

PREPARED BY:	Spencer Quantum Ltd	DOCUMENT:	Technical Advice Note: Mine Entry and Additional Ground Gas Monitoring
CLIENT:	Mr Wayne Goodridge	DATE:	15 th July 2025
PROJECT TITLE:	Heol Tabor, Cwmavon	OUR REF:	Q1218/TN01

Introduction

Upon the instruction of Iplan Architecture, on behalf of the Client, Mr Wayne Goodridge, Spencer Quantum Ltd have been instructed to undertake further investigation to establish the location of a mine adit and undertake additional ground gas monitoring at a site on Heol Tabor, Cwmavon, Port Talbot. The Client is proposing to construct 6 No. Residential properties at the site.

The approximate National Grid Reference of the site is SS 78212 92729 with a nearby postcode of SA12 9PR. The site location is presented in Figure 1.

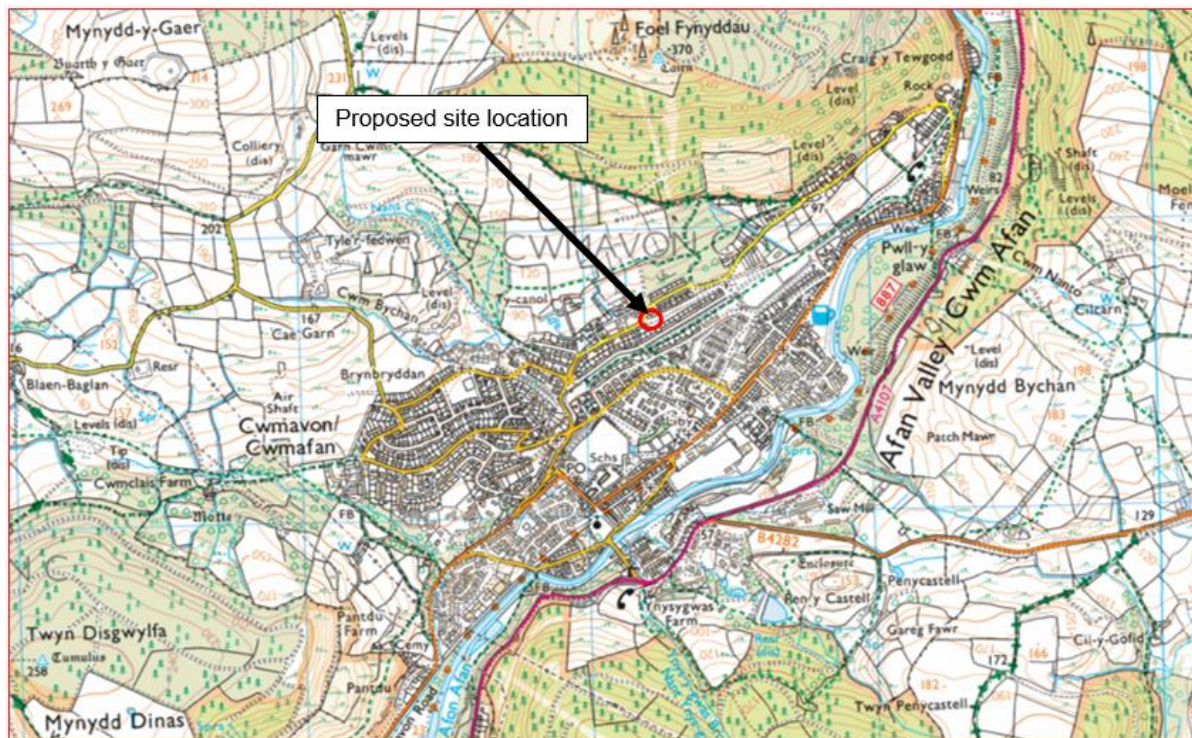


Figure 1: Proposed site location ©Ordnance Survey

This Technical Advice Note (TAN), presents the results of the additional investigation and monitoring undertaken.

Background

Quantum Geotechnic Ltd (QGL) undertook a Preliminary Risk Assessment / Desk Study (Ref: Q0353/PRA) for the site / development. The QGL Phase I Exploratory Investigation Report (Report Ref: Q0353/GIR) recommended a ground investigation should be undertaken to establish if potential contaminants are present at significantly elevated concentrations and to establish geotechnical parameters for proposed foundation design. There is also a requirement to identify any legacy mine features in the form of worked coal seam(s), the identification of any un-worked coal and to locate or confirm the absence of a mine entry mapped within

the vicinity of the site. Ground gas/ Groundwater monitoring standpipes were installed and a gas assessment undertaken.

Spencer Quantum Ltd (SQL) undertook a Ground Investigation to investigate the risks to the development identified within the Preliminary Risk Assessment / Desk Study. The findings were detailed within an Interpretative Report. The Ground Investigation was unable to quantify the risk associated with potential presence of a recorded mine entry and ground. Relevant extracts from the report are presented below:

The ground investigation works revealed that the site study area is overlain by variable Made Ground to depths of between 0.8 and 4.0mbgl over cohesive Glacial Till and granular Glacial Deposits. The depth of Made Ground was greatest in the central and northern areas of the site. Bedrock was proven at depths between 6.25m and 10.00m in the rotary boreholes. Voids, anticipated to be associated with historic shallow mine workings were located at depths of 10.25-12.00mbgl and 11.00-12.25mbgl below the central area of the site.

Groundwater was encountered locally within Superficial Deposits; during the intrusive investigation within BH01 at 1.2mbgl, BH06 at 4.5mbgl, TP04 at 1.7mbgl and TP05 at 1.9mbgl, and during the post fieldwork monitoring within WS03 at depths of between 2.0 and 2.41mbgl. Groundwater was measured during the post fieldwork monitoring in BH01 between 24.2 and 26.54mbgl, and in BH06 between 21.52 and 22.53mbgl.

All other exploratory holes and monitoring standpipes were dry.

The Mine Entry investigation established / concluded the following:

The Trial Trenches undertaken within the area of the site identified by the Coal Authority as potentially containing a Mine Entry 278192-003, did not identify the mine entry or any evidence indicating its presence. Natural superficial deposits were encountered within each Trial Trench at shallow depths.

