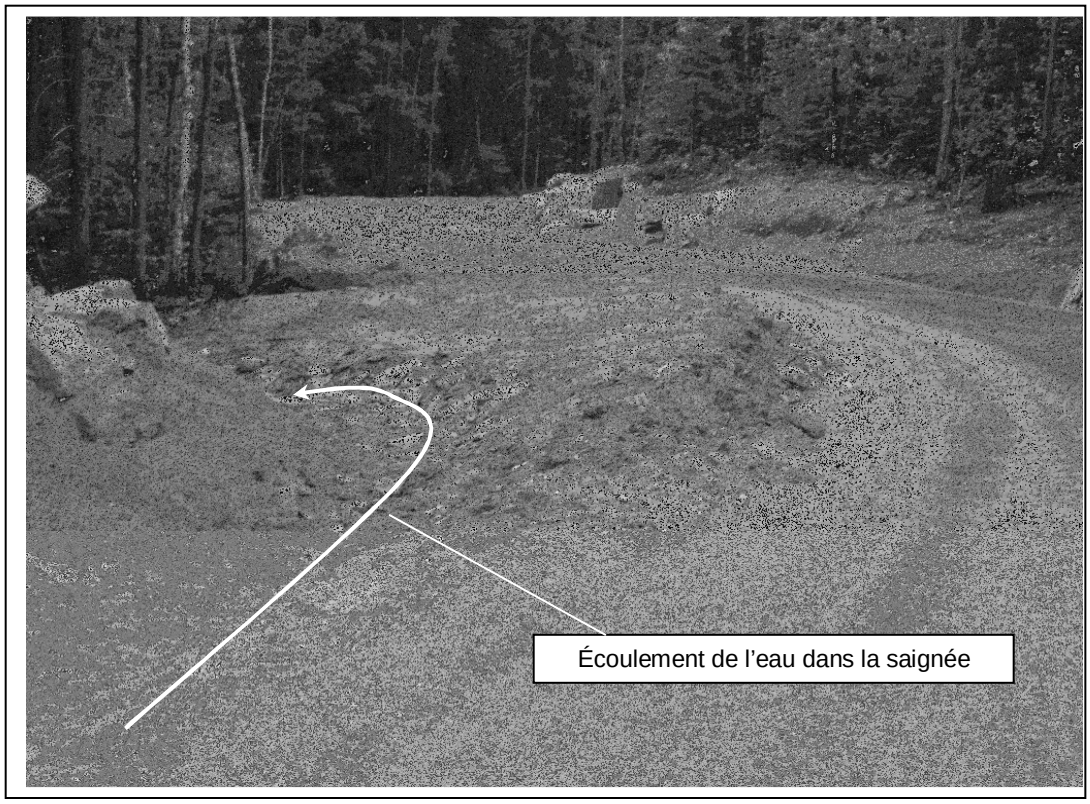
Construction note
Dig a channel about 45 cm deep in the ditch to divert its flow to a stable spot, allowing for the water to percolate into the ground. Breaking up the flow zones helps reduce water flow through the infrastructure, reducing risks of erosion. The space between channels should generally not exceed 150 metres. A ditch's last drainage channel should be more than 20 metres from a stream. At the end of the channel, a sedimentation basin may be set up when the vegetated area cannot hold the quantity of water mobilized.

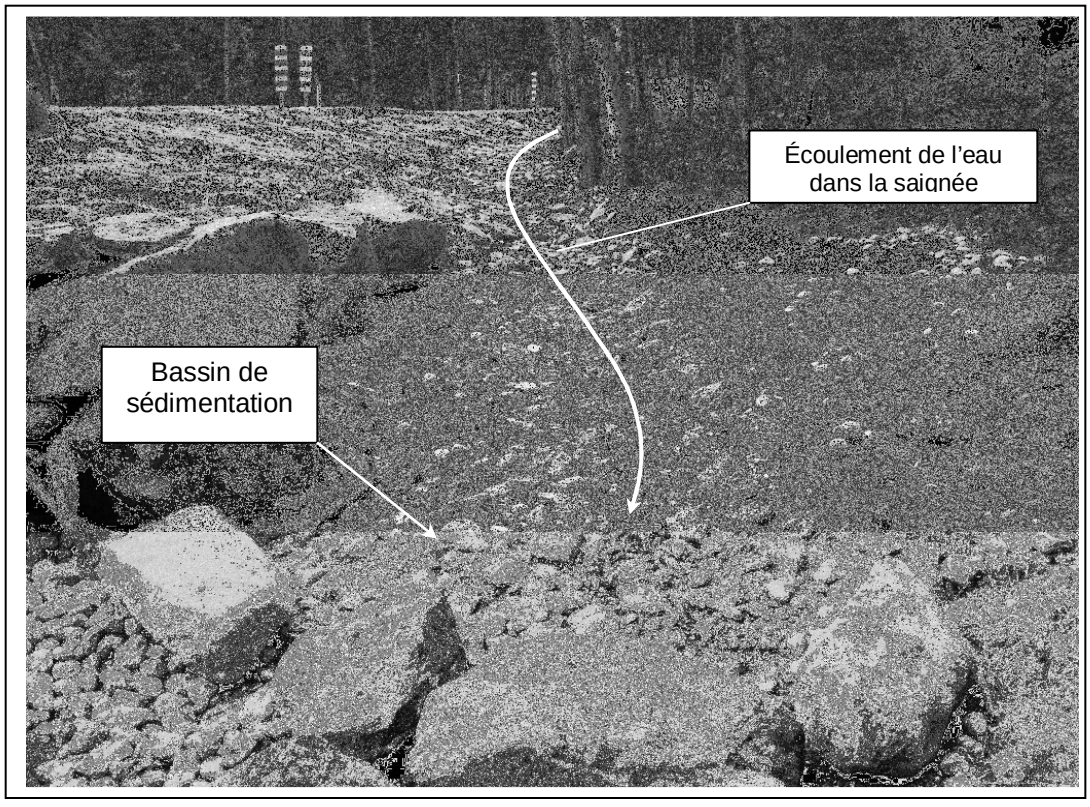
Maintenance
Low.





Images tirées de : Minnesota erosion control association guide book


Écoulement de l'eau dans la saignée


Écoulement de l'eau dans la saignée
Bassin de sédimentation

6.1.5 The lower third technique

Application
All ditches not lined with stone

Description
A ditch maintenance technique consisting of removing the vegetation strictly on the lower third of the ditch, favouring the stability of ditch walls by maintaining existing vegetation.

Goal
- To limit problems of excessive erosion and sedimentation in ditches;
- To improve water quality;
- To reduce ditch maintenance costs.

Materials required
- Small-gauge power shovel or backhoe;
- Truck for transporting excavated material.

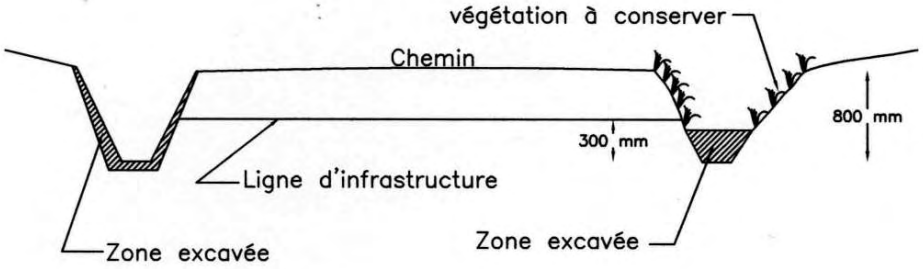
Construction note
Limit digging (cleaning) of the ditch to the portion equal to its lower third. Leave existing vegetation in the upper portion in place. Limit the ditch's depth to less than 300 mm from the infrastructure line (the road's natural base) and less than 800 mm from the road's surface. Brush-clearing prior to cleaning is recommended in places where the shrub stratum has large-diameter stems.

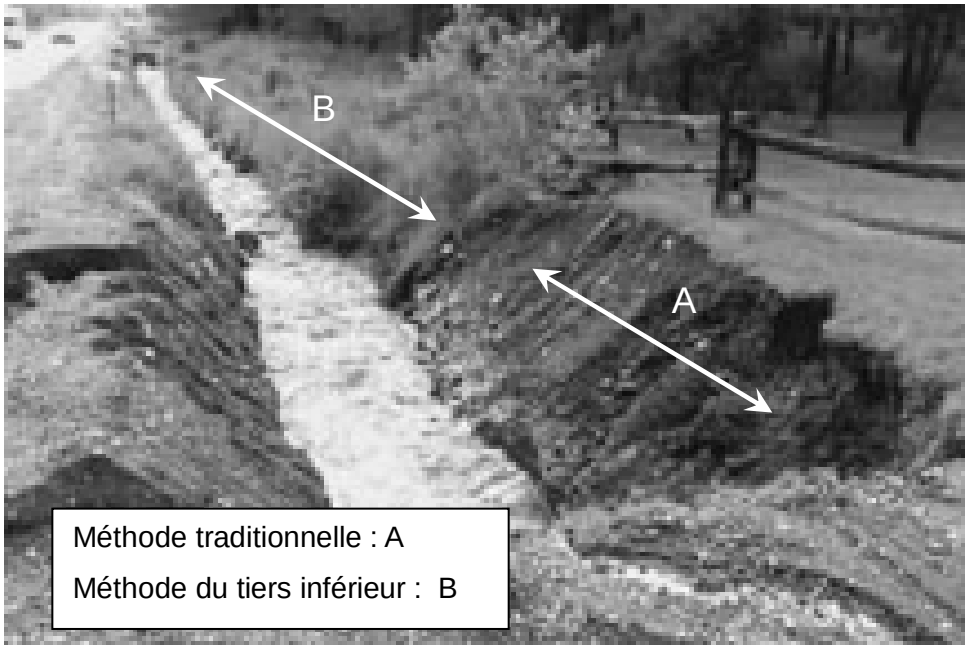
Maintenance
Low

C. VUE EN COUPE LATÉRALE

Fossé excavé selon la méthode traditionnelle

Fossé excavé selon la méthode du tiers inférieur





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	Conception : Vincent Clément	Dessin : Daniel Laramée	Date : 2 septembre 2004

6.1.6 Filtration Ditches

Application
Set up when runoff containing nutrients or pollutants drains into the ditch.

