

HOME RESOURCE KIT

Stormwater Management and Water Conservation



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Environment and
Climate Change Canada

Environnement et
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ECCC's EcoAction Community Funding Program provides financial support to non-profit and non-government organizations for Canadian communities to take on local action-based projects that produce measurable, positive effects on the environment and to build the capacity of communities to sustain these activities in the future.

<https://www.canada.ca/en/environment-climate-change/services/environmental-funding/ecoaction-community-program.html>

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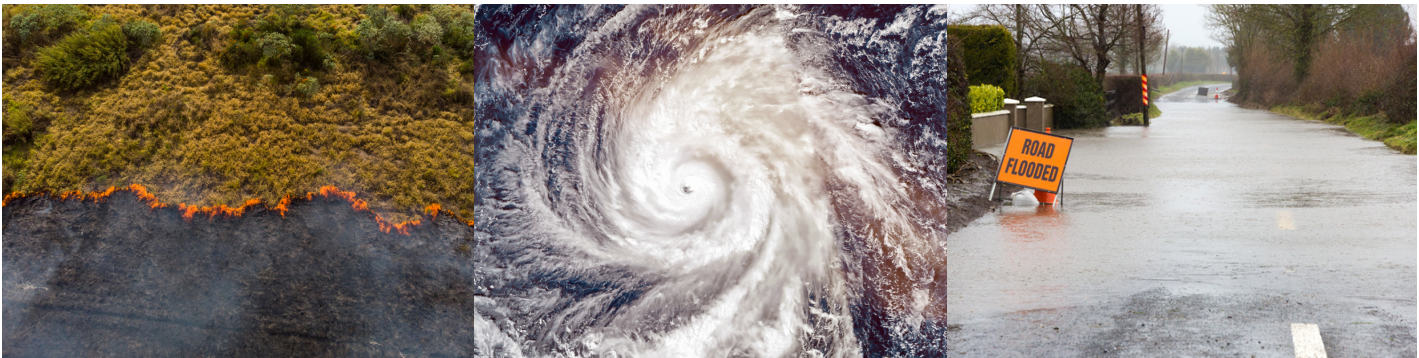


**Managing Water in Response to
a Changing Climate in
Southwest Nova Scotia**

What is climate change?

Climate change is the result of long-term weather patterns being altered. These changes can be the result of natural processes such as modulations in solar cycles or volcanic eruptions, or the result of human activities that release carbon dioxide and other greenhouse gasses. The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as: “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”.

There is consensus among the scientific community that Earth is currently experiencing human-caused or “anthropogenic” climate change. The Intergovernmental Panel on Climate Change (2015) has stated that... “human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.”



Nova Scotia's climate is warming. It is possible that precipitation, temperature, and wind patterns will continue to change for decades, affecting the way communities throughout Southwest Nova Scotia manage their natural resources and infrastructure, and also changing the lives of people who depend on these resources and assets to survive. Currently Nova Scotians are responding to known and potential impacts of climate change in two ways: mitigation - reducing greenhouse gas emissions, and adaptation.
(Nova Scotia Environment, 2014)

Climate Change and Water

Climate change is expected to have significant impacts on both water quality and quantity which will be felt globally and locally in Southwest Nova Scotia. Understanding how water flows through systems on Earth is important for understanding how we will be impacted by climate change.

Water cycle

The water cycle describes the continuous movement of water on, above and below the surface of the earth. The processes that comprise the water cycle include:

Evaporation: As water is heated by the sun, surface molecules become sufficiently energized to break free of the attractive force binding them together, and then evaporate and rise as an invisible vapour in the atmosphere.

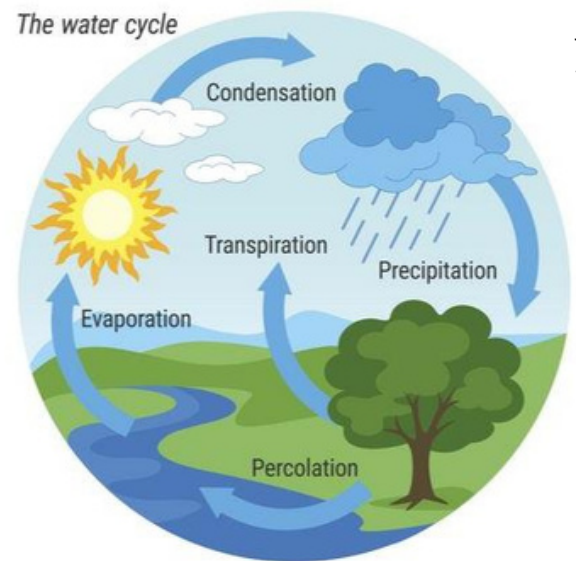
Transpiration: Water vapour is also emitted from plant leaves by a process called transpiration. Every day an actively growing plant **transpires** 5 to 10 times as much water as it can hold at once.

Condensation: As water vapour rises, it cools and eventually **condenses**, usually on tiny particles of dust in the air. When it condenses it becomes a liquid again or turns directly into a solid (ice, hail or snow). These water particles then collect and form clouds.

Precipitation: Precipitation in the form of rain, snow and hail comes from clouds. Clouds move around the world, propelled by air currents. For instance, when they rise over mountain ranges, they cool, becoming so saturated with water that water begins to fall as rain, snow or hail, depending on the temperature of the surrounding air.

Runoff: Excessive rain or snowmelt can produce overland flow to creeks and ditches. Runoff is the visible flow of water in rivers, creeks and lakes as the water stored in the basin drains out.

Percolation: Some of the precipitation and snow melt moves downwards and **percolates** or **infiltrates** through cracks, joints and pores in soil and rocks until it reaches the water table where it becomes groundwater.



