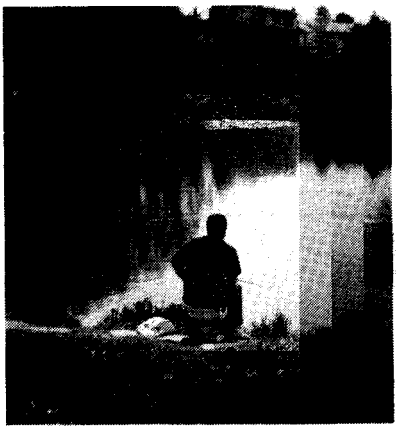
STORMWATER MANAGEMENT

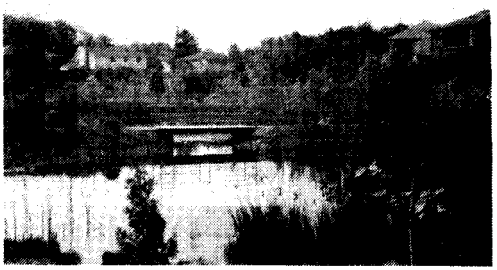
8.1 SITE CHARACTERISTICS

General considerations



Detention Pond

Stormwater ponds and surface treatment of urban runoff are increasingly becoming a feature of development areas as municipalities require alternative methods and approaches to conventional piped systems for treating urban drainage. They aim to redress hydrological imbalances by storing runoff and releasing it slowly to receiving water bodies; restore water quality by removing contaminants before they enter streams, rivers, and lakes; and protect aquatic life. Technical guidance to environmentally sustainable stormwater management is provided in the manual *Stormwater Management Practices* developed for the Ministry of Environment and Energy, Ontario (1994). For purposes here, several factors should be highlighted.



Wetland developing in stormwater pond

- The effects of urbanization on the water cycle are felt throughout the watershed and are linked to groundwater, streams, lakes and lakeshores, habitat and wildlife, and human activities.
- The functional requirements of stormwater management go beyond engineering and provide opportunities for an integrated approach that combines engineering with biologically productive aquatic and terrestrial habitats. The most relevant restoration efforts are centered on storage ponds, wetlands, naturalized drainage swales, and stream channels.

- As a general principle, the land required for stormwater retention should be an integral part of associated development and be designed for multiple uses that include recreation and education, as well as habitat regeneration.

Caution

Best Management Practices for stormwater are intended to promote environmentally sustainable development. However, concerns have been raised by various government agencies about the potential impact on fish and wildlife of contaminants collected in storage ponds. Warm stormwater can increase temperatures in receiving streams and affect cold water fisheries. Of prime importance, therefore, when integrating wildlife habitat with stormwater management, is the need to design pond systems that address these concerns.

8.2 DESIGN CONSIDERATIONS

Before you start

Consider the following:

- what are the soil conditions (type, moisture, nutrients, organic matter, drainage)?
- is the site exposed to winds and storms?
- what types of vegetation are there (cultivated, natural)?
- what are the flooding characteristics of the impoundment ponds?
- does the site lend itself to natural regeneration or direct planting?
- is this a site for contractor or community based planting?
- how can the pond be protected and made safe for children?
- is collaboration in pond design possible?

Habitat requirements for stormwater ponds

Permanent retention ponds and lakes are designed to retain urban runoff in new development where adequate space is available, where conditions for continuous natural drainage or springs are present, and where a variety of terrestrial and aquatic habitats can be developed.

Temporary storage ponds are designed for occasional and short-term retention, infiltration and groundwater recharge where a permanent water body may not be possible.

Two-pond systems have better biological and design characteristics for creating wildlife habitats. The first pond is used for settling out sediments and removing associated contaminants, and can be designed to *discourage* use by wildlife. The second acts to purify the water through the action of aquatic plants and can be designed to *encourage* wildlife.

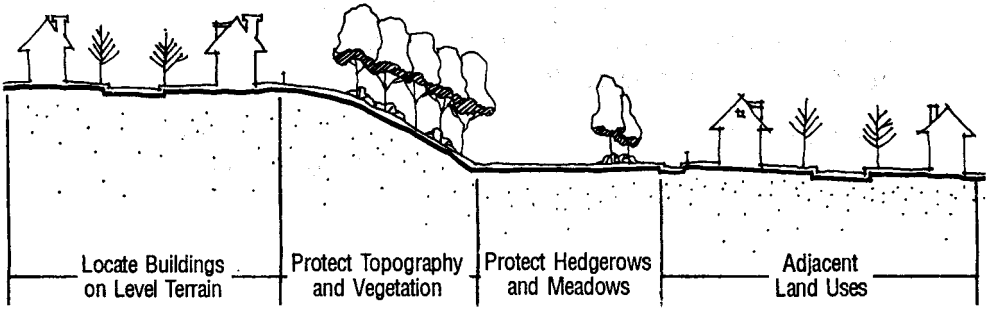
Since stormwater draining off paved surfaces is generally warmer than the receiving stream or water body, it will have an impact on water quality and aquatic life. Providing shade for surface water will help cool it before it is released into streams. Where edges can be maximized, shading by trees and edge vegetation can enhance cooling and habitat quality.

