Double take: Bentofix® GCL and the Miyagi earthquake

The Shibusawa agricultural pond in Yamamoto Town, Miyagi Prefecture, Japan, has the unique distinction of having been built twice with geo-synthetic clay liners (GCLs), both times to the client’s satisfaction, and without having experienced any failure in engineering or product performance.

The pond, which is located within a golf course, serves as drainage collection from the course but also provides water for a neighboring farm. The water is distributed for irrigation and other farm-related water needs.

Conventional clay is normally used in the region’s ponds, but this pond did not lend itself to the standard solution. The on-site soils were not strong enough to provide long-term stability to the pond banks. Neighboring sites did not provide acceptable sources, as the best available clay would have required moisture content adjustment that would have delayed construction and putting the pond into operation. Bringing in suitable clay would have been too expensive, especially considering the pond’s size: 7m deep with 1:2 slopes.

A more expedient solution was requested.

Bentofix® geosynthetic clay liners (GCLs) were specified as an alternative, one that could agree with the needs of both the golf course and the agricultural site. The GCLs could be delivered efficiently in easy-to-install rolls and ensure consistent, safe, environmentally sound pond performance.
The first installation on the site was conducted in 2007. It provided an economical, strong containment solution. However, in March 2011, the world’s fifth most powerful earthquake took place. A large degree of infrastructure in Miyagi Prefecture was damaged.

The Miyagi earthquake caused more than 15,000 fatalities and led to a meltdown at the Fukushima nuclear plant on the coast.

The banks of the agricultural pond, which is located in Miyagi Prefecture, were considerably damaged, like much of the surrounding area. An excavation was carried out to investigate the Bentofix® liner and the overlaps. It was identified that the overlaps did not separate during the earthquake and that they were fully intact (see picture). Permeability testing of the GCL on the damaged banks revealed that the Bentofix® panels were still performing as designed; however, the degree of repair work that would be needed on the pond slopes to return it to its as-designed contours led the site owner to request a full reconstruction.

Once again, the owner selected 4,000m$^2$ of Bentofix® BFG 5000.

**Advantages of Bentofix®**

Bentofix® utilizes high-swelling sodium bentonite in its core. This type of bentonite offers the lowest known permeability of naturally occurring geological materials. In contact with water, it swells immediately and creates an exceptional, liquid-impermeable seal.

NAUE’s unique needle-punch and Thermal Lock manufacturing system secures the bentonite core within the nonwoven geotextile cover and carrier layers. It also gives the GCL panels excellent frictional characteristics and durability.

The strong elongation characteristics of Bentofix® enable it to tolerate differential settlement. In the case of the Miyagi Prefecture project, that flexibility and durability helped the previously installed Bentofix® panels to continue performing their containment function du-ring and after the earthquake, despite the fact that the pond itself needed to be reconstructed. For Yamamoto Town, these performance benefits were deeply appreciated.
The banks of the agricultural pond were reconstructed and the site lined with new Bentofix® panels in 2012.

Today, life is returning to normal in the prefecture. The golf course continues to operate. The farm remains in operation and the pond continues to perform as designed.