UNDERSTANDING & MANAGING STORMWATER

A guide for homeowners in the Cape Breton Regional Municipality

Atlantic Coastal Action Program Cape Breton

Stormwater Education, Awareness, and Management Project

Financial support for this project provided by:

RBC Blue Water Project™

About ACAP Cape Breton

The Atlantic Coastal Action Program (ACAP) Cape Breton is a non-profit charitable community organization. ACAP Cape Breton has a vision for a community in which local people are actively engaged, working and learning together to build a healthy and sustainable Island. Established in 1992, the original mission was to develop a comprehensive ecosystem management plan for the watershed area of industrial Cape Breton. ACAP Cape Breton has grown into a dynamic group that integrates environmental, social and economic factors into projects focusing on action, education and ecosystem planning.

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Glossary

Impermeable (or impervious): A surface that will not allow water to pass through or sink in.

Infiltrate: To soak into the ground.

Permeable (or pervious): A surface that will allow water to pass through or sink in.

Ribbon test: Working wet soil in your hands to form a snake-like figure in order to determine the composition of your soil.

Saturation: In soil, when all available spaces are filled and the soil is completely soaked with water.

Schematic: A technical drawing.

Stormwater: Water that is generated from precipitation (snow/rain) which has fallen on impervious surfaces and is not infiltrated into the ground.

Swale: A shallow ditch with gently sloped sides which is used to capture runoff, filter pollutants and increase rainwater infiltration.

Urbanized: An area that has been developed by human activity and contains lots of hard surfaces such as buildings, roads, and parking lots.

What is Stormwater?

Stormwater is made up of rainwater and snow melt that lands on roofs, lawns, and other surfaces and then runs off into storm drains and waterways. If it can be absorbed into the ground, it's no problem; but in urban areas with limited exposed ground, it can cause flooding and strain on water management infrastructure. Stormwater also picks up pollutants such as sediment, oil, and salt as it flows and can cause pollution in waterways.

It's not just big buildings and parking lots that create stormwater. The roof of a typical family home can create a significant amount of runoff as well. A single home can produce over 700 gallons of runoff during a single 15mm storm. With Sydney's average annual rainfall of 1212 mm, that means a single home can produce 60,800 gallons of runoff each year! Capturing even a small percent of that runoff can help protect our homes, our infrastructure, and our environment.

Effects of Stormwater

Possibly the most obvious effect of excess stormwater is that it can collect on your property and cause flooding in or around your home. The same is true for rivers and water management infrastructure. When more water is generated than streams or pipes are designed to handle, they flood as well. The excess water can end up in homes or in the street, making driving conditions difficult and dangerous.

Stormwater is still a problem when it flows away. In fact, stormwater is the number one source of water pollution in urban areas today! It can pick up nutrients, contaminants, sediment, and bacteria along the way, and carry it all to local waterways. That includes streams, lakes, and the harbor where it harms the plants, animals, and ecosystem there. If it finds its way to wells or other water sources that serve humans, it has the potential to cause problems there as well.

Sources of Stormwater

Stormwater can come from all of the impervious surfaces on your property. Main sources include your roof, driveway, walkways, and deck. In heavy rain events, even somewhat pervious surfaces like your lawn can produce runoff-grass can absorb some water, but not all the water that falls during a storm!

Certain features of your home (particularly your roof) can cause stormwater to be concentrated and easier to detect. These include gutters, downspouts, drip-lines, and roof valleys.

Stormwater will not always accumulate into an easily detectable stream. Sometimes, it will flow along your property in a sheet – this is probably what will happen on your lawn in a heavy rain event. Keep this in mind when determining where your stormwater comes from, as runoff from your lawn could be a significant stormwater source on your property.

Tracing the Path of your Stormwater

In order to manage your stormwater, you have to know a couple of things:

- Where stormwater is generated on your property
- Where stormwater settles or collects
- The path it follows from the source to its destination

The best way to figure this out is to go outside during a heavy rain and look around. Check along your roof for drips and waterfalls and look at your driveway and lawn for little streams. Even after the rain has stopped, you may be able to see puddles where the water has settled.