Description
Use of marsh plants to clear water of organic pollutants and nutritive substances.

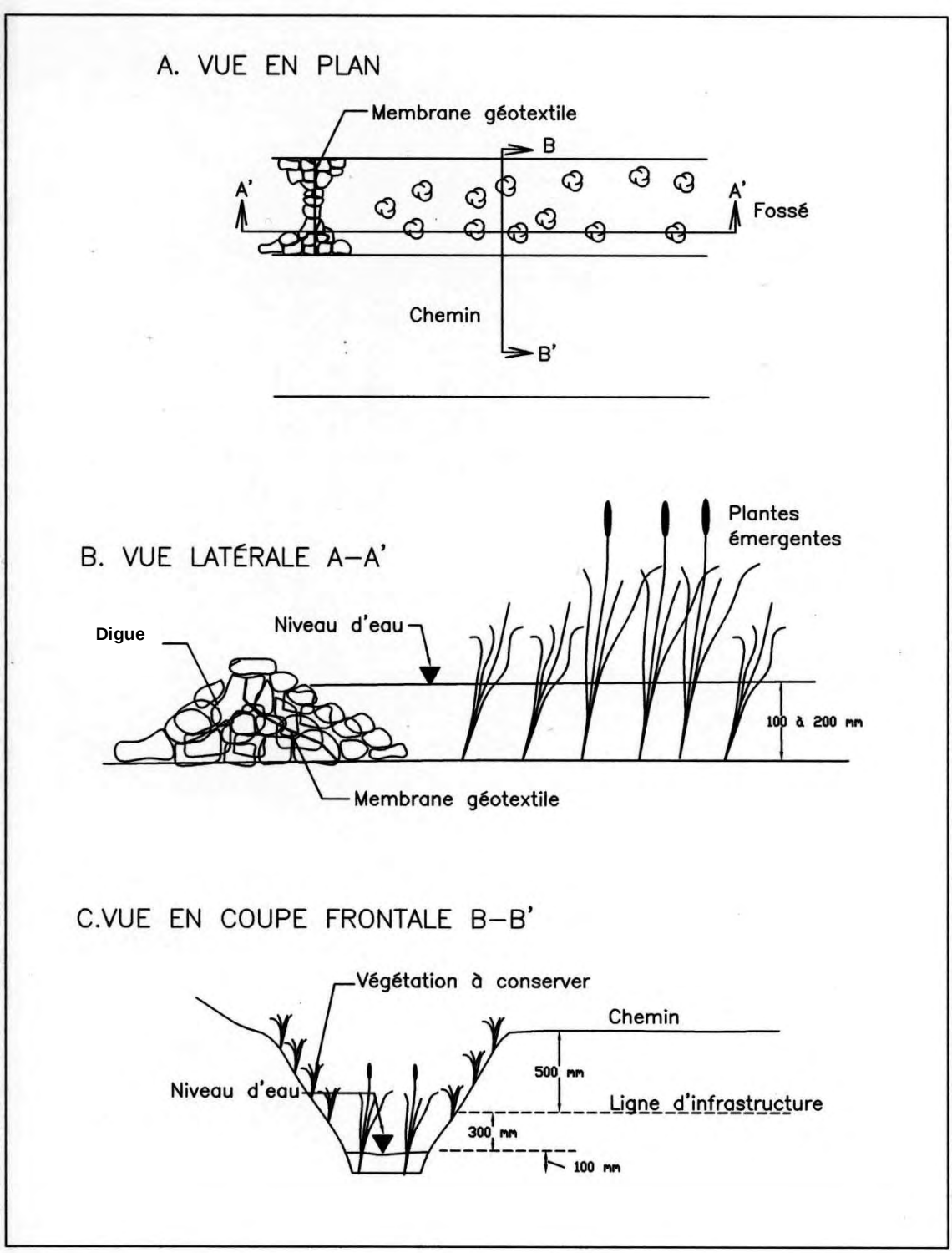
Goal
- To filter drainage water in ditches before it goes into streams or lakes;
- To collect the nutrients carried by the water;
- To reduce the speed of water flow and allow for sediments to settle.

Materials required
- Filtering aquatic plants (cattail, marsh bur-reed, water iris, water marigold, horsetail or arrowhead);
- Power shovel or backhoe;
- Geotextile;
- Crushed stone, 100 to 150 m (4 to 6 inches).

Construction note
Remodel the ground to build a small dike to provide a better separation between the filtering ditch and the stream, and to allow for the water to stay longer in the former. The dike must allow for a water column of 100 mm to be maintained. Excavate the ditch more deeply to keep the water level low enough not to hold back the road's drainage. Put in the plants, ensuring that the soil is loose enough to let them grow.

It is recommended that the vegetation (grass) already in place in the ditch be left before planting the hydrophilic plants.

Maintenance
Low.



BIOFILIA CONSULTANTS EN ENVIRONNEMENT	Titre : Fossé filtrant	Projet : Guide technique du contrôle de l'érosion	Échelle : Aucune
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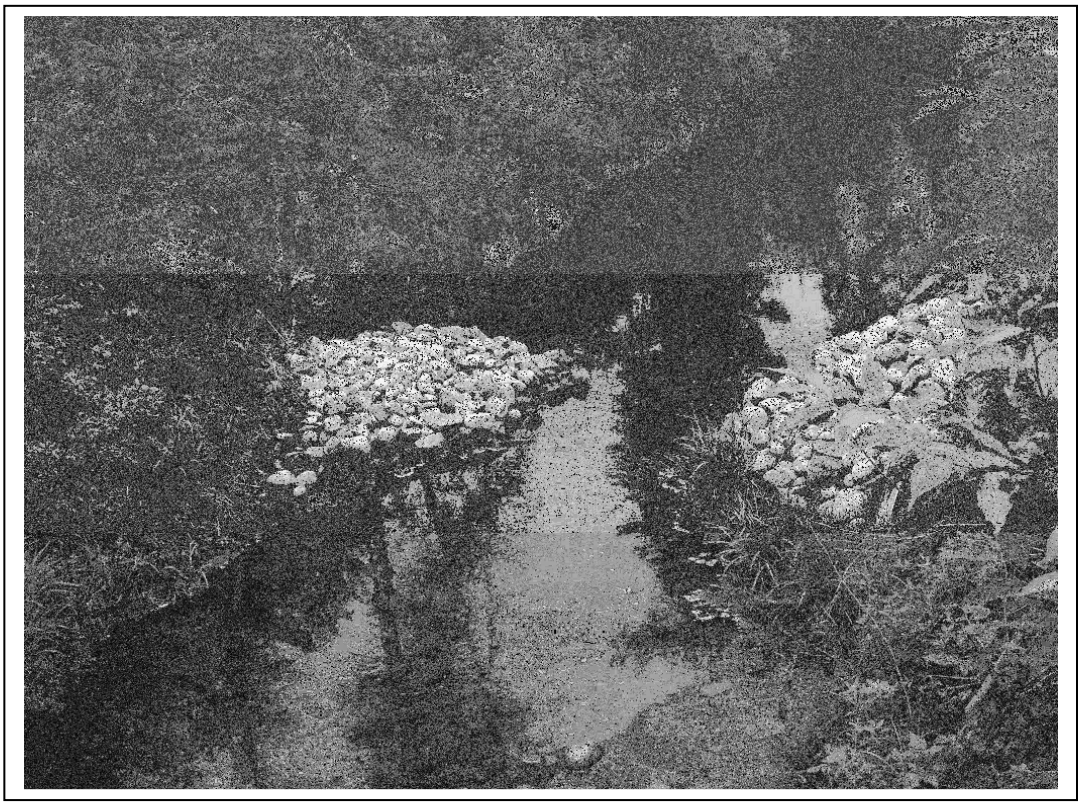
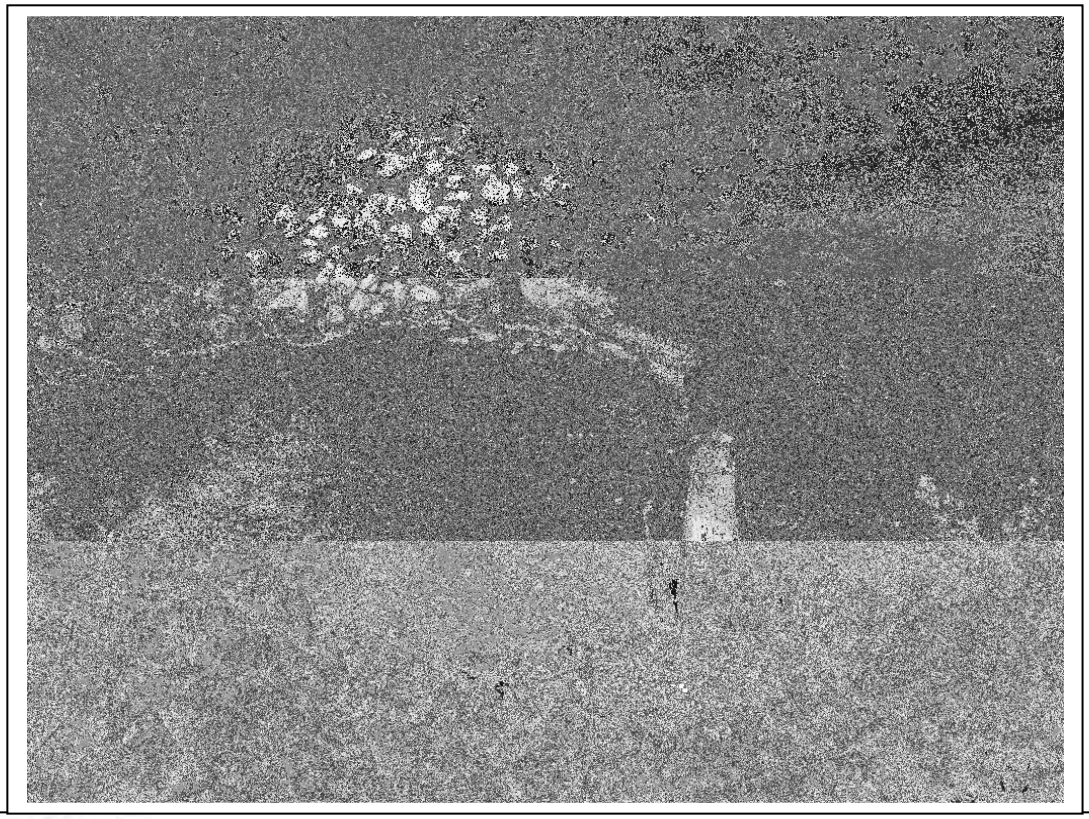




