

### INCREASE IN VOLUME OF CONTROLLED LANDFILL LA SPEZIA, ITALY

#### SLOPE REINFORCEMENT IN LANDFILLS

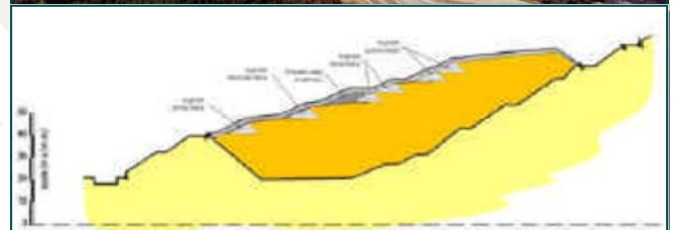
**Product:** Mac Grid WG 06

##### Problem

The landfill, which was designed in 1996 and opened for use in 1998, is located in a small valley and its original configuration provided for an embankment at the foot of the valley to hold a total volume of solid urban waster of 383,100m<sup>3</sup> (excluding provisional cover material, operation berms and final cover system). An expansion of the landfill was planned in 2002 to increase the total volume to 455,000 m<sup>3</sup>. As well as constructing a new area on the upstream side, the expansion planned to raise the berms on the first three levels of the landfill by moving forward and raising the existing downstream embankment.

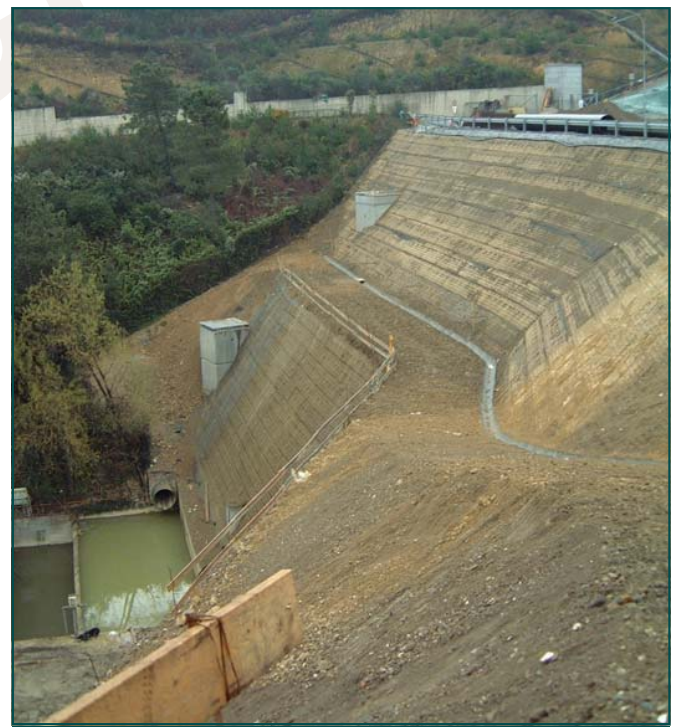
##### Solution

As a result of the extremely limited space available due to the morphology of the valley and the presence of the rainfall collection tank at the foot of the embankment, the embankment was raised by constructing three reinforced soil embankments using MacGrid<sup>®</sup> WG geogrids. The downstream expansion also made it necessary to consolidate the soil at the base of the embankment by means of jet-grouting and to construct a tied-back bulkhead to protect the above-mentioned rainwater collection tank. The raising of the downstream embankment made it necessary to extend the waterproofing to the upstream slope of the reinforced soils, increase the length of the wells for extraction of the leachate next to the existing embankment and move some ancillary facilities located in the service yard. The expansion was completed in the summer of 2004 and the landfill is currently being operated on the downstream side.



Before construction

Date 1998



During construction

Date: April 2004

Client:

ACAM — La Spezia

Designer:

STUDIO GEOTECHNICA ITALIANO (MILAN)

Products used:

MAC GRID WG 06

Date of construction

Autumn 2003—Summer 2004





During construction

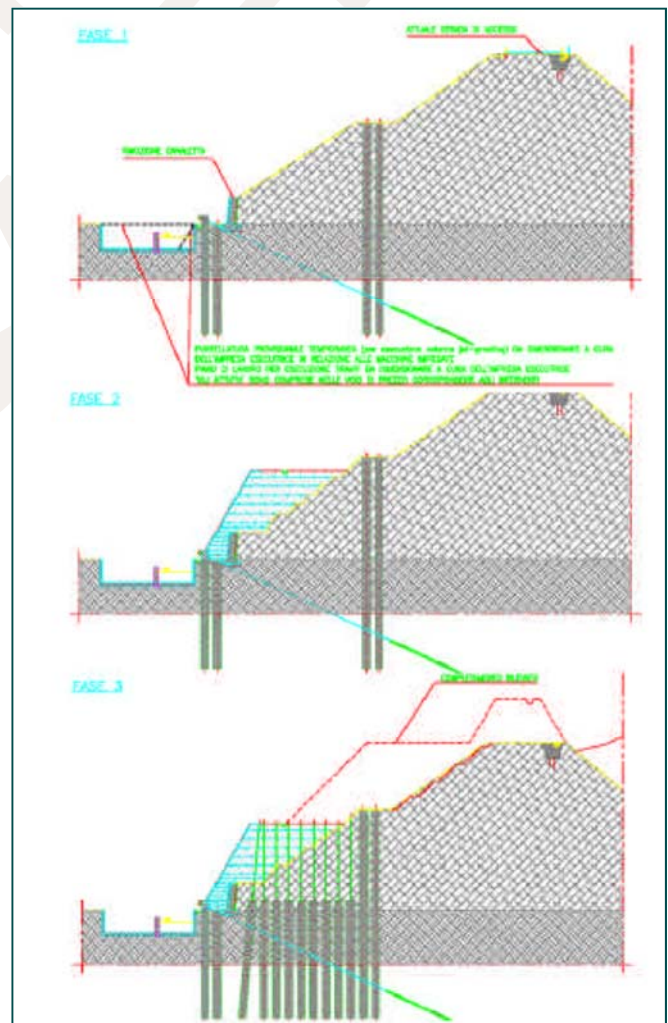
Date April 2004



During construction



During construction (future cell containment wall)



After construction (future cell 2 containment wall)





During construction

Date: November 2003



During construction

Date: November 2003



After construction



Date: April 2004

The two sequences of photos show the two methods used for construction of the reinforced soil structure.

The entire slope downstream of the access road to the landfill and the outer part (i.e. facing the yard) of the upper trapezium-shaped berm were constructed using a system of disposable formwork made from bent weldmesh. The photos show the phases for installation of the formwork and its anchoring as well as the operations for installation of the Mac Grid WG 06 geogrid reinforcement and the Biomac erosion protection mat.

The inner slope of the upper trapezium-shaped berm was, however, made with a reusable formwork system so as not to have any element which was not synthetic, and therefore potentially harmful from the point of view of mechanical damage in contact with the barrier system (in the specific case, a bentonite geocomposite and a high density polyethylene membrane). Construction details of the joint between the existing and new barrier systems are shown in the diagram. It should be noted that, regardless of the construction method used, a regular outer surface of the reinforced soil was guaranteed.

