Students for Stormwater Educational Resource

Credit Valley Conservation
inspired by nature

Contents

Welcome to Credit Valley Conservation's Students for Stormwater Program

Dear Teacher,

Credit Valley Conservation (CVC) is a community-based environmental organization, dedicated to protecting, restoring and managing the natural resources of the Credit River Watershed. Established by the provincial government in 1954, CVC is one of 36 Conservation Authorities in Ontario.

As the primary scientific authority for the watershed, CVC works in partnership with municipal governments, landowners, community organizations, schools and businesses to deliver locally based programs.

These programs support:

- Planning and Development
- Conservation Planning
- Land Stewardship
- Flooding Forecast and Warning
- Environmental Inventory and Monitoring
- Environmental Education
- Source Water Protection
- Experiences and Recreation in Nature
- Climate Change Action and Mitigation

CVC's Integrated Water Management and Education teams, in collaboration with community partners, are constructing rain gardens with schools and delivering educational resources through the Students for Stormwater program.

The goal of this program is to:

- Increase environmental literacy of students
- Manage stormwater and address drainage issues on school property
- Improve water quality
- Increase climate change resilience
- Increase biodiversity in the neighborhood

Your school's rain garden provides an outdoor experiential learning space where students can learn about stormwater, native plants and environmental stewardship. This resource includes background information for teachers and curriculum connected lesson plans for students in kindergarten to grade eight.

We hope that you and your class use this guide to connect with nature and learn about your rain garden. If you have any questions, please contact our team at education@cvc.ca.

Don't forget to share your activities with us on Twitter. Take some photos and tag us @CVC_CA, using the hashtag #LearnWithCVC

Teacher Background

What is a Rain Garden?

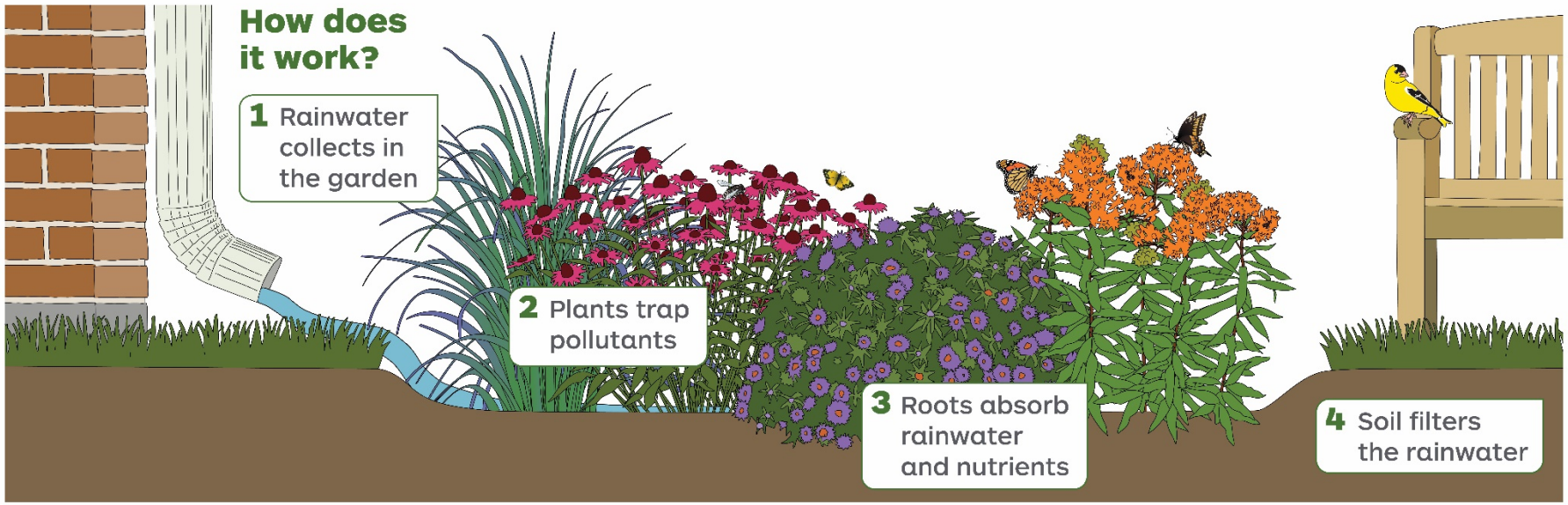
A rain garden is a shallow area planted with shrubs, flowers and grasses. It slows down, soaks up and filters rainwater coming from nearby rooftops, driveways and parking lots. Rain gardens help to keep our streams, rivers and lakes clean while also beautifying neighbourhoods.

Without rain gardens...

Rainwater picks up oil, salt, fertilizers and other pollutants from roofs, streets, sidewalks and parking lots that flow to streams and other water bodies without any treatment. By keeping pollution out of streams, rivers and lakes, we can protect our drinking water, fish and other wildlife.

A home for birds and pollinators

The plants in this garden provide valuable food and shelter to a variety of wildlife, including pollinators like birds and insects, as well as small mammals.

