

A Landowner's Guide to

# Constructing and Maintaining a Rural Pond



2006



This guide was produced by the Fleming College Ecosystem Management Technologist Program and the Peterborough County Stewardship Council.

This Landowner's Guide is intended to be used as a reference only. The authors or publishers assume no liability where concerned. Please consult a professional before starting any project if you are unsure of legislation and regulations.

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## Introduction

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Private ponds are one of the most common and sought after features on rural properties in southern Ontario. A properly designed and well-maintained pond can serve a variety of purposes such as:

- Water for livestock and irrigation purposes
- Fire protection for infrastructure
- Maintenance of water table levels
- Food and habitat for aquatic and terrestrial wildlife
- Fishing, swimming and other recreational opportunities
- Aesthetics, nature appreciation and education

Constructing and maintaining a pond can often become a time-consuming and expensive task if not properly planned. This guide is intended to assist landowners wishing to build a pond or those who are interested in maintaining an already existing pond. The guide focuses on three main purposes that a rural pond can serve: agricultural use, recreational fishing use, and ponds for wildlife enhancement.

### When To Consult A Specialist

This guide is best suited to landowners wishing to construct or maintain a pond of no more than one acre in size (approximately ½ ha). Landowners wishing to construct a larger pond should seek professional assistance

Professional assistance and/or advice should also be sought before construction if you plan to build a pond under any of the following conditions:

- In an area that experiences high seasonal flows (spring flooding)
- The Pond will be over one acre in size
- Built in soils that are porous
- Built on a steep grad
- Built in a residential area or within city limits



## The Planning Process

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It is important to have a clear goal of your ponds intended use as well as your own expectations before initiating the construction process. Having a clear goal will not only assist you in determining future management options for your pond but will also help to minimize and/or prevent any problems both during and after the construction phase.

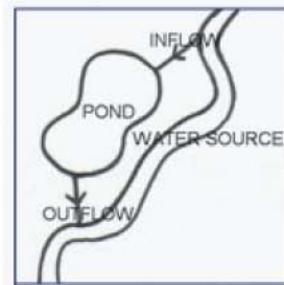
During the planning stage, you should visit landowners in your area with existing ponds to ask questions and obtain advice. It is also a good idea to create a work plan and budget for the construction of your pond.

## Pond Types

### Isolated Ponds

Constructed in any location where there is a sufficient water source to replenish the pond year round. Usually fed by springs and ground water however, water can also be pumped in from a well or a water body.

**\*Recommended Method and the only method approved for stocking fish.**



### By-Pass Ponds

Constructed beside a watercourse and fed and drained by separate channels that are connected to the watercourse.

### Embankment Ponds

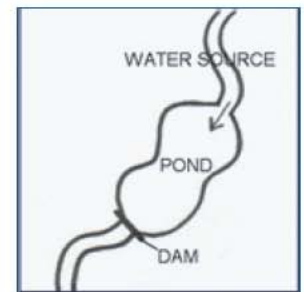
In stream ponds, constructed by damming a permanently flowing watercourse.

**\*Normally not approved by regulatory agency.**

### Impoundment Ponds

Constructed by damming an intermittent stream, draw or valley.

**\*Normally not approved by regulatory agency.**



## Permits

The legal requirements you will have to fulfill will depend on the type of pond you are building (by-pass or isolated\*) and its final intended use. Answering the following set of questions will assist you in knowing what specific regulations you should be aware of and also which regulatory agency to contact.

**\*Always consult a professional if you are unsure.**

Is the pond a by-pass type and will you be constructing a dam and diverting it from a natural watercourse to fill it?	-Lakes and Rivers Improvement Act (MNR permit required) -Federal Fisheries Act (DFO approval required)
Is the pond located on a floodplain?	-Conservation Authorities Act (contact local CA for further information)
Will you need to pump water greater than 10,000 gallons/day to fill the pond?	-Permit to Take Water (MOE)
Is the pond adjacent to a navigable water body?	-Public Lands Act (MNR permit required)
Is the pond an isolated type?	-No permit required (MNR)
Is the pond located in a wetland?	-Planning Act, Section 3 (Municipal Government)
Will you stock the pond with fish?	-Permit to Transfer Fish (MNR)



