TOPIC 3. CLEAN WATER — LIFE DEPENDS ON IT!

Chapter 3(A): *Are You Sure It's Good?*

Purpose

To have students understand the concept of water quality, how we measure water quality, and why we need to maintain water quality.

Subject areas

Environmental Studies, Science, Social Studies, Language Arts, Health

Procedure

1. Help the students focus on the topic of water quality by asking some of the following questions:

    - What does water taste like?

    - Do you think the water from your taps is good? Why? Who monitors it?

2. How do we measure water quality? What indicates if water quality is good or bad?

    - Point out that different uses of water need different water quality. For example, water can be clean enough for swimming or irrigation, but it might not be clean enough for drinking.

    - Ask: Do we really need water of pure quality to flush our toilets?

3. Lead a class discussion: "We have an obligation to return water to streams, oceans, and lakes as clean as possible and with the least waste."

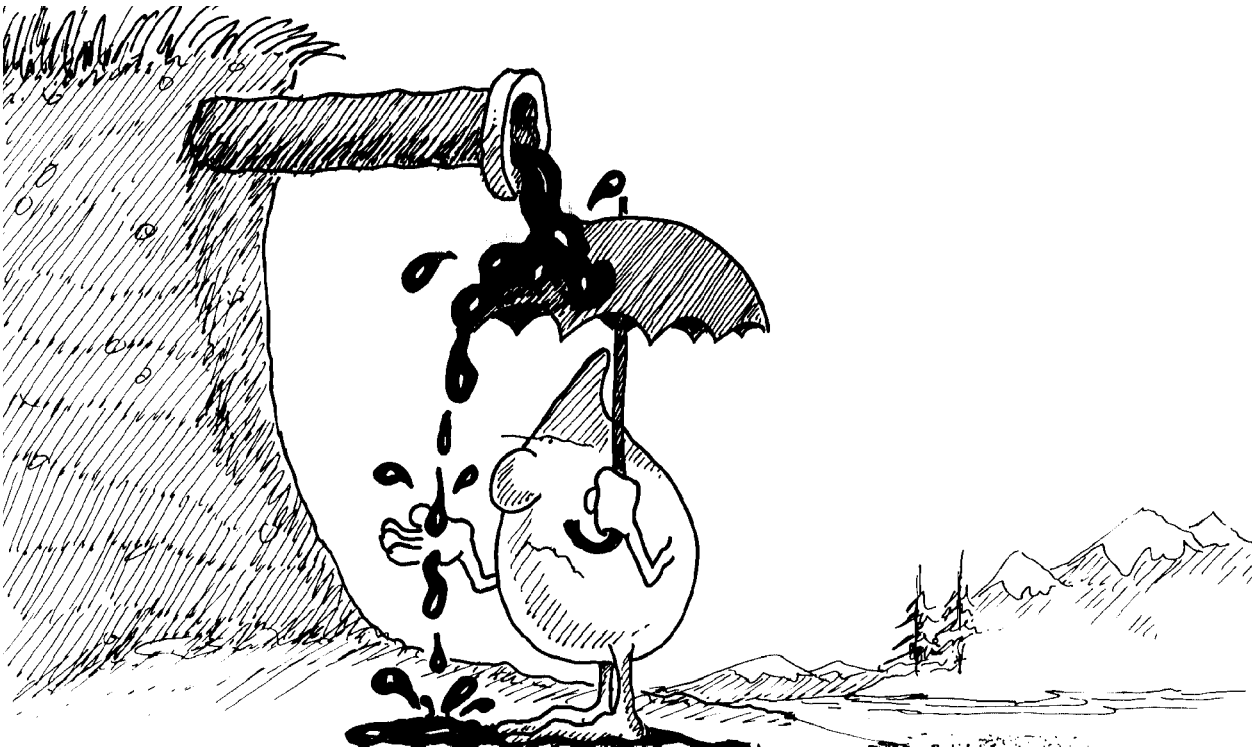
    - Why is water quality important?
    - What is the responsibility of industry and business?
    - What can you do as an individual?
    - What is your responsibility?

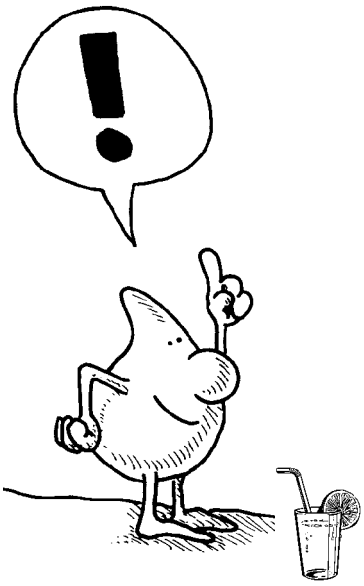
Vocabulary

contaminate *desalinization* *herbicides* *irrigate*	*monitor* *pesticides* *sanitation*	*sediments* *stringent* *toxic*

References

- Freshwater Series A-3: "Clean Water — Life Depends on It!"
- *A Primer on Fresh Water*: "How Good is It?"





TOPIC 3. CLEAN WATER — LIFE DEPENDS ON IT!

3(A): Are You Sure It's Good?

Is this good enough to drink?

Lucky you! It's holiday time and you and your family are going on a vacation to Mexico (or Africa, or India, or China, or Russia, or Asia). Pick a destination.

Whichever country is your destination, one of the first pieces of advice you will be given is, "Whatever you do, don't drink the water!"

You will also be warned against eating any fruit or vegetable that can't be peeled. You will not take water for granted again after this trip.

It's time to count your lucky stars. You live in one of the few countries in the world where you can *usually* drink water straight from the tap and the water fountain in your school.

What about water quality in Canada?

Because of Canada's **stringent** guidelines for good drinking water, we can be sure that water quality guidelines are always being **monitored** so that our health is being protected. At the same time, our water looks good, tastes good, and is generally free from bad smells or colours.

But, it's not easy being pure. Industries and technologies are introducing new chemicals into our water supply every year. Therefore, water quality guidelines have to be continually monitored and revised to keep the water quality we depend upon; and, we have to keep learning about the new chemicals being added to our water.

After your trip abroad you will understand why people from other countries envy us Canadians; we have plenty of water and it is generally safe to use. A scary fact is that in developing nations, 80% of diseases are water-related!

Take a moment to think about this:

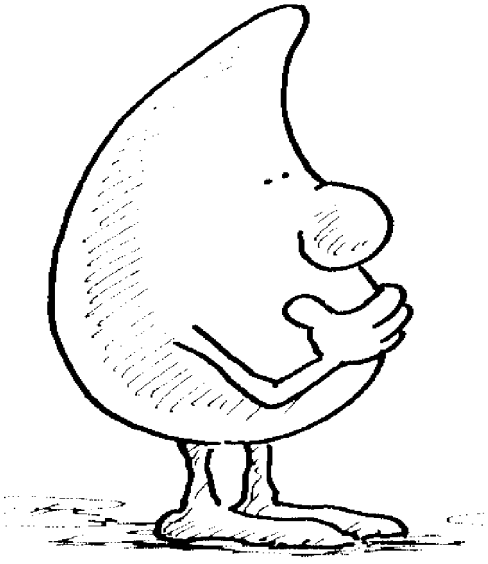
Officials estimate that every day throughout the world 34 000 deaths are caused by **contaminated** water and poor **sanitation** — that equals 100 jumbo jets crashing every day!