Source: <https://www.worldatlas.com/articles/what-is-the-water-hydrologic-cycle.html>

Southwest Nova Scotia's Changing Climate

The province of Nova Scotia is almost completely surrounded by water, making the ocean a major influence on our climate.

About 70% of the population in Nova Scotia lives along our 7600km of coastline making populations particularly vulnerable to impacts such as sea-level rise, severe storm events, and storm surge. This will result in damage to homes and businesses and other infrastructure through flooding and erosion. (Nova Scotia Environment, 2009)



According to Charles Bourque, Professor of Hydrology and Meteorology at the University of New Brunswick, Southwest Nova Scotia could see a 24% rise in mean temperature by 2040 (CBC, 2016).

Nova Scotia Environment also anticipates a higher demand for freshwater resources, making the conservation of freshwater resources an important step in climate change adaptation.

Declines in surface water can lead to increased issues with water quality as contaminants become more concentrated and increasing water temperatures create conditions suitable for algal blooms and other pathogens. This will affect the water resources that are available for tourism and recreation, municipal water supplies, agriculture, freshwater fisheries, etc. (Nova Scotia Environment, 2014).

Nova Scotia's freshwater supplies could also potentially be at greater risk from pollution due to increased runoff caused by heavy rain and snow events, bacteria outbreaks (parasites in warmer water conditions), and contamination of drinking water in wells (saltwater intrusion – sea level rising above water table) (Nova Scotia Environment, 2014).

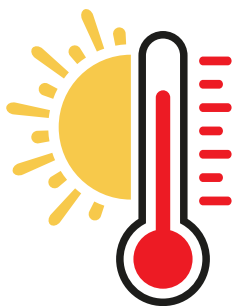


Storm surge in Cow Bay, NS

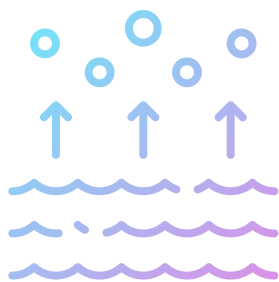


Highway 101

Southwest Nova Scotia's Changing Climate



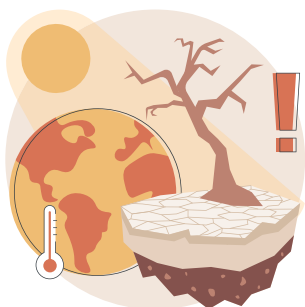
Higher average temperatures



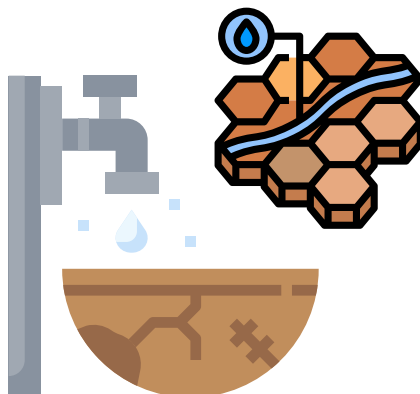
More evaporation resulting in lower surface and ground water and more water in the atmosphere



More frequent and severe storm events



Increased risk of seasonal drought conditions



Lower surface water levels and water tables making water availability an issue for the region



Increased rates of runoff and increased risk of flooding

Role of Water Conservation and Stormwater Management in Climate Change Adaptation

Adaptation to climate change requires collective action, including actions taken at the household or business level. Improved **stormwater management** and **water conservation** are two areas that offer many opportunities for action at an individual or community scale.

Stormwater management

In developed areas, surface runoff is traditionally conveyed directly into receiving water bodies, such as rivers, lakes, streams or the ocean. Water is collected from roads, roofs and other impermeable surfaces and transported through stormwater infrastructure such as drains, pipes, culverts and other water-carrying systems. This type of stormwater management infrastructure aims to evacuate runoff as quickly as possible, reducing the risk of flooding in targeted areas.

However, these traditional systems are not designed to handle increased storm events and surges, as projected due to climate change. This factor leads to overburdening of established infrastructure, risks of flooding, and potential for combined sewer overflows.

Two methods by which communities can address these concerns and sustainably manage stormwater in the changing climate are through the use of natural infrastructure and low-impact development.

Natural infrastructure refers to water management that protects, restores or mimics the natural water cycle using natural features (American Rivers, 2017). Natural infrastructure can be combined with traditional grey infrastructure to create a more resilient, financially stable, and a less polluting way of managing stormwater runoff.

Low Impact Development (LID) is a subset of approaches that utilize smaller-scale sustainable infrastructure. “LID refers to designing and implementing practices that can be employed at the site level to control stormwater and strive to replicate the pre-development hydrology of the site (Dickinson, 2013)”.



Water Conservation

As previously discussed, although Nova Scotia will experience more precipitation as a result of climate change, there may be an even higher rate of evaporation due to warmer temperatures resulting in an overall decline in water levels. This may mean reduced water levels in surface waters (eg. lakes, ponds) and a lowered water table, where well water is obtained. As a result, communities may face water shortages and droughts.

Water conservation includes all the policies, strategies and activities to sustainably manage freshwater resources, protect the hydrosphere, and meet the current and future human demand. By conserving water we can reduce the pressure placed on this limited resource and better manage the risk of water shortages during drought conditions.

