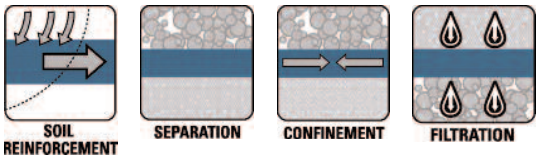
TENCATE Mirafi®



Case Study

application	Reinforced Soil Shallow Foundation	engineer	Nichols Environmental
location	Sherwood Park, Alberta	contractor	Voice Construction
product	Mirafi® RS580i	date of installation	August 2016

Nichols Environmental (Canada) Ltd. is a full-service geo-environmental consulting and remediation firm that provides environmental and engineering solutions to a wide range of industrial, government, and public sector clients. Nichols Environmental has a long history of being committed to providing timely, cost-effective, and innovative solutions tailored to each client's specific needs.

In late 2015, Nichols Environmental was part of a team approached by a large Dutch based multi-national energy company to provide geotechnical overview for a petroleum tank farm expansion in Sherwood Park, Alberta. A portion of this responsibility included recommending foundation strategies for a 39.5-meter diameter (16,000 m3) diesel tank on a subgrade comprised of approximately 4.8 m thick layer of soft high plastic lacustrine clay overlying silty sandy clay that extended greater than 10 m below.

Following completion of the geotechnical investigation, Nichols Environmental had recommended three different pile solutions:

1) Preferred option was a concrete perimeter friction pile strategy completed with a concrete ring beam. The perimeter friction pile system would consist of cast-in-place concrete friction piles installed at least 10 m into silty sandy clay.

2) Alternatively, the use of driven steel friction piles either "H" piles or open-end steel pipe piles completed with a concrete ring beam was also a suitable option for the proposed tank, providing that they were driven to refusal or at least 10 m below grade, into the lower silty sandy clay soil.

3) Helical screw piles was the third pile option deemed acceptable by Nichols Environmental for founding the proposed infrastructure.

The Engineering, Procurement and Construction Management (EPCM) consultant hired to design and build the tank reviewed the piling options and came back to Nichols Environmental requesting a more cost effective solution. Specifically, a request was made to look into designing a Reinforced Soil Foundation (RSF). Having attended a TenCate Geosynthetics technical seminar, Mathew Dean, a project manager for Nichols Environmental requested TenCate assistance in preparing the foundation design. Nichols had been attempting to model a RSF using a biaxial geogrid in the poor soil conditions at the time.

After an initial review of the geotechnical information and the goals of the client, it was confirmed that a RSF would likely be a viable solution for the foundation challenge that Nichols Environmental faced. Reinforced soil foundations using geosynthetics have been used for more than two decades.

Nichols Environmental was put in contact with Mr. Santino Piccoli, P.E., Engineering Business Manager for TenCate and resident expert on the design of Reinforced Soil Foundations. After several discussions confirming design parameters, settlement calculations and a bearing capacity analysis were completed for review Nichols Environmental. TenCate implemented information provided in:

1) "Use of Reinforced Soil Foundation (RSF) to Support Shallow Foundations," Louisiana Transportation Research Center (LTRC) / LTRC-04-2GT, 2008

2) "Supporting Capability of Geogrid-Mattress Foundation," Ochiai et al., 1994.

3) "Shallow Foundations Reference Manual," FHWA NHI-01-023, June 2001.

Nichols Environmental then confirmed the settlement calculations through their own calculations and modelling with GeoStudio.

The solution required 8-layers of TenCate's new integrated high strength woven geotextile, Mirafi® RS580i spaced at 375mm and backfilled with 80mm minus pit run material. Mirafi® RS580i is latest innovation of high strength woven geotextiles developed by TenCate which combine the benefits of high tensile modulus at low strain, higher flow capacity with a smaller average pore size distribution, increased soil confinement through an improved coefficient of interaction, and easy product identification.

