Rainscaping at Home

Workshop

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Subjects covered in workshop:

- Reasons for Rainscaping
- Hardscape Reduction
- Rainfall Calculations
- Soils
- Infiltration methods
- Dealing with leaves and debris
- Choosing a Location
- Soil Percolation Test
- Sizing Your System

Reasons for Rainscaping:

In a natural environment rain water soaks into the soil where it supports surrounding vegetation. Remaining water slowly permeates down to the water table, which feeds creeks, rivers and lakes. Contaminants picked up from the surface by the rainwater are filtered out by the soil.

In an urban setting a large proportion of the ground is covered by impervious surfaces such as roofs, roads and sidewalks. These are called hardscapes. Typically rain that falls on these surfaces is diverted to storm sewers, which whisk the rainwater through concrete pipes to outfalls by a creek, river, or lake, causing surges in these watercourses during heavy rainfalls. The water table then drops, leaving less water for creeks and rivers during dry periods. This strains the watercourses' vegetation and wildlife, which prefer more constant water levels. Also, rainwater arriving via storm sewers does not have the benefit of being filtered and cooled by the soil, and carries many of the pollutants and much of the heat from the hardscapes it landed on. Warm water holds less oxygen, which is detrimental to fish and other aquatic wildlife.

To reduce stormwater drainage to sewer systems and help raise the water table in your area you can implement rainscaping principles into your garden. Rainscaping is a method of landscaping your property to encourage rainwater infiltration to the soil.
Climate change predictions for our region are: prolonged periods of drought, coupled with intense rainfall events. Rainscaping helps to mitigate these effects.

Hardscape Reduction:

Hardscapes are impervious surfaces such as driveways, concrete walkways and patios, roofs, etc.

Can you give me some ideas on how to reduce hardscape surfaces at home?

- Install a green roof
- Reduce patio and walkway areas
- Use interlocking stone, flagstones, or pea gravel instead of conventional concrete for patios and walkways

Driveways can be made more permeable by:

- Using permeable paving techniques, such as interlocking stones and permeable concrete
- Using gravel
- Using pavers only where the wheels tread
- Grading the driveway towards a bioswale

Most of these changes will also reduce “heat island” effect in your area. Heat island effect is the result of hardscapes which absorb the suns energy and radiate it to the surroundings, in contrast with vegetation, which use the suns energy and shade the ground.

Rainfall Calculations:

Identify all of the impermeable surfaces on your property. This includes roofs and impermeable surfaces at ground-level such as driveways, patios and walkways. Measure their surface areas. For sloped surfaces such as roofs measure the plan view surface area, that is, the surface area you would see looking directly down upon the roof, as though they were flat. Use average rainfall data to determine the amount of rain falling on that area.

Average Precipitation for City of Kingston:

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Rainfall (mm)	31.5	28.1	47.5	74.8	74.9	72.3	58.8	88.1	93	86.4	84.9	54.3

Remember: 1mm of rain, on 1 square meter = 1 Liter

1 mm x 1 m2 = 1 L

10 mm rainfall can be assumed as an average rainfall in Kingston.

An average rainfall: 10 mm X An average house of 100 m2 = 1000 L

Anybody know the size of an average rain barrel?

200 L

Soaker hoses allow your rain barrel to drain down slowly to your garden, creating room for the next rainfall.

Plants naturally soak up water and evaporate it through a process call evapotranspiration.
Bu what about the fall?

Soils:

When evapotraspirtation is not occurring, the soil to absorb and conveys most of the rainwater. The soil type makes a critical difference to the rate at which it can convey the water.
Soil Infiltration Rates

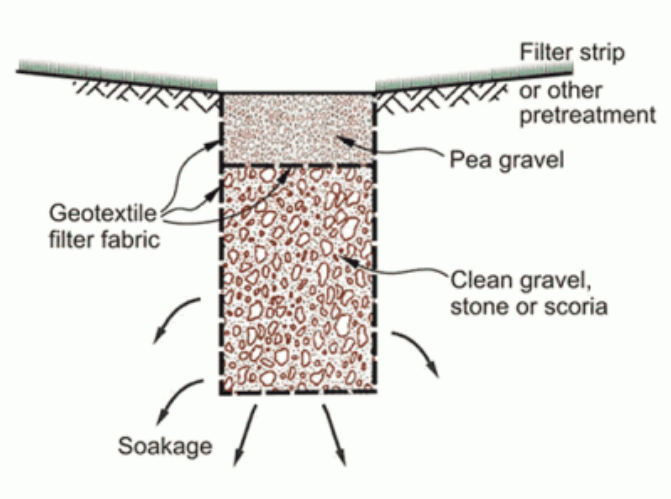
Soil type	Min absorption rate in mm/hr
Sandy soils	210 mm/hour
Sandy Loam	25 mm/hour
Loam	15 mm/hour
Clay soils	1 mm/hour