Solution Focused

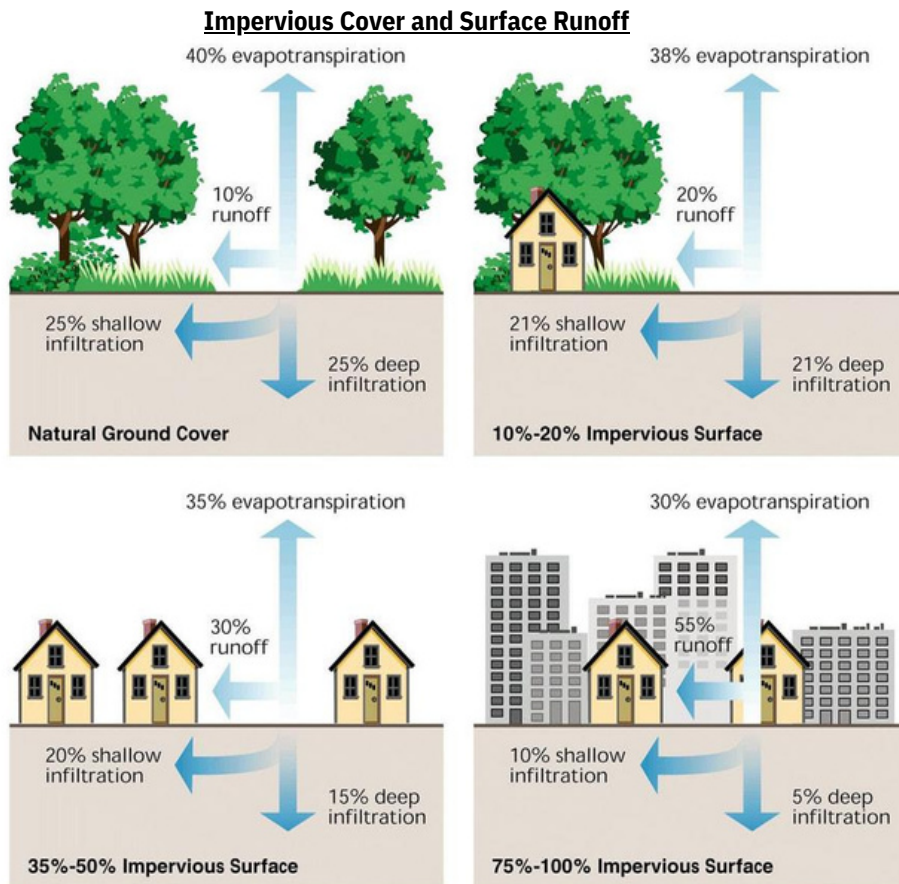
Throughout this resource kit you will find information and resources on natural infrastructure, low-impact development, and water conservation techniques. The practices and strategies provided are accessible and successful at multiple scales. Whether you are a renter, homeowner, business owner, municipality, community group, student, or activist these options are available to you and can make a big difference for you and your local area's water quality.

CARP and Coastal Action have worked with many communities throughout southwest Nova Scotia to implement the projects and techniques you will read about. The **Success Stories** section at the end of this kit provides highlights and information on our previous work. If you are interested, have questions, or would like to find out more, our contact information can be found on the back of this booklet. We look forward to hearing from you!



Stormwater Best Management Practices

Stormwater Management



Stormwater is water that originates during precipitation events and snow/ice melts. Stormwater can soak into the soil (infiltrate), be held on the surface and evaporate, or runoff and end up in nearby streams, rivers, or other water bodies (surface water).

In natural landscapes such as forests, the soil absorbs much of the stormwater and plants help hold stormwater close to where it falls. In developed environments, water is collected from roads, roofs and other impermeable surfaces and transported through stormwater infrastructure such as drains, pipes, culverts and other water carrying systems. The stormwater carries trash, sediment, bacteria, heavy metals and other pollutants from the landscape, degrading the quality of the receiving waters. Higher flows can also cause erosion and flooding in streams, damaging habitat, property and infrastructure.

Stormwater management reduces the negative impacts of stormwater runoff. Sustainable stormwater management aims to maintain the health of water bodies such as lakes and streams, prevent flooding and erosion, protect aquatic species, and sustain healthy sources of water for humans by mitigating the effects of urban development.

What can you do at home & in your community?

Many of our municipal sewage systems in the Annapolis watershed use combined sewage and stormwater collection. Combined sewer systems collect sewage from houses, businesses, etc. as well as surface runoff. During high-intensity precipitation or snowmelt events, the amount of stormwater collected by these combined systems can exceed the capacity of the sewage treatment plant they are connected to, resulting in untreated sewage waste overflowing into receiving waters (Clean Annapolis River Project).

Strategic landscaping alterations can help you significantly manage stormwater on your property. By doing so, you can reduce potential flooding of your property, help minimize negative impacts on lakes, streams and other receiving waters, harvest rainwater for additional uses (watering gardens, times of drought, etc.) and help to recharge the groundwater.

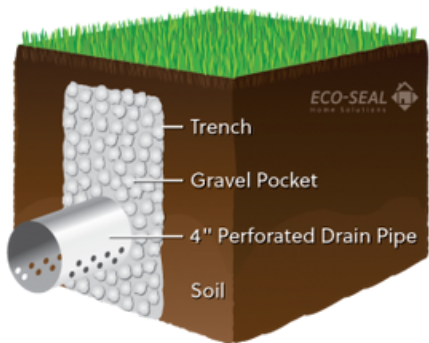
Listed below are Natural Infrastructure elements, Low Impact Developments, and best management practices for stormwater that you can consider for your home. *(Make sure to obtain any required permits prior to undertaking work)*



Constructed/Restored Wetlands

Wetlands recycle nutrients, filter certain pollutants, recharge groundwater, and provide habitat for fish and wildlife. They also reduce peak flows and flood damage, provide storage, and mitigate erosion. In developed areas, wetlands can collect and counteract the increased runoff from roofs, pavement, and other impervious surfaces.

Landowners in the Annapolis Valley have previously partnered with Ducks Unlimited Canada to restore wetlands or construct wetlands on their properties. <https://www.ducks.ca/resources/landowners/>



French Drain System/ Perforated Pipes

The purpose of a french drain system is to promote infiltration and redirect the water to a more suitable location (e.g. catch basin or rain garden).