6.2 Embankments and slopes

6.2.1 Revegetation

Application
Apply these methods to road embankments with gentle to steep slopes.

Description
Use of living material to secure soil and prevent erosion

Goal
- To protect soil from the erosive effect of rain and wind;
- To reduce the erosion of ditch embankments;
- To reduce the speed of water flow;
- To collect sediments carried by water.

Materials required
- Seeds;
- Plant blanket, peat;
- Wood pickets;
- Hooks (brads);
- Mass.

Construction note
Spread a layer of fertile earth (30 mm thick) on the embankment. Cover the ground uniformly with a protective cover, plant cover, sod or hydroseed).

Seeds
Spread the seeds uniformly in a back-and-forth motion on the surface to be covered. Use the type of seeds adapted to the site conditions (sunlight, moisture, soil type, etc.). Spread the quantities recommended by the producer. This method is recommended for embankments with a gentle to medium slope (0% to 25%).

Plant blankets
Plant blankets are biodegradable and made from living or inert natural materials. Living ones generally consist of a cohesive grassy matrix shaped like a carpet. Once installed, the plant matter takes root like sod. Plant blankets made of inert materials consist of natural biodegradable fibres such as coconut fibre. Installation of these blankets is done together with grass seeding or tree or shrub planting that will stabilize the embankment following the decomposition of the blanket. Once installed, they protect the soil against mechanical erosion by rain and surface

runoff, also enabling the soil to maintain an adequate level of moisture for the development of plant matter.

Place the plant blanket roll at the top of the embankment and unroll it about 60 cm. Fasten the edge of the roll with stabilizing hooks at intervals of 30 cm. Unroll the blanket downwards. Fasten the roll with hooks at fairly close intervals based on the incline of the slope. When two parallel rolls are joined, overlap their edges in a strip 5 cm wide. Fasten using hooks, across two blanket thicknesses. When two rolls are joined, superimpose the edges in a strip 10 cm wide. Fasten again with hooks. Seeding is done before or after the installation of the blankets, based on the type used (refer to the producer's recommendation). Plant blankets help stabilize steep slopes (25% to 150%)

Sod

Place the rolls at the surface. On slopes greater than 15^0, fasten the rolls using wood pickets. More pickets are needed when the slope is steep.

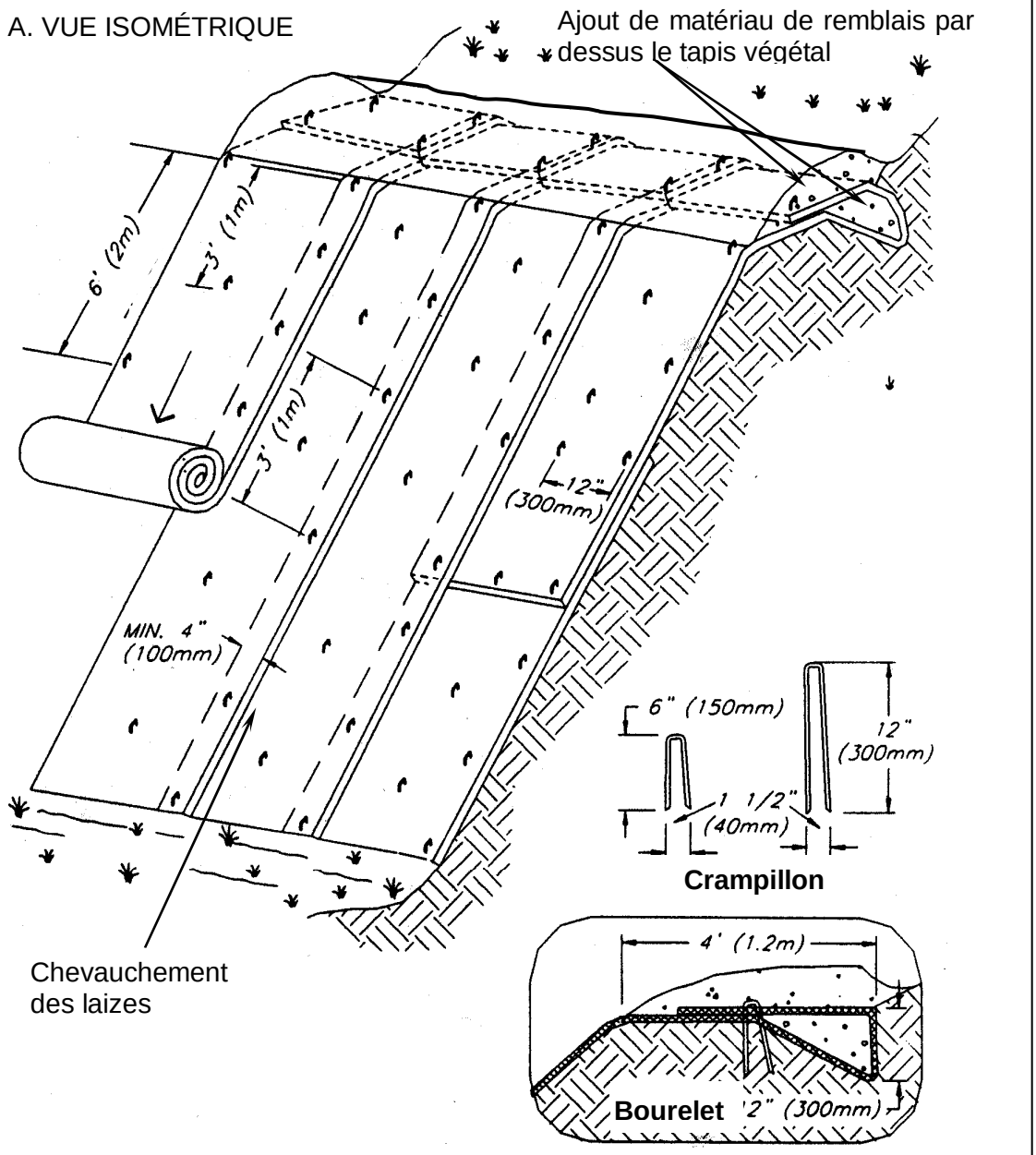
Hydroseed

When the slope of an embankment is steep and its width is sufficiently great (more than 500 metres), it is preferable to call upon companies providing a hydroseed covering service. A mixture of water, seeds and cellulose (enabling the seeds to stick to the soil) is applied using a water jet pump.

Maintenance

Low.

A. VUE ISOMÉTRIQUE



6.2.2 Diversion channels

Application
On the slopes or crest of an embankment, create channels aimed at collecting and directing water into stable and less sensitive areas.

Description
Establishment of intercepting channels perpendicular to a slope, helping reduce surface runoff and gullying of the slope.