What do we mean by water quality?

"Water, water everywhere, but not a drop to drink." You've probably been swimming in the ocean and tasted salt water. And you know that salt water doesn't taste good. This doesn't have to mean the ocean is polluted; it might mean that the salt water contains substances making it all right to swim in, but not to drink.

There is no single measure of water quality. Water that is used to **irrigate** fields may not be suitable to drink; and water that you swim in is a different quality from that needed for industrial use. Water samples are taken all the time to test the quality of water, to see if it contains chemicals that make it unfit for drinking or pollutants that make it unfit for swimming.

What affects water quality?



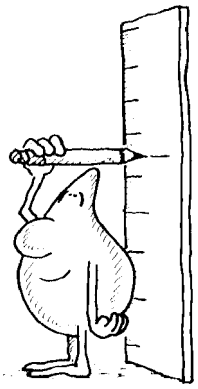
As mentioned earlier, it's not always easy to keep our water pure. From the introduction of new chemicals to natural causes, water quality can be affected by many factors.

For example, moisture in the atmosphere collects around dust, volcanic and natural gases, or any substances in the air like lead and **toxic** chemicals, and falls to the earth's surface as precipitation.

Runoff from land surfaces can drain into the water supply carrying all kinds of substances. In farming country this can mean animal wastes or fertilizer and **pesticides**; in the cities, street debris and chemicals end up in the water. One of the main problems in cities occurs after a storm when wastes from dogs and cats are washed into our storm drains and end up in our lakes and rivers. This is one reason why beaches near cities are closed after a major storm. Wastes from industries, mining, and forestry can also affect the water quality.

We ordinary householders affect water quality as well. We dump many things down our drains and into our toilets without thinking. Some of these substances are toxic, and our treatment plants cannot remove them from the water. We have to remember that everything we toss down the drain finds its way into the water system, and one of these days, you or someone else will be drinking that same water after it has been treated.

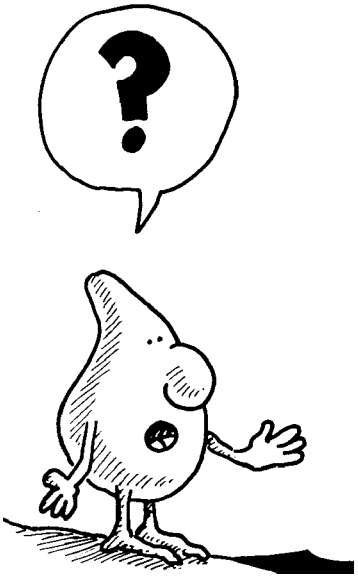
How do we measure water quality?



Scientists collect samples of water and living organisms from a lake or stream and analyse them in a laboratory with special instruments. Some of their instruments are so exceptional, they can detect one-thousandth of a teaspoon of salt in an Olympic-size swimming pool.

Did you know?

On the prairies, irrigation is the largest consumer of water. Irrigation can affect the quality of water because it runs back to the river, lake, or groundwater source carrying **sediments,** fertilizer, **herbicides**, and pesticides.



TOPIC 3. CLEAN WATER — LIFE DEPENDS ON IT!

3(A): Are You Sure It's Good?

Activity 1 — Environmental Studies

1. Many people in Canada buy bottled water to drink because they believe it is purer than water from the tap. Tests by the Consumers' Association of Canada and other organizations have found out that bottled water is no healthier than tap water and in some cases is not as good.

> **Note**: There is no law to enforce the limit of total bacteria in bottled water in Canada.

Find out the results of tests done on brands of bottled water. Make a graph to show the conclusions.

2. Find out about additives (chemicals added to our water supply) such as chlorine and/or fluoride in the water.

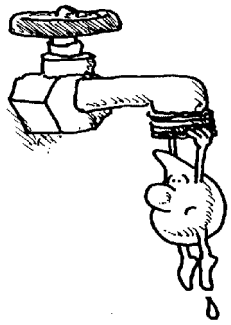
   - Why are these additives used? Are they used in your drinking water? Why or why not? (Some communities have voted against adding any chemicals to their water supply.)

3. Contact your local municipality to find out the types and numbers of chemicals that are monitored in your local drinking water; compare your results with the chemicals that are tested in bottled water.

Activity 2 — Social Studies, Language Arts

Conduct some marketing research.

There are several models and types of water filters that fit on taps and claim to filter out impurities from the water.



- Visit a shop selling these. Investigate the costs and find out how they work and how good they are.
- Make up a report for your class explaining what water filters do.
- Include whether or not you recommend them and which model you consider the best. Justify your choice.

Activity 3 — Research Skills, Science

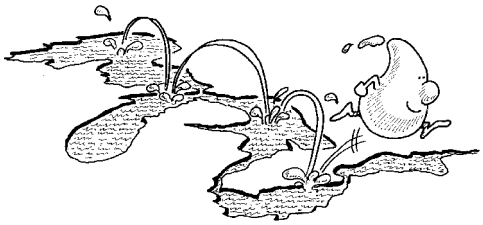
Make a "still."

- Your first task is to find out what the word "distillation" means — and then find out what a "still" is. (You may learn that having a "still" may be illegal — but that's not the kind meant here.)
- Go to your library and find a book that tells you how to find and make your own apparatus for distilling water.
- After you have a working model, demonstrate distillation to the class using a sample of water to which you have added salt and a little food colouring.
- Explain the scientific process of distillation.
- In which situations does distillation have a practical use as far as drinking water is concerned?
- Do you think this is an economical way for countries without good water supplies to produce their own water from salt water, a process called **desalinization**? Explain.

Activity 4 — Environmental Studies

What do you think of the following?

> Icebergs are made up of distilled and frozen water. Some business people have suggested that we can break off chunks of northern icebergs and tow them down to the dry California coast where they can be melted and used to irrigate the farmland there.



Can this idea work? Be creative and prepare a report about this project. Pretend you are one of these business people trying to sell your idea to others. Answer some of the following questions:

- What are the benefits?
- How do you "break off a chunk?"
- How will you tow this chunk?
- What are some other questions/problems that others may ask you?
- How will you answer these questions?

Activity 5 — Health

- In most parts of Canada we can get our drinking water samples tested free by the provincial or territorial Department of Health. Invite a speaker to explain this process to your class.
- Prepare a list of questions for your speaker beforehand about the quality of drinking water in your community.

TOPIC 3. CLEAN WATER — LIFE DEPENDS ON IT!

Chapter 3(B): *Pollution*

Purpose

To provide an overview of the different ways we pollute our water resources and to focus on our role in actively cleaning up.

Subject areas

Science, Language Arts, Environmental and Social Studies, Art, Health, Geography

Procedure

1. Lead a class discussion about Canada as a tourist's paradise. Show the students an advertisement which shows Canada as a land with pristine lakes, rivers, and streams.

