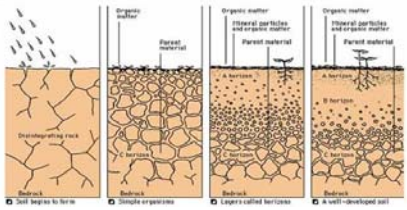
What is Soil?

- Soil is the "skin of the earth."
- Soil is a mixture of minerals, water, air, organic matter, and organisms.
- Soil is capable of supporting plant life and is vital to life on earth.

How does Soil form?



1. The forces of nature break rocks into smaller pieces.
2. These smaller pieces of rock create a place for water to collect and simple plants to grow.
3. The simple plants decay over time and combine with water and other minerals – giving food for microorganisms.
4. The combination of minerals, water, organic matter and small rocks over time create soil.

2

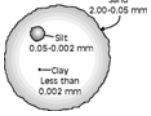
Three types of Soil

SAND

- Sand is largest soil type
- **Sand is low in plant nutrients and does not retain water well**
  - Sand is not great for plant growth
- Sandy soil is a **very good for drainage**

SILT

- Silt is smaller than sand, but larger than clay
- Silt can **hold considerable amounts of water**
- **Silt is the best soil for agriculture**



CLAY

- Clay is the smallest particles
- **Holds the most water**
  - **Sticky when wet but smooth when dry**
  - Clay soil is rich in plant nutrients but is slow to drain

3

Plant Nutrients

Nutrients in soil are food for plants. There are three main nutrients:

- Nitrogen: used by plants for leaf growth and good green color.
- Phosphorous: used by plants to help form new roots, make seeds, fruit and flowers. It's also used by plants to help fight disease.
- Potassium: helps plants make strong stems and keep growing fast. It's also used to help fight disease.

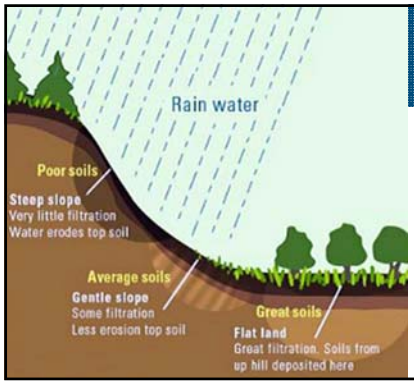
4

Nutrient Replenishment

- Organic waste, such as decomposing material in compost or fallen leaves, return nutrients to the soil
- Certain plants, known as cover crops and fertilizer trees, naturally replenish nutrients
- Humans can use fertilizer to add nutrients to soil
  - Soil tests can tell you if your soil is missing any nutrients

Soil Erosion

Erosion happens when land solids such as mud, rock, and other particles are moved or worn away due to wind, water, ice, movement in response to gravity or living organisms. Specifically, soil erosion is the wearing away of topsoil due to these agents.

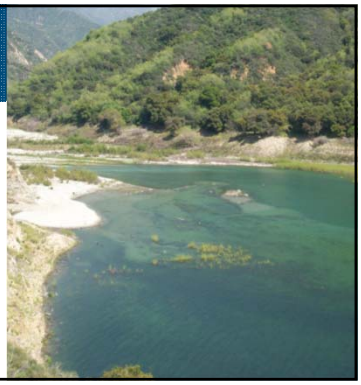


Soil Erosion

Erosion is important because it removes organic, nutrient-rich material from one area and deposits the nutrient material elsewhere.

Soil Erosion

Erosion affects many things. It reduces fertility of soil, meaning plants have a hard time growing. It adds to water pollution, preventing humans and animals from using the water.



Soil Erosion

Erosion is also the cause of many features of the Earth's surface including mountain peaks, valleys, and coastlines.

THREE KINDS OF SOIL EROSION

As water moves over the land surface, collects in little streams, and continues to run down a slope, it tears away soil particles.

As wind moves over the land surface it removes soil particles. As the soil-rich wind moves over land, it damages plants and blast loose more soil particles.

Cutting down forests, building highways and railways without protecting their banks, tramping grass and plants, and overgrazing by livestock increase erosion by wind and water.