Further consideration of the information gained from the ground investigation as a whole identifies a deeper zone of Made Ground' within the central area of the site, which may indicate the potential unlocated Mine Entry to be present within this area of the site. This coincides with the location of a Coal Level from the 1899 mapping contained within the PRA. As no structures or voids have been identified, the findings suggest the Mine Entry has been removed however, given some uncertainty exists relating to the location of the unlocated Mine Entry, it would be considered prudent to undertake further trenching in the central area of the site to further investigate the presence, location and nature of the Mine Entry, to assess any risk and the requirement for remedial measures.

The Ground Gas investigation established / concluded the following:

The investigation to date revealed a low-risk potential for elevated gas generation. From monitoring a characteristic situation of CS₂ is indicated, with protective measures recommended to suit. Based on the relevant guidelines, it is recommended that the ground gas monitoring regime be extended by a minimum of 3 months to confirm the gas screening value and characterisation of the site.

This investigation was required to investigate the unquantified risks associated with the mine entry and ground gas.

Mine Entry

Investigation

Further Trial Trenching was undertaken on 20th February 2025 to investigate the presence of the mine entry (reference: 278192-003) using a 9 tonne tracked excavator with a 1.0m wide bucket.

The Trial Trenches were undertaken in the central and northern central area of the site, in the area identified within the Ground Investigation report as potentially being at risk from the adit, based on the ground conditions proven.

The Trial Trenches were 1.0m wide with a 2.0m separation and were excavated in a southwest to northeast direction. The trenches were excavated to a depth which proved the natural superficial deposits.

The trench locations are presented in Table 1 and included within Appendix I:

Table 1: Trial Trench Location / Extent

Trial Trench	Easting	Northing	Elevation (mAOD)
TT101	278203.116	192717.882	73.204
	To		
	278219.302	192731.380	74.245
TT102	278208.925	192727.557	73.509
	To		
	278218.165	192736.983	74.417
TT103	278210.664	192738.655	73.714
	To		
	278216.748	192744.377	74.380

Sketches illustrating the findings of the investigation are presented in Appendix II.

A locally increased depth of Made Ground was identified running in a northerly direction which may be associated with mine entry. This was traced using perpendicular trial trenching techniques to close to the northern site boundary. The Made Ground and was 'bottomed out' within each trial trench.

Discussion & Conclusions

The trial trenching found a feature in the form of a narrow zone of deeper Made Ground that may be associated mine entry 278192-003. The base of this feature was proven which indicates the mine entry feature below the site has been removed, and the point at which the entry goes below ground is to the north the site. Although the mine entry is believed to be located off-site, it may have a zone of collapse that encroaches onto / below the site. Based on the available information / known ground conditions, the potential zone of collapse is 6.0m from the mine entry location. Assuming a worst case scenario in which the mine entry is located adjacent to the site boundary, no structures should be constructed within 6.0m of the northern site boundary. In addition, it is recommended a suitable geotextile is incorporated below the garden areas to mitigate against large magnitudes of future ground movement that may be associated the mine entry.

The extent of the trial trenches undertaken and the route of the deeper Made Ground, which may be associated with the mine entry is illustrated overpage:

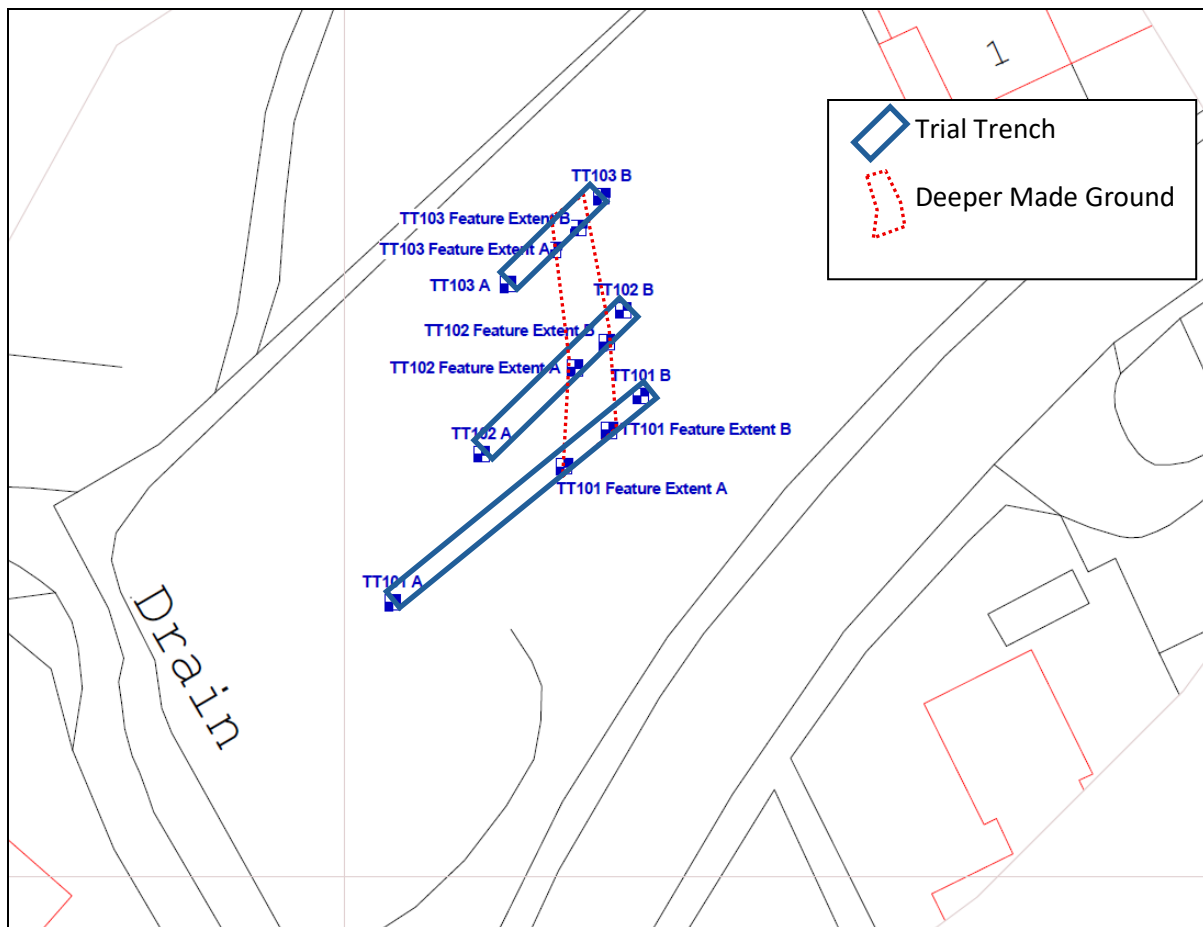


Figure 2: Trial Trenching Extents

Ground Gas

Investigation

Six further monitoring ground gas visits have been undertaken, in addition to the six visits undertaken during the main phase of ground investigation to all a suitable assessment to be undertaken. Appendix III presents the monitoring records. The monitoring has been undertaken over a range of atmospheric conditions, including during periods of low and falling pressures.

The additional monitoring rounds measured maximum CH₄ concentrations of 0.6%v/v and CO₂ concentrations of 6.9%v/v. Maximum measured flow rate was recorded as 0.6 l/hr whilst O₂ levels ranged between 8.5 and 21.1%v/v. Carbon Monoxide (CO) recorded 0ppm and H₂S recorded at 0ppm.

The results from all monitoring rounds are summarised in Table 2:

Table 2: Gas Monitoring Summary

Exploratory Hole	Flow / Gas Concentration Range					
	Flow (l/hr)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CO (ppm)	H ₂ S (ppm)
BH01	-0.2 – 0.2	0 – 0.4	0.1 – 4.9	9.6 – 21.1	0 – 1	0
BH02	-0.1 – 0.6	0 – 0.4	0.1 – 6.9	8.5 – 21.2	0 – 3	0 – 1
BH06	-0.2 – 0.2	0 – 0.4	0.1 – 3.3	8.9 – 20.7	0	0
WS01	-0.1 – 0	0 – 0.4	0.0 – 6.7	8.6 – 20.7	0 – 2	0
WS02	-0.1 – 0.1	0 – 0.4	0.1 – 3.3	13.4 – 20.8	0 – 1	0

For context / relevance, the response zones at each monitoring location and the associated strata is summarised in Table 3:

Table 3: Monitoring Standpipes Summary

Exploratory Hole ID	Installation Pipe ID	Standpipe Diameter (Internal mm)	Response Zone (mbgl)		Strata
			Top	Bottom	
BH01	A	50	10.00	30.00	Mudstone & Coal
BH02	A	50	10.00	30.00	Shallow Mineworkings, Coal & Mudstone
BH06	A	50	10.00	30.00	Mudstone & Coal
WS01	A	50	1.60	5.60	Made Ground & Glacial Till
WS02	A	50	1.00	5.00	Made Ground & Glacial Till

Discussion

The ground gas monitoring undertaken measured potentially significantly elevated concentrations of Carbon Dioxide during periods of low atmospheric pressures within both the bedrock, including mine workings, and the superficial deposits below the site. This indicates a potential source of ground gas to be within the bedrock, likely to be the historic mine workings and the Made Ground deposits at the site or, a pathway exists between the ground gas source at depth and the superficial deposits. The presence of a pathway from historic mine workings in the area is considered feasible based on the following:

In areas of former coal mining, there is a potential risk from the migration or liberation of mine gases that can affect developments.

The principal potentially hazardous gas associated with coal mining is Methane. Methane is released during coal mining operations but does reduce in emission over time. It can also accumulate in voids. The gas can migrate to the surface or may be displaced by mine or ground water flooding workings, where they can accumulate and pose a risk of explosion or asphyxiation at surface or in buildings. Carbon monoxide can also be liberated by spontaneous combustion.

It is well documented that the South Wales Coalfield seams have a poorly developed structure (or cleat) that inhibits the migration of methane gas through the coal mass and also that the coal seams of South Wales are not prone to self-combustion. These factors probably contribute to the lack of mine gas generally noted in ground investigations in South Wales.

Circumstances where mine gas risk increases include proximity to mine entries such as adits and shafts (typically <50m), proximity to recorded mine gas incidents, where development is located above or adjacent to very shallow and shallow (< 30m bgl) unflooded mine workings or roadway tunnels, coal seams with a history of spontaneous combustion, natural or artificial pathways providing routes for gas migration e.g. permeable soil cover, pathways created by geological faults, mining induced breaklines/fractures, collapsed mine roof strata, mining subsidence, mining sinkholes/crown holes and unsealed boreholes.

An assessment of the risk to the site from mine gases has been undertaken in line with the guidance contained in the CL:AIRE publication *Good Practice for Risk Assessment for Coal Mine Gas Emissions* (2021).