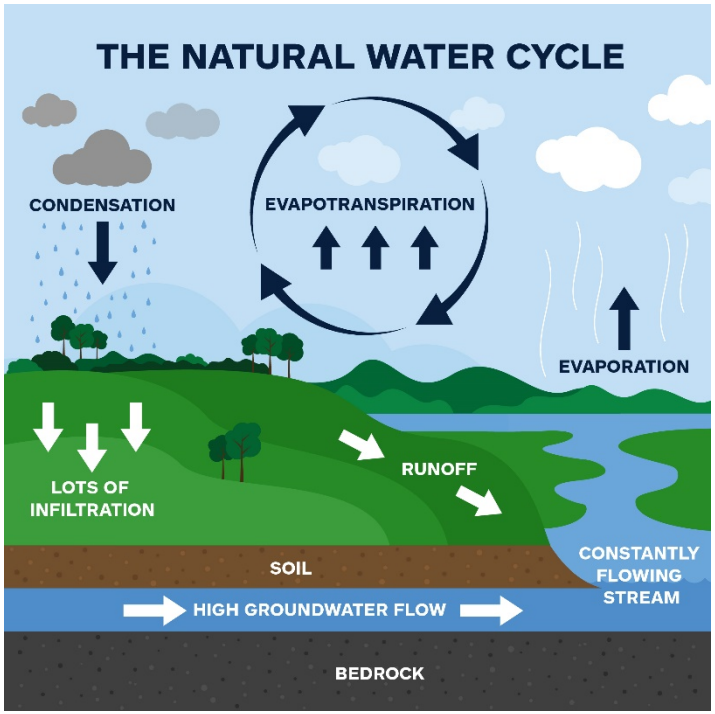


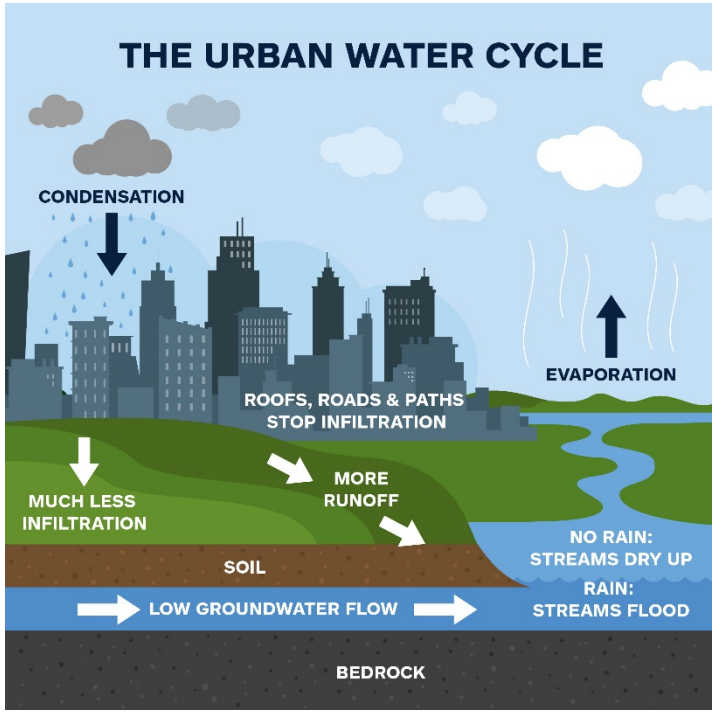
Why do we need Rain Gardens?

Can you spot the differences between these two photos? They can tell you a lot about how our water cycle changes, and why we need rain gardens.

Water constantly moves through a natural cycle of evaporation, condensation and precipitation which cleans water and allows it to move around the earth. As our population increases, we need to build more buildings, roads and houses. There are less places for water to absorb into the ground and complete its natural cycle.

Rain gardens are shallow depressions planted with deep-rooted native plants and grasses. They collect rainwater from hard surfaces like roofs and parking lots and allows it to slowly drain into the ground. This mimics the natural water cycle and stops polluted rainfall from going into the storm sewers.





Components of a Rain Garden

Dry Riverbeds

These rock channels take roof water and direct them into the rain garden. There are three dry riverbeds in the garden.

Rain Garden

This is the round, bowl shaped area in the centre of the garden. Water is directed from the dry riverbeds into this area, where it slowly absorbs into the ground. Plants in this area have been specially selected to withstand very wet and very dry periods.

Pollinator Gardens

The planted areas around the centre are called pollinator gardens. Plants have been specially selected to be drought tolerant and provide food and habitat for pollinators.

Example of a rain garden at Allan A. Martin Public School

Rain Garden Plants

False Indigo
Baptista x "Vanilla Cream
Attracts butterflies

Big Blue Stem
Andropogon gerardii
Native to Ontario

Yarrow
Achillea millefolium 'Paprika'
Attracts Butterflies

Drawf Sea Thrift
Armeria maritima
'Dusseldorf Pride
Drought tolerant

Purple Coneflower
Echinacea purpurea
Attracts butterflies
and birds

Slender Silouette
Sweetgum
Liquidambar
styraciflua
'Slender Silhouette'

Avens
Geum flora plena
Attracts hummingbirds

Anise Hissop
Agastache foeniculum
'Blue Fortune'
Attracts hummingbirds
and butterflies

Rain Garden Plants

Amber Jubilee Ninebark
Physocarpus opulifolius
'Amber Jubilee®'
Drought tolerant

Butterfly Milkweed
Asclepias tuberosa
Attracts butterflies, native to Ontario

Pink Turtlehead
Chelone obliqua
Attracts butterflies

Blue Flag Iris
Iris versicolour
Native to Ontario

Pot O' Gold
Hypericum kalmianum
Attracts butterflies

Blazing Star
Liatris spicata
Attracts butterflies and birds

Rain Garden Plants

Switch Grass
Panicum virgatum
Attracts birds

Joe Pye Weed
Eupatorium maculatum
Attracts birds and butterflies

Cardinal Flower
Lobelia speciosa
Attracts hummingbirds and butterflies

Lavendar Towers Culvers Root
Veronicastrum virginicum
Lavender Towers
Attracts butterflies

Nannyberry
Viburnum lentago
Attracts birds, native to Ontario

New England Aster
Aster novae-angliae
'Purple Dome'
Attracts butterflies

Caring for Your Rain Garden

Every student can play a role in helping to keep the rain garden healthy and looking its best. Here is a list of some of the ways you can help your rain garden.

Weeding

The rain garden should be weeded in the spring and fall to remove any unwanted plants. This will not only ensure the garden stays beautiful but will also make sure the chosen plants in the garden have lots of room to grow.

