Factsheet

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Subsurface Drainage System Outfalls

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INTRODUCTION

Outfalls connect the main drain of a subsurface drainage system to an outlet such as a drainage channel or natural watercourse. They are one of the most important components of a subsurface drainage system, equally as important as properly sized mains. This factsheet examines the design, construction, inspection and maintenance of a subsurface drainage system outfall.

DESIGN AND CONSTRUCTION

Ensure the subsurface drainage system outfall receives adequate care and attention during design and installation and is inspected at least twice per year. For ease of future maintenance, design drainage systems with a minimum number of outfalls by using one large main (collector) drain that provides an outfall for numerous sub-mains.

Protect the outfall from erosion, undermining, settlement, ice damage, rodents, silting, shifting and damage by machinery and livestock. If possible, use a length of continuous rigid, non-perforated pipe (usually corrugated metal pipe) as an end pipe for the outfall.

If plastic pipe is used as an end pipe, use a chemically treated material to resist degradation by ultraviolet light. Standard corrugated plastic tubing is not satisfactory for an outfall.

Install a recessed apron of rock riprap, with a filter cloth underneath, below the outfall pipe on the ditch bank, and extend the rock riprap across the ditch bottom to provide adequate erosion protection. Rock riprap equivalents such as geoweb, interlocking concrete blocks or cable concrete block material will also provide adequate erosion control at the outfall.

End pipes are either flush-mounted (Figure 1) or cantilever style (Figure 2), depending upon the erosion control protection and susceptibility to ice damage in the receiving ditch. Flush-mounted end pipes are less susceptible to damage from ice and floating debris than cantilever-style end pipes.

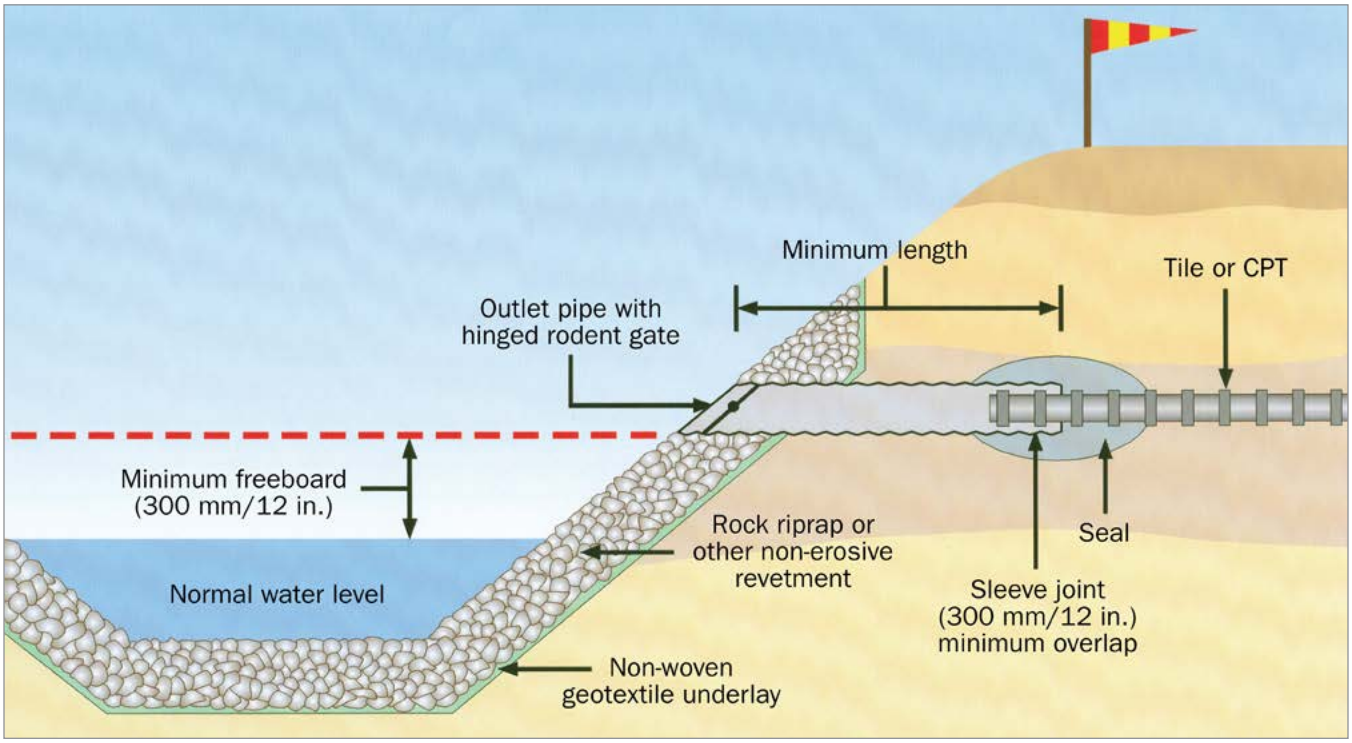

Figure 1. Flush-mounted outfall.

