

THE CLEAR WATER MUSKETEERS CHAMPLAIN COMPANY



Guide for **Mister
Porthos'** Musketeers

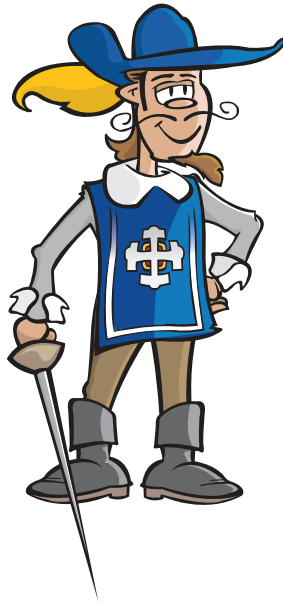
THE BASIN GRADE

Guide for Mister Porthos' Musketeers

The Basin Grade



Porthos



Aramis



Athos



D'Artagnan

The four musketeers were featured in a story written by Alexandre Dumas in 1844, namely **Porthos**, **Aramis**, **Athos** and **d'Artagnan**. They lived in the seventeenth century, from 1610 to 1670.

Name: _____

School: _____

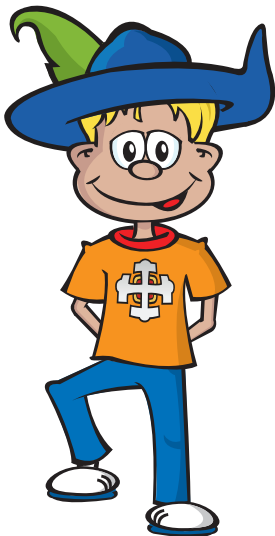
Class: _____

All for Water and Water for All!

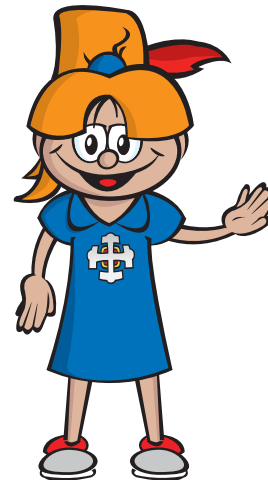
The Clear Water Musketeers' motto

The Clear Water Musketeers are in charge of water protection in their community. They are proud of their mission; they realize that water is their life-line, that it must be protected and saved. In order to become a Clear Water Musketeer, students must complete the four levels of the Clear Water Musketeer training program.

Porthos was renowned for his great strength. He became a big land owner and did not hesitate to travel mile upon mile with his companions to defend a worthy cause. Mister Porthos' musketeers will learn all about the land through which the rivers flow. **THE BASIN GRADE**



In this Guide for Mister Porthos' Musketeers, young musketeers AQUALINE and RIVERO will help you prepare for your Basin Grade Mission. Good Luck!



There are three other grades of the Clear Water Musketeer training program:

- Mister Aramis' Musketeers will discover the secret relationships between organisms living in the aquatic ecosystem.

THE AQUATIC ECOSYSTEM GRADE

- Mister Athos' musketeers will have ample opportunity to learn how various forms of human activity affect the quality of water.

THE WATER USAGE GRADE

- Mister d'Artagnan's musketeers will learn how to assess water quality and find solutions to water pollution problems.

THE WATER TREATMENT GRADE

Water, Essential to Life on Earth

The Clear Water Musketeers know that water is the most precious commodity on earth. Water occupies 70% of Earth's surface, but a mere 2.5% of it is fresh water, the salt-free water that we can drink. Oceans were formed 4 billion years ago and life forms started to appear in water 3.8 billion years ago. Water is an essential element of life. All living beings contain water, from the smallest vegetable or animal cell to the giant sequoias and great whales.



Dinosaurs drank the same water as you drink. Unbelievable, but true! That is because water is continually recycled on land, in the seas and in the atmosphere. This natural phenomenon is called the "water cycle". Our ever so precious water is at risk of being contaminated at every step of the water cycle. That is why we must protect it.

The Water Cycle

Water is a small molecule composed of hydrogen and oxygen (H₂O). Water molecules all look the same and form a transparent liquid that trickles onto the earth and ends up in the oceans. The sun, which warms the water, causes it to evaporate; water molecules then cling together in the atmosphere to form clouds. In Canada, clouds travel from the Pacific Ocean in the west to the Atlantic Ocean in the east. Over the Province of Quebec, these clouds are transformed into water or snow, depending

on the season. This eventually replenishes the water supply in our numerous lakes and rivers.