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EXAMPLES OF SOIL EROSION

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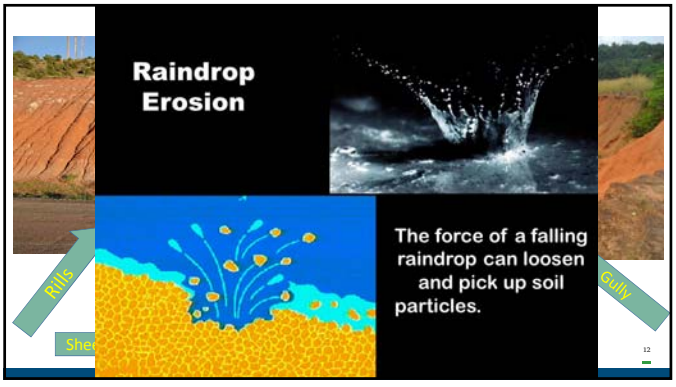

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What is meant by "conservation practices"?

A conservation practice is any specific action or process to care for natural resources so they are protected from damage and improved for certain uses.

Conservation Buffers

Also known as "Buffer Strips"

There are two kinds: 1) Grassed waterways; 2) Windbreaks

- Conservation buffers are a special practice encouraged by the U.S. Department of Agriculture.
- They are areas of land that are kept in permanent vegetation.
- Helps control soil erosion and pollution.
- Breaks up and slows down the movement of sediment and runoff.
- Helps reduce flooding, prevent blowing soil in windy areas, and provide habitat for wildlife.

Grassed waterway: A natural or artificial drainage channel where runoff flows after a storm. The grass helps protect the area from erosion and keeps sediment out of

Windbreak: A specific way of planting trees and shrubs to protect soil from erosion. Trees are usually planted in rows to provide a barrier from the wind

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Working with Vegetation

- Plants and vegetation are great protectors of land surfaces!
- There are many different types of erosion-control practices that are used widely on farms, forestlands, croplands, construction sites, and in gardens.
- Most of these methods involve the use and management of plants (they help hold soil in place).

- ***Contour planting*** is when crops, trees, and other plants are grown on sloping land, rather than uphill or downhill.
- ***Strip-cropping*** is the growing of crops in broad or narrow bands or strips across a field or large garden.
- ***Cover cropping*** is the growing of temporary plants or crops that cover up the soil to protect it from erosion.
- ***Mulching*** is when a thin layer of organic material is applied on the surface of the land to hold soil in place while grass is being grown.

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Working with Wind and Water

Sediments and debris can get into waterways from runoff!

- ***Terracing*** is the construction of ridges of earth that controls water runoff in wet areas, and conserves moisture in dry areas.
- A ***sediment basin*** is a constructed pool formed by putting a dam or barrier across a waterway to trap sediments and keep them out of lakes, reservoirs, and streams.

Winds can be very damaging! Trees and shrubs can be used as ***windbreaks*** to reduce the effects of harsh winds.

There are many benefits of having windbreaks:

- Helps control soil blowing in fields
- Protects homes, buildings, and plants from cold winds during the winter
- Traps snow, which is necessary for farm fields
- Provides food and shelter for wildlife

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Working with Wildlife

- ***Wildlife habitat development*** is an important part of conservation! It includes:
  - Planting trees and other vegetation
  - Creating water supplies
  - Making openings in dense woods
  - Putting limits on the use of a certain area, such as wetlands
- ***Wildlife wetland developments*** help improve an existing habitat, or help create new habitats by:
  - Establishing different plants to provide food, cover, and shelter for wildlife
  - Providing appropriate amounts of water by ditching or diking
  - ***Ditching*** helps drain excess water
  - ***Diking*** protects the wetlands from flooding

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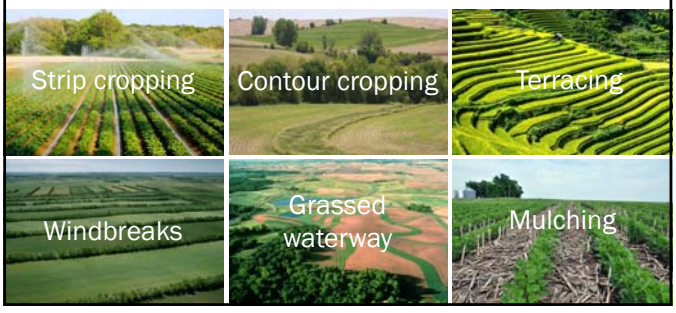
Types of Erosion-Control Practices



What is a watershed?

