WETLANDS

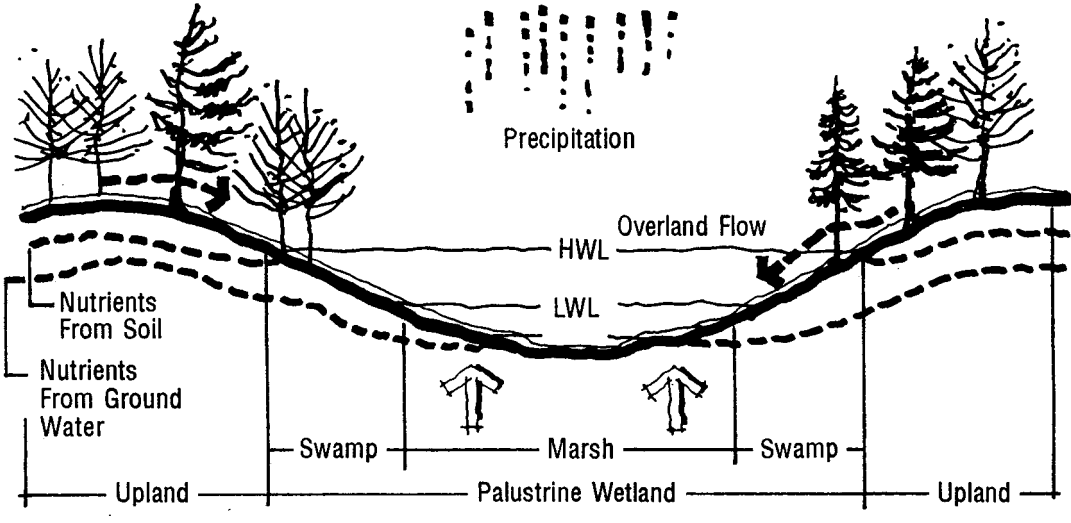
A wetland is an area that has standing water at or near the surface for most of the year and that supports plant species requiring wet conditions.

3.1 SITE CHARACTERISTICS AND TYPICAL PLANT ASSOCIATIONS

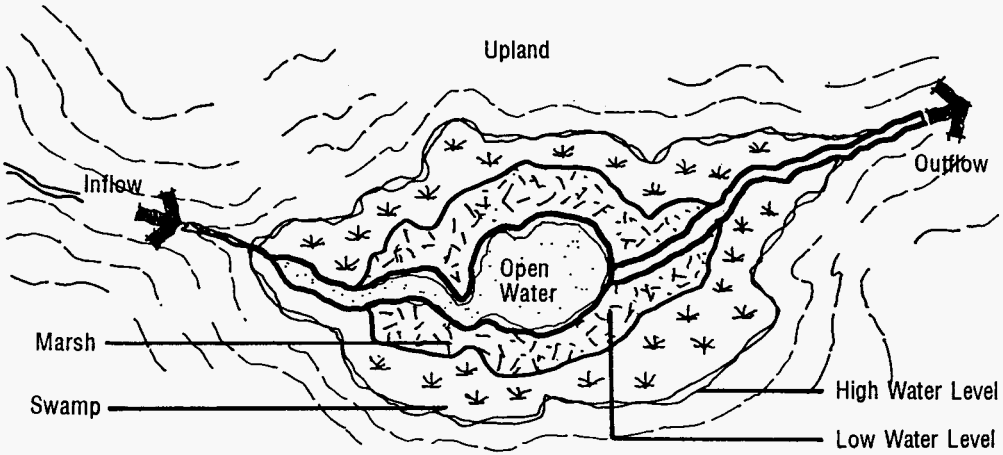
Four major wetland types can be distinguished by their vegetation communities which are determined primarily by the source of their nutrients and water.

Marshes

Marshes receive water and nutrients mostly from surface concentrations such as overland runoff, streams, rivers, ponds, and lakes. They are usually situated on mineral soils and have open water most of the year.



Section of water and nutrient flow into marshes and palustrine swamps (Adapted from: Cowardin *et al.*, 1979)



Plan view of water and nutrient flow into marshes and palustrine swamps (Adapted from: Coward *et al.*, 1979)

Annual changes in water level are an essential part of a marsh ecosystem. Most marsh plants are adapted to high spring levels, low summer levels, and slightly increasing levels in autumn. Marshes are very dynamic, with vegetation communities changing frequently in response to water fluctuations. If water levels remain static, marshes often evolve into another habitat type such as shrub swamp or open water. On the Great Lakes, there are also long-term cycles in water levels, with peaks occurring approximately every six years.

