Proof of Evidence
of
Christopher Leake BSc MSc FGS
Hafren Water Ltd

Public Inquiry of the Application by A D Calvert Architectural Stone Supplies Ltd

The evidence relates to proposed development of a dimension stone quarry at Horn Crag Quarry, Silsden, West Yorkshire

Water issues

CONTENTS

TABLES

DRAWINGS

1. EXECUTIVE SUMMARY

1.1 Planning permission has been sought for extraction of sandstone at Horn Crag Quarry.

1.2 Assessments were undertaken of the water environment in the vicinity of the site, including consideration of impacts which could potentially arise from the proposed development. The investigations were undertaken by consultants Hafren Water Limited, which culminated in the preparation of a Hydrogeological Impact Assessment (HIA) in January 2020.

1.3 The geology of the site and its environs is taken from published British Geological Survey (BGS) mapping, borehole records and site visits. The bedrock comprises sandstone of the Millstone Grit Group.

1.4 Without mitigation, a potential Source-Pathway-Receptor (S-P-R) linkage may exist from the site to the aquifer. This means that, without mitigation, there is a risk of pollutants entering the aquifer. Potential sources of pollutants at the operational site comprise principally mobilised suspended solids in surface water, hydrocarbons due to their storage and their use in mobile plant and from foul drainage from site facilities. The receptor is the groundwater in the sandstone and in particular a spring collector private water supply.

1.5 The S-P-R linkage would only occur if a pollution incident was to occur during mineral extraction or restoration.

1.6 Mitigation measures include the careful scheduling of mineral extraction and conforming to best practice in material handling, including compliance with the Control of Pollution (Oil Storage) (England) Regulations 2001.

1.7 To mitigate against suspended solids being mobilised into the sandstone, unworked rock will be retained in the floor of the quarry, above the watertable. This is a widely accepted practice in the quarrying industry, where similar conditions pertain. The proposed mitigation measures will minimise the likelihood of occurrence of a pollution incident and therefore the potential contamination of the sandstone aquifer. Three issues were identified by the Environment Agency in their response to the planning application. These have been addressed fully within an updated HIA report (September 2023), which has been submitted to the Council.

1.8 Based upon the updated report the Council has confirmed that they will not be progressing the hydrogeological reason for refusal, as it is agreed the issue can be dealt with by way of conditions.

1.9 The proposed planning conditions relating to water issues are considered to be appropriate and proportionate to the water issues at the site.

1.10 The proposed scheme addresses issues reportedly occurring at the site in the 1980s. Specifically, a) all foul effluent from welfare facilities will be stored and tankered off-site for subsequent treatment, b) robust monitoring, safeguarding and spill response measures will be in place and c) as-dug material will be exported for subsequent processing elsewhere.

2. BACKGROUND

Qualifications and experience

2.1 I, Christopher Charles Leake, am Managing Director of Hafren Water Limited.

2.2 I have over 35 years' experience in groundwater assessment and management, including assessment of surface water and flooding. Most of this experience has been gained in a professional consultancy capacity.

2.3 I hold a Bachelor of Science Honours degree in Earth Science from Kingston University and a Master of Science degree in Hydrogeology from Birmingham University.

2.4 I was the senior company hydrogeologist for Tarmac Limited, one of the largest mineral operating companies within the UK for seven years. During this time I was involved on a day-to-day basis with water-related matters of the entire interests of the company. This involved investigations at more than 100 quarries throughout the UK to support Planning Applications, ROMP reviews and a wide range of regulatory matters.

2.5 I established Hafren Water consultancy in 2000 and have been Managing Director since its formation. I am a Fellow of the Geological Society of London and am familiar with its Code of Conduct.

2.6 I am experienced in the assessment of groundwater behaviour including the interaction of surface water with groundwater in superficial deposits and bedrock.

2.7 I have provided technical support to Planning Inquiries as well as acting as an expert witness.

2.8 Hafren Water Ltd undertook the Hydrogeological Impact Assessment (HIA) for this proposed development in January 2021 with revisions and updates in September 2023. Hafren Water Ltd has been instructed to prepare this Proof of Evidence.

2.9 In preparing this Proof of Evidence, I can confirm that:

a) I understand my overriding duty and responsibilities are to the Planning Inquiry and not to the party instructing me

b) The views and opinions expressed are my own views and opinions

c) I have endeavoured in this evidence, and in my opinions, to be accurate and to have covered all the relevant issues

d) I indicate in this report the sources of all the information used in its preparation

e) I understand I may be cross-examined on this report and am likely to be the subject of public adverse criticism by the Planning Appeal if it is concluded that I have not taken reasonable care to try to meet the standards expected of me

f) I have not entered into any arrangement where the amount or payment of my fees is in any way dependent on the outcome of the case

The proposed development

2.10 Planning permission has been sought for extraction of sandstone to be used as dimension stone at Horn Crag Quarry (referred to hereafter as 'the site'). A scheme for working the site was submitted in January 2021, but refused on a number of grounds.

2.11 All mineral extraction will be above the prevailing groundwater table and no groundwater management is proposed.

2.12 Water collecting within the quarry void, which is derived solely from rainfall, will be allowed to drain into the residual, unsaturated sandstone which will be retained beneath the floor of the quarry. No surface water discharge from the site would be required.

2.13 Details of drainage and water management for the development and the restored landform are presented in Sections 3 and 4 below. All information discussed herein is derived from the submitted HIA report.

Reports prepared

2.14 The extant water regime in the vicinity of the site and the original development proposal have been assessed in detail. The findings are reported in Hydrogeological Impact Assessment, Version D1 (updated), September 2023. (Document reference 01-12) The report was prepared by Hafren Water.

2.15 The Hydrogeological Impact Assessment (HIA) assessed the groundwater regime at the site and in the surrounding area. The assessment also reviewed groundwater level data in the vicinity of the site. The proximity of surface water and groundwater supply was also reviewed.

