

The Problem

- A shaft being sunk into Chalk was predicted to intercept a steeply inclined water bearing fissure intercepting the base of a diaphragm wall (D-wall) shaft at 66mbgl. Lateral and vertical extent of fissure unknown.
- Baseline pumping tests >14 l/s, limited by discharge consents. Maximum possible water inflow rates unknown but postulated to be in excess of 80 l/s.
- Programme and equipment constraints meant that increasing diaphragm wall depth would not be possible.
- Additional investigation was required to confirm mitigation options to allow safe and successful shaft internal excavation.

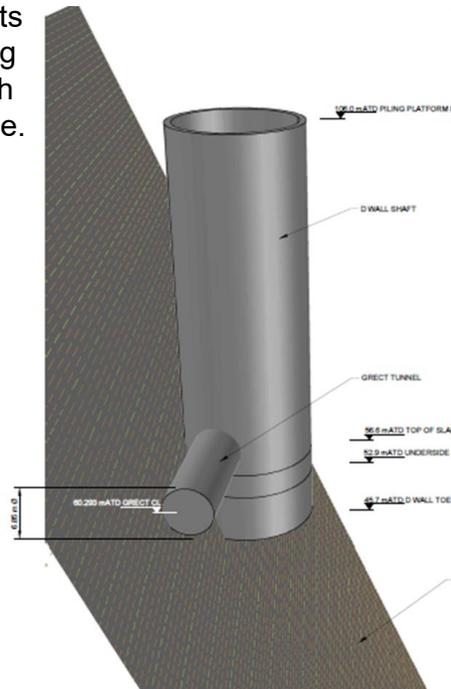


Figure 1 – Schematic of suspected feature on completion of contractor ground investigation (Golder, 2018).

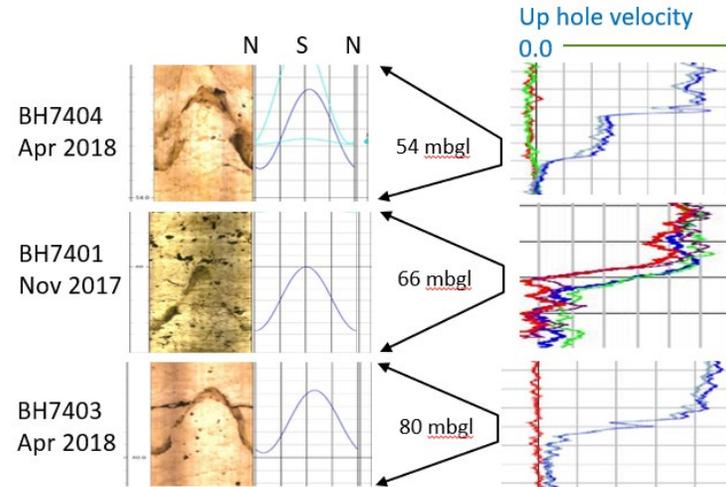


Figure 2: Borehole geophysics: Image and Fluid logs (EGS / WJUK, 2018)

The Solution

- Pumping tests, pumped borehole geophysics and geological logging North and South of the initial interception of the feature delineated the fissure plane.
- Confirmation of inflow. D-wall at planned depth would not provide an effective cut off.
- Targeted grouting inside shaft footprint, using known points of interception prior to D-walling.
- Verification via post D-walling pumping tests and coring through the base of D-wall to verify grouting extent

References:

Mortimore, R.N., Newman, TG, Royse, K, Scholes, H and Lawrence, U (2011). *Chalk: its stratigraphy, structure and engineering geology in east London and the Thames Gateway*. Quarterly Journal of Engineering Geology and Hydrogeology. Vol 44.
 Stanley, M. et al. (2012). *Design and construction of the Thames Water Lee Tunnel shafts, London*. Tunnels and Tunnelling International, April 2012, 103-108.

The Contribution

- Inflow from fissure identified at the expected depths within additional boreholes, confirming feature.
- A grouting campaign using cement-based grouts utilised the known points of interception. Injection of 20m³ of grout which accounted for 38% of predicted fissure infill if a continuous planar feature 50mm wide across the full shaft diameter was assumed.
- No additional mitigation works required to permit shaft excavation, minimising programme impact.
- Logging of marker horizons during borehole drilling and shaft excavation indicated offsets of >1m, which may have been overlooked if geophysical data not available.
- The fissure investigations highlighted the importance of undertaking integrated investigations, and enabled an efficient grouting campaign.



Figure 3 – Identification of grout within fault zone. Confirmed by materials testing