



## **Tracer Dilution Profiles for Mine Dewatering: Approach and Case Study**

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# Presentation plan



- Introduction and quick literature review
- Methodology
- Case Study of a mine in Mexico

# Introduction



Groundwater Flow in fractured aquifer is often complex

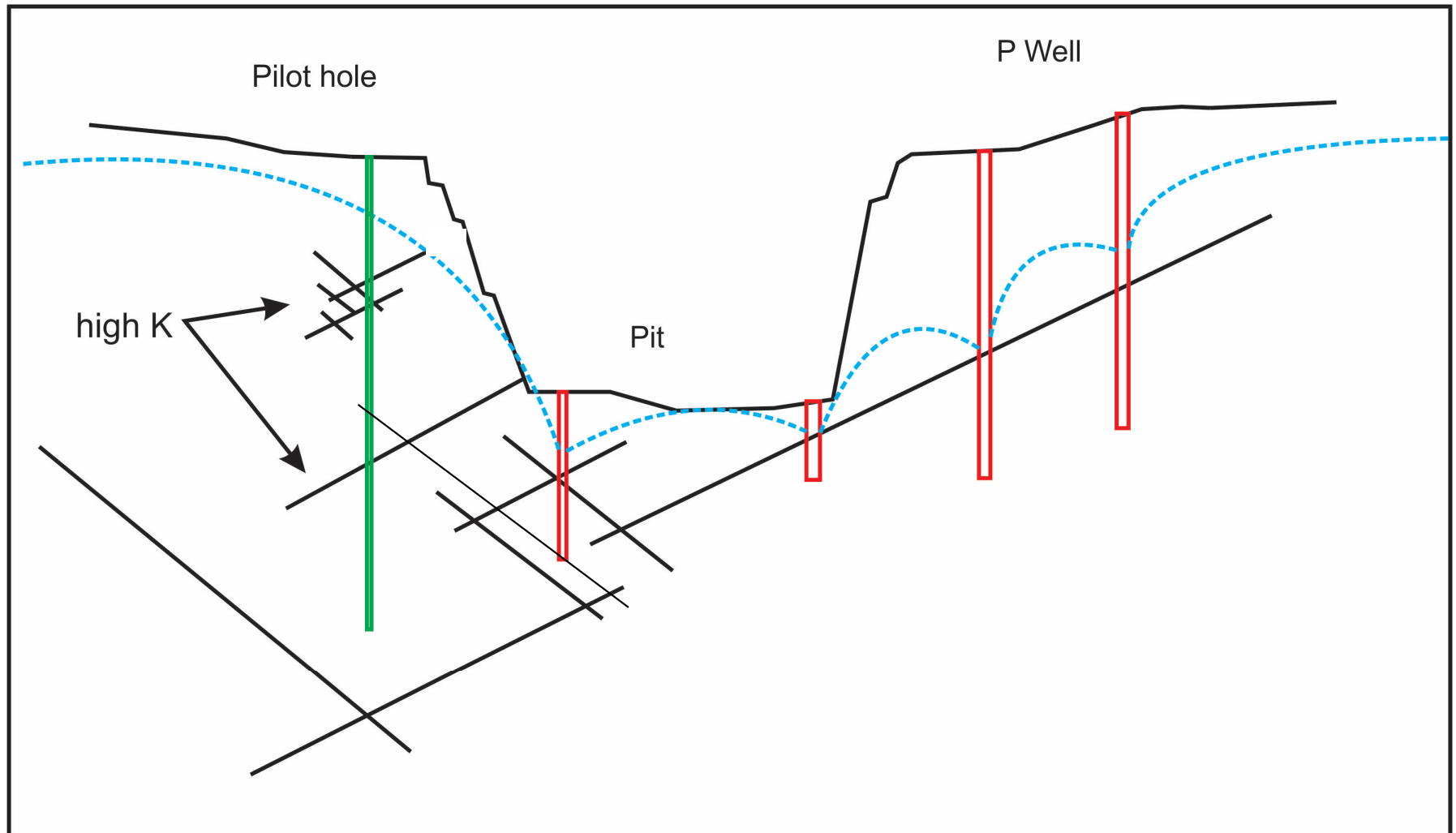
Understanding the flow is a key for an efficient dewatering project



Methodologies utilized have limitations that may caused incorrect interpretation

The most important artifacts will be related to 'pocket of trapped water'.

# Introduction



# Introduction



In mining, those existing approaches are often utilized:

1-Slug Test

2-Air Lift Test

3-Underground flow test (slug equivalent)

4-Pump Test

5-Packer test

6-Spinner Logging

All of them requires to add a stress

# Introduction



## Underground Flow Test – Artesian Holes

Allow to obtain an average K value plus a short term Sc

Easy and Quick

Can be utilized as long term flow (pump) test

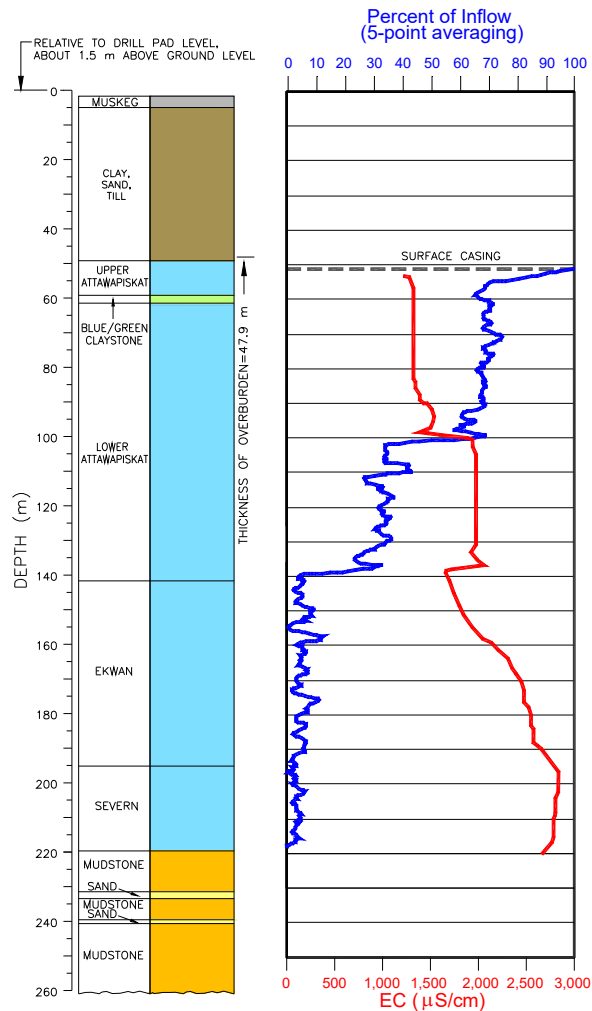
Eleonore Mine (Newmont Canada)



# Introduction



## Spinner Logging



Allow to isolate discontinuities with accuracy

Often imply to add a stress with cylindrical flow regime

Depending on permeability, some water bearing faults may not be visible.