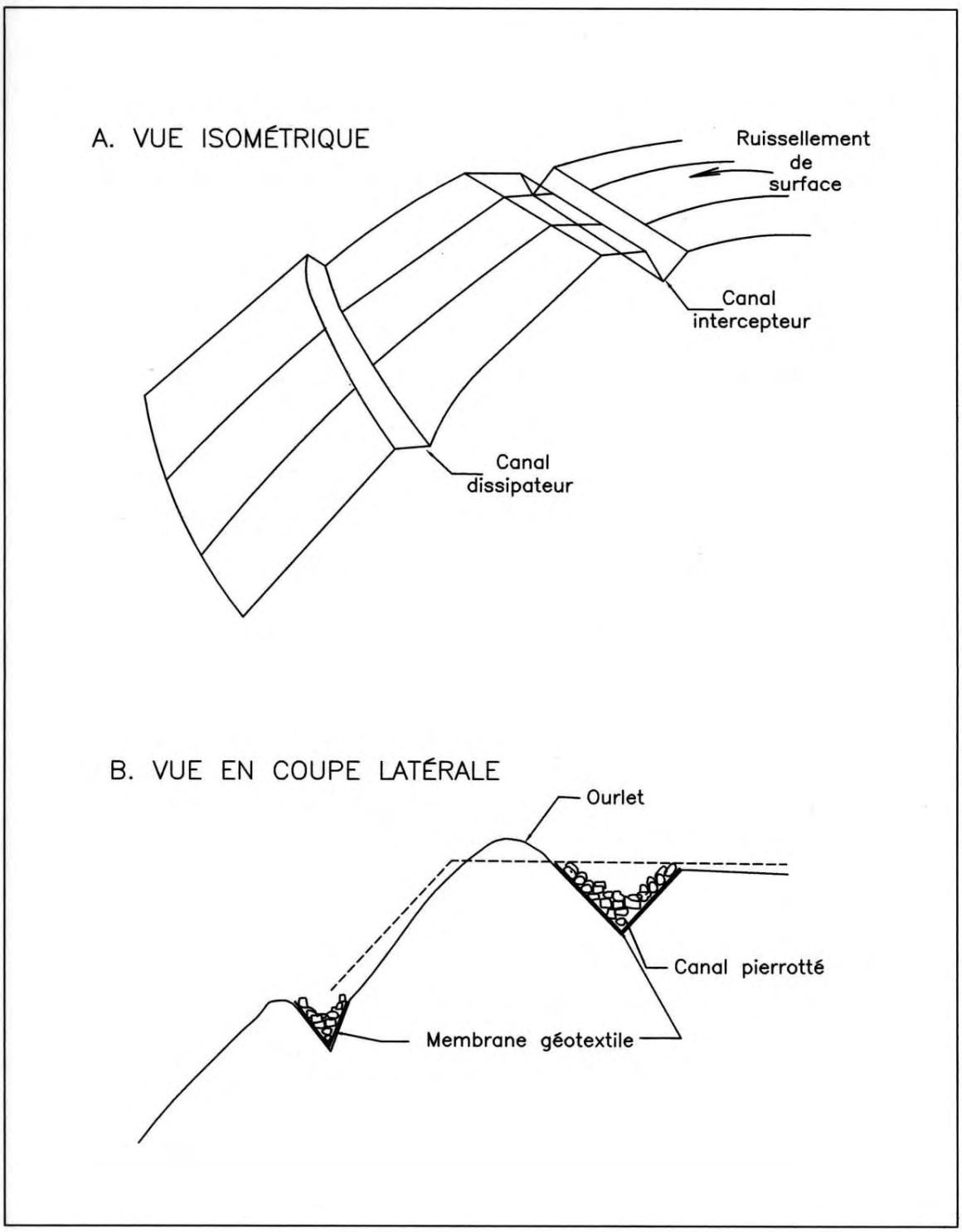
An intercepting channel must be located on the crest of the slope to intercept the water before it goes further. A dissipating channel can be arranged on the slope, helping dissipate runoff and sending it away from the slope.

Goal
- To limit surface erosion and gullying of slopes.
- To reduce the speed of surface flow and to send runoff to stable areas.

Materials required
- Small-gauge power shovel or backhoe;
- Geotextile;
- Crushed stone, 100 to 200 mm (4 to 8 inches);
- Grass seed.

Construction note
Dig a channel about 45 cm deep on the slope with a slightly inclined angle (about 60^{0}). Create a ridge on the downstream side of the slope with excavated material. Protect the bottom of the channel with a geotextile cloth. Cover the geotextile cloth and the sides of the channel with stone. Spread on both sides of the channel to limit heating of the stone and water. The channel should direct the water to a stable and vegetated spot.

Maintenance
Low.



Titre : Canal dissipateur/ intercepteur	Projet : Guide technique du contrôle de l'érosion	Échelle : Aucune
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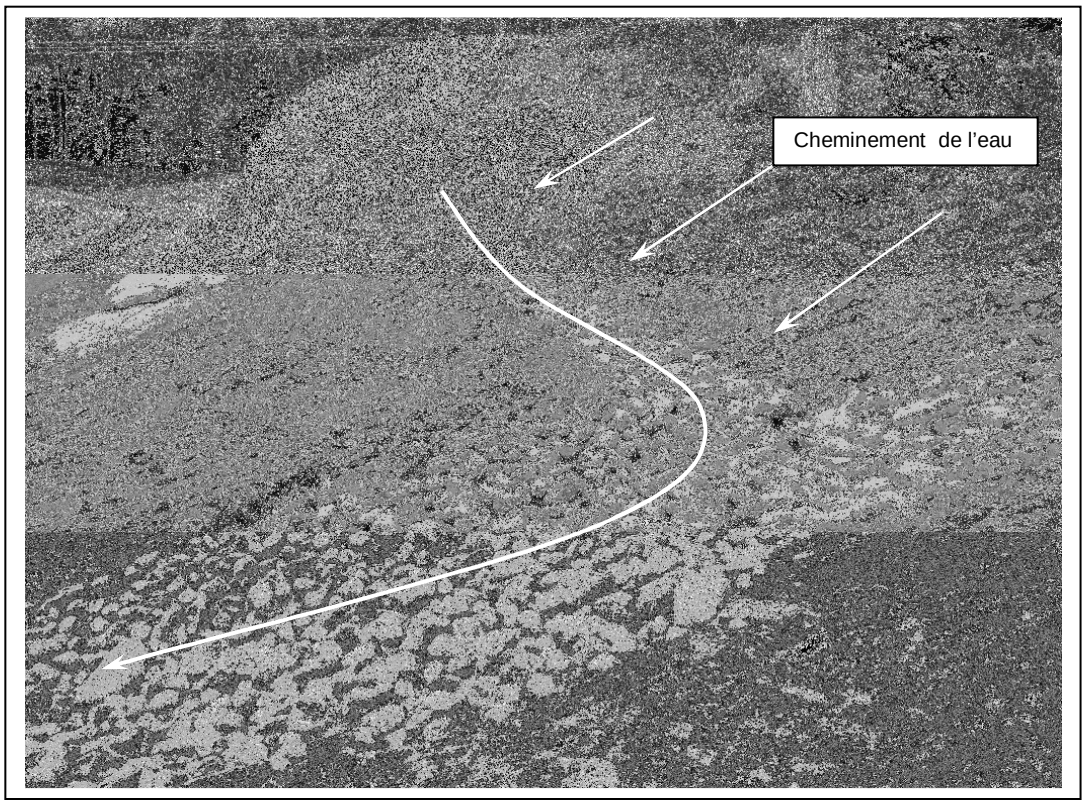
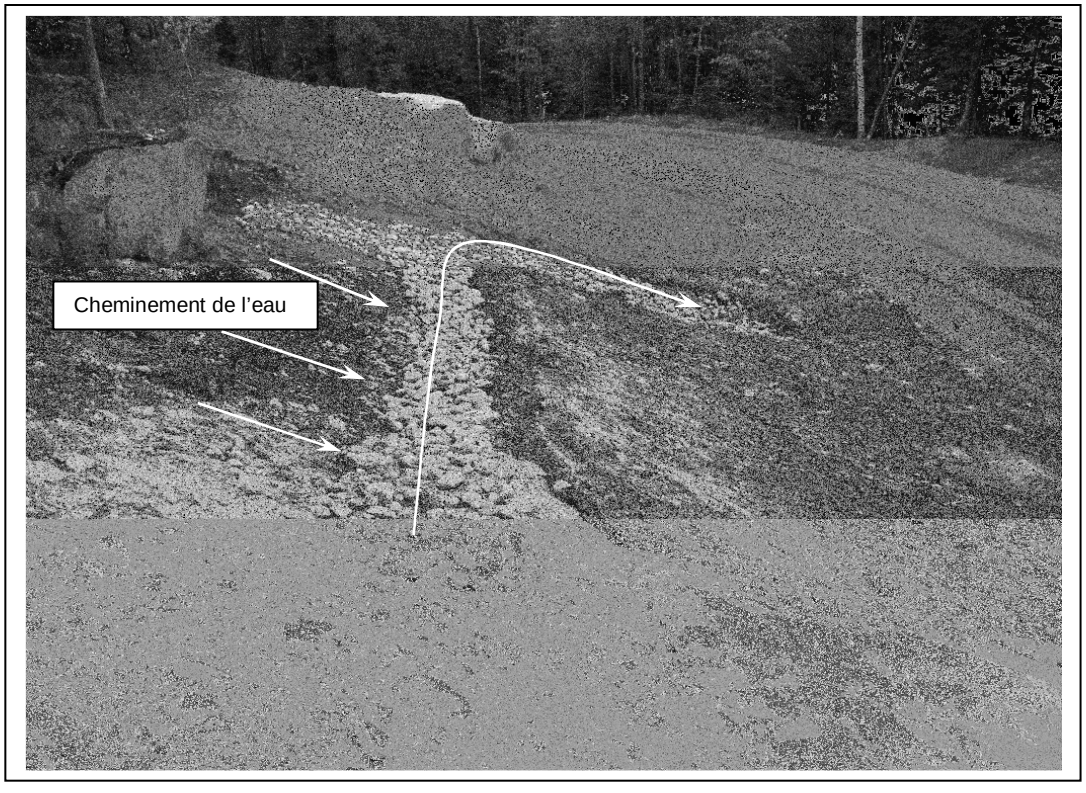

Cheminement de l'eau


Cheminement de l'eau

6.2.3 Plant matter stabilization

Application
Apply this method for revegetating the shores of lakes or streams when the slope of the shore is steep or when a waterway has a rapid flow.

