DEPRESSURIZATION STUDY AT PORGERA GOLD MINE, PAPUA NEW GUINEA

Client: the Porgera Joint Venture

Issue: Plan depressurisation tests on pit benches

Solution: Hydrogeologist Workbench of ANSDIMAT was used to predict pore pressure reduction caused by Horizontal Drain Holes

The Porgera mine in Papua New Guinea is a world class gold mine but “it is also one of the world’s most difficult mines to operate”[1].

One of the challenges at the Porgera open pit is related to the adverse impact of high pore pressure on slope stability. Because rock formations have low permeability, the only possible option for depressurisation requires the installation of Horizontal Drain Holes (HDH). The number of HDH and the spacing between them must be determined **to optimize the cost/efficiency ratio**.

This study objective was to simulate the aquifer’s drawdown in response to depressurisation by HDH. The results were used to design a testing program for depressurisation trial and also provided the basis for the simulation of slope depressurisation.

The major rocks of the pit wall are Brown Mudstones, that are highly heterogeneous and have very low permeability, in the order of 1E-7—1E-9 m/s.

As the rock properties (i.e. hydraulic conductivity and storage) are not precisely known, 4 scenarios were tested as presented in the Table below.

The simulation was carried on using the Drain Holes tool of the ANSDIMAT Hydrogeologist Workbench. This module applies the drawdown superposition principle to confined and unconfined aquifers with drawdown-controlled wells.

The tool dialog window is presented on Fig.1. The two slotted HDH were approximated by two lines of 200 vertical wells with a screen length equivalent to the diameter of the horizontal well. One line of closely spaced vertical wells with 156 mm screen length and 156 mm well diameters effectively corresponds to a horizontal well with a 156 mm diameter, as illustrated on Fig.2.

Table. Summary of properties and reservoir hypotheses for the 4 scenarios tested

Scenario number	1	2	3	4
Hydraulic conductivity, m/day	0.009		0.0009	
Storage coefficient	0.001	0.005	0.001	0.01
Specific yield	0.01	0.03		
Aquifer type	infinite, unconfined, homogeneous			
Saturated thickness, m	100			
Drain depth under water table, m	50			
Screen length, m	0.156			
Borehole radius, m	0.078			

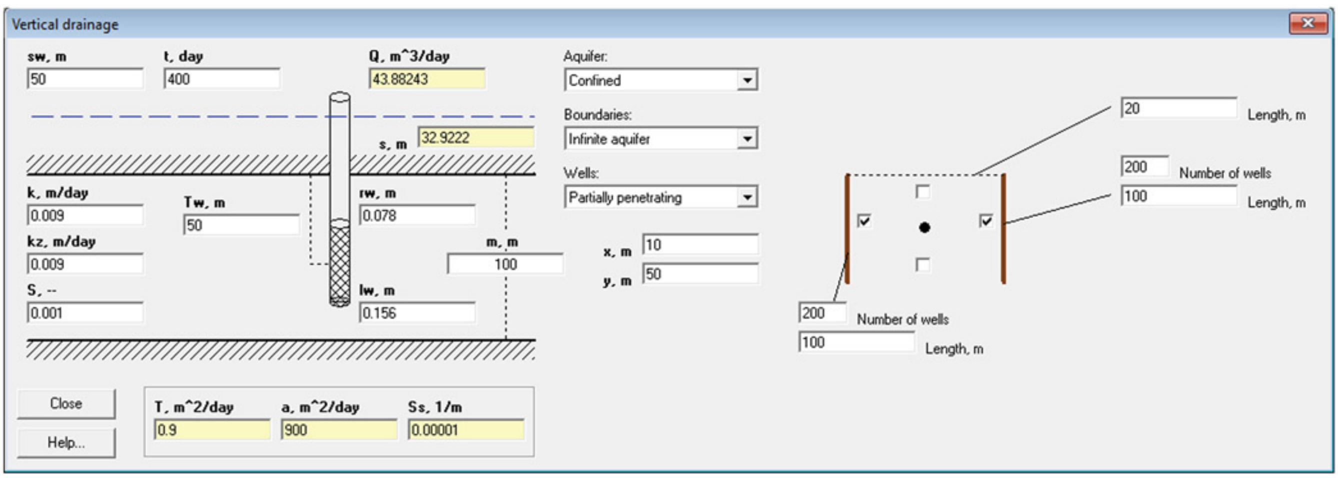

Fig. 1. HDH calculation window from the Hydrogeologist Workbench of ANSDIMAT

[1] Business Advantage Papua New Guinea (https://www.businessadvantagepng.com/the-huge-risks-and-rewards-of-papua-new-guineasporgera-gold-mine/)

Two HDH were **set up at the intervals of 20 m, 40 m and 60 m for the four depressurisation scenarios**. Drawdown was calculated for periods of 15, 30, 90 and 365 days at the mid-distance point between the two HDH (**Fig.1**). Other details of model set up are presented in the **Table**.