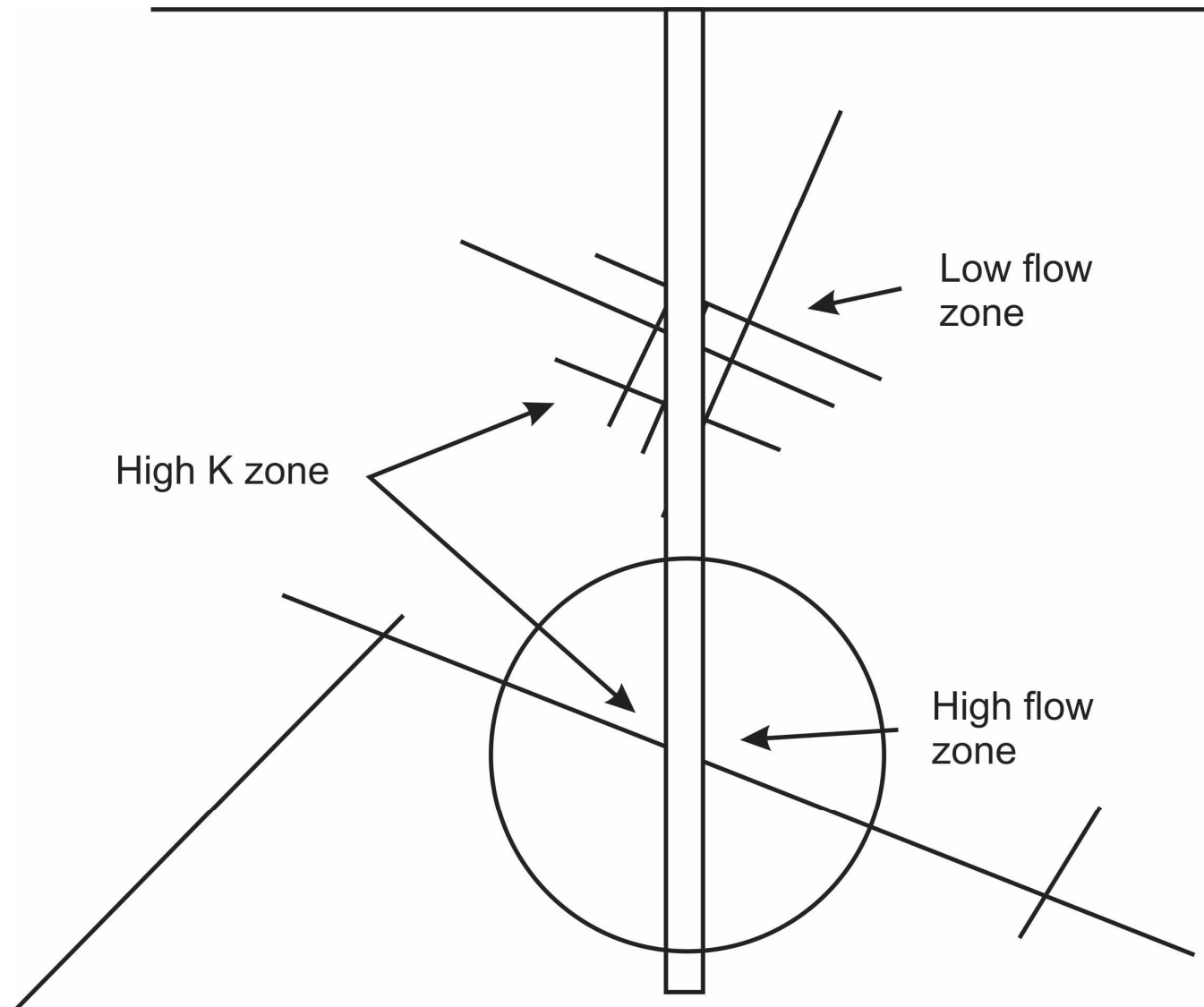
# Methodology

## Tracer Test



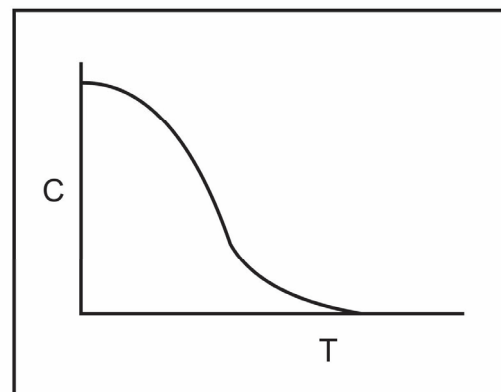
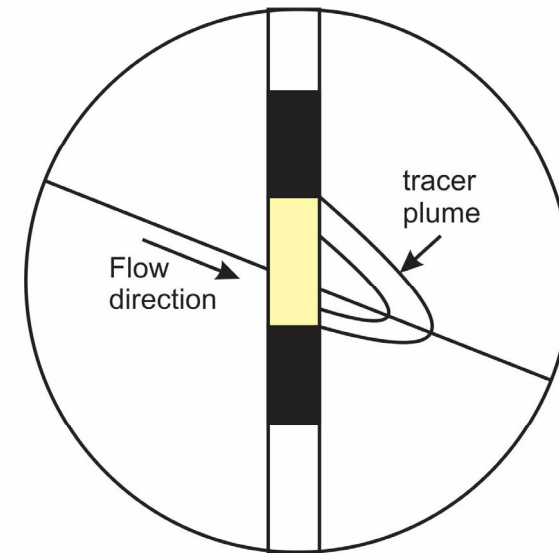
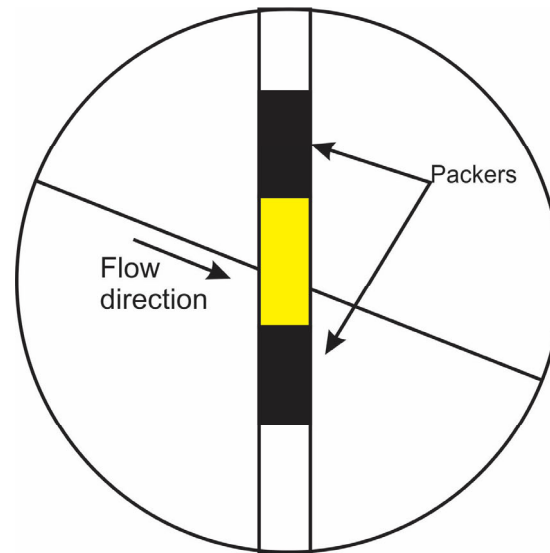


