PERMATHENE Earth Solutions

PROJECTS

Geotextile Tubes

High Strength Geotextile (Syntex®)
De-watering of industrial process pond

Site: Incitec Pivot, Australia
Date: April 2004

Incitec Pivot manufactures super phosphate at a plant in Geelong, Australia. A byproduct of super phosphate manufacture is formation of silica in fluorosilicic acid (H2SiF6). The silica and acid, along with any entrained super phosphate dust is captured in the process ponds for storage. The level of solids content in the process pond tends to increase over time, as the pond is not agitated. Every few years, the solids have to be removed to restore storage capacity. Due to the highly corrosive nature of the acid, the means of solids removal are expensive, messy and potentially hazardous.

The objective of the project was to separate the solids in the process pond (primarily silica and super phosphate) from the liquid (approx 20% fluorosilicic acid). The solids removed can be recycled back into the product, while the liquid can either be bled back into the process or treated. In order to return the solids back into the process in a timely fashion, the level of moisture content in the solids has to minimised.

Syntex High Strength Woven bags were used to remove the solids. These bags met the primary requirement of being able to separate the very fine solids from the process liquor, whilst also providing a high solids content cake after only 5-10 days of drying. The heavy individual yarns are woven into a unique twill pattern to form a strong geotextile with superior hydraulic characteristics. A piping manifold was manufactured to supply sludge to up to six bags (10m long x 4.5m circumference). Sludge was supplied from the pond via a Sandpiper diaphragm sludge pump. This system had a major SH&E benefit by enabling the bag filling to be done by only one or two operators.

After the bags were full (approximately 20 tonnes of 50% solids sludge), the supply piping manifold was disconnected and relocated to enable a further 6 bags to be set up. The first set of bags was then left to dry for as long as possible. Drying periods varied between 5 days to 3 weeks. A longer drying period is better, however due to the very high solids content of the supplied sludge, and the 'pressure filtration' effect provided by the bag, the cake was diggable almost from day one. After the drying period, the bags were split open and the material picked up using a large front-end loader. The dry product is then returned to the plant for production. The results were excellent with an estimated 250 tonnes of sludge removed using 14 sludge bags. The sludge removal was possible during normal operation and did not disrupt plant operations.

Additionally, the high solids content after drying allowed the sludge to go to secondary conditioning within 2 weeks of removal when previously this used to take up to 6 months. The bags also had a low visual impact. The high strength of the bags allowed a large volume of sludge to be removed at a high rate. Each bag was acting as a pressure filter, with incoming sludge forcing liquor to be filtered out through the bag mesh depositing solids behind. The cost savings using this method are estimated to be approximately AUD100,000.

PROJECTS

Geotextile Tubes

High Strength Geotextile (Syntex®)
De-watering of lake

Site: Rippon Lea Estate, Australia
Date: December 2001

Remediation of a lake in the Rippon Lea Estate in Victoria is a part of National Trust of Australia (NTA) Site Remediation Action Plan. The lake contained approximately 150 m^3 of sludge and the size of the lake is 2-3 acres x 1.2 m deep. The long-term goals of the action plan are to identify contaminated sites, investigate and, if necessary, remediate them within a 40 year period. Several hundred of these sites involve contaminated sediments. Without remedial action the sediment and sludge would have caused problems for many decades. Several investigations and studies were carried out to determine how and under what limitation clean up could be performed.

An alternative for the remediation was selected that included vacuum dredging using the high strength geotextile tubes. Dredged material was to be de-watered and disposed of in a landfill. For this treatment process a work area was set up off site in a neighbouring car park. A pontoon with a pumping unit was designed, constructed and installed in the lake. The pumping system was commissioned and pumps were altered to ensure the most appropriate flow rate of sludge and water mixture was achieved. A flexible pipeline was installed from the pump to the temporary de-watering area and to the mobile wastewater treatment plant. The sludge was pumped from the lake to the de-watering system; excess water taken from the de-watering system was pumped through the water treatment plant and returned to the lake as treated water.

The de-watering system consisted of two geotextile tubes; 20 m long and 1.4 m wide each fabricated from Syntex high strength woven geotextile. This product has sufficient tensile strength to withstand the stresses. The fabric opening size may seem large when compared to the grain size of the dredged material, and might lead to the question of how efficient retention of solids might be. The answer partly lies in the fact that a filter cake forms on the inside of the fabric shell, thus creating the equivalent of a two-stage filter. Filtration efficiencies above 98% are not uncommon for fine grained dredge materials filtered through Syntex 4x4 high strength geotextile. The dredged material was pumped into the tubes using trash pump through a 150 mm discharge line. The water percolates out through the fabric, leaving a dense sludge and sediment mixture in the tube. The tubes were pumped until full, reaching heights of 1.0 m – 1.2 m and widths of 0.8 – 1.0 m. The 20 m long each tube contained nearly 20 m^3 of dry sludge material. Prior to filling, the de-watering area was lined with a nonwoven geotextile to prevent local erosion, which occurs as water is released from the tube.

De-watering and consolidation in the geotextile tube reduced the volume of the dredged material by a factor of 7 to 8 within 2-4 weeks of filling the tube. Thus, 450 m^3 of material was initially dredged and approximately 56 m^3 to 64 m^3 placed at the final disposal site. The dredged material was highly cohesive and has a high organic content. This stage of de-sludging was carried out in tight and confined conditions and it is expected that greater productivity can be achieved in the larger section of the lake. The ideal process rate for the treatment is between 3 to 5 m^3 per hour.

Syntex tubes provided a cost effective solution to a very difficult dredging project. The tubes de-watered the material at a greatly accelerated rate when compared to open air retention, and eliminated safety issues inherent with disposal pits. The de-sludging provided a significant increase in the storage volume of the lake to allow for reticulation of the Rippon Lea Estate gardens.

Note: This project was the topic of a technical paper presented at the IECA conference Philadelphia 2004.

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