

### **Monitoring beneath a landfill in vertical wells**

In some situations, the monitoring beneath a landfill or building is preferred in vertical wells. The ability of a propagating liner to travel horizontally and through turns in the piping was used in one situation and is planned for another. The first situation was in a brown field with an existing set of wells. A very large building was to be constructed on the site and it was desired to continue a soil vapor extraction remediation and monitoring of the same wells beneath the building. It was not desirable to have the vertical wells protrude through the floor of the building. In order to obtain water samples and make head measurements beneath the building, horizontal piping was installed in trenches beneath the building which ran from a vault outside the building, through various turns, to a sweep elbow connecting to the vertical wells. FLUTE single sampling port systems were installed in the horizontal piping for distances of several hundred feet. The piping was 3 and 4 inch diameter with sweep elbows in the turns.

In a more recent design, larger horizontal piping is to be installed beneath a landfill as it is being constructed to allow access to vertical wells beneath the landfill with multiple sampling intervals. Details of the horizontal path to vertical wells for monitoring are provided in the white paper [“FLUTE Wells Under Landfills and Buildings”](#) FLUTE has numerical models which predict the driving pressure needed to overcome drag, gravity, and turn angles for tortuous passages of specified geometry and liner assemblies of various characteristics such as weight, length, friction coefficient and diameter of liner. The models have been well tested against actual installations.

These installations are easier than the installations in horizontal drill holes as the hole is being drilled in the [liner augmentation of horizontal drilling](#) used beneath existing landfills.