- The area of land from which water runs off – your own backyard, a vacant lot, or just about anywhere – and travels to a specific stream or outlet.

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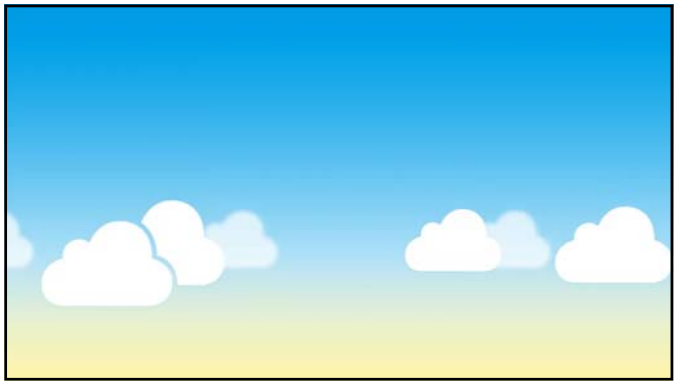
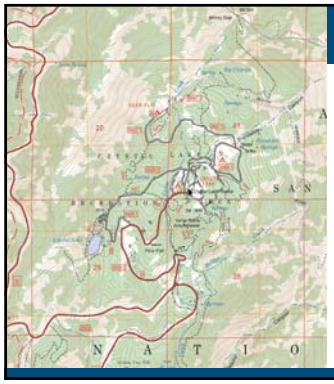
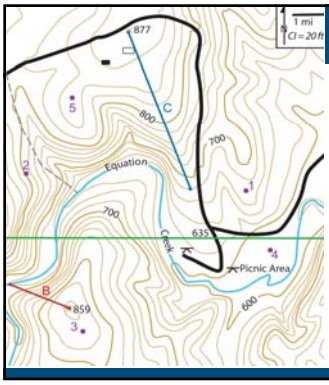




Topographic Map

- Topographic maps are a type of contour map that provides a detailed representation of the natural and man-made features of an area, such as valleys, mountains, rivers, campsites, roads, cities, etc.
- Provides a three-dimensional look at terrain. A relief of the surface of the earth is shown by using contour lines.



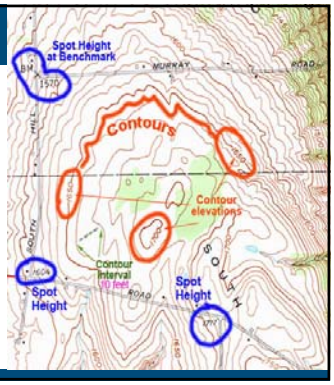
Topographic Map

- Since water always runs downhill, using a topographic map, you can locate the areas of high ground from which water will drain in some kind of pattern to a lower elevation.

Contour Map

- Contour maps are a type of topographic map that shows only natural features by means of contour lines.
- Each contour line represents a single elevation; all points along a contour line are equal in elevation.

** If you walked along such a line on the land, you would always be walking on that same level, never going uphill or downhill.*

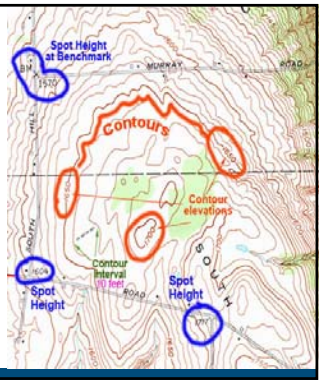


Contour Lines

- Each contour line represents a single elevation; all points along a contour line are equal in elevation.

If you actually walked along such a line on the land, you would always be walking on the level, never going uphill or downhill.