Depending upon the water regime, marshes may be relatively simple or highly complex. They may range from pure stands of cattails to more diverse areas of riparian vegetation, with emergent macrophytes in shallow areas and submergents in deeper water.

Riparian vegetation adds great diversity to a marsh. Such species are able to accommodate everything from having their feet in water to growing on slightly moist soils. Many of these species are lost if water levels cease to fluctuate, or if they fluctuate too widely.

Swamps

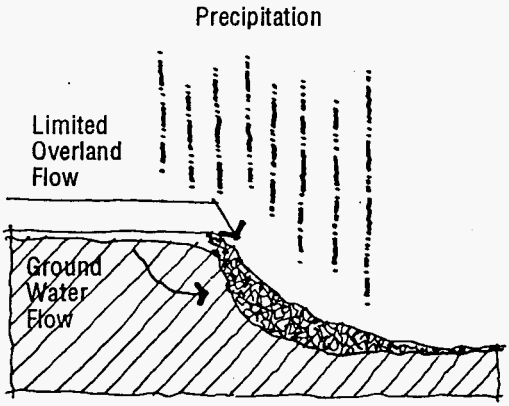
Swamps receive water and nutrients from several sources, but particularly from surface water combined with groundwater. The surface water may come directly from overland sheet flow, a stream or river, from an adjacent lake, or from most or all of these sources. Swamps are also frequently situated in areas of groundwater discharge. They may contain standing water most of the year or be wet only for short periods of time. Many are situated in riparian areas and are flooded regularly. Soils may be either organic or mineral, and there are frequently both in a single swamp.

Because of their varied sources of nutrients and water, swamps are very nutrient rich. They may be divided into two general types: shrub swamps and treed swamps.

- Shrub swamps may be dominated by species such as red osier dogwood, buttonbush, willows or speckled alder.
- Treed swamps can be further subdivided into coniferous and deciduous. In southern Ontario, white cedar is the most common coniferous dominant, but tamarack and black spruce swamps may also occur. Balsam fir may be a common species. Several deciduous trees may form the dominant cover in swamps depending upon climate, soils, moisture regime, age of the swamp, and disturbance factors. Common ones include willows, red and silver maple, white and black ash, white elm and bur oak.

Most swamps are very complicated ecosystems. A change in water level of only a few centimetres can result in a complete transformation of the plant communities. Many contain small hummocks, often around the base of tree trunks, that provide a microhabitat for upland species. Of all the wetland types, swamps support the greatest diversity of plant and animal species. The character of a swamp may also change dramatically seasonally and annually depending on hydrological cycles. In many cases, it takes an expert to distinguish a swamp from an upland forest in the drier seasons.

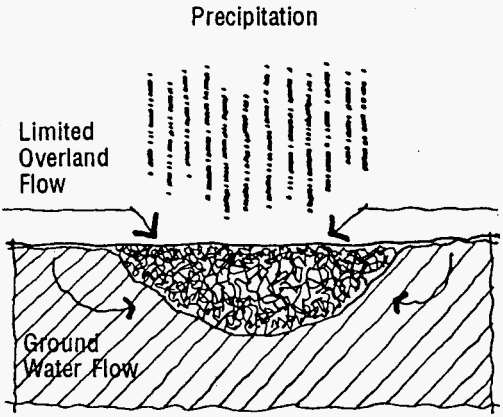
Fens



Water and nutrient flow of a sloped fen (Source: Ministry of Transportation, Ontario)

Fens receive most of their water and nutrients from groundwater and precipitation, usually with relatively minor contributions from surface flow.

The vegetation communities that fens support depend on the quality and quantity of groundwater flow. In acidic and low-flow conditions, fens may appear almost identical to bogs, with subtle differences in the species of mosses, sedges and other low plants that are present. Some large wetlands contain adjacent bog and fen communities, and some wetlands may exhibit characteristics of both. In these cases, an expert botanist, and possibly a hydrologist and hydrogeologist, may be necessary to determine wetland type.



