Click here to return to TOC

Liner system protects oils sands' tailings area

Syncrude Canada produces a large part of Canada's crude oil supply. The company processes about 225,000 bbl/day. The oil produced is used for jet and automobile fuel, home heating oil, plastics and other consumer synthetics.

Crude oil is produced through a process of mining, extracting and upgrading bitumen. A rich supply of bitumen is contained in the Athabasca oil sands deposit in northern Alberta. Tailings from the bitumen processing are sent to a settling basin.

A nonwoven geotextile is placed over the prepared oil sand foundation.

Project overview

In December 1998, at Syncrude's oil sands facility near Fort McMurray, Alberta, an external sump area was designed to contain the tailings and function as an emergency sump pit. A large amount of water is required for the containment. So the tailings are processed to take out the suspended solids found in the water. A geosynthetic protection system was required to protect the slopes and floor from the water, prevent contamination of the surrounding area and withstand heavy equipment.

In case of a power failure in the main building, the containment pond is equipped to handle all of the tailings material that is diverted to the sump area.

An impervious, hydrocarbon-resistant geomembrane is placed over the geotextile and the field seams are completed using a solvent weld.

The external sump area is about 38- x 38- x 2.6-m deep (125- x 125- x 8.5-ft deep) with 0.9-m (3-ft) horizontal to 0.3-m (1-ft) vertical side slopes.

The requirements for the containment pond's erosion-protection system were complicated because a 276-kN (65,000-lb) wheel loader must clean the sump area. Another challenge at the project was temperatures that reached as low as -10° to -15° C (14° to 5° F).

Geosynthetics

Syncrude selected Presto Products' Geoweb cellular confinement system with concrete infill for the tailings project because of the system's good load support, slope and membrane protection. Armtec Ltd. provided preliminary design and installation assistance. CoSyn Technology completed the final design. Both are in Edmonton, Alberta.

The Geoweb system (geocells) evolved from a cooperative development effort between Presto Products, of Appleton, WI and the US Army Corps of Engineers. High-density, polyethylene strips that are ultrasonically welded at specific intervals form a structure of three-dimensional honeycomb cells. Installed in expanded form, these flexible panels are then filled with a variety of infill materials to meet the specific requirements of the project. Geocell systems are available in several pre-engineered cell dimensions and depths. The selection of the appropriate configuration is site specific.

Standard applications include soil retention in gravity and geogrid-reinforced retaining walls, erosion protection in channel linings and slope protection. Depending on the project parameters, variations in hydrologic and hydraulic conditions and aesthetic requirements, the infill material may be a vegetated topsoil, aggregate structural fill or concrete. Poured concrete infill provides hard, durable protection for slopes exposed to hydraulic or mechanical stresses.

The perforated Geoweb system selected for the Syncrude project contains an engineered pattern of holes that increases frictional interlock with the concrete infill. The system can reduce construction costs by eliminating the need for complicated structural elements and expensive, time-consuming construction techniques.

In addition, concrete quantities and costs can be controlled because there is a defined, uniform thickness to the sections. Embankments armored with the system retain flexibility and the ability to conform to potential subgrade movement.

After the liner is installed, a second layer of geotextile is placed on the pad to minimize damage to the liner before placing the concrete-filled Geoweb system.

Geoweb sections with two polyethylene-coated tendons per cell and load-transfer clips every four cells are suspended over the liner.

Concrete infill is placed in the cells and raked flush with the top of the Geoweb cells.

Project solution

A 30-mm (1.2-in.), hydrocarbon-resistant geomembrane was specified to contain the processed tailings and prevent the material from entering the environment. A nonwoven geotextile was first placed over the prepared foundation. This was a base comprised of oil sand with a California bearing ratio value ≥6. The impervious geomembrane was placed over the geotextile and the field seams were completed using a solvent weld. A second layer of geotextile was then placed to minimize potential damage to the liner before placing the Geoweb system and infilling with concrete. The third layer of nonwoven geotextile completed the design. About 1,800 m^2 (19,375 sq ft) of 100-mm- (4-in.-) deep perforated Geoweb sections was specified and installed for the external sump's side slopes and floor.

A concrete pump truck is used to place infill in the Geoweb sections.

The Geoweb system was staked on slopes to provide necessary anchorage and stability. However, with the need for the underlying geomembrane to remain impermeable, it was necessary to employ high-strength, polymeric tendons to secure the system without stakes. The use of the tendons allowed the system to be suspended over the slopes without the use of stakes. This was necessary to protect the integrity of the geomembrane.

The tendons were tied around a 75-mm- (3-in.-) diam PVC pipe that was placed in a trench at the slope's crest and run downslope through pre-drilled holes in the cell walls. The tendons supply the required restraint on slopes where the downslope component of the cover's self-weight exceeds the available frictional resistance. In the Syncrude case, high-strength, polyethylene-coated tendons were specified to provide the required resistance to:

- The additional downslope driving forces from the wheel loader traffic.
- Exposure to the concrete's high pH content and hydrocarbon material.

All tendons in the sump were pre-installed and threaded through holes in the Geoweb cells with the sections collapsed on a flat surface. The basin was contained due to these quality control measures.

ATRA Clip restraining clips were attached to the tendons every four cells to provide the proper load transfer. The preassembled sections were then carried to the slope, positioned in place and the trailing tendon ends secured to the crest anchor pipe. The secured Geoweb sections were expanded down the side slopes and over the base of the floor. Adjacent sections were joined together and connected with a pneumatic stapler.

A concrete pump truck was used to infill the Geoweb sections with type 50 portland cement 25 MPa (3,650 psi) concrete. North American Construction Group of Spruce Grove, Alberta completed the installation of the Geoweb in two-and-a-half weeks, including the concrete fill. This project was the contractor's second time working with the Geoweb material at a Syncrude site. ■

Testing improved for roof supports in longwall mining

A British company has developed a software-based, noninvasive test system that saves money in the maintenance and repair of hydraulic components. Midland Preventative Maintenance's system helps to ensure the safety of powered roof supports used in longwall mining. The system also has applications in other industries where hydraulic components are employed in critical situations.

Midland Preventative Maintenance's software helps ensure the safety of powered roof support.

The software package is used in conjunction with portable monitoring equipment. It checks relief valves, valve block modules and internal seals on cylinders and legs, to give accurate information on their operational state. The possibility of hydraulic fluid contamination is prevented because these tests are noninvasive.

The system assesses the ultrasonic noise generated when a fluid flows through an orifice. Factors affecting such noise include operational pressure and temperature, and orifice shape and size. The company's handheld portable test system detects noise generated by fluid flows — as low as 50 ml/min — and measures it in decibels. The results are fed into the software. It calculates all bypass flows and generates an exception report where remedial action is recommended.

Hydraulic-component integrity testing is invaluable at all stages in the life of powered roof supports. At commissioning, it indicates any early defects while supports are covered by warranty. During the supports' operational life, the system warns of developing defects and the need for maintenance, to ensure continuous efficiency. It can check a system being transferred to a new environment.

For more information contact: Midland Preventative Maintenance, Unit 16, Botany Commercial Park, Botany Ave., Mansfield, Nottinghamshire, NG18 5NF, England, phone 44-1623-472223, fax 44-1623-472225, e-mail enquiries@mpm-uk.com, Web site www.mpm-uk.com. ■