3. SITE CONTEXT – BASELINE ASSESSMENT

3.1 The site comprises an area of land part of which has been subject to previous mineral extraction. It is understood that waste rock from the historical workings has been placed above original ground level in the west of the site.

3.2 The only significant watercourse near the site is a small, southwards flowing stream, Fish Beck, which is located 150 m to the west of the quarry (*Drawing 3080/POE/01*). It is culverted beneath Fishbeck Farm and, after re-emerging, flows westwards before discharging into Silsden Reservoir.

3.3 No wells or springs are indicated within 500 m of the quarry, according to current Ordnance Survey (OS) mapping. However, historical OS maps indicate the presence of such features and these are shown on *Drawing 3080/POE/01*. One spring has been identified within the quarry, located close to the access track. The spring is situated at an elevation of approximately 232 mAOD and is located at the western margin of the mapped outcrop of the sandstone.

3.4 A water collection chamber is located close to, and within, the western site boundary at an elevation of 228.3 mAOD. Two manholes are present at this location. The eastern chamber contains a collector pipe that receives water from the direction of the historical waste rock tip on the western boundary of the site. A 50 mm egress pipe, fitted with a filter, is located close to the base of the eastern chamber, which conveys water westwards. The water passes to a second chamber, from where it is reportedly piped to several properties.

3.5 It is noted that the spring is not a registered private water supply. Furthermore, it is understood that the original agreement to supply water from the spring has lapsed.

3.6 The HIA was prepared to address concerns regarding the development's potential to pollute this reported water supply.

Geology

3.7 The quarry is located in an area underlain by the Carboniferous Millstone Grit Group (MGG). This formation comprises fine to coarse-grained sandstones, interbedded with grey siltstones and mudstones. Subordinate mudstones, claystones, coals and seatearths are also present within the sequence.

3.8 The strata in the vicinity of the quarry belong to the Silsden Formation, a subdivision of the MGG.

3.9 BGS mapping (*Drawing 3080/POE/02*) records several named sandstone units, specifically the Nesfield Sandstone (NS), which crops out to the west of the quarry, the

Middleton Grit (Mn), which is worked at the quarry, and Brocka Bank Grit (BB), to the east of the quarry. A cross-section reproduced from the 1:50,000-scale geological map for Bradford (Sheet 69) illustrates the relationship between the units (*Drawing 3080/POE/02*).

3.10 The BGS map records dips to the ESE of the site of between 6 and 9 degrees and indicates that the area is heavily faulted. However, direct observation shows that within the former quarry the beds are inclined northwards, with a dip of 10–15 degrees.

3.11 Five mineral evaluation boreholes were drilled in 2019 and their details are provided in *Table 3080/POE/T1*. A sixth borehole ('Old') is also present, for which no geological information is available.

3080/POE/T1: Borehole data							
ID		BH1	BH2	BH3	BH4	BH5	OLD
Easting		405252	405369	405350	405415	405350	405344
Northing		447993	447902	448073	448057	448073	447980
Ground level	(mAOD)	242.25	250.5	255.5	254	259.75	256.9
Depth	(mbgl)	14.4	21.53	30.08	16.52	15.00	
Base SST	(mbgl)	12.19	20.04	>30.08	16.2	12.7	
	(mAOD)	230.06	230.46	<225.47	237.8	247.05	
Top mudstone	(mbgl)	13.57	20.04	-	16.2	-	
	(mAOD)	228.68*	230.46	-	237.8	-	
Groundwater level at completion (July 2019)							26/10/20
Depth	(mbgl)	12.30	11.10	10.60	8.60	11.60	18.0
Elevation	(mAOD)	229.95	239.4	244.9	245.4	248.15	238.9
* In BH1 siltstone is present between the sandstone and the mudstone							

3.12 The sandstone is described as fine to coarse-grained and heavily fractured in places. Several siltstone bands occur within the sequence. In borehole BH1 a siltstone horizon exists between the base of the sandstone and the underlying dark grey to black mudstone. In BH5 the base of the sandstone is more gradational into the underlying siltstone.

3.13 The base of the sandstone was not encountered in BH3.

3.14 The locations of the boreholes are shown on *Drawing 3080/POE/03*.

4. HYDROGEOLOGY

4.1 The MGG is classified by the Environment Agency as a Secondary 'A' aquifer. The sandstones are well-cemented and it is thus considered that groundwater flow occurs predominantly through fractures, with little interaction with the matrix.

4.2 There are no published details available on the hydraulic parameters of the specific sandstone units at the quarry.

4.3 Groundwater level measurements were taken in the mineral evaluation boreholes completed in July 2019. These are reported in *Table 3080/POE/T1*. It is understood that the water levels were allowed to recover after borehole completion and are therefore considered to be representative of a true rest water level at that time.

4.4 Groundwater occurs only within the sandstone unit, with the exception of BH1, where groundwater lies within the underlying siltstone. Despite the difference in lithology in which the levels were measured, it is considered that the data indicates the presence of a contiguous groundwater body. This is considered to be due to the extensive fracturing reported in both the sandstone and siltstone.

4.5 Groundwater level monitoring has been undertaken in the Old borehole since October 2020. The results are provided in *Table 3080/POE/T2*. A hydrograph of the data is provided on *Drawing 3080/POE/05*.

