

Indicator Report

Status of the Petitcodiac Watershed



Petitcodiac
Watershed Alliance



The Petitcodiac Watershed Alliance (PWA) was founded in 1997. We are a non-profit environmental science and education organization that works to enhance and maintain the Petitcodiac and Memramcook Rivers and their tributaries. Our actions are guided by what we want to leave behind for future generations.

Our vision

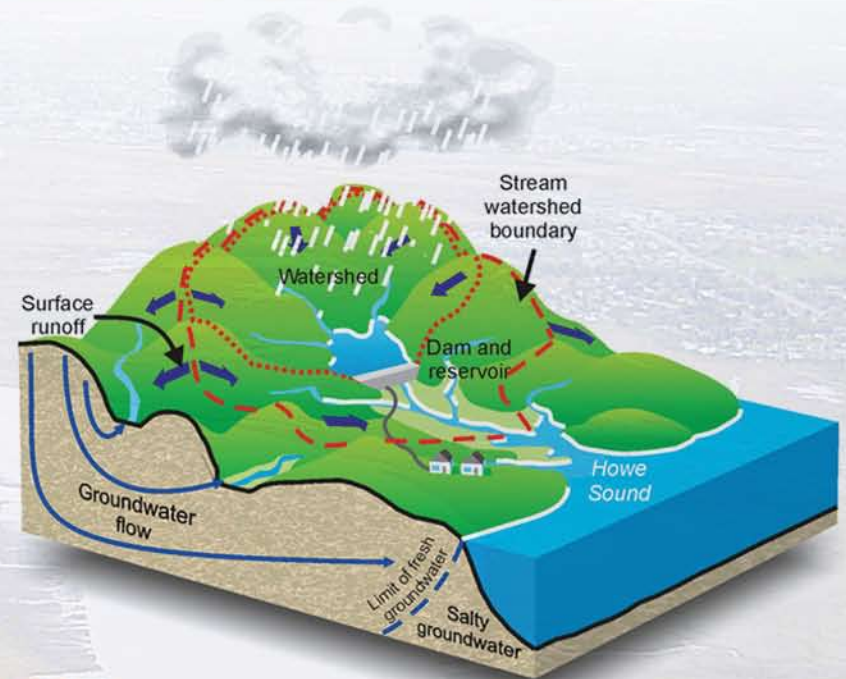
To achieve a healthy environment for the greater good of the Petitcodiac and Memramcook watersheds (hereafter referred to as Petitcodiac Watershed).

Our purpose

The Petitcodiac Watershed Alliance promotes watershed awareness, encourages the community to take part in identifying environmental problems and follows through with actions to restore and protect the watershed.



Example of a watershed



Wherever you are, you are in a watershed. A watershed (or drainage basin) refers to a geographical area where water, including rain, snow melts and groundwater, drains downhill into a body of water, such as a river, lake, dam, estuary, wetland, sea or ocean. The watershed encompasses the streams and rivers that convey the water as well as the land surface from which the water drains.

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Description of the Petitcodiac Watershed

The Petitcodiac and Memramcook Rivers have many small streams that flow into them. Both rivers empty into Shepody Bay, which drains into the Bay of Fundy. The watershed is located in South East New Brunswick, covering approximately 2400 km². This area stretches from the Village of Petitcodiac to the Village of Dorchester, including the Greater Moncton area.

The Petitcodiac Watershed lies within the Acadian forest, which is characterized by a mix of conifers and deciduous trees. Approximately 111, 000 people inhabit the Petitcodiac Watershed.

The watershed's claim to fame is its tidal bore, which comes up the Petitcodiac River twice a day. The bore is the result of immense tidal action that characterises the Bay of Fundy, which is home to the highest tides in the world.