A french drain is a trench that is dug below ground level, lined with geotextile fabric (preventing matter from clogging the holes in pipe), and filled with clear stone/gravel with a perforated pipe sitting in the middle of the trench.

A perforated pipe is designed to allow water to enter or exit through small holes or slots along the pipe.

Photo source: <https://envirocareonline.com/how-to-build-an-exterior-french-drain-system/>



Depaving / Removal of Impervious Surfaces

Depaving is the process of removing hard surfaces such as concrete and asphalt, and "freeing" the soil - allowing the surface water the chance to infiltrate into the ground. By removing pavement and creating gardens, polluted runoff is reduced and groundwater is then recharged.

Photo source: <https://floodlist.com/protection/depave-community-based-approach-storm-water-management>



Rain Barrels

Rain barrels collect, redirect and store rainwater from your roof to be used for other purposes on your property. The collected water can be used to:

- Water your lawn, garden, or indoor plants
- Wash your car, boat, muddy shoes etc...

Photo source: Canva



Cisterns

A rain cistern is essentially a larger rain barrel. Usually connected to a building/structure's eavestrough downspout, it can be located above or below ground and is primarily used for landscaping. It may also be used indoors as part of a grey-water system for flushing toilets and washing machines. For use of collected rainwater on edible plants, it is required that the storage container undergo regular water quality testing.



Rain Gardens

Rain gardens are planted depressions or landscaped holes that allow stormwater runoff from impervious urban areas, like roofs, driveways, walkways, parking lots, and compacted lawn areas, the opportunity to be absorbed. They reduce rain runoff by allowing stormwater to soak into the ground (as opposed to flowing into storm drains and surface waters) ultimately improving water quality. They are usually planted using plants that can withstand flood and drought conditions.

Photo source: Canva



Bioswales, Grass Swales, Infiltration Trenches

Bioswales and *grass swales* are vegetated channels that direct water downhill to a destination point such as a rain garden. The stormwater is filtered along the way, through gravel and grass/soil layers, promoting infiltration. *Infiltration trenches* are excavated channels that are lined with geotextile fabric and filled with stone to promote water infiltration.

Photo source: <https://fknursery.com/rain-gardens-and-bioswales/>



Tree & Shrub Planting

Tree roots take up water and help to prevent flooding and erosion. Their leaf canopies act as a buffer and reduce erosion caused by falling rain. Trees capture the surface water runoff and release it back into the atmosphere through evapotranspiration - contributing to the hydrologic cycle.

It is important to choose highly water tolerant and absorbent trees/shrubs when using them for stormwater management. Common species used are Red Maple, Willows, White Cedar, and Ash trees.

Photo source: Canva



Permeable Pavers

Permeable pavers are a great way to reduce impervious surfaces on your property without losing valuable footprint for other uses (ex. driveways, patios, walkways, etc...). Permeable pavers include a range of options, such as inter-locking paving blocks, permeable asphalt and cement, and vegetated cement grids. Permeable asphalt/cement have a porous binder, whereas inter-locking paving blocks have built-in spacing and a cement or stone grid with vegetation growing in a sandy soil medium between the guidelines. (Bluenose Coastal Action Foundation, 2016)

Photo source: Canva



Soil Enhancement

Soil amendments are specific organics and inorganics that can be used to improve the soil's physical properties in order to increase water storage capacity and allow plants to flourish. It is important to know what type of soil you are dealing with (clay, silt, sand) in order to properly choose which amendments to use/add. Examples of amendments:

- Organic: *compost, wood chips, manure, peat moss, etc.*
- Inorganic: *gravel, lime, etc.*

Photo source: Canva



Redirecting your Downspout and/or Lot Grading

Downspouts transport the water on your roof to the ground, directing it away from the foundation. To prevent flooding, it is recommended that you extend your downspout at least six feet from your foundation. You should release this water into vegetated areas on your property such as a wet pond or a rain garden, or redirect it into a cistern or rain barrel to harvest the rainwater at a later date.

Lot grading alters the slope of a property to direct water away from buildings and redirects it towards areas where water retention is preferred. Any graded areas should be revegetated in order to prevent erosion on site and promote water infiltration during storm events.

Photo source: Canva



Water Conservation Best Management Practices

The importance of water conservation in southwest Nova Scotia

Although we expect to see more precipitation as a result of climate change, there may be an even higher rate of evaporation due to warmer temperatures resulting in an overall decline in water levels. This may mean reduced water levels in surface waters (eg. lakes, ponds) and a lowered water table.

In the summer and fall of 2016, Southwestern Nova Scotia (NS) experienced moderate to severe drought conditions, with data from provincial observation wells showing historical lows or below normal water levels (Kennedy, 2017). “It is estimated that over 1000 private well users in Southwestern NS experienced water shortages because of the drought, especially well users relying on dug wells for domestic water supply (Kennedy, 2017).”

Prolonged summer drought conditions and changes in precipitation regimes may also create challenges for users that rely on surface water for their regular operations, such as farmers who use water for irrigation or livestock watering, plant nurseries or home gardeners.

Economic benefits of water conservation (Nova Scotia Environment)



Save money on your water and sewer bills



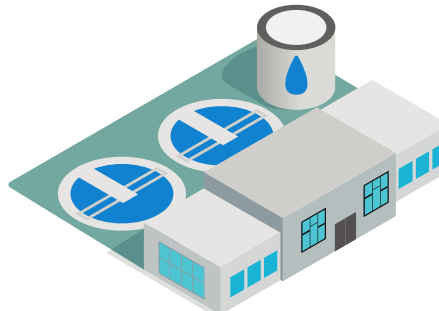
Save money on your power bills by using less energy to heat and pump water



Make your home sewage disposal system last longer by not overloading it.