Respect the Space

As much as possible, stay on the pathways and benches, and don't walk in the garden. Walking in the garden can injure the plants and compact the soil, making it harder for water to absorb into the garden. Keep rocks in place, as they serve an important function conveying water into the garden.

Litter Pick-up

Any litter in the garden should be removed. This can be done at the same time as weeding.

Glossary

- **Catch basin:** collects rainwater and transports it to local waterways through a system of underground pipes.
- **Companion plants:** the minor or secondary plants that are spread throughout the garden.
- **Core plants:** the main or primary plants that are found in the middle of the garden.
- **Edge plants:** the plants around the edge of the gardens that act as a border. These plants generally prefer a drier environment.
- **Drinking water:** clean, treated water that comes out of our taps and showers, and is used for drinking and cleaning inside our homes.
- **Habitat:** a place or type of place where a plant or animal normally lives and grows.
- **Impermeable:** something that does not let liquids pass through it.
- **Infiltration:** to pass into or through by filtering.
- **Native plants:** species or types of plants that are naturally found in an area.
- **Permeable:** something that has holes or openings that let liquids pass through it.
- **Rain garden:** a feature that collects rainwater that flows off hard surfaces. A rain garden is full of layers that water can soak down through. As the water soaks through the layers, the plants and soils clean pollutants from the water.
- **Storm drain:** a channel or pipe used to carry rainwater away from a street, parking lot, etc.
- **Stormwater:** rainwater that falls in our urban areas and washes over hard surfaces like parking lots and sidewalks and is directed through ditches and catch basins to the sewer system.
- **Wastewater:** dirty and polluted water we wash down drains and flush down toilets.
- **Watershed:** an area of land where all the surface water drains into the same place (i.e. the Credit River)

Additional Video Resources

What is a Watershed?

Watersheds! (Watch the first 1:30 minutes)

Rain Garden Introduction Video

Rain Gardens Explained in 2 Minutes

Building a Rain Garden at Kenollie Public School

Kenollie Public School Rain Garden

Freddy the Fish Teaches About Stormwater

Climate Change Solutions- Low Impact Development

Primary (Grades K-3) Activities

Primary Activity #1: The World Beneath our Feet

Rain gardens are an amazing feature teeming with living and non-living things. Through exploration and discovery, students will gain a better understanding of the world that exists just below their feet!

Materials:

- Hula hoops (three students per hoop)
- Magnifying glasses
- Living and non-living chart

Instructions:

1. Tell students they will be out in their rain garden conducting experiments today. Explain they are taking on the very important role of scientist; ask students: can anyone tell me what a scientist does? (Allow for various answers). Scientists are very curious people who like to solve problems. They solve these problems by doing science projects called experiments and observations. What are some of these problems? Well, they can be about keeping our air clean or finding a way to cure people when they have certain diseases.

2. Explain that today we are going to be investigating living and non-living things by performing experiments like scientists do. Your job as a scientist is to help me figure out the difference between what is living and non-living!

3. We come across living and non-living things in our daily life. Sometimes it's easy to tell the difference between living and non-living things, but many times it's a little difficult. There are a few things we can talk about that will help us tell what things are living and what are non-living.

4. Ask students to give you examples of things they think are **living.** For items that are living we say, "It's living!" and have our hands "grow" upward like a tree. Some examples of living would be humans, apples, animals, trees, etc.

5. Then ask students for examples of things they think are **non-living.** For things that are not living, we pretend to be a robot and say "it is not living" in a robot voice. Examples of non-living: rain, water, rocks, etc.

6. Now we want to talk about the features that make something living.
   What makes something living?
   a. Answers vary (they have a face, can talk, move, etc.)
   b. Looking for: **eat, breathe, grow**

7. Debrief:
    a. A plant doesn't move or have a face or talk, but it eats, breathes and grows = **LIVING**
    b. An apple doesn't eat, breathe or grow once it is off the tree, but it used to do those things = **LIVING**
    c. A chair does none of those things and never has = **NON-LIVING**

8. Define Terms:

a. **Living**: Something that is alive and eats, breathes and grows or something that used to do these things.
b. **Non-living**: Something that has never been alive and never will (things that have been processed too).

9. Today our experiments and observations will focus on living and non-living things that can be found in our rain garden. We are going to learn a song that will help up remember what is living!!

10. Sing the song once and then go line by line and have them repeat.

To the tune of Frère Jacques:

It is living,

It is living,

I know why!

I know why!

It eats and breathes and grows,

It eats and breathes and grows,

It's alive!

It's alive!

11. Tell students this song will help them remember if something is living or non-living!

12. Ask students, who can remind me what the three things are that help us know if something is living? (Eats, breathes, grows)

13. Use the provided living and non-living chart to guide students through the next activity and to help record your findings.

14. Now students will move into investigating the rain garden for living and non-living items.

15. Have students get into six groups (just break the three groups in half). Give each group magnifying glasses, a hula hoop and have them find a space to put their hoop down in the area. Have them find all the living and non-living things within the area of the hula hoop. How many items can they find? How close can they get with their magnifying glasses? Students can move the hula hoop after they locate the living and non-living items to another spot.

16. Try and investigate the whole rain garden! If there is time, investigate things around the rain garden. Are there more living things in the rain garden than outside of it? Take a tally of all the things the students can find.

17. Ask the students, did any group find flowers in their hula hoops? Allow for answers. Ask, did anyone see any pollinators (butterflies, bees, other insects) on the plants? Tell students that the plants that were chosen for your rain garden are considered native plants. Native plants are plants that have not been introduced by humans. It wasn't brought over on a ship or snuck through airport security. It just grows in the area naturally. They attract wonderful wildlife to our garden and can provide things like shelter, food and places to raise their young.

18. Once students have investigated a few areas, have them return as a group and discuss all the things they found. You can use the chart provided for a debrief to reaffirm what is considered living and non-living and the characteristics associated with each.

