

Hydrology of the West Campus, SUNY Stony Brook

Andrew Tuomey and Steven Gessler
Summer 1998

[Link here](#) to get a printable double sided brochure of this walk on 8.5 x 14 inch paper.

Some of the images are thumbnails. Click on the images to get a larger image.

INTRODUCTION

This walk follows the path of rain water as it falls on impervious surfaces on campus, enters catch basins, passes through the storm water drainage system, enters a recharge basin (sump) and eventually enters the groundwater system. On Long Island, groundwater is the only source for drinking water. In the natural environment on Long Island about 50% of the rain and snow infiltrates the ground and becomes part of the groundwater. The other 50% is lost to the atmosphere by evaporation or transpiration by plants. In developed areas a large part of the surface is covered by sidewalks, parking lots and buildings. These structures are impervious to water. During development engineers planned and designed storm water runoff systems so water will not collect on the surface and cause flooding.

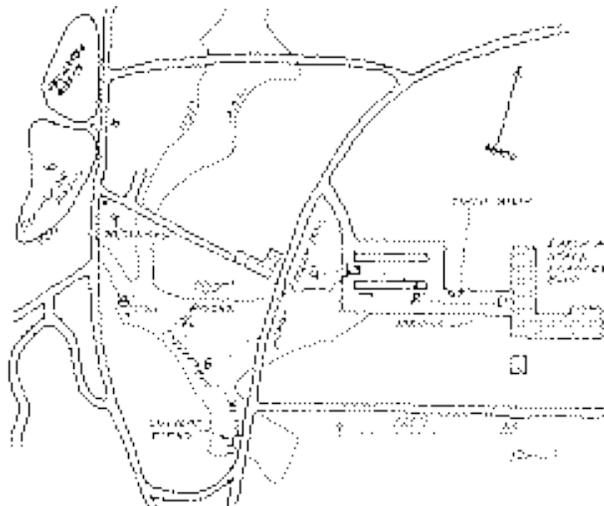
The campus has an intricate network of open bottom catch basins that can drain water directly into the ground, or overflow into the storm water drainage system that ends at the recharge basin. Open bottom basins are effective when rain is light. When rains are heavy water overflows to the next basin or ultimately to the recharge basin. As time goes by, finer sediment clogs the open bottom catch basins and infiltration rates decrease. These finer sediments should be removed periodically to re-establish the recharge rates. Developed areas with storm water drainage systems allow more water to enter the groundwater system than occurs in undeveloped areas.

Besides storm water runoff, this system carries water leaking from the cooling and heating systems on campus.

This walk gives you the opportunity to view the landscape in a different way. Think of the path rain takes as it falls from the sky to the ground, into the groundwater, and eventually to your house where you drink it. As you walk the trail keep your senses open. You are on an adventure! The length of the trail is less than a mile, it should take you approximately 45 minutes to complete.

Discovery Stations

Topographic map of west campus showing location of stops.



Map showing impervious surfaces on west campus in black and buildings from which rain water is sent to storm sewers.



Air photo of west campus

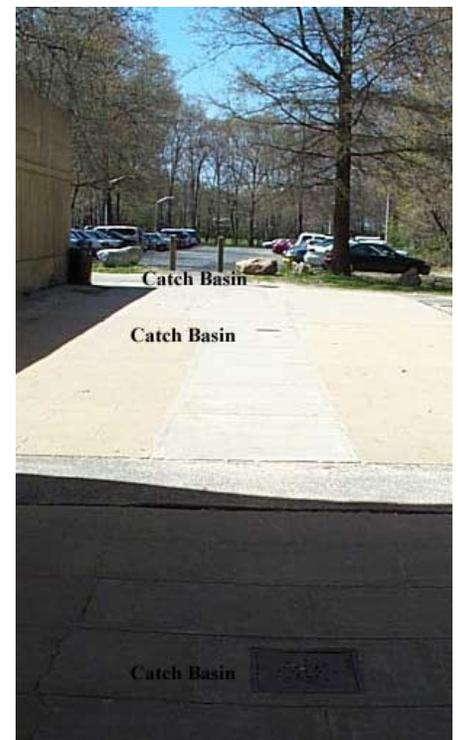


1. Impervious Surfaces & Pervious Surfaces

Locate yourself on the maps. What is the contour interval between each line? What elevation are you standing at? Look at the map on the front cover. Estimate the percentage of campus covered with impervious structures such as buildings and parking lots? Note the catch basins along the walk, what purposes do they serve?