# Methodology



# Methodology

## Point Dilution Method (first by Ogilvy, 1958)

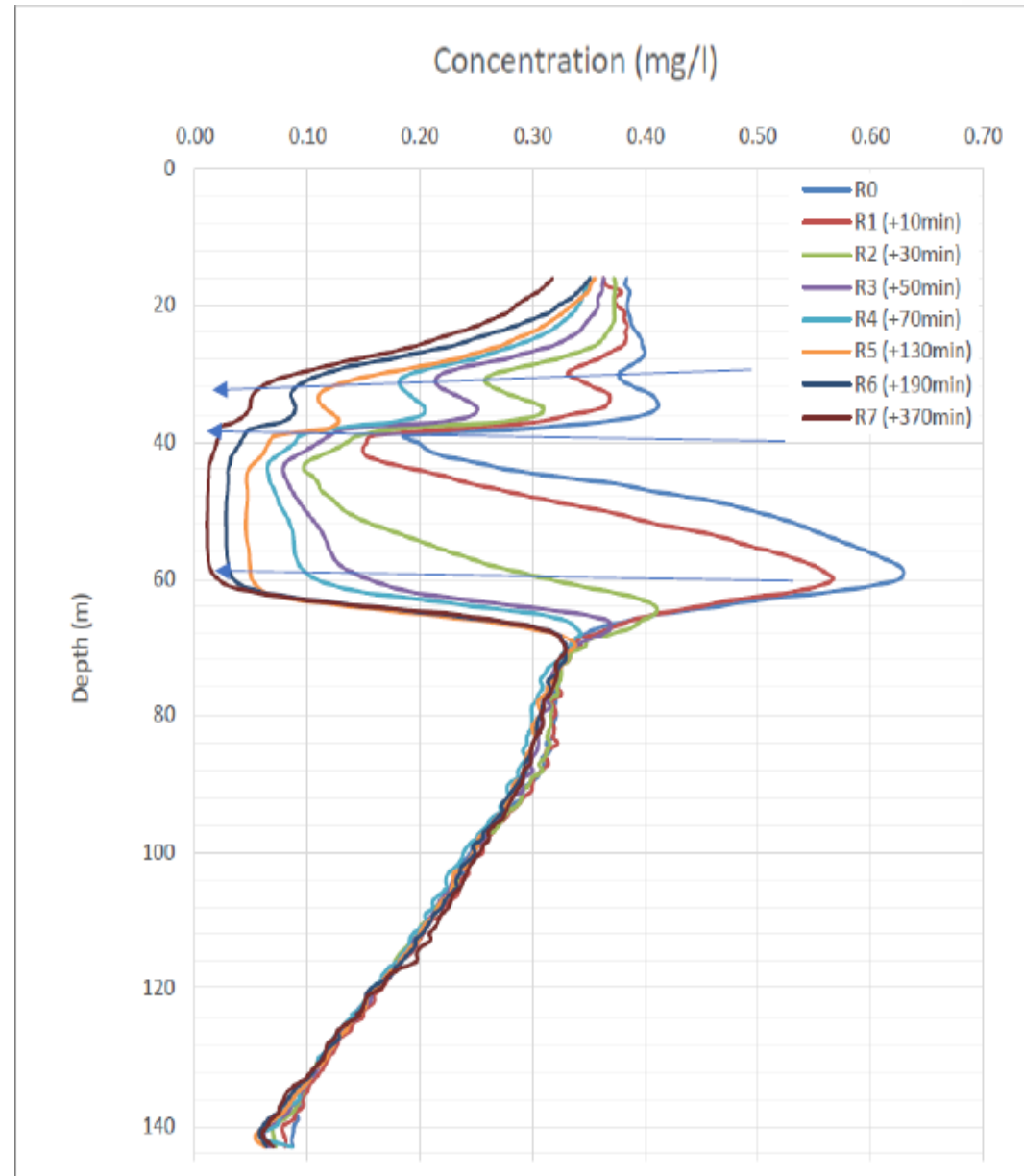


Resulting is the apparent velocity

$$Q = VA$$

$$V = v / n$$

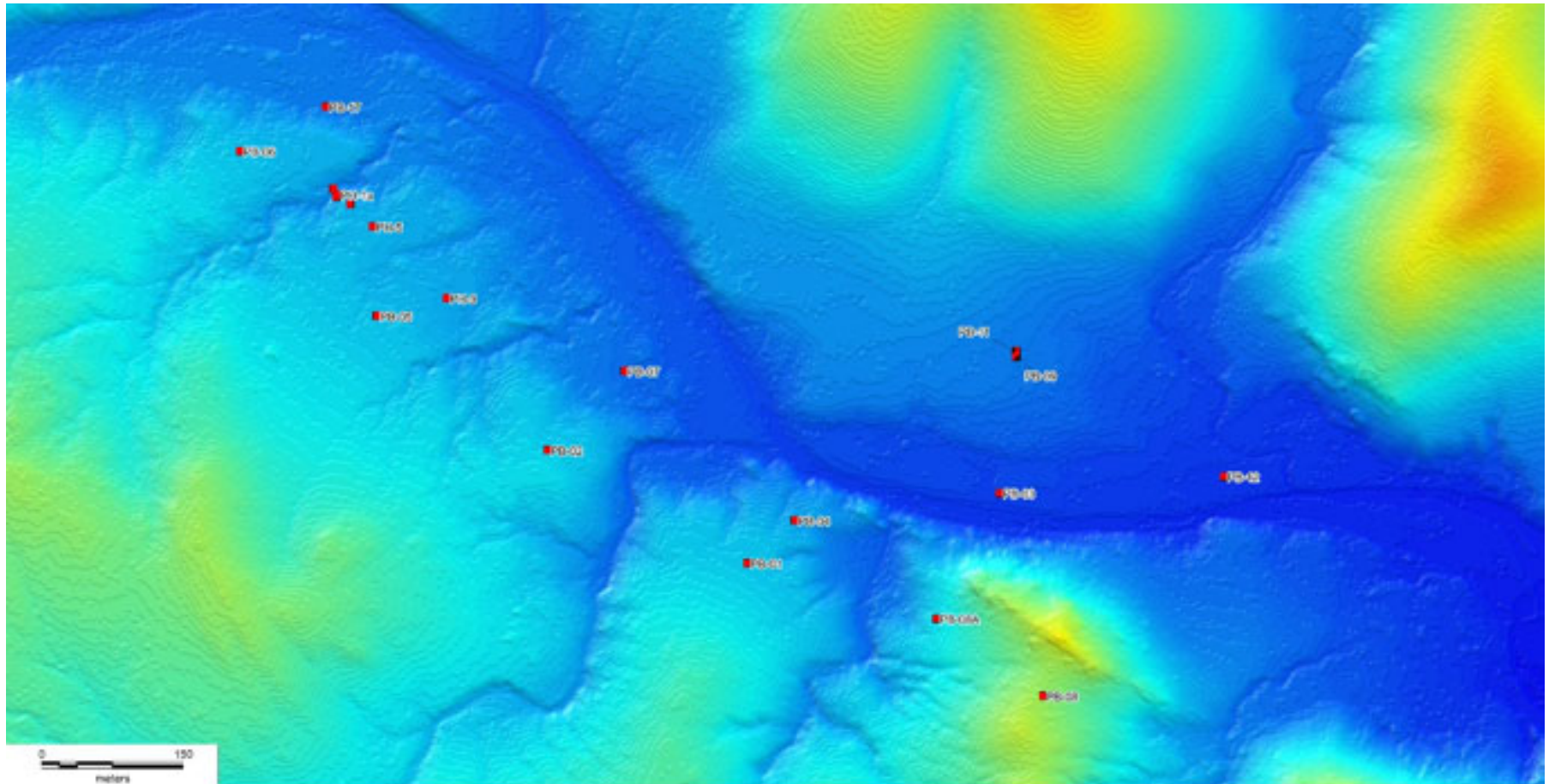