Description
Fagots and fascines – Use of living material to stabilize soil, to limit gullying and to prevent erosion.

Goal
- To reduce erosion of embankments;
- To reduce inflows of sediments;
- To filter nutrients.

Materials required
- Shrubs with strong rooting potential (willow or dogwood);
- Galvanized wire;
- Wood pickets, 5 x 7.5 cm, 1.2 metres in length (2'' x 3'' de 4');

Construction note
Fagots
Assemble the stems (1 to 2 cm in diameter), alternating branched and non-branched ends. Attach in the middle with iron wire to form a bundle 1.5 to 2 metres long and 10 to 20 cm in diameter. Dig a trench about 30 cm deep below the embankment. Join the fagots using iron wire to form a chain. Place the fagots assembled in this way in the trenches at a depth equal to two-thirds of the fagot. Set the fagots perpendicularly to the slope of the embankment using pickets spaced 1.5 metres apart. Cover the fagots to one third of the diameter with non-clay soil. It is important for the top of the fagot to be visible. Space the ranks 1 to 3 metres apart according to the situation.

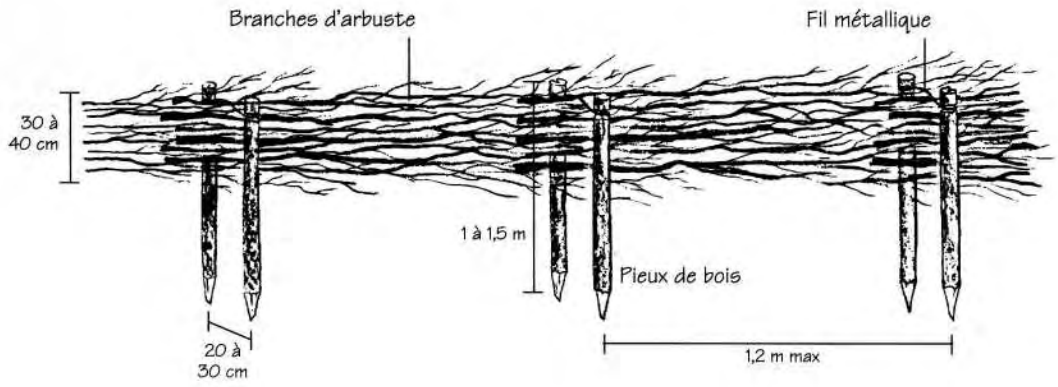
Fascines
Install two parallel rows of pickets in the lower part of the embankment with spacing that does not exceed 1.2 metres horizontally and 30 cm vertically. Place the branches between the rows of pickets, taking care to superimpose the edges of the branches to be installed with those already in place. Fasten the edges with galvanized wire to form a chain. Add a little earth above the fascines so that they do not dry out.

Straw
Straw may be used to protect slopes and other uneven spots on a permanent basis, outside the germination period. These places may be

seeded later without the straw being removed. Spread the straw over the entire embankment to obtain a thickness equal to 5 cm.

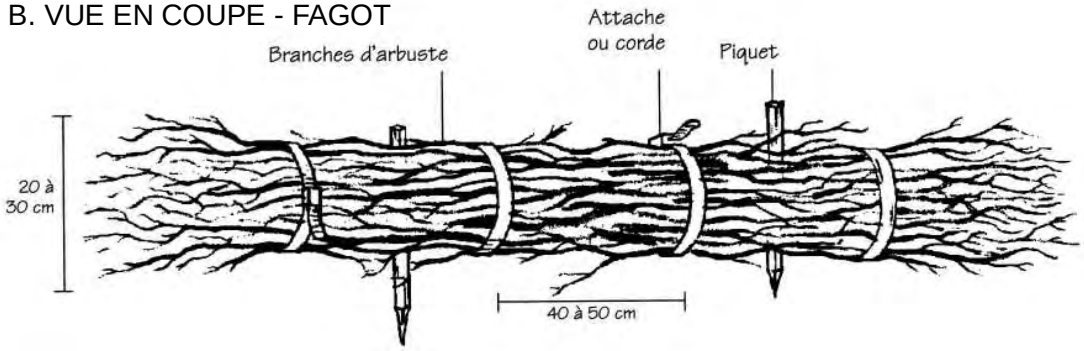
Maintenance
Low.

A. VUE EN COUPE - FASCINE

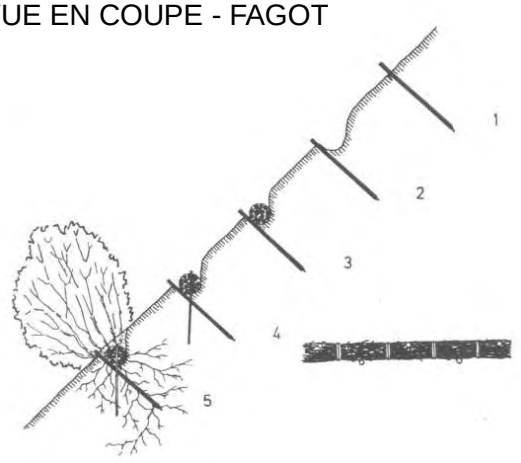


Images A et B tirées de : Protection des rives, du littoral et des plaines inondables, guide des bonnes pratiques. Ministère de l'environnement, 1998.

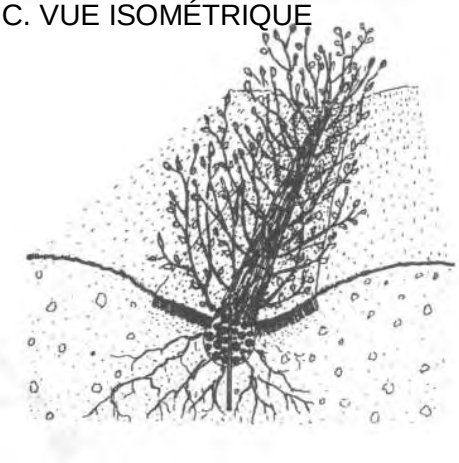
B. VUE EN COUPE - FAGOT



C. VUE EN COUPE - FAGOT



C. VUE ISOMÉTRIQUE




CAT

6.3 Crossings (culverts and bridges)

6.3.1 Stabilization of culvert heads

Application
Apply on all culvert heads.

Description
Surrounding the culvert heads with crushed stone to create a stable covering.

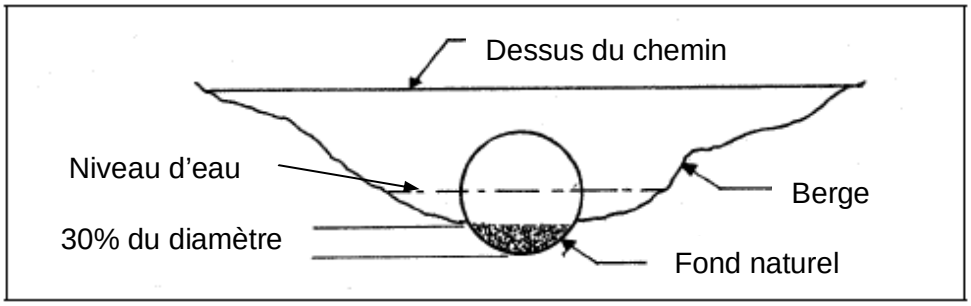
Goal
- To strengthen the edges of a culvert;
- To prevent degradation and obstruction of the culvert opening;
- To prevent erosion of the fill and of the streambed.