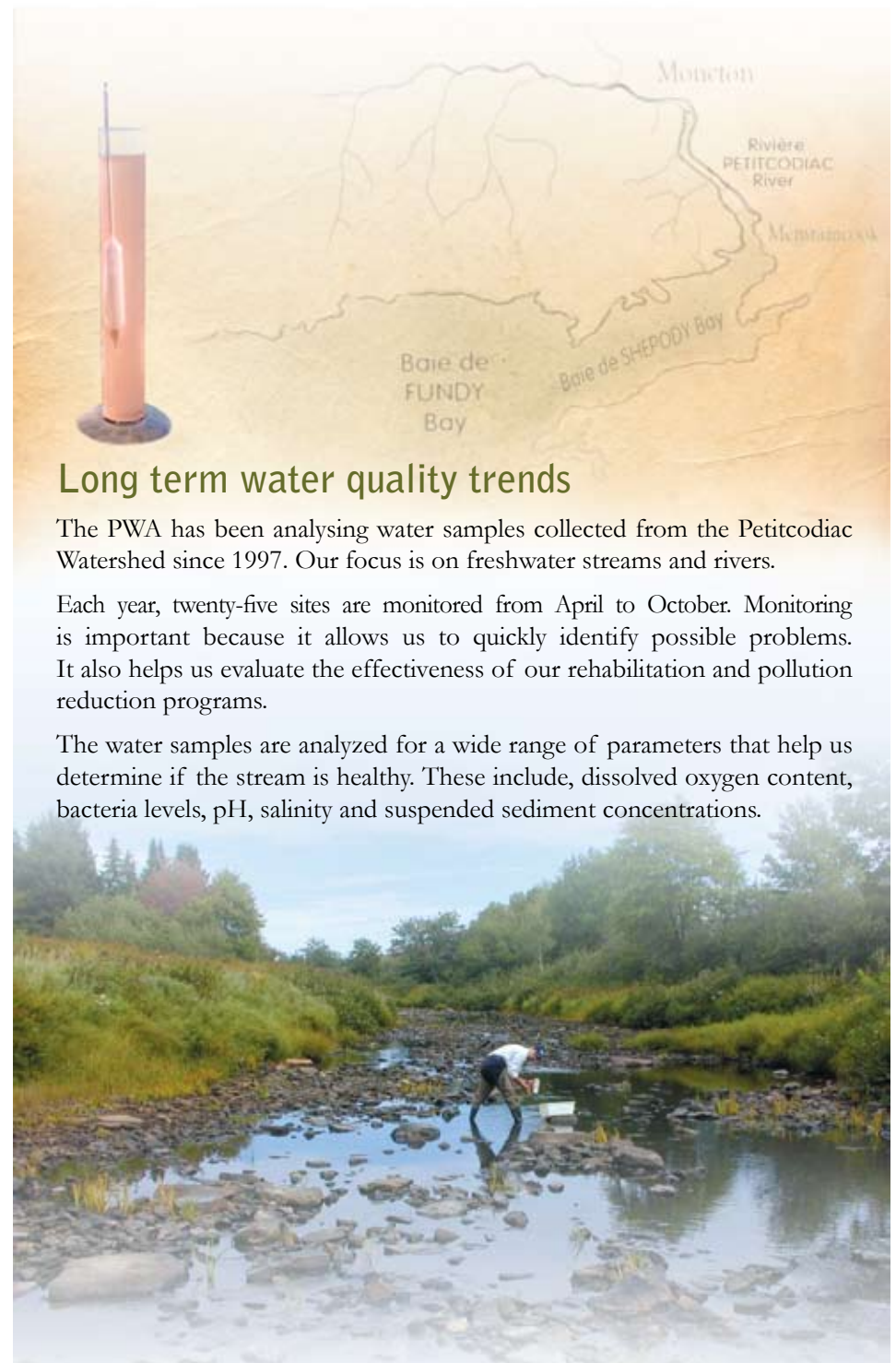
The Petitcodiac Watershed is part of the newly appointed UNESCO Fundy Biosphere Reserve (United Nations Educational, Scientific and Cultural Organization). It has the distinction of being the first such reserve in New Brunswick.

Why is the Petitcodiac Watershed important?

Watersheds are an integral part of our environment because they support habitat for plant and animal life, they provide drinking water and they provide recreational areas to enjoy nature and play.