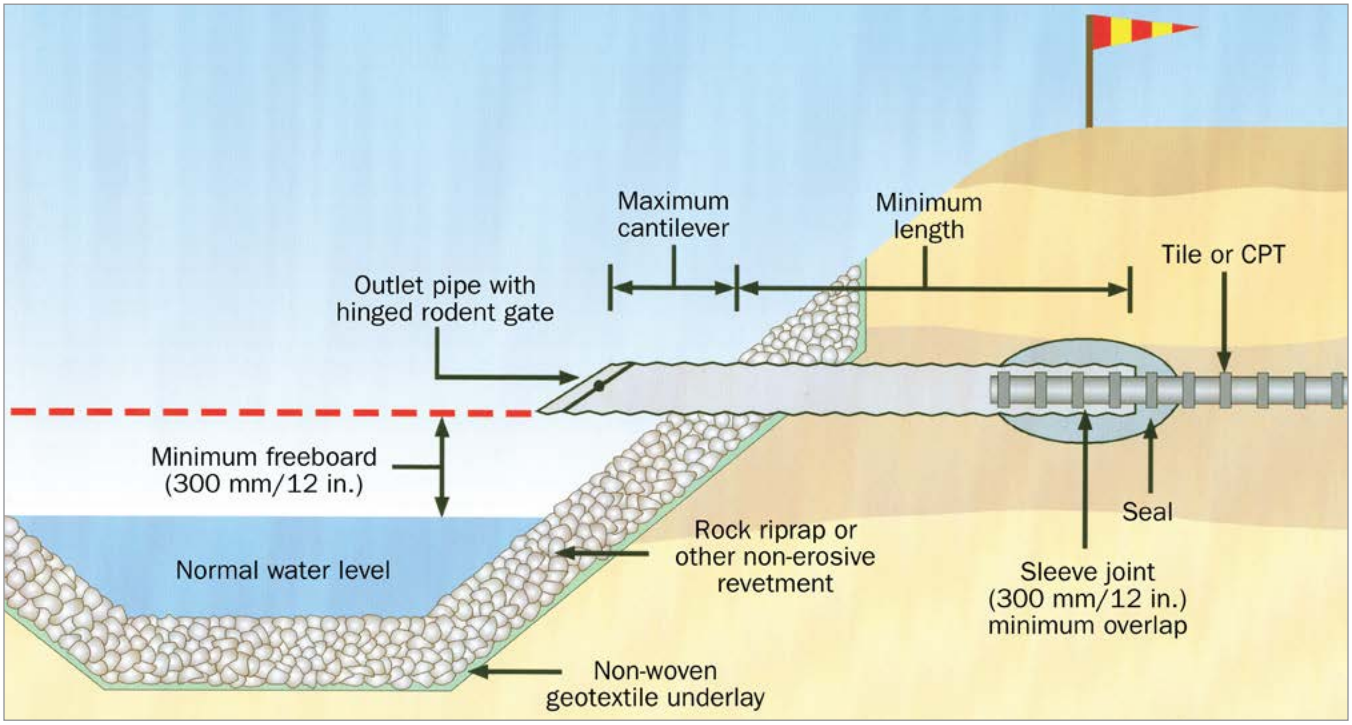

Figure 2. Cantilever-style outfall.

End pipes are joined to the drain pipe by sleeve joints or butt joints with a minimum length of 3 m (10 ft) depending on the diameter of the drain pipe. Table 1 provides the minimum end-pipe diameter, minimum length of end pipe and maximum cantilever for both types of joints and outfall styles.