The path water takes is determined by gravity and obstacles it encounters. So, water will flow down slopes (never up) and around bumps or hills. It is important to become acquainted with the slopes on your property, as they are critical in determining the placement of management methods. You can use the worksheet in this handbook to help you record the location of slopes and stormwater flow on your property.

If you live in a highly urbanized area, you may not have the space needed to capture and infiltrate all the stormwater your property creates – that's ok! It is better to manage some of your stormwater than none at all, so doing the best you can with what you have is still valuable and worthwhile.

Schematic Drawing

Get your pencils ready! This manual includes a sheet for you to make a schematic drawing of your property and an example drawing to guide you. Use this checklist to ensure you have included all the important features of your property. Remember – it doesn't have to be pretty, just informative, so don't worry about your artistic skills!

In your drawing, include:

- House & other structures
- Driveway & walkways
- Downspouts or drip-lines
- Trees
- Gardens
- Septic tank and field bed
- Slopes
- Misc. features (e.g. fire pits, swing-set, etc.)

Home Stormwater Worksheet

The first step toward managing stormwater at home is to see what you are working with. This checklist will help you record which sources of stormwater you have on your property. It also includes a list of features which will be relevant to you when selecting a stormwater management method. Take a walk around and check off the items that are present! Then, compare the criteria on this list with those on the stormwater management techniques to help you choose the right method.

Important Property Features

- ○ Driveway
- ○ Walkway
- ○ Garage, Barn or Shed
- ○ Patio or Deck
- ○ Yard-space more than 10ft from house
- ○ Level ground
- ○ Downspout (piped to sewer)
- ○ Downspout (piped to grass)
- ○ Rain gutter / eaves trough
- ○ Drip-line
- ○ Sump-pump
- ○ Garden
- ○ Septic system *
- ○ Well *

* Be sure to record the location of your well, septic tank, and septic bed on your drawing!

Ribbon Test – #1

Ribbon test instruction on Pg. 8

My ribbon length: _____

My soil type: _____

Ribbon Test – #2

Ribbon test instruction on Pg. 8

My ribbon length: _____

My soil type: _____

If your soil type is clay, consider working in another location or improving soil with sand & compost.

Stormwater Management Techniques

Stormwater can be managed using Low-Impact Development (LID). Low-impact development is a method of stormwater management that involves capturing runoff before it reaches stormdrains. Once the water is captured, it can be filtered, infiltrated, evaporated, or stored for later use. LID uses small-scale, easy to implement techniques to manage stormwater using landscape features. Some common methods include infiltration trenches, rain barrels, and rain gardens.

Even small steps like installing a rain barrel or planting a rain garden can help reduce the negative effects of stormwater. This manual will help you decide which LID methods are right for your property and provide the basic information you need to implement them.

Things to keep in mind...

Water obeys gravity, even while underground, so be mindful of the slope in areas where you plan to place stormwater management structures. Make sure that you do not infiltrate water in a location that is uphill from your house as it could leak into your basement. The danger of this is reduced if the structure is far away (more than 10ft) from your house or if the amount of water captured by the structure is small.

Many people think that rain gardens and rain barrels will breed mosquitoes, but this is not true. Rain gardens and other infiltration structures which are properly placed will drain completely in two days or less. This is not long enough for mosquitoes to breed. A simple screen over your barrel's opening will stop mosquitoes.

It can be difficult to capture all the rainwater you generate, especially in urban areas where there is little space available. But it is always better to capture some water rather than none! Do the best you can with the space and resources you have available.

Soil Drainage

Rain gardens and infiltration trenches should not be installed in areas with poor soil drainage or a high water table. In these cases, the water has no where to infiltrate to and will only increase saturation. If you have serious water problems at home, consult a professional before installing rain gardens or infiltration trenches on your property.

Driveway Infiltration Trench

A Driveway Infiltration Trench helps collect, store and filter stormwater that runs off of your driveway. It prevents water from running off of your property and polluting nearby waterways.