The rain water that falls onto the ground runs downhill and forms ditches, brooks, rivers and lakes. Every body of water in southern Quebec eventually flows into the St. Lawrence River, and finally into the Atlantic Ocean. Part of the water infiltrates the soil and creates an underground water supply. We depend upon this source of potable water to fill our wells. Plants absorb this water through their roots.

When the water contained in plants reaches the leaves, it evaporates and returns to the atmosphere. The water from the soil also evaporates. This phenomenon is called evapotranspiration. We also perspire and return water to the atmosphere in the form of urine. That is why it is so important to continually replace our water loss by drinking clean water. It is also important that the waste water from our homes be treated.



Our bodies are 60% water. If you pinch your skin gently, you will be able to tell whether your skin is properly hydrated or dry. To ensure that the tissues in your organs receive an adequate supply of water, you should drink five glasses a day.

Exercise 1: Diagram - The Water Cycle

Grades 1 and 2

Drops of Water

Draw a rain cloud, rain falling, a lake, the sun, a tree and a child swimming. Draw a drop of water in every element that contains water.

Grades 3 and 4

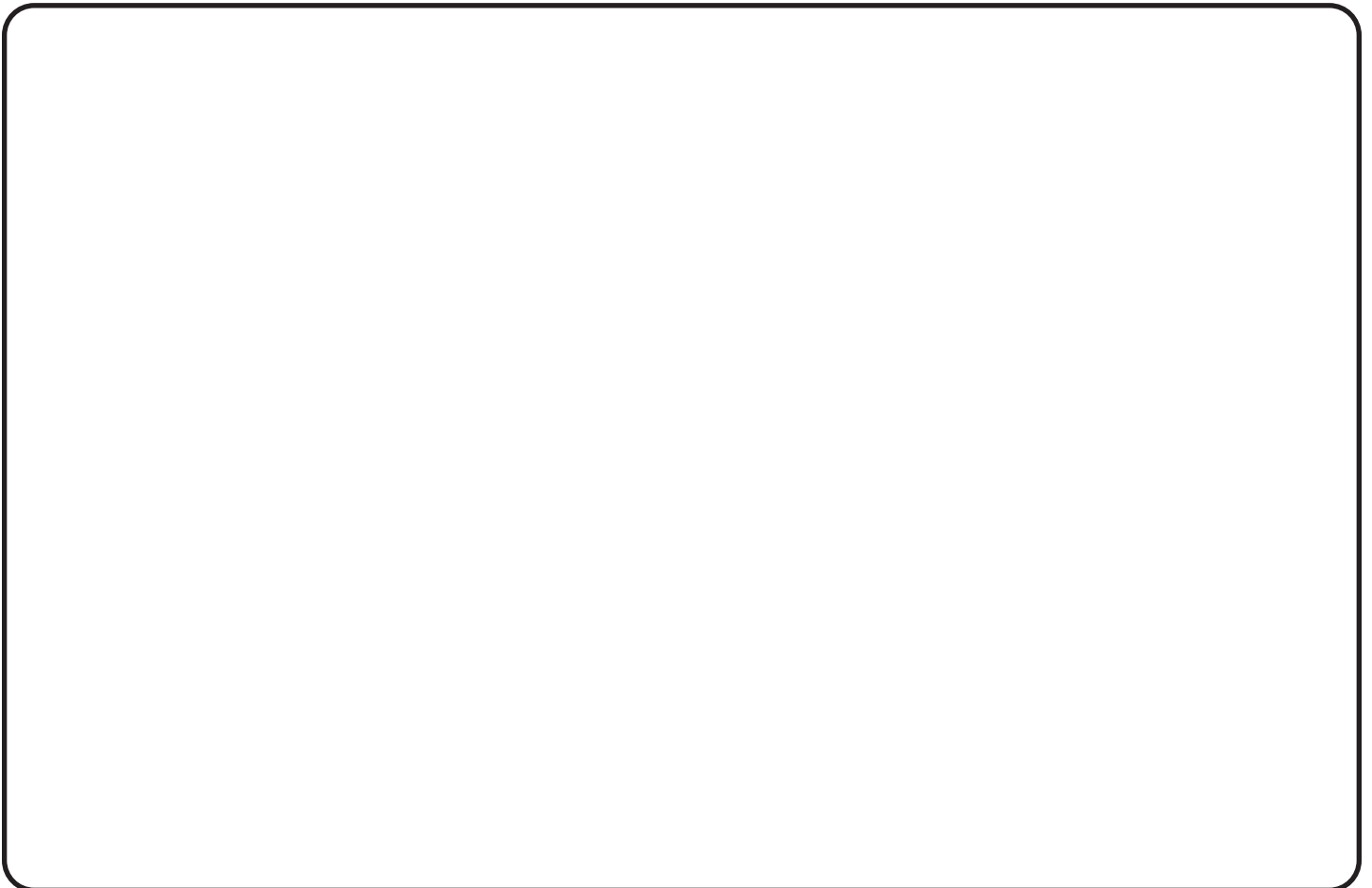
Water Runoff

Draw a mountain, a river, a lake, the sun, the clouds, rain, underground water, a plant, an animal and a child drinking water. Then draw a blue line with arrows showing the water runoff.

Grades 5 and 6

Water Travel

Draw a city at the foot of a mountain with rain, water streaming, a river, underground water, evapotranspiration, two sources of clean water and the disposal of waste water. Draw arrows to show the direction in which the water travels, using a blue line for clean water and brown for polluted water.



Missisquoi Bay Basin

The rain water that falls on the ground runs down the slopes and creates rivulets. Water always flows from the highest level of the ground toward the bottom level, from upstream to downstream. In other words, the water flows from the mountain toward the valley of the basin.

The basin is the surface of the ground through which the water runs off into a river or a lake. The following drawing shows the basin area and human activity that takes place therein.

