

Topic 6 – Water Quality and Management (pgs. 448 – 468)

What Determines Water Quality?

Water contains **dissolved solids** (salts such as sodium, calcium and magnesium). If it contains a lot of calcium and magnesium it is called **hard water**, whereas **soft water** contains less. Hard water can cause *scaly deposits* in pipes, fixtures and appliances.

Other factors that can affect water quality include: organisms, chemicals and sediments. When changes occur in the environment, the water supply can be affected. The quality can change when natural events or human activities affect what is being added or taken from the water.

The presence of different substances (**toxic substances**) that do not normally occur in the water supply, determines how people will use it.

Water and People

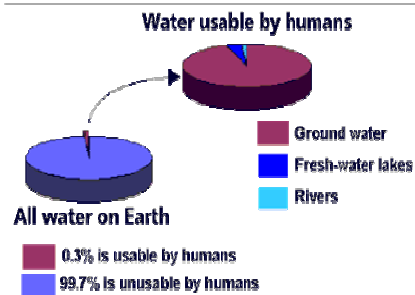
Water is recycled around the world through the **water cycle**. This doesn't mean that any one area will always have the same amount of water. In fact, it means just the opposite. No one area can expect the same amount of water year after year. This is because of other **natural cycles** and **human intervention** (use) that can cause changes to occur. People are part of the water cycle.

How we use water determines the substances that are added to it when it is returned.

There are **direct** (domestic or personal use) and **indirect** (industrial and agricultural) ways that humans use water. Many indirect uses can have negative effects on Earth's water supply, such as:

- Pollution of surface and groundwater
- Depletion of groundwater supply

How much of Earth's water is usable by humans?



There are **benefits** and **costs** to using water. **The Major Uses Of Water**

	Water Use	Direct /Indirect	Benefit (+)	Cost (-)
	Agriculture (irrigation) 73%	indirect	Food Economy Jobs	Soil salinity Decreases vegetation Depletes groundwater supplies
	Industry (coolant, solvent, washing, diluting pollutants) 22%	indirect	Jobs Consumer Products & Services	Pollution contributor Depletes groundwater supplies
	Domestic 5%	direct	Convenience Jobs	Cost

Power stations - can discharge warm water into lakes or rivers (thermal pollution) killing organisms that cannot tolerate the increased temperature.



Runoff - from farmland contains fertilizers that can cause excessive plant growth. It may also contain toxic chemicals (pesticides and herbicides) that can kill living organisms. Runoff - from cities contains large amounts of oil and salt, which can affect plants and animals in the water.

Factories - may add toxic chemicals (which can cause tumors, birth defects, sterility and even death) or, add to the thermal pollution problem.



Habitat destruction takes away the places where animals and plants can live and interact in an aquatic ecosystem.

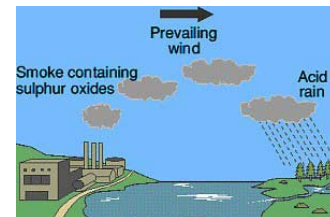
Sewage - contains large amounts of nitrogen, which causes micro-organism populations to increase. These micro-organisms use up the oxygen in the water and many organisms can die as a result.



Oil Spills - from ships transporting oil from place to place can cause harm to plants and animals in, on or near the water.

Acid Precipitation (Acid Rain)

A wide range of species depends on the quality of water for survival. Some species can tolerate certain changes because those changes are within their **range of tolerance**. Other species may have a very different range of tolerance to certain conditions, like increased **pH level** and will not be able to survive when the water quality changes. Not only the species that cannot tolerate an increased **acid level** dies, but also those species which depend on that species for survival (in the food chain) will also perish.

