

Dam Description

The Waimea Community Dam is a 53m high concrete face rock-fill embankment dam in the Lee Valley, 35km south-west of Nelson. Dam foundation treatment included construction of a cementitious grout curtain.

The geological environment generally comprises moderately strong, jointed, fissile interbedded argillite and sandstone, folded in varying orientations. Tectonism has generated multiple complex crush zones.



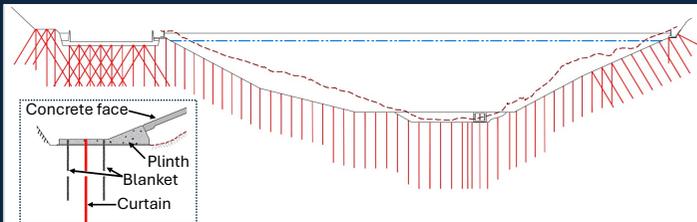
A. Mawdsley, WWL

Design Philosophy

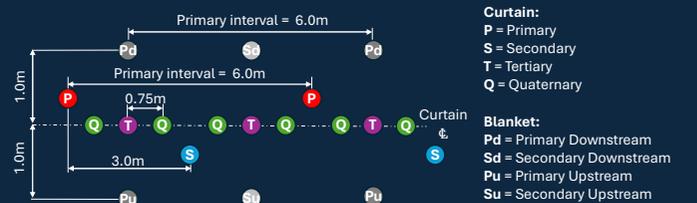
The intention of a grout curtain is to reduce foundation material transmissivity, thereby reducing seepage rates and pressure gradients-reducing the risk of some potential failure modes developing.

Grouting comprised pressurised injection of cementitious grout through pre-drilled holes in the foundation through a plinth upstream of the face.

Two shallow (8m) blanket rows preceded a deeper (typ. 24m) central curtain. Grout hole depths and orientations were determined and refined through geological mapping and regular testing. A representative section of the grout curtain (primary holes only) is shown below, with the plinth shown inset.



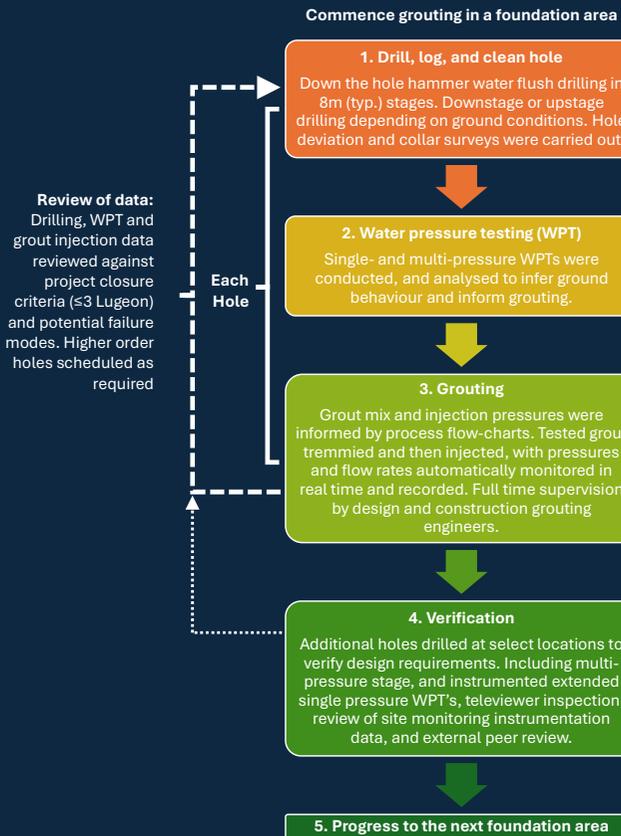
Split-space grouting on evenly spaced holes was generally applied, allowing efficient and well-informed construction. Schematically represented collar spacings are shown below. Primary, secondary, and tertiary holes were completed sequentially. Review of this data informed further grouting.



Process & Verification

Field trials determined safe but effective testing and injection pressures. Stable grout mixes were developed and tested on site to ensure suitable rheology for the ground conditions. High mobility, low pressure grouting was found to be suited to most parts of the site. Some parts of the site required the use of low mobility, low pressure grouting.

Construction was observational and iterative, following the process below.



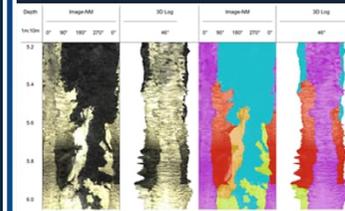
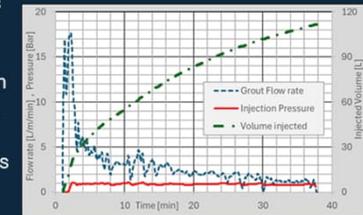
Quality Assurance

Data collection and review was central to the process of foundation grouting, which continued through to commissioning.

Water pressure tests were completed for all stages of each hole. Extended duration tests (typ. ≤ 5hrs) were routinely carried out for verification purposes, and the response of nearby vibrating wire piezometers analysed. The full WPT dataset was reviewed throughout the verification and commissioning process.

Each hole was surveyed for collar location and downhole deviation to ensure no physical gaps existed in the curtain.

During construction the process was adjusted based on grouting and verification observations. A computerised data collection system was found to be useful in developing an understanding of the ground response to grout injection. A graph is shown illustrating a primary order hole after tremie- with grouting system and hole pressurisation (0 to 3min), fissure filling (3- to 30min), and closure (30 to 38min). If persistent high flows were observed (not shown in this graph) the grout rheology would be adjusted.



Progress and effectiveness was also verified using a site based optical and acoustic televiewer. An example of optical televiewer data assessment is presented, showing a complex crush zone (rock indicated by cyan shading) being stabilised by multiple grouting instances (other colours).

Dam safety instrumentation and monitoring system data was used to assess groundwater levels to determine effective pressures and ground response to grouting. The inset graph presents piezometric pressures at one position upstream of the grout curtain, and two locations downstream. The grouting period is shaded grey. It can be noted that during grouting a safe working pressure was maintained, and following grouting a hydraulic gradient develops across the grout curtain. The downstream piezometric response to rainfall is also reduced following grouting.



The Waimea Community Dam provides an enduring positive impact to the Lee Valley and Tasman District. Foundation grouting was a collaboration between contractors and designers, with a verified effective outcome.

Acknowledgements

We are grateful to the many contributions of Waimea Water Limited, Damwatch, Fulton Hogan Taylors Joint Venture, and Rock Control.