Table 1. Dimensions of End Pipes

Nominal Drainpipe Diameter mm (in.)	End Pipe Dimensions			
	Minimum Diameter mm (in.)		Minimum Length mm (ft)	Maximum Cantilever mm (in.)
	Butt Joint	Sleeve Joint		
100 (4)	100 (4)	maximum outside diameter of drainpipe + 50 mm (2 in.)	3,000 (10)	400 (16)
150 (6)	150 (6)		3,000 (10)	600 (24)
200 (8)	200 (8)		3,000 (10)	600 (24)
250 (10)	250 (10)		3,600 (12)	600 (24)
300 (12)	300 (12)		3,600 (12)	800 (32)
350 (14)	350 (14)		4,800 (16)	800 (32)
400 (16)	400 (16)		5,400 (18)	800 (32)
450 (18)	450 (18)		6,000 (20)	1,000 (40)

For sleeve-style joints, insert the drain pipe into the end pipe at least 300 mm (12 in.). The inside diameter of the end pipe should not exceed the outside diameter of the drain pipe by more than 50 mm (2 in.). If the inside diameter of the end pipe is less than 25 mm (1 in.) larger than the outside diameter of the drain pipe, no wrapping is required. Otherwise, wrap the joint.

For butt joints, the inside diameter of the end pipe must be equal to or larger than the inside diameter of the drain pipe but not exceed the outside diameter of the drain pipe by more than 25 mm (1 in.). Wrap the joint with a filter material or seal to ensure that soil does not enter the joint.

In coarse soil conditions, an anti-seep collar may be required to eliminate the possibility of water seepage around the external diameter of the outlet pipe. The water seepage can destabilize the soils, ultimately causing a failure of the drainage outlet.

Where it is necessary to check or control the drain flow or inspect mains or other drains, install a junction box. Construct a junction box using concrete, steel or plastic, or purchase one from drainage material manufacturers. A specialized junction box called a water control device (Figure 3) can also be installed to control or completely stop the flow in the drain from getting to the outlet. This is particularly valuable if the water in the drain becomes contaminated from a spill caused by pesticide or manure application. Place junction boxes far enough upstream of the receiving water body to allow for proper design of the outfall.

Angle the end pipe downstream into the receiving ditch or drain so as not to impede normal flow, and discharge with the outside bottom of the pipe at least 0.3 m (1 ft) above normal water level or ditch bottom.

Install the outfall pipe immediately after digging the trench. Backfill and compact the trench in 75-mm (3-in.) layers to the same density of the surrounding soil for a distance of 5 m (16 ft) from the outfall. Seed the backfilled ditch/stream bank immediately. A recommended seeding mixture is creeping red fescue at 20 kg/ha (18 lb/acre) and bird's-foot trefoil at 12 kg/ha (11 lb/acre).

A hinged grate or rodent guard on the outfall pipe is essential. Install the guard immediately following the installation of the pipe. The grate can be hinged or removable to allow for cleaning and have openings with a maximum width of 25 mm (1 in.). Several different styles are available from material suppliers.