# Methodology



# Case Study

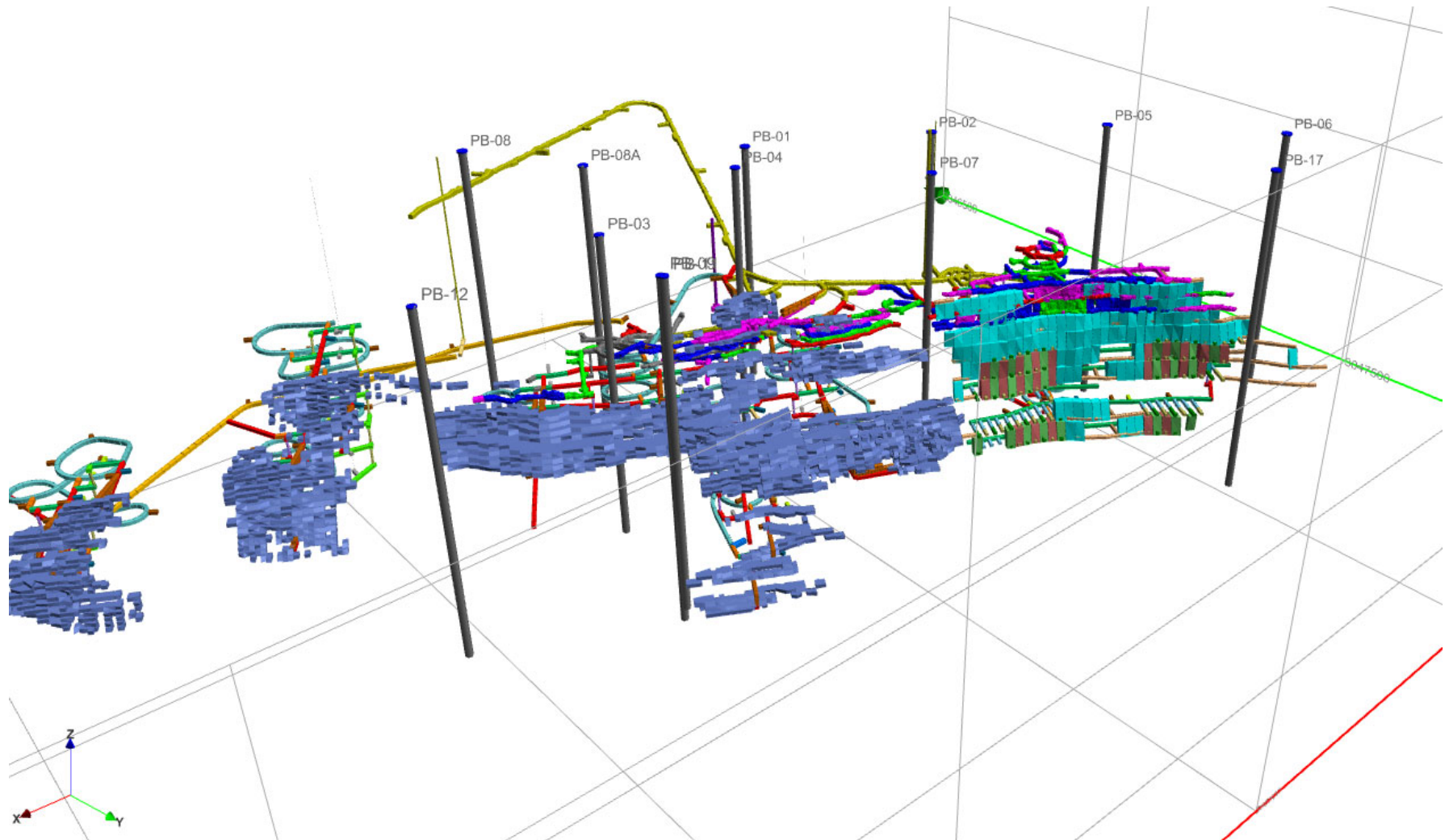


# Case Study



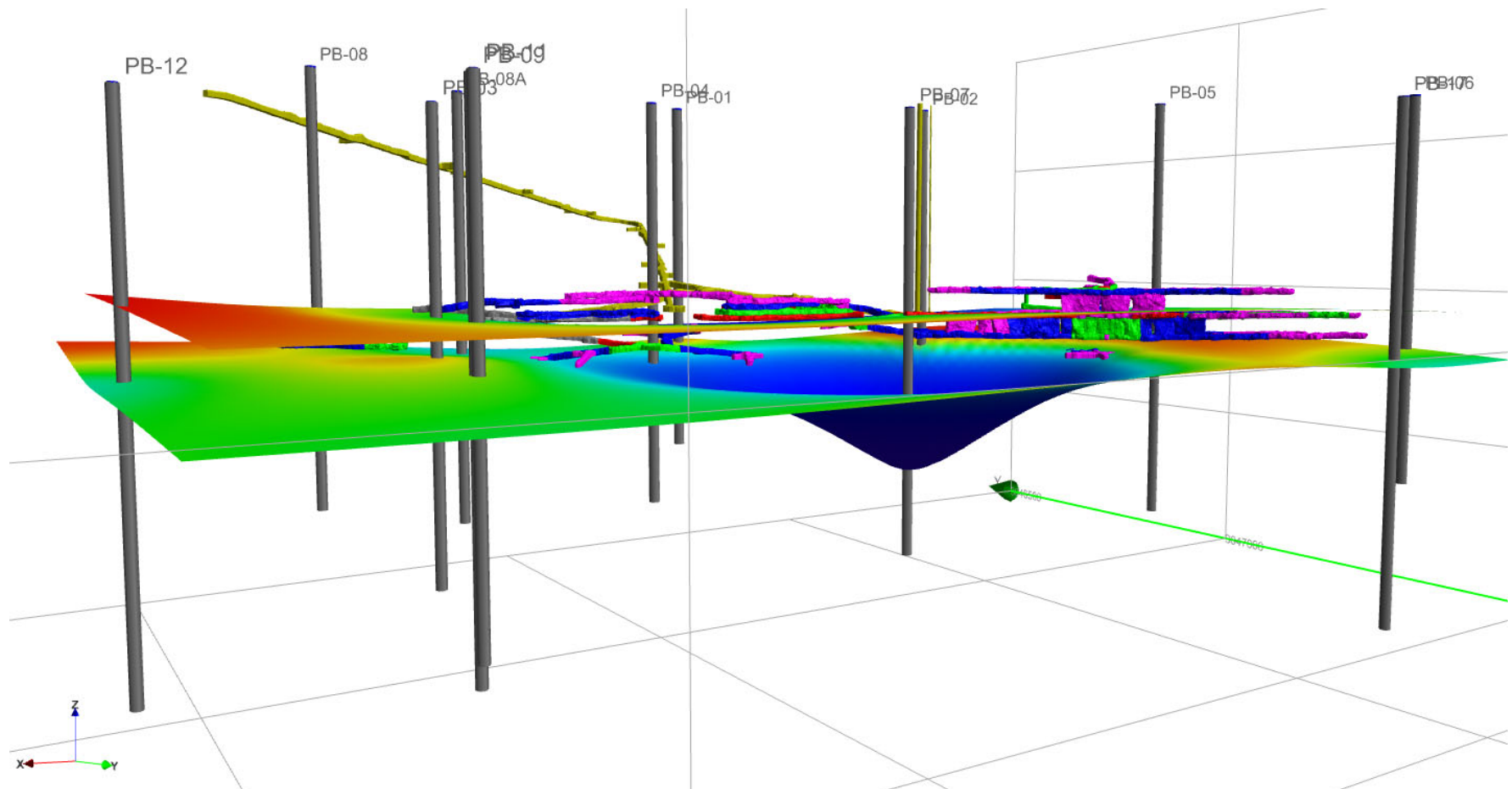
# Case Study

- 11 wells active
- 11 000 usgpm