Close up of catch basin at bottom of picture on right. In picture on right the catch basin are in a row and transfer surface water to the storm sewer below the surface.





2. Storm Water System in the parking lot

These manholes and drains are connected to a complex storm water system which drains water from approximately $\frac{1}{2}$ the main campus. Look down into a catch basin and observe what is inside. If the catch basin is full of leaves and fine sediments, can water flow easily into the underlying sediments? When too much fertilizers and pesticides are applied they get transported to the water table.

You may be surprised to know that animals pollute also. Dog waste in the street can be carried by runoff water. Animal waste (human waste also) is high in nitrogen, bacteria and other living organisms that can pollute water. Usually bacteria are removed as water passes through soil

because it acts as a filter.

Do you see any dark stained debris in the catch basin? Some parking spaces have oily stains from cars. Most of the water that falls on this parking lot ends up in a catch basin. Motor oil leaking from a car is a mixture of many different organic compounds and heavy metals. Many are toxic or can cause cancer. Since oil is less dense than water, would you expect oil to be carried into our storm water system and eventually into our groundwater? Remember, its your duty to remind someone if you see them dumping hazardous material on the street or in a parking lot that it will end up in catch basins and ultimately in the water you and they will drink.



Storm water drain from parking lot opening into stream valley shown on right.



3. Entrance to abandoned stream valley

This parking lot is slightly lower in elevation than the surrounding area. In the woods, you can see a storm water drain which feeds the beginning of this stream. The engineers who designed the storm sewer system used the abandoned stream valley as part of the runoff system for storm water. Look at the trees in the area. Where there is water plants thrive. The floor is covered by layers of old leaves, branches, and smaller plants. These small plants help lessen the effects of erosion by slowing the water. When the water velocity decreases, infiltration increases. Small plants and shrubs have extensive root systems. Erosion is reduced because the root systems hold the sediments in place. Most of this forested area contains trees that lose their leaves in Autumn. Trees such

as oaks that shed leaves are called deciduous. Poison Ivy is everywhere and dangerous all year. So be careful. Picture how the vegetation would appear in other seasons. What happens to areas of low elevation when it rains heavily?



4. Abandoned Stream Valley

Here the stream is flowing gently through the valley. The groundwater table is at an elevation of 35 feet above sea level. This location is about 115 feet above sea level. Is groundwater supplying water into this stream or is the stream feeding the groundwater table? Campus engineers installed an asphalt base between the two culvert pipes beneath the stream. Why do you think they did this?