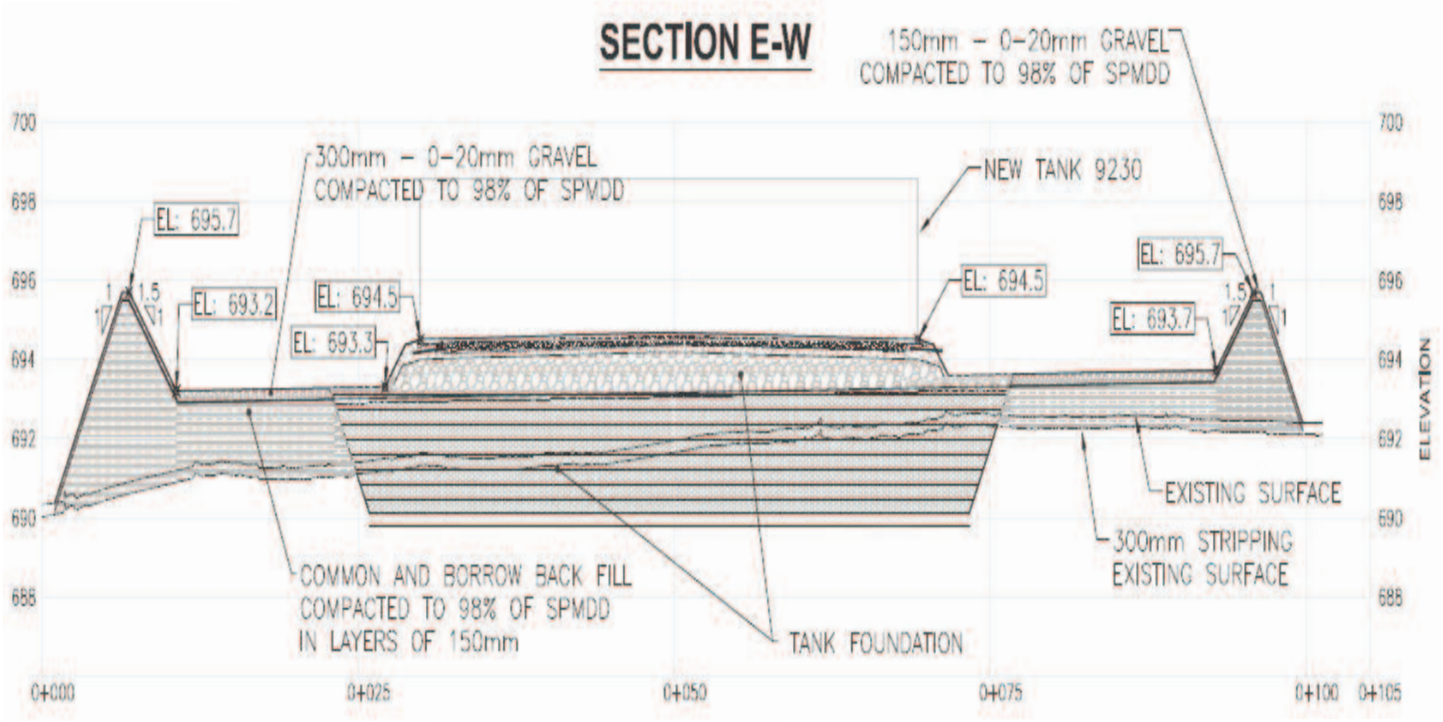
Settlement using the RSF solution was anticipated to be 40 mm under the tank edge and 74 mm under the centre of the tank. A concrete grade beam ring wall, founded on the silty sand, was utilized to minimize potential differential settlement and lateral deflection of the soil under the tank edges.

Nichols Environmental included all four options in their geotechnical report and left it to the EPCM consultant to evaluate and ultimately determine which option would be the most cost-effective.

Construction of the RSF began in August 2016 by Voice Construction, the primary civil earthworks contractor. Voice had previous experience installing Mirafi® RSi-Series products on other embankment projects.
The finished structure held true to the Nichols Environmental's dedication to innovative and cost effective solutions, and now provides a safe and stable foundation. TenCate is proud to have been part of this design effort and looks forward to replicating this success in the future.

The contractor used low pressure construction equipment at the base of the excavation.