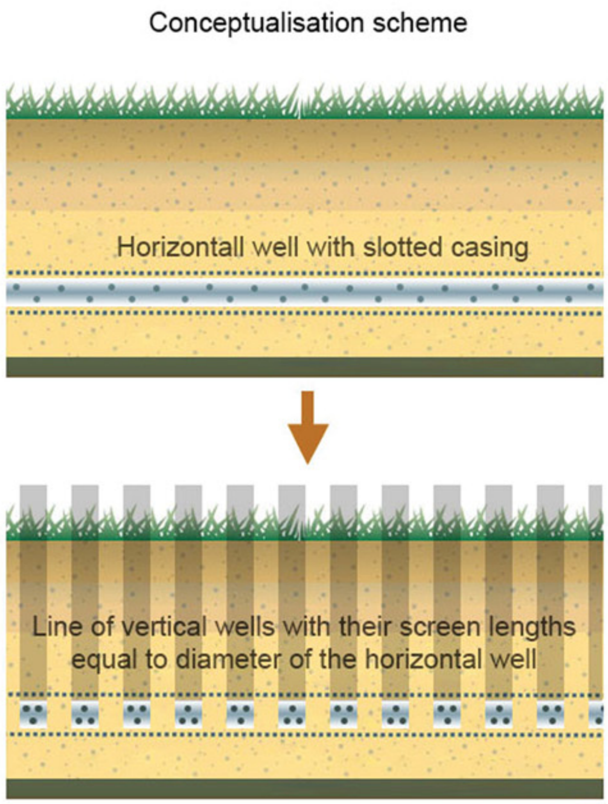

Fig. 2. Conceptual scheme using the superposition principle to simulate a HDH by a line of vertical wells

Hydrographs for the monitoring well (**Fig.3**) show that the spacing of the HDH has a significant impact on depressurisation. The drawdown between the two HDH varies between 35 and 25 m when they are located 20 m apart while drawdown varies between 25 and 15 m when the two HDH are located 40 or 60 m apart. The simulations also reveal that the transmissivity of the formation is a more significant factor for the efficiency of the depressurisation than storage or specific yield, especially with shorter spacing between HDH.

These results were used to plan depressurisation trials that will allow:

- decreasing range of uncertainties in **Table**
- predicting real impacts on pore pressure at various locations of the Porgera pit
- designing efficient depressurisation measures.

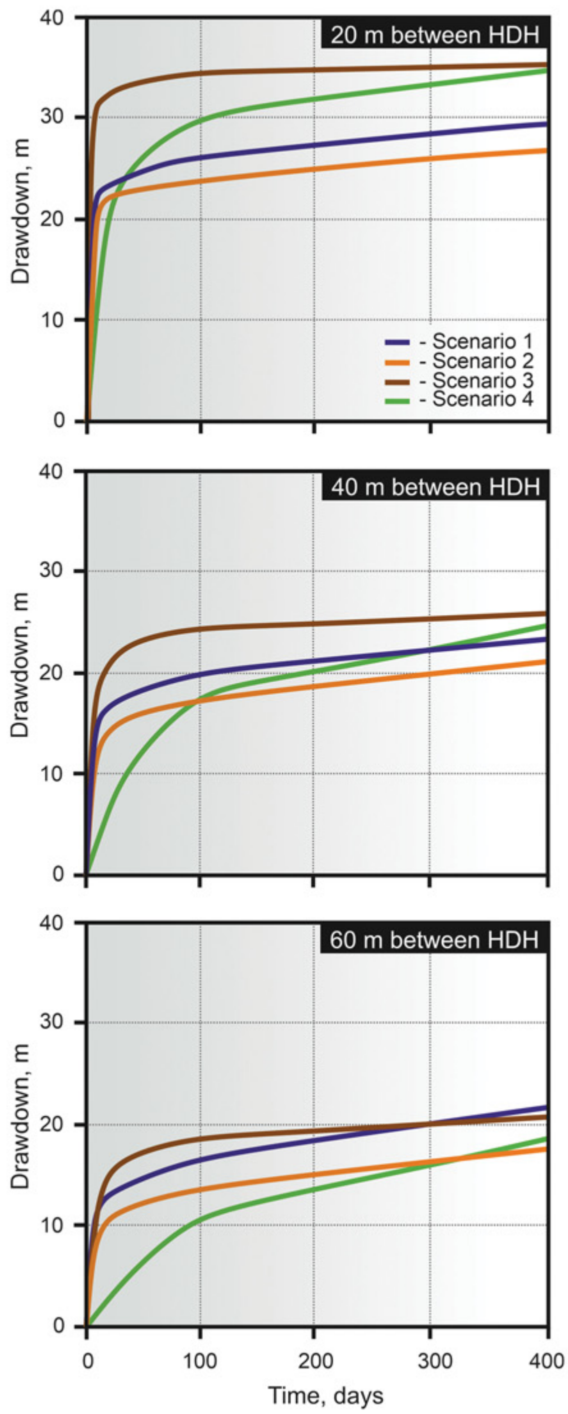

Fig. 3. Hydrographs in the monitoring well with HDH spacing of 20, 40 and 60 m respectively