Before you dig, determine the soil type in the location where you would like to put your trench. An easy way to do this is with the ribbon test (see page 8). If you have clay soil, your trench will drain poorly. If this is the case, a vented pipe can be added amidst the gravel to let water flow through the pipe to a lower/better-draining area of the property.

Step 1: Identify the direction that stormwater runs off of your driveway. This will be the location of your trench. For example, if your driveway is tilted left, place the trench on the left side of your driveway.

Step 2: Dig a trench about 18" wide and 8" deep. Dig along the entire length of the area from which you want to capture water – this can be just a few feet or the entire length of your driveway.

Step 3: Fill the trench with gravel. A sheet of filter fabric should be added across the trench before being filled entirely with gravel.

A driveway infiltration trench might be appropriate for you if:

- You have limited space available

-You wash your vehicle in your driveway

-Your driveway is tilted (if it is not, dig two trenches!)

Warning!

Before you install a driveway infiltration trench, take special care to ensure that it will not negatively impact your neighbour's property!

Drip-line Infiltration Trench

A Drip-line Infiltration Trench is a way to help runoff rainwater from your roof seep in to the soil. This reduces the amount of stormwater that runs off of your property. This trench is very similar to the Driveway Infiltration Trench, only instead of being beside your driveway, this trench is beside your house.

Before beginning, determine the soil type in the location where you would like to dig your trench. An easy way to do this is with the ribbon test (see page 8). If you have clay soil, the drainage will be poor. In this case, a vented pipe can be added amidst the gravel to let water flow through the pipe to a lower/better-draining area of the property.

Step 1: Your trench should be about 18" wide and about 8" deep. It should be just under the overhang of your roof, slightly away from your house or barn. Its length should be the same length as the section of roof that has water running off of it.

Step 2: Fill the trench with gravel. A sheet of filter fabric should be added across the trench, about 3" under the surface, before being filled entirely with gravel.

An infiltration trench might be the right choice for you if:

- You have a drip-line (i.e. lack downspouts or gutters)
- You have limited space to work with
- You are placing the trench next to a barn or structure without a basement or if your property is sloped away from your house

Dry Well or French Drain

A Dry Well serves as a storage and filtration system for runoff water until it seeps in to the ground, helping to prevent erosion, pollution, and standing water.

Step 1: Select an area for the well where runoff water collects and contacts the ground.

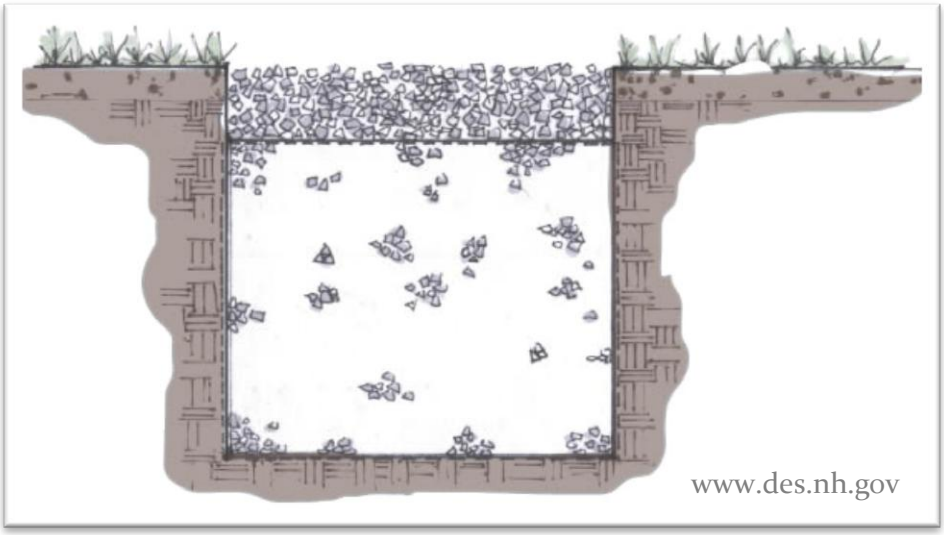
Step 2: Dig a hole that is approximately 3 feet deep and 3 feet in diameter.

