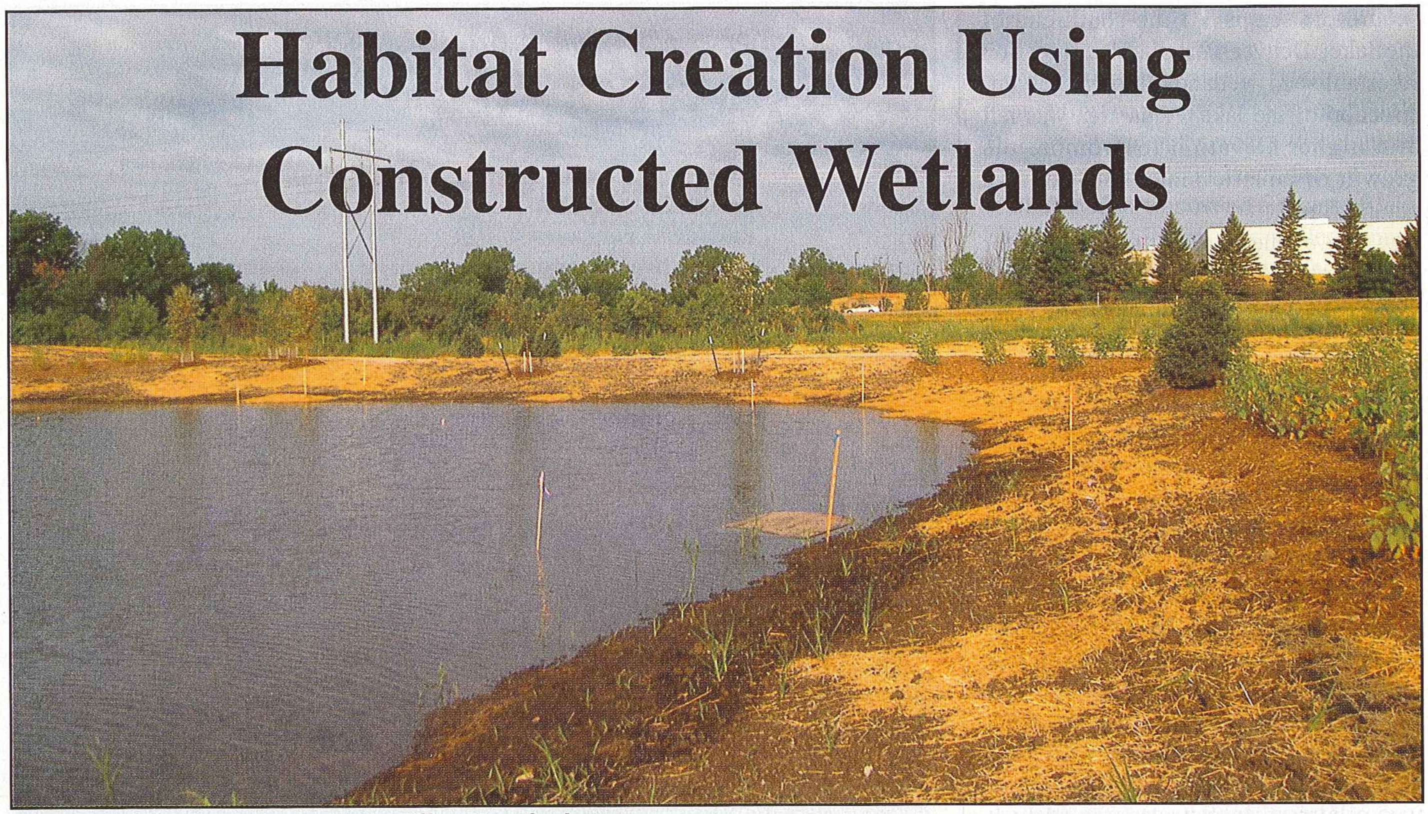
# Habitat Creation Using Constructed Wetlands



During planting. The stakes mark the different wetland zones.

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## Introduction

*THE* U.S. Environmental Protection Agency estimated in 1997 that the contiguous U.S. contained approximately 105.5 million acres of wetlands, which is less than half of the estimated 220 million acres that existed pre-settlement. Millions of acres of wetlands have been drained or filled to make way for agriculture and development. Today, the high cost of this loss of habitat is recognized and wetlands are being created to mitigate this trend while providing both watershed protection and a habitat for fish and other wildlife. As the protection of our streams, rivers and wildlife continues to become a public concern, constructed wetlands provide a marriage between human and wildlife needs. Wetlands—while attracting wildlife—also can provide natural degradation of potential pollutants, settle particulates, and buffer high flow stormwater events.

## Constructed Wetlands Create Habitat

Constructed wetlands are man-made systems that have been designed to emphasize specific characteristics of wetland ecosystems. There are primarily two types of constructed wetlands for habitat creation: subsurface and free water surface. Subsurface flow wetland systems are typically used as stormwater or wastewater treatment systems, and are designed to direct water flow though a porous media (such as gravel) while maintaining water levels below the surface. Subsurface flow conditions allow treatment wetlands to avoid the development of odors and other undesirable problems. Free water surface wetlands are designed to have an exposed water surface as water flows both through and over the soil medium. Constructed wetlands are typically created in basins that reduce the potential for contamination of the local groundwater aquifer.

Both subsurface flow and free water surface wetlands attract wildlife. While subsurface flow wetlands are unique landscape features that support a variety of facultative wetland plants, they have limited potential to create a diverse wetland environment because of the unexposed water surface. In contrast, surface flow wetlands have been designed to both purify wastewater from a variety of sources while simultaneously creating valuable wildlife habitat.