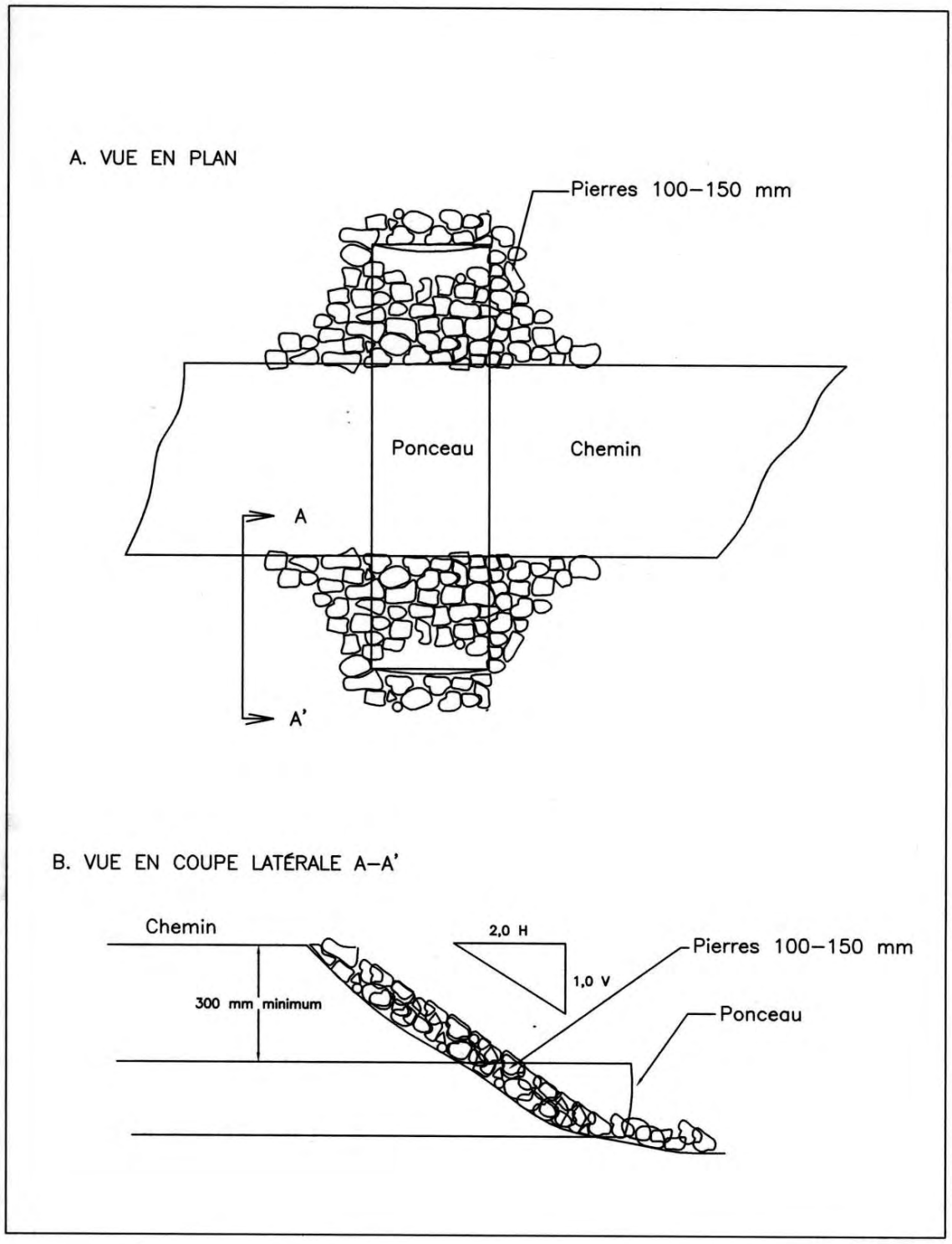
Materials required
- Power shovel or backhoe;
- Crushed stone, 100 to 150 mm (4 to 6 inches).

Construction note
Use a culvert longer than the road's maximum width to leave enough room to place the stone around the perimeter. Smooth the slope of the embankment so that is does not exceed the ratio of 2.0 horizontal to 1.0 vertical to prevent erosion and provide for stability of the stone. Clean, compact and level the surface to be coated with rock and then remove some material from both sides of the pipe to prepare the anchoring crown that will be receiving the first stone. Cover the embankment with stone (100 to 150 mm in diameter (4 to 6 inches) on both sides of the pipe, fully surrounding the culvert head. A geotextile cloth may be applied beneath the stone if the risk of erosion is substantial. The stone must go from the bottom of the stream to the upper limit of the road. The layer of stone must be a minimum of 200 mm (8 inches) thick.

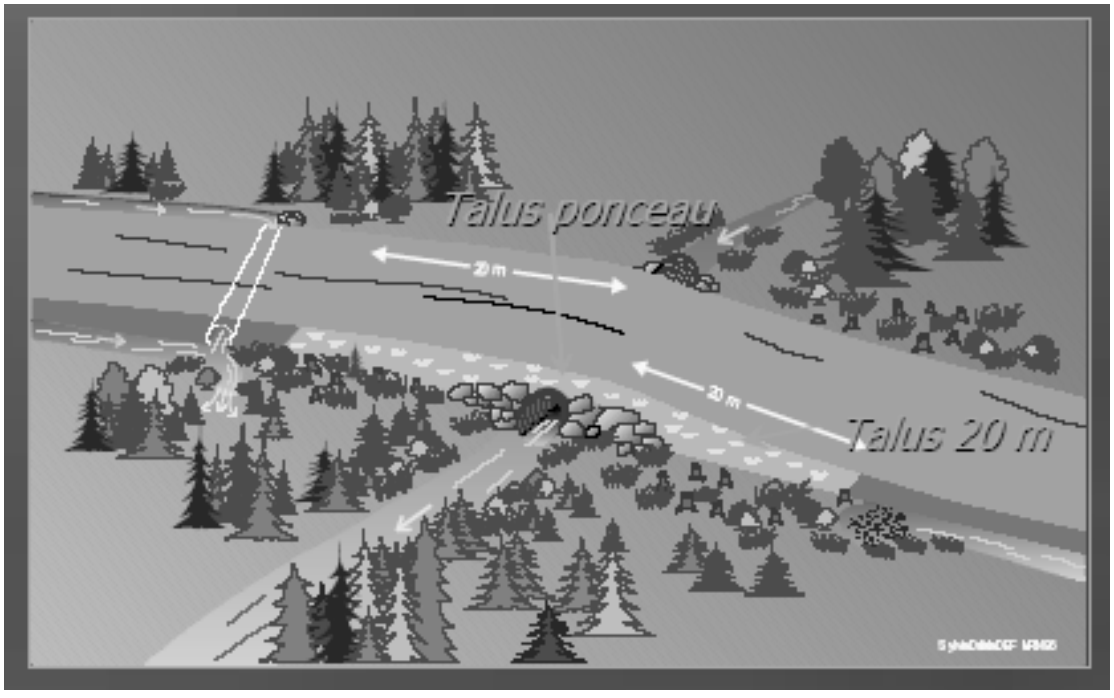
Installation of a culvert in a stream must be at a depth that provides, as much as possible, for the previous profile of the streambed to be re-established so as not to obstruct the movement of fish. Thus, the culvert should be buried to at least 30% of its diameter below the natural streambed line. Culverts with soft interiors must be avoided in streams that can receive fish populations.

Maintenance
Low


Dessus du chemin
Niveau d'eau
Berge
30% du diamètre
Fond naturel



BIOFILIA CONSULTANTS EN ENVIRONNEMENT	Titre : Stabilisation des têtes de ponceaux	Projet : Guide technique du contrôle de l'érosion	Échelle : Aucune
	Conception : Vincent Clément	Dessin : Daniel Laramée	Date : 2 septembre 2004


Talus ponceau
2 m
2 m
Talus 20 m

6.3.2 Arranging a bridge and its surroundings

Application
On all areas around a bridge.

Description
Covering the areas around a bridge with crushed stone to create a stable covering.

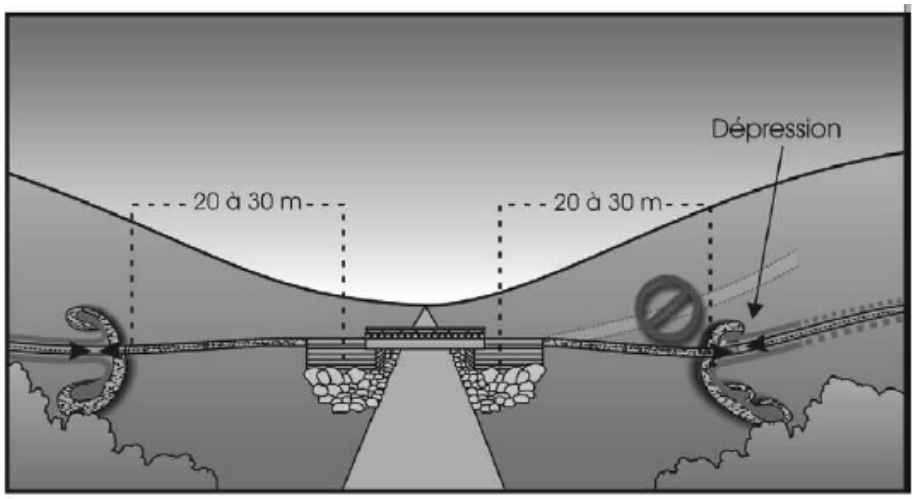
Goal
- To strengthen the areas around a bridge;
- To prevent erosion of the fill and of the streambed.

Materials required
- Power shovel or backhoe;
- Cornerstones, 100 to 150 mm (4 to 6 inches).

Construction note
Clean, compact and level the surface to be coated with rock. Cover the embankment with stone, 100 to 150 mm (4 to 6 inches) on both sides of the bridge to surround the stream embankment fully. The stone must go from the bottom of the stream to the upper limit of where the slope is smoothed and where the vegetation is stable. The layer of stone must be a minimum of 200 mm (8 inches) thick.

Raise the bridge slightly during construction to prevent gravel from accumulating on the deck or spilling into the stream.

Maintenance
Low.



6.4 Construction sites

6.4.1 Sediment barriers using bundles of hay

Application
Use in places (temporary ditches and trenches, etc.) where sediment dispersion through surface runoff has been noted.