# Case Study

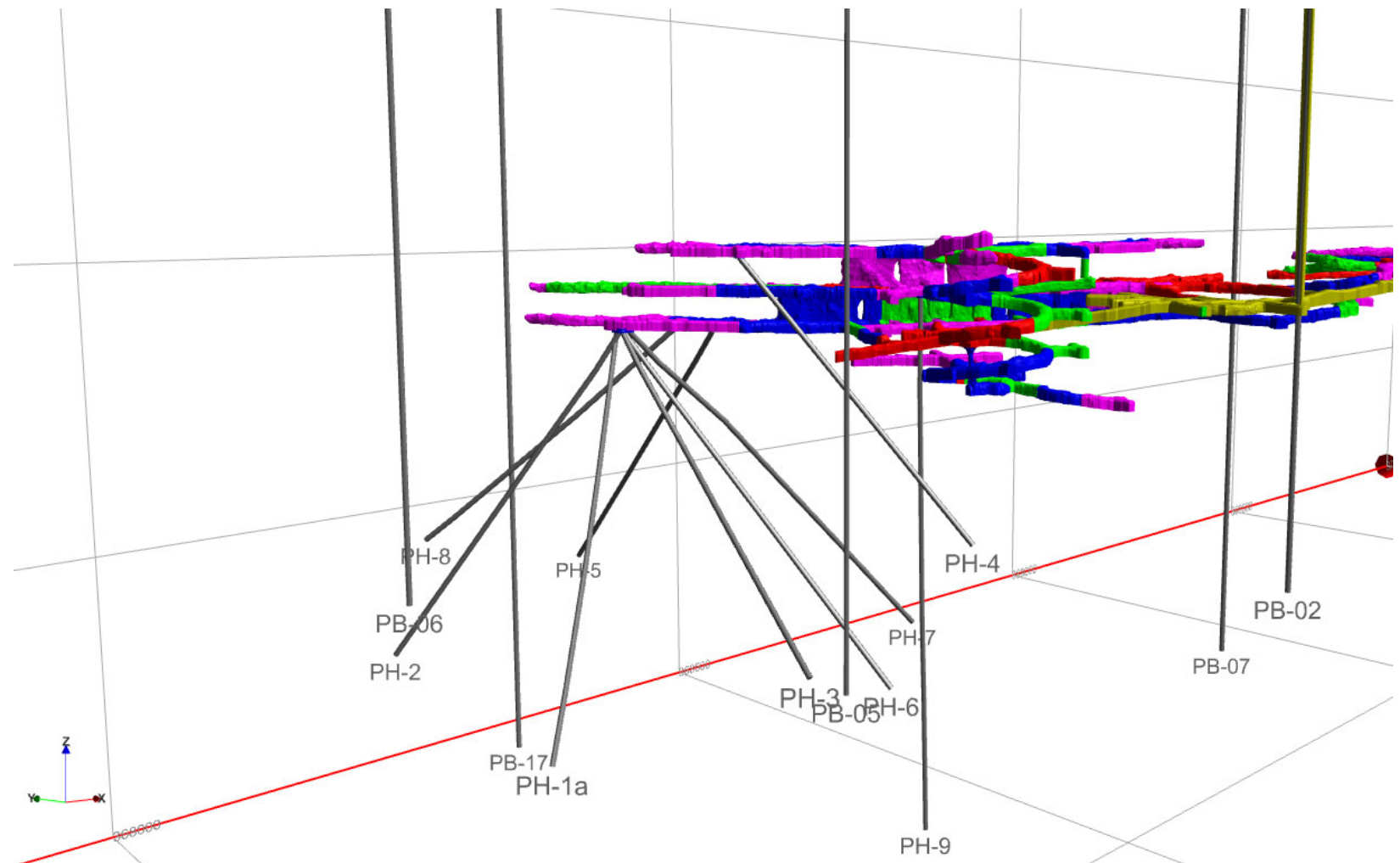
- Initial water elev +/- 1390mamsl
- Current water elev +/- 1350mamsl
- Final level to reach +/- 1170mamsl
- Still 180m of drawdown required
- Level almost stabilised: + flow



