Project Name
Riverfront Restoration and Stabilization of the Edgeboro Landfill Site

Client
Edgeboro Disposal, Inc.

Services Provided
- Geotechnical investigation, analysis and recommendations for restoration of the riverbank
- Design of stabilization measures for the riverbank

Project Description

Edgeboro Landfill, in East Brunswick, is the largest private landfill in New Jersey. SAI performed a number of projects/services at the site, beginning in 1989. One such project addresses the Raritan River, which borders the landfill on one of its sides. SAI was retained by the Owner to provide design and other services for the riverfront Restoration and Stabilization efforts. Site visits were conducted by SAI in 2004 to assess riverbank conditions during low and high tides. The visits indicated that the current problems related to waste adjacent to the river are caused primarily by the deposition of waste from the landfill as well as floatable debris from off-site sources onto the banks.

Approach

After preliminary site visits, the main design objectives for the proposed remedial activities for the banks of the Raritan River along the Areas 3 and 4 of the Edgeboro Landfill included: riverfront stabilization designed to prevent further erosion and exposure of waste located in these areas, regrading and protection of the steep riverbank surfaces, and removal and disposal of the disturbed waste. Several approaches were presented in different general categories including: self-adjusting armor (riprap blankets), rigid armor, flexible mattresses, flow detention approaches, and vegetative approaches. These possibilities include both traditional engineering approaches that have been used for decades as well as techniques that have been more recently developed.

The main concern from the geotechnical point of view regarding the evaluation of the performance of the riverbank was the stability of the embankment with regard to global and veneer slope failures.

A subsurface investigation was performed including 12 Standard Penetration Test (SPT) borings; eight of the borings were drilled on the top of the river embankment in Area 3 and four borings were drilled in Area 4. The eight borings drilled at Area 3 extended to depths ranging from 26 to 42 feet below existing grades and the four borings drilled at Area 4 extended to depths ranging from 18.5 to 27 feet below grade. Boring logs were compiled after reviewing the recovered waste/soil samples in the laboratory.

In order to determine the physical characteristics, Atterberg Limits (ASTM D 4318) and Natural Moisture content (ASTM D 2216) tests were conducted on representative soil samples. Shear strength of the organic deposits underlying the waste, was determined by performing Unconfined Compressive Strength (ASTM D 2166) and Unconsolidated-Undrained Triaxial Tests (UU) (ASTM D 2850).

Engineering evaluation was conducted performing veneer stability analysis to determine the maximum slope at which the banks can be restored without the cover soil/material, which is placed on top of the riverbank for erosion protection, failing through sliding. The veneer stability of each component of the cover system was evaluated including the stability of 1.5 feet of riprap and 6 inches of gravel placed on top of a non-woven needle punched geotextile fabric, over sandy soil cover. Taking into consideration the various soil parameters and slope profiles, the Factors of Safety for veneer stability were calculated taking into account seismic and/or seepage forces.

In addition, global slope stability analyses at critical cross-sections of the existing and proposed embankment profiles were conducted using the computer program X-STABL. The program performs a two-dimensional limit equilibrium analysis to compute the Factor of Safety for a layered slope according to the general limit equilibrium method, Janbu's Generalized Procedure of Slices, Simplified Bishop, and Simplified Janbu. The analyses were performed taking into consideration various river embankment profiles, which differed from one portion along the riverbank to another; the soil subsurface conditions, which varied from one location to another; and different water elevations ranging from mean low water (MLW) to mean high water (MHW) elevations along the riverbank.