Water and nutrient flow of a fen (Source: Ministry of Transportation, Ontario)

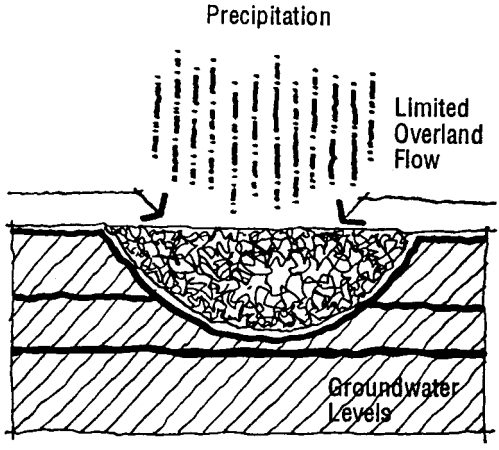
Another type of fen that may develop under acidic conditions is one dominated by sedges. Superficially, these appear to be sedge meadows but closer examination will usually reveal some of the nonwoody and low shrub species that are typical of acidic bogs and fens. They may also have an overstorey of tall shrubs or conifers.

In limestone areas, groundwater discharge to a fen may be calcareous, resulting in entirely different plant associations. Soils supporting calcareous fens are predominantly mineral, while acidic fens are dominated by organics. Soils supporting calcareous fens are predominantly mineral. Many such fens are open and dominated by nonwoody vegetation, but they may also have an overstorey of white

cedar. Calcareous fen species may include water horsetail, variegated horsetail, hooded ladies-tresses, downy willow-herb and Kalm's lobelia.

Bogs

Bogs get almost all their water and nutrients from precipitation. They are isolated from groundwater and receive minimal surface water. The soils are organic and the water highly acidic. Although some bogs have central areas of open water, the surface of others may be relatively dry, even convex.



Water and nutrient flow in bogs (Source: Ministry of Transportation, Ontario)

Bog vegetation is characterized by a ground layer of sphagnum moss, and the wetland surface is often very hummocky. Because of the low nutrient flow, the dominant plant species are those adapted to acidic conditions or that are evergreen so photosynthesis can take place year round. Carnivorous plants such as sundews and pitcher plants that do not rely on soil nutrients may be common on bogs.

Bogs may be predominantly open, being dominated by mosses, non-woody vegetation and short shrubs, or they may have overstorey layers of tall shrubs or trees. The lower level of vegetation is often similar regardless of whether the bog has an overstorey or is open. Typical plants found in bogs are listed in the Appendix.

Abiotic factors that control wetlands

Vegetation communities are usually used to describe wetland types and most other habitats. However, it is critical to realize that the vegetation is essentially a result, as well as an indicator, of abiotic or non-living factors. These include:

- soil types;
- topography;
- surface water;

- groundwater;
- climate;
- nutrient and sediment flows and cycles.

It is essential to have a clear understanding of how these factors affect a wetland being considered for rehabilitation.

Restoration opportunities for wetland types

Only marshes are considered further in this section; however, techniques presented for woodlands are also applicable to swamps and are explained in the section on woodlands. Because of their sensitivity to changes in water quality and quantity, bogs and fens are not generally suitable for restoration.

Caution

Public acceptance of marshes is now high and wetlands are enjoyed by a wide spectrum of people. Your restoration/ rehabilitation work may not ***find immediate public acceptance*** *if:*