3080/POE/T2: Groundwater levels (Old borehole)		
Date	**Depth (mbgl)**	**Depth (mAOD)**
26/10/2020	18	239.06
18/10/2021	19.09	237.97
15/11/2021	18.55	238.51
13/12/2021	18	239.17
27/01/2022	18.42	238.64
01/03/2022	17.79	239.27
25/09/2023	18.81	238.25
22/11/2023	18.71	238.45
29/11/2023	18.5	238.66
04/12/2023	18.2	238.96
12/12/2023	17.5	239.66
19/12/2023	18.1	239.06
29/12/2023	17.2	239.96
09/01/2024	18.0	239.16
15/01/2024	18.2	238.96

4.6 The temporal range of recorded groundwater levels is relatively small, being 0.89 m over the entire monitoring period. It is noted that a groundwater level increase of only 1 m was recorded between the start of December 2023 and mid-January 2024. During this period rainfall levels were exceptionally high.

4.7 Inferred groundwater level contours, utilising data from all of the boreholes, are shown on *Drawing 3080/POE/03*. They indicate a southwesterly groundwater flow direction, towards a topographic low on the western site boundary. Water egress at this location is evidenced by an area of waterlogged ground within the site boundary and 'reed-like' vegetation, down-gradient to the west (see *Drawing 3080/POE/01*). The spring collector is located in this area.

4.8 It is noted that the geology beneath the boggy ground and spring collector is shale/ mudstone, rather than sandstone.

In summary, groundwater within the sandstone is considered to be perched on the underlying shale unit. Groundwater flow is westwards and can be inferred to drain into the historical mineral spoil heaps present in the west of the site. No spring discharges from the sandstone are indicated on current or historic Ordnance Survey maps. However, one spring has been identified during site surveys, located in the southwest corner, possibly associated with the geological faults mapped by the BGS (see *Drawing 3080/POE/03*).

Water management during operational phase

Operational phase – surface water

4.9 Rainfall incident to the quarry will be allowed to infiltrate into *in situ* sandstone, which is to be retained beneath its floor. Any surface water run-off will be directed to specific low areas on the quarry floor, from where it will infiltrate.

4.10 Run-off from areas of hardstanding will pass through an oil interceptor prior to conveyance to the quarry floor.

4.11 During storm events it is anticipated that standing water may accumulate temporarily on the quarry floor.

4.12 There will be no direct discharge to surface water. No mineral processing will occur on site other than the mechanical breaking of blocks into manageable/transportable sizes. A one-off 6 month period of crushing and screening of mineral waste heaps will be undertaken to enable access to the working faces.

4.13 The wheel wash will be a self-contained unit with water recycled for re-use.

4.14 Foul water drainage from the site welfare facilities unit will be contained within a sealed storage system and be emptied and tankered off-site when required.

Operational phase – groundwater

4.15 The base of the workings will remain above the groundwater table throughout the duration of the development. Active groundwater management will, therefore, not be required.

4.16 Two additional groundwater monitoring boreholes will be installed to allow on-going assessment of the water environment, as mineral extraction proceeds. The boreholes would be located in the west of the site between the proposed workings and the spring collection chamber. The locations of the proposed boreholes are shown on *Drawing 3080/POE/06*.

Water management during site restoration

4.17 The site will be restored progressively as development proceeds.

4.18 Passive water management and groundwater level monitoring will continue until the restoration of the site has been completed.

Water management on the restored site

4.19 The surface of the restored site will be lower than the original ground level and drainage will be directed towards attenuation/SuDS features, which will be incorporated into the restoration design.

5. POLICY RELATING TO WATER MANAGEMENT

Mineral planning policy

5.1 Mineral planning policy for mineral developments is set by National Planning Policy Framework (NPPF) and regulated by the Mineral Planning Authority. Core reference documents 05-01 and 05-02.

5.2 The Environment Agency is the regulator and Statutory Consultee for all water-related aspects of the development that may affect groundwater resources and drainage to main rivers, including flooding.

5.3 Drainage and flooding of watercourses which are not main rivers is the responsibility of the Lead Local Flood Authority (LLFA), which is usually the Drainage Department of the Local Authority.

5.4 Comments within NPPF, paragraph 188 are pertinent to consideration of the potential impacts of the proposed development on the water environment. It states…. "*The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities*".

Environment Agency Policy

5.5 The Environment Agency's approach to managing and protecting groundwater is given in a series of position statements. Those considered relevant to the application site are as follows (from The Environment Agency's approach to groundwater protection. February 2018, version 1.2):

'D1 - General principles of pollutant storage and transmission: You must design and maintain storage and transmission facilities, such as tanks, lagoons and pipework, in such a way that hazardous substances are prevented from being released to the environment and the input of non-hazardous pollutants to groundwater is limited so as to not cause pollution. The Environment Agency expects operators to adopt appropriate engineering standards, taking into account the nature and volume of materials stored and the sensitivity of the groundwater. For petrol filling stations, systems should meet the specifications within the accepted industry standards in design, construction and operation (Blue Book).'

Where the Environment Agency judges there to be an unacceptable risk to groundwater from the storage of pollutants or their transmission through associated pipework, it will normally oppose such storage or transmission. If other material planning considerations determine that the development should proceed, the Environment Agency expects best available techniques (BAT) to be applied.

Where storage already exists the Environment Agency will work with operators to assess and, if necessary, mitigate the risks to groundwater, with an aim to meet the objective set by this position statement. Re-use of existing facilities for new applications must be accompanied by a thorough assessment to demonstrate that the facilities are adequately designed and fit for purpose for the proposed new use, and that there will be no unacceptable input of pollutants to groundwater.

'*N7 Hydrogeological Risk Assessment:* Developers proposing schemes that present a hazard to groundwater resources, quality or abstractions must provide an acceptable hydrogeological risk assessment (HRA) to the Environment Agency and the planning authority. Any activities that can adversely affect groundwater must be considered, including physical disturbance of the aquifer. If the HRA identifies unacceptable risks then the developer must provide appropriate mitigation. If this is not done or is not possible the Environment Agency will recommend that the planning permission is conditioned, or it will object to the proposal.'