5. Culvert Pipes

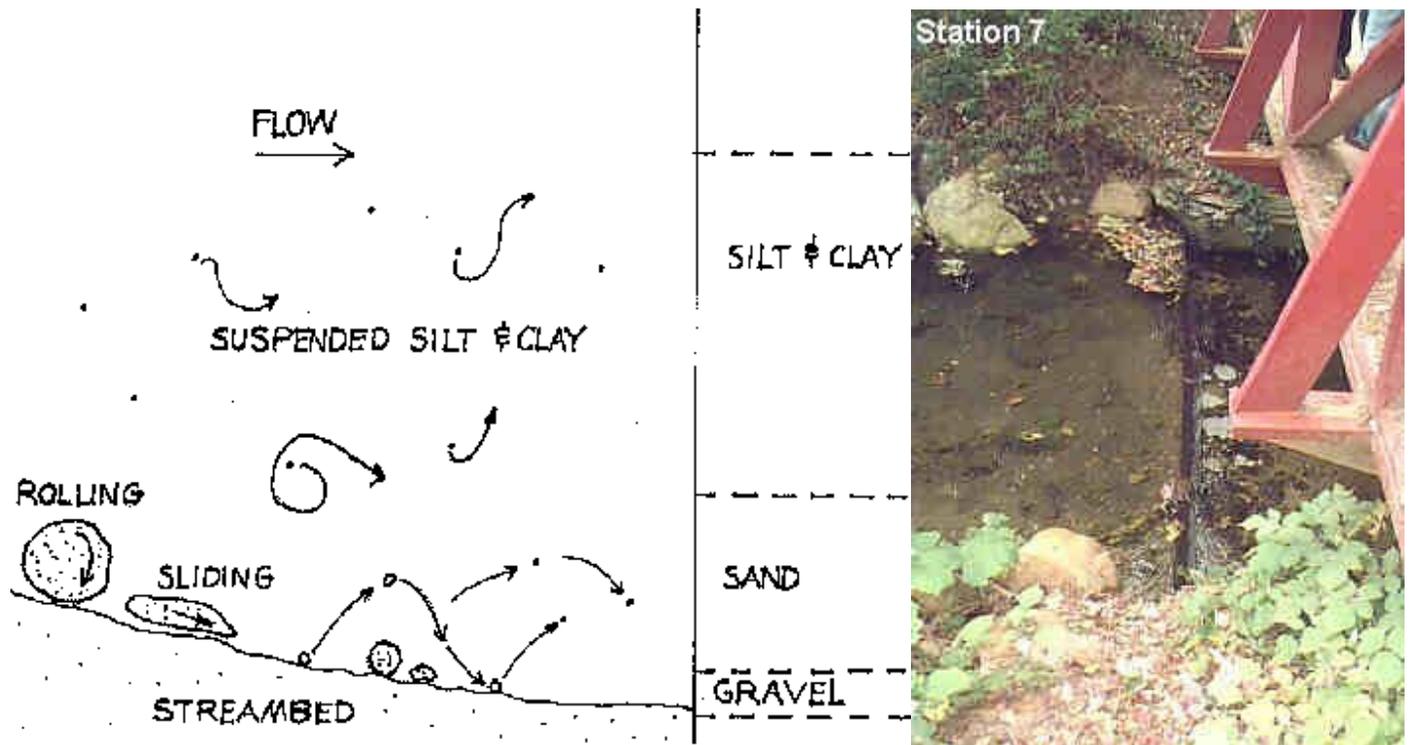
During storms large volumes of water come through these pipes. Long Island groundwater is typically 55° F. The water here is usually warmer than 55° (in warm months) because it was used for cooling facilities. See how the water has cut into the side of the river bed (cut bank) directly in line with the pipes. Across from the cut bank, the river is depositing sediments (bar). At which of these two locations would you expect the velocity of the water to be greatest? Why is water constantly flowing through the pipes even during dry spells?



6. River Bed

Walk down to the river bed. At this site the river bed is dominantly gravel. In the cut bank wind blown silt (loess) overlies windblown sand with intercalated layers of clay which overlies till.



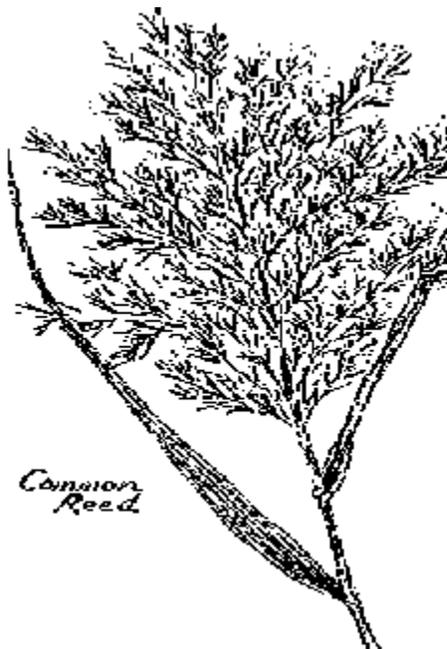


7. Poison Ivy Bridge

Under the bridge the stream bed is wider and the stream velocity is slower than near the waterfall. Notice the height of the stream banks near the outfall as compare to the banks near the bridge. What could explain the differences? Does water velocity increase or decrease as a stream gets wider? Notice a change in the size of the sediments from the culvert pipes to the dam underneath the Poison Ivy Bridge. Based on the diagram shown to the left what size particles would be carried furthest when water flows down stream? What size particles would be left behind?