Delay and prevent the expansion of costly water and wastewater treatment plants which can save money on taxes



How can you conserve water?

Water conservation includes all the policies, strategies and activities to sustainably manage freshwater resources, protect the hydrosphere, and meet the current and future human demand.

Homeowners interested in conserving water can implement physical water conservation infrastructure into their home water systems in addition to following lifestyle best management practices.



Physical water conservation measures involve the use of simple devices and technology that can be installed in your home, such as:



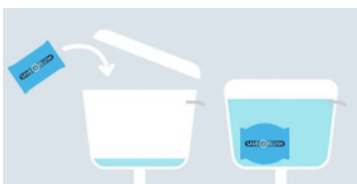
Low -flush / Dual-flush Toilets

A dual-flush toilet is a variation of the flush toilet that uses two buttons or a handle mechanism to flush different amounts of water.



Low-flow Faucet Aerator

The aerator acts as a sieve, separating a single flow of water into many tiny streams which introduces the air into the water flow. Also as there is less space for the water to flow through, the water flow is reduced, resulting in water savings.



Toilet Tank Displacers

A toilet tank displacement device is an object you place into your toilet tank to take up room. Less space in your tank means it takes less water to fill up, so you can save water with every flush.

Best Management Practices (BMPs)

Changes to everyday practices and behaviours play a critical role in meeting water conservation objectives.

BMPs for outdoor water use:

- Don't water lawn and garden if rainfall has been sufficient (established lawns only need about 2.5cm/week)
- Water early in the morning or in the evening to limit evaporation
- Situate sprinklers to avoid watering paved surfaces and instead only lawns and gardens
- Check hoses and sprinklers regularly for leaks
- Don't mow your lawn shorter than 6-8 cm (longer grass has more protection for roots and will retain water better)
- Leave grass clippings when you mow (they return nitrogen to the soil and make for a healthier lawn)
- Aerate lawn yearly to better allow percolation of water into the soil
- Water plants with harvested rainwater from rain barrels
- Use mulch in your garden to protect against water evaporation and decrease the frequency of watering
- Plant native plants that are adapted to the climate and require less water
- Manage stormwater using a rain garden to filter runoff and aid in restoring groundwater
- Decrease stress on wells by collecting water from your roof into a rain barrel and using it for irrigating lawn and garden
- Avoid using the hose to clean the driveway, sweep it instead
- When washing your car, use a bucket of soapy water to wash (only use the hose for the last rinse or wash it while it's raining!)
- Put a cover on your swimming pool to reduce evaporation



BMPs for indoor water use:

Toilets (single biggest user of water)

- Replace a toilet that is older than 10 years with a new ultra-low-flush toilet and reduce water use by 15-20 percent.
- Retrofit an older toilet to use less water with a specifically designed flapper valve that closes more quickly, a dual-flush device, a toilet dam or a tank insert that displaces water.
- Only flush when necessary ("When it's yellow, let it mellow...etc")
- Repair toilet leaks promptly (check for a leak by putting a few drops of food colouring in the tank. Without flushing, see if the food colouring moves from the tank into the bowl. If it does - you have a leak. Also, check for leaks around the base of the toilet and repair them promptly.)
- Ensure that the float ball is properly adjusted so the tank water level does not exceed the height of the overflow tube. Periodically examine whether the plunge ball and flapper valve in the tank are properly "seated" and replace parts when necessary.
- Finally, consider replacing a water toilet with a composting toilet and reduce total water use by 30 percent!



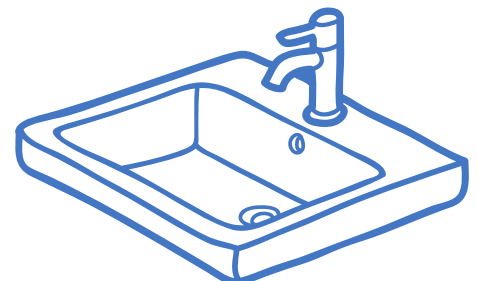
Showers

- Install low-flow shower heads or adjustable flow reducer devices, preferably with shut-off buttons (saves 25 percent of shower water and about \$100/year in heating costs)
- Short showers use less water than baths
- Turn taps off snugly so they don't drip
- Promptly repair leaks



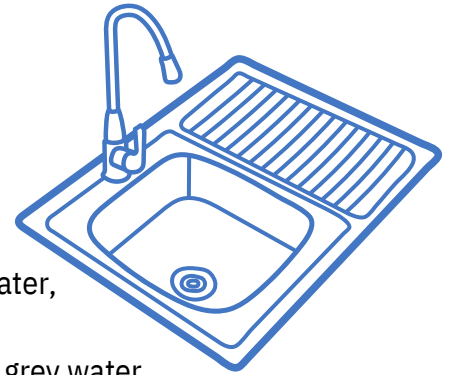
Bathroom Sinks

- Install an aerator and/or a water flow-reducer attachment on your faucets
- Turn taps off snugly so they don't drip
- Promptly repair leaks in and around your taps (one leak can waste several thousand litres of water each year - enough to fill a swimming pool or stress out your leaching bed)
- Use a partly filled sink rather than running water for shaving or washing hands
- Turn off the water between wetting your toothbrush and rinsing



Kitchen Sinks

- Put a pipe wrap on basement hot water pipes so heated water arrives at your tap more quickly.
- When hand-washing dishes, don't run water continuously.
- Wash dishes in a partly filled sink and rinse in a second partly filled sink or with the spray attachment.
- Wash fruits and vegetables in a partly filled sink, not under running water, and rinse quickly under the tap.
- In summer, wash dishes, fruits and vegetables in a basin and put this grey water on trees and bushes.
- In winter, try using used dishwater on house plants. However, don't store used water



Dishwashers

- Wash only full loads in the dishwasher, use the short or water/energy saver cycle and let dishes dry on their own (following these practices can also mean using less water than hand washing).
- If replacing your washer, choose a high-efficiency model.



