PROJECT PROFILE
Y17O008

New Terefirm™ Resin Injection Delivers Seismic Strengthening Solution for Fully Operational Wastewater Treatment Plant

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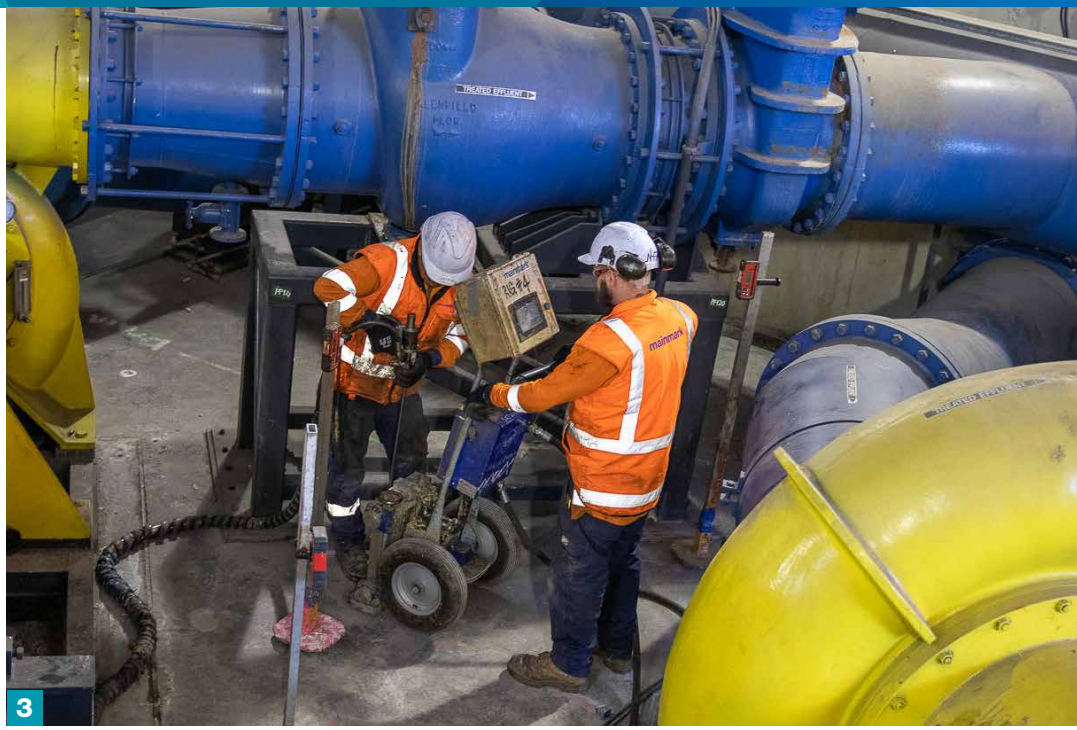
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INDUSTRY
Infrastructure

STRUCTURE
Wastewater Treatment Plant

PROBLEM
Seismic strengthening

LOCATION
Wellington, New Zealand

DURATION / YEAR
5 months / 2019

TECHNOLOGY
Terefim™ Resin Injection

BUSINESS UNIT
Mainmark New Zealand

Above: 1) the exterior of the wastewater treatment plant. 2) computer controlled testing and monitoring allowed for extremely precise injection. 3) Mainmark technicians were required to work in tight spaces that would have been impossible to treat with other methods.

Summary

The Seaview Wastewater Treatment Plant is located in New Zealand's North Island near an active seismic fault. The facility treats up to 53 million litres of water daily, servicing around 146,000 residents in Upper Hutt and Lower Hutt as well as a large number of local industries.

The plant was built in 2002 to the current engineering standards of the time, helping to ensure it had the ability to withstand seismic events, and prevent wastewater from escaping into the ocean. It is jointly owned by the Upper Hutt and Hutt City Councils.

In response to recent changes to the Seismic Prone Building Act Amendment 2016, Wellington Water proactively sought a long-term solution to strengthen the ground underneath the Seaview Wastewater Treatment Plant, further improving the resilience of the critical infrastructure.

The seismic strengthening ground remediation project forms part of the Hutt City *Te Awa Kairangi* 30-year Infrastructure Strategy. It is the first government owned asset of its kind to be retrofitted in preparation for a seismic event, without having sustained any previous damage to date.

Under Wellington Water's Regional Specification for Water Services, pumping stations and treatment plants must achieve an Importance Level of IL4 performance, meaning the building and connected hydraulic services must remain operational following a significant seismic event. Therefore, the ground beneath the existing milliscreen and pumping station building at the plant required improving, in order to reduce the risk of liquefaction induced settlement as a result of a seismic event.

The facility has a number of rooms containing large pumps, generators and other sensitive computer and electrical equipment, making it nearly impossible to strengthen the facility's resilience to earthquakes using conventional invasive methods such as stone columns, screw piles or jet-grout.

Wellington Water selected Mainmark's Terefirm™ Resin Injection after an open tender process, due to its unique and proven ability to be applied under existing structures.

Objectives

Wellington Water was seeking a ground strengthening and liquefaction mitigation solution that would ensure the Seaview Wastewater Treatment Plant could continue operating following an earthquake. It was also seeking to increase the facility's New Building Standard (NBS) rating to 55%, in compliance with the HCC Earthquake Prone Policy 2011 for IL4 critical infrastructure.

As the facility is operational 24/7, the Mainmark team was required to work around difficult site access restrictions to deliver the solution in a confined environment.

Solution

After four years of extensive testing and trials in the Christchurch 'Red Zone' following the 2010 and 2011 earthquakes in New Zealand, Mainmark introduced Terefirm, a resin injection solution that can be applied beneath existing structures.

Terefirm is a proven, non-invasive, ground improvement and liquefaction mitigation technique that is validated by geotechnical testing. The technique is applied with surgical precision in a non-invasive and relatively clean process to densify soil and increase liquefaction resistance.

During injection of the treatment zone, the low viscosity resin both permeates the soil to a limited extent, and penetrates under pressure along planes of weaknesses within the soil profile. The material reacts soon after injection, rapidly expanding to many times its original volume. The expansion of the injected material results in compaction of the adjacent soils, due to new material being introduced into a relatively constant soil volume.

At the Seaview Wastewater Treatment Plant, the main pumping station had been originally assessed at 14% New Building Standard (NBS) under Importance Level IL3 or 10% under IL4, whilst the milliscreen plant building was rated 45% NBS under IL3 or 33% under IL4 standard.

Following the successful application of Terefirm Resin Injection, the facility now meets 55% New Building Standard (NBS), the required importance level (IL4) standard for continuing function following a seismic event.

Over 80,000kgs of Terefirm resin were injected with up to 15 personnel required on site at any given time, working within very tight access. The project commenced in February 2019 and was completed in June 2019.

Tristan Reynard, Project Director for the Seaview project said Mainmark delivered an ideal solution for the challenge. *"Upgrading this plant while it keeps operating presented a unique challenge, which Mainmark's solution helped us to address. Wellington Water is now evaluating the use of this technology on another important water treatment plant. We look forward to continuing to work with Mainmark for ground improvement works in the future."*

Over 80,000kgs of Terefirm resin were injected in total.