Turtle Creek, part of the Petitcodiac Watershed provides drinking water for the residents of Moncton, Riverview and Dieppe.

With our first Indicator Report, the PWA hopes to increase public awareness on the health of the Petitcodiac Watershed. Seven environmental indicators have been used to assess the health of the Petitcodiac Watershed.



Long term water quality trends

The PWA has been analysing water samples collected from the Petitcodiac Watershed since 1997. Our focus is on freshwater streams and rivers.

Each year, twenty-five sites are monitored from April to October. Monitoring is important because it allows us to quickly identify possible problems. It also helps us evaluate the effectiveness of our rehabilitation and pollution reduction programs.

The water samples are analyzed for a wide range of parameters that help us determine if the stream is healthy. These include, dissolved oxygen content, bacteria levels, pH, salinity and suspended sediment concentrations.

Dissolved Oxygen

Dissolved Oxygen (DO) is the most important parameter in aquatic ecosystems because it allows all aquatic species to breathe and to digest food. Therefore, the amount of DO present in an aquatic ecosystem is an important measure of water quality.

High levels of DO generally indicate a healthy and stable ecosystem that is able to support many different kinds of plants and animals. Different organisms require varying levels of DO; trout and salmon require high levels of DO (7-14 mg/L) while carp and catfish flourish in waters with low levels of DO (below 7 mg/L).

The Canadian Environmental Quality Guidelines state that 5.5 mg/L is the lowest acceptable DO concentration for the protection of all life stages of aquatic organisms in freshwater systems.

There are several factors that influence the amount of DO in freshwater:

- Temperature
- The level of photosynthesis
- Degree of light penetration (turbidity and water depth)
- The level of turbulence
- Amount of decaying organic matter and nutrients



How are we doing?

Healthy



Unhealthy

Overall, the DO levels in all streams and rivers in the Petitcodiac Watershed have been at or above the level required for a healthy aquatic habitat. However, there are a few instances every year where the DO levels fall below the healthy level of 5.5 mg/L.

What is being done?

The PWA is re-establishing indigenous plants and shrubs along streams and rivers. This “riparian vegetation” provides shade for the stream, which helps to lower water temperature (Riparian vegetation refers to the green ribbons of lush vegetation adjacent to water courses). Fish like cooler water that consequently has higher DO levels. Increased riparian vegetation also helps reduce the erosion of stream banks. Furthermore, the vegetation helps filter out sediment, organic matter and pollutants from water runoff from streets, housing lots and businesses.



Bacteria

In order to assess the microbiological quality of the water, *E.coli* levels are measured. *E.coli* is a form of bacteria that is found only in human or animal faecal waste. Studies have shown that certain illnesses, such as gastroenteritis, eye infections, skin rashes, ear, nose and throat infections and respiratory illnesses can result from exposure to high levels of faecal bacteria. A high *E.coli* count signifies the presence of human and/or animal waste, and possibly the presence of other, more serious, disease-producing pathogens. The main sources of *E.coli* are municipal sewage discharges running directly into a watercourse, runoff from failing septic systems and livestock and agricultural operations. The bacteria level in the water is often highest immediately following a rainstorm. The CCME (Canadian Council of Ministers of the Environment) environmental quality guidelines state that *E.coli* levels should not exceed 200 *E.coli* / 100 mL of water in any watercourse where people could be swimming or boating.

How are we doing?

Healthy

Unhealthy

High levels of *E.coli* are very common in the Petitcodiac Watershed. Median yearly *E.coli* concentrations in Rabbit Brook and Jonathan Creek are consistently over 200 *E.coli* / 100 mL, making the water unsafe for humans and animals to live and play in. All other rivers and streams that we study have also had *E.coli* levels greater than 200 *E.coli* / 100 mL.