Step 3: Fill the hole with gravel. It is suggested that a sheet of filter fabric also be added to the sides of the well when empty or, across the opening of the well when partially filled before filling entirely with gravel.

Step 4: Ensure everything is running smoothly. Make sure the runoff water enters the well, either by digging the well in a place where water already runs off of the roof or by extending a downspout to the surface of the dry well. If water collects on the surface, the well is likely clogged.

Warning!

DO NOT place a dry well within 10ft of your house foundation. If you wish to use a drywell to collect water from your downspout, direct the water from the downspout to the well using a swale or sloped trench.



A dry well might be appropriate for you if:

- You need to or wish to collect a large amount of water
- There is a location available which is 10ft from your home or other foundations, not on a septic tank or field bed, and not under the canopy of a tree
- You have good or very good soil drainage

Rain Garden

Rain gardens are landscaped plant beds designed to collect and absorb rain water. They are planted in a shallow depression which allows them to capture storm water as it runs off and give it time to infiltrate into the ground.

Step 1: Select a location for your rain garden. Be sure to check out the guidelines below to help you!

Step 2: Determine the type of soil where you plan to install your rain garden. One way to determine the soil type is by conducting a ribbon test.

Ribbon Test

- Dig a 1 ft deep hole and take a handful of soil to create a ball. Ensure the soil is damp.
- Press the ball of soil together with your thumb and index finger upward to create a ¼ inch thick ribbon.
- Keep pressing the soil to continue lengthening the ribbon until it breaks. Measure the length of the ribbon in inches.

Soil Type	Ribbon Length (inches)
Sand	Does not form ribbon
Silt	Weak ribbon <1.5 inches
Clay	Strong ribbon >1.5 inches

Step 3: Calculate the slope to determine the depth of the rain garden.

You can use a 1 meter stick to measure the slope in your desired location.

- Lay your stick down on the ground so that one end is uphill from the other.
- Elevate the downhill end of the stick until it is perfectly horizontal (use a level for this).
- Finally, measure how far from the ground you have elevated the end of your meter stick. If it is more than 10cm off the ground, the slope is too high.

Once you know the slope, use the table on the next page to determine how deep to dig your garden. A deeper garden is required in areas with steeper slope because slopes reduce the storage capacity of the garden.

Step 4: Design your rain garden

- The rain garden can be any size, but must have a level bottom. The bigger it is, the more rain it can hold.
- Stabilize the area where water will enter the garden with rocks or gravel. This will slow the flow of water and prevent erosion.
- Install hardy flood tolerant plants where storm water enters the garden. Choose plants that can tolerate wet, dry and freezing conditions. Native plants often meet these specifications.

Step 5: Installing the rain garden

- Define the borders by using string or paint to outline the shape of the garden.
- Remove the grass within the area. This can be done by digging through the lawn or placing a tarp within the area for several weeks to kill the grass. Do not use herbicides, this can kill your new plants.

Step 5 cont'd….

- Dig the rain garden
  - Dig the rain garden bottom 4-6 inches deeper than desired to make room for compost and mulch. Once the rain garden area has been dug, level out the bottom.
  - Apply at least 2 inches of compost and mix with native soil to help retain moisture and enhance plant growth.
  - Place plants where desired.
- To help retain moisture and prevent weeds, apply 2-3 inches of mulch all over the rain garden area.

A rain garden can work for you if:

- There is an appropriate location with a slope less than 10%.
- You have at least 4 square feet of space available.
- There is a concentrated (e.g. a downspout) or semi-concentrated (e.g. a sheet) of run-off to feed your garden.

Warning!

Rain gardens infiltrate lots of water and must be placed with care. A rain garden should not be placed…

…Within 10 feet (3 meters) of your home, barn, or well.

…Over your septic tank or field bed.

…Under the canopy of a tree. if it is under the canopy it is probably above the roots and can make the tree unstable.

