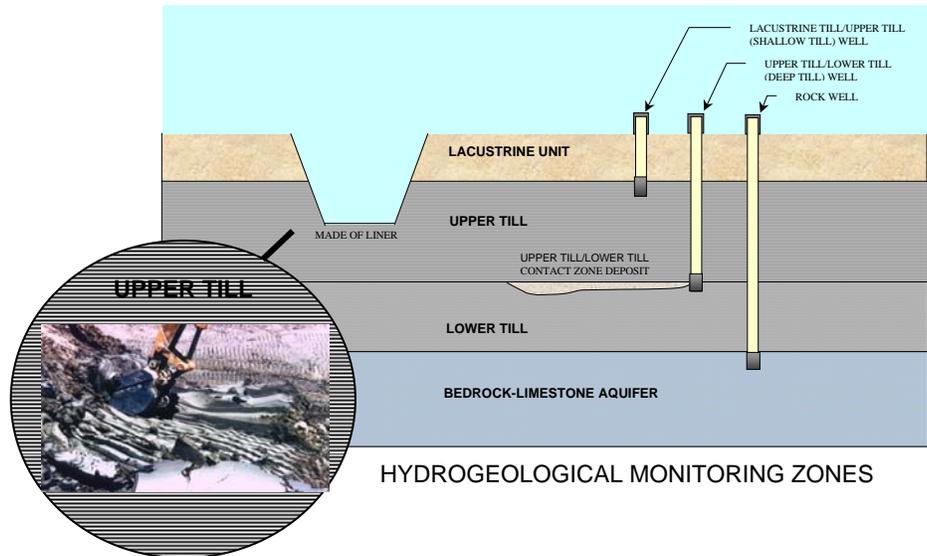


## HYDROGEOLOGICAL CHARACTERISTICS / MONITORING

### Characteristics

ESOI's Groundwater Monitoring Program is a comprehensive plan which ensures the protection of groundwater by providing a method of early detection in the unlikely event a leak were to occur at the facility. The program involves the following areas: Hydrogeologic investigation, sampling, laboratory analysis, quality assurance/quality control, statistical analysis and regulatory review.

ESOI monitors three hydrogeologic zones at the facility. These include the contact between the lacustrine clays and the Upper Wisconsin Till, the contact between the Upper Wisconsin Till and the Lower Wisconsin Till, and the bedrock aquifer underlying the site. The Lacustrine material, deposited in the deep, quiet water of post glacial lakes covering the area, is 10-20 feet thick with hydraulic conductivity ranging from  $2.0 \times 10^{-7}$  cm/sec to  $3.8 \times 10^{-8}$  cm/sec, (i.e., water will move through these materials at a rate of 0.4-2.0 feet every 10 years.) The upper till represents a period of several minor glacial advances and retreats. Thickness range from 35 to 50 feet thick and hydraulic conductivities are comparable to the lacustrine sediments. EnviroSAFE has agreed to monitor these deposits despite the fact that this material is over excavated and recompacted with impermeable clay.



HYDROGEOLOGICAL MONITORING ZONES

The lower till lies directly over the bedrock aquifer and is approximately 12 - 30 feet thick with hydraulic conductivity up to  $1.0 \times 10^{-9}$  cm/sec or 1 foot every 1000 years. The lower till contact zone is a unit described in the hydrogeologic studies of the site. This unit may consist of impermeable clay or sometimes more permeable sands. Since this unit is the first deposit capable of yielding small quantities of groundwater beneath the impermeable clay and plastic liners, it was determined that this unit should also be monitored. The purpose of the contact zone wells is to determine if the primary and secondary artificial liners do their job to prevent leaks. If, in the unlikely event that the liners fail, the lower till contact wells will detect any contaminants before they reach the uppermost bedrock aquifer and therefore give time for the appropriate corrective action.

Underlying these "aquitards" is the bedrock aquifer, which is the only unit below the site capable of producing usable amounts of water. The bedrock aquifer consists of Silurian and Devonian age limestones and dolomites. EnviroSAFE samples wells within the bedrock aquifer. All of the studies at the site indicate that the bedrock is the first groundwater aquifer beneath EnviroSAFE capable of yielding significant amounts of water. For an aquifer to be "significant" it must be capable of yielding a reliable and sustainable supply of groundwater. The regulations require that the uppermost aquifer beneath every landfill be monitored. Consequently, EnviroSAFE also monitors this deposit despite the fact that there are two networks of monitoring wells installed at shallower depths.

## Monitoring

A total of 119 wells were installed as part of EnviroSAFE's groundwater monitoring system; 24 wells monitor the bedrock formations, with other monitoring wells installed at the two contact zones discussed above. Each monitoring well is designed individually using either plastic or stainless steel casing. The well installation methods are very specific, and qualified professionals experienced in the techniques of monitoring well installation construct each well. Great care is taken to insure that the materials used for constructing the monitoring wells are free from any external contaminant sources. The ultimate goal for every groundwater monitoring well is to obtain groundwater samples representative of the groundwater at that particular level.



DEEP & SHALLOW TILL WELLS

EnviroSAFE's permit requires EnviroSAFE to monitor the groundwater quality "in perpetuity" which is, in essence, forever. The permit requires special accounts to be set up and funded to cover the costs associated with closing the site. This includes funds set aside to cover the expenses of maintaining and testing the groundwater-monitoring network. The results of all groundwater testing are reported to the regulatory agencies for review.

Groundwater sampling is performed on a semi-annual basis using procedures set forth in ESOI's agency approved "Sampling and Analysis Plan". Sampling is performed by an independent third party sampling team. The samples are analyzed by an independent laboratory for groundwater quality parameters, drinking water quality parameters and various organic constituents. ESOI critically inspects and reviews the laboratory's procedures and its quality control/quality assurance documents to insure high standards of analytical results. The results are then statistically analyzed and compared to background data collected prior to waste disposal. The Ohio EPA regularly inspects the groundwater monitoring program and is provided with an annual report of groundwater activities.

One can easily determine, by comparing the relative depths of the wells along with their respective locations, that the EnviroSAFE facility is monitored by a redundant set of wells, which completely surround the entire facility. With respect to the new area M, the network of wells is even more tightly spaced, and again surrounds the entire area making it nearly impossible for a contaminant to pass the network of monitoring wells undetected.

The final design and location of the monitoring wells has been approved by both the Ohio EPA and the USEPA. The USEPA did an exhaustive review of the monitoring network for the facility in 1986, using a special team designated as the USEPA Groundwater Task Force. This review and subsequent reviews by the USEPA and their outside hydrogeology consultant, affirmed that the existing monitoring network as designed by EnviroSAFE and its consultants, monitors the appropriate deposits beneath the facility. In 1986, the Ohio EPA also hired an outside consultant to review the geology and monitoring system at EnviroSAFE, and the conclusions of their study indicated that the facility was both geologically suitable and maintained an appropriate groundwater monitoring network.