8. Exposed Till

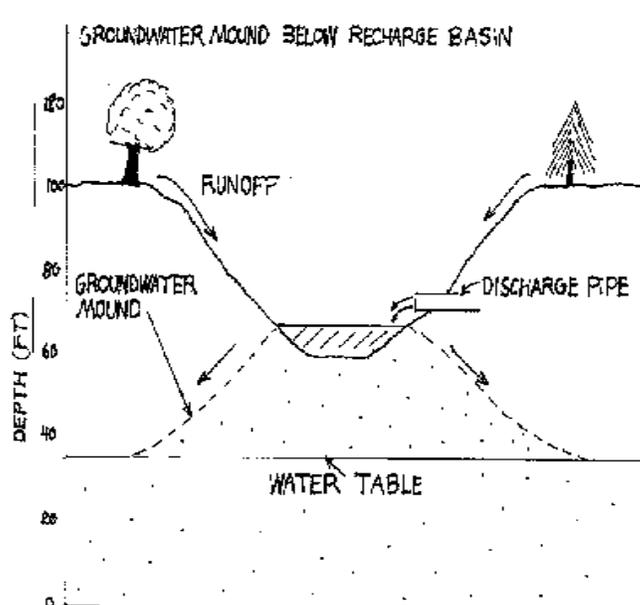
West of the bridge at the top of the rise the exposed sedimentary layer that you are standing on is till. Till layers are common on Long Island and typically are a few feet thick. Till is poorly sorted sediment deposited immediately in front of or at the base of a glacier. It is a mixture of silt, clay, sand, gravel and boulders. Till has low porosity and permeability. Do you think rainwater can easily infiltrate this till layer? Would you expect infiltration to dominate on a flat surface or a steep surface? Where would runoff dominate? How would plants affect infiltration?



9. Wetlands

Welcome to the wetlands. Here the stream is spread over a larger area. This area is a marsh. A marsh contains a variety of small plants, sedges and grasses. Hydrophilic plants are specially suited to survive in soils that are always wet. Cat tails and Phragmites are competing species of hydrophilic plants. There are two varieties of cattail, narrow-leaved and broad-leaved. The narrow-leaved variety is more tolerant of pollution. The cattails here are narrow-leaved. Often wetlands that are polluted have the Common Reed known as Phragmites instead of cattails. What does the presence of cat tails indicate about the quality of the water here? Wetlands act as a giant filter sorbing the pollution in the water that flows through it.

In this setting solid pollutants sink to the bottom of the marsh increasing the clarity of the water. With time more sediments accumulate burying the pollutants. Bacteria in the bottom sediments break down the pollutants to less harmful materials.



10. Recharge Basin

The storm water system is finally connected to these large recharge basins which have been placed in an abandoned stream valley which has been dammed by the Long Island Railroad track. State highway 25A follows this valley to the west. These basins can each hold several million gallons of water. The water slowly infiltrates into the ground. The regional groundwater table is about 35 feet above sea level (if the recharge basins were not here). The elevation of this spot is 100 feet above sea level. The top of the water in the basin is 87 feet above sea level. The deepest part of the basin is 27 feet deep. Due to the large volume of water entering the recharge basin the water surface in the basin is the water table at this particular spot. The recharge basin has created a local recharge mound on the regional water table. Groundwater moves similar to surface water, that is down gradient. Regional groundwater is moving very slowly toward the Long Island Sound.

There are over 2000 recharge basins on Long Island that drain residential and commercial areas, most of which do not hold water. Sometimes recharge basins hold water, but usually they are dry. Why might some basins hold water while others are dry? What type of sediments could be on the floor of the basin that prevents water from escaping the basin? Do you think more water percolates into the ground from the sides of the basin or the bottom of the basin? (Think about where the fine sediments collect.)

Vocabulary

- Recharge-the addition of water to the groundwater system
- Water table-the boundary between soil that is saturated and unsaturated with water.
- Loess-wind blown silt
- Till-sediments deposited by a glacier that are unsorted in size and shape with grain sizes ranging from boulders to clay.
- Sump-a pit in the ground surface for collecting runoff water, recharge basin.

Illustrations by Maria T. Weisenberg of the Museum of Long Island Natural Sciences Stony Brook, New York and Steven Gessler of SUNY Stony Brook.

For more information about the chemistry and the water budget link to:

Michelle E. Pizzulli and Gilbert N. Hanson, 1998, Fate of Nitrogen in a Poned Recharge Basin, Conference on the Geology of Long Island and Metropolitan New York, http://www.geo.sunysb.edu/lig/Conferences/Abstracts99/Pizzulli/Pizzulli_MS.htm