

## Introduction

*O. Crnosija, A. Tuomey and S. Gessler*

Stony Brook University is situated on the Harbor Hill Moraine, formed by the last glacial advance approximately 20,000 years ago. The original soil on campus developed on a loess layer (wind blown silt) a few inches to a few feet thick which usually overlays a till layer several feet thick. This loamy soil supports a deciduous forest.

The soils of the Pine Barrens in the center of Long Island in contrast are sandy, drain rapidly and retain little water. Pitch pine and scrub oak which can tolerate such conditions are able to survive in the Pine Barrens.

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 and transpiration by plants. In developed areas a large part of the surface is covered by sidewalks, streets, parking lots and buildings. These structures are impervious to water. During development engineers designed storm water runoff systems so that water will not collect on the surface and cause flooding.

## 1. Impervious Surfaces & Pervious Surfaces

*A. Tuomey and S. Gessler*

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. With time fine sediment clogs the open bottom catch basins and infiltration rates decrease. These fine 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 drainage system carries cooling water and water from leaks in the cooling and heating systems on campus. Note the catch basins along the walk, what purposes do they serve?

## 2. Storm Water System

*A. Tuomey and S. Gessler*

These manholes and drains are connected to a complex storm water system which drains water from approximately one-half 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 sand because sand 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, if you see someone dumping hazardous material on the street or in a parking lot remind them that it will end up in catch basins and ultimately in the water **you** and **they** will drink.

## 3. Boulders

*W. Pacholic*

Studies of the distribution and sources of rock types, suggest that most boulder size rocks at the base of a glacier travel only some 20 miles before they are destroyed by crushing and abrasion. This does not mean that some boulders did not travel much further. It is just means that if there is a continuous source of boulders in a gla-

ciers path, those boulders that traveled a longer distance make up only a small percentage of the boulders. Also not all boulders travel at the base of the glacier. Some may be placed in the ice above the base and as a result are transported with little crushing or abrasion.

An analysis of boulders on the Stony Brook University campus suggests that while some of these boulders may have traveled some 30 to 40 or even more miles from their source (Pacholik, 1999), many came from the basement rocks underlying Long Island Sound. The closest place that basement rocks would have been exposed during glaciation is about 6 miles to the north under the Long Island Sound. These boulders, found during construction of the buildings on campus, were plucked by glaciers from the bedrock of Long Island Sound and Connecticut and deposited on the Stony Brook Campus.

Rock particles of all sizes are concentrated at the bottom of a glacier. This material is known as till. This densely packed material about a meter or two thick is kept in constant motion at the base of the ice. The rocks are abraded and broken in this grinding machine. As the boulders are transported, their size, shape and degree of roundness change. Our hypothesis is that the least rounded boulders traveled the shortest distance, excepting those that traveled within the glacier ice and not at the base.

## 4. Modified Woodland

*O. Crnosija*

A few years ago the understory, shrub and herb layers were ripped out and the floor was covered with woodchips. As a result there are now many paths across it. The lower layers are now returning and the woodchips have decomposed.

This site represents the effort of University planners to retain managed wooded landscapes adjacent to paved areas. Why do you suppose they stripped out the lower layers of the woodland?

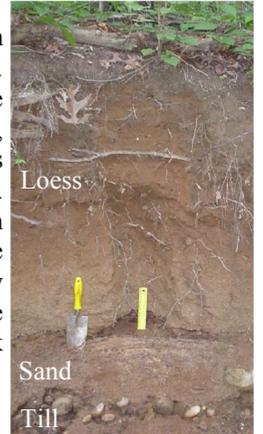
When leaves fall, the litter they create breaks down and returns nutrients back to the soil. The litter consists of a topmost layer of dry leaves, then below the more decomposed older leaves, the humus (rotted leaves and twigs), and finally

mineral soil. Note the color of the soil. Do you see any roots? Long Island's soil is transported—where did it come from? How did it get here?

Earth worms greatly increase the rate of decomposition of litter. Earth worms are not native to Long Island. During the glacial times the ground was permanently frozen which killed off the worms. The worms were first introduced by the colonists who brought potted plants from Europe.

## 5. Exposed Section

The exposed section in the stream valley (Fig. 1) consists of till at the base, overlain by sand, which is overlain by loess which is wind blown silt. This is a rather common sequence found along the North Shore in the Stony Brook Area. Note that the loess is about 1 meter thick here.



## 6. Exposed Till

The exposed section in stream valley is standing on is till. Till (J. Zhong) 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. The till is quite compacted here, probably by the thick layer of glacial ice that was over this area.

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?

How thick is the loess layer here? Why is it thinner? Is the till here at the same elevation as that in the stream valley. If the stream valley formed after glaciation the till would be cut (Fig. 2A). If the valley formed before or during glaciations it would be draped with the till (Fig.

2B). Does the till drape the valley walls?