## Site Selection

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### Site Selection

Choose a site that is above the floodplain, in an area that is presently well vegetated with suitable slopes and contours. Areas that are already low-lying with moist soils year-round make excellent sites. Some places to consider are; low-lying areas between fields, wet corners in fields and along edges of woodlots, and abandoned drainage ditches. Make sure site selection is well away from local lakes and streams. As well, make sure to locate the pond a reasonable distance from any buildings and avoid sites where runoff from barns and sewage systems may pollute the pond. If the pond must be located near infrastructure, trees or a hedgerow should be used as screening. **Locating a pond in your front or back yard is unacceptable.**





## Liability

Once you have selected an appropriate site be sure to verify that constructing the pond will not affect any neighbouring properties (e.g. spring flooding). If it will, you will need to obtain permission from these property owners before initiating construction. Verify that the pond is not located in an area with buried utility services or overhead wires that may affect excavation equipment. Think of the worst case scenario that could happen, if for some reason your pond fails (e.g. dam breaks causing flooding on adjacent properties). Remember that in most cases, you can be held responsible for any damage caused to

## Water Sources

Your water source must be sufficient to fill and maintain your pond at a constant level throughout the year. This can be tested by digging a test hole near or in your site. If the test hole retains water throughout the year the area should be suitable for pond placement. The best water source is groundwater from springs, wells or seepage, as it tends to be well filtered and in constant supply. Avoid using surface water runoff as your primary water source as it may contain silt, excessive nutrients and other contaminants that will inevitably pollute your pond. Additionally, stream water that may appear to be pure may carry fish diseases, parasites, nuisance species, and other noxious substances.

## Soil Type

The sides, bottom and dam side (if applicable) of your pond must be composed of soils that hold water and minimize seepage. The most ideal soils for this are fine-textured clays and silty clays with a minimum of 10 to 20 % clay content. Be sure to verify that the same soil type extends well below the proposed depth of your pond. Sandy clay soils are usually satisfactory, however, some sort of containment may be required depending on what percentage of the soil is sand. Gravel and sandy soils do not make good sites, as these soils are porous and can be expensive to seal.



## Design

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### Shape, Depth and Size

Despite your ponds final intended use, it should have an irregular shape to maximize “edge” effect. Edge is the point where two different habitat types meet and therefore supports a greater diversity of species. It should be located so that the longest end is laying in a north-south direction in order to minimize wind-wave action.

The actual design you choose will be largely dependent on the soils at your site and the lay of the land (contours). For example, it may be possible to construct a pond on a gentle, sloping spillway by constructing a low berm. Additionally, already low-lying areas can be excavated to create depressions of differing depths. The depth of your pond will depend on its final intended use. Generally, ponds intended for fishing or swimming are deeper than those intended for waterfowl and wildlife. Its size will be dependent on your personal preferences keeping in mind that the larger your pond, the more difficult and costly it will be to construct and maintain.



Photo courtesy of Ernie Silhanek

## Containment Devices

You may need to invest in some type of containment device, depending on the soil type at your site. Listed below are three general types of containment devices that can be utilized to control seepage in ponds.

### Clay Liner

This type of liner should contain greater than 30% clay to be most effective. Line the bottom and sides of the pond to a thickness of 0.3 to 0.6 metres (1-2 feet). Clay liners can become expensive if clay is not readily available nearby.

### Bentonite

Bentonite is a colloidal clay that expands ten to twenty times its original size when wet. When incorporated in with existing soil, it can greatly reduce seepage, however, it is not equivalent to using an impermeable liner.

### Synthetic Liners

These liners are made of high and low density polyethylene, polyvinyl, or butyl rubber. Cost to purchase ranges from \$8.00 to \$43.00 a square metre. A note to remember: higher priced liners are more durable, last longer and require less site preparation than less expensive ones.

## Erosion Control

Every effort must be made both during and after the construction phase to minimize and/or prevent erosion from occurring. The use of silt blankets is recommended while construction is taking place to control silt and sediment from being deposited in nearby water-courses. Once construction is completed all exposed areas should be re-planted with native vegetation as quickly as possible.

