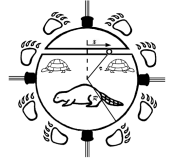




THE ENVIRONMENT

Worksheet 3

A worksheet produced by the Native Access to Engineering Programme



What is the environment?

According to Webster's Dictionary the environment is:

1: the totality of surrounding conditions

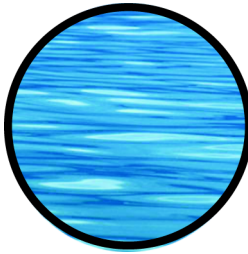
2: the area in which something exists or lives

The environment is

the soil,



the water,



the air,



the plants,



the animals,



and how they interact

In fact, the environment consists of anything and everything which surrounds us and has a potential effect on our being. That makes it a very large and complex subject. It becomes even larger and more complex when you consider that we are not only in the environment, but that we, ourselves, are a part of it. So, not only does the environment affect us, we affect the environment.

Aboriginal people and the Environment

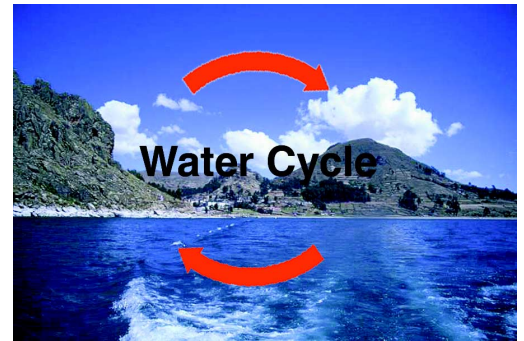


The fundamental capacity for a culture to survive is directly related to its relationship with the Earth. A culture which abandons the Earth, abandons itself and its future.

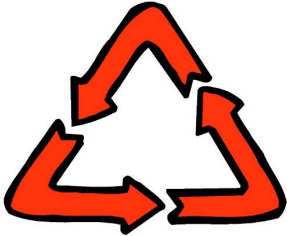
Aboriginal peoples all over the world share the belief that the Earth is our mother; that we are a part of the Earth and the Earth is a part of us. This belief has led to a deep and respectful relationship between Aboriginal peoples and the planet. Traditional practices in all areas of life, including hunting, fishing, agriculture and community management, account for this relationship. Aboriginal peoples have a long history of what could be called environmental science and engineering and a huge potential to contribute to the future.

Cycles

Cycles are a large part of how the environment works. They take into account how different elements of the environment interact with or affect each other. One of the most important cycles is the water cycle.



What happens to lakes, rivers, plants, soil and animals if pollution enters the water cycle?



The symbol of the recycling movement illustrates a cycle. It encourages people to be aware and minimize their negative impact on the environment by reducing the amount of waste they produce and reusing, recycling or recuperating objects they would otherwise throw away

Can you think of ancient Aboriginal practices which were excellent examples of recycling?

Words used to describe the environment

When scientists deal with large and complex subjects, they develop a vocabulary to help them talk about the subject. Scientists and engineers have many words to describe the environment.

Natural and constructed environments

Natural environments are those that exist in nature. Lakes, rivers, forests and the tundra are natural environments.

Constructed environments are made by people. Houses, igloos and schools are constructed environments.



Biodome de Montreal
<http://www.montrealcam.com/en-biodome.html>

Some constructed environments are meant to mimic natural environments. For instance, at Montreal's Biodome a number of different natural environments have been constructed to help preserve endangered species. The penguins in the picture to the left still feel like they are in the Antarctic, but they are really in a building in the middle of Montreal!

What natural and constructed environments can you identify in your community?

Local and the global environments

The **local environment** is the environment of surrounding and nearby areas. It may be the environment around your community.

The **global environment** is much bigger. It may refer to the environment of a country, like Canada, or the environment of the entire planet.



Source: NASA
<http://antwrp.gsfc.nasa.gov/apod/ap950622.html>

Macro- and micro- environments

Macro-environments are very big. The environment surrounding a large lake, like Lake Superior, might be a macro-environment



Micro-environments are very small. The environment inside a beaver dam, might be a micro-environment.



Environments may be described in more than one way.

Can you think of...

- ... a local, constructed environment?
- ... a global, natural environment?
- ... a constructed micro-environment?

What kinds of environment can you identify in your community?