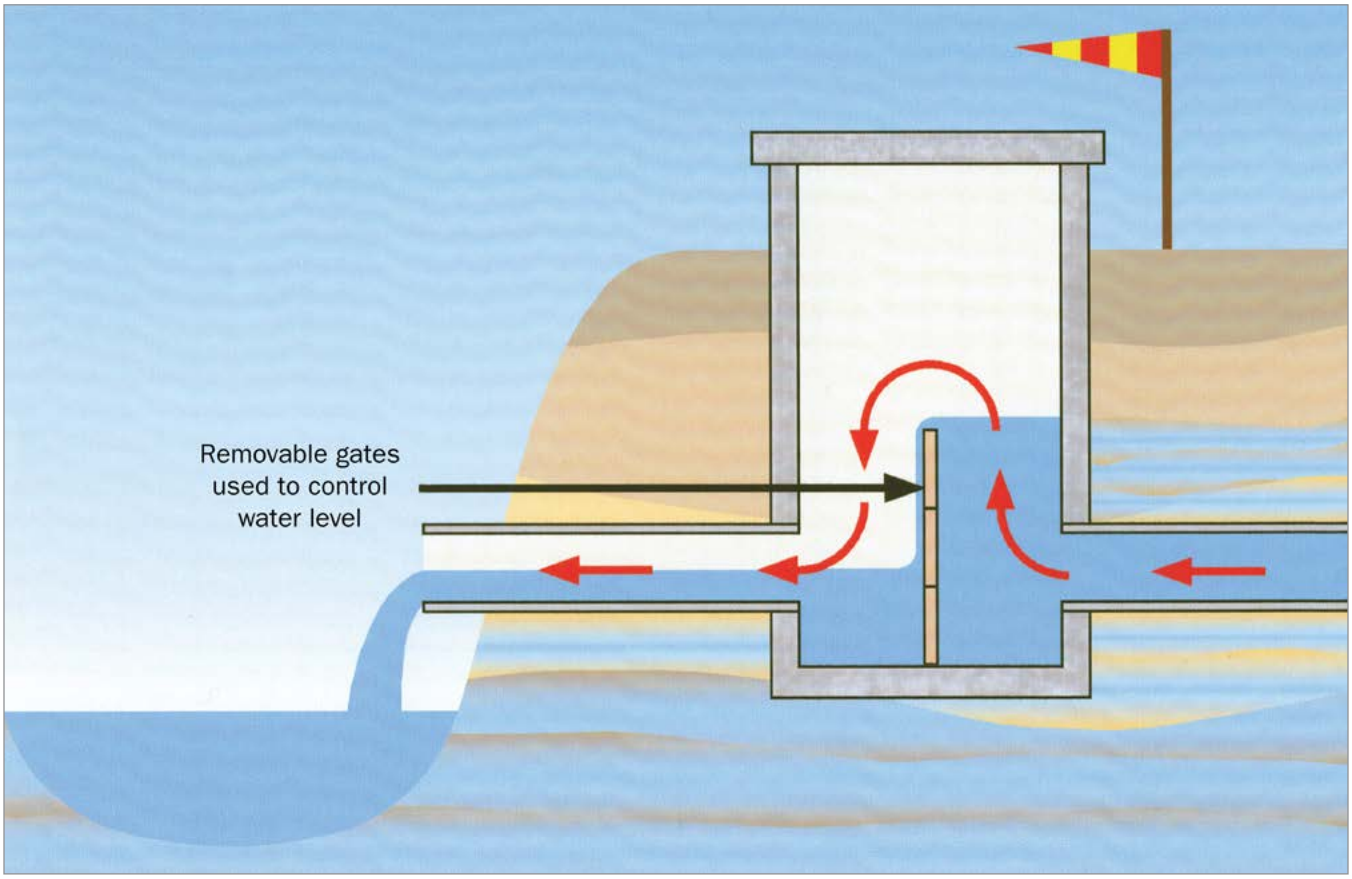

Figure 3. Water-control device.