Description
Installing a filtering membrane to collect sediments before they are carried outside the construction site.

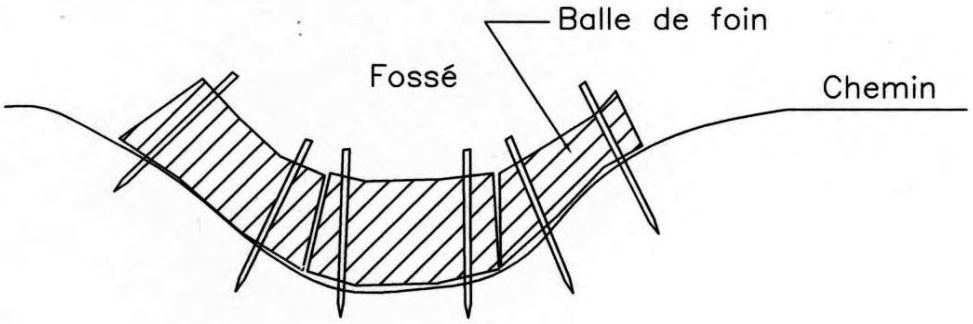
Goal
- To collect sediments carried by water.

Materials required
- Bundles of hay;
- Wood pickets, 1.2 metres long.

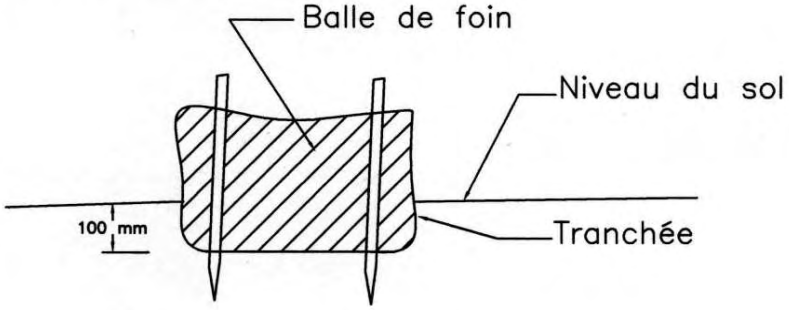
Construction note
Dig a trench 10 cm deep. Place the bundles of hay in the trench, moving them close together. Anchor each bundle with two wood pickets. Place the bundles on the sides of the channel up to the high water mark.

Maintenance
Low.

C. VUE EN COUPE FRONTALE



D. VUE EN COUPE FRONTALE



BIOFILIA CONSULTANTS EN ENVIRONNEMENT	Titre : Barrière de sédimentation Balle de foin	Projet : Guide technique du contrôle de l'érosion	Échelle : Aucune
	Conception : Vincent Clément	Dessin : Daniel Laramée	Date : 2 septembre 2004

6.4.2 Fine sediment barriers using geotextile

Application
Apply in place where a diffuse dispersion of sediments from an embankment, a sand pile or other sources of erosion have been noted. Provides for surrounding and isolating zones that are bare or have a large quantity of movable materials.

Description
Installing a filtering membrane to collect sediments before they are carried outside the construction site.

Goal
- To collect sediments carried by water.

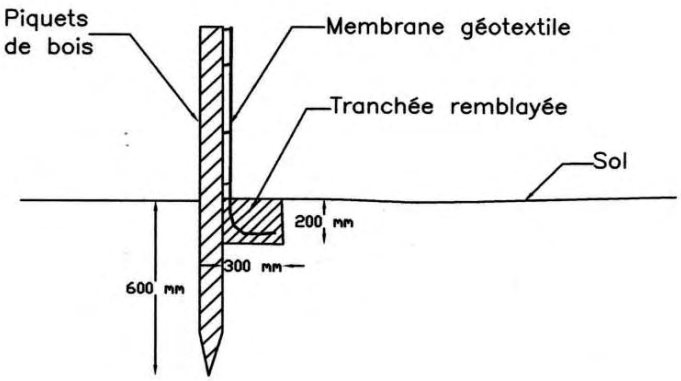
Materials required
- Geotextile;
- Wood sticks;
- Pickets, 1.2 metres long;
- Screws.

Construction note
The geotextile barrier must be installed prior to the start of any rearrangement of soil, on a flat surface.

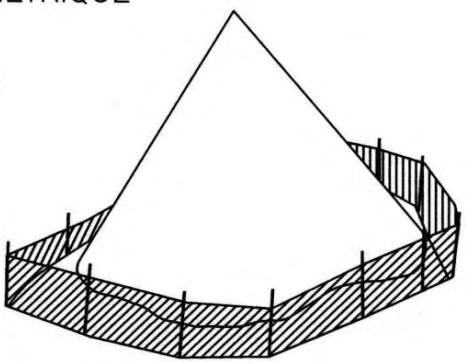
Place the barrier at a minimum distance of 1.5 metres below a slope or a place where the water is calmer in the channel where it is flowing. Dig a trench 300 mm wide and 200 mm deep. Plant the pickets in the ground at a minimum depth of 600 mm and at intervals of 1 metre. Fasten the geotextile to the wood sticks, taking care to stretch the cloth taut. Fill the trench, covering the strip of folded tissue (90^{o}) and compacting the ground to prevent water from flowing beneath the cloth. These barriers must be used only in places with a low water flow.

Maintenance
Low.

A.VUE EN COUPE



B. VUE ISOMÉTRIQUE



BIOFILIA CONSULTANTS EN ENVIRONNEMENT	Titre : Barrière de sédimentation Géotextile	Projet : Guide technique du contrôle de l'érosion	Échelle : Aucune
	Conception : Vincent Clément	Dessin : Daniel Laramée	Date : 2 septembre 2004

6.5 The shores of bodies of water and streams

6.5.1 Stabilization using inclined rockfill

Application
This method applies to the shores of streams with fast currents and substantial erosive action by ice.

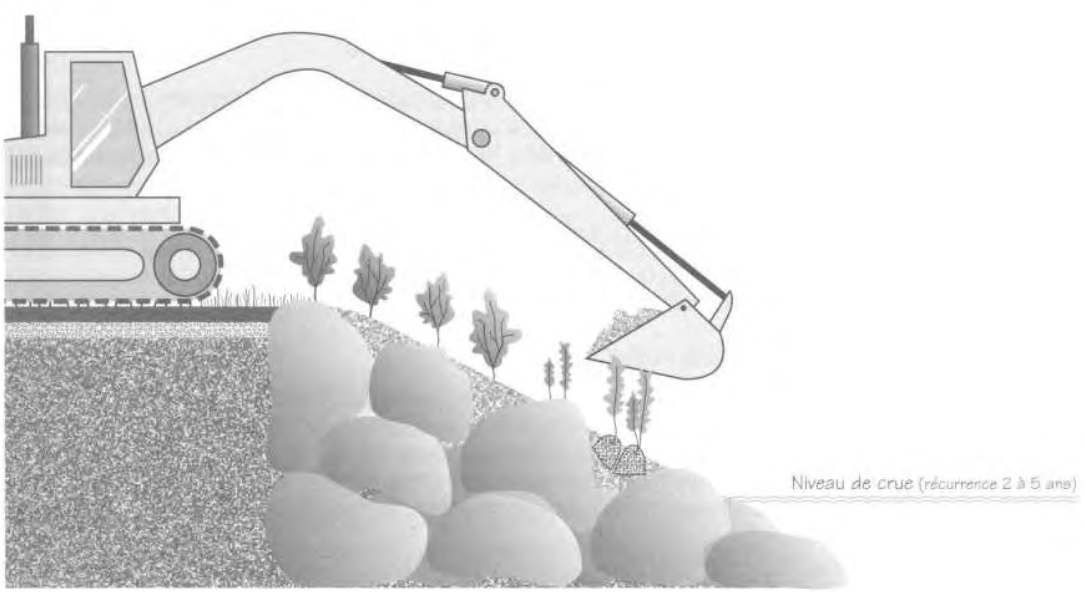
Description
Installation of a structure of unlinked stones, capable of countering the erosive action of waves, currents or ice.

Goal
- Protecting the banks against erosion.

Materials required
- Power shovel or backhoe;
- Geotextile;
- Cornerstones of varied dimensions.

Construction note
Build a crown to extend the rockfill under the streambed. Stretch the geotextile cloth over the embankment. Cover the embankment with rock up to where the establishment of vegetation is possible. If possible, plant shrubs between the stones so as to promote a full revegetation of the shore.

Maintenance
Low.



Images taken from: *Protection des rives, du littoral et des plaines inondables, guide des bonnes pratiques*. Ministère de l'environnement, 1998.

6.5.2 Stabilization using a vertical curb

Application
This method applies to the shores of streams or bodies of water where the current is fast and where the erosive action of ice is substantial. Unlike the inclined rockfill method, this method is applied when the horizontal depth of the shore is limited and does not allow for installation on an inclined area.