Name: _____

Living Things	Non-living Things


Joe Pye Weed


Log


Rock


Bee


Wood Chips


Rain Drop


Soil


Ant


Butterfly Weed


Butterfly

Curriculum Links

Kindergarten
4.3 Belonging and Contributing
OE.29: Demonstrate an understanding of the natural world and the need to care for and respect the environment.

Grade 1
Science and Technology : Understanding Life Systems – Needs and Characteristics of Living Things

Overall Expectations:

2. Investigate the needs and characteristics of plants and animals, including humans.
3. Demonstrate an understanding of the basic needs and characteristics of plants and animals, including humans.

Grade 2
Science and Technology: Understanding Life Systems – Growth and Changes in Animals

Overall Expectations:

3. Identify ways in which animals are helpful to, and ways in which they meet the needs of, living things, including humans, to explain why humans should protect animals and the places where they live.

Grade 3
Science and Technology: Understanding Life Systems – Growth and Changes in Animals

Overall Expectations:

1. Investigate similarities and differences in the characteristics of various plants, and ways in which the characteristics of plants relate to the environment in which they grow.

Primary Activity #2: Weather Watchers

Through a review of the water cycle, students will participate in a teacher-led demonstration of a small-scale water cycle. Students will then record the daily weather over the period of a week to develop a weather portfolio to understand their rain garden.

Materials:

- Water
- Kettle
- Glass jar
- Plate
- Ice cubes
- Drawing paper and markers
- Optional: oven mitts (in case you need to handle the jar with hot water)
- Graduated cylinder
- Paper
- Pencils/markers crayon

Instructions:

1. Review the water cycle with students. For example, water starts as a liquid in Lake Ontario, and then the sun warms it up and some of it turns into a gas (water vapour) and rises in the sky. Once it meets the cooler temperatures in the atmosphere it condenses and forms clouds. Eventually the clouds are so full of water that it falls as precipitation down to the earth, where it is collected into rivers, lakes, ponds, etc.

2. Explain to students that today the class is going to be creating their own water cycle in a jar which will demonstrate the same water cycle process that happens outside in the environment.

3. Set up the materials on a table. Boil water in a kettle.

Note for Teacher: Check out this video for a demonstration of the experiment. During the experiment be sure to tell students not to touch the kettle or jar filled with hot water.

4. Fill the glass jar about one-third with hot water. Place a plate over top to seal the jar. After 20 seconds, place ice cubes on the plate over top of the jar. The ice will cool the air in the upper part of the jar and the water will condense and precipitate in the jar.

5. Explain the water cycle process that is happening in the jar, so students understand each step.

   For instance:
   - Water in jar – represents a lake that has been heated by the sun.
   - Ice on plate – represents the cooler atmospheric air.
   - Water vapour – represents evaporation that occurs to create clouds in the sky.
   - Water droplets on side of jar – represents precipitation (rain/snow) that falls and collects in a lake.

6. To reinforce the learning, have students draw a picture of a natural water cycle related to Lake Ontario or the Credit River. Be sure to have them label the different steps (i.e. evaporation, condensation, precipitation, collection).

7. After the experiment, tell students that rain gardens help collect rain and restore and recharge our groundwater system, just like we saw in our water cycle experiment. Since soil and plants in our rain garden can absorb the rain like a sponge, most of the water doesn't run over the surface into the storm drain. It can go back into the groundwater. Over the next (predetermined amount of time, best to do over a season), we will be recording the weather in the garden. We will also be choosing a few class plants that we are going to follow over this time. We will visit these plants throughout our monitoring to observe how they grow and change. We will take a photo of it or draw it on our first day and then weekly/monthly.

8. In a notebook, have students record the daily weather over a period (i.e. one week) to develop a weather portfolio. Create a spot in your weather portfolio to document your class plants.

9. In this weather portfolio, students can write words or draw pictures of their observations of the weather. This can include the temperature, wind speed (i.e. how fast the trees swaying), precipitation, etc.

10. Students will build and install a rain gauge in a spot in the rain garden.

How to build a rain gauge:

Materials:

- Empty two-litre plastic bottle
- Scissors
- A few handfuls of clean pebbles, gravel or marbles
- Masking tape
- Water
- Ruler
- Permanent marker
- Rainy weather
- Paper and pencil

Experimental Procedure:

1. Carefully use the scissors to cut the top of the bottle off at the wide part just below where it begins to get narrow.
2. Put the pebbles in the bottom of the bottle—these will help keep it from getting blown over if it's windy.
3. Turn the top of the bottle upside down—make sure there's no cap on it! Place it
   in the bottom part of the bottle pointing downward. It's going to act like a funnel. Line up the cut edges and tape them together so the top part is held firmly in place.
4. Use a long piece of tape to make a straight vertical line from the top edge of the bottle to the bottom. Use the marker to draw a line on the vertical piece of tape just a little above the top of the pebbles. This will be the bottom of your rain gauge.
5. Set the ruler against the vertical tape so that the "0" line lines up with the bottom mark. Use the marker to mark every quarter inch (or, if you want to get fancy, every eighth inch) along the piece of tape. Then label the inches from bottom to top. (Alternatively, you can mark centimetres and half-centimetres instead.)
6. Set the bottle on a level surface and pour some water in until it reaches the bottom mark. Your rain gauge is now ready to go!
7. Put the rain gauge outdoors—you'll need to pick a really good spot! You want somewhere level that is open to the sky and not likely to get too windy, so the gauge remains undisturbed. There shouldn't be anything hanging over the gauge that could either block rain or make extra raindrops drip into the bottle (like a tree or a power line or the edge of a roof).

8. Pay attention to the forecast. On a day that you're likely to get rain, make sure the water in the bottom hasn't evaporated below your bottom mark; if it has, refill it to that mark.
9. If it rains within 24 hours, check your gauge and see how high the water is now. That's how much rain has fallen in the last day! On your piece of paper, make a note of the date and the amount of rain. Then read the newspaper or go online and find out the official amount of rainfall in your area for the day and make a note of it—see how closely your figure matches the official one!
10. Repeat steps 7-9 for several rainy days.