As water flows and runs off on the basin floor, it is used for various human activities. The water can be polluted by each of those water uses and also naturally, by vegetation and animals. Water thus becomes more and more polluted on its way from the source to the mouth of the river.



Missisquoi Bay and the Tributaries

Missisquoi Bay is one of the largest bays on Lake Champlain, the greatest part of which is in the United States. All of the water from Lake Champlain flows into the Richelieu River, located in the Province of Quebec, and eventually into the St. Lawrence River near the municipality of Sorel-Tracy.

Missisquoi Bay covers an area of 75 sq. km. (East-West width of 6 km by North-South length of 12 km). Its average depth is barely 2.8 m and its greatest depth is 4.5 m.



Photo credit: Municipalité de Venise-en-Québec

Two centuries ago, Lake Champlain played an important role in the development of the northeastern part of North America. Champlain's ships had come up the St. Lawrence River, entered the Richelieu River to finally reach Lake Champlain in 1609. Missisquoi Bay was colonized later, in the early 1800s. But it had been familiar territory to the Amerindians 5,000 years ago! The region's mild climate was well-suited for agriculture but the swampy terrain limited its potential as a mixed farming site at the beginning of the 19th century.

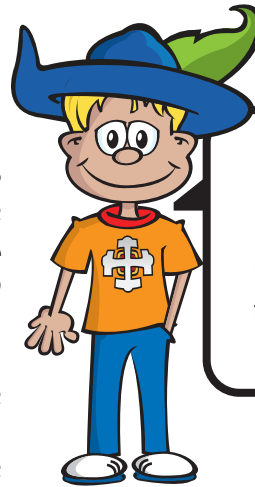


Tourism became a big industry in the 20th century since Missisquoi Bay lent itself to many outdoor activities. Fishing was very popular, given the great variety of fish that could be caught there. Village dwellers as well as visitors could enjoy sailing, rowing and power boating, swimming, using the beautiful beaches, bird-watching, and even horse racing on ice!

Unfortunately, development led to water pollution. During the last twenty years, steps have been taken to clean up the water and new agricultural practices have been introduced. This has led to an improvement in water quality. Unfortunately, the Bay waters are still not free of contamination from phosphorus and blue-green algae, which is why action must be taken to reduce pollution in the basin.

The Missisquoi Bay basin encompasses the area into which flow the Pike River, Rock River and the Missisquoi River. The map that follows illustrates the boundaries of the basin. The arrows indicate the direction in which the water flows. The network made up of brooks and rivers that pour into Missisquoi Bay is called the hydrographic network.