'N11 - Protection of resources and the environment from changes to aquifer conditions*: For any proposal that would physically disturb aquifers, lower groundwater levels, or impede or intercept groundwater flow, the Environment Agency will seek to achieve equivalent protection for water resources and the related groundwater-dependent environment as if the effect were caused by a licensable abstraction.'*

This is under review following implementation on 2nd October 2023 of the Environmental Permitting (England and Wales)(Amendment)(England) Regulations 2023.

5.6 The storage of fuel for mobile plant machinery is regulated by the Control of Pollution (Oil Storage) (England) Regulations 2001. Static tanks and mobile bowsers must include certain design features that are specified in the Regulations.

6. EFFECTS OF THE SCHEME

Context

6.1 The relative elevations of the base of the proposed quarry void and groundwater are such that all of the proposed workings will be above the watertable.

6.2 Restoration will be undertaken using materials derived from the site and will comprise a 1.5 m thickness of soil placed over the undisturbed, sandstone in the base of the quarry void.

6.3 The nearest reported water supply to the site is the spring collector, which is located close to the western site boundary. Sandstone will be extracted from the quarry faces by mechanical ripping only – blasting/explosives will not be used.

Effects

6.4 The potential effects of the scheme on the water environment have been assessed using the Source–Pathway–Receptor (S-P-R) model. This is a widely accepted approach to risk assessments which describes the origin of potential effects (the source) and the means (or pathway) by which the effect reaches the particular sensitive feature (the receptor).

6.5 Within the site, potential sources of contamination include:

- Fuel storage tank for mobile plant, fuel tanks on mobile plant, oil contained within engines on mobile plant and hydraulic oil, from which accidental spillages, or leaks could occur
- Accidental spillages in refuelling areas or where localised small-scale maintenance is undertaken
- Foul sewage from welfare facilities located on site
- Silt and mobilised fines in surface water, which could enter the bedrock aquifer
- Run-off from areas of hardstanding

6.6 A potential pollutant linkage is present between the above contamination sources, the geological pathway and the receptor (ie the sandstone aquifer and the private water supply). Mitigation measures are thus required.

Mitigation

6.7 The approach to managing risk at the site is to remove the pollution source risk and thereby break the Source-Pathway-Receptor linkage. The following measures are proposed.

6.8 There will be no activities involving potentially contaminating materials, such as storage of fuel and oil, within 50 m of the spring collector; 50 m is used as a minimum distance by the Environmental Agency to assign Inner Source Protection Zones (SPZ1), where modelling has not been undertaken, as detailed in the Environment Agency's "Manual for the production of Groundwater Source Protection Zones" March 2019.

6.9 Neither mineral extraction to within a 75 m radius of the spring, nor mineral extraction below 240 mAOD (8 m above the chamber elevation), will be undertaken until groundwater monitoring has been completed over two winter periods, to identify watertable highs and hence the minimum working elevation.

6.10 Storage of potentially contaminating materials should preferably be kept off the sandstone, possibly in the southwest corner of the site where the ground is underlain by mudstone. All potentially contaminating materials will be stored in accordance with best practice. Fuel tanks will be bunded and refuelling of plant will be undertaken, where feasible, on hardstanding. No refuelling of mobile plant should be undertaken within the mineral extraction area.

6.11 Foul effluent from welfare facilities will be stored and tankered off-site to a treatment facility, as required.

6.12 The proposed mitigation measures are illustrated on *Drawing 3080/POE/06*.

6.13 In the unlikely event of a pollution incident occurring, absorbent materials within spill kits would be deployed to contain the incident. The resultant contaminated material would be disposed of at a suitable facility. Site personnel will be trained in the correct usage of spill kits and spill kits will be provided in mobile plant and at strategic locations across the site.

6.14 Suspended solids will be controlled by both prevention and management. Surface water management measures, including the construction of low berms to channel water away from areas of high mobile plant movement, and wedge pits, will be incorporated into site housekeeping measures. These will serve to reduce the mobilisation and transport of fines.

6.15 After the completion of mineral extraction all sources of contamination will be removed from the site, hence the long-term, residual risk to the water environment is considered to be insignificantly small.

Groundwater level monitoring

6.16 The 'Old' monitoring borehole is operational and would be used to monitor groundwater levels regularly.

6.17 Two new groundwater monitoring boreholes will be installed between the existing ('Old') borehole and the spring collection chamber. The proposed locations of the boreholes are shown on *Drawing 3080/POE/06*.

Comments received from statutory consultees

6.18 The principal comments received were from the Environment Agency in their role as the primary regulator for the water environment.

6.19 Planning Permission was refused on several grounds. Comments were subsequently received from the Environment Agency, on 24th April 2023 (Core document reference 03-02) but the most pertinent of which were included in their letter of 19th May 2023 (EA reference RA/2023/145760/01-L01). Core document reference 03-01. The letter stated the Environment Agency objected to the proposals; the reasons for their stance were stated and ways of overcoming the objections were itemised, viz:

- Acknowledge the presence of a spring supply with a default SPZ of 50 m
- Mitigation measures to protect the spring are to be proposed
- Continue monitoring groundwater levels at the Old borehole to establish temporal groundwater level variations.

The three issues are addressed fully in the updated HIA report of September 2023, which is supported by additional data and comments, where necessary.

7. CONCLUSIONS

7.1 Planning permission has been sought for the extraction of sandstone. Dry mineral processing would be undertaken on-site using mobile plant. The site would be restored progressively to a lower level landform using site-derived soils and overburden.

7.2 Mineral would be extracted entirely above the watertable and consequently dewatering or disturbance of groundwater would not occur.

7.3 A series of both passive and active mitigation measures are proposed to ensure the safeguarding of the water environment. These comprise the use of bunded fuel tanks, the provision of impermeable hardstanding for mobile plant storage and refuelling and the use of an oil interceptor prior to drainage.