2. Ask them to come up with examples of local, provincial, and national situations which show we are not as pure as we would like to be. Think about agriculture, mining and forestry operations, industries, municipal dumps, etc.

3. Ask the students how they contribute to pollution. How many cars do their families own? Do they use fertilizers or pesticides on their lawns? Continue by asking how the convenience of today's lifestyles can have a negative effect on the environment.

    - Lead them to discuss that pollution is caused by many groups and individuals; the solutions will have to come from everyone.

4. The students will likely have heard about acid rain. Explain to them that acid rain is one of the phenomena known as LRTAP — long-range transport of airborne pollutants. Go over the information about measuring acid rain and review the pH scale with them.

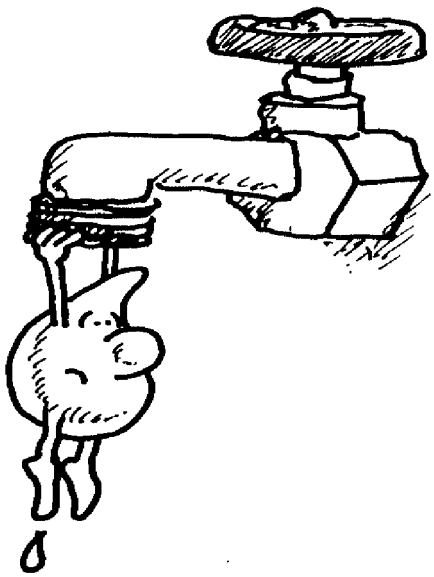
    - Point out to them that pollutants released into the air or into the water have no political or geographical boundaries. Pollutants are carried by winds and currents.

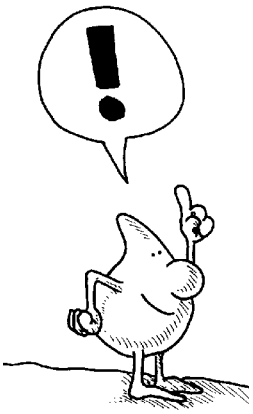
Vocabulary

acid rain	degradable	eutrophication

References

- Freshwater Series A-3: "Clean Water — Life Depends on It!"
- *A Primer on Fresh Water*: "Water — How Good is It?"





TOPIC 3. CLEAN WATER — LIFE DEPENDS ON IT!

3(B): Pollution

Is Canada a water paradise?

Remember that trip you went on with your family to a country where the water was not clean enough to drink? And how lucky you felt to be from a country which has so much good, clean, sparkling water? Well, just a minute. Before you get carried away with how environmentally clean Canada is, consider the following:

- Do you live in a part of Canada where local beaches are closed every summer because of pollution?
- Has your well ever been polluted by underground storage areas or other industrial wastes?
- Do you feel safe eating fish from your local river or lake?
- Does your city or municipality dump its untreated sewage right into the harbour or river near where you live? (Thirty-three percent of Canadians live in regions that do not provide sewage treatment.)
- Have you heard stories about fish being polluted by mercury poisoning in Canada as well as other countries?

- Are there manufacturing plants or industries nearby which dump untreated chemicals into a water body? Many factories do.
- Do any of these polluted areas affect you?

The sad truth is . . .

If you were to survey large water bodies across Canada, for example, the Great Lakes or the St. Lawrence River, you would find out that we are spoiling the quality of our water. We are doing this with human wastes, animal wastes, and chemical substances. And many of our treatment processes are unable to cope with the increasing complexity and number of chemicals being added to the system.

Our water supply is having a harder and harder time cleansing itself. Normally nature has its own "purification cycle" whereby it uses energy from the sun, oxygen, bacteria, and carbon dioxide to purify itself. Unfortunately, this purification process does not work on some of the more toxic chemicals we are adding to our air and water supply.

How have we polluted our water supply?

Let's look at some of the ways we have affected the quality of our water.

1. We allow non-persistent (**degradable**) pollutants such as domestic sewage, fertilizers, some household cleaners, and some industrial wastes into our water supply areas. These degradable pollutants can be broken down slowly.

2. Our waters have become home to persistent pollutants, the most rapidly growing type of pollution. The damage takes decades or centuries to break down, if at all.

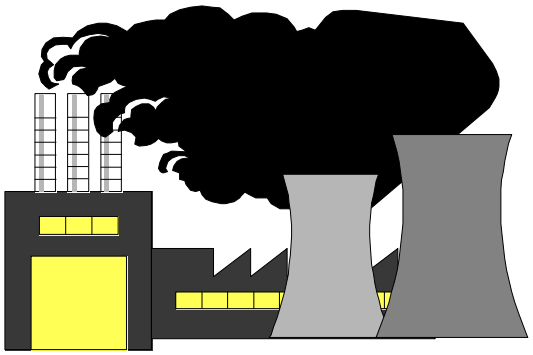
   These include some of the following:

   - some pesticides, for example, DDT
   - some waste from landfill sites
   - petroleum products
   - PCBs, dioxins
   - metals such as lead and mercury

3. We have other kinds of pollution:

   - floating debris and garbage — dumped directly into our lakes and rivers where they may be carried away by the currents only to turn up somewhere else

   - thermal pollution — after artifically heated water is used in power plants, it is released back to the water body where it can disturb the chemistry of the source



   - dams — affect the land behind them through flooding and often accumulating sediments in the reservoir

   - dredging — can disturb the natural ecological balance through removal of aquatic life and by the deposit of material

Did You Know?

One litre of oil can contaminate up to 2 million litres of water.