# Water Level Management

Your pond should be equipped with some type of water level management device to prevent overflows and minimize water loss. The four most common devices used in ponds to control water levels are listed below.

## Drop Inlet

This device sits upright in the pond and allows the user to maintain water at a fixed level. A check valve can be installed at the bottom of the structure to remove all water from the pond.

## Half Round

This device consists of a half round corrugated steel pipe. It controls water at variable levels through the use of a plank located at the front of the structure.

## Overflow Pipe

This device consists of a steel pipe located through a roadway or berm. It allows the user to maintain a fixed level of water in the pond.

## Hickenbottom

This device sits upright in the pond and is connected to a 6" tile drain through a berm. Holes in the structure allow water to escape as the water level rises.



# Aeration

One of the problems of artificially created ponds can be decreased oxygen levels. This can lead to problems such as odour, reduced water quality and fish kills. If you find this to be a problem, you may have to aerate artificially. Two methods of artificial aeration are Surface Aeration and Diffuse Aeration. The method used will depend on the depth of your pond as well as your intended use.

## Surface Aeration

This method is usually used when the pond is less than 2 metres in depth (6 feet). It helps to control surface algae and duckweed. It will also help to maintain open water in the winter time. This is beneficial for wildlife and fish species. Fountain aerators are the most frequently used for this method.

## Diffuse Aeration

This method is usually used when the pond depth is greater than 2 metres (6 feet). With this method the diffuser sits on the bottom of the pond. This helps to minimize water loss due to evaporation. Windmills are popular for this type of aeration and are an efficient energy saver.





## Ponds for Agricultural Use

### Special Design Considerations

- Appropriate fencing to keep livestock, pets and children from accessing the pond area.
- Pond should be deep enough to provide for watering needs of livestock.
- If pond is to be used for fire protection then it should be located in an area that is easily accessible.

### Livestock Access and Water Quality

If you intend to use your pond to provide water for livestock, you must equip the pond with a watering system that will fulfill the water needs of your livestock without compromising the water quality and health of your pond and areas ground water supply. Manure and urine from livestock is a potential source of bacteria and contamination in a watercourse and can be transported great distances



Photo courtesy of Mike Parker

\*The Federal and Provincial Governments offer many different environmental cost-share opportunities for Ontario farmers. Please contact the Ontario Soil and Crop Improvement Association for more details on these programs.

## Watering Systems

### Nose Pump

- Easily installed for seasonal use, water bowl is activated by cattle with their nose
- Water source should be nearby as pump has limited ability to lift and carry water (within 900 metres)
- Recommended one pump per 15-20 animals
- Approximate cost is \$400 to \$500 per unit

### Windmill Pump

- Wind energy either charges pump batteries or operates pump directly, which draws water from pond to a separate storage area
- Must be >10 metres (30 feet) higher than any obstruction within a 300 foot radius
- Approximate costs range from \$1700 to \$6000 per unit

### Solar Powered Pump

- Energy from the sun either charges pump batteries or operates pump directly, which draws water from pond to a separate storage area
- Framework should be adjustable so as to maximize sunlight exposure at different times of year
- Approximate cost is \$1500 to \$8000 per unit (dependent on pond location and water source)

### Gravity Fed System

Certain situations may allow water to be forwarded to watering troughs by gravity through a piping system.



## Recreational Fishing Ponds

**\*Please Note That Not All Ponds Can Support Fish**

### Special Design Considerations

Adequate amount of good quality water relative to the number of fish (should be spring fed or from reliable ground water source)

- Best depth is between 3.7-4.6 metres (12-15 feet) throughout most of pond
- Ponds with depths of less than 3.7 metres (12 feet) should have strong flow of well-oxygenated spring water or a strong inflow/outflow with a bottom draw off device.
- Ponds with depths of over 4.6 metres (15 feet) should be equipped with a bottom draw-off spillway to allow deeper, de-oxygenated water to be taken out.
- Surface area should be a minimum of .25 acres.
- Dissolved oxygen (DO) content of even the deepest waters should be 5 ppm

