Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Environmental Statement

Volume 4

Appendix 7.6: Shaft Dewatering Calculation

June 2021

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Shaft Calculations

General parameters		
Parameter	**Value**	**Source**
Sichardt constant (C)	3000	Preene *et al* (2016)
Drawdown factor	0.5	To account for limited time of open excavation

Shaft parameters	Bonstone Compound Reception Shaft			Braddup Compound Launch Shaft				
Parameter	**Intermediate depth**	**Intermediate depth**	**Total depth**	**Intermediate depth**	**Intermediate depth**	**Total depth**	**Units**	**Source**
Depth	**6**	**10**	**14**	**6**	**10**	**13.5**	m BGL	
	172.24	168.24	164.24	170.42	166.42	162.92	m AOD	
Shaft ground level	178.24	178.24	178.24	176.42	176.42	176.42	m AOD	
Groundwater level	1.00	1.00	1.00	1.00	1.00	1.00	m BGL	No GI available - assumed high rest levels
Open face	2	2	2	2	2	1.5	m	Costain briefing
Shaft diameter	15	15	15	15	15	15	m	Costain (2020)
Horizontal hydraulic conductivity (Kh)	2.00E-06	2.00E-08	2.00E-08	2.00E-06	2.00E-08	2.00E-08	m/s	Geotechnics (2020) where possible, otherwise generic parameters
K data source	Generic value for Till (clay with cobbles and boulders) provided by Domenico *et al* (1990) - higher end of the range used	Generic value for shale provided by Domenico *et al* (1990) - higher end of the range used	Generic value for shale provided by Domenico *et al* (1990) - higher end of the range used	Generic value for Till (clay with cobbles and boulders) provided by Domenico *et al* (1990) - higher end of the range used	Generic value for shale provided by Demenico *et al* (1990) - higher end of the range used	Generic value for shale provided by Demenico *et al* (1990) - higher end of the range used		
K anisotropy factor	10	10	10	10	10	10		Assumed as default

Summary Table

Location	Shaft ID	Shaft diameter (m)	Shaft depth (m)	Original groundwater level (m BGL)	Construction stage	Depth (m BGL)	Radius of influence (Ro) (m)	Total groundwater inflow (horizontal + vertical) (m3/d)	Total groundwater inflow (horizontal + vertical) (l/s)
Bonstone Compound	Reception Shaft	15	14	1	Intermediate depth (superficial)	6.0	10.61	11.47	0.1328
				1	Intermediate depth (bedrock)	10.0	1.91	0.52	0.0060
				1	Total depth (bedrock)	14.0	2.76	0.58	0.0067
Braddup Compound	Launch Shaft	15	13.5	1	Intermediate depth (superficial)	6.0	10.61	11.47	0.1328
				1	Intermediate depth (bedrock)	10.0	1.91	0.52	0.0060
				1	Total depth (bedrock)	13.5	2.65	0.48	0.0055