Infiltration Methods:

Adding sandy soils over your existing lawn and sodding over top of that will greatly improve the drainage of your property, however this is an expensive option. Another effective way is to create a low point where water can collect and infiltrate the ground. This can be filled with gravel. Gravel has large voids between the stones where water can be stored, approximately 40% of the gravel volume. This allows for the gradual infiltration of rainwater into the ground. By adding a liner of filter cloth, or landscaping fabric, between the ground the gravel prevents soil from infiltrating the soil and clogging up the gravel. The cloth also prevents roots from growing into and clogging the gravel, but still allows for water to pass through and infiltrate into the sub soil. Mulch also has large voids, but is moved much more readily by flowing water.

Trenches:

Trenches are typically between 25cm to 1m deep, and 30cm to 1 m wide, and can be any length.



They are sloped to direct water from one end to the other, and are used to direct water away from foundations to large permeable surfaces such as a rain garden, or soak away pit. A drop of 2.5 cm for every meter in length is enough to move water. A clear tube filled with water can be used for leveling and determining slope. Avoid leading overflow to sidewalk or street.

Once the trench has been dug, lay the filter cloth along the bottom and sides. Adding permeable pipe, such as weeping tile, will increase the trenches capacity to convey water. Fill the bottom of the trench with 5 cm of the washed stone as a base. Lay the perforated pipe in the trench length-wise on the stones. Perforations, if one sided, should face down. Fill the trench with the rest of the washed stone, leaving a gap of 2- 5 cm between the top of the gravel and the top of the trench.

You can now either connect the higher end of the pipe to your rain barrel overflow, or simply allow the downspout to spill into the trench (a splashpad will reduce the erosion and movement of stones from strong water currents). An overflow tube or down spout should lead the water at least 1m from the house foundation to a trench that drains away from the house.

Infiltration trenches easily become clogged with sediment. Be sure to clean sediment from the downspout regularly, and rinse the filter cloth placed just under the top layer of stones. If infiltration slows significantly, clean the stones and filter cloth. By adding a layer of filter cloth on top the gravel and covering it with river stones, you can create a dry river bed effect in your garden, which can be attractive and also easier to service.

Soak away pits:

Similar construction to trenches, except soak away pits are vertically oriented (deep), and are meant to convey water deeper into the ground and act as storage capacity as well. Trenches can end at soak away pits. Locate soak away pits at least 4 m (13’) from house foundations or sensitive areas.

Soakaway Pits (continued)

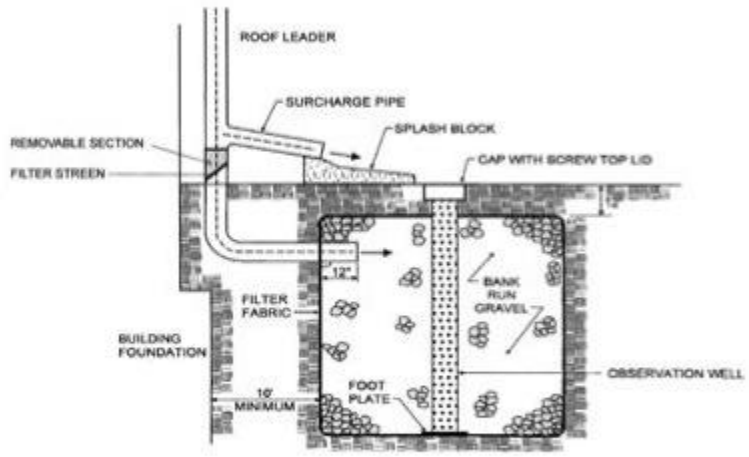


Figure 4: Soakaway Pit Profile
Source: Adapted from Maryland Department of the Environment, 1998.

A similar system is a manufactured plastic drywell with perforated walls. Because 100% of the space in these drywells is devoted to water storage, a smaller hole can store more water. These should be installed with a layer of gravel around the outside the drywell.

