

Case Study

application Subgrade Stabilization/Separation
location Calcasieu River Foreshore Dike, LA
product Mirafi® FW404 and Mirafi® HS900PP

job owner US Army Corps of Engineers (USACE)
engineer Keith O’Cain, P.E.
contractor Luhr Bros., Inc.

TenCate develops and produces materials that function to increase performance, reduce costs and deliver measurable results by working with our customers to provide advanced solutions.

THE CHALLENGE

The Port of Lake Charles encompasses 203 square miles in Calcasieu Parish, LA and is the 12th largest seaport in the U.S. The Port accommodates 5 million tons of cargo annually at its public facilities. The Port sits approximately 12 miles inland from the Gulf of Mexico. One of the vital lifelines between the Gulf and the Port is the Calcasieu River.

The Calcasieu River has been dredged since the early 1800’s to allow for ship and barge traffic to pass between the Port and Gulf. Disposal sites for the dredged material are near capacity and some have spilled over into adjacent bodies of water. To help solve this problem, the U.S. Army Corps of Engineers (USACE) is implementing a plan to construct a rock dike approximately 5 miles long and 70 feet wide (at the base), about 500 feet from the existing east shoreline of the Calcasieu River. Over at least the next 20 years, the area between the rock dike and the shoreline will be backfilled with dredged materials from the ship channel. The rock dike will serve two purposes: (1) reclaim some of the eroded shoreline and, (2) provide a containment area for the dredged material.

The rock dike will need to withstand wave action created by the tide and passing ships, remain at a constant elevation, retain the dredged material, and be able to pass water freely through the structure. Also, the existing soils below the dike, which are approximately 6 feet underwater, are extremely soft. Therefore, global stability of the rock dike, as well as overall settlement, was a high concern.

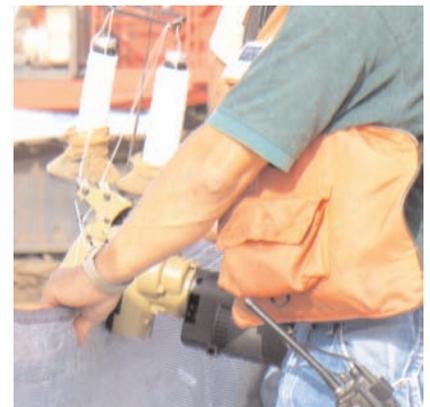
THE DESIGN

The USACE used a specific arrangement of aggregate and geotextiles to meet their needs. To help stabilize the subgrade, limit and evenly distribute overall settlement, and create long-term global stability for the dike, Mirafi® HS900PP was used directly on the river bottom under the dike. Mirafi® HS900PP is a woven polyester and polypropylene hybrid geotextile. The combination of the polyester and polypropylene yarns creates a stable geotextile with very high tensile strengths at low strains. This combination also creates a material with a specific gravity such that it floats for a short time and then sinks on its own, which aids in the construction process.

The rock core and rough shape of the dike were then created using 1 inch to 4 inch aggregate (1X4). Luhr Bros graded the aggregate to ensure maximum aggregate interlock for stability within the dike and friction along the reinforcement geotextile. The dike was capped and dressed with 2,200 pound (maximum) rip-rap with a high-flow separator geotextile (Mirafi® FW404) between the 1X4 and rip-rap. The rip-rap over the stable core will easily withstand the wave action in the Calcasieu River. With one of the primary functions of the rock dike being a containment area for disposal of the dredged material, Mirafi® FW404 will allow water to flow freely through the system while keeping the suspended dredge material in its intended place.



Finished section of rock dike



Field sewing of Mirafi® HS900PP



1x4 aggregate and 2,200 lb. rip rap with Mirafi® FW404 used as a separation geotextile

THE CONSTRUCTION

Construction began at the south end of the project with the installation of Mirafi® HS900PP directly on the river bottom. Mirafi® HS900PP was prefabricated at the manufacturing facility into panels ranging in sizes of 54 to 74 feet wide by 105 feet long. Mirafi® HS900PP was placed in about 6 feet of water using a barge that Luhr Bros. designed and built specifically for marine geotextile installations. After surveying and staking the centerline of the dike, Luhr Bros guided the barge down the centerline as they seamed the panels together and rolled the geotextile off of the barge in a continuous layer. Sand bags were placed at the edge of the seams to take the geotextile to the river bottom in a controlled fashion. A small quantity of rip-rap was then randomly placed on the geotextile to keep it in place on the river bottom.