A Note about Slope…

If the rain garden is on a slope you will need to install a berm or low wall on the downhill side of the garden. This will ensure the water is held in the garden. A berm can be created while digging the garden by piling the extracted soil around the downhill side of the garden. The berm should be equal height as the uphill side of the garden to make the entire perimeter of the garden level. Once the berm is shaped, stabilize it by compacting mulch, sod or other stabilizing materials.

If the rain garden is on level ground then no berm or wall is necessary, you can use the extracted soil for other purpose around your property. Surrounding the perimeter of your garden with stone can help hold water.

Table 1 – Garden Depth

Slope (%)	Depth (inches)
<4	3-5
5-7	6-7
8-10	8+

Vegetated Swale

Vegetated Swales are a useful tool for redirecting stormwater runoff. They are a simple, shallow trench which slows down runoff and directs it to an area where it can infiltrate.

Step 1: Select a location. Swales should always be placed where the stormwater runoff flows in one end, along the swale, and out the other.

Step 2: Dig the swale. The depth of the swale depends on where you put it, but the depth at the centre should be at least 1.5ft deep with sloped (not vertical) sides. To make sure water will move, dig your swale in an area with at least 1% slope.

Step 3: Add plants. Swales should be densely covered with plants native to your area. This will make the swale more resilient to both flooding and droughts.

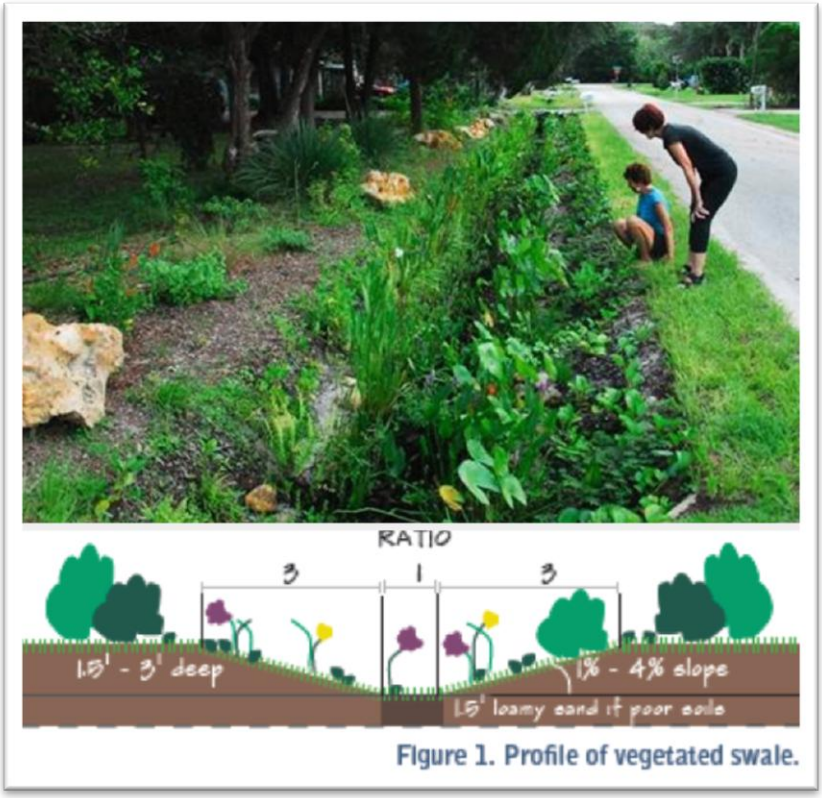


Figure 1. Profile of vegetated swale.

To reduce erosion at the start of your swale, install a splash guard where water enters. This can consist of anything that will break up the stream of water, including a piece of wood, a cinder block, or a pile of stones.

Rain Barrel

Rain barrels capture and store rainwater runoff from your roof. The water can be used during dry periods to water plants, wash your car, and other outdoor activities. This reduces both stormwater runoff and the need to use tap water for such activities.