Refrigerators

- Keep a pitcher of chilled water in the fridge to avoid waiting for cold water to arrive at your tap.



Laundry

- Wash only full loads in the washing machine.
- Use suds-saver, short cycle and load size features.
- Promptly repair any leaks.
- Select a front-loading washer the next time you replace your machine (they generally use much less water than top-loading machines). Also if replacing your washer, choose a high-efficiency model.
- Spread your laundry out over the week (consider doing one or two loads on laundry day versus several loads on the same day).





Stormwater Management Success Stories

Success Stories

Over the years, CARP has been dedicated to improving the way stormwater is managed throughout Southwest Nova Scotia. Through a partnership with Coastal Action and funding from Environment and Climate Change Canada, we have successfully implemented projects at more than 10 sites and conducted home assessments across 7 municipalities.

Low-Impact Development Success

In 2019 CARP and Coastal Action partnered with three local businesses to install 1000L rainwater cisterns, allowing for the capture of surface runoff and displacing the use of municipally treated water. Cubitaner Cisterns were donated by Acadian Seaplants Ltd. and repurposed as rainwater collection and storage systems. An educational interpretive panel was installed in a publicly visible area at each of these businesses, highlighting the role of rain capture as a water conservation and stormwater management technique.



Ragged Robin Nursery (pre-work)



Ragged Robin Nursery (post-work)



Bunchberry Nursery



Summerland Plant Nursery

Business partners included Bunchberry Nursery, Summerland Plant Nursery, Ragged Robin Farm & Nursery, Sweet Fern Farm, and Wayward Farm. An educational interpretive panel was installed in a publicly visible area at each of these businesses, highlighting the role of rain capture as a water conservation and stormwater management technique.

Natural Infrastructure Success

NSCC - Middleton

CARP partnered with Nova Scotia Community College (NSCC) in Middleton to construct two rain gardens and a dry creek bed to channel surface water and runoff in 2018. Additional work and maintenance for this site was then completed in 2019. This project was undertaken as part of an initiative to establish stormwater management demonstration sites across the province.



Raquette Pond - Town of Digby

Another demonstration site was implemented in partnership with the Town of Digby at Frank Mackintosh Memorial Park in 2019. Three rain gardens were constructed around Raquette Pond to intercept stormwater runoff from surrounding impervious surfaces (roads, sidewalks) prior to the water entering nearby waterbodies. CARP has continued to conduct maintenance on these gardens each year since their completion.



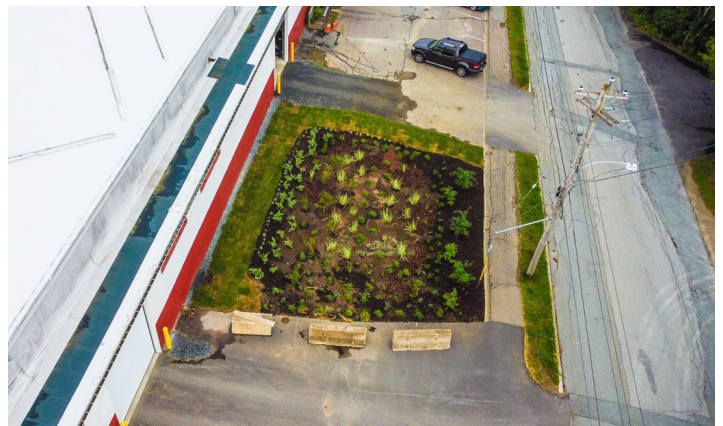


Bridgewater Memorial Arena - Bridgewater

In 2022, Coastal Action partnered with the Town of Bridgewater to implement a Depave Paradise project and install a rain garden at the Bridgewater Memorial Arena.



The project involved the removal of over 200 m² of unused pavement and the installation of native plants to aid in the absorption of stormwater runoff from surrounding impervious services, such as the parking lot and nearby building. Over 300 plants were planted in the rain garden with the help of community volunteers, including youth from local schools.



'Hospital Hill' Park - Town of Digby

In 2018, CARP partnered with the Town of Digby to improve stormwater management at their park site located behind Digby General Hospital. Surrounded by impervious surfaces and characterized by hills and valleys, this site experiences large volumes of overland runoff and drainage issues. Working with the natural topography, CARP developed a plan to address multiple problem areas throughout the park.