7.4 Passive mitigation will be provided by the retention of unworked , unsaturated sandstone beneath the quarry floor. This is a widely-applied mitigation measure which has been proven to work well over time. In this case in-situ material will be a minimum of 1 m thick, above the watertable.

7.5 All foul effluent will be stored temporarily on-site and tankered to an appropriate treatment facility, when required.

7.6 In the unlikely event of a pollution incident occurring on the quarry floor, robust response measures would be in place. Spill kits being readily available on-site and staff trained in their use.

7.7 With employment of the above mitigation measures it is considered that the groundwater S-P-R linkage for the site is broken.

7.8 Two additional groundwater level monitoring boreholes will be installed to allow monitoring of groundwater level and quality, between the site and the spring collection chamber.

7.9 The mitigation measures proposed by the applicant address fully the three issues which were highlighted by the EA as being reasons for objecting to the planning application.

7.10 Based upon the updated report the Council has confirmed that they will not be progressing the hydrogeological reason for refusal, as it is agreed the issue can be dealt with by way of conditions.

7.11 The proposed planning conditions relating to water issues are considered to be appropriate and proportionate to the water issues at the site.

7.12 The proposed scheme addresses issues reportedly occurring at the site in the 1980s as a) all foul effluent from welfare facilities will be stored and tankered off-site for subsequent

treatment, b) robust monitoring, safeguarding and spill response measures will be in place and c) as-dug material will be exported for subsequent processing elsewhere.

DRAWINGS

Key

- Issue
- Spring
- Well

Scale correct at A4

Client	Mineral Planning Group Ltd.
Title	Water features
Project	Horn Crag Quarry
Drawing	3080/POE/01
Version	1
Date	Jan 2024
Scale	1:4,000

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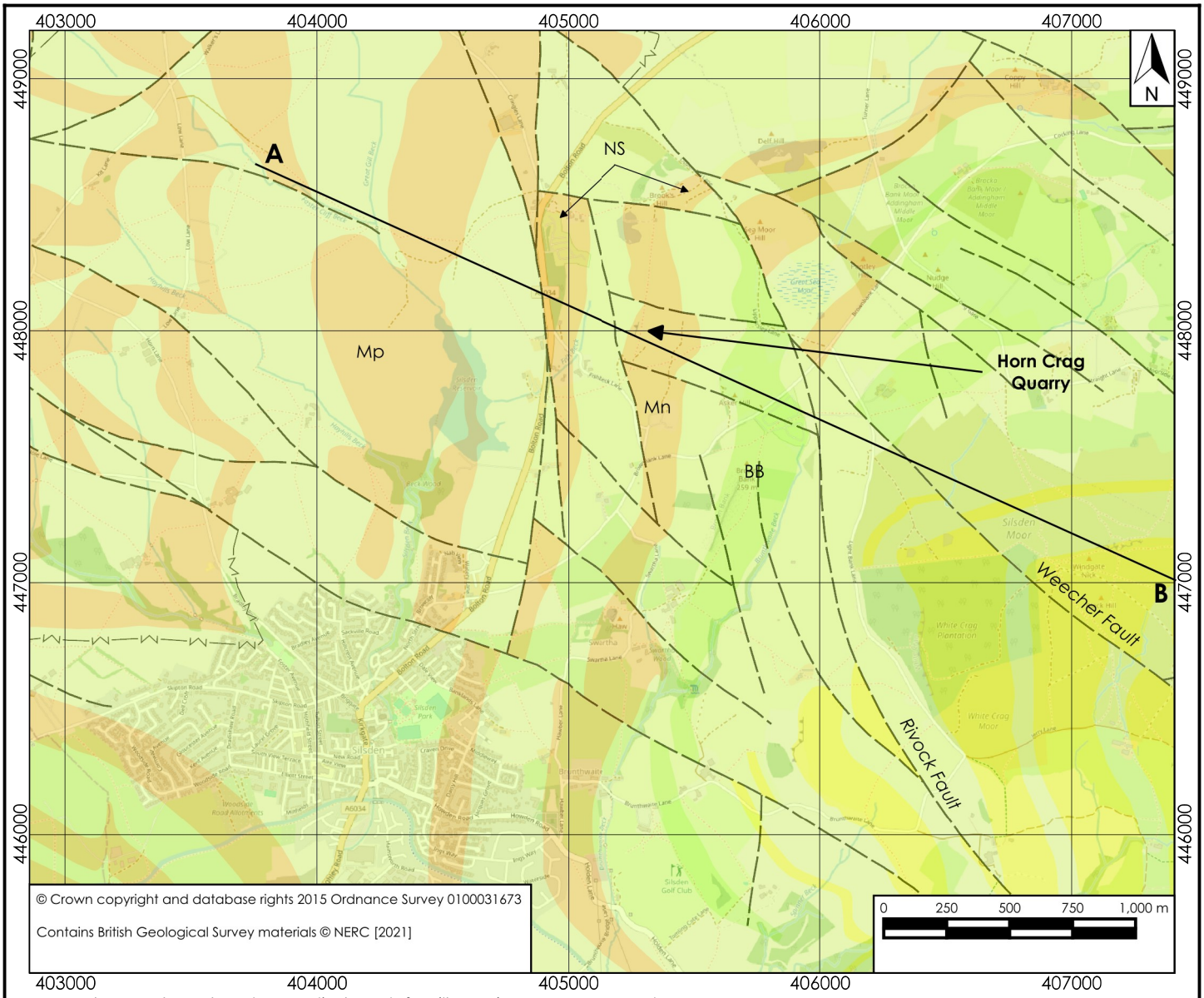
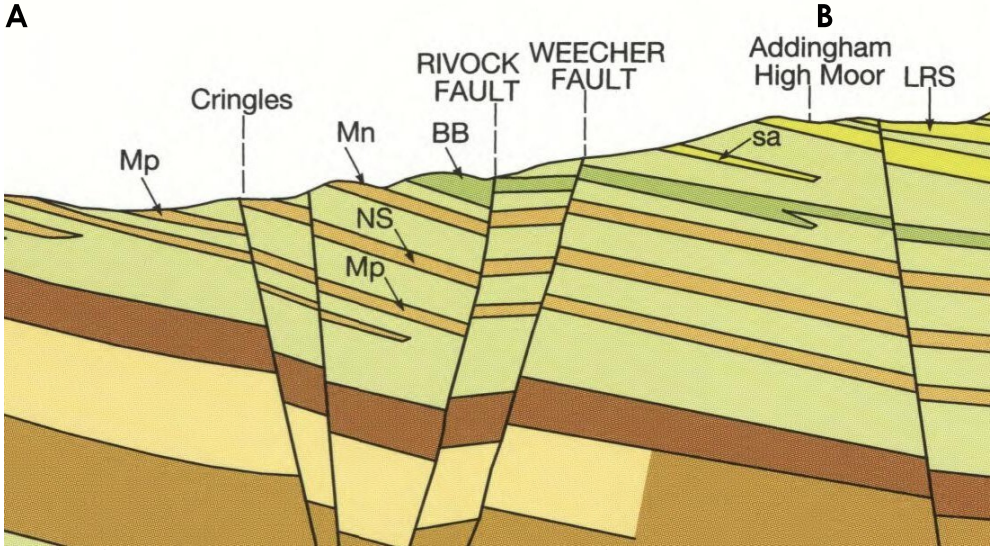