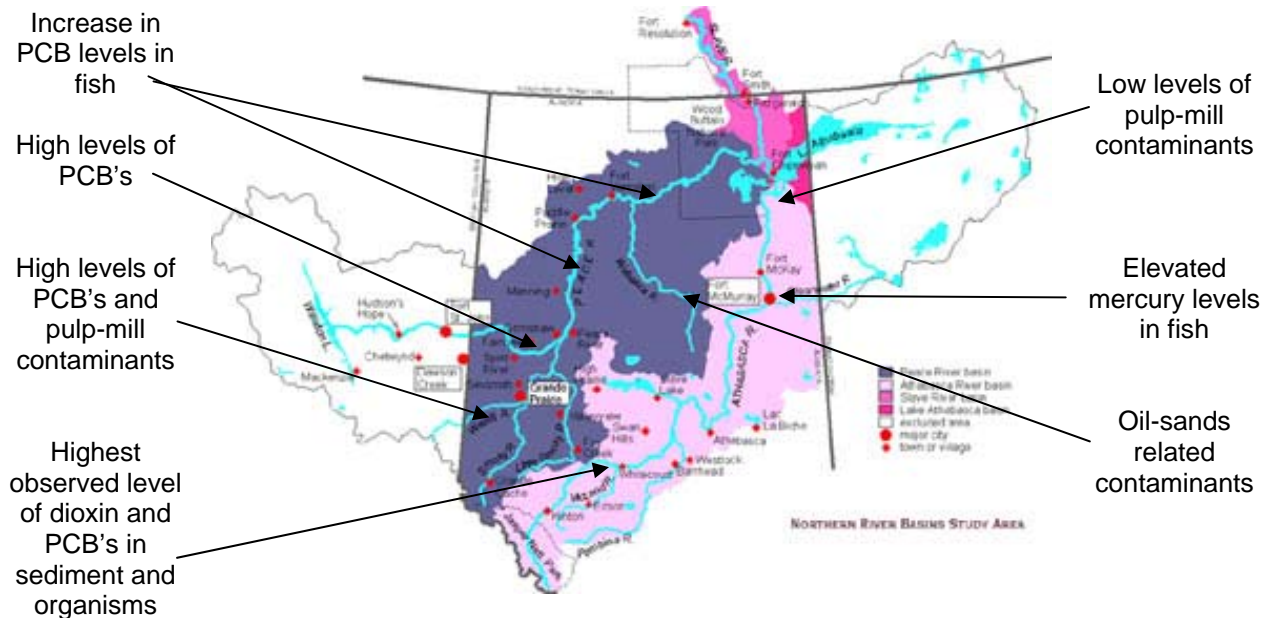


Measuring Water Quality

Besides the pH level of the water there are other indicators, or variables that determine the quality of the water. The table lists some below ...

Basic properties	Solids	Acidity	Nutrients	Toxic substances	Organisms
temperature rate of flow oxygen level colour odour	sediments turbidity	pH	phosphorus nitrogen dissolved solids	heavy metals chemicals	bacteria plants animal species

Water sampling (like that done in the *Northern River Basin Study*) has given scientists evidence that toxic substances are in our water supply – in large and small doses.



Organisms In Water

The diversity of aquatic organisms in a water system helps to indicate the quality of the water. The level of dissolved oxygen will determine which species will be able to survive and, which ones will perish. High levels of dissolved oxygen would likely see a vast diversity of aquatic organisms. However, not all of these species are positive indicators, because some micro-organisms can cause disease and death.

Bioindicator Species

Organisms that are affected by changes in the environment or in the quality of the water help us to identify what is positive and negative. These organisms are called **bioindicator species** because they can tell scientists how different environmental factors can influence normal growth and development of a species.

The **River Watch Web Site** helps to identify many of these bioindicator species for flowing streams and rivers. http://www.riverwatch.ab.ca/how_to_monitor/macroinvertebrates.cfm

Monitoring Water Quality

One way to help guard against problems with water quality is to monitor the water supply. To **monitor** means to observe, check, or keep track of something for a specific purpose. Town and city water supplies have to be monitored on a regular basis to ensure that the quality of the water remains high.

Ongoing Monitoring

Ongoing monitoring of a site helps scientists observe change. The information they gather is then interpreted and suggestions are made to help the ecosystem recover. This can be through regulations to limit human activities in this ecosystem or develop technologies, which can address the problem and protect the environment. The studies they undertake are long-term and all encompassing, so that as many of the interactions as possible that are affected, will be addressed.



Water technicians (freshwater biologists) regularly measure the level of chemicals in the water and the numbers and kinds of different species of organisms. They also make observations on how it looks and smells. In this way they can identify potential problems in the water supply and adjust the treatment of the water to eliminate them. Research scientists use monitoring techniques (evidence of toxins in the water and living organisms) to help them develop technologies to help protect the environment.

Guidelines are established by many different levels of government to monitor the 'safe' levels of substances that can be added to the water system. Water quality standards are set for ...

- Drinking water for people
- Protection of organisms living in or near water
- Drinking water for livestock
- Irrigation of crops
- Recreational uses (swimming, boating, fishing, etc.)

Water Management

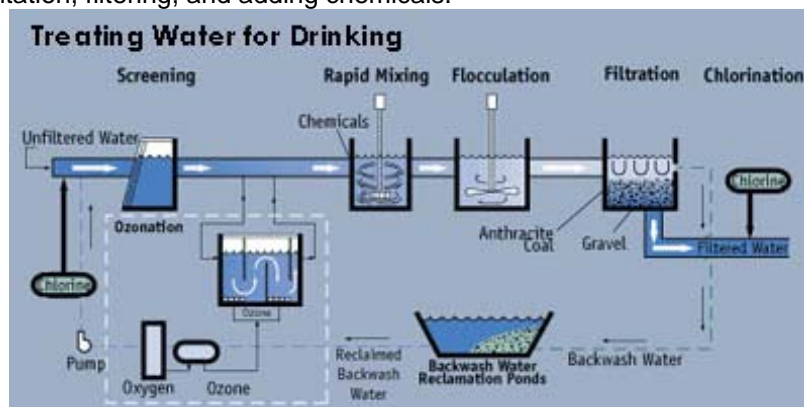
Water systems everywhere need to be monitored and cleaned up if they are causing a problem. The **solutions** to many of the problems may already be available, or new technologies should be developed to address the concern. Most importantly **people must work together to solve the problems**, because our water supply is our life source and without it, we will all perish. Maintaining a reliable and safe water supply is called **water management**.

Water for Life – Alberta's Water Management Strategy

<http://www.waterforlife.gov.ab.ca/>

Purifying Water

As you saw at the beginning of this topic, humans use water in many different ways. To make water safe to drink, or **potable**, for humans it has to be treated. The treatment of water involves screening, mixing, sedimentation, filtering, and adding chemicals.



After water has been used by humans, the solid and liquid waste - **sewage** - , has to be treated again before it goes back into the water system as **effluent**. In rural areas an underground treatment system for this sewage involves using a **septic tank**.

Sustaining Water Resources

Three additional processes are used to increase the potable water supplies in different parts of the world. **Desalination** (removing salt from water) **Distillation** and **Reverse Osmosis**. We all have an impact on the water supply – responsible use of water will help to sustain this valuable resource.