There are many sources that can lead to elevated *E.coli* levels. In the case of Rabbit Brook, high *E.coli* levels are caused by sewage cross-connections, where raw sewage from households accidentally flows directly into the stream. Sewage cross-connections and large amounts of dirty storm-water runoff from surrounding commercial parking lots have given Rabbit Brook the dubious distinction of being the most polluted stream in the Petitcodiac Watershed.

What is being done?

Prior to the creation of the Greater Moncton Sewerage Commission in 1983, wastewater flowed untreated into the Petitcodiac River. Since 1983, our high-tech, internationally recognized wastewater treatment plant has helped to stop most raw, untreated sewage from entering the Petitcodiac River.

In 2004, the PWA built fences along farmland streams. The goal was to stop cows and other livestock from stirring up bottom sediments and from directly contaminating the stream. This project helped to raise awareness regarding agricultural sources of pollution and resulted in the reduction in the amount of faecal waste entering local watercourses.

Since 2005, the PWA has been working actively with the City of Moncton to identify the most problematic sewage cross-connections. The City of Moncton fixes numerous sewage cross-connections each year.

What else can be done?

- Rural residents should maintain their septic tanks through regular inspections, at least every three years
- Riparian vegetation should be protected
- Livestock should be excluded from streams. The proper collection, storage, transportation, and application of animal waste on the farm can significantly reduce bacteria loss from runoff (Best Management Practices available from Agricultural Alliance)
- Clean up after your pets. Pet waste contains nutrients and pathogens that can contaminate surface water
- The PWA will continue to educate the public, so that we can all reduce our impact on the watershed



Suspended Sediments

Suspended sediments are the floating particles that cloud our streams. They are primarily clays, silts and fine sands, which require only low velocities and minor turbulence to remain suspended. Suspended sediments cause streams to appear dark brown after a rainstorm. High suspended sediment concentrations are very harmful to fish and other aquatic life.

The negative effects include:

- Abrasion and damage to fish gills, increasing risk of infection and disease
- Loss of sensitive or threatened fish species
- Reduces light penetration causing a reduction in plankton and aquatic plant growth
- Adversely impacts aquatic insects, which are the base of the food chain
- Turbid water increases the probability of boating, swimming and diving accidents
- Increased water treatment costs to meet drinking water standards

The CCME's Canadian Water Quality Guidelines for the Protection of Aquatic Life states that in clear flow conditions long term increases (1-30 days) of more than 5 mg/L and short term increases (24 hours) of 25 mg/L will be detrimental to aquatic life.



How are we doing?

Healthy

Unhealthy

The urban streams of the Petitcodiac Watershed are very susceptible to sediment loading during and after rain events. For instance, Rabbit Brook and Jonathan Creek remain turbid for up to a week following a heavy rainfall. This is bad for fish, aquatic plants and insects that live in these streams.

There are also many construction projects that cause more sediment to enter the streams. The PWA has observed numerous situations where silt fences, built to trap sediment, were improperly installed. If they are not installed correctly, they can not trap sediment. For example, after a rain event during the summer of 2007, we measured a 460 mg/L increase in suspended sediments in Humphrey's Brook. This significant increase was caused, in part, by improperly installed silt fences along a construction site.

The good news is that suspended sediment concentrations in our rural streams remain relatively low in all weather conditions. We must keep working to maintain these clean flowing streams.

What is being done?

The PWA and the NB Department of Environment as well as the Department of Fisheries and Oceans have been working together to make sure that silt fences are properly installed on construction sites.

The PWA is planting trees and shrubs along rivers and streams in order to stabilize their banks. This riparian vegetation will also filter sediments from runoff before it enters and damages the streams.

What else can be done?

- Support the PWA in their efforts to educate residents and developers on sediment reduction strategies
- Re-establish trees and shrubs on your own property, especially along riparian zones
- Plant a roof-top garden



Salinity

The rising level of salinity in our watersheds is alarming. Salt is a natural component of our landscape, being deposited from a variety of sources over millions of years. Salt enters our waterways from groundwater, from the weathering of rocks or from the atmosphere. In Canada, de-icing salt has become a major source of anthropogenic salt in our rivers and streams. Improperly stored road salt, snow disposal and roadway salt application are contaminating our waterways.