References: *What's Up? 45 Hands-On Science Experiments That Explore Weather*, by B. K. Hixson, pp. 82-83 (Loose in the Lab Science Series, 2003).

11. Students will also install a thermometer in the rain garden to help them track air temperature through the experiment.

12. Alternatively, you can record the weather on a weekly basis over several seasons, and at the end, students can look back to see how the weather changes with the seasons.

13. Discuss as a class the diversion of rain from storm drains and the importance of rain gardens for the environment. Watch as a class: Freddy the Fish Teaches About Stormwater to learn more about stormwater and storm drains.

Curriculum Links

Kindergarten
4.3 Belonging and Contributing
OE.29: demonstrate an understanding of the natural world and the need to care for and respect the environment.

Grade 1
Science and Technology: Understanding Earth and Space Systems - Daily and Seasonal Changes

Overall Expectations:

1. Assess the impact of daily and seasonal changes on living things, including humans.
2. Investigate daily and seasonal changes.

Grade 2
Science and Technology: Understanding Earth and Space Systems - Air and Water in the Environment

Overall Expectations:

1. Demonstrate an understanding of the ways in which air and water are used by living things to help them meet their basic needs.

Grade 3
Science and Technology: Understanding Earth and Space Systems - Soils in the Environment

Overall Expectations:

1. Assess the impact of soils on society and the environment, and of society and the environment on soils.

Junior (Grade 4-6) Activities

Activity #1: Rain Garden Metaphors

Students will investigate wetland metaphors in this engaging activity where household items will be associated with the benefits of rain gardens!

Materials:

- Large pillowcase
- Bag or box
- Small pillows
- Sponge
- Small doll cradle
- Sieve/coffee filter
- Wild rice
- Charger

Instructions:

1. Prepare a "metaphor container" (pillowcase, bag, or box) filled with the objects. The container should have an opening large enough for a hand to reach in and retrieve an object.

2. Introduce rain gardens to the class through a word wall.

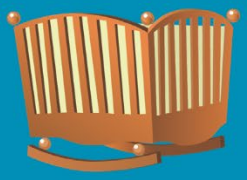
3. Ask students:
   - Have you ever seen a rain garden before?
   - What words do you think of when you hear rain garden?
   - What animals or insects would you expect to find in a rain garden?
   - What types of native plants would you find in a rain garden?
   - Do you think rain gardens are important? Discuss their answers.

4. Share details from the introduction to rain gardens located on page 5.

5. Take students outside to the rain garden.

6. Explain that you are going to make a list of reasons rain gardens are important using metaphors. A metaphor is a term or phrase that is used to make a comparison between two things that aren't alike but have something in common. A metaphor can be helpful for kids who are learning the meaning of specific words because they provide a more visual description of the word or thought.

The metaphors in this activity are common objects that represent benefits of rain gardens.

	Object	Metaphoric Function
	Sponge	Absorbs excess water caused by runoff; retains moisture for a time even if standing water dries up.
	Pillow	Provides a resting place for migratory birds.
	Coffee Filter	Filter stormwater runoff before entering waterways.
	Cradle	Provides a nursery that shelters, protects and feeds young wildlife.
	Charger	Restores and recharges our groundwater system.
	Wild Rice	Provides food for wildlife.

7. Have students form small groups. Go around the groups and have them choose an object out of the pillowcase filled with metaphors. Give each group a few minutes to determine why their object is like a rain garden.

8. Have each group report back to the class and discuss each idea and invite other groups to add to those ideas. At the end, ask the class to summarize the major roles that rain gardens perform and add these concepts to your word wall.

(Adapted from: WOW!: The Wonders of Wetlands, Environmental Concern Inc., 1991, p. 20.)

Curriculum Links

Grade 4
Science and Technology: Understanding Life Systems - Habitats and Communities

Overall Expectations:

2. Demonstrate an understanding of habitats and communities and the relationships among the plants and animals that live in them.

Grade 5
Science and Technology: Understanding Structures and Mechanism - Forces Acting on Structures and Mechanisms

Overall Expectations:

1. Analyze social and environmental impacts of forces acting on structures and mechanisms.

Grade 6
Science and Technology: Understanding Life Systems - Biodiversity

Overall Expectations:

2. Demonstrate an understanding of biodiversity, its contributions to the stability of natural systems, and its benefits to humans.

Activity #2: Rain Gardens as Filters

Rain gardens are beneficial for many reasons, including they filter stormwater runoff before entering our waterways. In this activity, students will compare different elements in the rain garden and test their ability to hold or absorb water. As an extension, students will build their own water filter with different soils and test it against soil from the rain garden.

Materials:

- Water bottle
- Scissors or knife
- Coffee filter, cotton balls or fabric
- Sand or charcoal
- Gravel
- Large gravel or small rocks
- Cup to hold filtered and non-filtered water
- Non-filtered water (or water mixed with soil and dirt)

Instructions:

1. Discuss with students the benefits of rain gardens as described on page 5.

2. Explain to students they will be creating a rain garden in a bottle. They will then see how a rain garden is like a water filter that can reduce the quantity of pollutants that run from our yards and roads straight into our waterways.

3. Hand out materials to students. You can also do one demo bottle for the whole class, or if doing it independently have the bottles and lids pre-cut.

4. Follow the steps on how to make your rain garden water filters activity.

How to Make your Rain Garden Water Filters

Step 1:

Using your scissors or knife, cut off the very end of the water bottle.

Step 2:

Using your knife, scissors or anything sharp, make a small hole in the center of the cap. Make sure the cap is on tight.

Step 3:

Now stick your coffee filter (or cotton balls or fabric) through the hole and down by the cap. You may have to cut the size of the coffee filter to make it fit in the bottle.

Step 4:

Get your sand or crushed charcoal and fill up the bottle about two inches.