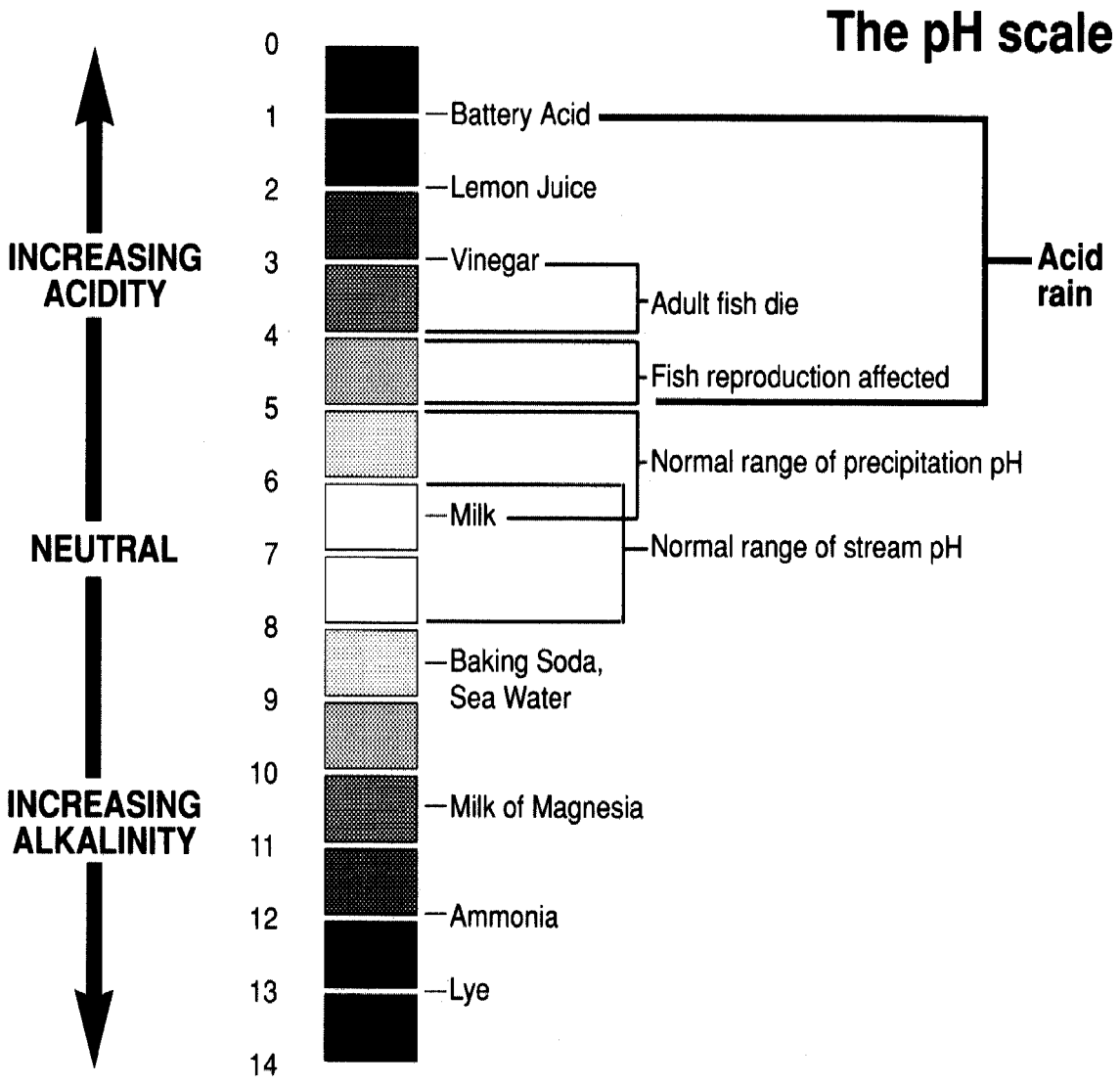
Acid rain: Long-range transport of airborne pollutants (LRTAP)

As you know, pollution caused in one province, territory, or country does not stay in the area where it occurred. We find airborne pollutants like **acid rain** in our northern lakes — carried there by wind currents from the south of Canada, from the United States, and even from Europe. Remember, the air above us does not recognize borders.

Acid rain comes from rainwater contaminated with chemicals from sources such as iron and steel mills, pulp and paper mills, oil refineries, and motor vehicle exhaust.

How do we measure acid rain?

By its pH. Scientists measure the acidity of rain by its pH factor, which stands for "potential for hydrogen," on a scale of 0 to 14.



The zero end of the scale is the maximum in acidic content, while the 14 is the other end of the scale, the highest possible alkaline content.

This is not too hard to remember if you realize that zero is something like a test mark. It's bad. You would think that pure rainwater would be right in the middle of the scale, but it stands at 5.5, since there is always some natural acid in rain.

Is it all gloom and doom?

There is much that can be done about pollution, but it will take all nations of the world working together. After all, we all share the same atmosphere and the same hydrologic cycle — you won't find borders to keep out air pollution or water pollution.

How can we control water pollution?

Since nature cannot cope with pollution from our growing populations and industries, governments and citizens must set out guidelines to protect the environment. Laws and regulations must keep pollutants in check.

Technology can also help reduce harm to the environment. For example, water treatment plants and wastewater treatment plants help keep our water clean.

We all have to play our part. Talk your parents into practising some of the following at home:

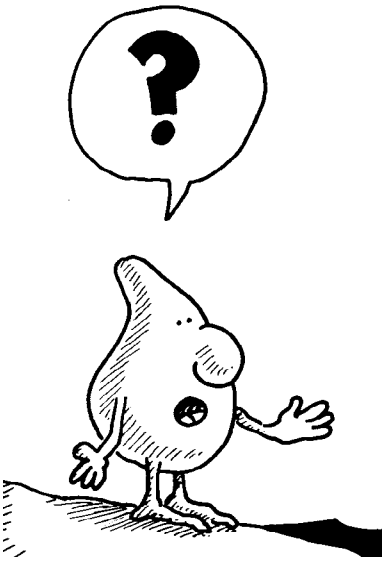
- don't use hazardous products
- don't misuse the sewage system
- don't use pesticides or herbicides in your garden
- don't dump hazardous products into storm drains
- learn all you can about becoming a good environmental citizen — and then practice your skills

A good news story

In the 1960s, Lake Erie experienced such serious **eutrophication** that fish were dying, and decomposing algae washing up on the beaches had to be removed by bulldozers.

The phosphorous (phosphate) from laundry detergents was the main problem. A law was passed to reduce this substance and, in 1972 phosphates were cut by 90%.

Since 1972, Lake Erie has made a remarkable recovery.



TOPIC 3. CLEAN WATER — LIFE DEPENDS ON IT!

3(B): Pollution

Activity 1 — Environmental Studies, Social Studies

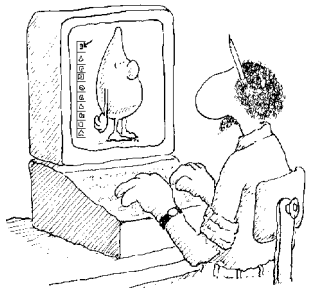
Water pollution in your town?

- Survey your local area.
- Find out what wastes go into the water bodies where you live.
- Explore the following:
    - industries such as pulp and paper, mining, chemical plants
    - manufacturing plants
    - garages, gas stations
    - dry-cleaning companies
    - farm run-off
    - untreated sewage

- What about airborne pollution from smoke stacks, for example, acid rain? Remember, what goes up must come down.
- Most cities in Canada wash their streets. What kinds of debris eventually make their way into water systems from this source?
- Prepare a report based on your findings.

Activity 2 — Environmental Studies

What pollution are YOU responsible for?



- Conduct surveys around your home, school and community. Before you begin your survey, prepare a list of questions to ask.
- Interview interested and concerned people. Find out how we as individuals contribute to pollution and what we can do about it. Remember, we all have to do our part.
- Display the results of your survey with graphs, charts, and posters.

Activity 3 — Social Studies, Art

You hear a lot of talk these days about being "proactive," in other words, taking responsibility and doing something about a problem before we have to *react*. Let's look at an example.

> Students at a school in Toronto were upset because fast food restaurants were packaging their food in materials which were not friendly to the environment. The students decided to do something about it.
>
> They boycotted the restaurant — made signs and posters to get people's attention, and wrote letters to the companies and to politicians. Their actions forced the companies to use new kinds of wrappers for their food.

That is just one example of a group of people being proactive. There are lots of other ways — and simpler things you could do. For example, look around the school and around your own house.