The core of the dike was built up and shaped with 1X4 aggregate, then Mirafi® FW404, prefabricated into panels ranging in size from 34 to 44 feet wide by 150 feet long was installed and held in place using the rip-rap. Once the Mirafi® FW404 was installed, the rip-rap was placed and shaped to form the outer shell of the dike.

Before placement of the rip-rap, metal plates were installed every 1000 feet on the Mirafi® HS900PP to measure the settlement of the dike system.

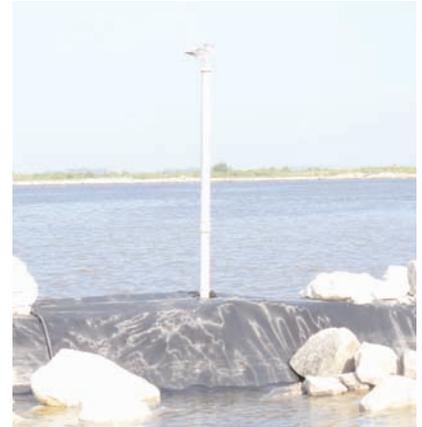
THE PERFORMANCE

The already constructed portions of the dike are performing superbly. The USACE knew the dike would settle, but TenCate's Mirafi® HS900PP provided the high tensile strengths at low strains that they needed to decrease the overall settlement, limit as much of the settlement as possible to the initial construction phase, and evenly distribute the settlement of the dike; thus creating a long-term globally stable foundation.

Consistent settlements of 0.4 feet have been measured from the settlement plates along the 5 miles of the dike constructed to date.

Without the use of the Mirafi® HS900PP the dike settlements would be much higher and largely inconsistent, requiring the use of a much larger quantity of rock to maintain a constant dike elevation. This dramatically reduced initial construction and annual maintenance costs of this rock dike system.

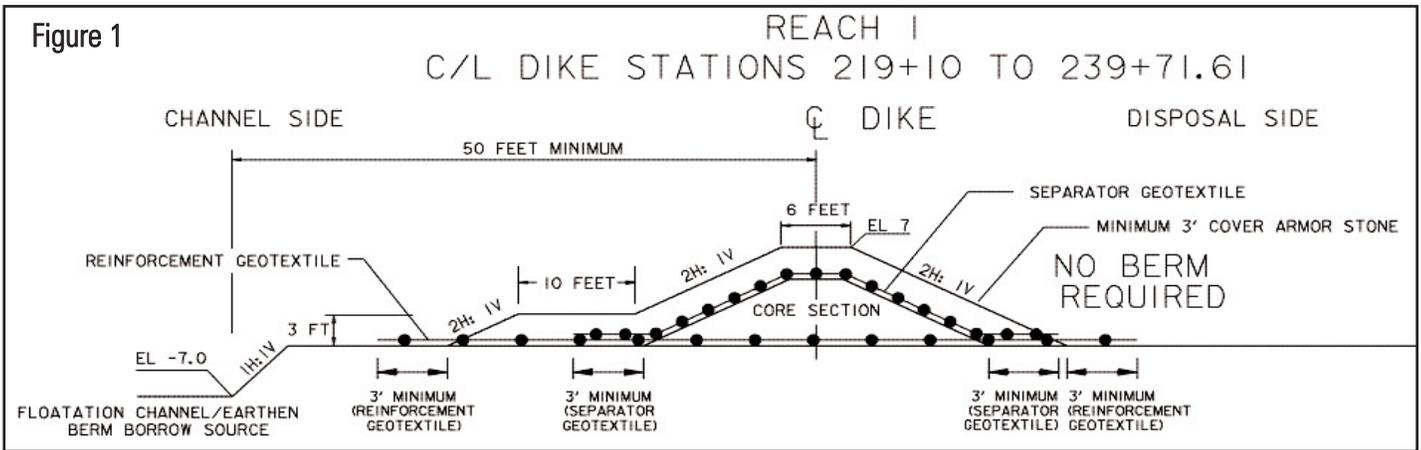
The Mirafi® FW404 will aid in the storage of the dredge material, keeping the core of the dike stable and free of too many fines, and preventing the rip-rap from pushing and settling into the 1X4.



Installed plate for monitoring settlement



Installation of Mirafi® HS900PP



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