Where space permits, overland swales can form naturalized corridors while at the same time increasing the volume of water storage and infiltration.

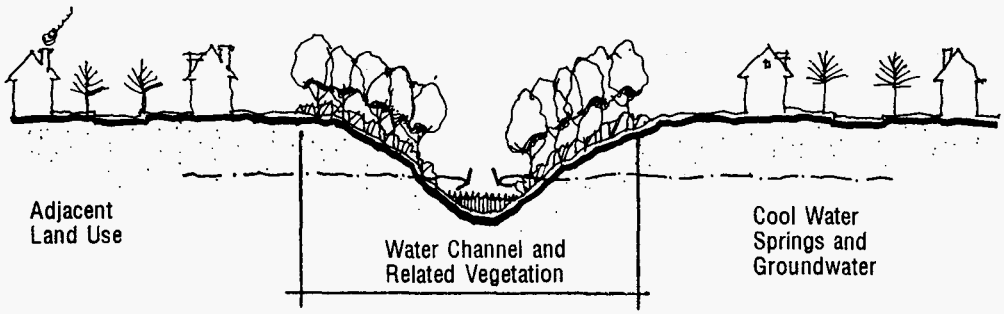
Objectives

Collaboration and integration of objectives is necessary between the restoration agency/individual and the site planner and developer, not only in the design of stormwater ponds and marsh habitats, but also in the protection of the existing landscape. Where collaboration exists, prior to and/or during project construction, consider opportunities for:

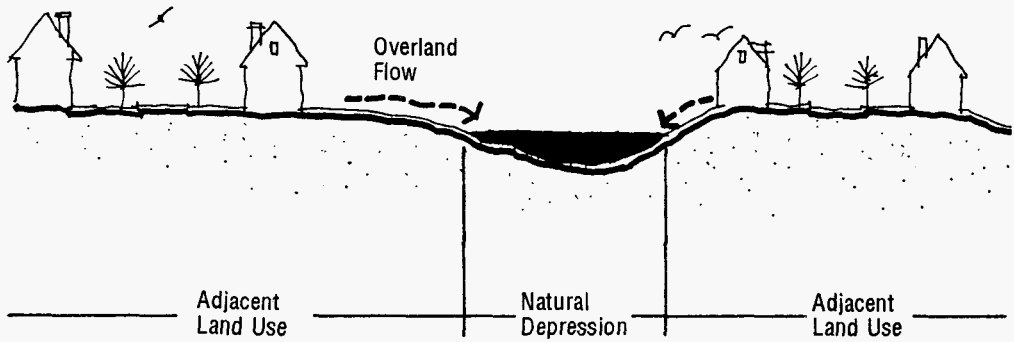
- protecting existing topography, vegetation, and cultural landscape features such as hedgerow links to other habitats, woodland;



- protecting surface water drainage channels, cold water springs and streams;

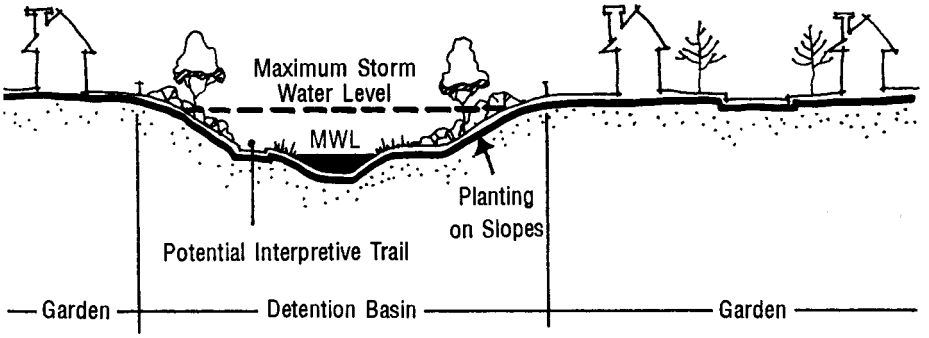


- preserving natural depressions that might be used for water detention/ retention ponds;

