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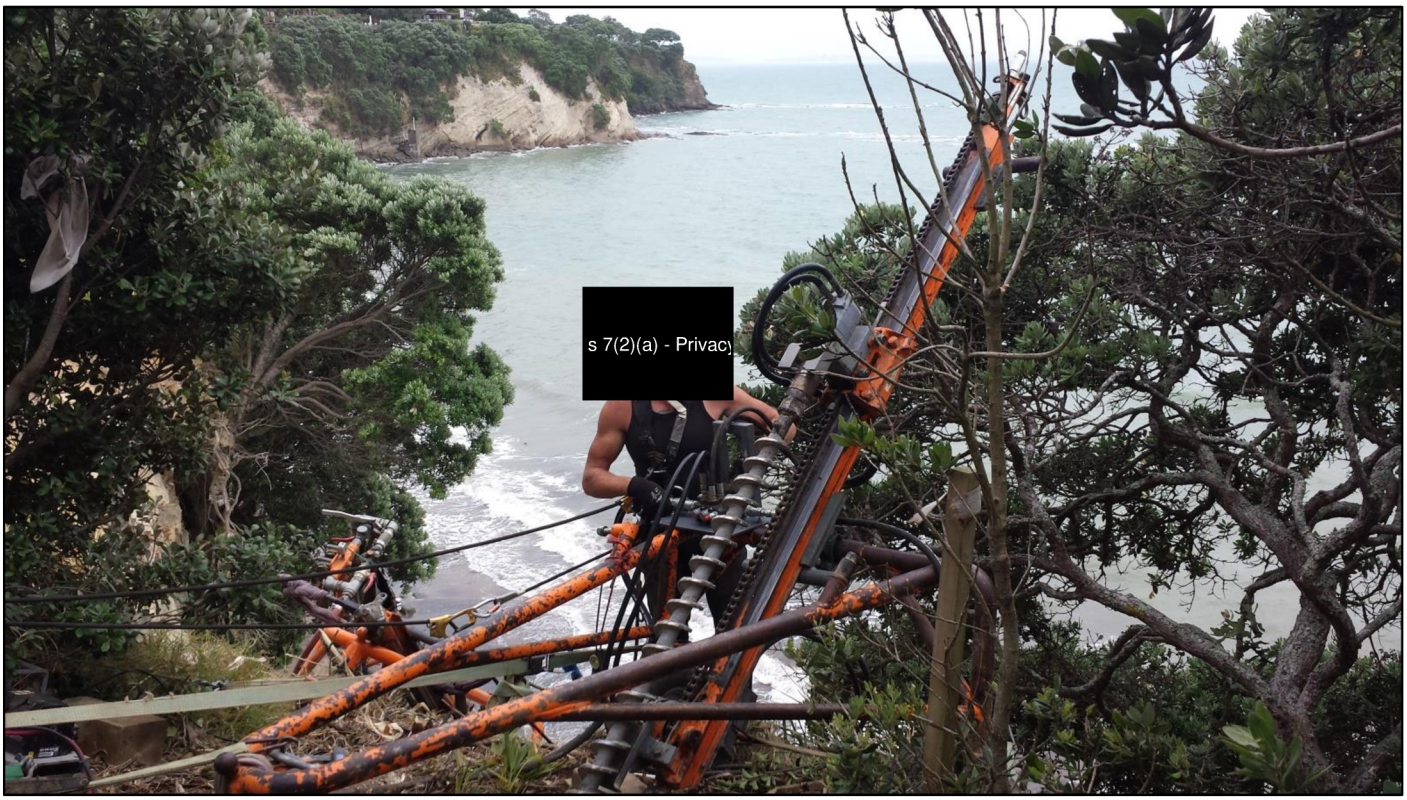
EARTH STABILITY
CIVIL & GEOTECHNICAL ENGINEERING SOLUTIONS

CONSTRUCTION METHODOLOGY



PROJECT: Mauao Base Track Stability Works

CLIFF STABILISATION WORKS

Figure 1 – Site safety signage at track closure point.

All required plant and materials shall be mobilised to site with Small truck and 4WD Utes with no impact or delays to residents or road/track users. All access will be via the access way to be identified by Waiotahi prior to starting works.

All of ESL's drilling and grouting plant required for the project is lightweight man portable minimising any impact to property owners or the need for reinstatement.

Prior to commencement of any physical works on site, appropriate warning signage installation will be put in place along the full length of the site below and around the area of works.