Studying the environment

All sorts of people study and examine the environment - biologists, physicists, meteorologists, hydrologists, geologists, etc.... Engineers who study the environment are called environmental engineers. They study things like how to keep houses warm, how to make factories less polluting, how to remove pollution from toxic sites and how to respond to environmental disasters, like the crash of the Exxon Valdez off the coast of Alaska in 1989.

Think about oil spills. How do they affect the environment?

Recently, environmental engineers and scientists have begun to recognize we need to live with the environment, not just in it. And so, they have started to look at ways we can live in harmony with our environment. This is something Aboriginal peoples have been doing for thousands of years.



This environmental testing chamber is used by engineers at Concordia University. It has two sections so that outdoor conditions can be created on one side, and indoor conditions on the other. This lets engineers test how well walls, windows and doors work in different climates.

The Hohokam

The Hohokam people lived in what is now the south western part of the United States, a very dry and hot area of North America. For more than 1000 years (beginning around 500 AD), they practiced farming in the middle of a desert.

Can you imagine how they did this?



The Hohokam developed a very sophisticated water management system. They engineered a vast and complex irrigation system of canals and dams which brought and stored water near the areas they cultivated. By combining this expertise with land-management practices, the Hohokam were able to raise crops and maintain their canals while not overpopulating any area in their territory.

The Hohokam were able to achieve a sustainable existence in harsh environmental conditions because they had an intimate knowledge and understanding of their land and its rhythms and cycles. The development of this respect for the land was vital - their lives flowed with the water.

In other areas of the world, other Aboriginal peoples living in different conditions also came to an understanding with the land. That relationship continues for many people today, until or unless something happens to the land.

Remediation and Reclamation

One of the things which can interrupt a people's relationship with the land is pollution or scarring of the land. Pollution can come from industrial processes, like those in the pulp and paper industry, but it can also come from something as simple as the garbage we produce in our homes. Scarring of the land may occur during mining or other extraction activities, including forestry. These are human impacts on the environment. Nature can also impact the environment. Storms and fires may scar the land and cause trees and plant life to die creating waste products. Within its natural rhythms and balances, the Earth can heal itself from most natural impacts. Because many human activities do not fall within these rhythms, we have the potential to upset the Earth's balance and can create long-lasting damage.

Environmental engineers study and develop ways in which the environmental impact of human activities can be minimized. They also work on remediation and reclamation projects. Remediation is the process of returning contaminated land or water to its natural state. Reclamation is the process of returning scarred land to its natural state. One of the first things environmental engineers do with pollution problems is look for the source of contamination.

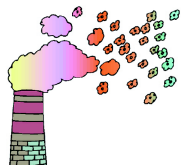
*How would you find a contamination source?
Why would it be important to find the source first?*



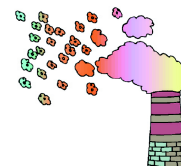
Measuring pollution

Pollution is usually measured in terms of its concentration. Scientists often use the units parts per million (ppm) or parts per billion (ppb) to measure concentrations because they are very versatile measures. For instance, a measurement of 10 ppm of mercury in water means that in every million particles there are 10 particles of mercury and 999,990 of water; it also means that for every million milliliters there are 10 milliliters of mercury, and 999,990 milliliters of water. In other words ppm and ppb measurements provide ratios of the amount of pollutant to a fixed amount of water or soil or air.

Usually, the closer you are to the source of a pollutant, the higher the concentration of it will be. Think about this in terms of smoke coming out of a chimney.



*How does the smoke look near the chimney?
What happens to smoke as it moves further away from the chimney?*



At its source, pollution is very concentrated. As you move further away from the source, the pollution disperses or spreads out and becomes much less concentrated. When you are very far away from the source, you may not be able to detect the pollution at all or only in very small amounts. Still, tiny amounts of many pollutants can remain dangerous.

Environmental engineers try to eliminate or filter out pollution before it enters the environment. When pollutants get outside they are usually much more complicated to clean up. In some cases, however, man-made waste can be eliminated by the Earth itself. For example, carbon dioxide (CO₂), a gas produced by the burning of fossil fuels, is absorbed by plants and some types of water-borne pollution can be absorbed in wetlands like bogs and marshes which act like natural filter systems. Environmental problems occur when we exceed the capacity of these natural systems.