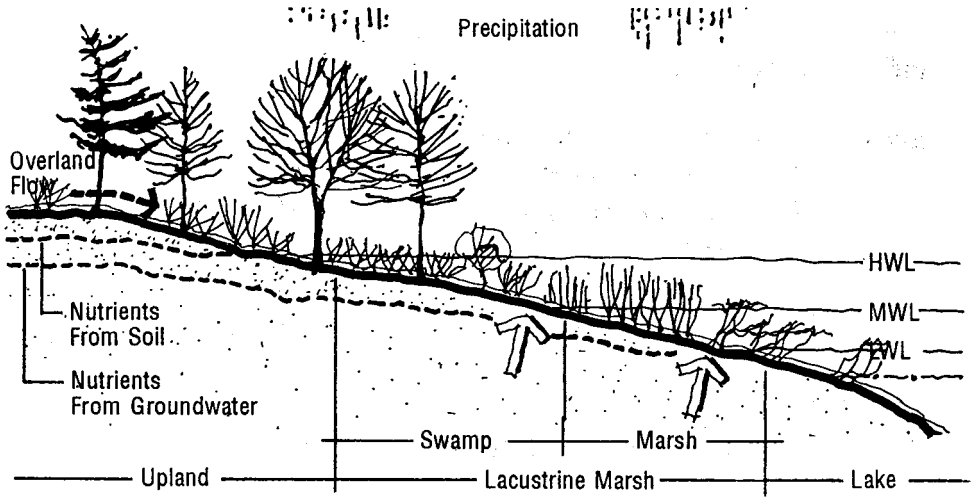
- *water is currently turbid;*
- *there are algae blooms;*
- *aggressive species such as cattails, reed canary-grass or reed grass have taken over the entire area;*
- *it is dominated by species such as purple loosestrife;*
- *it is a potential safety hazard;*
- *it is perceived as a mosquito breeding area.*

A public education session would be useful to clear up apprehensions and recruit community members to help with the restoration plan.

Types of marshes

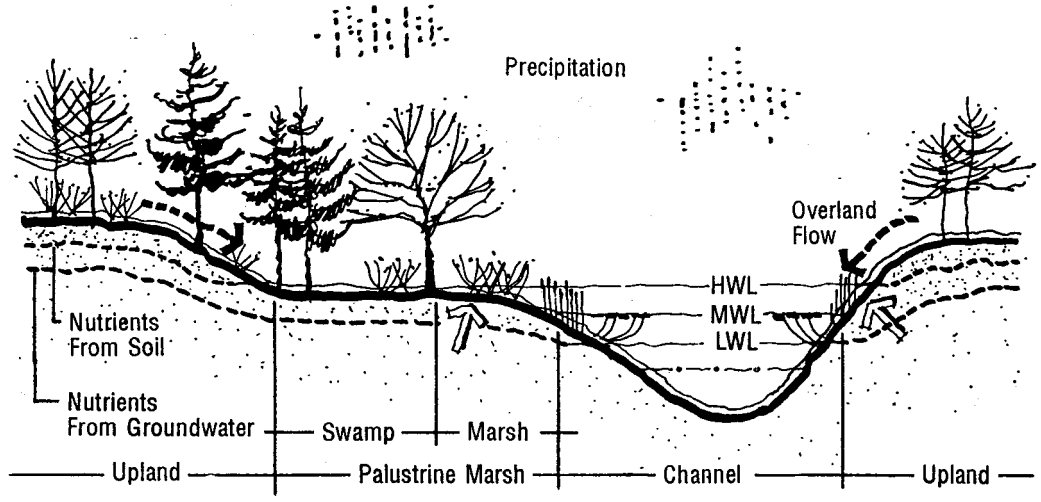
Not only are there different wetland types, there are also different types of marshes. These, again, are defined by abiotic factors, especially by source of water. For the purpose of this manual, wetlands have been placed into three general categories: lacustrine, palustrine and isolated.

Lacustrine marshes are those situated at the shoreline of a lake. Their primary source of nutrients and water is the lake, and their plant species distribution is highly dependent on water-level fluctuations and water depths.



Section of a lacustrine marsh and swamp (Adapted from: Cowardin *et al.*, 1979)

Palustrine marshes may have a stream running through them and receive nutrients from the watercourse. Often they are in groundwater discharge areas and form the headwaters of a stream. They have the potential to be more productive than lacustrine marshes, as they receive nutrients constantly from the flowing water. Marshes along rivers are called riverine marshes, but are considered palustrine here as the same general processes occur regardless of the size of the watercourse.



Section of palustrine swamp and marsh (Adapted from: Cowardin *et al.*, 1979)

Estuarine marshes—those occurring at the mouth of a river—are considered palustrine as well, although they are also greatly influenced by lake dynamics.

Isolated marshes are not connected to watercourses or other water bodies. Most of their water is received from precipitation and overland flow. They are frequently situated on clays that inhibit percolation of water.