- Contour lines next to each other will represent different elevations.
- The closer the contour lines are to each other, the steeper the slope of the land.



River Basins

- A river basin is an area of land drained by a river and all its large and small tributaries
- All river basins are large watersheds, but not all watersheds can be called river basins – some watersheds are very small and their runoff is collected by a small stream.

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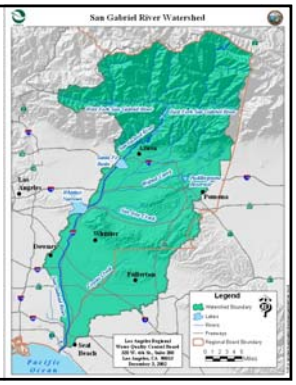
San Gabriel River Watershed



Watershed Community

When poorly or improperly treated waste is released into streams from sewer systems or industry, or allowed to run off carrying sediment and harmful materials into streams, the polluted water is a problem for the entire watershed community.

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Runoff

- Run off doesn't stop at artificial boundaries such as county lines, city limits, or the fence around your yard.
- All the people, plants, and animals are affected by what happens to the water and the land in the watershed; they depend on the watershed and they influence what happens there.
- When runoff from hundreds of small streams enter a larger stream, flooding often occurs.

Flood water runoff from a cane field in the Herbert River catchment northern Queensland

Streambank erosion in the Hagara Sodicha catchment (Ethiopia)

Care of the Land

Watersheds are the healthiest when….

- Land and therefore run-off is unpolluted
- There is plenty of vegetation to bind soils
- Surface water can flow naturally over flood plains and from headwaters to outlets.

Soil conversation practices can help reduce the damaging effects of fire and erosion, but local people must work together to protect their watersheds and resources in them.

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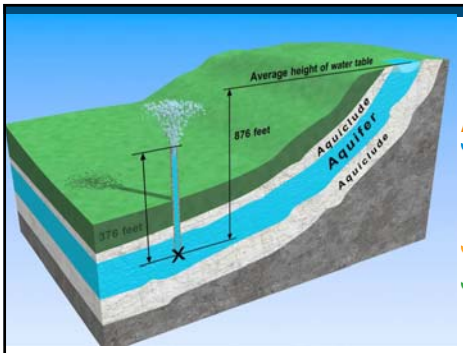

Aquifer

- A body of rock and sediment that's saturated with water is in, around, and through it. It can be made of sand, gravel, sandstone, and carbonated, and miscellaneous rocks.
- Humans rely on aquifers for most of our drinking water.
- If the quality of aquifer's water is compromised and become unusable →so does our water!

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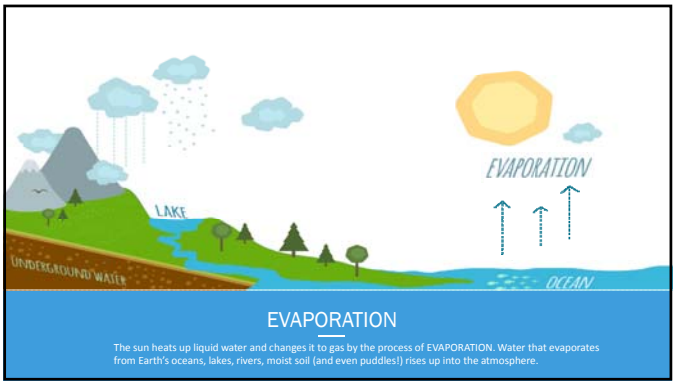
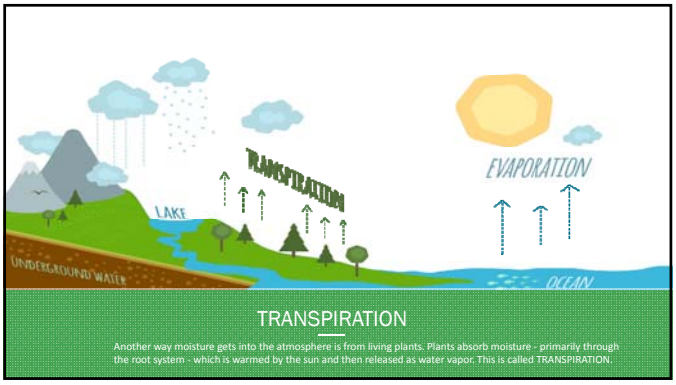
The Water Cycle or, The Hydrologic Cycle

- Did you know that water never actually leaves the Earth? It is constantly being recycled through a process *driven by energy from the sun* called The Water Cycle or, The Hydrologic Cycle.