Sufficient cover to control and maintain required water temperature

- Shade trees planted along banks will lower water temperature
- In water structures such as logs and boulders provide cover and habitat

Spillway structures to prevent fish loss (most commonly used is bottom draw-off type)

Bank slope should be steep, at least a ratio of one foot (vertical) to three feet (horizontal)

Moderate amount of aquatic plants and/or algae (less than 25% of the pond bed or surface)

Should be located in an area of natural, undisturbed vegetation with a fertile soil base to allow for a moderate inflow of nutrients to the system



## Warm Water Ponds Versus Cold/Cool Water Ponds

The average water temperature of your pond during the summer months will determine what species of fish will survive there. You will have to collect water temperature readings on a weekly basis during the first summer to determine what the average water temperature of your pond is.

The following table will assist you in determining what species of fish your pond will support.

Cold Water	Cool Water	Warm Water
<ul style="list-style-type: none"><li>• Summer temperature rarely exceeds 18c</li><li>• Usually found in head waters or spring-fed areas</li><li>• Oxygen rich low in nurturance</li><li>• Often well shaded</li><li>• Will support trout</li></ul>	<ul style="list-style-type: none"><li>• Summer time temperature between 18 and 24C</li><li>• Intermediate levels of oxygen and nurturance</li><li>• Will Support Walleye, yellow perch, northern pike, muskellunge, minnows</li></ul>	<ul style="list-style-type: none"><li>• Summer temperature will exceed 24C</li><li>• Low oxygen, High Nurturance</li><li>• May cone heavy growth of Aquatic plants or algae</li><li>• Will support Bass, Sunfish and Minnows</li></ul>

## Stocking the Pond

You should wait at least a year to stock your newly constructed pond with fish. Be sure to check the specific habitat requirements of the fish species you have chosen to stock and verify that your pond supports these requirements. Water temperature and dissolved oxygen (DO) content are two factors you must take into consideration along with availability of food and underwater structures for cover and protection.

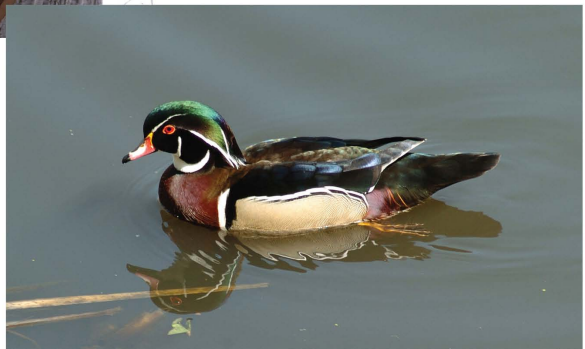
DO NOT stock your pond with fish taken from the wild or from someone else's pond, as they may carry diseases and parasites. Purchase healthy, disease-free fish only from a reputable commercial hatchery making sure to obtain a permit to transfer fish from your nearest Ministry of Natural Resources office beforehand.



## Wildlife Enhancement Ponds

### Special Design Considerations

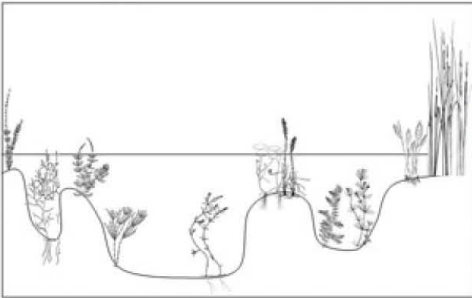
The key to constructing a successful wildlife enhancement pond is a variety of cover types (conifers, shrubs, areas of grasses and legumes, aquatic vegetation) and limited areas of open water. At least half of the surface area of your pond should have a depth of no more than three feet with emergent aquatic vegetation such as cattails covering a significant portion of this area. Some portion of the pond should be deep enough so as not to freeze to the bottom during the winter. Open water is favourable habitat for ducks and also necessary for survival of muskrat during winter. Try to maintain a buffer strip around the pond of at least 20 metres. This will protect the water quality in your pond and also prevent predation on nests by other wildlife. Mimic nature when revegetating the area by planting native species in thickets and clumps instead of in an uniform manner.