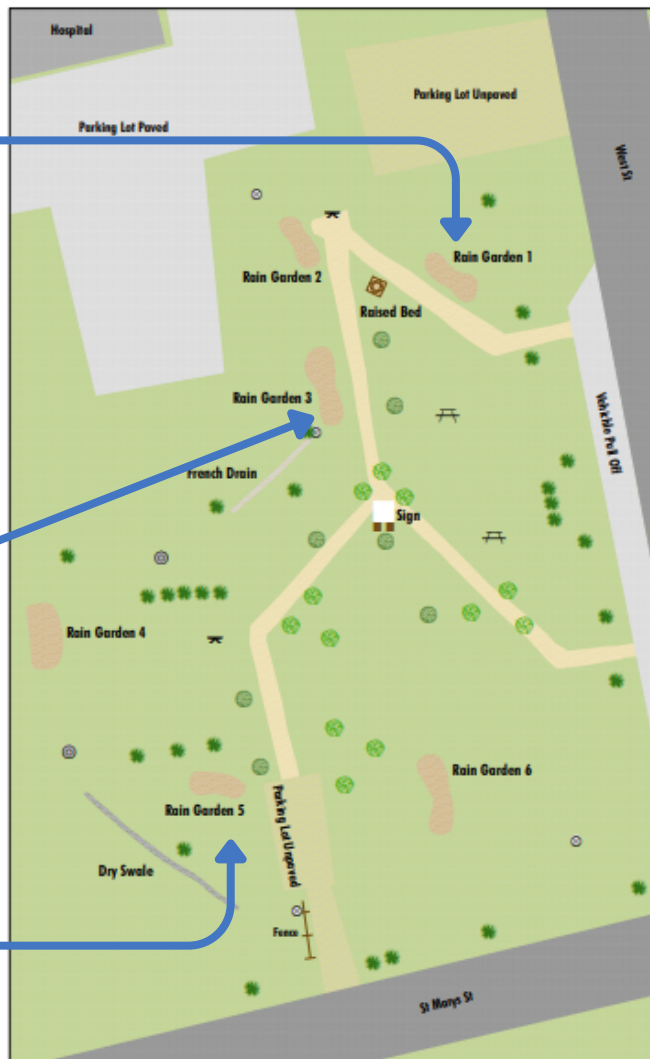


Post rain event at site in Digby (pre-project implementation)

Design & Implementation

A complex of six rain gardens, a bioswale, and raised bed were designed and constructed on site. These natural infrastructure features are contributing to a larger initiative by the Town of Digby to create a new public green space.

Digby Stormwater LID Site



- Bench
- Picnic Table
- Planted Tree (2017)
- Planted Tree (2016)
- Existing Tree
- Drain
- Observational Well

N
0 5 10 20 Metres
1 centimeter = 6 meters

Map prepared By:
Samantha Hudson
& Randy Fredericks
Project:
Stormwater Management
Location:
Digby, Nova Scotia
PID: 30251847
PID: 30228035

Prepared by:
 Clean Annapolis River Project
With support from:
The ESRI Conservation Program

Current & Future Success

Currently, CARP and Coastal Action are working with municipalities and community groups to implement natural infrastructure projects for stormwater management to be completed by the end of 2023. These exciting projects have been made possible through Environment and Climate Change Canada's EcoAction Program.

CARP is thrilled to be expanding upon the work we have accomplished at 'Hospital Hill' park. Working with the Town of Digby, we will be collaborating on their development plans for the site and ensuring that stormwater management remains at the forefront of design. CARP will then construct any natural infrastructure elements included within the site plans.

In CARP's newest partnership, we are addressing the large volume of runoff coming from Beacon United's roof in the Town of Yarmouth. This project will collect a portion of the rainwater to be reused in the community garden on site and then redirect the rest away by way of a bioswale. This work aims to reduce the pressure on municipal sewer systems and mitigate flooding issues within the building.

Our partner Coastal Action is building a rain garden at the Memorial Arena in Bridgewater. This rain garden will be the second on site, the first was also constructed by Coastal Action in 2022. Their work is implementing a dual system of stormwater management by depaving sections of impervious surfaces on site while also creating a garden that will intercept runoff, filter water, and recharge groundwater.



For more information on ways to manage stormwater or to get involved in CARP's work, contact us at:

Clean Annapolis River Project

314 St. George Street,

Annapolis Royal, NS B0S 1A0

Phone: (902) 532-7533 | Email: carp@annapolisriver.ca

www.annapolisriver.ca

Appendix A

Sources

Appendix A - Sources:

All images used are provided from contributing partners or Canva unless indicated/sourced otherwise.

Managing Stormwater in Southwest Nova Scotia's Changing Climate

- American Rivers. (2017). *What is Green Infrastructure?* Retrieved from www.americanrivers.org:
<https://www.americanrivers.org/threats-solutions/clean-water/green-infrastructure/what-is-green-infrastructure/>
- Atlantic Climate Adaptation Solutions Association. (n.d.). *About ACASA*. Retrieved from www.atlanticadaptation.ca:
<https://atlanticadaptation.ca/>
- BC Climate Action Toolkit. (n.d.). *Integrated Community Sustainability Planning ICSP*. Retrieved from www.toolkit.bc.ca: <https://www.toolkit.bc.ca/icsp>
- CBC. (2016, September 19). *Southwest Nova Scotia droughts could increase with climate change*. Retrieved from www.cbc.ca: <https://www.cbc.ca/news/canada/nova-scotia/droughts-climate-change-1.3768971>
- Change, I. P. (2015). *Climate Change 2014: Synthesis Report*. Geneva, Switzerland: IPCC.
- County of Annapolis. (2013, September). *Municipal Climate Change Action Plan*. Retrieved from Municipality of the County of Annapolis: <https://annapoliscounty.ca/government/municipal-climate-change-action-plan>
- David Suzuki Foundation. (2018). *What is climate change?* Retrieved from David Suzuki Foundation:
<https://david Suzuki.org/what-you-can-do/what-is-climate-change/>
- Government of Canada. (2015, November 27). *Causes of Climate Change*. Retrieved from Canada :
<https://www.canada.ca/en/environment-climate-change/services/climate-change/causes.html>
- Municipality of the District of Shelburne. (n.d.). *Municipal Climate Change Action Plan*. Retrieved from www.municipalityofshelburne.ca : <https://www.municipalityofshelburne.ca/municipal-climate-change-action-plan.html>
- NASA's Jet Propulsion Laboratory. (n.d.). *A Blanket around the Earth*. Retrieved November 15, 2018, from NASA: GLOBAL CLIMATE CHANGE: Vital Signs of the Planet: <https://climate.nasa.gov/causes/>
- Natural Resources Canada. (n.d.). *CHAPTER 1: An Introduction to Climate Change Adaptation*. Retrieved from Government of Canada: <https://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/municipalities/10081>
- Nova Scotia Environment. (2014). *Climate Change in Nova Scotia*. Retrieved from Province of Nova Scotia: <https://climatechange.novascotia.ca/>
- Nova Scotia Environment. (2014). *Climate Data for Nova Scotia*. Retrieved from Province of Nova Scotia : <https://climatechange.novascotia.ca/climate-data/nova-scotia#climate-data-map>
- Nova Scotia Environment. (2014). *What Nova Scotia is Doing*. Retrieved from Province of Nova Scotia : <https://climatechange.novascotia.ca/what-ns-is-doing>
- Clean Annapolis River Project| Managing Water in Response to a Changing Climate in Southwest Nova 12 Scotia: *Climate Change and Impacts in Nova Scotia* (2019)

Managing Stormwater in Southwest Nova Scotia's Changing Climate

Nova Scotia Environment. (2009, January). *Toward a Greener Future: Nova Scotia's Climate Change Action Plan*.