References

Books

1. Houp, Kenneth W. et al. *Reporting Technical Information*, 1996 (Allyn & Bacon Canada, Scarborough), pp. 112-113.

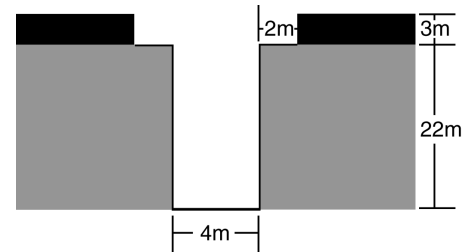
On-line

1. Biodome de Montreal
<http://www.montrealcam.com/en-biodome.html>
2. NASA
<http://antwrp.gsfc.nasa.gov/apod/ap950622.html>
3. Syncrude
<http://www.syncrude.com/5-env/5-01.htm>
<http://www.syncrude.com/5-env/5-03.htm>
4. Techno-Ho-Ho-Kam
<http://www.cudenver.edu/stc-link/weblink/hohokam/technology/techno3.htm>

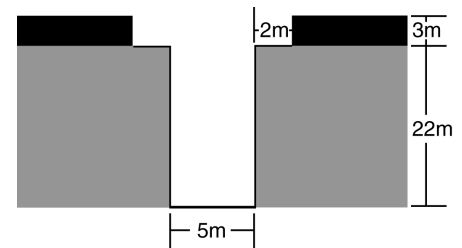
Math Problems

- You are the community's environmental engineer. Your community is leasing land to a mining company which is removing gold ore from the ground. The company knows that here are significant ore deposits in four separate sites around the community. The leasing agreement states that the mining company must return the land at each site to its natural state before beginning excavation at the next site. It is your job to ensure they honor the agreement.

- At site 1, the miners have to dig deep. They move through 3m of soil before hitting bedrock. They then drill through the rock to a depth of 22m. The mine shaft is 4m wide on one side and 5m wide on the other. To make sure the topsoil does not fall into the main mine shaft, soil is excavated to 2m back from each edge of the shaft. How much soil is excavated? How much rock is excavated?
- The miners extract 7m³ of gold ore from the rock they excavated to make the mine shaft and another 20m³ of gold ore from the mine itself. When they are finished at site 1 they no longer have enough rock left to refill the hole. How much rock will they have to buy in order to refill the hole?
- How much grass will be needed to cover the mine, once it is refilled, assuming the land at site 1 was flat?



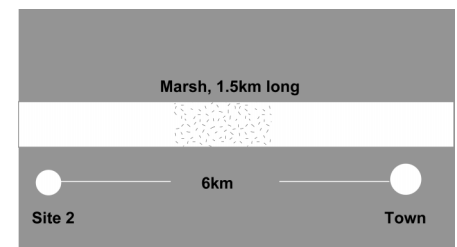
Front view of Site 1



Side view of Site 1

- Your agreement also states that environmental impact is to minimal. Site 2 is 6km from the community and is right near the river from which your community gets drinking water. One day a truck bringing a chemical cleaner to the site blows a tire and spills cleaner into the river. Working together you manage to clear most of it from the river quickly, but tests still show a concentration of 24 ppm at the source.

- 8 ppm is considered a safe concentration for this cleaner. If the concentration decreases by 2 ppm for each kilometer it travels, will the water be safe for drinking at the community?
- Between site 2 and the community there is a marsh. The plants in the marsh will help reduce the amount of cleaner in the water. If the marsh is 1.5 km long and in the marsh the concentration decreases by 5 ppm per kilometer, will the water be safe for drinking at the community?



Site 2

- Your community has a recycling programme. You are in charge of it. You collect newspaper, metal products (tin cans etc....) and plastic. You get paid by the recycling plant for what you collect – 1\$/tonne for paper, 2\$/tonne for metal and 50¢/tonne for plastic – but you have to get it there yourself and it is 60 km away. The money you raise recycling goes to buy supplies for the community school. Two local truckers bid for the contract to haul the recycling to the plant.

Ms. Cree has a 20 tonne truck. She will charge 5\$ for each round trip to the plant. Mr. Loon has a 40 tonne truck. He will charge 10¢/km to take the recycling to the plant. It is 120 km round trip.

The people in your community are regular recyclers. Each week they produce 15 tonnes of paper, 10 tonnes of metal and 5 tonnes of plastic. Who should you award the contract to? How much money will the school get in a year?