Appropriate warning signage and safety fencing (installed by Waiotahi) will be installed as required around the site to eliminate public access *(refer figure 1).*

Temporary anchor points will then be installed to allow safe access for the crew and drilling rig.

The proposed anchors consist of slinging the mature Pohutukawa Tree within the middle of the site, which has been reviewed and deemed suitable by the projects supervising arborist.

On completion of the mobilisation and equipment setup, s 7(2)(a) - Privacy out of drilling locations, drilling and installation of the soilnails will commence. If required, an engineer's inspection of the mark out can be facilitated to ensure they are happy with the coverage.

Drilling will be undertaken by rope access trained drillers and technicians utilising a specialist lightweight Marini drill rig designed for steep gradients *(refer figure 2).*

The proposed drilling technique for this site is continuous flight auger which eliminates dust and potential to damage any tree roots. The CFA rig is powered by a small Hydraulic powerpack which is ideal in minimising the required site storage footprint.

Grouting will be completed with a small Whyte hall grout plant, which can easily be operated by a small team. The grout plant is pneumatically driven. A three-man team can manage the operation with three distinct roles being, a batcher, a spotter and a man on the nozzle. There will be both visual and audio communication via 2-way radios at all times during the grouting procedure

If required Earth Stability can provided soilnail acceptance testing on the installed soilnails once the grout has cured *(ref figure 3).*

The Driller will complete a drill, grout & anchor fabrication log for all holes drilled on site capturing all necessary information such as ground conditions, grout volumes, and anchor details etc. Any changes or differences in ground conditions will be immediately reported to the engineer for review.

Grout sampling for UCS testing as per NZS4402: 1996 Test 6.3.1will be undertaken for every day of batching for the soilnails to ensure a grout strength of 30mpa or greater is achieved.

Figure 2 – Restricted access drill rig

Figure 3 – Testing of soilnails

Once all soilnails have been completed the slope reinforcement system will be installed consisting of Biocior 450 Coconut matting overlaid with Duramat RF rock fall mesh (refer *figure 5)*. The mesh will be installed from the top down in continuous drops with stainless steel hog rings joining the vertical drops.

All soilnails will have a 200x200x16mm thick plate followed by a galvanised spherical washer and nut fitted to secure the mesh to the slope, all components will have corrosion protection consisting of hot dip galvanising (*refer figure 4).*

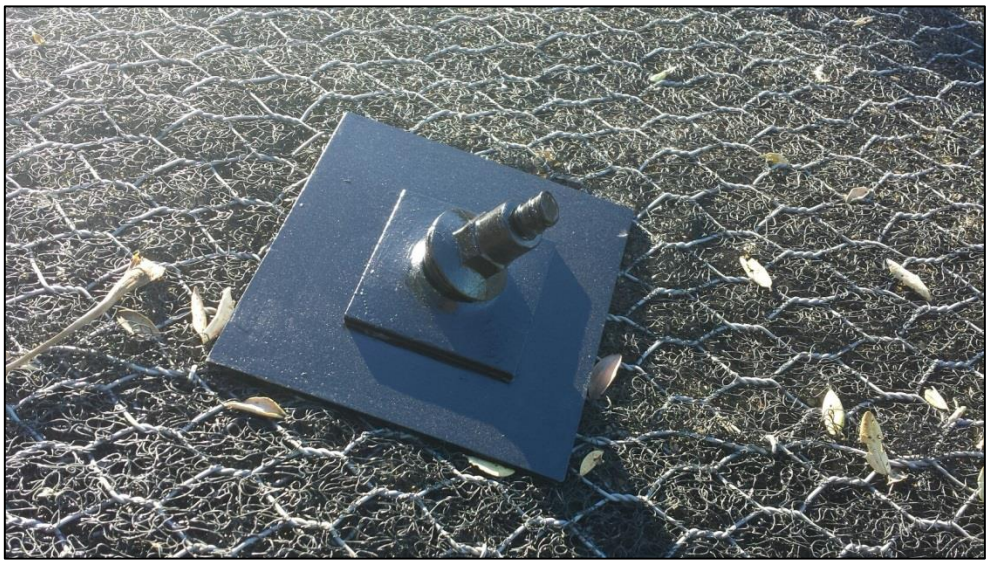


Figure 4 – Typical soilnail head detail

Figure 5 - Example of Duramat RF Installed in a coastal environment

"Before and After" Showing natural revegetation of an Soilnail and Duramat repair