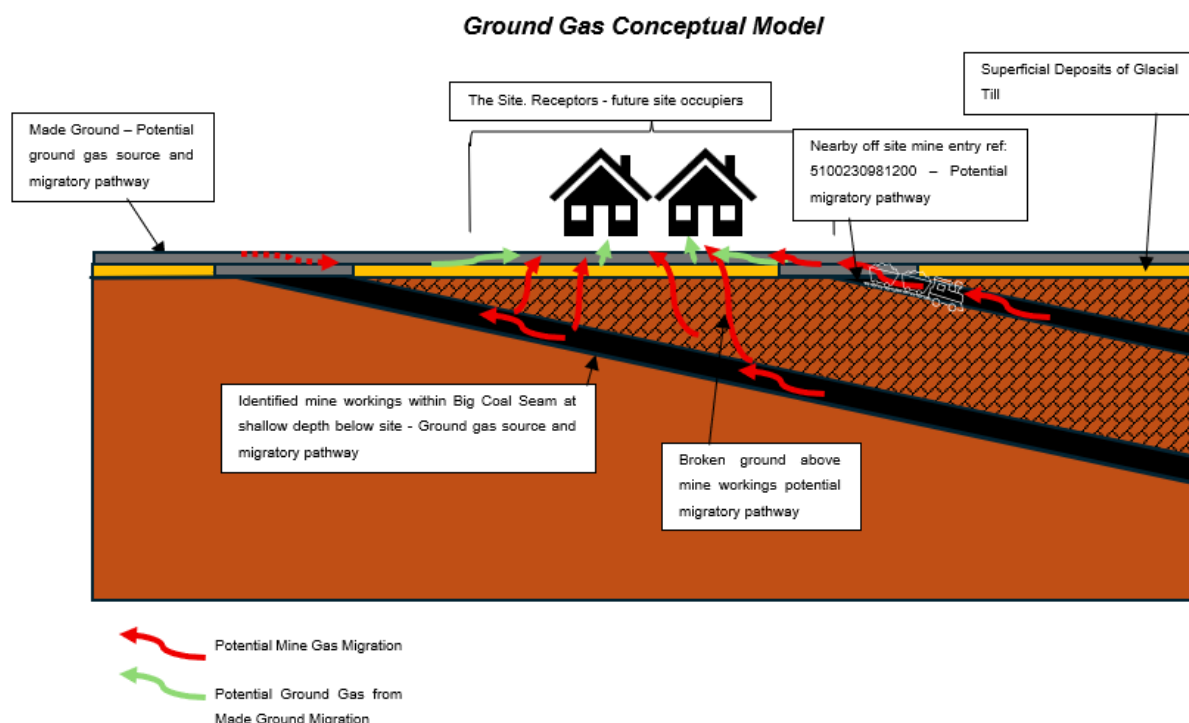
The guidelines within CL:AIRE (2021) includes a support tool to assess the level of risk from mine gases that follows the rationale contained within BS8485. This lays out a series of criteria to define the level of risk from mine gas and the appropriate course of action, depending on the responses.

The following table summarises the protocol and conclusions drawn.

Table 4: Mine Gas Risk Assessment Decision Matrix

Criteria		Conclusion / Action
Stage 1	Mine Entries >50m from site	No, Closest entry <50m from site.
	Workings >150m depth	Unknown. Potential for shallow workings to be present beneath site
	No faults or other potential pathways	No Faults identified on-site
	Outside area of past or probable shallow workings (on MRA Viewer)	No
		PROCEED TO SECOND STAGE
Stage 2	Workings between 30m and 150m but permanently flooded or covered by 10m+ of low permeability deposits	Shallow workings to present <30m beneath site. <10m of superficial deposits
	Mine Entries >50m from site	No, closest entry <50m from site.
		PROCEED TO THIRD STAGE
Stage 3	Mine Entries on site or <20m from site	Yes, closest entry <20m from site.
	Workings below site <30m and unflooded/not permanently flooded	Shallow workings are known to be present beneath site.
	Faults or other pathways connecting to surface	No
	Within area of past or probable shallow workings on Viewer	Yes
		CONCLUSION: HIGH RISK ZONE

The Ground Gas related Conceptual Model is presented overpage:



Given a gaseous phase pathway from shallow mine workings to the superficial / Made Ground deposits may exist, and the Made Ground itself may potentially be a ground gas source, the worst case monitoring data from the monitoring programme is considered to be an appropriate basis for assessing the requirement of gas protection measures for the proposed development.

Based on the measured ground gas concentrations, the potential risks posed by any recorded presence of potentially harmful gases can be assessed on a semi-quantitative basis by reference to the guidance in documents CIRIA 665 and BS8485. The assessment comprises multiplying the maximum measured steady gas flow rate (expressed as litres per hour) by the maximum steady gas concentration (expressed as percentage-by-volume; divided by 100) to derive a Gas Screening Value (GSV). Where no flow is found, the detection limit of the instrument can be used to derive a GSV. The GSV calculated using this approach is 0.04l/hr, i.e., characteristic situation 1. However, as the peak gas concentration for CO₂ is in excess of 5%, guidance within BS8485 recommends increasing the characteristic situation by one, giving a characteristic situation of CS2 for the development.

Table 4: Gas Screening Value and Characteristic Situation Classification

Characteristic Situation	Risk Classification	Gas Screening Value (l/hr) - GSV
1	Very low	<0.07
2	Low	>0.07, <0.7
3	Moderate	>0.7, <3.5
4	Moderate to High	>3.5, <15
5	High	>15, <70
6	Very High	>70

Based on the ground gas monitoring findings to date, the site is classified as Characteristic Situation 2 (low

risk). Typical protection measures required, based on CIRIA C665 guidance are:

- a) Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft) with minimum 1200g DPM.
- b) Block beam or precast concrete slab and minimum 2000g DPM/ or reinforced gas membrane
- c) Possibly under-floor venting or pressurisation in combination with A) and B) depending on use

As the shallow mine workings will require stabilisation in the form of drilling and grouting to fill the voids present, the behaviour and migratory routes of mine gas below the site may change following stabilisation. Therefore post grouting monitoring should be undertaken to establish the nature of any changes in ground gas concentrations and behaviour. It is recommended the installation of gas monitoring standpipes and further monitoring should be incorporated into the grouting contract. The installation and monitoring regime should be detailed in the associated Remediation Strategy / Grouting Plan.

The extent of the protective measures should be confirmed post Grouting works.

Note: To further minimise the risks associated with ground gases, monitoring boreholes should be decommissioned prior to / during construction to remove the associated potential gas migration pathway.