Recent studies have shown that salt concentrations in surface freshwaters are frequently at levels that have, or may have, immediate or long-term effects on the environment and its biological diversity. Increased salt concentrations are leading to the loss of soil stability, which in turn increases soil erosion. In addition, high salt concentrations are damaging plants and provoking negative effects on fish communities that are poorly adapted to the elevated salt concentrations. Toxicity occurs at concentrations as low as 210 mg/L, these concentrations have been observed in numerous urban creeks and streams.

How are we doing?



In 2007, the PWA started measuring salinity levels in the Petitcodiac Watershed. Most streams had acceptable levels of salinity. However, median salinity levels in Fox Creek and Rabbit Brook were well above the 210 mg/L guideline. Therefore, initial measurements suggest that salinity levels at these sites are toxic to aquatic organisms.

What is being done?

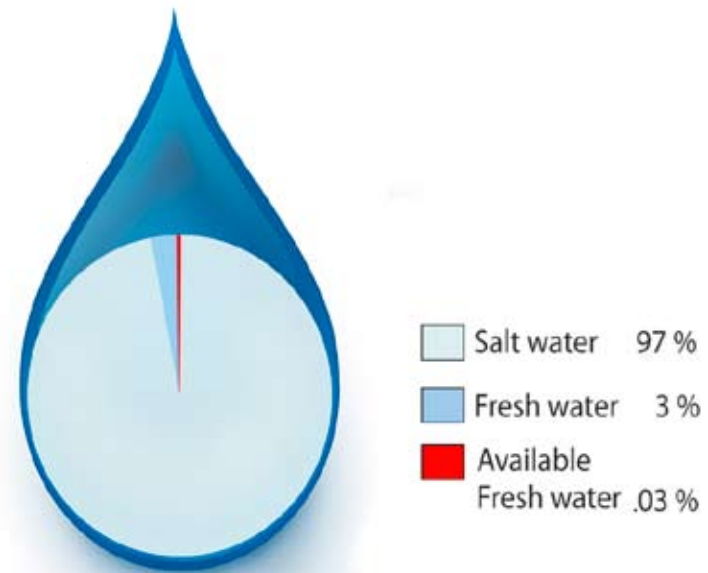
The City of Moncton is currently using a pre-wetting technique during road salt application. This technique reduces the amount of salt applied by 15%.

What else can be done?

- “Best Management Practices” need to be applied to road-salt storage
- Salt application needs to be minimised in ecologically sensitive areas
- Snow dump locations need to be carefully chosen, to minimise environmental damage
- The use of new salt application technologies and alternative de-icing chemicals need to be investigated

Water Usage

Water is an important part of our daily life. It covers 71% of the earth’s surface and is essential for all living things. Water is found in oceans, seas, lakes, rivers, aquifers, ice caps, glaciers, swamps and in air vapours. Freshwater only accounts for 3% of the Earth’s water, while salt water makes up the other 97%. Humans can only use 0.3% of the world’s freshwater for drinking because the rest is “locked up” in the ground or in glaciers and ice caps.





Humans tend to treat this natural resource as if it's limitless, but it is not. Population growth has dramatically increased water demand and man-made pollution has contaminated many of our freshwater resources. In Canada, we have more freshwater than any other country in the world (20% of the earth's freshwater). However, we only possess 7% of the earth's renewable freshwater. Despite our relatively vast water resource, the growing Canadian metropolitan population and the rising water demands are stressing available water supplies. More than half of our water resources are located north of the Arctic Circle, while 84% of the Canadian population inhabit the southern part of the country, making access to this water supply difficult and expensive.

How are we doing?

Healthy



Unhealthy

Canadians consume on average 343 L of clean drinking water per person per day. We are some of the highest water users in the world. Water is used for cleaning, drinking, cooking, lawn watering, etc. To compare, our friends in Britain and France only use 150 L a day!