- Plan a campaign. What can you do to make your surroundings pollution-free?
- Design posters, buttons, or bumper stickers to broadcast your message.

Activity 4 — Social Studies

Scenario: You know that a business or industry (dry-cleaning plant, pulp and paper mill, mining operation, chemical plant, etc.) is polluting a nearby stream.

- What can you and your class do?
- Set up a step-by-step action plan.

Activity 5 — Environmental Studies

In your information sheets you read about different ways we pollute our water supply by dumping persistent and non-persistent pollutants, or with dredging, thermal discharge, acid rain, etc.

- Select one example of pollution that affects our water and research to find out more about this kind of pollution.
- Make a class presentation and clarify this pollution problem to others.

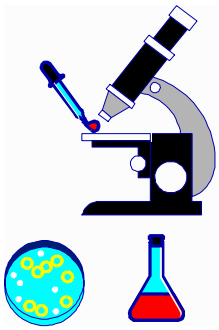
Activity 6 — Language Arts, Art

Collect headlines about pollution and acid rain.

- Start a bulletin board for clippings and news about water pollution, acid rain, and the international efforts to fight the causes. Make your display interesting so that people will want to look at it.
- Examples of recent newspaper headlines:
    - \$90-million price tag attached to river cleanup
    - Pollutants threaten nation's fresh water
- When you have completed the display, write a report to present to the class about what you have learned.

Activity 7 — Science

Can you boil away impurities?

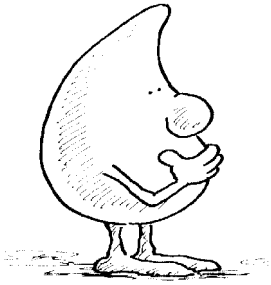


You will need:

- a 500-mL beaker to collect a speciman
- a microscope
- two slides for the microscope
- a means to boil your water sample

What to do:

- Collect a sample of water from a pond, a brook, or a puddle.
- Place a drop of the sample water on one of the slides. Observe it under magnification.
- Make notes of what you observe.
- Boil some of the remainder of the water sample for ten minutes.
- Let it cool and place a drop of the boiled water on the other glass slide. Observe it carefully.
    - Describe what has happened to the water sample when it was boiled.
    - Do you think boiling removed all impurities from the water? Justify your opinion.
    - Write up your findings.



Activity 8 — Language Arts

What if . . . ?

In groups of two to four students, make up some "what if" questions for the rest of the class. Each of your groups will make up four such situations and present them to the class for discussion.

Option: Select one of the "what if" situations to role play or act out.

Sample situations:

- What if you saw a neighbour pouring used car oil down a storm sewer?
- What if you watched your neighbour (for the umpteenth time) allowing his Great Dane to use your lawn for a bathroom without cleaning up?
- What if you were with a wilderness camping group and you met a group leaving garbage around?
- What if you were at a town meeting where politicians wanted to spray your local park with herbicides for weeds?

Activity 9 — Research: Geography, Science, Health

In the developing world, it is estimated that between 13 million and 25 million people die from diseases caused by unsanitary conditions. Many of these diseases are related to unclean water.

- Research one of the following diseases and prepare a report on it: diarrhoea, polio, typhoid, cholera, leprosy, scabies, roundworm, malaria, sleeping sickness, river blindness, hookworm. Describe the disease, what its effects are on people, and explain how unsanitary water helps spread the disease.

or

- Choose a country where you suspect the quality of water may not be as good as Canada's. What kinds of diseases might you get there? What precautions should you take to avoid disease? What shots will you need? How do you find out this information? What are some of the diseases you can catch from contaminated water?

Activity 10 — Environmental Science

Adopt a stream.

In many parts of Canada, concerned citizens have organized groups to keep the environment free from pollution. For example, some groups (or individuals) will volunteer to keep a mile of highway free from litter, or students will adopt a ditch in their community to keep clean.

Why not organize your classmates (or community) to adopt a nearby body of water. Invite people from the community into your class to help set it up. Get as many people involved as you can.

Activity 11 — Language Arts

What's wrong with this ad?

> *Mr. Mighty* Does the Job for You!!
>
> Tired of seeing the mess left in your sink after the day's grease, paint, suds, and food remains have disappeared down your drain?
>
> Have no fear! *Mr. Mighty* is here!
>
> *Mr. Mighty* will rid your sink of all these ugly, leftover stains. Just spread *Mr. Mighty* around your sink, rub gently, rinse with warm water, and voilà! All that residue will flow into your drain and out of your life!

Have you seen ads which make the same promises?

- Take a week to monitor ads on TV. Or look for ads in magazines. Are there products similar to *Mr. Mighty*? Pick one and discuss what might be wrong with the approach.

> **Note:** Some products which claim to be excellent and safe to use for cleaning actually are. Make sure your research is accurate

- Find alternate solutions to cleaning up without using chemicals.
- Create your own ad for a cleaning product.

TOPIC 3. CLEAN WATER — LIFE DEPENDS ON IT!

Chapter 3(C): *How Is Water Treated?*

Purpose

To help students recognize there is a water cycle made by humans as well as the hydrologic cycle made by nature; and to examine the treatment of water before and after use.

Subject areas

Science, Environmental Studies, Social Studies, Art, Language Arts

Procedure

1. Review the concept of the hydrologic cycle and point out to the students that we have had to create our own water cycle so that we can treat water before and after we use it.

    - Remind them of the point made in the last chapter, "Pollution," that because of new chemicals and other substances being added to water, nature's purification cycle needs help from humans to keep water pure.

2. Depending on the area of Canada you live in, students may be served by individual septic tanks or water and wastewater treatment plants. Chances are they will not have had occasion to think too much about their water supply and how it is cleaned. Lead a discussion about the necessity of cleaning our water both before and after use.

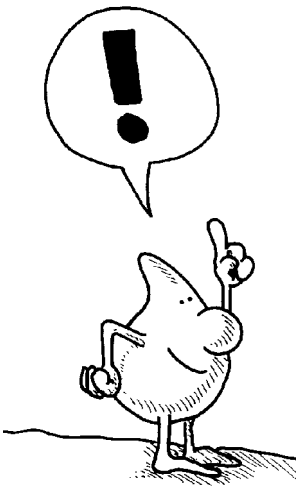
3. The topic of wastewater treatment can generate a great deal of interest. If possible, arrange a visit to a plant or invite a guest speaker into the classroom. When students realize how much water is wasted by them, they may be more conscious of misuse.

Vocabulary

aeration	effluent	purify
alum	filtration	reservoir
chlorine	fluoride	sedimentation
coagulation	infrastructure	sewer

References

- Freshwater Series A-3: "Clean Water — Life Depends on It!"
- Freshwater Series A-4: "Water Works!"
- A Primer on Fresh Water: "Water — How Good is It?"
- Water, No Time To Waste: A Consumer's Guide to Water Conservation



TOPIC 3. CLEAN WATER — LIFE DEPENDS ON IT!

3(C): How Is Water Treated?

Can dirty water be cured?