Three tributaries flow into Missisquoi Bay: on the Quebec side, the Pike River, and on the U.S. side, in Vermont, the Missisquoi and Rock Rivers. The map also shows the boundaries of each municipality. You will notice that these streams run through municipalities and even the border between Quebec and the State of Vermont, in the United States. Because, as neighbours, we share the same water, we must agree on its use and its protection. We have to avoid polluting it because everyone needs pure, clean water.



To identify the right and the left bank of a stream, you must look downstream. The right bank is then to your right. To determine the direction in which the river flows, just follow a branch floating on the water.

The speed at which streams flow varies according to the seasons. Flow is calculated in cubic metres of water per second. During summer, the flow is slower. The water is then at its lowest level. Flooding occurs mostly in spring, when the snow melts, or in autumn when there are heavy rainfalls. Streams then overflow into the floodplain where excess water spreads out. The floodplains, river banks and river beds must be protected.

Exercise 2: Missisquoi Bay Basin

Grades 1 and 2

Colour Missisquoi Bay and the rivers pink and the boundaries of Missisquoi Bay basin red.

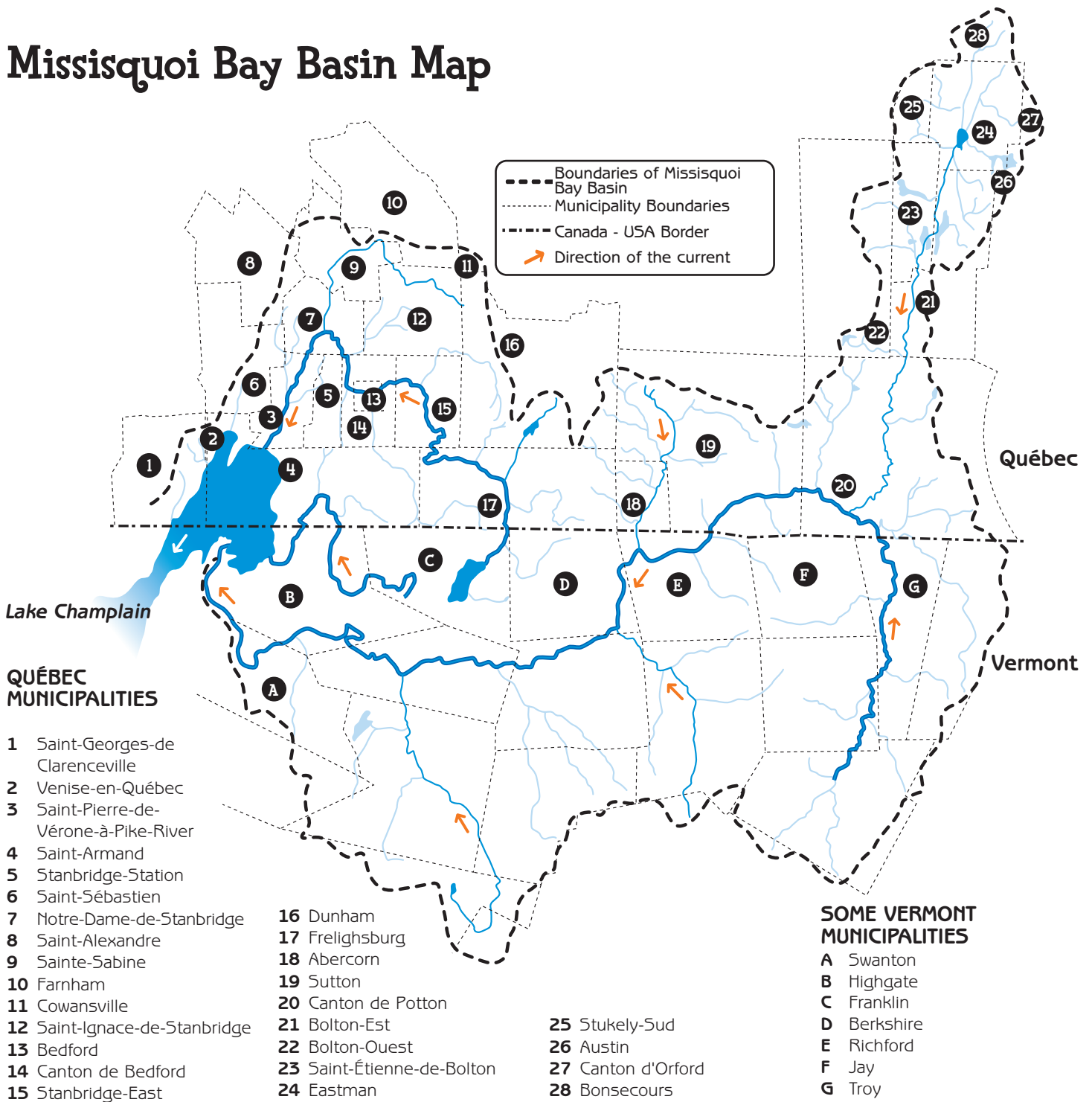
Grades 3 and 4

Colour the boundaries of Missisquoi Bay basin in red, and Pike, Missisquoi and Rock Rivers using different colours. Mark your municipality with an X and colour its boundaries.

Grades 5 and 6

Imagine that you throw a bottle containing a message in a stream. Mark with an X the place from which the bottle is thrown. Using the letters S, M, R and L, show the source and the mouth of the stream, its right and left banks. Trace your bottle's journey to Missisquoi Bay. List the municipalities through which the bottle will pass. What is the message in your bottle?

Missisquoi Bay Basin Map





The Pike River has its source in Lake Carmi in the United States and its length is approximately 55 km. It crosses the border at Frelighsburg, passes through Bedford and flows into Missisquoi Bay via Saint-Pierre-de-Véronne à-Pike-River. The Pike River crosses forested lands as well as agricultural and urban areas. By the time it flows into the Bay its waters are contaminated. Its wetlands, on the other hand, are full of a rich array of flora and fauna.