# Case Study



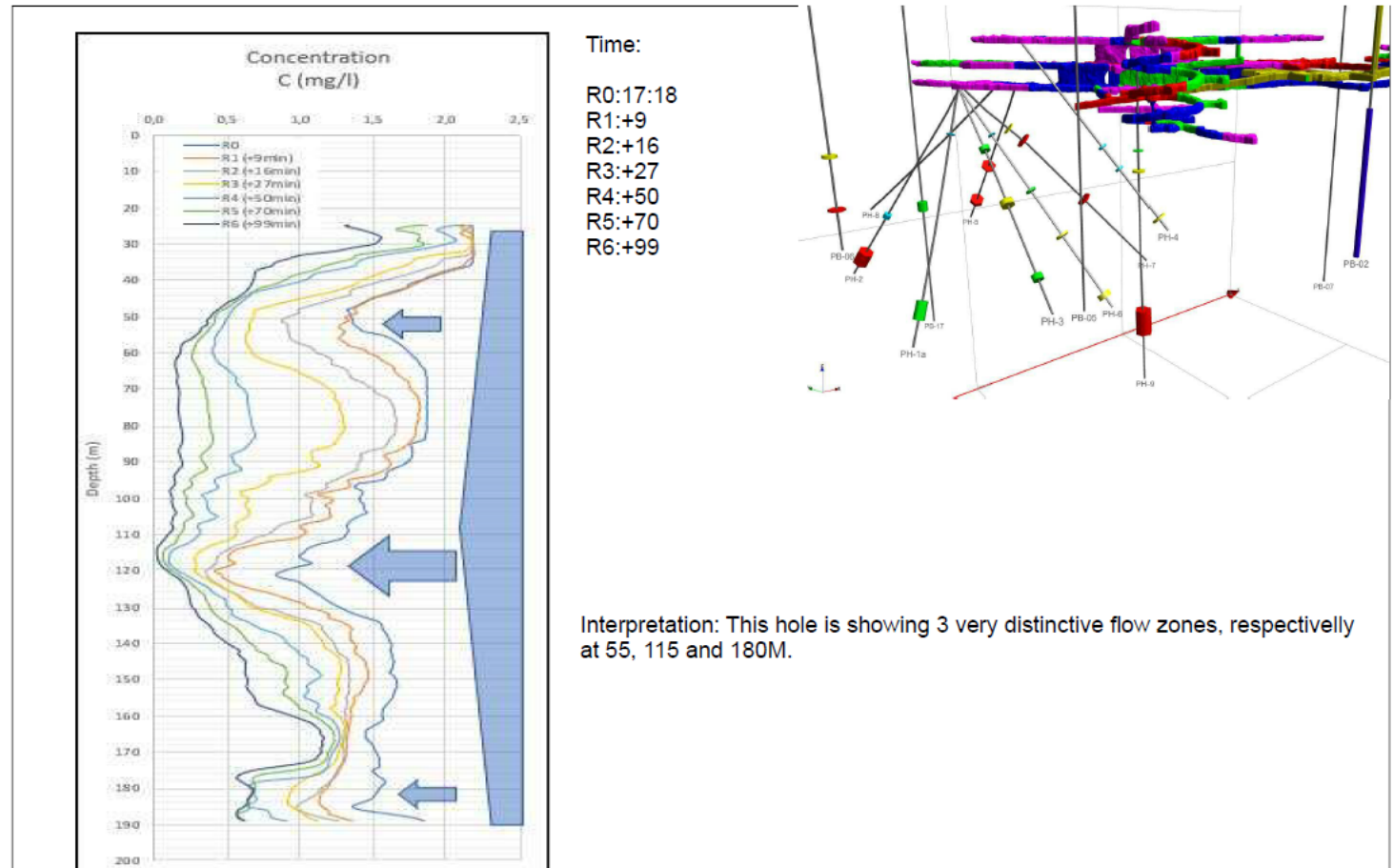
- Pilot hole program to isolate the flow zones on the NW side
- 9 PH tested with PTTs and other conventional test





# Case Study

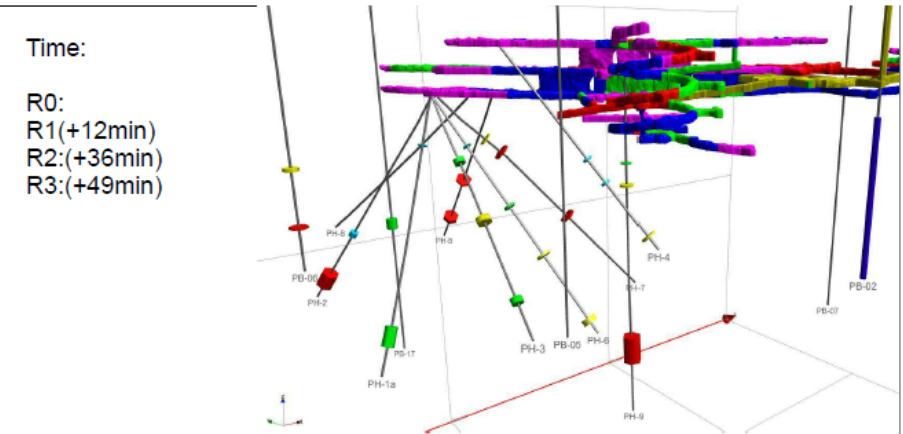
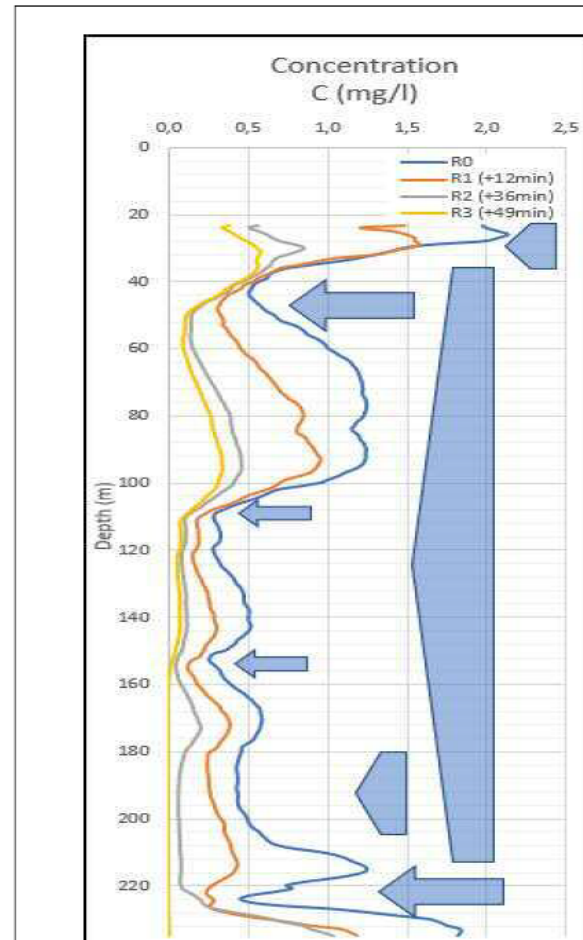
## Example of results in PH3