If you are like most people, you have not given ten seconds of thought to how water got into your house or why it comes out of a tap ready to drink whenever you feel like it. And you probably never think that the wastewater you flush through your toilets or let run from your drain will turn up again in your drinking water supply. But it does. It's like the old saying, "what goes around, comes around."

Except for areas where people get their drinking water directly from a well, most water that comes into Canadian homes has been **purified** or treated at a water purification plant so that we can drink it safely. Your homes and your school make up one part of a community water cycle made by humans.

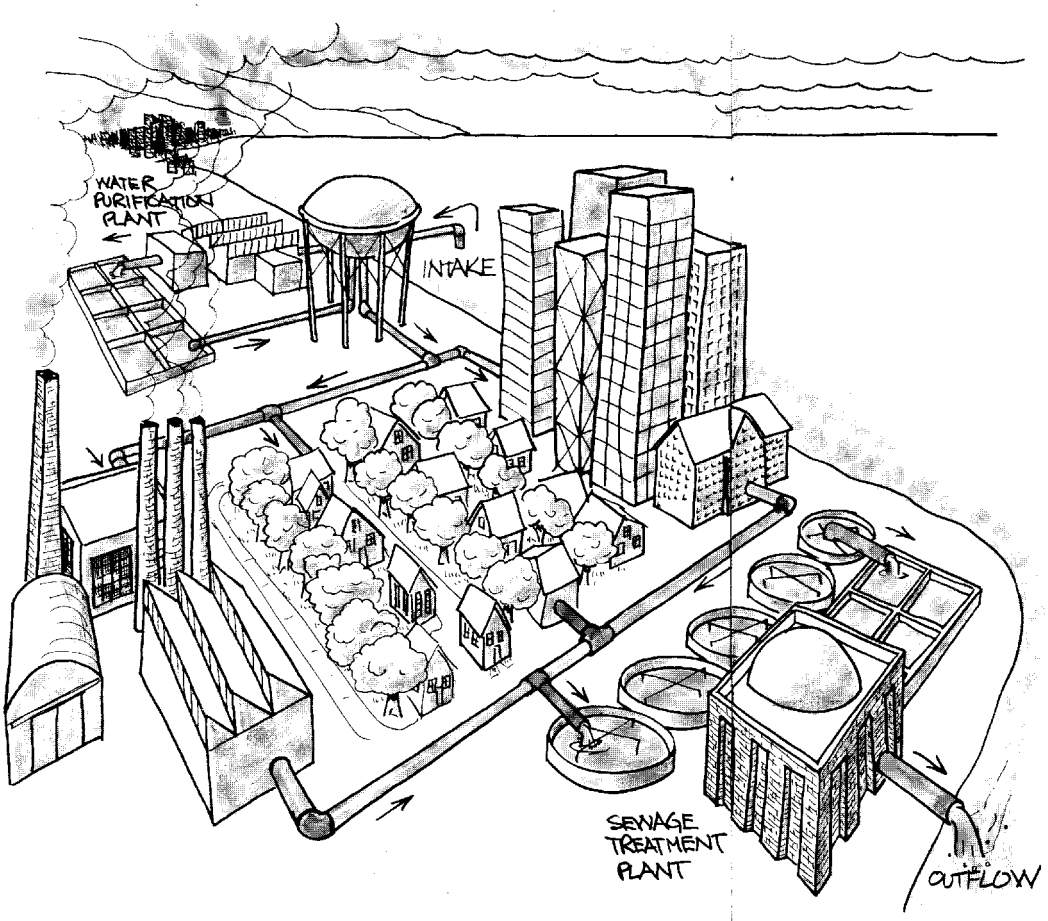
And, once the water goes down the drain, it travels through wastewater pipes or a sewer system to another treatment plant, this time a sewage treatment plant, where it gets treated again before it is released into nature's cycle.

Another water cycle

Water is collected in a **reservoir** or lake, piped to a water purification plant, treated for our use, and pumped through pipes or water mains to our houses. After we have used the water (or sometimes wasted it), it leaves our houses through **sewer** lines and heads to a sewage treatment plant. There it goes through another treatment before it is released to nature's water system to be recycled yet again. And on it goes.

A word of caution here — both treatment plants are very different; it wouldn't do to get them mixed up!

Look at the diagram that follows and trace the route that water can take.



One example of another water cycle.

Other areas of Canada rely on individual wells and septic tanks — but this is still part of another cycle — from your well, to the taps in your house, and out to the septic tank.

A closer look at where your water comes from

If you get a chance, try to visit a water purification plant and find out firsthand the treatment process water goes through before it begins its trip to the taps in your house or the water fountain at school. Remember, no matter how fresh water is, it usually picks up some impurities as it goes through the hydrologic cycle.

What happens in a water purification plant:

1. First there must be a source of water nearby. This could be a river or lake, or it could be a reservoir created by the building of a dam to hold the water back.

2. As this water is needed, it is carried by pipes into a purification plant where it is made safe for drinking by going through the following treatments:

   - First of all, water is sprayed into the air where it mixes with oxygen. This step is called **aeration**. The oxygen helps bacteria grow which in turn destroy some of the impurities.
   - The next step is **coagulation** where **alum** is added to the water. Alum forms sticky particles to which dirt and other particles cling.
   - In the next stage, **sedimentation**, these impurities settle to the bottom of a settling tank.
   - The water then goes to a filter tank where **filtration** occurs. Any impurities left in the water are filtered out through layers of sand, charcoal, and gravel.
   - In many communities, **chlorine** is added to the water to destroy any disease-causing germs that may remain; and in more and more communities, **fluoride** is added.

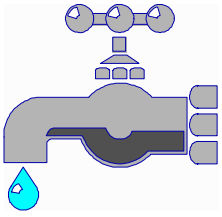
When water has gone through these steps, it is ready for your use. The clean water is pumped to large storage tanks and from there it is pumped into pipes that carry it to your homes, schools, businesses and industries.

What happens next?

So, that's the first half of the community water cycle. What happens to the water after it has been used and leaves your house or school? This is where it gets the name "sewage" or "wastewater," and goes into another set of pipes to be taken to the sewage treatment plant. As the name tells you, this is where water gets another series of treatments before it is released back into the environment.

Let's hope that your community or city has a method to treat waste and that waste does not get dumped directly into the nearest body of water.