The Rock River, 15 km in length, is the Pike River's smallest tributary. It starts in Vermont, crosses the municipality of Saint-Armand, Quebec, and flows back into the United States and into the Bay. It flows

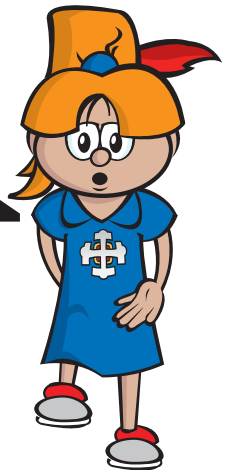
at a rate of approximately $1 \text{ m}^3/\text{sec}$. It is made rather attractive by small rapids. As the water runs off into Rock River, soil particles fall into the water to give it a brownish colour and cover its bed with sediment.



Photo credit: Christine Caron

The Missisquoi River is the largest tributary and its length is approximately 100 km. In Quebec, it receives the waters of the North Missisquoi River as well as those of Sutton River that run through mountainous and forested regions. It flows at an average rate of $50 \text{ m}^3/\text{sec}$. Its water quality is good in Quebec, but it becomes increasingly contaminated as it flows into the Bay, due to the fact that it crosses an extensive agricultural region.

One cubic meter is somewhat larger than the space occupied by your desk and chair. Check with a tape measure: one meter in height by one meter in length by one meter in width. One cubic meter of water equals to 1000 litres.



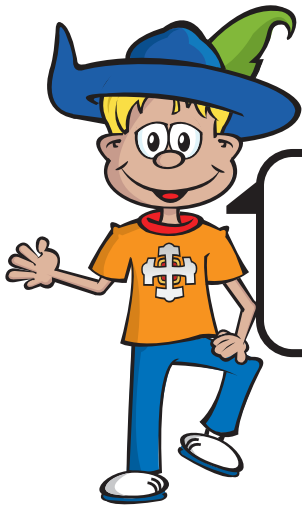
Land Use

As we have seen, human activity as well as other natural elements such as aquatic plants, algae and animals, contribute to the contamination of waters. Contaminants can occur in the form of fecal matter, soil particles, phosphorous fertilizers, toxic products, etc. Every waterway within the hydrographic network contributes to water contamination, which becomes progressively worse as water flows from its source to its mouth. The entire basin is contaminated by the various forms of land use.

Various forms of human activity take place within the Missisquoi Bay area. Land is used for four main purposes:

- 1- municipal and residential use**
- 2- agriculture and forestry**
- 3- industry and commerce**
- 4- recreation and tourism**

Water is used directly or indirectly in each of these spheres of activity. It can be contaminated through any of these uses, as will be demonstrated in Exercise 3, dealing with land use.



As it reaches the Bay, the water is filled with everything it has gathered on its way through the basin. The pollutants contained in tributaries, from their source to their mouth, determine the quality of water and sediment in Missisquoi Bay.