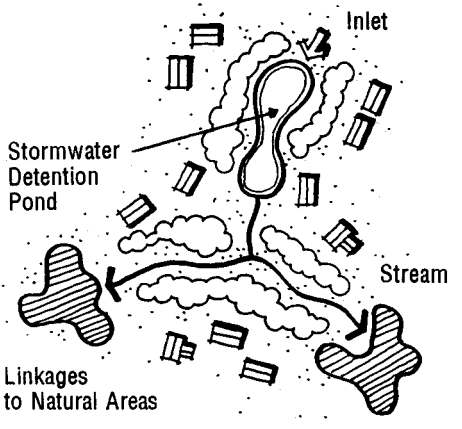


Where collaboration is not possible, i.e., in an existing or newly developed subdivision, or where stormwater drainage ponds are already constructed, consider:

- the presence of existing natural regeneration of drainage ways and wet areas, and whether active planting is needed;



- the potential for natural regeneration or planting of existing water courses and ponds in relation to existing gardens and landscaping;
- existing circulation routes and activity areas;
- existing drainage ways and the character/design of storm ponds;
- potential for linkages between naturalized storm ponds and other habitat areas;
- the need for a public participation process to determine the community's attitudes towards naturalization and their willingness to become involved in planning and management of a restoration plan.

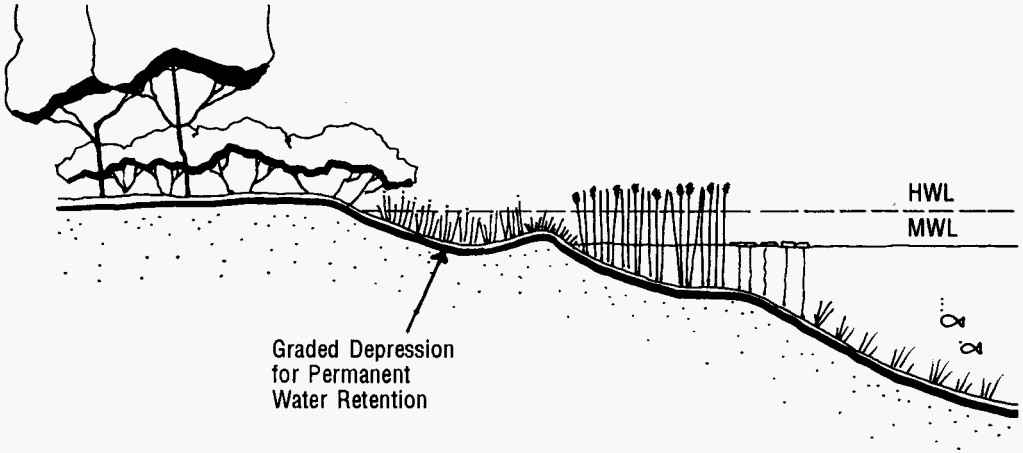


8.3 RESTORATION OPTIONS AND TECHNIQUES

Permanent ponds

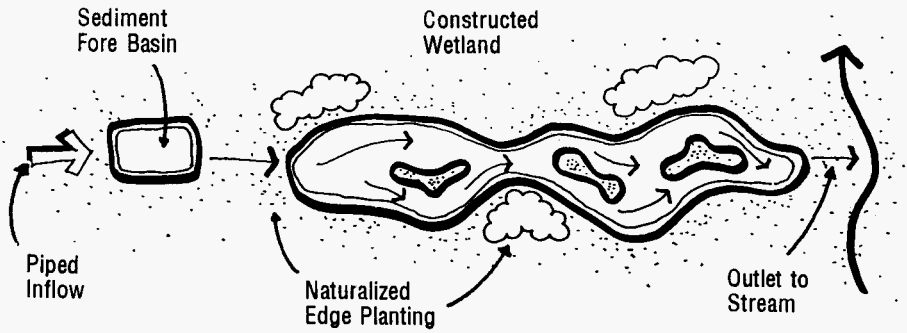
Where the right conditions exist, a permanent water body can be allowed to develop naturally and/or be planted for a variety of habitat types. (For plant associations, see sections on wetlands [4], meadows [5], woodlands [6] and riparian zones [7].)

Appropriate landforming and shaping of pond edges is essential for achieving productive and varied plant communities. In such situations, they can be left to naturalize on their own or be assisted by active planting.