Note: the geology has been displayed for illustrative purposes and boundaries may not be accurate at the scale displayed.

Key

Geological key

- sandstone
- sandstone (eg BB)
- sandstone (eg. NS & Mp)
- mudstone, shale



Section line reproduced from 1:50,000-scale geological map, Sheet 69, Bradford

Scale correct at A4

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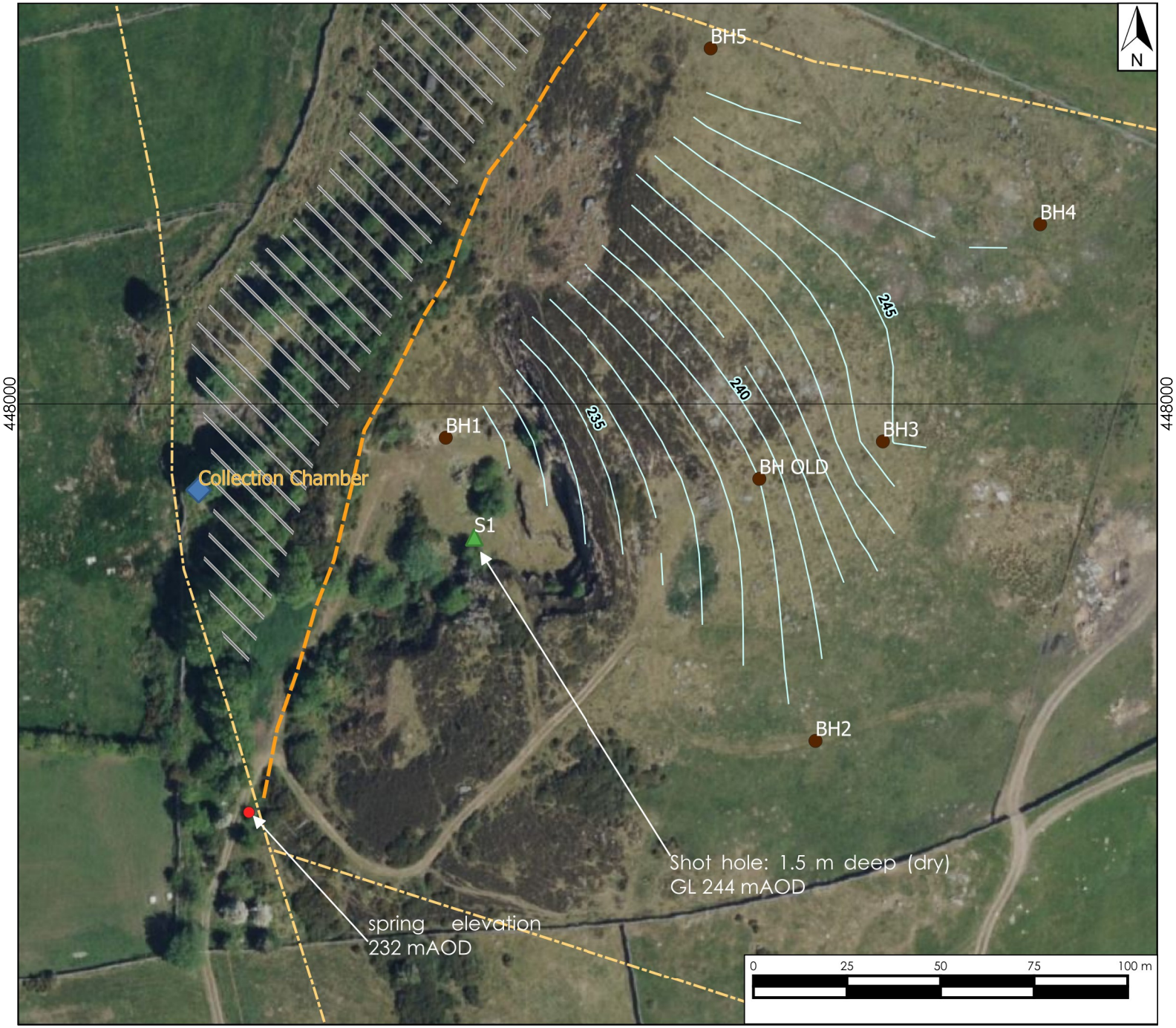
Client	Mineral Planning Group Ltd.
Title	Geology
Project	Horn Crag Quarry
Drawing	3080/POE/02
Version	1
Date	Jan 2024
Scale	1:25,000