Exercise 3: Users of Basin Territory

Grades 1 and 2

In the rectangle of the four uses of the territory, draw a pool, a restaurant table, a boat and a cow drinking water.

Grades 3 and 4

Write down in the rectangle of the four uses of the territory one way of using water and one pollutant.

Grades 5 and 6

List at least three ways of using water and three pollutants for each of the four uses of water in the territory shown.

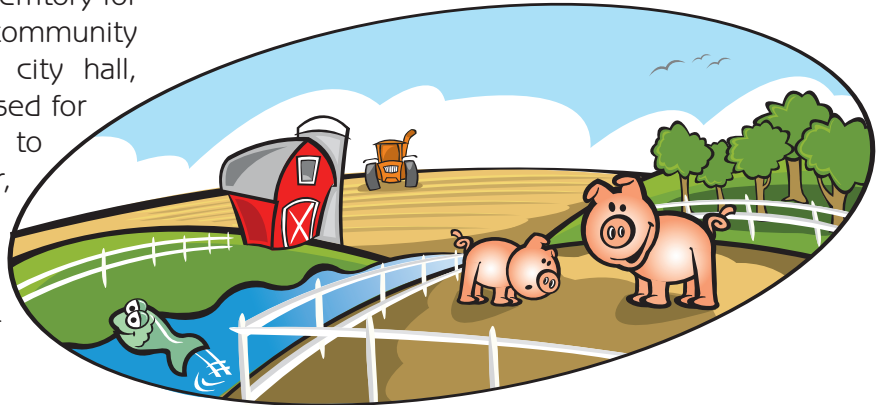
1- Municipal and Residential Use



Twenty-eight (28) municipalities are located in the Basin area. These municipalities use the territory for the building of homes, and for such community services as streets, aqueducts, drains, city hall, schools, libraries, arenas, etc. Water is used for drinking, to clean streets, to make ice, to water lawns. Every time we use water, there is a danger of polluting it. Water can also be contaminated by the incorrect use of river banks: dumping of garbage and debris, erosion, use of fertilizers near the river banks, and washing the car.

2- Agriculture and Forestry

The area surrounding the basin is made up of forest and fields, orchards, vineyards, market vegetable gardens, etc. Agricultural uses include the cultivation of land or raising cattle. Forest use can include wood cutting, maple syrup production, the gathering of mushrooms, hiking, and conservation of wild animal habitats, etc. Water can be polluted by all of these water uses: manure, waste materials left after the sawing of wood, dirty waste water, and fertilizers.



Municipal and Residential Use

Agriculture and Forestry

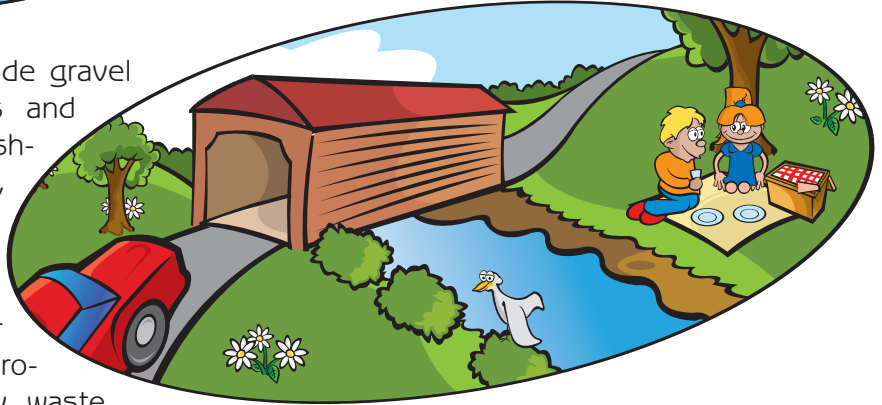
3- Industry and Commerce

4- Recreation and Tourism



Recreational activities are naturally most appealing, but they often lead to a deterioration in water quality. Water can be used for swimming or boating. Water courses are also attractive for the fish they produce and for the walking trails near their banks. Again, water pollution can occur in different ways as a result of recreation or tourism, mostly due to throwing rubbish into the water instead of placing it in a garbage or recycling bin, and from boats that leak motor oil or gas.