Step 1: Place your barrel in a location where it will collect water. This can be under a downspout, under a roof valley, or even at the corner of your roof. Under a downspout is the most effective location, but you may have to modify your downspout to accommodate your rain barrel.

Step 2: If your barrel has a spout at the bottom it is best to elevate your rain barrel on a sturdy base such as cinder blocks. If you do not wish to elevate your barrel, attach short length of hose to the spout.

Try to use the water in the barrel between periods of rain so that it does not over flow. A good rain barrel will have a screen over the inflow to prevent debris, animals, and mosquitoes from getting in the barrel.

A rain barrel may be a good choice for you if:

- You have a use for captured rain water, such as watering your lawn or garden, bathing your pet, or washing your car.
- You have level ground to place the barrel on.
- You lack the yard space required to use other water management methods.

Stormwater Best Management Practices

Pollution Prevention

Test your soil to see what it needs before fertilizing, and when you do fertilize, use compost rather than chemical fertilizer. You can also just keep grass clippings on your lawn as a natural fertilizer!

Watering your lawn too much encourages weak roots. Aerate, and let the rain water your lawn!

Use sand on your walkways and driveways as much as possible.

If you have a dog, clean up after him or her regularly and dispose of droppings in the regular garbage.

Maintain your septic system and oil tank to prevent leaks and spills; spilled substances could be carried to waterways during rain events (see Nova Scotia Environment website for more info).

Water-use practices

Consider taking your car to a car wash when it is dirty. This actually uses less water than washing at home, and it's easier for you!

Never dispose of anything down storm drains; they are only for rain!

If you have a sump-pump connected to the municipal sewer, consider disconnecting it from the municipal sewer line and link it to a French drain or rain garden instead. This can be risky, so consult with a professional if you plan to do this.

If your downspout links to the sewer, consider disconnecting it and using a rain barrel instead.

Stormwater Management Methods

There are other stormwater management methods which are not covered in this manual. These include green roofs, permeable pavement, infiltration steps, interceptor drains, and others. Most stormwater management methods are good for your curb appeal in addition to helping manage water, so don't be afraid to get creative and find the method that works best for you!

Resources

Resources used in the preparation of this manual include:

New Hampshire Homeowner's Guide to Stormwater Management
http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf
RAIN Community Solutions
http://www.raincommunitysolutions.ca/en/for-property-owners/soak-it-up/
Stormwater Central – A blog by Ecology Action Centre
http://managingstormwater.blogspot.ca/
Vermont Rain Garden Manual
http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20028271.pdf