Retrieved from Climate Change Nova Scotia :

<https://climatechange.novascotia.ca/sites/default/files/uploads/ccap.pdf>

Nova Scotia Environment. (2014). *Climate Impacts* . Retrieved from Province of Nova Scotia :

<https://climatechange.novascotia.ca/climate-impacts>

Nova Scotia Environment. (2014). *Water Impacts* . Retrieved from Climate Change Nova Scotia :

<https://climatechange.novascotia.ca/adapting-to-climate-change/impacts/water>

The Guardian. (2011, February). *How do trees and forests relate to climate change?* Retrieved from The Guardian :

<https://www.theguardian.com/environment/2011/feb/11/forests-trees-climate>

The Guardian. (2017, July 28). *Ultimate bogs: how saving peatlands could help save the planet*. Retrieved from The

Guardian: [https://www.theguardian.com/environment/2017/jul/28/ultimate-bogs-how-saving-peatlands-](https://www.theguardian.com/environment/2017/jul/28/ultimate-bogs-how-saving-peatlands-could-help-save-the-planet)

[could-help-save-the-planet](https://www.theguardian.com/environment/2017/jul/28/ultimate-bogs-how-saving-peatlands-could-help-save-the-planet)

Wikipedia . (n.d.). *Climate of Nova Scotia* . Retrieved November 5, 2018, from Wikipedia :

https://en.wikipedia.org/wiki/Climate_of_Nova_Scotia

Wikipedia . (n.d.). *Water cycle*. Retrieved October 4, 2018, from Wikipedia :

https://en.wikipedia.org/wiki/Water_cycle

WWF. (n.d.). *THE EFFECTS OF CLIMATE CHANGE*. Retrieved from WWF:

<https://www.wwf.org.uk/effectsclimatechange>

Stormwater Best Management Practices

Bluenose Coastal Action Foundation. (2016, October). *Innovation Stormwater Management Guidebook*. Retrieved

from Bluenose Coastal Action Foundation: [http://coastalaction.org/Wordpress/wp-](http://coastalaction.org/Wordpress/wp-content/uploads/2015/03/Innovative-Stormwater-Management-Guidebook-Oct-2016-FINAL.pdf)

[content/uploads/2015/03/Innovative-Stormwater-Management-Guidebook-Oct-2016-FINAL.pdf](http://coastalaction.org/Wordpress/wp-content/uploads/2015/03/Innovative-Stormwater-Management-Guidebook-Oct-2016-FINAL.pdf)

Clean Annapolis River Project. (n.d.). *Soaking up Stormwater*. Retrieved from Clean Annapolis River Project:

<https://www.annapolisriver.ca/stormwater-management>

Ministry of the Environment, Conservation and Parks. (2012). *Understanding Stormwater Management: An*

Introduction to Stormwater Management Planning and Design. Retrieved from Ontario:

[https://www.ontario.ca/page/understanding-stormwater-management-introduction-stormwater-](https://www.ontario.ca/page/understanding-stormwater-management-introduction-stormwater-management-planning-and-design)

[management-planning-and-design](https://www.ontario.ca/page/understanding-stormwater-management-introduction-stormwater-management-planning-and-design)

Water Conservation

ThoughtCo. (2018). *How Much of Your Body Is Water?* Retrieved from ThoughtCo.:

<https://www.thoughtco.com/how-much-of-your-body-is-water-609406>

Wikipedia . (2018, December 7). *Water Conservation*. Retrieved from Wikipedia :

https://en.wikipedia.org/wiki/Water_conservation

[https://blogs.ifas.ufl.edu/sarasotaco/2021/02/26/diy-toilet-tank-displacement-](https://blogs.ifas.ufl.edu/sarasotaco/2021/02/26/diy-toilet-tank-displacement-device/#:~:text=A%20toilet%20tank%20displacement%20device,save%20water%20with%20every%20flush.)

[device/#:~:text=A%20toilet%20tank%20displacement%20device,save%20water%20with%20every%20flush.](https://blogs.ifas.ufl.edu/sarasotaco/2021/02/26/diy-toilet-tank-displacement-device/#:~:text=A%20toilet%20tank%20displacement%20device,save%20water%20with%20every%20flush.)

<https://lowenergysupermarket.com/product/save-a-flush-toilet-cistern-water-saver-device/>

<https://www.pinterest.ca/pin/213569207298999321/?lp=true>

[https://www.savewatersavemoney.co.uk/water-efficiency-tips-advice/view/120/tap-aerators---how-do-they-](https://www.savewatersavemoney.co.uk/water-efficiency-tips-advice/view/120/tap-aerators---how-do-they-work.html#:~:text=The%20aerator%20acts%20as%20a,reduced%2C%20resulting%20in%20water%20savings.)

[work.html#:~:text=The%20aerator%20acts%20as%20a,reduced%2C%20resulting%20in%20water%20savings.](https://www.savewatersavemoney.co.uk/water-efficiency-tips-advice/view/120/tap-aerators---how-do-they-work.html#:~:text=The%20aerator%20acts%20as%20a,reduced%2C%20resulting%20in%20water%20savings.)

