



# Drains Done Differently.

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**South Innisfil Creek Drain (SICD) Improvement  
Ecological Enhancements**

Green Infrastructure: Bank Stabilization







## South Innisfil Creek Drain (SICD) Ecological Enhancements

### Green Infrastructure: Bank Stabilization

#### METHODOLOGIES

Many drainage improvement projects are necessary to repair existing drain banks that are severely eroded and slumped, which causes sediment to deposit in the drain, degrading capacity and habitat. Commonly used bank stabilization techniques include the placement of geofabrics, the installation of riprap, and the application of erosion control blankets and/or hydroseed to rapidly re-establish vegetation growth. This Drains Done Differently bulletin identifies three other bank stabilization techniques that are natural and eco-friendly, and which use surplus materials that may be readily available on site.

#### Sod Mats

Sod mats are used to quickly re-establish vegetative cover on disturbed or exposed areas by transplanting existing native vegetation. They are large pieces of existing soil and well rooted vegetation salvaged from areas being disturbed during construction or located adjacent to the existing drain corridor within the boundary of a drain widening. Vegetation can consist of existing flora such as grasses and flowers, small shrubs and trees, milkweed, field thistle, etcetera.

The sod mat is shaved off the source area/site and placed on or over disturbed and exposed soil using an excavator (or other suitable equipment).

- **Mat Thickness:** (minimum) 150 mm to (maximum) 300 mm.
- **Mat Length:** 1.0m to 1.5m long (longer is better), this length is also based on the size of the equipment (i.e. backhoe, skid steer, excavator, etc.).

Each sod mat is positioned on the bank and/or bench (as per proposed drain geometry) and tamped into place, compacting the sod mat. Adjacent sod mats need to be placed so that the ends abut to ensure complete,



consistent and appropriate coverage and stability. An articulating/wrist bucket is strongly recommended for the application of sod mats.

#### Root Wads

Root wads are another material that can be used for bank stabilization, and are the stump of a dead tree or a tree obtained from a clearing operation with its root system intact. Root wads are harvested from larger trees and have up to 3.0m of trunk still attached to provide a footer log. The root wad should be at least 1.5m in diameter and the attached trunk at least 0.3m in diameter.



Trees that have large, circular, and fibrous root masses are preferred, such as a non-native Manitoba Maple or an Ash; the many native Ash trees in Ontario killed by the emerald ash borer provide a readily available supply.



*A single root wad c/w wood pins and stone for anchorage or ballast*

The root wad stabilization technique involves burying the footer log into the eroded or slumping drain bank until the root is flush with the bank's soil. In soft native soils, the end of the trunk can be cut on a 45-degree angle (or flatter) with a chainsaw and inserted or pushed on a downward angle into the bank using an excavator. If bank soils are hard, a keyway or trench is excavated to install the footer log, which is typically oriented perpendicular to the flow, particularly if multiple root wads are installed abutting each other. Root wads also work effectively when placed facing upstream at a 30-degree angle to the drain bank, with the footer log extending downstream and into the bank.

Once installed, the root wad is anchored or pinned into it place, preferably with wooden pins; duck-billed soil anchors and aircraft cable with crimps can also be used. Where a keyway or trench is excavated, fill should be placed over the footer logs to anchor them with sod mats on top. Root wads can be installed in combination with other woody material, live stakes, river stone or

riprap; stone acts as ballast and also serves as a pinning material. Dogwoods and willows provide suitable material for live stakes which can sprout and grow to increase long-term bank stability.