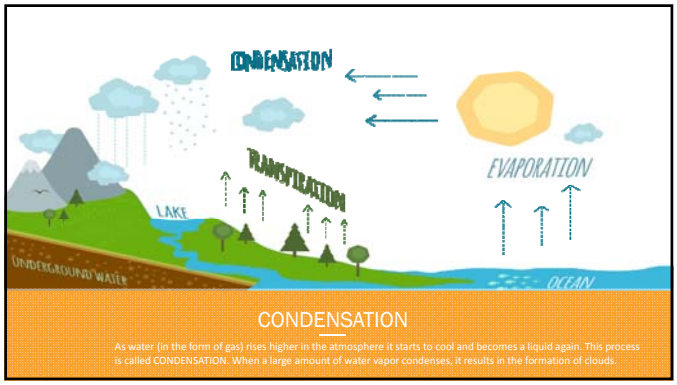
EVAPORATION

The sun heats up liquid water and changes it to gas by the process of EVAPORATION. Water that evaporates from Earth's oceans, lakes, rivers, moist soil (and even puddles!) rises up into the atmosphere.



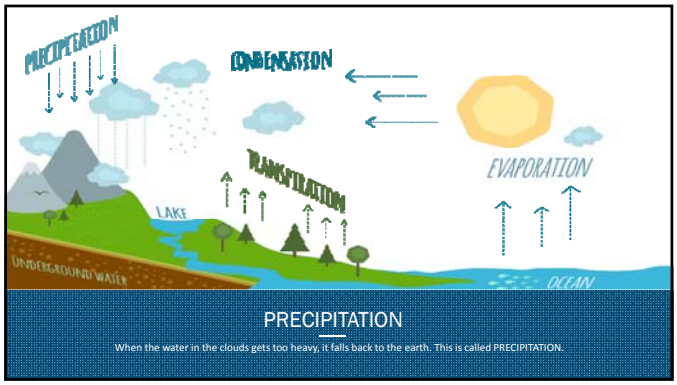
TRANSPIRATION

Another way moisture gets into the atmosphere is from living plants. Plants absorb moisture - primarily through the root system - which is warmed by the sun and then released as water vapor. This is called TRANSPIRATION.



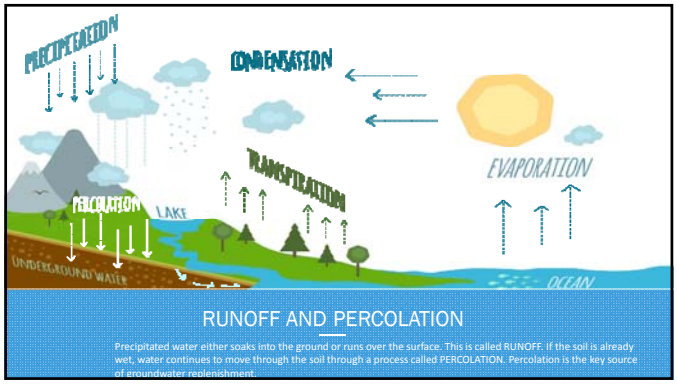
CONDENSATION

As water (in the form of gas) rises higher in the atmosphere it starts to cool and becomes a liquid again. This process is called CONDENSATION. When a large amount of water vapor condenses, it results in the formation of clouds.