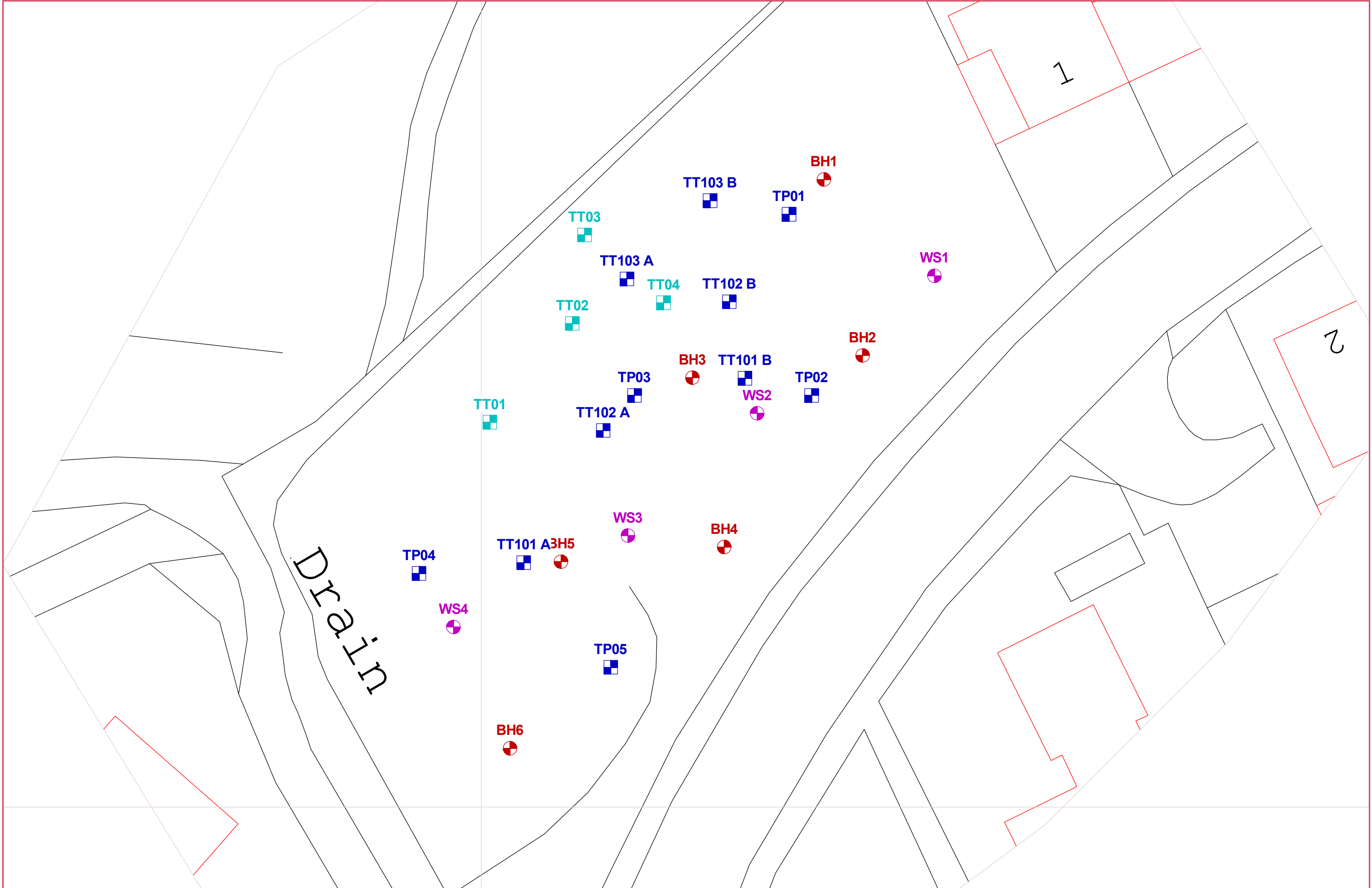
The protective measures should be designed in accordance with CIRIA C665 and BS8485 and undertaken in accordance with a suitable Remediation Strategy and a Verification Plan adhered to. The extent of the protective measures should be confirmed post Grouting works.

We trust that the above is of assistance; however, if you need any further clarification or have any queries please do not hesitate to contact us.

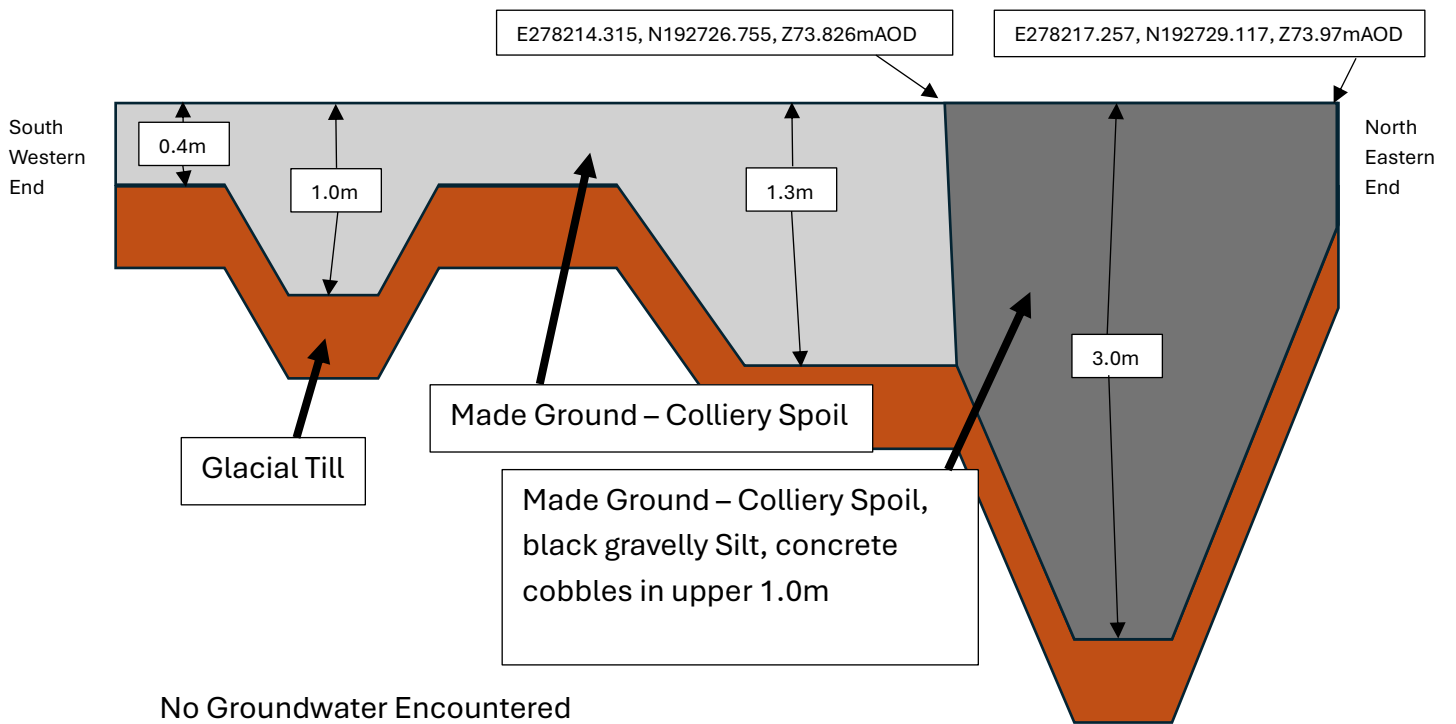
Yours faithfully,
For and on behalf of
SPENCER QUANTUM LTD