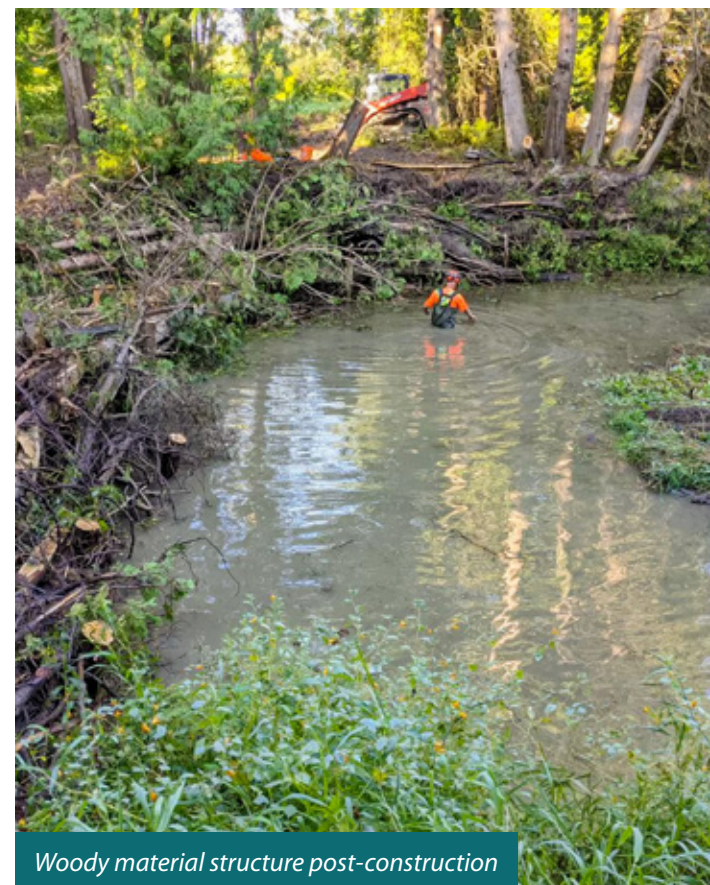
## Woody Material Structures

This procedure involves the removal and/or manipulation of existing log jams consisting of woody material (WM). Material which has accumulated in the middle of the drain is typically moved over to one or both sides to improve bank stability and re-establish the main flow path. In order to supplement existing materials, the process can also include the manipulation and placement of additional WM, which is either imported or acquired from a nearby clearing operation. WM structures are stabilized using wooden pins and/or duck-billed soil anchors.

WM is pulled back from the middle of the drain to the bank(s), which allows the main flow path to properly form and provide suitable velocity to convey sediment. All WM (existing and new) is manipulated, moved, and placed using appropriate equipment such as a backhoe or excavator; where access is limited, hand work may be required by the Contractor and crew.



*Log jam pre-construction*



*Woody material structure post-construction*

Once placed, WM is pinned horizontally and vertically with an excavator by inserting or pushing smaller sharpened wood pieces of appropriate diameter (150 to 200mm) and length (2.0 to 3.0m) into the soil to ensure that all of the material is held against the bank being protected, while also preventing it from floating or lifting during higher flows and more significant runoff events. WM is often used in combination with riprap/river stone and/or sod mats, both acting as ballast with the latter also providing instantaneous vegetation coverage and future stability once deeper and denser roots are established.

## BENEFITS

### Sod Mats

Sod mats provide immediate and long-term stabilization of a drain bank and create an instantaneous vegetated cover on an overflow shelf or floodplain bench without the need for fine grading and seeding. The roots and vegetation in and on the mat are local to the area, have a

higher probability of survival, are in full growth, and mat roots often become denser and grow deeper.

This form of vegetative cover can provide pollinator and wildlife habitat, provide shade for aquatic habitat, reduce flow velocity on the floodplain bench, and promote sediment deposition on the graded bench instead of in the drain. They are a valuable natural resource that can be harvested from areas proposed for demolition that are otherwise buried or discarded. With the proper equipment, they are easily salvaged from within or adjacent to the drain corridor and within the reach of the excavation equipment. They can also be used in combination with other forms of bank protection such as root wads, woody material, and riprap.

### Root Wads

Root wads are a natural resource and surplus material that is often discarded in or beside the spoil bank where clearing is required for a drain improvement or widening project. Although they require heavy equipment for installation, root wads can effectively provide toe and bank stability, enhance aquatic habitat, and collect sediment and floating debris. They are particularly valuable to fish by providing refuge habitat.

### Woody Material Structures

Woody Material is another surplus natural resource that is also often discarded when improving a drain, especially if clearing is required. If there are access restrictions that will not allow the use of an excavator, an all-terrain vehicle (ATV) may need to be substituted and used to haul the WM. These natural structures can restore bank stability, create habitat, and enhance flow conditions in a way that will naturally create a main flow path within the drain. These structures also collect sediment and floating debris, and can become more stable over time as new vegetation colonizes the sediment deposits.

WM manipulation and placement can establish a long lasting and natural looking open drainage system. If properly placed, WM structures can stabilize drain banks, establish suitable areas for sediment deposition, and provide habitat for aquatic and terrestrial species.



## MAGNITUDE OF COSTS

### Sod Mats

Although sod mats are typically more costly to apply on a square metre basis than spreading topsoil and seeding, their long-term benefits can outweigh these short-term costs. Furthermore, they are less vulnerable to the impacts of washout and poor germination that can impact topsoil and seed. Costs will vary depending on the scope of the drain improvement project, the availability of the natural sod, and the area proposed for stabilization. Costs for installation can range from \$15 to greater than \$25 per square metre.

### Root Wads

This form of rehabilitation requires large equipment and relatively easy access to the drain bank to facilitate installation. Root wads can be imported if no clearing is required and no root wads are available near the site. Accordingly, depending on the number of root wads being installed, payment on an hourly basis for equipment, labour, and material is recommended.

### Woody Material Structures

In order to complete this type of work, the Contractor will typically require an excavator with claw, labourers with waders and safety gear, chainsaws, winches, chains, and ropes. The Contractor will need to remove and/or manipulate the existing log jams as well as to supplement the structure with additional WM. Consequently, payment on an hourly basis for equipment, labour, and material is recommended.







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This "Drains Done Differently" engineering bulletin was funded by the Ontario Ministry of Agriculture, Food and Rural Affairs, authored by Jeff Dickson, P. Eng. from R. J. Burnside & Associates Limited and was reviewed by the Town of Innisfil, the Nottawasaga Valley Conservation Authority and R. J. Burnside & Associates Limited.