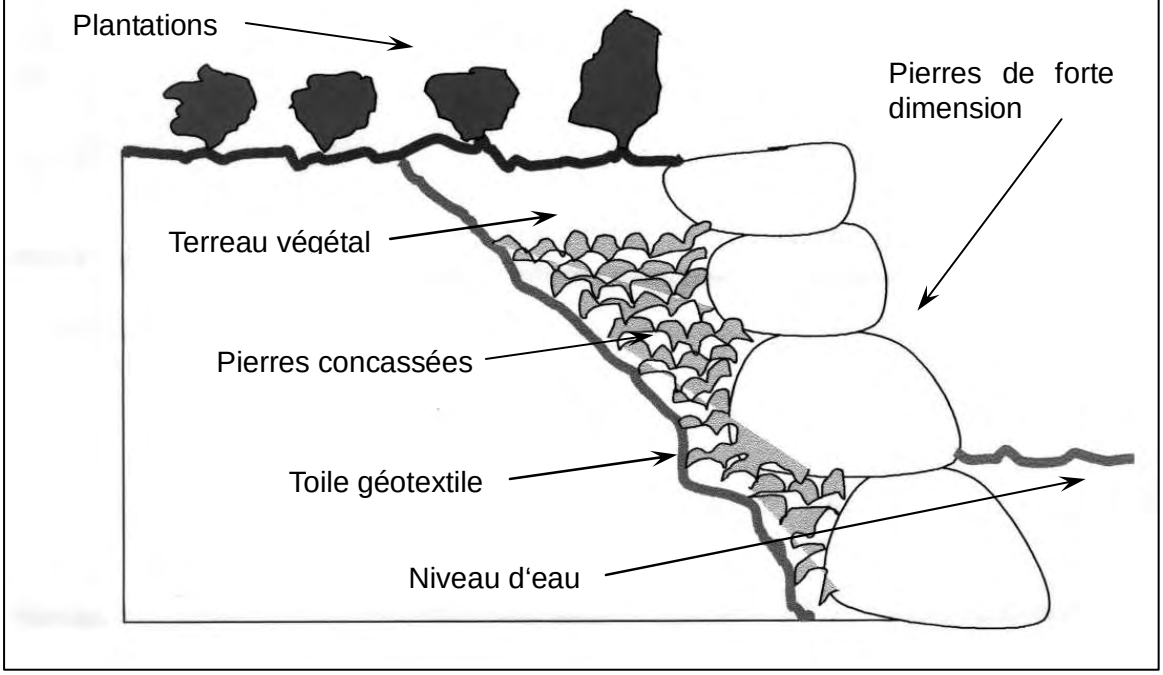
Description
Installation of a structure of unlinked stones, capable of countering the erosive action of waves, currents and ice.

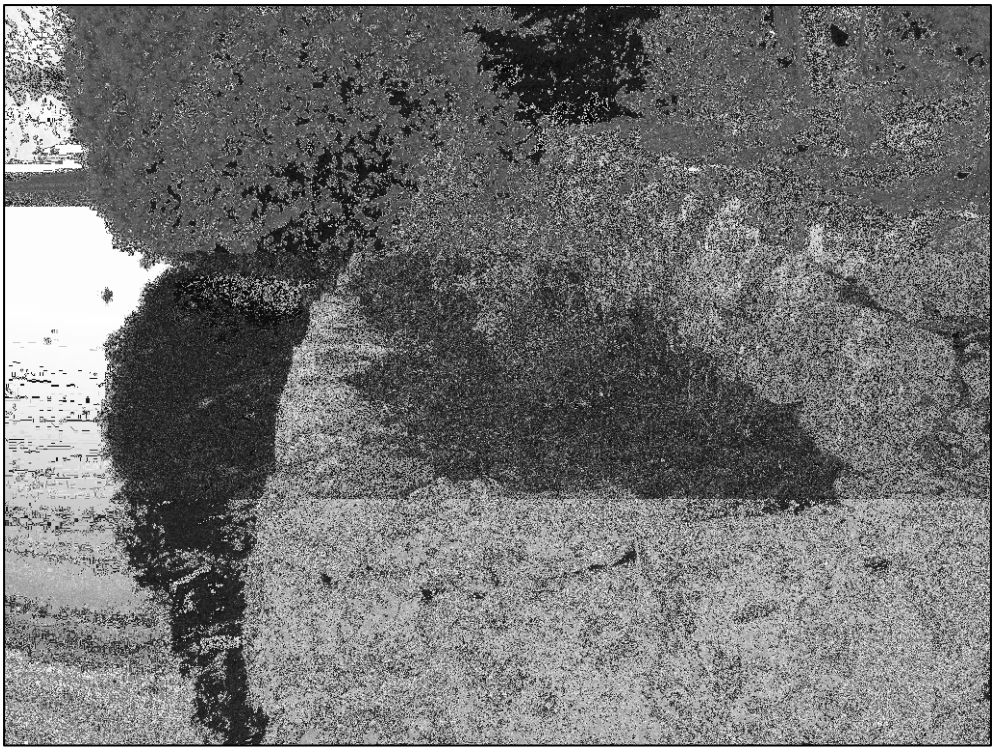
Goal
- To protect banks against erosion.

Materials required
- Power shovel or backhoe;
- Géotextile;
- Large-dimension cornerstones (variable according to the site);
- Humus.

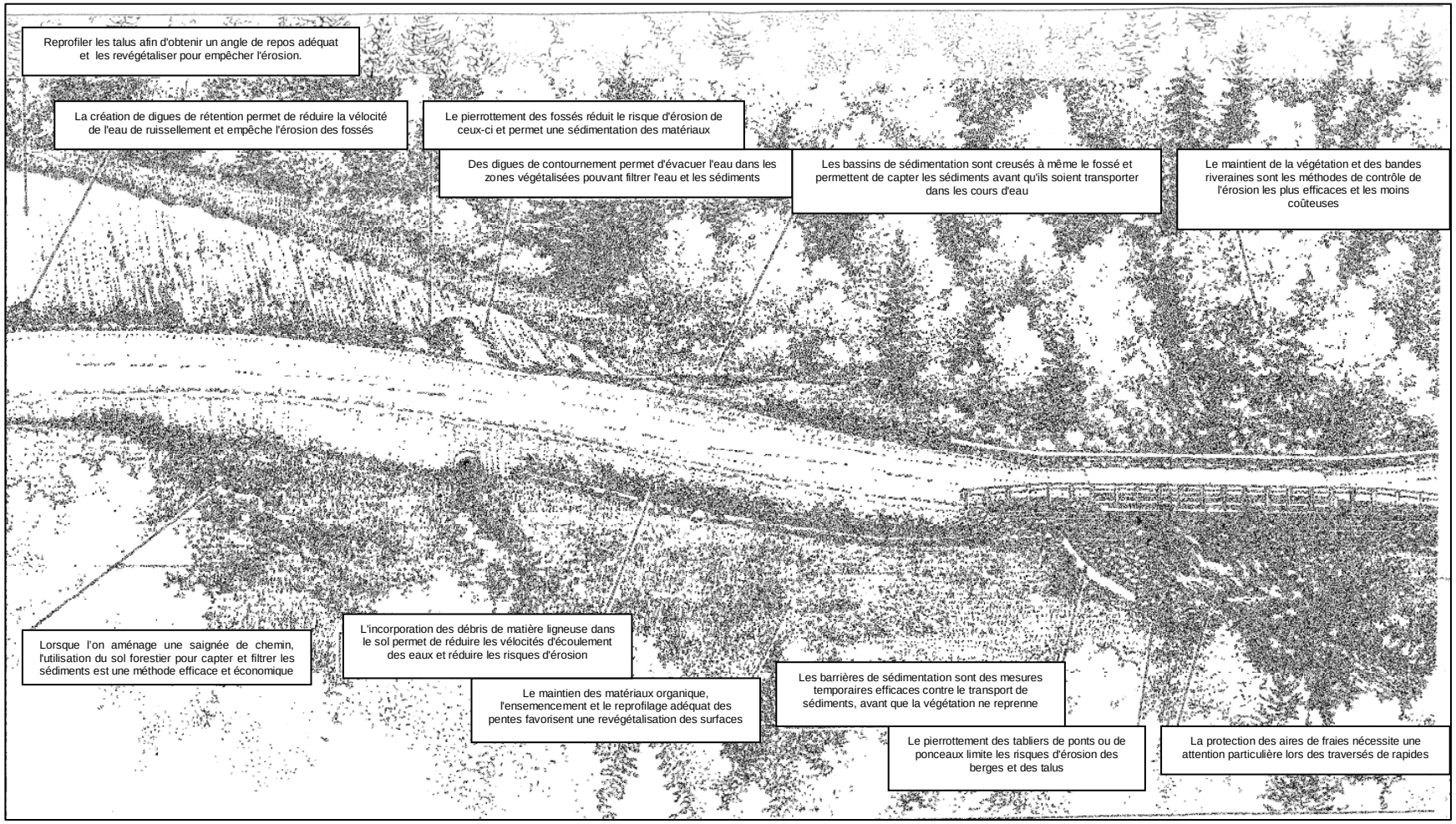
Construction note
Build a low wall by superimposing large cornerstones. A geotextile cloth must be placed on the internal vertical face of the wall to present movable materials from going between the stones. Crushed stone 100 to 150 mm (4 to 6 inches) deep must be placed at the bottom of the trench between the wall and the shore to balance the hydrostatic forces between the body of water and the shore. Humus is placed above these stones up to the maximum height of the shore. Planting shrubs between the stones and on the shore is recommended to promote the revegetation of the shore.

Maintenance
Low.


Plantations
Pierres de forte dimension
Terreau végétal
Pierres concassées
Toile géotextile
Niveau d'eau



7. PLAN CONCEPT D'AMÉNAGEMENT



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