

ARAPUNI DAM FOUNDATION GROUTING PROJECT

The Problem

Pressures and drainage flows from underneath Arapuni dam were found to be rising unacceptably in September 2000, in an area where near lake pressures had been encountered.

Objective

To safely and economically establish and monitor acceptable, long term, stable seepage conditions at the Arapuni Dam.

HISTORY

Historical records show the dam has previous seepage problems – a grout curtain was installed in 1929 following significant leakage from the dam during its first two years of operation.

Client

Mighty River Power Limited

Location

Arapuni Dam, Waikato River, New Zealand

The Dam

Built in the 1920s, the dam is a 64m high curved concrete gravity dam with a crest length of 94m.

Scheme Components

- 64m high concrete gravity dam
- 186 MW power station
- Diversion tunnel through right abutment.

Background

Drainage holes were drilled in the downstream toe of the dam in 1995 during which a zone of high water pressure was intersected resulting in the establishment of a detailed monitoring programme. In September 2000 the pressures and drainage flows were found to be rising significantly.

An intense programme of investigations followed to identify the extent and path of the leaks, while the dam was under heightened surveillance to ensure safety did not become unacceptable.

Some Conference And Journal Articles Related To The Arapuni PROJECT:

1. Amos, P., Newson, T. & Gillon, M. (2003). Investigation of a Deteriorating Seepage Condition in Arapuni Dam Foundation, ANCOLD Annual Conference 2003.
2. Amos, P. Newson, T. Gillon, M., & Stewart, J. (2003). Grouting High Pressure Seepage at Arapuni Dam, NZSOLD Symposium 2003.
3. Gillon, M & Bruce, D. (2003). High Pressure Seepage at Arapuni Dam – a case history of monitoring, exploration and remediation. USSD Annual Conference on Dams, June 2002.

Technical Expertise

Damwatch engineers combined with international expertise were used in the grouting operation. The key seepage monitoring instruments continue to be monitored by Damwatch' 24-hour alarm warning system

Engineering Solution

- The seepage feature was successfully grouted without lowering the reservoir
- Immediately following the grouting, the total drainage flows from the dam dropped from 800 litres/min to 30 litres/min
- Monitoring since the grouting has shown stable conditions in the foundation of the dam.

Engineering Investigation

From September 2000 drilling was undertaken to install piezometers to monitor the seepage zone. A range of groundwater investigation techniques were used to identify the leakage path:

Dye testing from the lake, within boreholes and from the diversion tunnel

- Water chemistry
- Temperature analysis
- Underwater remote vehicle surveys
- Response tests