# Natural Vegetation

## Vegetation in your pond?

You may want to help start vegetation growth in your pond by adding some native plants from the region. However, much of the initial vegetation in your pond will develop naturally from seeds deposited by birds and other wildlife. These pioneer plants create conditions that attract wildlife inhabitants. Their presence creates organic debris that accumulates at the bottom of the pond. Submergent vegetation appears as a result of this high nutrient content. The next group of plants that appear are emergents around the edges of the pond. Over time these plants grow, die and decompose causing a layer of decomposing matter to accumulate on the bottom of the pond. Sunlight penetrates to deep into the pond and initiates the growth of more aquatic plants. The oxygen and cover all these plants provide, creates ideal living conditions for fish.



Cross-section showing submergent vegetation and emergents around the edge of the pond.

Photo of a pond after 1 year of vegetative growth around the edge of the pond.



Photo courtesy of Ernie Silhanek

# Native Aquatic Plants

## Emergent

water plantain	<i>Alisma plantago-aquatica</i>
swamp milkweed	<i>Asclepias incarnata</i>
sedges	<i>Carex spp.</i>
turtlehead	<i>Chelone glabra</i>
spike rushes	<i>Eleocharis spp.</i>
water horsetail	<i>Equisetum fluviatile</i>
wild blue flag	<i>Iris versicolor</i>
rushes	<i>Juncus spp.</i>
pickerelweed	<i>Pontederia cordata</i>
arrowhead	<i>Sagittaria latifolia</i>
bulrushes	<i>Scirpus spp.</i>
green fruited bur-reed	<i>Sparganium chlorocarpum</i>
giant bur-reed	<i>Sparganium eurycarpum</i>
cattails	<i>Typha spp.</i>
American brooklime	<i>Veronica americana</i>

## Floating-leaved

yellow water lily	<i>Nuphar variegata</i>
white water lily	<i>Nymphaea odorata</i>
water smartweed	<i>Polygonum amphibium</i>

## Submergent

coontail	<i>Ceratophyllum demersum</i>
waterweed	<i>Elodea canadensis</i>
watermilfoil	<i>Myriophyllum exallescens</i>
bladderworts	<i>Utricularia vulgaris</i>
tape grass	<i>Vallisneria americana</i>

## Free-floating

common duck weed	<i>Lemna minor</i>
star duckweed	<i>Lemna trisulca</i>
greater duckweed	<i>Spirodela polyrhiza</i>

## Native Terrestrial Plants

### Trees

Red Maple  
Silver Maple  
Eastern White Cedar

*Acer rubrum*  
*Acer saccharinum*  
*Thuja occidentali*

### Shrubs

Red Osier dogwood  
High-bush Cranberry  
Nannyberry

*Cornus stoloifera*  
*Viburnum trilobum*  
*Viburnum lentago*

### Wildflowers

Black-eyed susan  
Spotted joe-pye weed

*Rudbeckia herta*  
*Eupatorium maculatum*





# Long Term Management Issues

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## Troubleshooting Guide to Common Problems

Problem	Cause	Solution
<b>Growth of excessive aquatic vegetation</b>	Excessive nutrients such as nitrogen and phosphorus entering the pond from outside sources	<ul style="list-style-type: none"><li>-Fence all livestock from pond</li><li>-Divert runoff from pond via berms and ditches</li><li>-Aerate the pond mechanically to maintain continuous movement of oxygen</li><li>-Manual removal should be attempted before chemical control measures are taken</li></ul>
<b>Fish die during summer months</b>	As the temperature of the water increases, it holds less oxygen, causing fish to suffocate	<ul style="list-style-type: none"><li>-Ensure you are stocking with suitable species</li><li>-Aerate the pond mechanically to maintain continuous movement of oxygen</li></ul>
<b>Fish die during winter months</b>	Dense snow covering over the ice reduces light penetration thus preventing aquatic plants from photosynthesizing and producing oxygen	<ul style="list-style-type: none"><li>-Remove snow from the ice to permit light penetration</li></ul>
<b>Turbid Water</b>	Newly constructed ponds may experience this problem (due to suspension of clay particles in the water column)	<ul style="list-style-type: none"><li>-Stabilize exposed banks by planting native vegetation</li></ul>