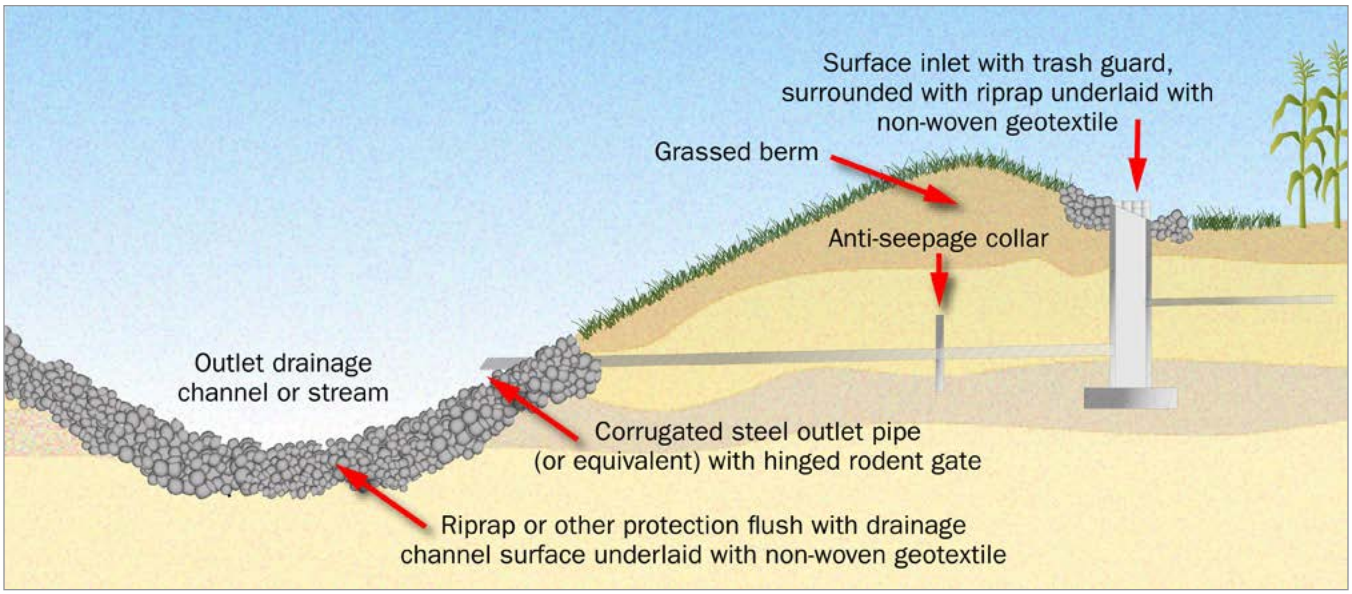

Figure 4. Drop pipe outlet structure for subsurface drainage system with optional surface inlet.

When it is necessary to construct a drainage system outfall in a very high ditch bank, prevent erosion using either of the following methods:

- Install a properly designed drop pipe structure to move the water down to the lower elevation. These structures are sized large enough to serve as a junction box for several main lines. The drop pipe structure, with an optional surface water inlet, is shown in Figure 4. Avoid using a surface water inlet if the tile drain has winter flow (e.g., springs), since this can cause blockage through ice build-up. Secure a trash guard or inlet grate on the surface inlet.
- Install a sloped, non-perforated drain pipe and end pipe.

There should be no surface flow over the ditch bank at the drain system outfall location. Where it is necessary to allow surface water to enter a ditch, construct a properly designed drop structure as shown in Figure 4, or a rock chute spillway as shown in Figures 5 and 6.

For further assistance with the design and installation of a drop pipe outlet or rock chute spillway, get advice from a certified soil erosion control contractor. They are trained in the use of OMAFA Publication 832, *Agricultural Erosion Control Structures — A Design and Construction Manual* and its associated design software.

Use a durable, permanent marker that is highly visible above crops and tall grasses to mark the location of all drainage system outfalls. If possible, note the GPS coordinates, using a handheld GPS device, so you can locate the outfall in the future. This will be especially useful once the receiving ditch and channel have matured and the outfall is difficult to see from the edge of the field.

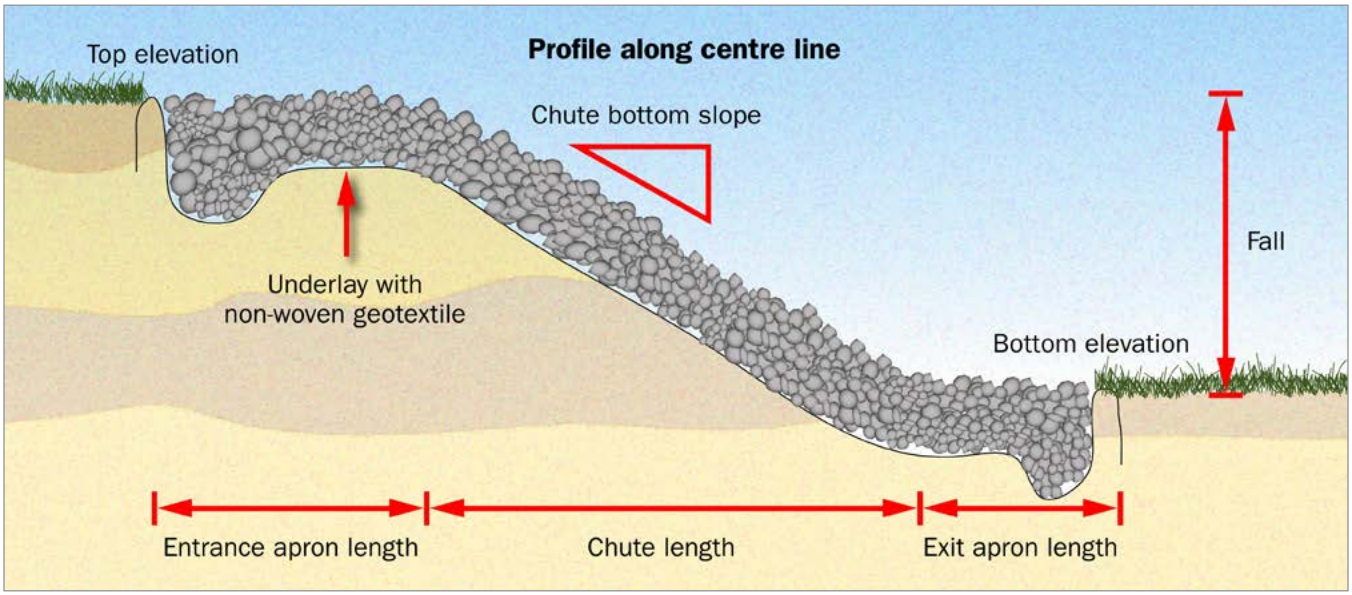

Figure 5. Rock chute spillway (profile).

