



ARAPUNI DAM FOUNDATION REMEDIATION

THE PROBLEM

The client was seeking a solution to a history of seepage issues. Seepage changes have often involved sudden and significant increases and not usually related to external events such as earthquakes.

Investigations showed the presence of highly erodible joint infill in the dam foundation that is vulnerable to piping erosion. This combined with near-lake pressure in areas under the dam due to open fractures in the ignimbrite rock foundation pose a risk of a major leak under the dam.

The client required that the solution would not interfere with generation revenue (equivalent to 1.6m megawatt hours)

PROJECT OBJECTIVE

A targeted and cost effective fix appropriate to the nature of the problem, removing the potential for future leaks that will not impact on the operation of the reservoir or electricity generation.

- Quality systems development for construction
- Design support during construction

SERVICES

An extensive programme of investigative core drilling and detailed foundation mapping was completed to determine the extent and nature of the fissure systems.

The investigation findings allowed partial cutoffs to be designed to specifically target each of four sets of identified vertical fractures. Joint infill is removed and the open joint cut off by a grout or concrete wall in order to create stable permanent barriers, one across each of the fissure sets.

- Geological and groundwater investigation of the dam site
- Dam safety instrumentation installation and 24 hour monitoring
- Investigation and trial of cutoff options and techniques
- Contractor procurement documentation and contractor selection for Alliance contract
- Cutoff wall design and specification
- Participation in construction methodology selection with contractor
- On site dam safety supervision during construction

This innovative project extended international cutoff wall practice for dams, working with the contractor (Trevi SpA of Italy and Brian Perry Ltd of NZ).

CLIENT

Mighty River Power Limited

LOCATION

Arapuni Dam, Waikato River, New Zealand

SCHEME COMPONENTS

- 64m high concrete gravity dam
- Built in the 1920s, crest length of 94m
- 186 MW power station
- Diversion tunnel through right abutment.

ENGINEERING SOLUTION

The concept and methodology is a world first and is known as the "Arapuni Method". This featured the construction of four overlapping bored pile walls while the reservoir remained full. Made up of 400mm diameter holes drilled at 350mm centres, the 95m deep holes from the dam crest extend through the concrete dam and 40 to 60m into the vertically jointed ignimbrite. The cutoff wall was constructed in discrete segments to limit the construction induced tensile stresses on the unreinforced upstream face of the dam and avoid collapse of the weak foundation rock.

The cost effective solution achieved successful control of foundation seepage flows with up to 90% reduction in flow rates without affecting electricity generation.