The residents of Greater Moncton obtain their drinking water from the Turtle Creek reservoir. On average, Greater Moncton consumes 17 751 000 m³ of water per year (this is enough water to fill 7 100 Olympic sized swimming pools). Industrial, commercial and institutional organizations use 30 % of this water while residential homes use the rest. Residents of Greater Moncton on average consume 340 L of clean drinking water per day. All our water is eventually cycled back to the Petitcodiac Watershed.

What is being done?

In spite of the ever-increasing metropolitan population, water consumption has remained consistent over the past 7 years. Our stable water consumption is most likely a benefit associated to the implementation of residential water meters. When consumers are asked to pay for a resource, they usually curb their usage. The City of Moncton is also one of the first municipalities in the Atlantic Provinces to implement a lawn watering by-law.

What else can be done?

Although water consumption seems to have levelled off in recent years, the amount of water being extracted from the Petitcodiac Watershed is still high. Reducing the amount of water you use is an important step towards protecting this precious resource. Reduced water bills are an added bonus associated with reduced water consumption!

The following tips will help you protect our freshwater resource:

- Follow the municipal lawn watering by-law. “ Even numbered houses can water their lawn/garden for a maximum of two hours a day on even numbered calendar days, while odd numbered houses can water on odd numbered calendar days. There is no watering permitted between 08h00 and 18h00”.
- Install water efficient (dual flush) toilets and low flow shower heads and faucets
- Take shorter showers
- Turn the water off while brushing your teeth, shaving, or washing your face
- Fix leaky faucets and toilets (a leaky toilet can waste 200 000 L of water in a year)
- Install grey water systems (used water from laundry, sinks, etc.)
- Install rainwater tank or rain barrel. This water can be used for garden and lawn watering.
- Use water-wise plants. Native and adaptive plants will use less water and be resistant to local plant diseases and pests
- Put a layer of mulch around trees and plants. Chunks of bark, peat moss or gravel slows down evaporation
- When washing a car, use a bucket and sponge (this can save 300 L)
- Only use the washing machine and dishwasher when they're full
- Purchase water efficient appliances (look for product ratings)



Forest Cover

All watersheds have two major ecosystems that are continually interacting: a terrestrial ecosystem and an aquatic ecosystem. Human land based activities can affect water quality and cause the loss of important wildlife habitats. For example, water quality is negatively affected by forest clear cutting.

The detrimental effects associated with deforestation:

- Loss of wildlife habitat
- Increased erosion that results in an increase in sediment entering watercourses
- Increased rainwater runoff
- Shade provided by forest cover is lost, which leads to the warming of streams
- Non-porous surfaces, such as pavement and buildings, reduce the amount of water infiltration, which leads to lower groundwater levels. This can cause critically low summer and winter flows that cannot support aquatic life.

The benefits of forest cover are numerous:

- Removes air pollution
- Produces oxygen
- Conserves energy by providing shade in summer and acting as a windbreak in winter
- Reduces stormwater runoff and improves water quality
- Provides wildlife habitat
- Increases property values
- Improves appearance of a community

How are we doing?



Environment Canada states that 30% forest cover is needed to maintain a healthy watershed. Currently the Petitcodiac Watershed has approximately 68% forest cover. Despite the relatively high forest cover in our watershed, some human activities continue to degrade and threaten the health of the forest in our watershed. Heavy deforestation has occurred in ecologically sensitive areas, such as the immediate vicinity of most rivers and streams (riparian zones), where people like to live and build houses. The ongoing development in the Moncton and Dieppe areas is drastically decreasing forest cover.

Type of land use	Petitcodiac River (km ²)	Memramcook River (km ²)
Forest	1445.2	178.24
Residential developments	194.6	118.28
Farms	143	31.32
Recreational	121.2	62.68
Wetlands	58	-
Institutional	15.8	5.04
Industrial	14.6	3.56
Commercial	7.6	0.88
Total	2000	400

Land use in the Petitcodiac Watershed, (see center spread for detailed map)

What is being done?