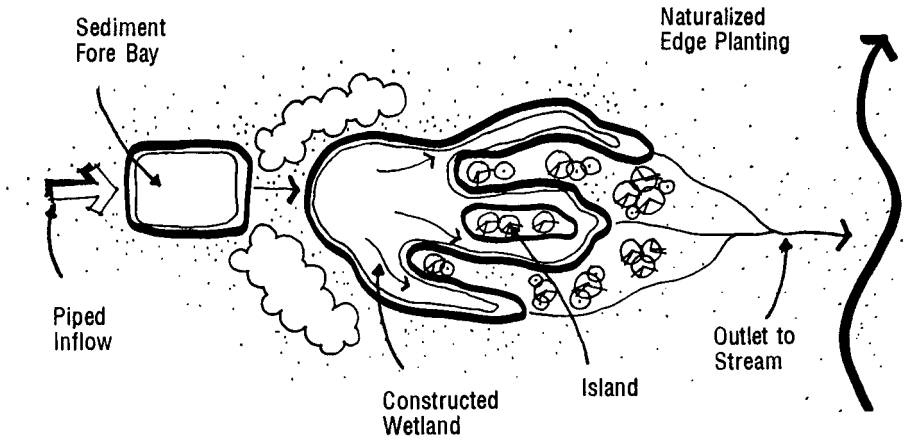


Two pond systems

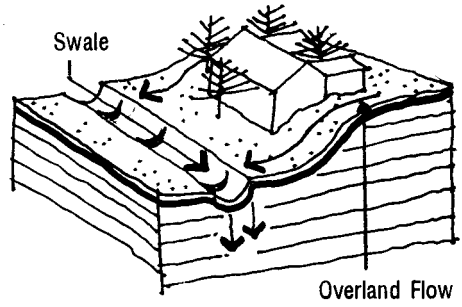
Inlet ponds act as a sedimentation basin with a stormwater detention time of 24 hours (see MOEE *Stormwater Management Practices*, 1994). Water then flows into a shallow, constructed wetland and overland to the receiving water body.



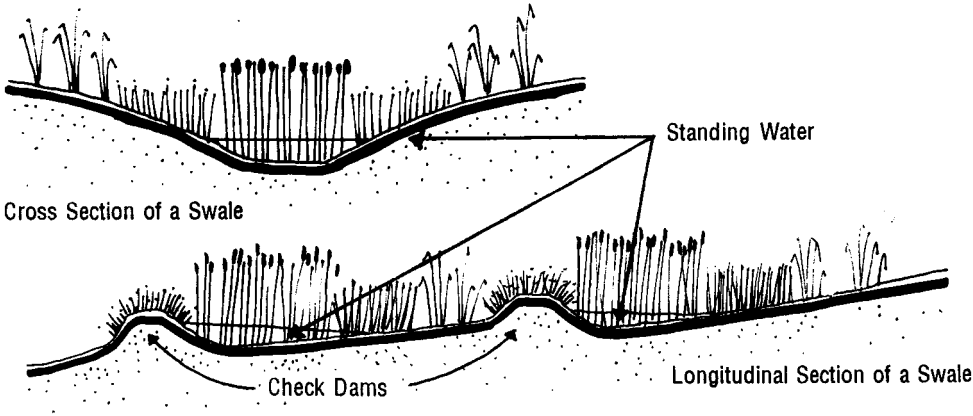
Pond form should preferably be long and narrow to maximize edges and opportunities for planting of vegetation to provide shading and cooling over the water surface.



Swales



Vegetated swales are generally associated with low density development. When designed as shallow, wide drainage areas, they can be effective for filtering and detaining stormwater runoff, and may be used to establish linear connections to other habitats. (For further information on design, see MOEE *Stormwater Management Practices*, 1994; and on plant species, other sections of this manual).



8.4 MANAGEMENT

With the appropriate design of two pond systems, several important management practices may be required, including:

- the sedimentation pond, or forebay, will require periodic removal of accumulated sediments and disposal in accordance with required MOEE procedures;
- water levels should be managed to minimize fluctuations downstream of the sedimentation pond (this will require appropriate engineering at the design phase);
- management of plant species are similar to the procedures noted in Section 3 Wetlands, of this manual.

8.5 MONITORING

Monitoring of wetland species established in stormwater pond systems is similar to procedures noted in the wetland section of this manual. Monitoring should also include:

- water sampling for phosphorus, nitrogenous compounds, suspended solids, heavy metals, and organic compounds;
- periodic sediment sampling for metals and organic materials;
- monitoring of plant survival. Where survival is low, determine possible causes, i.e.:
  - → high sediment loads (decreased light penetration into the water column, shifting substrate);
  - → excessive water level fluctuations;
  - → improper selection of plant species;
- checking for algae blooms. If these are present determine possible causes, i.e.:
  - → high phosphorus concentrations;
  - → warm water.

Where monitoring reveals problems objectives may require reevaluation and/or remedial management may be needed.

Marshall Macklin Monaghan Limited, June 1994. *Stormwater Management Practices Planning and Design Manual.* Prepared for Environmental Sciences & Standards Division, Program Development Branch, Ontario Ministry of Environment and Energy.

Taylor, Mark E. & Associates, April 1992. *Constructed Wetlands for Stormwater Management: A Review.* Prepared for Water Resources Branch, Ontario Ministry of the Environment and Metropolitan Toronto and Region Conservation Authority.

Taylor, Mark E. & Associates, April 1992. *Constructed Wetlands for Stormwater Management: An Annotated Bibliography.* Prepared for Water Resources Branch, Ontario Ministry of the Environment and Metropolitan Toronto and Region Conservation Authority.