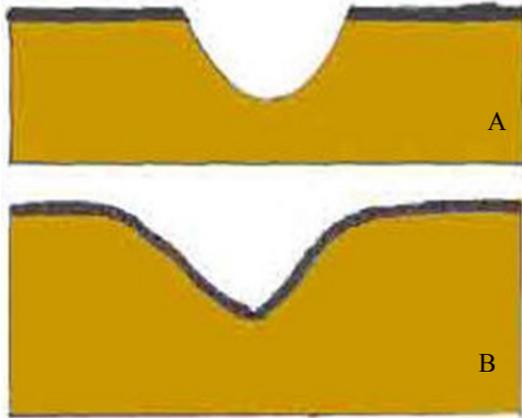


Fig. 2. Cross sections through two stream valleys. The black line is till. A is a valley formed after glaciations. B is a valley formed before or during glaciations. (G.N. Hanson)

### 7. Recharge Basin

A. Tuomey and S. Gessler

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. 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 recharge basin has created a local recharge mound on the regional water table (Fig. 3). 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

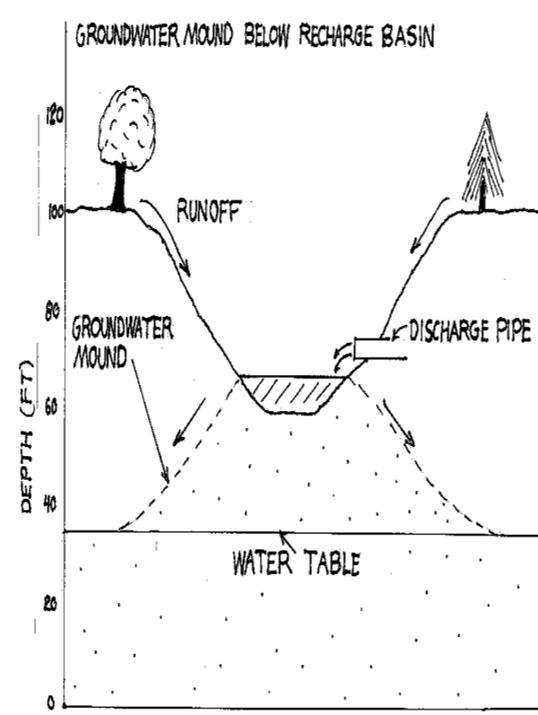


Fig. 3 Cross section showing the recharge basin and the ground water mound under the basin. A. Tuomey and S. Gessler

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.)

### 8. Tunnel Valley

G.N. Hanson

From this point we can look out over the large tunnel valley at the bottom of which is NY State Highway 25A. Locate yourself on the DEM. Imagine that there was hundreds of feet of ice above us and there was a tunnel in the ice with water running uphill eroding the valley.

### 9. The Wall

G.N. Hanson

In front of us is "The Wall." How can you tell that this is not a valley wall? Note that the wall has a surface of till and that there are a large

number of boulders on the wall. The wall was formed by the advancing glacier bulldozing the underlying sediments, pushing them forward as the glacier advanced (Fig. 4A). At some point the glacier then advanced over the deformed sediments (4B). This is shown because basal till can be found overlying the folded and faulted layers in the Ashley Schiff Park Preserve east of here.

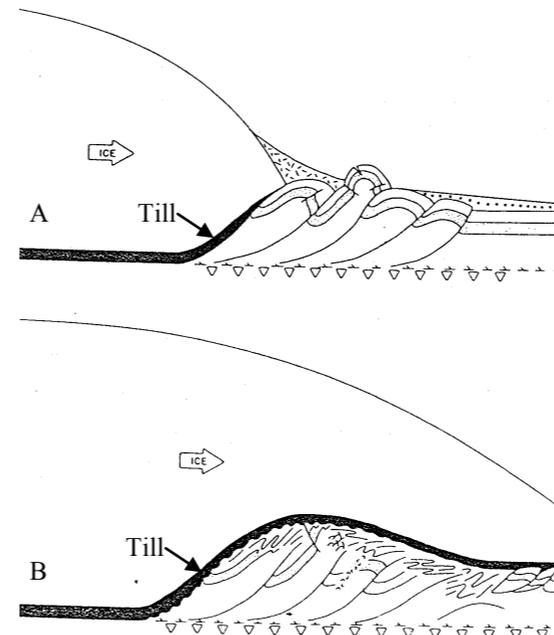


Fig. 4 Glaciotectonic deformation of the underlying strata. In Fig. 4A the glacier is advancing and pushing the underlying strata in front of it. At some stage it is too difficult for the glacier to continue pushing and it takes less energy for the glacier to go up and over the deformed sediments (Fig. 4B). The black line under the glacier is till. (Illustration is from Aber, 1982)

Most of the information in this Science Walk is taken directly from or modified from Science Walks created as part of research projects by earth science education students or earth science teachers. The science walks can be found on the web at [www.geo.sunysb.edu/esp](http://www.geo.sunysb.edu/esp)

## Stony Brook University Campus Geology

