AN INNOVATIVE APPROACH TO LANDFILL CAPPING

BACKGROUND

When landfills reach their capacity, they are typically covered (i.e., "capped") with layers of impermeable clay or plastic. ARS is investigating an innovative method to cap landfills using a combination of plants and compost to prevent precipitation from entering landfill wastes and forming undesirable leachates. The combination of bioreactive compost, which retains water and provides nutrients for vegetative growth, and vegetation selected for its ability to produce extensive systems that utilize water, achieves the same result of preventing precipitation from entering underlying waters. This 3 year study is designed to demonstrate the effectiveness of a vegetative cap. In addition to potential cost savings, the benefits of using vegetation and compost to cap landfills include:

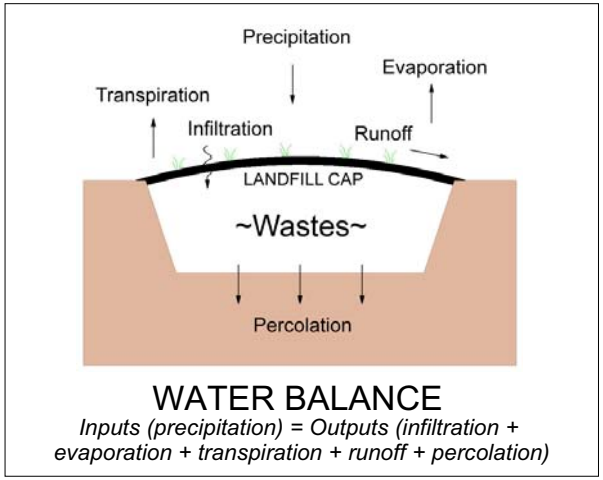
- Minimizes the use of limited resources, such as geo-fabric and clay, while optimizing the use of sustainable resources, such as vegetation and compost.

- Does not require the use of elaborate equipment, maintenance, and monitoring, thereby reducing energy and maintenance costs.

- Increases the potential use of the property for parks or other beneficial uses.

- Enhances natural habitat and ecological environment.

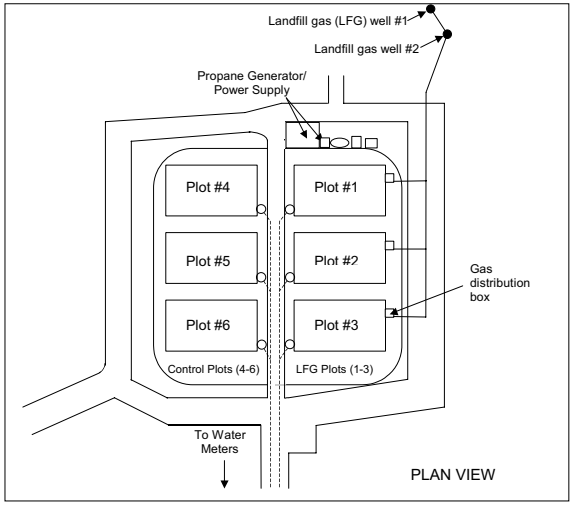
An additional benefit that is being studied is the use of soil microorganisms to sequester methane and carbon dioxide present in the landfill, thereby reducing emissions of these powerful greenhouse gases.



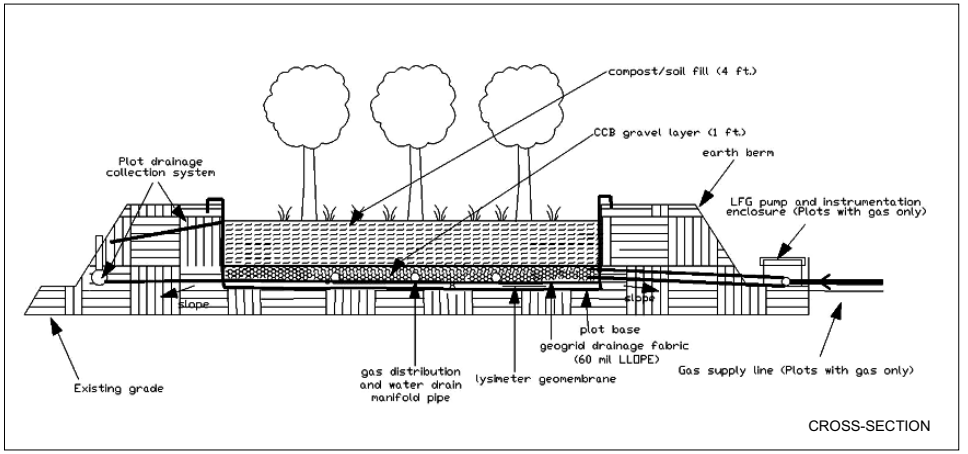
WATER BALANCE

Inputs (precipitation) = Outputs (infiltration + evaporation + transpiration + runoff + percolation)

Landfill capping systems reduce the quantity of water moving into and through underlying wastes. Water movement through the organic waste matrix creates leachate, and can result in contamination of ground water and surface water. The effectiveness of a cap design is based on the classical water balance equation based on the principle of conservation of mass:



Six study plots have been established to simulate a vegetative cap using vegetation (i.e., trees and understory), and varying compost/mulch soil mixtures. Plots are identical in all respects, except for the composition of the compost/mulch substrate, and vegetation. The pilot system will measure the volume of infiltrating precipitation that does not run off or evaporate, or is not captured by soil or transpiration. Landfill gas is piped into the plots to evaluate the extent of carbon sequestration occurring within the plots.



Each study plot consists of a gas distribution plenum (sandy-gravel) covered with a bioreactive layer of landfill cover soil mixed with compost. Lysimeters installed in each study plot are designed to capture infiltrating precipitation. Infiltrating precipitation is conveyed to water meters to measure volumes over time. A sub-base gravel mixture has been spread to form the base of each research plot. Landfill gas distribution piping is embedded into the base mixture.

Compost/soil mixtures have been selected based on laboratory studies that indicate optimum water-holding capacities. Vegetation has been selected for test plots based on their characteristics to maximize water usage. Each bioreactor prototype contains hybrid poplar trees and other mixed tree and plant species.

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