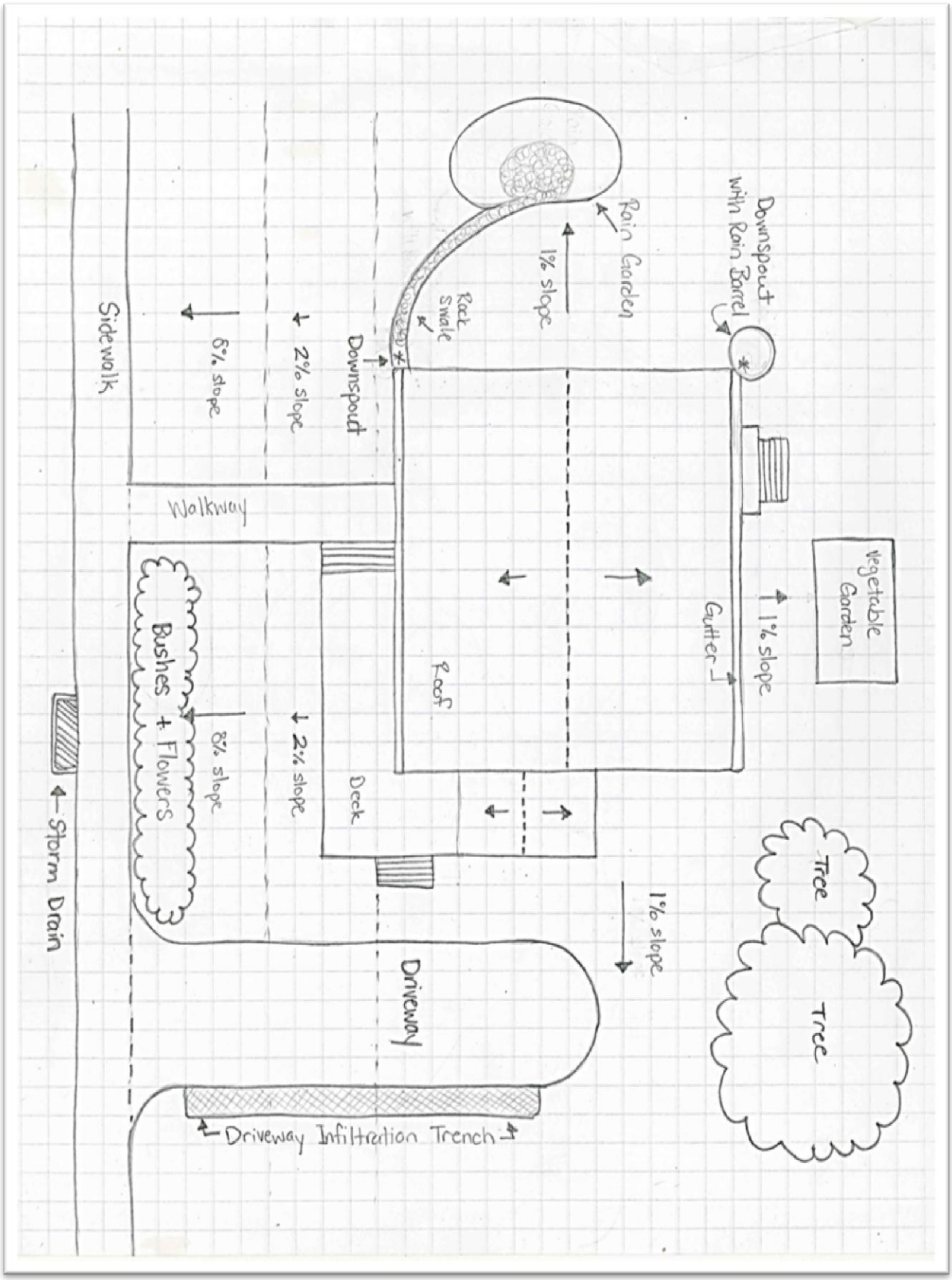
Rain Garden Plants

As in any garden, try to use native plants as much as possible. They are beautiful and well-adapted to our climate, and often do well in rain gardens! We recommend:

Blue flag iris	Native columbine
Black-eyed Susan	Serviceberry
Red twig dogwood	Joe-pye weed
Sensitive fern	Cardinal flower
Swamp milkweed	Switch grass
Vernal witch-hazel	White turtlehead

Ecological Gardening

Avoid using herbicides, pesticides, and chemical fertilizers in your garden. There are gentler options available for pest and weed control, and compost is an excellent fertilizer that you can make yourself or get for free. Try using vinegar for weeds, soap and trap plants for bugs, and other ecological gardening methods before resorting to chemical controls.


Vegetable Garden
Downspout with Rain Barrel
Rain Garden
1% slope
Rock Swale
Gutter
1% slope
Roof
Deck
Downspout
2% slope
6% slope
Sidewalk
Walkway
Tree
Tree
1% slope
Driveway
8% slope
Bushes + Flowers
2% slope
Storm Drain
Driveway Infiltration Trench

Use this sheet to complete the schematic drawing of your property. Use the list on page 3 of your handbook to help you.

Notes

About the RBC Blue Water Project

The RBC Blue Water Project is a wide-ranging program dedicated to protecting the world's most precious natural resource: fresh water. We support initiatives that help protect water in our growing towns and cities. Since the project began in 2007, RBC has pledged over $44 million to 740 charitable organizations worldwide that protect watersheds and promote access to clean drinking water.

For more information about the RBC Blue Water Project and how you can help protect fresh water, visit http://www.rbc.com/bluewater.

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