Step 5:

Next, add approximately two inches of gravel into the bottle.

Step 6:

Finally, add your larger gravel or small rocks into the bottle. Adding 1-2 inches of larger gravel is enough. Your water filter is now complete!

Step 7:

5. Pour your unfiltered water through your rain garden water filter and watch your dirty water come out filtered!

6. After the students have completed filtering the water a few times, explain that just like our created model, rain gardens collect rainwater runoff from streets, houses, schools, etc., which allows the water to be filtered by vegetation and different materials likes rocks and gravel. These processes filter out pollutants, returning the runoff to the groundwater.

7. After students complete their filters, take them into the rain garden. Have students compare the different soil/rock elements in the rain garden and schoolyard (e.g. dry riverbed, soil in pollinator garden, mulch, oil from another location in the schoolyard, sidewalk/asphalt).

8. Make predictions about which ground type will absorb the most/least water.

9. Give students a beaker/measuring cup that they can fill with water.

10. Students will slowly pour water onto each ground type. Have students measure how much water the ground will absorb before it starts to pool on the surface. Record the volume of water.

11. As a class, compile and graph all the data. Which ground type absorbed the most water? The least?

12. Discuss the benefits of a rain garden in terms of water absorption and reducing water runoff.

Lesson adapted from: https://www.instructables.com/Simple-Water-Filter-out-of-a-Waterbottle/

Curriculum Links

Grade 4
Science and Technology: Understanding Earth and Space Systems - Rocks and Minerals

Overall Expectations:

3. Investigate, test and compare the physical properties of rocks and minerals.

Grade 5
Science and Technology: Understanding Structures and Mechanisms - Forces Acting on Structures and Mechanisms

Overall Expectations:

1. Analyze social and environmental impacts of forces acting on structures and mechanisms.

Grade 6
Science and Technology: Understanding Life Systems - Biodiversity

Overall Expectations:

1. Assess human impacts on biodiversity and identify ways of preserving biodiversity.

Intermediate (Grade 7-8) Activities

Activity #1 : Here Comes the Rain

In this activity, students will simulate a flood in three different locations and compare the results. As an extension, students will design a town, according to specific conditions, that will withstand a severe climate change related flash flood.

Materials:

- Bucket
- Water
- Video equipment (a cell phone with the slo-mo feature works great!)

Instructions:

1. Tell students: Urbanization in the Credit River Watershed is increasing, and research has shown that this can result in significant changes to natural systems. Water quality in urban areas of the Credit River Watershed is already reduced and likely to get worse. Many wetlands and forests in urban areas have been altered or destroyed, leaving these areas more prone to problems like flooding and erosion. Today, we are going to observe flooding events in three different environments.

2. Give students a large bucket of water. They will use this water to simulate a flood.

3. Students will flood three different environments and observe the results. The three environments will be (1) the dry riverbed of the rain garden, (2) a grassy spot on the school yard or a nearby park, and (3) an asphalt or concrete area.

4. Use video recording equipment (the slo-mo feature on a phone camera works well) to record each flood. Students will analyze the footage afterwards.

5. Have students pour the bucket of water at each location and observe the results. Have students design their own observation sheet ahead of time. What kind of data will be important to record?

6. When you return to class, have students re-watch the footage of the floods. How long did it take for the environment to be flooded after the "rain" began? Students can use timestamps to answer this question. How much water was absorbed by each ground type? Why are areas like rain gardens important?

7. Complete the extension activity that will simulate a flood event on a watershed scale.

Extended Activity for Here Comes the Rain

In this activity, students will design a town, according to specific conditions, that will withstand a severe climate change related flash flood.

Materials:

- 1 x aluminum baking pan (watershed)
- Multi-coloured sponges (these are green spaces, such as grass, forests, wetlands)
- Square wood pieces (these are buildings and houses)
- Plastic rectangle pieces (these are concrete, like roads and parking lots)
- 1 x full 250 ml water bottle
- Clay for river
- Instruction sheet for students

Instructions:

1. Climate change is also expected to be a significant stress on the health of the Credit River Watershed. Studies suggest climate change will result in increases in the frequency and severity of extreme events such as floods, droughts, heat waves and winter storms. It will also have long-term changes in climate conditions, ecosystems and ecological functions.

2. Ask students: Does anyone know what a watershed is? A watershed is an area of land that catches rain and snow that drains or seeps into a marsh, stream, river, lake or groundwater. Homes, farms, cottages, forests, small towns, big cities and more can make up watersheds.

3. Can anyone name the main river within our watershed? What body of water does our river flow into? Water within our watershed flows into the Credit River and then into Lake Ontario.

4. Why are watersheds important? Watersheds are more than just drainage areas in and around our communities. They are necessary to support habitat for plants and animals, and they provide drinking water for people and wildlife. They also provide the opportunity for recreation and enjoyment of nature. Protection of the natural resources in our watershed is essential to maintain the health and well-being of all living things, both now and in the future.

5. Using the provided materials, design a town according to specific conditions, that will withstand a severe climate change related flash flood. At the end of the activity we will discuss certain changes we can make to our watershed to withstand effects of climate change and urbanization.

6. Divide students into equal number of groups, depending on how many watershed pan sets you are using. Each group can stand/sit at their materials bin so they can see what materials they have as you explain.

7. Show all students the instruction sheet and briefly outline what everything is on the sheet. Show the students what each piece represents.