P. Darby
Principal Engineering Geologist
B.Sc. (Hons), M.Sc., C.Geol., F.G.S.

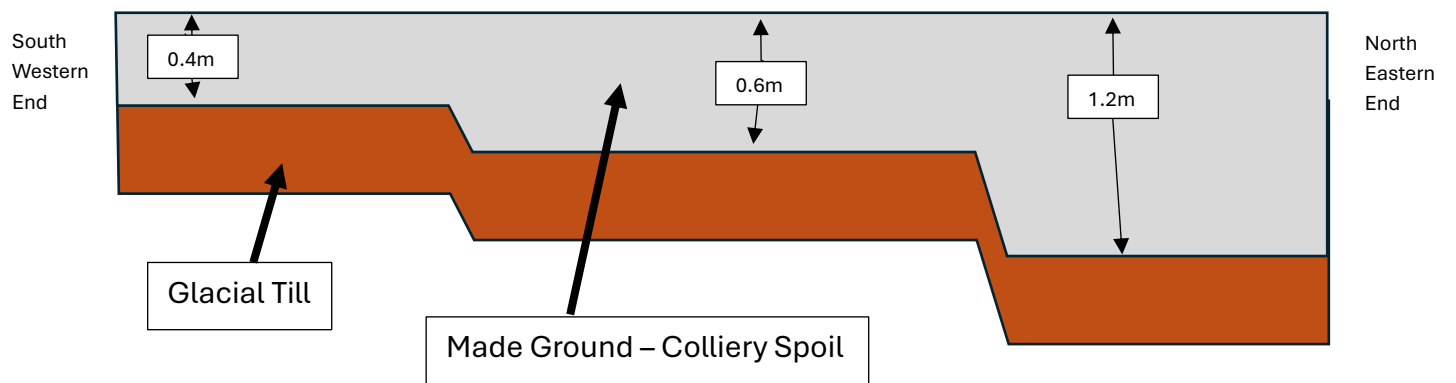
APPENDIX I: Exploratory Hole Location Plan



APPENDIX II: Trial Trench Sketches



TT101 Northern trench face



TT101 Southern trench face

Contract : Land off Heol Tabor Client : Wayne Goodridge		Trial Pit No. TT101 A
Dates : - Location :	Job Number : Q1218 Engineer :	Ground Level : Coordinates: 278203.12 E 192717.88 N <i>Co-ordinates to Local Grid</i>



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				2 Of 3			

Contract : Land off Heol Tabor

Client : Wayne Goodridge

Trial Pit No.

TT101 A

Dates : -

Job Number : Q1218

Ground Level :

Location :

Engineer :

Coordinates: 278203.12 E

192717.88 N

Co-ordinates to Local Grid



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email: enquiries@spencerquantum.co.uk

Operator:

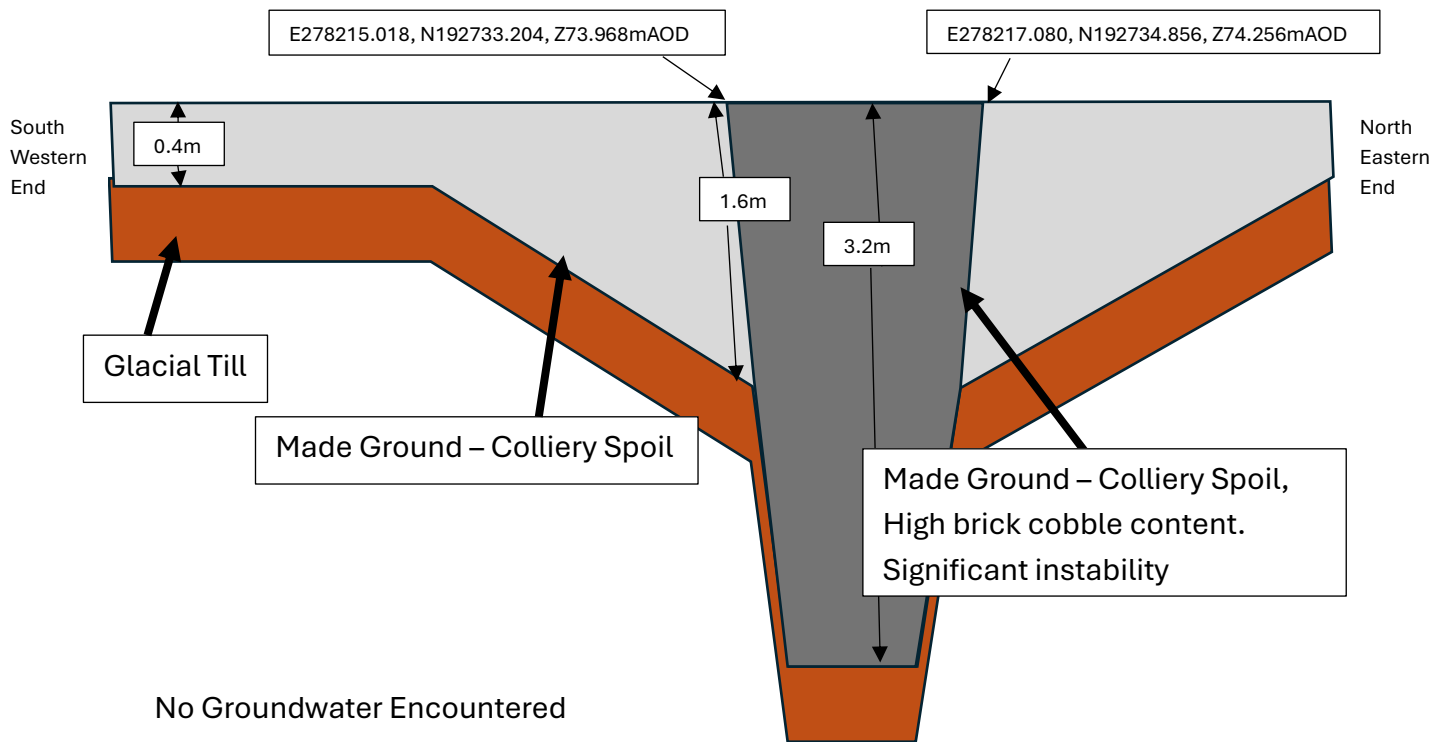
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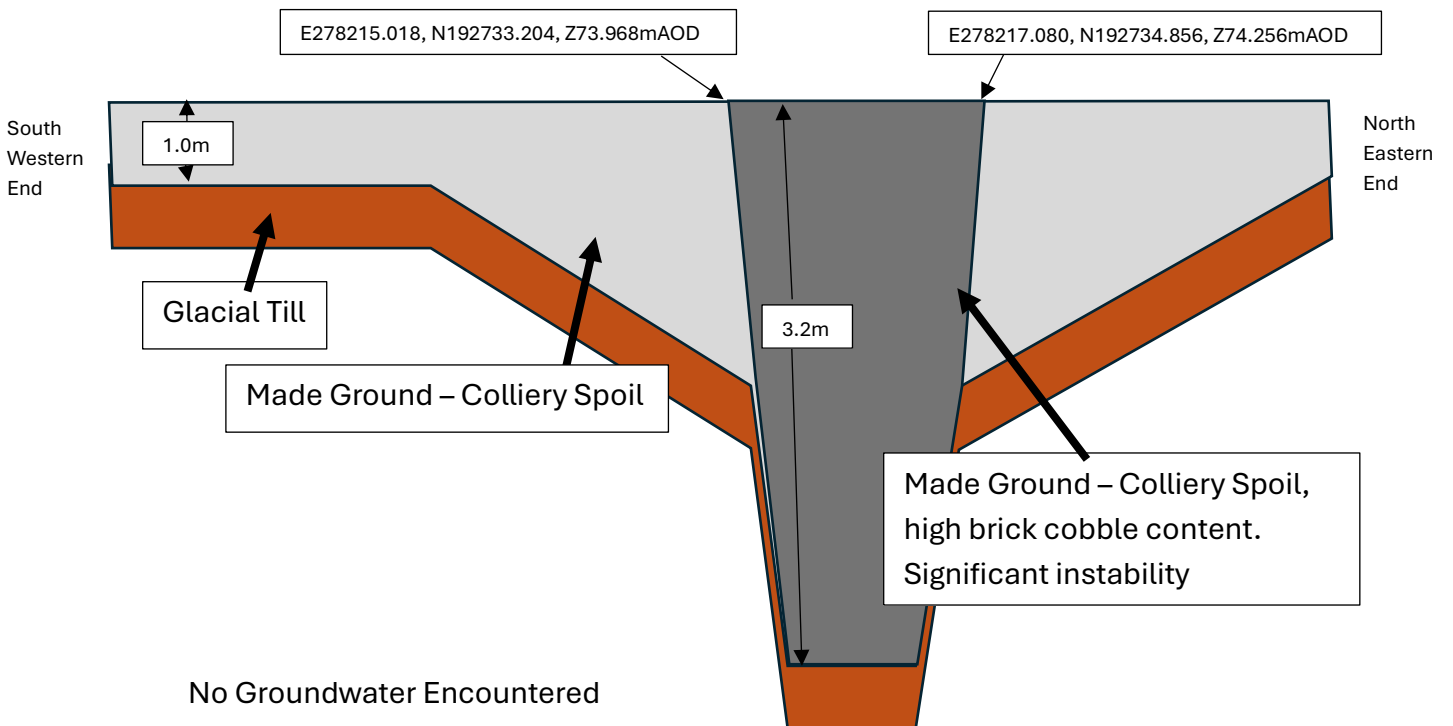
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All measurements in
metres unless
otherwise stated