Key

- Groundwater Level (GWL)
- Private Water Supply (PWS)
- Spring

Boreholes

- Borehole
- Shot hole
- Rock Waste (indicative)
- Outcrop of base of sandstone (BGS mapping)
- BGS Faults

Scale correct at A4

Client	Mineral Planning Group Ltd.
Title	Groundwater contours
Project	Horn Crag Quarry
Drawing	3080/POE/03
Version	1
Date	Jan 2024
Scale	1:1,500

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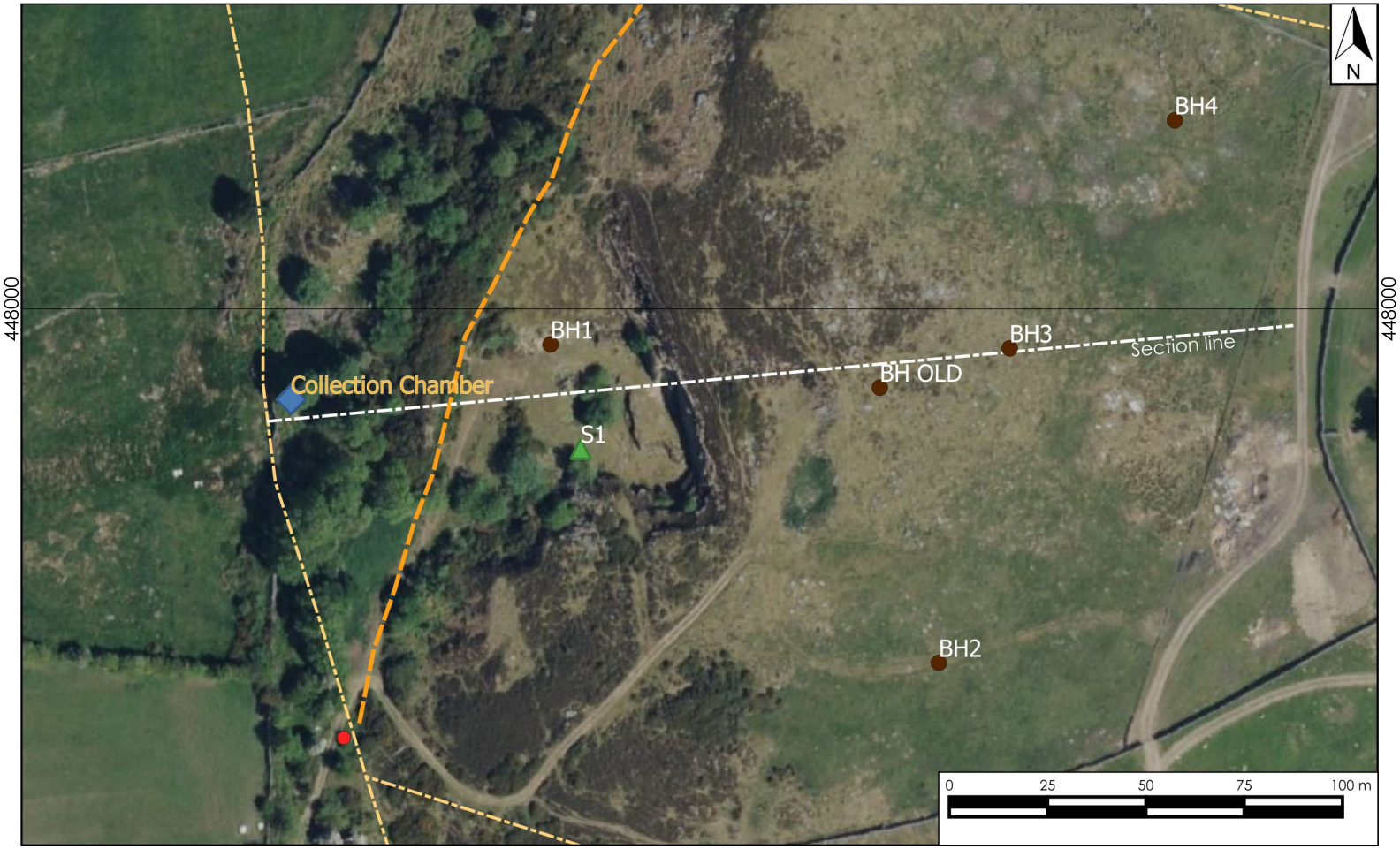