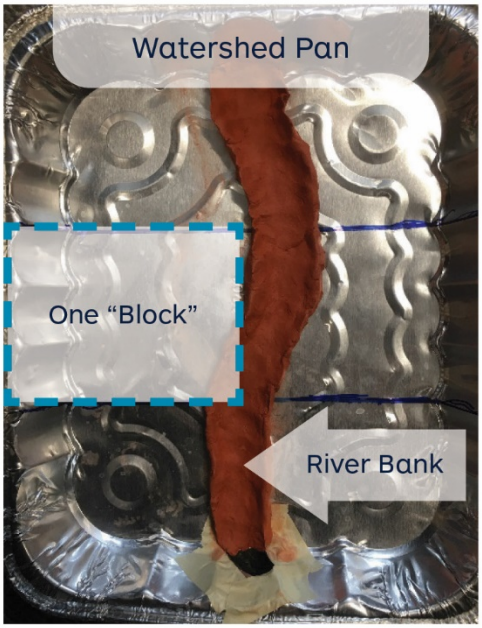
8. Outline the goal of the activity. Students will fill in all the space in their watershed pan. Next, they will pour one full bottle of water through the river and everyone will see what amount of flooding occurred in their town plan.

9. Ask if anyone has any questions. Release them to construct their pans! Hand out materials to students (can do in small groups). You can have the pan prepared beforehand with clay river and blocks marked off in pan, or have the students prepare during class.

10. Once students are ready for the flood test, either pour water individually with each group or as a large class group. Ask students what happened and if they would change anything. Debrief with real-life examples of situations that are like their plans (i.e. people building in floodplains that flood year after year, or give greenspace buffer next to river, make rain gardens mandatory etc.).

11. Once everyone has had their town flood tested, and if you have enough time, you can give the groups different scenarios and see if there are different results.
    a. For example:
        - A group can build with only green spaces
        - A group can build with no green spaces
        - A group can alter their river (straight, meandering, braided)
        - A group can alter their river with bank stabilizations/levies (i.e. build higher bank all along or where needed)
        - A group can dam their river (i.e. debris jam, beaver dam, human dam)
        - A group can build without any of the conditions
        - Another scenario of your choosing

Example of Pan Sectioned Off:



12. Some conditions to remember:
    a. Place green space, building and concrete pieces within your watershed, meeting the conditions on your handout
    b. Fill in every space on your watershed pan
    c. See teacher for water pouring instructions
    d. Wish your town good luck, and hope flooding is minimal!

13. Conditions on handout:
    a. Three grid blocks of the watershed must be urbanized (i.e. a minimum of five buildings within the block)
    b. Every building piece must be connected to a concrete piece which are connected to other concrete pieces (i.e. roads)
    c. Wetland pieces cannot be placed in urbanized blocks

****MUST BUILD WITH THESE CONDITIONS****

Example of Completed Pan:

14. At the end of the demonstration: collect materials, have students sort the different pieces, wring out any wet sponges and lay materials flat, if able to.

15. Based on the flood tests, what town plan flooded the least? What flooded the most? Why?

16. Did groups consider real-life impacts when constructing their plan? What were they?

17. Why is it important to have green spaces or rain gardens?

18. What are some challenges that communities might face with climate change?
    - Increased severe weather events (flash flooding) could be an issue. Having more green spaces that have wetlands (sponges), trees and less paved areas could help mitigate the effects on urbanized communities

19. What are some things that students can do to help minimize flooding and unhealthy waterways in their communities?
    - Plant more trees, shrubs and native plants
    - Be mindful of pollution getting into stormwater drains (i.e. ice salt, leaky cars, pool water), and act if they see something that's damaging (like tell parents not to use chemical soaps in their driveway when washing their cars, etc.)

- Encourage family to use a rainwater barrel for eavestrough, or landscape their yard in a way that will benefit the environment (rain garden, different plants other than grass, etc.)
- Clean up garbage in their communities, especially close to rivers and streams

Additional Information:

- According to CVC's Watershed Report Card we are noticing patterns consistent with climate change model predictions emerging through CVC's climate monitoring. Predictions for warmer than normal air temperatures are evident in the watershed. The pattern of drier summers and wetter winters predicted by climate models is not as clear across the entire watershed, although average values during the **Integrated Watershed Monitoring Program** (IWMP) indicate the upper watershed had wetter winters and the middle watershed had drier summers than normal.

Here Comes The Rain!

The Issue:

Urbanization is increasing in the Credit River Watershed and research has shown that this can result in significant changes to natural systems. Water quality in the urban areas of the Credit River Watershed is already impaired and likely to get worse. Many wetlands and forests in urban areas have been altered or destroyed, leaving these areas more prone to problems like flooding and erosion.

Climate change is also expected to be a significant stress on the health of the Credit River Watershed. Studies suggest climate change will result in increases in the frequency and severity of extreme events such as floods, droughts, heat waves and winter storms, as well as long-term changes in climate conditions, ecosystems, and ecological functions.

The Task:

Using provided materials, design a town, according to specific conditions, that will withstand a severe climate change-related flash flood.

The Procedure:

What You Need:

- 1 x aluminum baking pan (watershed)
- Multi-coloured sponges (these are green spaces, such as grass, forests, wetlands)
- Square wood pieces (these are buildings and houses)
- Plastic rectangle pieces (these are concrete, like roads and parking lots)
- 1 x Full 250 ml water bottle
- Clay for river

What to Do:

- Place green space, building, and concrete pieces within your watershed, meeting the conditions on the back of this page
- Fill in every space on your watershed pan
- See facilitator for water pouring instructions
- Wish your town good luck, and hope flooding is minimal!