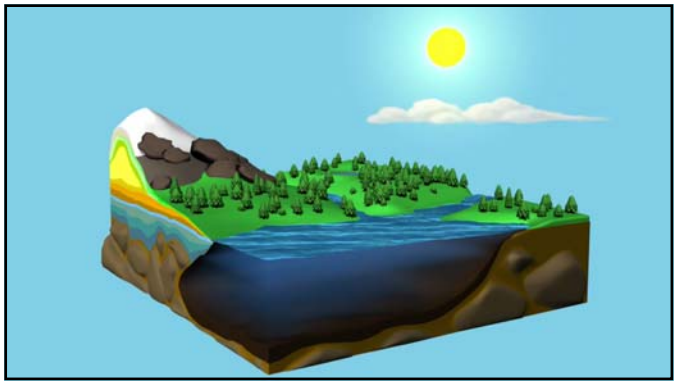
PRECIPITATION

When the water in the clouds gets too heavy, it falls back to the earth. This is called PRECIPITATION.



RUNOFF AND PERCOLATION

Precipitated water either soaks into the ground or runs over the surface. This is called RUNOFF. If the soil is already wet, water continues to move through the soil through a process called PERCOLATION. Percolation is the key source of groundwater replenishment.



Water Pollution

Water is considered *polluted* when it contains anything that makes it ***unfit for a specific purpose (such as drinking or swimming)***

Pollutants are a substance or condition that contaminates air, water, or soil

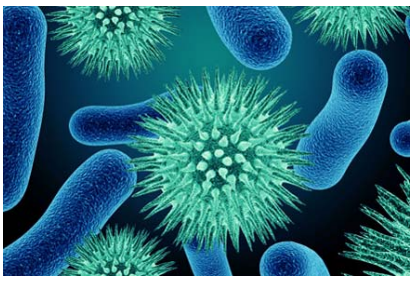
Causes and Effects of Water Pollution

Water Pollution Type: Sediment

- Degrades water quality and blocks waterways preventing use for water storage or recreation
- Destroys habitat for aquatic plants and animals
- Prevent this pollution with soil conservation techniques

Water Pollution Type: Infectious Agents

- Microorganisms and bacteria cause illness in humans and animals, even if only swimming in the polluted water
- Chlorine is used to treat for infectious agents



Water Pollution Types: Organic Chemicals

- Pesticides, herbicides, and petroleum products made by humans – or spilled – are toxic to aquatic plants, animals, and humans
- Careful use of these products is the key to preventing them from getting into the water

Water Pollution Type: Plant Nutrients

- Plant nutrients cause algae blooms, which **disrupt balance of ecosystem**
  - Algae can be toxic to humans and aquatic animals
  - When the algae die, microorganisms work to decompose the algae, **stealing oxygen from other aquatic animals**

Water Pollution Type: Sewage and Organic Waste

- Sewage and organic waste carry infectious agents and plant nutrients, which degrade water quality
- These give water a bad smell and upsets the natural order of a body of water
- Microorganisms work harder to remove organic wastes, consuming available oxygen in water

Water Pollution Type: Salt and Mineral Substances

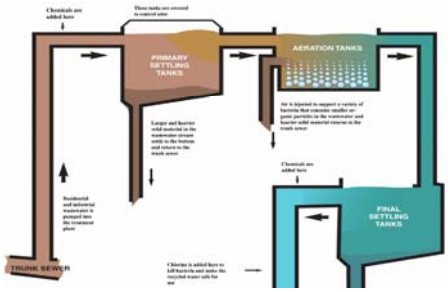
- Too much salt – no human or animal can drink (or live in) it
- Too many mineral substances cause water to turn acidic – killing plants and animals ☹

Water Pollution Types

The easiest way to prevent water pollution is reduce run-off from landscaping, pickup after pets, use as little fertilizer as required, and use green waste bins for landscape clippings. **You are the solution to water pollution!**

Water Recycling Treatment

Removing pollutants from water so it may be reused or released into a body of water.



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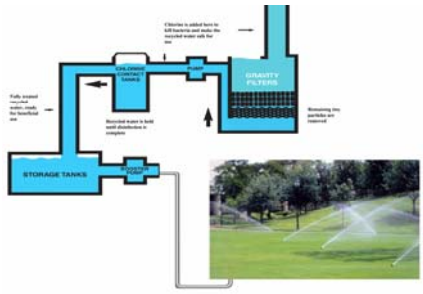
Water Recycling Treatment



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