A closer look at a sewage treatment plant



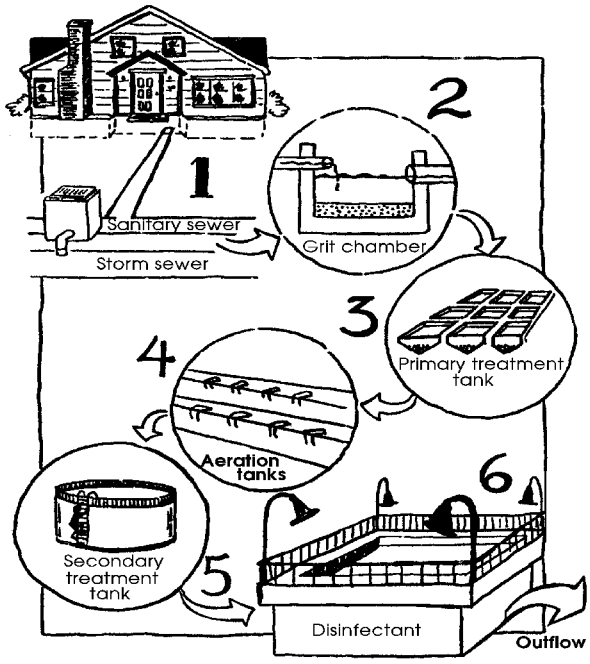
Wastes can be easily removed from the majority of our homes, just the turn of a handle or tap and whoosh! It's gone. Where does it go from there? To a sewage treatment plant where it goes through one or more of the following steps:

- Primary treatment — sand, grit, and other solids are separated from the liquids by screens and settling tanks

- Secondary treatment — air is added (aeration) to stimulate the growth of bacteria to consume most of the remaining waste materials
- Tertiary or advanced treatment — chemicals are added which remove nutrients that stimulate algae (tiny plants that use up oxygen needed by fish)

Sludge is what is left behind after wastewater is treated. When harmful microorganisms are removed, sludge is either burned, taken to landfills, or used to condition soil.

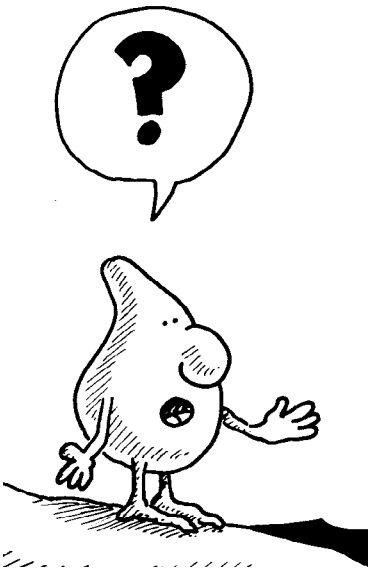
Processed wastewater is called **effluent** or "greywater." It is disinfected, tested, and returned to rivers and streams where the cycle begins again.



One example of wastewater treatment

You would not want to drink this processed wastewater right away. But by the time it comes gushing out of your taps again it has been given one more thorough cleansing back at the water purification plant. Remember, don't get the two treatment plants mixed up!

As a human race, we haven't looked after water very well. You've seen how we have spoiled the pristine quality of many lakes and rivers, and you know we would not be very healthy if we had to drink water straight from the lakes or rivers on our doorsteps. Fortunately, this is not the case. Our own water cycle (water purification and sewage treatment plants) helps keep us free from diseases which trouble developing countries.



TOPIC 3. CLEAN WATER — LIFE DEPENDS ON IT!

3(C): How Is Water Treated?

Activity 1 — Social Studies

One of the best field trips some of us have been on hasn't really been to a field. Quite the contrary. It has been to a sewage treatment plant. Ask your teacher if you can arrange a tour to such a plant or to a water purification plant.

Plan your trip. Review any information you can find about these plants. Prepare questions in advance so that you can learn what it is you wish to know.

For example, how many kilometres of sewer pipes or water mains service the area where you live? How much does it cost? Find out about the taxes charged to individual houses. How many people work in a plant? What do they do?

In many cities the water mains or **infrastructures** are getting old and worn out. The costs are high to replace these pipes. Is this the case where you live?

What about lead pipes? Are these being used where you live? Why? Why shouldn't they be used?

Contact the proper authorities. If a field trip is not possible, invite a speaker to visit your class. You will probably find that most water supply agencies are very eager to talk about these issues as they are becoming serious problems in many areas in Canada.

Activity 2 — Environmental Studies

In Ocala, Florida, the municipality has a great use for its "greywater," which is water that has gone through a treatment but is not good enough for humans to drink. The city officials there just direct this water to their municipal golf course where it is used to water the greens and the fairways.

Is there a similar program where you live? Could there be? Is this a good use of processed water?

Check to see if some industries reuse water within their complexes before releasing it to the sewage treatment plant.

Think about it. Do we really need to use "fresh water" from our water purification plants to water our lawns, wash our cars, and flush our toilets? Can't we use greywater? How much would this save in tax dollars?

Activity 3 — Language Arts

You would be surprised at the number of cities and communities in Canada which dump untreated wastewater straight into the harbour or nearest body of water. It's not a pretty sight. In Great Britain, for example, where many beaches on the ocean are becoming too polluted to swim in because of untreated waste, one solution was to build longer sewer pipes and dump the waste farther out at sea! What do you think of that solution?

Research to find out where in Canada untreated waste is dumped directly into the ocean or nearest body of water. Write about it. Find out why these places do not have sewage treatment plants. In one Canadian city, everybody wants such a plant but nobody wants it near them. This is called NIMBY, an acronym for "Not in my back yard," or GOOMBY, "Get out of my back yard."

Become a community activist. Write a letter to your municipality or newspaper about NIMBYs or GOOMBYs in your region.

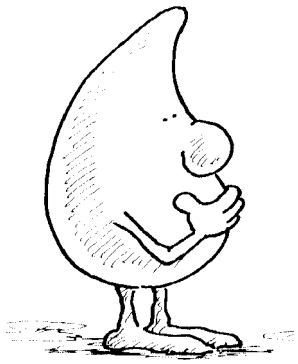
Think up your own acronym for people who do not want to become good environmental citizens.

Option: Imagine that you are a river flowing through one of those communities. Write a short story or a couple of paragraphs describing how it feels to you to have all this junk dumped in the middle. Be imaginative!

Think about some questions you would like to ask those people who continue to allow the dumping of raw sewage into water bodies.

Activity 4 — Science

Research to discover why old-fashioned lead pipes are a problem. What damage have they caused? What can be done about them? What can they be replaced with? What kinds of pipes service your community?

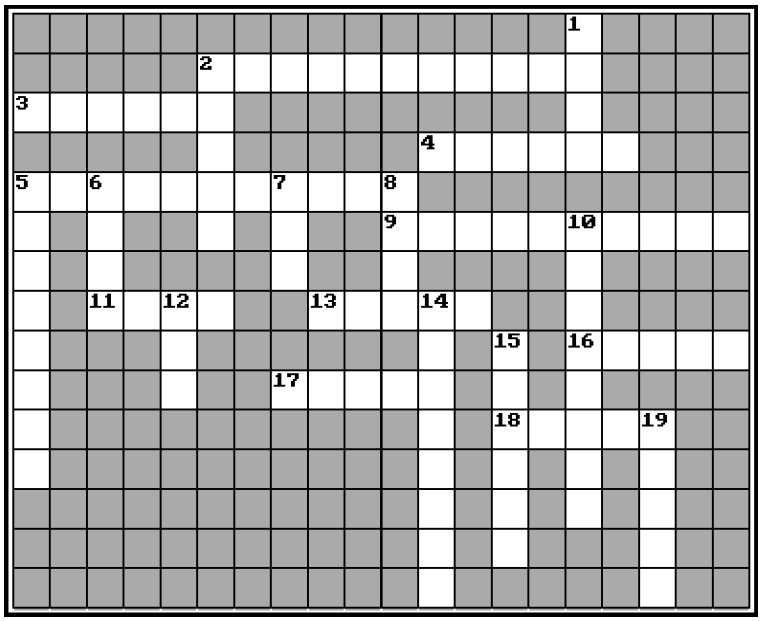


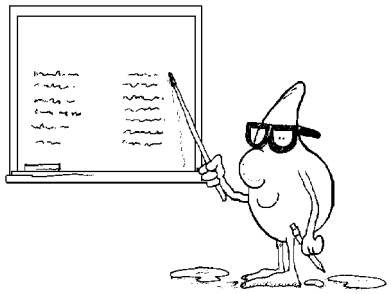
Activity 5 — Environmental Studies, Art

Trace your own community water cycle. If you are like most people, you have no idea of the route water takes to get to your house and the route wastewater takes when it leaves your house and goes to the treatment plant.