CONDITIONS:

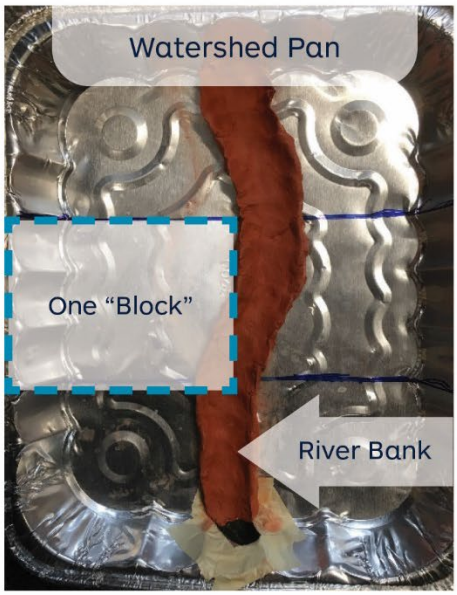
- 3 grid blocks of the watershed must be urbanized (i.e. a minimum of 5 Buildings within the block)
- Every building piece must be connected to a concrete piece which are connected to other concrete pieces (ie. roads)
- Wetland pieces cannot be placed in urbanized blocks

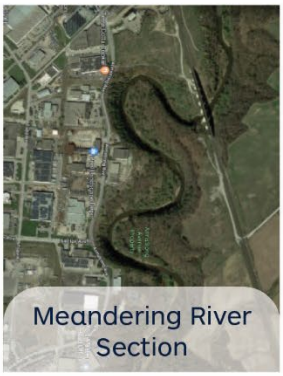
****MUST BUILD WITH THESE CONDITIONS****

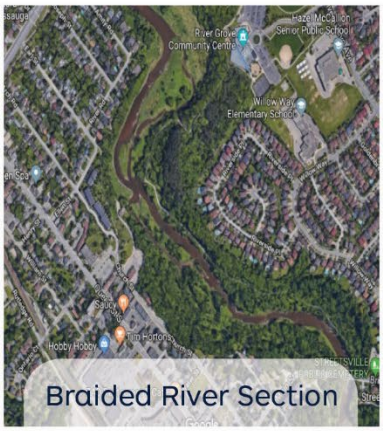
THINGS TO CONSIDER:

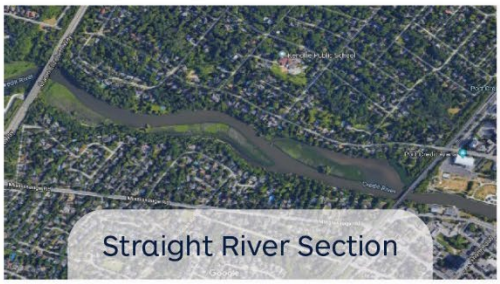
- Bridges
- Houses next to rivers are worth more money and are more desirable
- Most houses have grass lawns, not forests or wetlands
- A town with lots of buildings is more realistic to the CVC Watershed
- Towns with many buildings have higher monetary value

Legend









Curriculum Links

Grade 7
Science and Technology: Understanding Life Systems - Interactions in the Environment

Overall Expectations:

1. Assess the impacts of human activities and technologies on the environment and evaluate ways of controlling these impacts.

Grade 8
Science and Technology: Understanding Matter and Energy - Fluids

Overall Expectations:

2. Demonstrate an understanding of the properties and uses of fluid.

Activity #2: Rain Gardens in Action

In this activity, students will complete a plant identification and study on the species that exist in their school's rain garden.

Materials:

- Worksheets to create guidebook of their rain garden
- Paper
- Coloured pencils
- Pencils
- Optional: digital cameras/phones/iPad
- PowerPoint presentation on "How to Identify Plants"

Other resources:

- **Books:**
  - **Trees in Canada –** John Laird Farrar
  - **Shrubs of Ontario –** James H Soper
  - **Newcomb's Guide to Wildflowers -** Lawrence Newcomb

- **Plant Databases:**
  - **CanPlant -** https://can-plant.ca/
  - **CWF Native Plant Encyclopedia -** https://cwf-fcf.org/en/resources/encyclopedias/native-plant-encyclopedia/

- **Apps:**
  - **Seek** (by iNaturalist)
  - **iNaturalist**
  - **LeafSnap**

Instructions:

1. CVC does large scale restoration projects, however smaller urban, pollinator, and rain gardens are also a large part of the work that we do. One of the important key components of your rain garden, is that plants are assessed for suitability. When CVC staff came to help install the rain garden, it was investigated to determine what plants would survive and thrive in your rain garden. You also had a role in designing your rain garden!

2. Ask students: How do we identify plants? Allow for various answers. Plants can be identified in more than just guidebooks. We can use plant databases located online and even using apps on our phones/tablet. Today you are going to be creating a guidebook for plant species that exist within our rain garden.

3. Tell students: They will be using the provided worksheets (or a creation of your own), to document their rain gardens and create a guidebook. They will be getting up close to the plants to determine their species, characteristics, and any other relevant information, like a fun fact. Students must also determine and indicate if the plant they are observing is invasive or native.

4. Give the PowerPoint presentation to the students. Notes are included in the slides. This PowerPoint includes how to identify a plant using its location, features and identification tools.

5. Provide students with worksheets to draw and identify three to five plants in the rain garden. Remind them to draw the plant they are identifying, noting any features that will help them identify the plant. Use any of the provided tools to aid in identification.

6. If they determine there are invasive plants in their rain garden or in their school yard, discuss the appropriate next steps (e.g. proper removal). Once completed, have students share with the class and compile their findings into a class guidebook.

7. To further extend learning, have students investigate native and invasive species. Possible discussion questions:
   a. Why do they think they were incorporated into the design of the garden?
   b. What are some of the issues associated with invasive species?
   c. Research one of the invasive species in the watershed. You can visit our website for more information.

Credit Valley Conservation
inspired by nature

Rain Garden Plant Identification

Plant name: _____

Plant features:

_____

_____

_____

Plant picture:

Plant species fact:

_____

_____

Curriculum Links

Grade 7

Science and Technology: Understanding Life Systems - Interactions in the Environment

Overall Expectations:

3. Investigate interactions within the environment and identify factors that affect the balance between different components of an ecosystem.

Grade 8

Science and Technology: Understanding Structures and Mechanisms - Systems in Action

Overall Expectations:

2. Investigate a working system and the ways in which components of the system contribute to its desired function.

Students for Stormwater Program Funding

This project was undertaken with the financial support of:
Ce projet a été réalisé avec l'appui financier de :

Environment and Climate Change Canada
Environnement et Changement climatique Canada