Free water surface wetlands can be utilized in a variety of applications from stormwater treatment and management to polishing wastewater treatment plant effluent. The design of free water surface wetlands has a significant impact on wildlife attraction. To understand the basis for these design techniques, let's first explore the basic wetland zones.

## Wetland Habitat Zones

Habitat can be created or limited through an understanding of the basic zones and the design techniques that create them. These zones include open water, emergent vegetation, and the upland/wetland transition zone bordering the wetland.

*Open Water:* This open water zone attracts waterfowl and can support a variety of fish. Water elevations above three feet are typically open water and can support submergent vegetation. Submergent plants live completely below the water surface or have some floating components. Submergent vegetation, such as pondweed, bladderworts and water lilies, are examples of plants that populate this wetland zone. Considerations can be given in the design of a wetland system to incorporate the open water zone and appropriate plant species through gradual or terraced grading and a planting scheme of submergent vegetation.

*Emergent Vegetation:* The emergent zone contains plants that live under partial submergence (one inch to three feet of water). This zone may be dense with sedges and bulrushes. It is the place where breeding waterfowl find safety, while many fish and amphibians rest, feed and breed. Establishing a stable water level by the use of control structures is a design element that will aid in the establishment and stability of this zone. While emergent plants are adapted to thrive in fluctuating water levels, a water "bounce" greater than two feet will challenge the stability of the system.

*Upland/Wetland Transition:* This zone is an important element in wetland design for habitat restoration because it is where uplands and wetlands merge. In this transition zone, amphibians and reptiles rest, while migrating birds and small mammals come to the water's edge. The zone exists above the wetland's water level and can be incorporated into a project from the beginning.

**One year after planting wetland.**

Defining the type of habitat desired or the wetland restoration goals will determine which of the habitat zones to incorporate into a project. For example, subsurface flow wetlands will not attract waterfowl or contain fish and this is

During planting of wetland - 4" pots - water levels were below normal levels.

desirable in some applications. On the other hand, designing a gradually sloping, terraced or undulating grade with planting scheme to fit each of the resulting water levels will create a variety of habitats for flora and fauna alike.

**Case In Point: Constructed Wetland Provides Power Plant Cooling and Supports Area Wildlife**

The Minnesota Municipal Power Authority (MMPA) constructed a natural gas fired power plant in Faribault, Minnesota. The MMPA and Project Manager, Avant Energy, commissioned Jacques Whitford NAWE and Stanley Consultants to develop a cooling water wetland complex around which miniature alternative energy demonstrations are featured for public information and education. Concern over the appropriation of groundwater for the cooling system brought about an innovative water use system consisting of surface water from an agricultural ditch system draining about 500 acres of commercial land, stormwater runoff from the power plant site, and groundwater. A cooling water supply system comprised of strategically configured created wetland zones allows the facility to reduce the groundwater needs of the plant to less than one million gallons per year.

The volume of the wetland complex is approximately 6,000,000 gallons and the wetland is divided up into alternating deep and shallow zones. Deep zones are approximately eight feet in depth while shallow zones are approximately one foot in depth. A combination of terracing and gentle grades (approximately 20:1) transitions water between shallow and deep zones.

Deep water zones provide greater volume to increase storage, as well as creating zones of potential wind mixing to blend flows. The deep zones also allow a resident population of fish refuge from freezing. Shallow water zones promote cooling and allow emergent wetland vegetation to grow. The emergent vegetation provides biologically active surfaces to treat contaminants and feces from resident waterfowl. The alternation of zones provides habitat variation that is both aesthetically pleasing to visitors and of excellent educational benefit. The gentle grading of depth transitions provides habitat variation because wetland plant species are self-zoning by water depth. The process engineering, ecological and educational design elements of the wetland are complimentary. The area of the wetland complex is approximately 9.5 acres.

Upon completion of the wetland construction, JW NAWE was responsible for the planting and seeding of the wetland areas. Over 12,000 wetland plants in rootstock and potted forms were planted at the site in July 2007. Plant species vary from Hardstem Bulrush, Sweet Flag, Blue Flag Iris, and Bur Reed in the emergent zones to Water Lilies, Floating Leaved Pondweed, and Bladderworts in the deep water zones. Emergent vegetation was planting directly into the soil substrate while the deep water vegetation was planted through rock bagging that floated to the bottom of the wetland, allowing the plants to root in the substrate before the bags biodegraded. A wetland seed mixture containing sedges, grasses, and wildflowers was used in the upland/wetland transition.

The deep zones in the wetland also serve as reservoirs for firefighting. There are three or four deep zones that hold approximately one million gallons each. The organically sculpted race-track design places two deep zones, inlet and outlet, adjacent to each other with access for large, emergency vehicles. The layout of the wetland complex provides a habitat variety that the public can experience on paths and boardwalks. The grading plan establishes zones of plants and animals that are adapted to varying aquatic environments.

**In Conclusion**

Meeting the environmental needs of communities, reducing our impact on ground water, conserving natural open spaces, and recycling treated wastewater for beneficial purposes are all part of the long-term solution for creating a sustainable water infrastructure. Wetlands can play a vital role in the health of our watersheds and be an essential part of creating diverse and healthy habitats that will sustain the natural world around us. Restoring once thriving wetland communities of the past or creating a wetland that will become a wildlife refuge of the future enhance community aesthetics, well-being, and provides recreational value. **L&W**

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