Find out from your local water works department and draw your own diagram showing the class where water comes from and where wastes go.

TEST 2
Crossword Puzzle





Across

2. Another word for pollute.
3. We need to __ our water before we drink it.
4. A person swallows water or __ it.
5. A step in water treatment where particles in water cling together.
9. Method by which farmers water their crops.
11. Name for pipe that carries water to your home.
13. Lake Huron is one of the __ Lakes.
16. Water leaves the house by going down the _ _.
17. Pipes that carry wastewater from your home.
18. Our water is usually purified in a treatment _.

Down

1. A __ in your pipes wastes water.
2. The hydrologic or water __.
5. Chemical element used in water purification.
6. A chemical added in water treatment to help particles cling together.
7. When we need water, we turn on the __.
8. Canada has _____ percent of the world's freshwater supply.
10. Rainwater contaminated by pollution from industry (two words).
12. Frozen water.
14. Process where oxygen is added to water in a treatment plant.
15. In many rural areas, wastewater goes into _ tanks.
19. A chemical substance which can harm organisms.

True or False

T F 1. On the prairies, pulp and paper industries use the most water.

T F 2. Another name for wastewater is sewage.

T F 3. Once wastewater is treated, it is released into rivers and streams.

T F 4. Water is purified for our drinking purposes at a sewage treatment plant.

T F 5. All Canadian households have their own septic tanks.

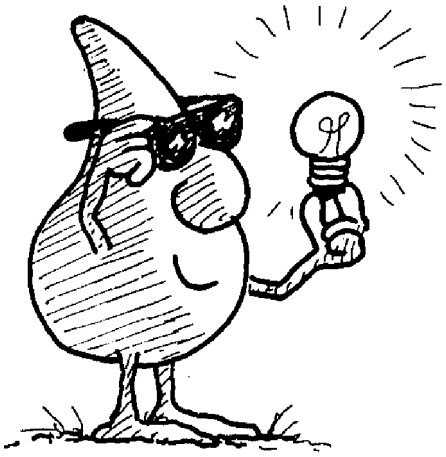
T F 6. All wastewater in Canada is treated before it is released back into nature.

T F 7. Rainwater stands at 0 on the pH scale.

T F 8. Acid rain falling in Canada comes from Canadian andAmerican industries.

T F 9. Effluent and greywater mean the same thing.

T F 10. Oxygen is added to water in a treatment plant during the sedimentation stage.

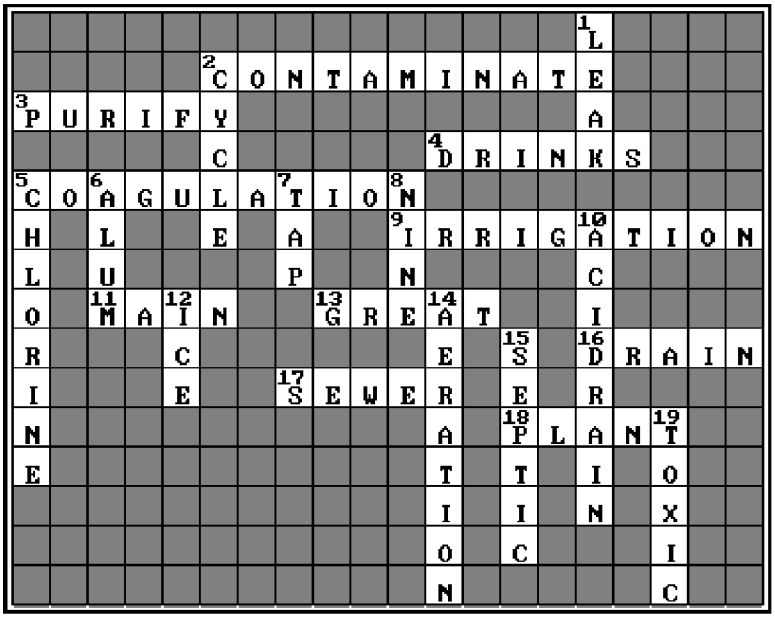


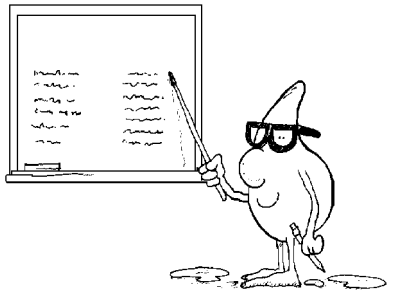
Match the Meanings

Show that you understand what happens in water purification and sewage treatment plants.

1.	coagulation	( )	impurities percolate through layers of sand, charcoal and gravel
2.	sedimentation	( )	what is left behind after wastewater is treated
3.	filtration	( )	purifying chemicals are added to waterbefore it goes to your home
4.	aeration	( )	alum is added to the water causing dirt and other particles to stick together
5.	sludge	( )	water is sprayed into the air where it mixes with oxygen
6.	primary treatment	( )	impurities settle to the bottom of the tank
7.	chlorination	( )	stage at which solids are separated from liquids in wastewater treatment

TEST 2
Crossword Puzzle





True or False

1. False. On the prairies, irrigation uses the most water.
2. True. Another name for wastewater is sewage.
3. True. Once wastewater is treated, it is released into rivers and streams.
4. False. Water is purified for our drinking purposes at a water purification plant.
5. False. Most Canadian households do not have their own septic tanks.
6. False. Some wastewater in Canada is not treated before it is released back into nature.
7. False. Rainwater stands at 5.5 on the pH scale.
8. True. Acid rain falling in Canada comes from Canadian and American industries.
9. True. Effluent and greywater mean the same thing.
10. False. Oxygen is added to water in a treatment plant during the aeration stage.

Match the Meanings

1.	coagulation	(3)	impurities percolate through layers of sand, charcoal and gravel
2.	sedimentation	(5)	what is left behind after wastewater is treated
3.	filtration	(7)	purifying chemicals are added to waterbefore it goes to your home
4.	aeration	(1)	alum is added to the water causing dirt and other particles to stick together
5.	sludge	(4)	water is sprayed into the air where it mixes with oxygen
6.	primary treatment	(2)	impurities settle to the bottom of the tank
7.	chlorination	(6)	stage at which solids are separated from liquids in wastewater treatment