PTT: In hole no PH-3  
Date of completion: 27-6-2020

# Case Study

## Example of results in PH6



Interpretation: Four very obvious medium flow zones (50, 110, 155 and 220m). The lower flow zones and the one at 155m are showing higher flow

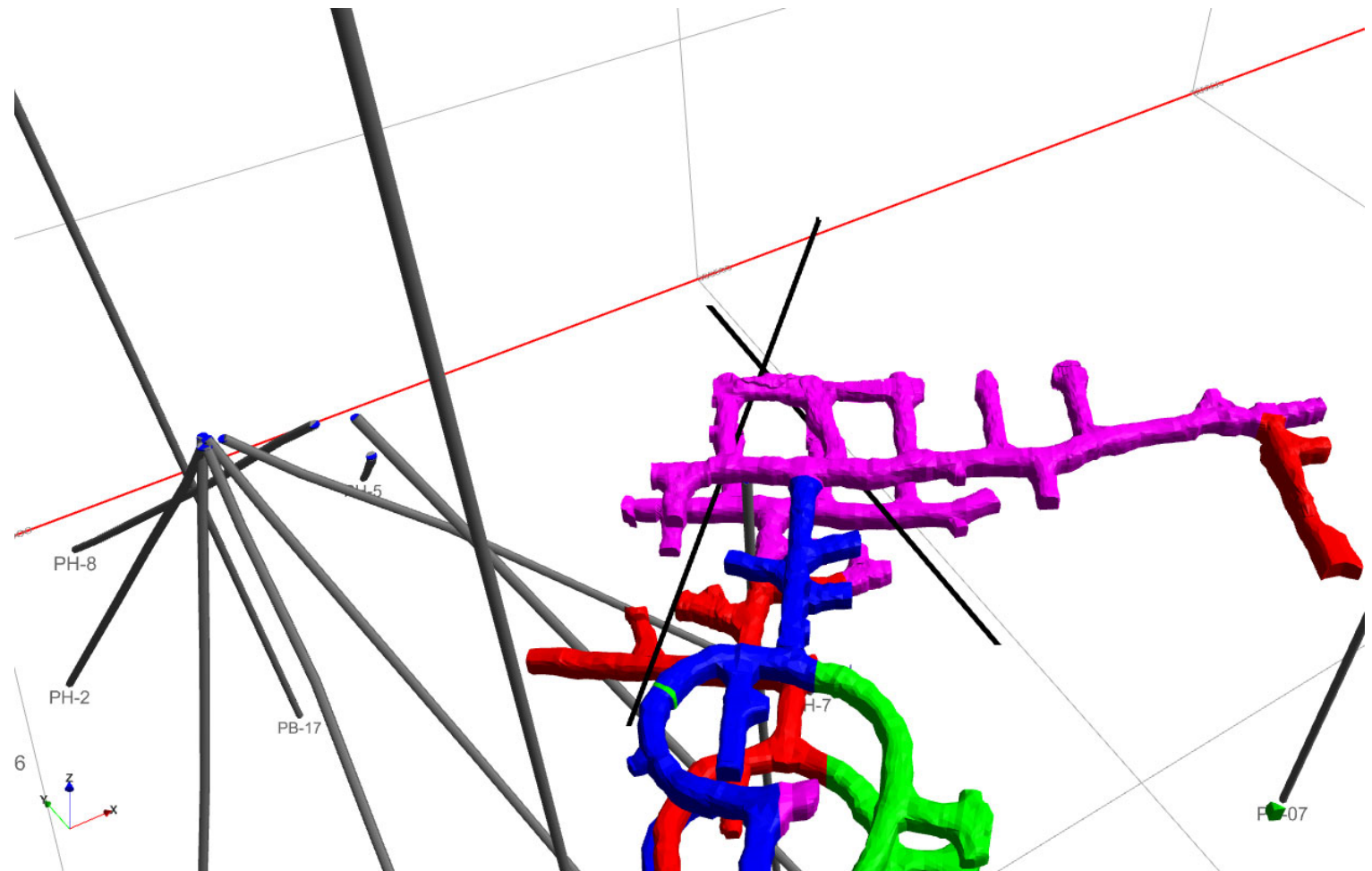


PTT: In PH 6  
Date of completion: 21-6-2020

# Case Study



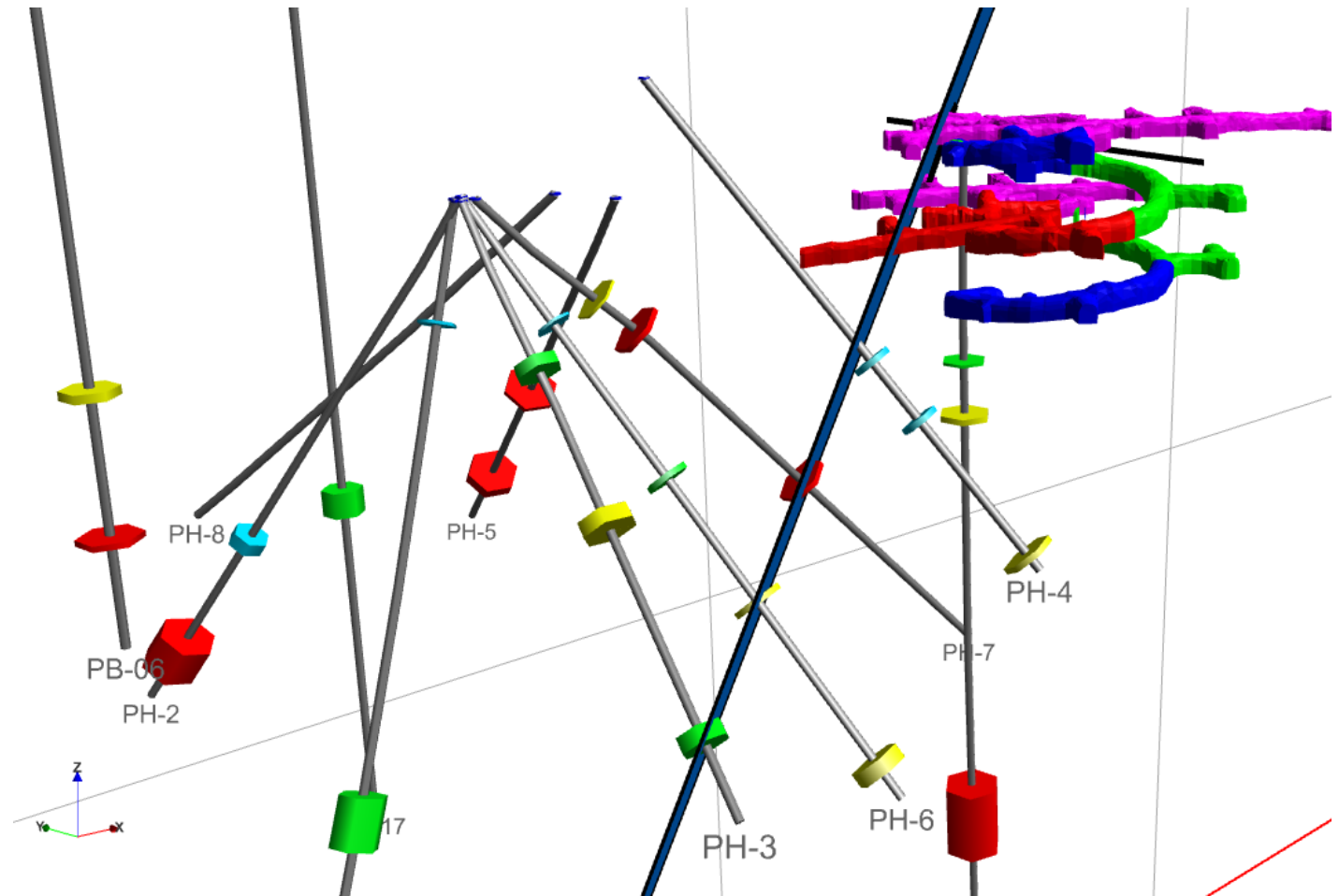
Mapping of 2 faults underground to verify flow zones extension. 2 Faults (black line have been located in the drift above).



# Case Study

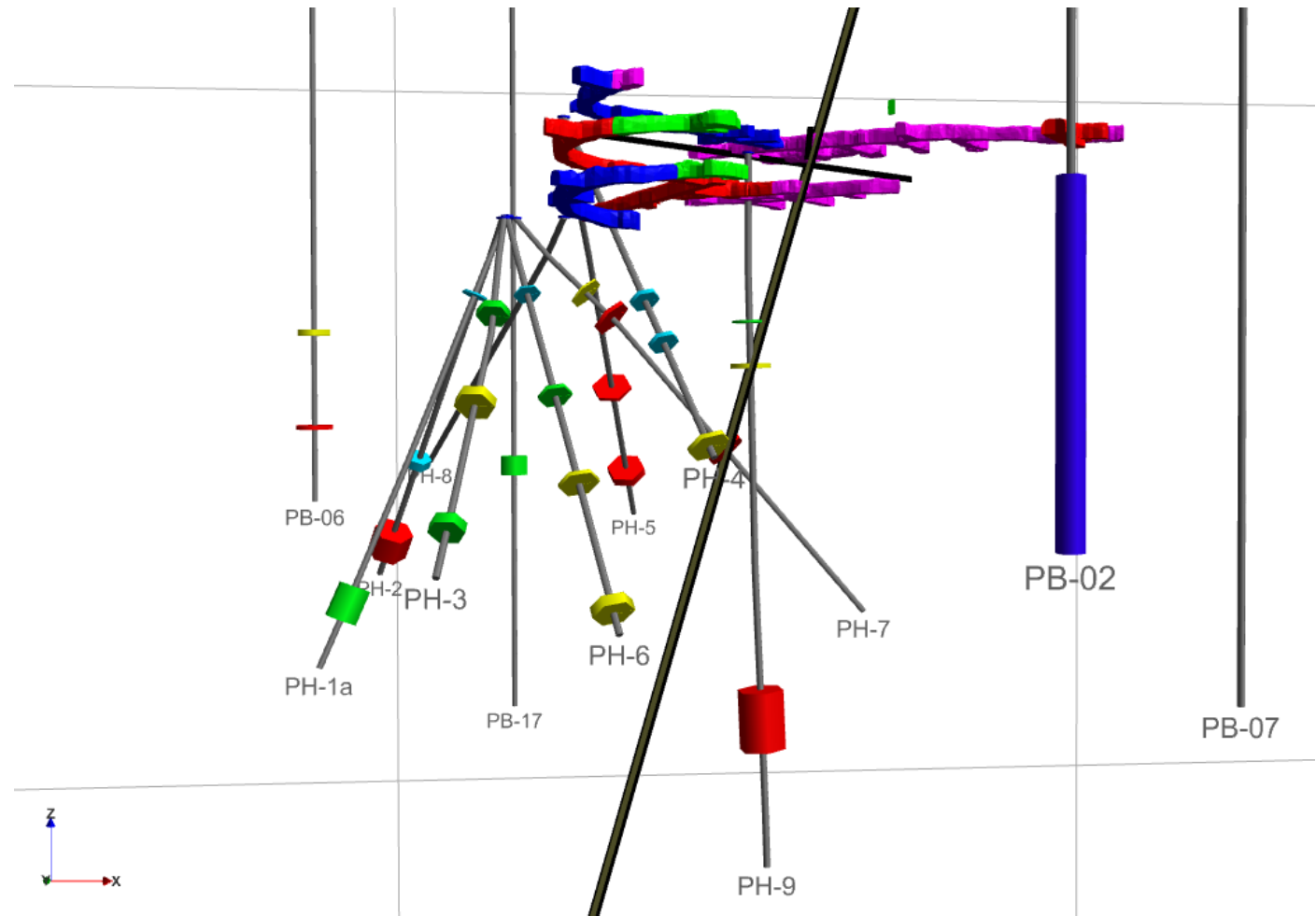


Fault no 13 have been drawn in 3D according to mapping underground...its extension goes through 4 different flow zones identifies (including PH3 and PH6 shown previously)



# Case Study

Fault no 11 have also been drawn in 3D according to mapping underground...its extension goes through 3 different flow zones identified



## Case Study



- This program at Los Gatos lead to the location of 2 wells underground
- The 2 wells were tested at flow rate of 3500usgpm each for a total of 7000usgpm, compared to 11 000usgpm for 11 surface wells.
- After a year, the yield was maintained to help dewater the mine.

Question



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