RIPARIAN ZONES

6.1 SITE CHARACTERISTICS AND TYPICAL PLANT ASSOCIATIONS

A riparian zone is defined as land that is saturated by groundwater or subject to flooding every 2 to 20 years.

There are two broad categories of riparian habitat:

- shoreline zones;
- riparian zones along stream corridors.

Both the near shore zone and streams are sensitive natural systems that contain fish habitat.

Near shore zones

Shorelines are complex and dynamic. The character of a shoreline riparian zone is closely linked to its geomorphology and the type of material that constitutes the lakebed near it. Under natural conditions, wave action shapes the shoreline through erosion and sediment transport. However, most of the Lake Ontario shore in the highly urbanized area between the Rouge River and Burlington has been modified by lake filling or erosion and flood protection measures. Natural shoreline processes have been drastically altered.

The natural shoreline types listed below support characteristic plant communities. Some, such as dynamic beaches and dunes, are very specialized systems requiring expert advice. Detailed information regarding specific plant associations will also require professional input.

Shoreline types and features along Lake Ontario include:

- dynamic sandy beaches with dunes (Burlington Beach, Presqu'ile);
- shoreline bluffs (Scarborough Bluffs);
- shingle beaches (Halton);
- sand and cobble beaches (Northumberland);
- river mouths with associated low lying areas (Humber River);
- shoreline wetlands (Rouge River);
- barrier beaches (Lynde Shores).

Modified and altered natural shorelines include:

- lake fill areas (Tommy Thompson Park);
- beaches (Toronto Islands);
- places where the shoreline has been reinforced with riprap, rock, groynes, or piers.

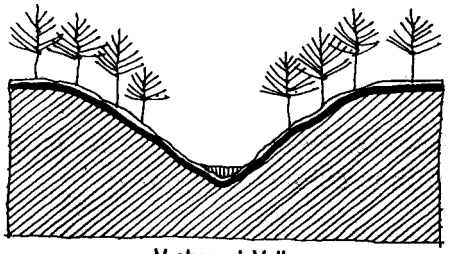
In these modified areas, vegetation can mimic the plant associations that typically occur along natural shorelines. This manual will not deal with the restoration of shoreline structure or processes. It is concerned with habitats along the shore that are quite similar to riparian habitats.

Stream corridors

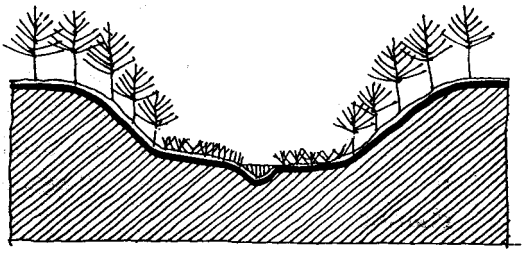
The riparian zone of a stream is closely related to its geomorphology and that of the surrounding lands. The valley and watershed influence the character and condition of a stream. Modifications to the permeability, groundwater recharge and surface runoff components of a watershed can all lead to changes in the stream class, shape, bank erosion, sedimentation, base flows, etc. A natural stream is dynamically stable, biologically self-regulating, and self-sustaining. Its valley corridors contain healthy plant communities and diverse habitat.

Definition of stream corridor and width is based on valley profile:

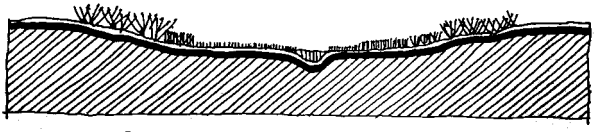
- V-shaped valley;
- U-shaped valley;
- irregular shaped valley;
- riverine wetland or riparian/bottomland;
- stream with no defined valley system.



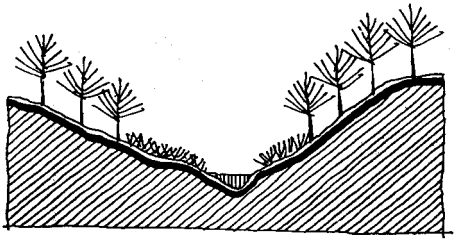
V-shaped Valley



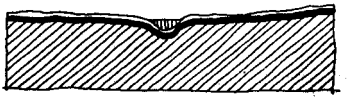
U-shaped Valley



Stream Corridor Defined by a Wetland

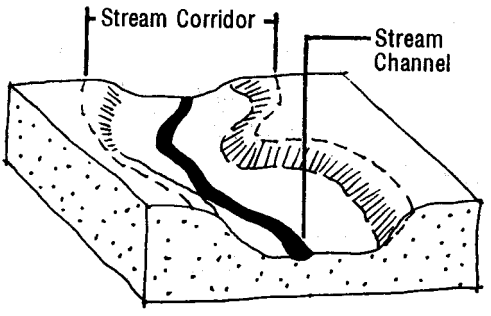


Irregular Valley



No Defined Valley

In urban locations, the extent to which development may encroach on the natural system is regulated via setbacks. A number of factors influence setbacks, such as cold water fish habitats, flood and fill lines and the presence of wetlands. Setbacks included in the stream corridor are typically:



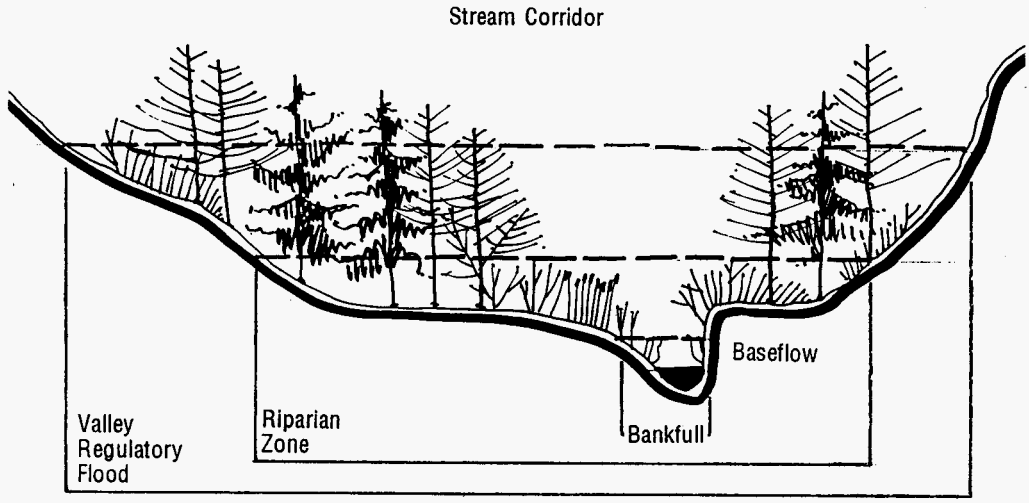
- 10 metres from stable top of bank for valleys;
- 15 metres from minor wetlands.

For watercourses with no defined valley system, setbacks are based on whether they are cold or warm water streams. The setback for the former is 30 metres and 15 metres for the latter. Contact the Ministry

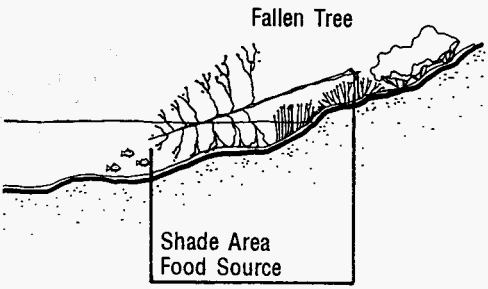
of Natural Resources and local conservation authority for specific information.

Defining the riparian zone for stream corridors

The width of a riparian zone varies with the type of stream corridor. The riparian zone buffers the banks from the erosive forces of flowing water, which in turn keeps vegetation from colonizing a stream channel.



Cross-section of stream corridor



The near stream zone provides shading, leafy debris and a food source for aquatic species. Fallen trees and branches trap sediment, reduce bank erosion and provide valuable fish habitat. Log jams normally form on the outside bends of a meandering section of stream. Woody debris can also enhance pool depth. Healthy riparian zones help maintain a high water table, reduce nutrient levels and improve water quality.

The following chart summarizes typical plant communities in the riparian zone. (For wetland species see Section 4.)

SWAMP THICKETS	*TREE SPECIES*	*RIVER AND STREAM EDGE*	*SANDY, GRAVELLY RIVER EDGE*
mountain maple	red maple	speckled alder	gray dogwood
speckled alder	silver maple	buttonbush	red osier dogwood
bittersweet	green ash	silky dogwood	firethorn
firethorn	black walnut	gray dogwood	common ninebark
winterberry	cottonwood	red osier dogwood	pin cherry
honeysuckle	trembling aspen	firethorn	chokecherry
sweet gale	bur oak	sweet gale	staghorn sumac
chokecherry	peachleaf willow	Virginia creeper	sand bar willow
swamp rose	black willow	Canada plum	wild grape
peachleaf willow	eastern white	chokecherry	
pussy willow	cedar	flowering dogwood	
sand bar willow	basswood	pussy willow	
black willow	white elm	sandbar willow	
elderberry		slender willow	
meadowsweet		elderberry	
whithrod		meadowsweet	
nannyberry		nannyberry	
highbush		highbush cranberry	
cranberry		wild grape	

6.2 DESIGN CONSIDERATIONS

Before you start

Consider the following:

- Is it shoreline? If so:
  - → what are the predominant soil types?
  - → is active erosion occurring?
  - → is soil eroding from the site being deposited in adjacent wetlands or along beaches?
  - → what are the characteristics of the adjacent aquatic habitat (substrate type, aquatic vegetation, water clarity, and temperature)?
  - → will restoration require working in the water and, if so, can this be done without adversely affecting fish habitat?