# Nuisance Wildlife

## Beaver

Beavers can pose problems to your drainage system and can also cause serious flooding. Humane trapping and removal is probably the best management practice in most cases. Another approach is to install a “beaver baffle”, which consists of a pipe that is installed through the beaver dam and into the pond. An inlet is placed a few meters upstream and controls the water level in the pond. The beaver will have difficulty hearing the flowing water and will not be able to locate and fix the leak.

## Muskrat

Musk rats dig burrows a long banks in marshy areas and for this reason can cause damage to banks that are already unstable. Burrows are usually situated in areas where the water depth increases fairly rapidly from the shore, to provide them with an easy escape from predators. To prevent muskrats from burrowing in areas that are already unstable, cover bank edges with rip rap or chicken wire to one foot above and three feet below.

## Geese

Once geese have established their territory around your pond, they pose a potential and serious threat to its water quality. The key to successful management of geese is to maintain a buffer of dense vegetation around the pond. Geese are attracted to flat, open areas of land where they can quickly spot and flee from a potential predator. They will avoid feeding, nesting and congregating in areas of tall vegetation that inhibits their ability to view the surrounding landscape and their escape route.



# Invasive Species

Invasive or exotic species are terms used to describe organisms that have been introduced into habitats where they are not native and do not belong. These species have the potential to cause serious damage to the natural areas that they invade and should therefore be avoided. Learn to identify invasive species and avoid introducing them into your pond. A list of the most common aquatic invasive species can be found below. For a complete list please contact the Ontario Federation of Anglers and Hunters

## Common

## Scientific

Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>
European frog-bit	<i>Hydrocharis morsus-ranae</i>
Fanwort	<i>Cabomba caroliniana</i>
Flowering Rush	<i>Heracleum mantegazzianum</i>
Giant Hogweed	<i>Butomus umbellatus</i>
Purple Loosestrife	<i>Lythrum salicaria</i>



## **Sources of Information and Assistance**

### **Stewardship Councils**

[www.ontariostewardship.org](http://www.ontariostewardship.org)

Peterborough County	705-755-1951
Northumberland County	705-755-3298
Victoria County	705-324-1478
Durham Region	905-713-7375

### **Conservation Authorities**

[www.conservation-ontario.on.ca](http://www.conservation-ontario.on.ca)

Kawartha Conservation	705-328-2271	<a href="http://www.kawarthaconservation.com">www.kawarthaconservation.com</a>
Lower Trent Conservation	613-394-4829	<a href="http://www.ltc.on.ca">www.ltc.on.ca</a>
Ganaraska Conservation	905-885-8173	<a href="http://www.grca.on.ca">www.grca.on.ca</a>
Otonabee Conservation	705-745-5791	<a href="http://www.otonabee.com">www.otonabee.com</a>

### **Federal Government**

Department of Fisheries and Oceans	613-993-0999	<a href="http://www.dro-mpo.gc.ca">www.dro-mpo.gc.ca</a>
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### **Provincial Government**

Ontario Ministry of Natural Resources	1-800-667-1940	<a href="http://www.mnr.gov.on.ca">www.mnr.gov.on.ca</a>
Ontario Ministry of Agriculture, Food and Rural Affairs	1-888-466-2372	<a href="http://www.omafra.gov.on.ca">www.omafra.gov.on.ca</a>

### **Public/Non Profit Orgs.**

Ducks Unlimited	1-800-665-8825	<a href="http://www.ducks.ca">www.ducks.ca</a>
Ontario Federation of Anglers and Hunters	705-748-6324	<a href="http://www.ofah.org">www.ofah.org</a>
Ontario Soil and Crop Peterborough Green-Up	1-800-265-9751 705-745-8238	<a href="http://www.ontariosoilcrop.org">www.ontariosoilcrop.org</a> <a href="http://www.green-up.ca">www.green-up.ca</a>