The PWA has been involved in planting projects to help increase urban forest cover. Also, the cities of Dieppe, Moncton and Riverview all employ arborists (tree specialists) to protect and maintain the remaining forest. These municipalities also allocate money for tree planting. In 2007, the City of Moncton allocated \$100,000 for tree planting in our community.

What else can be done?

- The municipalities have a role to play in maintaining and re-establishing forest cover in the Petitcodiac Watershed. They must plan properly to protect the remaining forest cover. They must also work hard to reconnect patches of forests so that animals have a corridor in which to move.
- New developments need to focus on keeping as many trees as possible and limiting the amount of pavement in their designs, particularly in ecologically sensitive areas.
- We need to continue to re-establish vegetative cover where it has been lost.
- We need to educate residents and developers on the benefits associated with forest cover.





Increased Urbanization

When more people move into an area a host of support facilities must be built. Growing cities mean more sewage flowing through treatment plants, more construction projects, more roads, more cars on the road, more housing and more shopping developments. Also, the need for more food can lead to agricultural intensification. In rural areas, agricultural activities intensify to meet the growing food demand. This means that there are more natural or manufactured fertilisers used to increase crop production. We can also expect an increase in the concentration of farm animals. It is inevitable that an increasing population creates unique challenges and stresses on the streams and rivers flowing through our watershed.

How are we doing?



The urban areas within the Petitcodiac Watershed, especially Moncton and Dieppe are currently experiencing high levels of growth and development. Greater Moncton is the only census metropolitan area in the Atlantic Provinces whose growth rate surpassed the national average between 2001 and 2006. It now has a larger population than any other urban area in New Brunswick (Statistics Canada, 2007). The total population of the Petitcodiac Watershed has increased by nearly 12,000 residents since 1991.

Municipality	1991	2001	2006
Moncton	59,313	61,046	64,128
Dieppe	12,496	14,951	18,565
Riverview	16,684	17,010	17,832
Memramcook	4,904	4,719	4,638
Salisbury	1,882	1,954	2,036
Petitcodiac	1,425	1,444	1,368
Hillsborough	1,272	1,288	1,292
Dorchester	1,179	954	1,119
Total	99,155	103,366	110,978

Population in the Petitcodiac Watershed

What is being done?

- The Greater Moncton Sewerage Commission assures that the wastewater returning to the watershed is properly treated
- The installation of water meters has lowered the per capita consumption of water in the Petitcodiac Watershed
- The PWA continues to educate local residents on how to minimize their impact on the watershed. We will continue our school education programs, teaching students to be responsible watershed citizens.

What else can be done?

To minimize the effects of urbanization on our watershed, we should:

- Reduce our water consumption
- Increase the value associated to green spaces and vegetation, especially near watercourses, as these areas have shown to alleviate some of stresses associated to human activities
- Support organic farms, because they don't use manufactured fertilizers and pesticides
- Educate developers and residents on the importance of proper planning in minimizing runoff from developed areas
- Install wood decking, bricks or interlocking stones instead of impervious cement walkways
- Stop the use of cosmetic pesticides
- Store and dispose of chemicals correctly
- Choose indigenous plants that have low requirements for water, fertilizers and pesticides
- Compost yard and food waste

Summing up: what does it all mean?



How healthy is the Petitcodiac Watershed? In terms of overall health, the Petitcodiac Watershed is in "fair" health. The evaluation of the seven environmental health indicators revealed that bacteria and suspended sediment concentrations are currently at unhealthy levels, while salinity, water usage and urbanization are at "fairly" healthy levels. Finally, dissolved oxygen and forest cover are at healthy levels.

Although the Petitcodiac Watershed seems to be in "fair" health, we must continue our efforts to minimize the effects of our actions on the watershed. Working together we can achieve a healthy Petitcodiac Watershed that is livable, sustainable and prosperous. By being responsible watershed citizens we can ensure that the beauty of the Petitcodiac Watershed will be passed on to future generations.



LAND USE WITHIN THE PETITCODIAC WATERSHED UTILISATION DES TERRES DANS LE BASSIN VERSANT PETITCODIAC