There are few large industries in the basin area, but it does include gravel and sand pits, manufacturing facilities and agri-food industries. Commercial establishments abound in the form of restaurants, garages, food stores, specialty boutiques, etc. Industrial and commercial buildings use up large quantities of water in the transformation of their products or to power equipment. As a result, they produce pollutants such as dirty oil, dirty waste water, debris that has fallen into the water, and rust from pipes.



Industry and Commerce

Recreation and Tourism

Glossary

Tributary

A water course that flows into another or into a lake.

Upstream

Toward the mountain or the place where the stream takes its source.

Downstream

Toward the valley or in the direction of the water flow.

Basin

The land area through which water runs on its way to a stream or a lake.

Embankment/bank

The naturally occurring edge of a stream, escarpment.

High water mark

Highest level of a stream or a lake.

Blue-green algae

Bacteria that multiply in water to produce a blue-green layer that can emit toxic substances.

Flow

The rate of movement of a volume of water over time.

Waste water

Water that has become unclean though use for residential, industrial and commercial purposes.

Mouth of a stream

The point at which water leaves a stream to flow into another body of water.

Erosion

The wearing away of land surfaces through the action of rainfall, running water, wind, waves and water current.

Low water mark

Lowest water level in a stream or lake.

Evapotranspiration

Phenomenon caused by water vapour being ejected into the atmosphere through the soil or vegetation.

Hydrographic

Relating to a network of lakes and bodies of water in a given area.

Bed

The bottom of a stream or a lake.

Molecule

A small particle made up of chemical elements and atoms.

Potable

Fit to drink.

Runoff

Overflow of rainfall or melted snow not absorbed by soil, as it rushes downhill.

Sediment

Solid fragments of organic or inorganic material that come from the weathering of rock and accumulate on the bottom of a body of water.

Source

The point of origin of a stream or river.

Books... Internet Sites... and Places to Discover

BOOKS

Water Champs: Water Quality in the Champlain Drainage Basin, Adirondack Park Institute, inc.
Healthy Water, Healthy People, Testing Kit Manual, The Watercourse International Project WET. Montana State University.

INTERNET SITES

Lake Champlain Basin Program:
www.lcbp.org
Lake Champlain Basin Atlas:
www.lcbp.org/Atlas/HTML/intro.htm
Quebec's Waters - A Resource to be Protected:
www.mddep.gouv.qc.ca/eau/inter_en.html

PLACES

The Biosphere - My Planet at Play:
www.biosphere.ec.gc.ca
ECHO at the Leahy Center for Lake Champlain (Lake Aquarium and Science Center in Burlington, VT)
www.echovermont.org
Lake Champlain Maritime Museum in Vergennes, VT
www.lcmm.org

Your Mission as one of Porthos' Musketeers

With the assistance of your teacher, your parents and your friends, explore the area where you live and find a water course near your home. Make a rough drawing of it in a notebook, showing the direction of the current, its source (upstream) and its mouth (downstream), the left and right banks. Based on your observations, list the different ways water is used (minimum of twenty) and the various steps that can be taken to protect the water. Why don't you ask the people around what they do to save water and to avoid polluting it. Once your mission report has been accomplished, you will be admitted to Champlain Company as one of Mister Porthos' Musketeers. You will be eligible to take the oath along with the other musketeers in your company.

Mission Report

The Musketeer's Oath

We are Mister Porthos' Musketeers of Clear Water and we have successfully completed the Basin Grade. We undertake to protect with honour and pride the quality of water and its preservation. We are the new guardians of the Missisquoi Bay Basin.

ALL FOR WATER AND WATER FOR ALL!

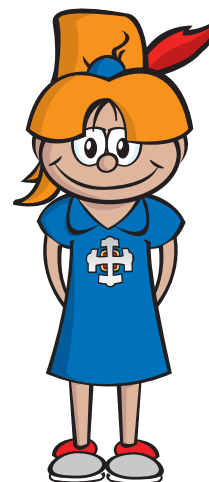


Production

Corporation Bassin Versant Baie Missisquoi - 2006



Porthos the Musketeer served the king and queen of France. Clear Water Musketeers work toward the protection of the environment and nature. One must be thoroughly familiar with the basin area to properly fulfill one's mission as water protector. Let us take pride in belonging to the Missisquoi Bay basin area.



Production Team:

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Illustrations: Le Bipède Graphique

Graphics: Ekorce creative workshop

Printing: Caractéra

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