- Is it a new stream riparian area? If so:
  - → is the stream stable or eroding?
  - → does it have a well defined floodplain or valley?

- → is the floodplain inundated seasonally?
- → does the stream exhibit wide fluctuations in flow?
- → what vegetation is present along it and in the floodplain?
- → will restoration require working in the water and, if so, can this be done without adversely affecting fish habitat?

Restoration of shoreline and stream habitats generally involves one or more of the following:

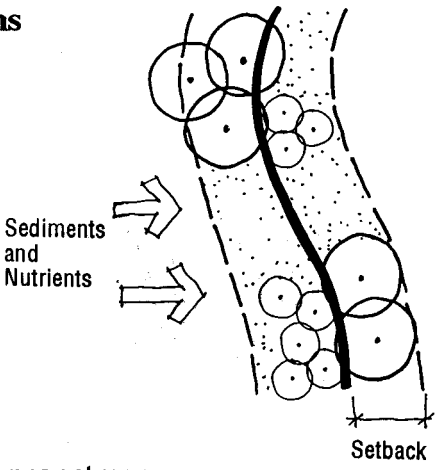
- flood protection;
- erosion control;
- fisheries habitat creation;
- terrestrial wildlife habitat enhancement.

If flood protection or erosion control is contemplated in the near shore zone or in stream and river corridors, exploring fisheries habitat improvement is a priority. In all cases expert advice should be sought and the appropriate regulatory agencies contacted to obtain the necessary permits and approvals. Only some of the terrestrial habitat enhancement techniques do not require permits.

Condition of the stream channel

In all projects involving the riparian zone of streams and rivers, consider their hydrological condition before embarking on planting to reduce erosion. Recently established vegetation can easily be washed away during floods because of the regular scouring action of the flowing water. The physical condition of the stream must function to maintain a dynamically stable geomorphological condition. Once this is achieved, planting in the riparian zone can create considerable benefits for fisheries and wildlife.

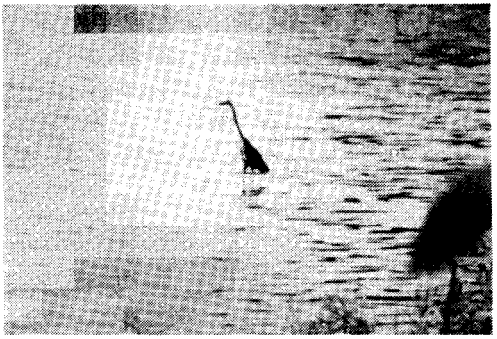
Buffer requirements and edge conditions



The purpose of setbacks and buffers is to allow streams to regain their floodplain, dissipate energy over larger areas, and improve water quality, fisheries and wildlife habitat. Setbacks discussed under valley and stream characteristics (Sub-section 6.1) indicate the minimum buffer requirements. In general, wider buffers will be more beneficial to wildlife. Buffer design should consider:

- shading requirements for fisheries in the near stream zone;
- the need for rough vegetation, such as sedges, grasses and other herbaceous species;
- shrubby plants to trap sediments and nutrients.

Wildlife considerations



Some wildlife areas will require wide corridors along streams. It should be noted that a 30 m wide corridor is not adequate for many wildlife species. (For a discussion on corridors and the need for further research see *Ecological Restoration Opportunities for the Lake Ontario Greenway*, June 1994, prepared for the Waterfront Regeneration Trust.)

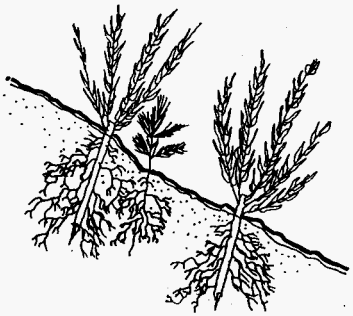
6.3 Restoration Techniques for Terrestrial Habitat

Within the riparian zone, protect edges of streams with planting and, where necessary, with rocks. Shading enhances fish habitat and serves to reduce water temperature. Fertilizers and herbicides should not be used. The primary techniques for establishing plant material include:

- planting of shrubs and trees;

- bioengineering techniques, including live stakes, mats and hydroseeding herbaceous vegetation.