3.2 DESIGN CONSIDERATIONS

Before you start

Consider the biophysical characteristics of the marsh site:

- how big will it be?
- how deep is it now and are there options for altering depths?
- what soils exist there?
- where will the marsh get its water?
- is it connected to groundwater?
- what is the resultant water quality likely to be?
- will there be large influxes of sediment?
- will it be subject to wave action or flows that may move sediments?
- what is the anticipated magnitude of water-level fluctuations?
- what are the potential effects on the existing environment?

Prior to project initiation, it is useful to predict what species of fish and wildlife may benefit from the marsh. For areas connected with watercourses or water bodies, the Ministry of Natural Resources will be able to provide data on fish species present and those likely to benefit from marsh enhancement or creation. Information on fish and wildlife may also be available from the local conservation authority.

Potential Wildlife Species in Different-sized Marshes in the Toronto Bioregion

SPECIES	*MARSH SIZE*				
	Under 2 ha	2 ha	5 ha	10 ha	20 ha or larger
* Mudpuppy		x	x	x	x
American Toad	x	x	x	x	x
Spring Peeper	x	x	x	x	x
Gray Treefrog	x	x	x	x	x
Striped Chorus Frog	x	x	x	x	x
Northern Leopard Frog	x	x	x	x	x
Green Frog	x	x	x	x	x
Bullfrog		x	x	x	x
Snapping Turtle	x	x	x	x	x
Midland Painted Turtle	x	x	x	x	x
* Map Turtle		x	x	x	x
Blanding's Turtle	x	x	x	x	x
* Eastern Spiny Softshell Turtle			x	x	x
Eastern Garter Snake	x	x	x	x	x
Northern Ribbon Snake		x	x	x	x
Northern Water Snake		x	x	x	x
Pied-billed Grebe	x	x	x	x	x
American Bittern			x	x	x
Least Bittern				x	x
Mute Swan					x
Canada Goose	x	x	x	x	x
Mallard	x	x	x	x	x
Northern Pintail		x	x	x	x
Blue-winged Teal	x	x	x	x	x
Gadwall			x	x	x
American Wigeon			x	x	x
Osprey					x
Northern Harrier					x
Virginia Rail	x	x	x	x	x
Sora	x	x	x	x	x
Common Moorhen				x	x
American Coot				x	x
Spotted Sandpiper	x	x	x	x	x
Black Tern				x	x

Marsh Wren		x	x	x	x
Common Yellowthroat	x	x	x	x	x
Song Sparrow	x	x	x	x	x
Swamp Sparrow	x	x	x	x	x
Red-winged Blackbird	x	x	x	x	x
Muskrat	x	x	x	x	x
Mink	x	x	x	x	x

* Species that require access to larger bodies of water

Sources: Brown and Dinsmore (1986). DeGraaf and Rudis (1986), Sandilands and James (in prep.)

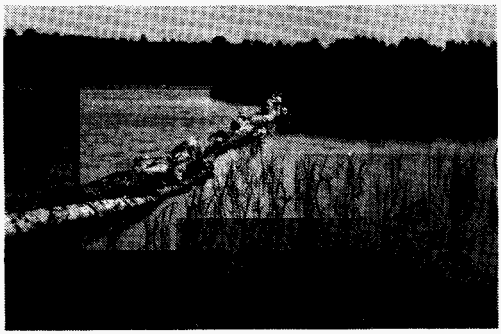
Note: Only breeding birds and wetland-dependent mammals are listed. Marshes will attract many species of birds during migration, and several mammal species will visit in search of food.

The table demonstrates that the larger a marsh is, the greater is its potential to support wildlife species. However, even the smallest wetlands will attract and support a wide variety.

3.3 Creating or Rehabilitating Lacustrine Marshes

Such a project will greatly improve fish habitat, although other wildlife species will also benefit. Because it involves working in waters inhabited by fish, it is essential to cooperate closely with the Ministry of Natural Resources and adhere to the provisions of the Fisheries Act.

This portion of the manual, which focuses on creating wetland lagoons that provide access to lake fish, is most relevant to Lake Ontario. The technique can be used to increase the size of an existing marsh, to create marsh where there is only open-water habitat, and to provide fish and wildlife habitat that is currently limited. This enhancement technique is also highly accepted by the public and pedestrian trails, boardwalks, and bridges can be worked into the design.



Oshawa Second Marsh: barrier beach enhancement/planting area