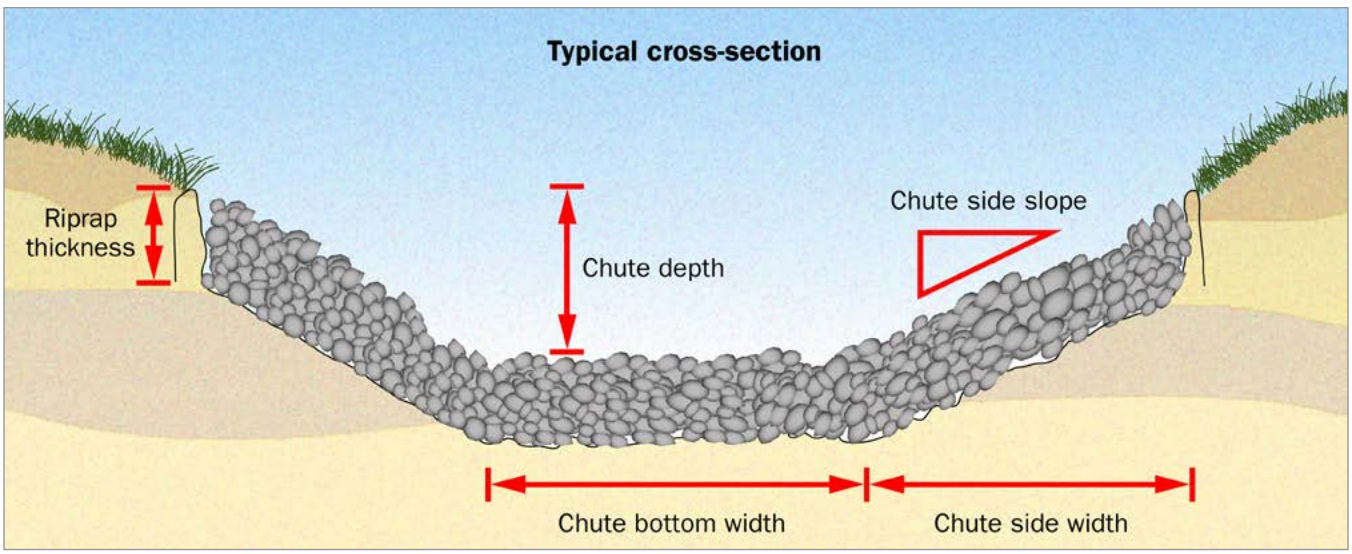

Figure 6. Rock chute spillway (cross-section).

INSPECTION AND MAINTENANCE

A drainage system outfall must be kept clean and in good condition or the drainage system cannot function properly. Carry out an inspection in spring, fall and after severe storms to check for silting, debris, erosion, settlement and misalignment. Correct all problems immediately. Further information on the maintenance of a drainage system outfall is found in the OMAFA factsheet, *Maintenance of a Subsurface Drainage System*.

Remember that all construction and maintenance projects must comply with existing provincial and federal legislation where applicable, e.g., *Drainage Act (R.S.O. 1990)*, *Conservation Authorities Act (R.S.O. 1990)*, *Lakes and Rivers Improvement Act (R.S.O. 1990)*, *Fisheries Act (R.S.C. 1985)*, etc., and their associated regulations.

Contact the local municipality if the outfall discharges to a municipal drain — never complete any work on a municipal drain. Contact the local conservation authority or Ministry of Natural Resources office if the outfall discharges to a natural watercourse. In all cases, obtain all the necessary approvals prior to starting any work.

RESOURCES

Qualified tile drainage and erosion control contractors are available for the design and construction of drainage system outfalls.

AgriSuite – AgErosion tool

For more technical information on planning, design, construction and maintaining a drainage system, refer to OMAFA Publication 29, *Drainage Guide for Ontario*.

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