Bioengineering techniques

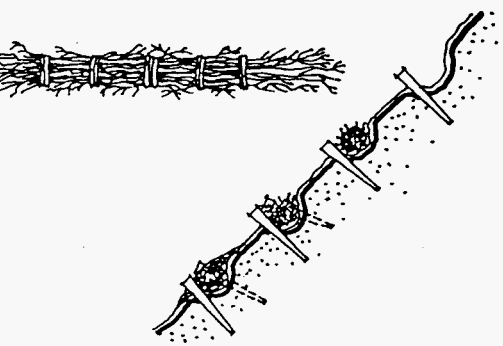


Live Stakes

Cuttings of certain species will root easily when planted. To make live stakes, take cuttings of last season's growth from suitable stock, such as poplar, willow or dogwood. The cuttings should be approximately 1 m in length with a diameter of approximately 2 to 3 cm. Insert each stake wide end first into the ground, burying it approximately 70 to 80 percent of its length. If the soil is too hard to insert the cutting directly, use a metal stake to make a hole, taking it out carefully to ensure the live stake has good contact with the soil. Cuttings are often planted in rows following the contours of the land. Spacing is typically 30 cm on centre within the row, with approximately 1 metre distance between rows.

Rooting and substantial growth occur during the first growing season, so live stakes can provide quick and effective cover. Success of the installation depends on:

- the use of suitable species (those that root easily);
- ensuring that the small end is above ground;
- ensuring that the lower end of the cutting is inserted deeply into the ground.

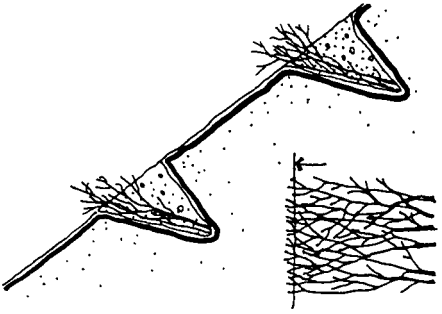


Fascines

Fascines can be used to stabilize eroding stream banks. Live branches of species that root readily (e.g., willows and dogwoods) are bound together with binder twine to form tight bundles approximately 2 m long and 20 cm in diameter. These are placed horizontally along the edge of the bank starting at the bottom of the

stream. They are stacked along the eroding bank. Soil is carefully tamped around the fascines. Compaction of the soil around the sides of the bundle is critical to get good plant-soil contact. The top of the bundle should remain showing above the soil. For best results, cuttings should be taken, bound, and placed on the same day.

Brush layering



Brush layering can be used to stabilize severely eroded banks and slopes where fill is required. Cuttings of shrubs, i.e. branches, are laid in horizontal rows across the slope to maintain sheet drainage and reduce the speed of the water and thereby its erosive force. The cuttings should be at least 1 m long and are inserted into the slope with only 25% of the branch length extending beyond the slope. The ends of the branches which stick out from the slope should form a horizontal row. The individual branch cuttings are placed perpendicular into the slope as shown in the diagram. After placement of the cuttings the soil is carefully compacted to ensure that no air pockets remain. Good soil compaction is critical to the success of brush layering.

The type of plant material used should root easily, i.e., willows, dogwoods, alders and native viburnums. If such cuttings are difficult to obtain, filler shrubs can be used in combination with species that root more easily or in combination with potted material. Ensure that the wide ends of the branches are inserted into the slope and that the top extend outward.

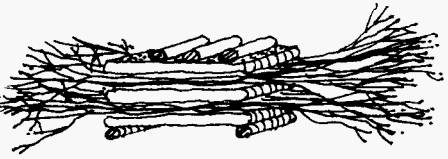
When using bioengineering techniques, consider:

- the ease of rooting of the plant material;
- the time of year. Spring installations may perform better than mid-summer installations. For fall installations, cuttings from hardwood species that root well over the winter can be selected;
- where to obtain the source material.

These techniques are relatively labour intensive and require specialized knowledge and experience. Installation crews should be carefully supervised by an experienced leader. Use of a combination of techniques is common.

Before stream bank restoration

After stream bank restoration



Other techniques include the construction of crib walls with logs to retain newly placed soil along stream banks. Live stakes can be placed in the cribwall to accelerate plant regeneration.

Live stakes can also be used to introduce plant material in riprap slopes or along stream edges.

Fibre mats and rolls

Mats and rolls are often made from coco fiber, a natural product that is very strong and disintegrates slowly. They provide a growing medium for establishing plants. In order to withstand stream currents and potential floods, the mats and rolls must be tightly secured with long stakes anchored into the ground. Sediments and seeds accumulate naturally within the fibrous structure, protected from the scouring effect of the water flow. Over time (generally one growing season), herbaceous species begin to establish themselves. Mats are particularly useful for gentle slopes. Rolls can be stacked and are used to rehabilitate steeper stream banks.