Constructed Wetlands- Nature's Purifier

This activity is part of the **Water Technology** theme

What's the purpose of this activity?

Children will come to understand that there are different methods of treating our waste that don't include expensive facilities or harmful chemicals. Nature has a way of taking care of pollution and waste. They are called wetlands

Key Messages:

- There is concern about over concentration of wells and septic systems within rural communities. The chance of groundwater contamination is high.
- With a little creativity and using the cleansing nature of certain wetland plants, we can design other methods of water purification
- This model is designed to provide an example of what such a community could look like and how it would function.

Materials

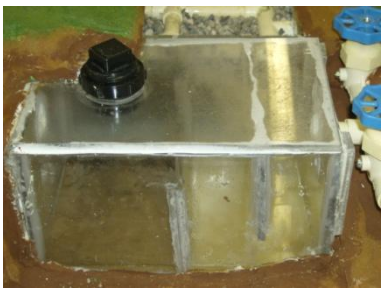
Permanent:

- Model provided
- Wetland plants

Model components

Septic System

The Urban inspired sewer system will be connected to each rural house, connecting them to the communal septic tank



Holding Tank

The septic tank will be the first pre-treatment system. Here, a system of baffles will separate solid waste and oil residues from the cleaner water

Filtration Bed

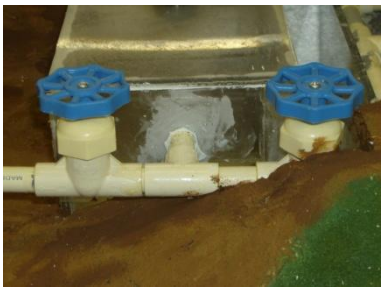
The Substrate Filtration bed is a secondary pre-treatment system, Here, sand and gravel filtration removes much of the residual suspended matter Filtration over activated carbon will help remove residual toxins.

Wetland

Area within system where primary treatment occurs. In this model, the wetland features numerous baffles to increase residence time within the system The wetland body has been split into 2 smaller wetlands in order to increase wetland surface area for maintenance As a design consideration for winter use, there is an included a water level control system to increase insulation during colder seasons.

Outflow Holding Area

The clean water outflow for this system is directly fed into a retention pond. The water from this pond can be used to irrigation or be further treating for human consumption. In Ontario, in order to gain a certificate of approval for a constructed wetland, a class 4 septic system must be constructed as a backup. This model includes a constructed a bypass valve directly after the septic tank to protect the wetland in case of system failure. See below.



Background Information:

A **constructed wetland** is an artificial marsh or swamp, created for different types of discharge such as wastewater, storm water runoff or sewage treatment, and as habitat for wildlife, or for land reclamation after mining or other disturbance. Natural wetlands act as biofilter, removing sediments and pollutants such as heavy metals from the water, and constructed wetlands can be designed to emulate these features.

Vegetation in a wetland provides a substrate (roots, stems, and leaves) upon which microorganisms can grow as they break down

organic materials. This community of microorganisms is known as the periphyton. The periphyton and natural chemical processes are responsible for approximately 90 percent of pollutant removal and waste breakdown. The plants remove about seven to ten percent of pollutants, and act as a carbon source for the microbes when they decay. Different species of aquatic plants have different rates of heavy metal uptake, a consideration for plant selection in a constructed wetland used for water treatment.

Constructed wetlands are of two basic types: subsurface-flow and surface-flow wetlands. Subsurface-flow wetlands can be further classified as horizontal flow and vertical flow constructed wetlands. Subsurface-flow wetlands move effluent (agricultural or mining runoff, tannery or meat processing wastes, wastewater from sewage or storm drains, or other water to be cleansed) through a gravel lavastone or sand medium on which plants are rooted; surface-flow wetlands move effluent above the soil in a planted marsh or swamp, and thus can be supported by a wider variety of soil types including bay mud and other silty clays. In subsurface-flow systems, the effluent may move either horizontally, parallel to the surface, or vertically, from the planted layer down through the substrate and out. Subsurface horizontal-flow wetlands are less hospitable to mosquitoes, whose populations can be a problem in constructed wetlands (carnivorous plants have been used to address this problem). Subsurface-flow systems have the advantage of requiring less land area for water treatment, but are not generally as suitable for wildlife habitat as are surface-flow constructed wetlands. Plantings of reedbeds are popular in European constructed wetlands, and plants such as cattails, sedges, Water Hyacinth and *Pontederia* spp. are used worldwide. Recent research in use of constructed wetlands for subarctic regions has shown that buckbeans and pendant grass are also useful for metals uptake.

How to engage the group.

You may want to ask the group what they think the model represents.
Do the students know where the water goes that is flushed down their toilet or drained from the bathtub?
Point out the different components of the model and the role each one plays in the purification of sewage water.
See if the students can identify the following:

What are the benefits of this system?

- Uses the natural features to purify.
- Eliminates expensive, large facilities
- Small scale project pest suited for rural communities, Water can used for agriculture or community gardens.
- Saves use of other water sources ie. lakes, groundwater.

What are some of the drawbacks?

- How well does it work in the winter?
- Retaining pond could be a hazard if not properly managed
- Could be expensive to build

Have samples of cattail and sedge to help them identify basic wetland plants that have a role in water purification.

Clean Up procedures

Drain model. Store plants for properly for next day other wise compost.