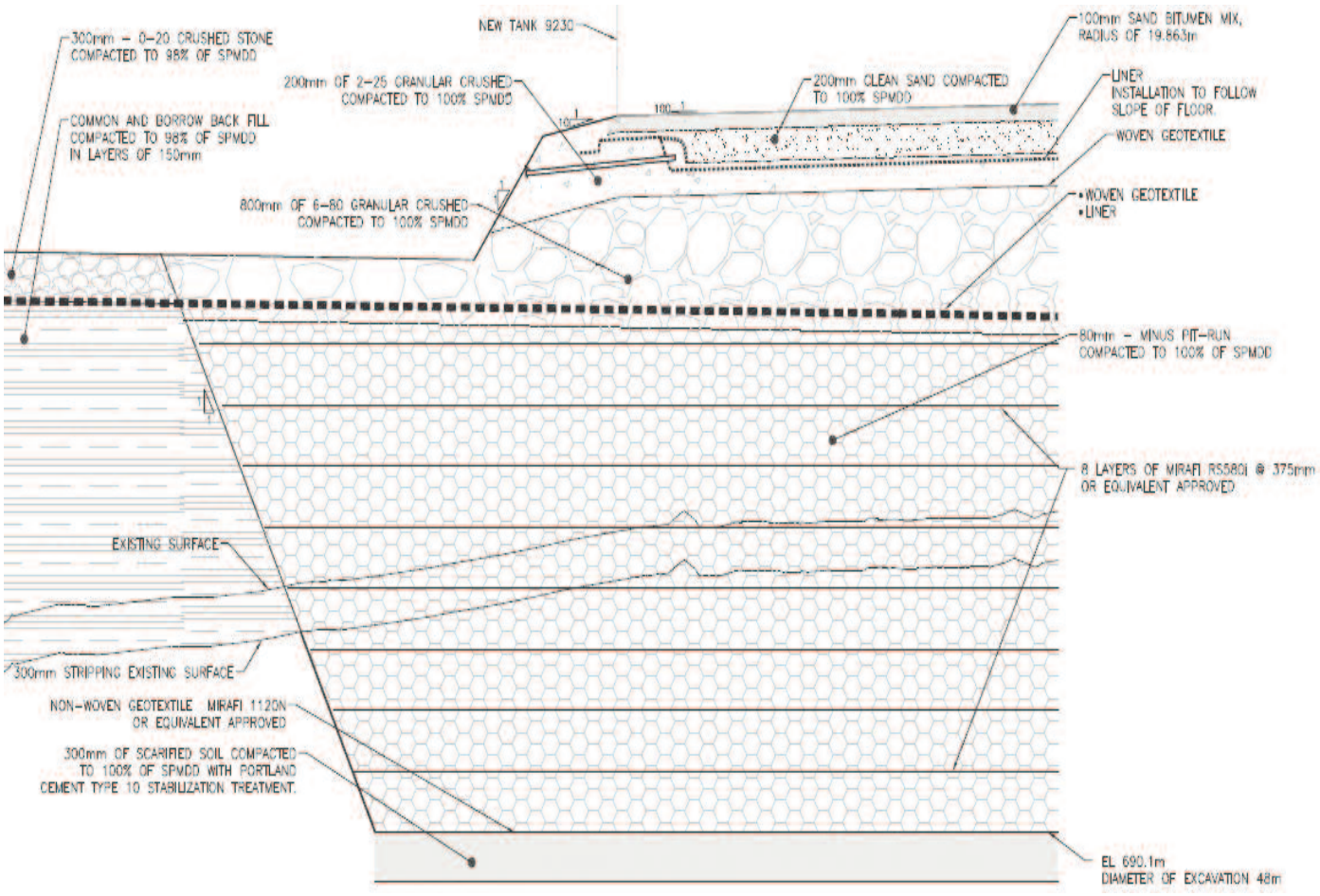
Labourer deploying panel edge to prepare for overlap of the adjacent panel.



Cross section of foundation and berm.

The new tank would be connected to the existing infrastructure.

Overlap of adjacent panels was reduced as sections of the Mirafi® RS580i layers were completed.



Reinforced soil foundation details.

1116

365 South Holland Drive
Pendergrass, GA 30567
Tel 800 685 9990
Tel 706 693 2226
Fax 706 693 4400
www.mirafi.com