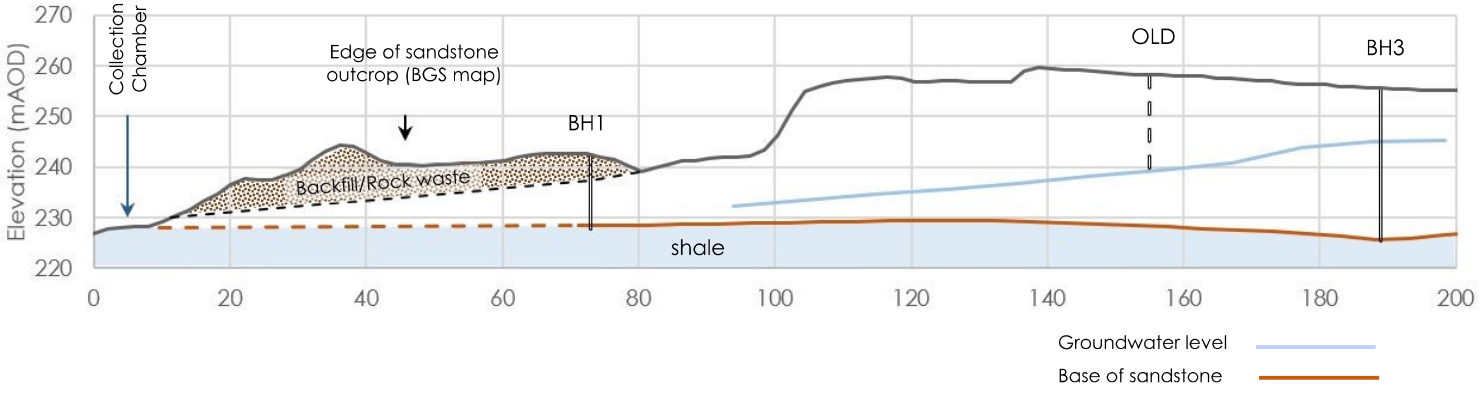

Key

- Private Water Supply (PWS)
- Spring

Boreholes

- Borehole
- Shot hole
- Outcrop of base of sandstone (BGS mapping)
- BGS Faults

Scale correct at A4

Client	Mineral Planning Group Ltd.
Title	Cross section
Project	Horn Crag Quarry
Drawing	3080/POE/04
Version	2
Date	Jan 2024
Scale	1:1,700

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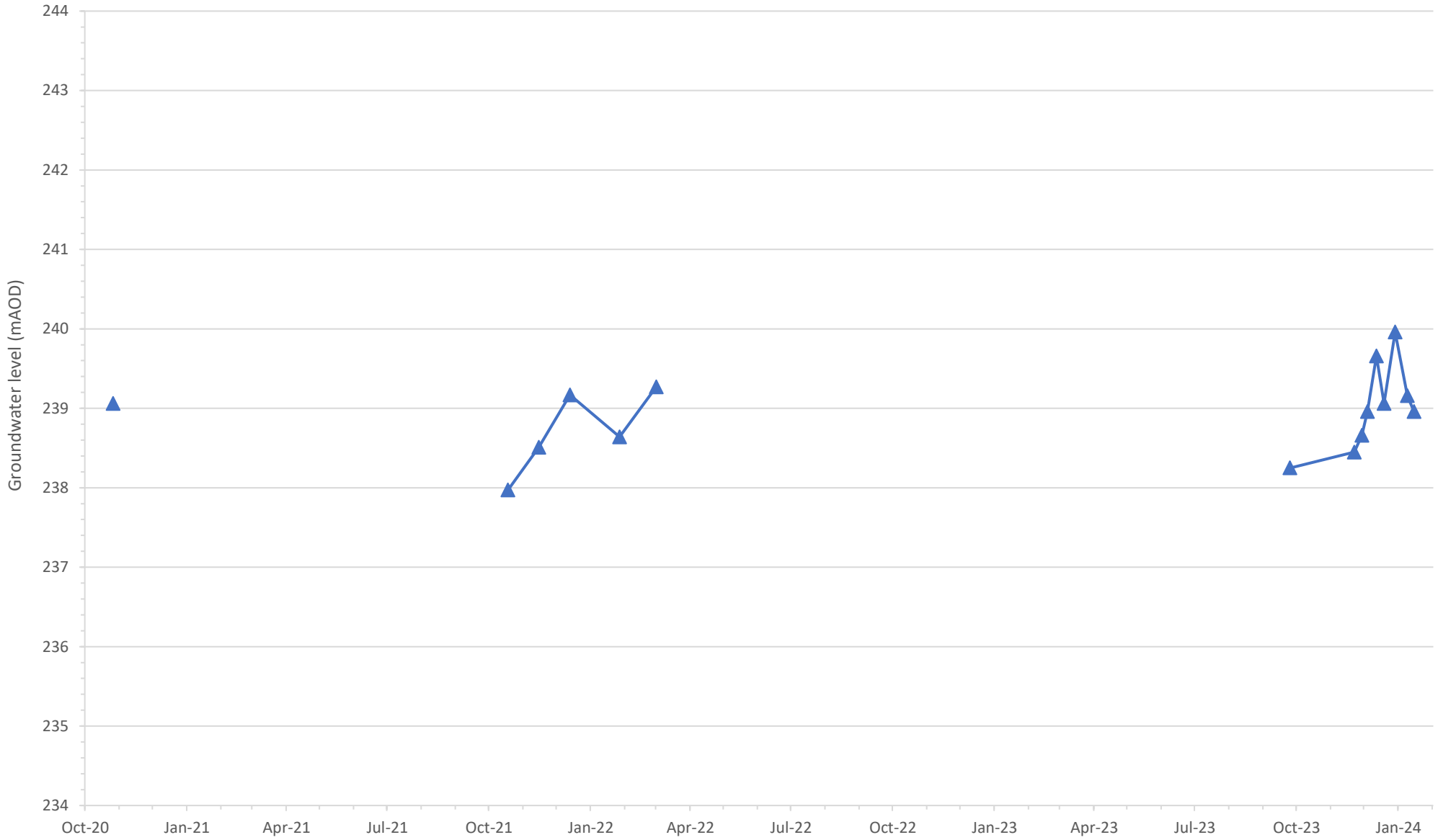

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Client	Mineral Planning Group Ltd		
Title	Hydrograph		
Project	Horn Crag Quarry		
Drawing	3080/POE/05	Version	1
Date	Jan 2024	Scale	n/a

Key

- Private Water Supply (PWS)
- Spring

Boreholes

- Borehole
- Shot hole
- Future Monitoring Borehole (BH1,BH2)
- Base sandstone at outcrop (BGS)
- BGS Faults

Scale correct at A4

Client	Mineral Planning Group Ltd.
Title	Proposed Mitigation Measures
Project	Horn Crag Quarry
Drawing	3080/POE/06
Version	2
Date	Jan 2024
Scale	1:1,700

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