Bioswales, Retention Ponds and Constructed Wetlands:

Bioswales are biological filtration canals. Like trenches, they are designed to soak up water while conveying it. They are shallow and wide, with vegetation growing on bottom. They tend to be larger than trenches, and thus require more space, soil removal, materials and planted vegetation, but can handle much larger volumes of water.

Retention ponds retain rainwater for the slow infiltration of water into the soil. They must be carefully constructed to avoid biological and pest issues.

Constructed Wetlands are designed to mimic the natural cleansing processes of wetlands. They usually consist of a series of pools, each one progressively improving the water quality. They require a significant level of expertise to run properly.

Dealing with debris:

Leaves, twigs, gravel from asphalt roofs can clog up rainwater infiltration systems. Here's what you can do:

- Use rain barrel as a filter
- Cut back branches that hang over the roof
- Clean and maintain eves troughs

- Install a leaf diverting rain head such as a “Leaf Eater”
- Keep the splash pad clear of sediment

Choosing locations for your infiltration system:

Lead stormwater away from house foundations, and other areas sensitive to water. Watch out for ground that slopes in towards the foundation, this is called reverse grading. Change the grading in those areas by building it up. Locate rain gardens or soak away pits at least 4 m (13’) from your house.

Choose areas of Natural Drainage. After a storm observe the natural drainage patterns on your property including the paths where water runs, and where water pools. Choose a low point for your storm water landscape solution, or a location somewhere along the natural flow path. If your yard is relatively flat and evenly drained, you can create a depression anywhere.

Keep your drainage system above the water table. The water table is the level underground where water has fully saturated the soil. It is determined by the permeability of the soil and the depth to bedrock. In areas of high water table do not increase the infiltration rate of the soil, as this reduces the soil's ability to remove pollutants. To check the depth of the water table dig pilot hole slightly deeper than the depth of your planned drainage system. Cover the hole and leave overnight. If the bottom of the hole fills overnight, the level of water in the hole indicates the water table height. Note: the water table level may fluctuate through the season.

Call Before You Dig. Before starting any excavation project, it is your responsibility to locate any underground utilities on your property. Most utilities can be reached by calling the free service Ontario One Call or 0N1Call *at least one week prior to digging*. Some utility providers are not participants in this free service and need to be contacted directly; check your utility bill for the Ontario1Call symbol or a contact number for excavation information.
Ontario One Call: Call 1-800-400-2255 or use their online form at
http://65.93.248.67/on1prequalify2.htm.

Test Your Soil Infiltration Rate:

Start workshop by digging a 30 cm (12”) square hole (call before you dig). This can be same hole you dig to determine the water table depth. Fill the hole with water if it’s above the water table. Start this process early in the workshop to get the ground fully saturated. Ideally the hole should be dug and filled with water the night before to reach full saturation. Measure the water depth every 15 minutes until the drop measurement becomes fairly constant. Multiply this number by 4 to get the distance of infiltration in an hour. This will give an idea of the rate, or speed, at which water percolates through this soil. Once you know this, and the amount of rainwater you can expect to collect (see Rainfall Calculations), you can begin sizing your rainscape system.

Sizing Your System:

Multiply the Rate of Infiltration for the soil in m/hr by 24 hours to get the rate of infiltration of your soil in one day, (to compare with the average rainfall over one day).

R = Rate of infiltration (m/hr)
I = Infiltration in one day (m)

$$R \times 24 = I$$

Example: 15mm/hr / 1000 = 0.015m
0.015 x 24 hrs = 0.36m/day

Divide the average 24 hr rainfall volume from your roof (from Rainfall Calculations) by the Infiltration in one day. Aiming for a slightly higher rainfall volume will reduce the number of overflows and prevent run off during larger storm events or rainy seasons.

V = Volume of Stormwater (m^3)
I = Infiltration in one day (m)
A = Area of ground required (m^2)

$$V / I = A$$

Example: 1000 L /1000 = 1 m3
1m3 / 0.36 m/day = 2.77 m2

This area represents the amount of unobstructed permeable soil required to soak in the water over a 24 hour period. Trenches and soak away pits increase that area by exposing rainwater to subsurface soil areas. A trench 30 cm deep and 30 cm wide will have a length of one meter. Multiply this by the length of the trench to get the area of the trench's infiltration surfaces.

Example: 1m x 1m = 1m2