



wassara

**STRAIGHT  
FORWARD  
DRILLING**



## WATER-POWERED DRILLING IN CONFINED GALLERIES IN ANGOSTURA DAM

**When complete, the Angostura Hydroelectric Plant will deliver power to around 300 000 households. The bedrock needed water-proofing, this was done by drilling 64 mm holes and then grouting with cement. The Wassara system was also used for drainage drilling with 102 mm diameter holes.**

**The allowed borehole deviation was set to 2% at full length. Wassara managed to meet the requirement by far. The drilling environment was healthy, friendly and comfortable as it was dust-free and held a low noise level.**

### **A 320 MW hydropower plant under construction**

The Angostura Hydroelectric Plant is located some 600 km south of Santiago, being the largest hydropower plant being built in Chile since 2004. A total of 200 000 m<sup>3</sup> concrete will be used in the construction. When completed, the plant will have a generation capacity of 320 MW, enough to power around 300 000 households. The total production will be 1 542 GWh a year.

### **Waterproofing the bedrock**

The dam is a RCC (Roller-Compacted Concrete) dam. Although the bedrock was in good condition for placing a dam on, it was stipulated that it should be made water-proof by drilling and grouting with cement. The drilling would also detect any weak or permeable zones along the dam body.

### **Drilling in cramped galleries**

Part of the drilling took place in 2.5 meter high galleries. This made drilling of the 64 mm holes a bit particular as there was only 1.2 meter free space to operate on above the drill rig. The drill tubes were as short as 1 meter, not optimal for straight drilling. Despite this, Wassara managed to meet the accuracy requirement.

### **Drainage drilling**

The Wassara system was also used for drainage drilling with 102 mm diameter holes. One site drilled for drain curtain along the dam, 3 200 meters downwards and 1 100 meters upwards. The other site drilled along the gallery around the principal machine cavern (comprising 3 turbines and generators), 1 000 meters downwards and 800 meters upwards.



**CASE STUDY**

# WATER-POWERED DRILLING IN VERY LOW ROOFED GALLERIES IN ANGOSTURA DAM

## A pleased customer

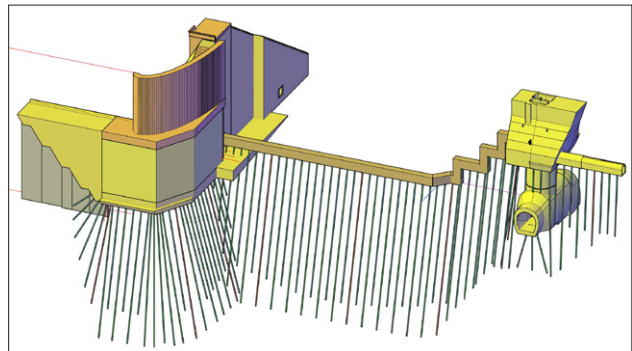
Alberto Mukden is Production Manager at the drilling contractor Pilotes Terratest. He says: “The Wassara system was very satisfactory along this project. We were able to meet the target for minimum drilling deviation and we improved the production ratios with no tool cost increase. The dust-free drilling and low noise emission from the equipment gave us a healthy, friendly and comfortable work environment inside the working gallery”

## Borehole accuracy

The allowed borehole deviation was set to 2% at full length. Wassara managed to meet the requirement by far.



The Angostura Hydroelectric Plant



Drawing of the drilling plan

Equipment used	
DTH hammer	Wassara W50
	Wassara W80
Drill bits	Ø 64 mm (2.5")
	Ø 102 mm (4")
Rig	Commacchio MC 235 with a 1.2 m free stroke length
Pump	Hammelmann HDP -127
Drilling fluid	Clean water from the dam
Drill pipe	Wassara 1 000 mm, OD 48mm
Borehole length	5-60 meters
Scope of drilling	4 000 meters (W50)
	6 100 meters (W80)
Geologic formation	Sedimentary rock



Drilling in confined galleries

September 2013

## CASE STUDY