TT102 Northern trench face

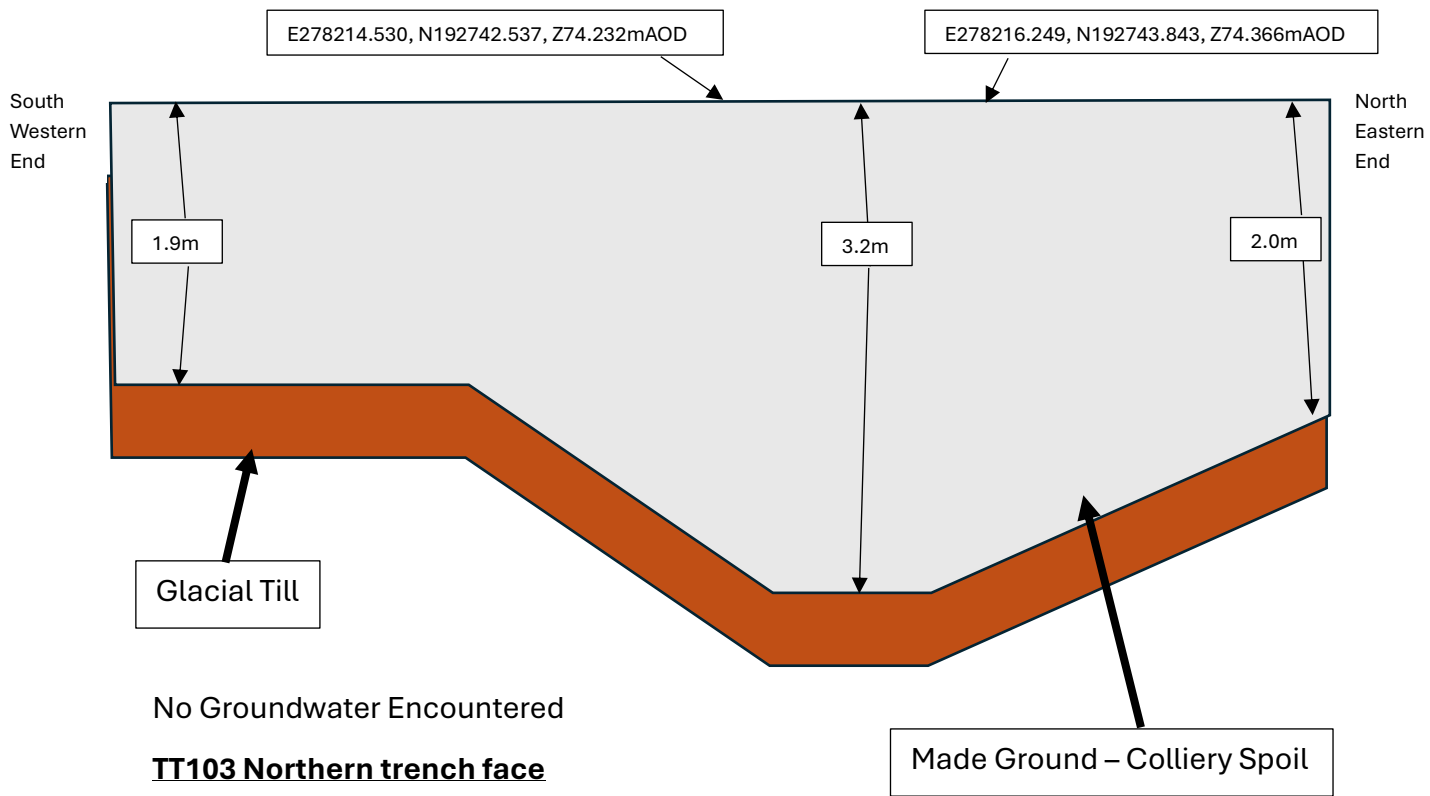


TT102 Southern trench face

Contract : Land off Heol Tabor Client : Wayne Goodridge		Trial Pit No. TT102 A
Dates : - Location :	Job Number : Q1218 Engineer :	Ground Level : Coordinates: 278208.93 E 192727.56 N <i>Co-ordinates to Local Grid</i>



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TT103 Southern trench face as TT103 Northern trench face

Contract : Land off Heol Tabor Client : Wayne Goodridge		Trial Pit No. TT103 A
Dates : - Location :	Job Number : Q1218 Engineer :	Ground Level : Coordinates: 278210.66 E 192738.66 N <i>Co-ordinates to Local Grid</i>



APPENDIX III: Gas Monitoring Records

Page 1 of 1

Project Name:	Cwmavon, Heol Tabor
Project No.:	Q1218
BH/TP No.:	BH01
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Analyser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
74.93	A	50mm standpipe	30.00	10.00 - 30.00



Pipe	Date	Time (24hrs)	Atmos	Differential	Flow	CH ₄	CO ₂	O ₂	CO	H ₂ S	Water Level		HoleDepth		Local Weather		Remarks	
			Pressure	Well Pressure														
			mBar	mBar	L/hr	%	%	%	ppm	ppm	mbgl	mAOD	mbgl	mAOD	Recent	Current		
A	19.12.23		1014	0.02	0.1	0.3	1.8	13.9	0	0	25.47	49.46	30.77	44.16	Overcast	Overcast		
A	11.01.24		1031	0.00	0.0	0.3	0.1	20.1	0	0	25.08	49.85	30.73	44.20	Overcast	Rain		
A	25.01.24		1014	-0.05	0.0	0.4	0.7	19.1	0	0	24.86	50.07	30.77	44.16	Rain	Rain		
A	7.02.24		997	0.02	0.0	0.4	2.5	16.4	0	0	24.53	50.40	30.75	44.18	Overcast	Overcast		
A	21.02.24		992	-0.02	0.1	0.4	4.9	9.6	0	0	24.20	50.73	30.79	44.14	Overcast	Overcast		
A	6.03.24		1011	0.04	0.0	0.0	0.1	20.6	0	0	26.54	48.39	30.80	44.13	Overcast	Overcast		
A	20.02.25		997	0.02	0.0	0.4	3.6	14.2	0	0	28.31	46.62	30.80	44.13	Overcast	Overcast / Showers		
A	25.03.25		1019	0.22	0.0	0.3	0.4	19.5	0	0	Dry		30.80	44.13	Dry/Sunny	Dry/Sunny		
A	23.04.25		1004	0.10	-0.2	0.1	0.3	19.6	0	0	29.20	45.73	30.80	44.13	Dry / Overcast	Rain / Overcast		
A	23.05.25		998	0.10	0.0	0.4	2.0	17.9	0	0	29.10	45.83	30.80	44.13	Rain	Rain		
A	26.06.25		1010	0.14	0.0	0.0	0.1	21.1	1	0	24.25	50.68	30.80	44.13	Dry/Sunny	Dry/Sunny		

Page 1 of 1

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
74.64	A	50mm standpipe	30.00	10.00 - 30.00

[illegible]

Page 1 of 1

Project Name:	Cwmavon, Heol Tabor
Project No.:	Q1218
BH/TP No.:	BH06
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Analyser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
72.46	A	50mm standpipe	30.00	10.00 - 30.00

[illegible]

Page 1 of 1

Project Name:	Cwmavon, Heol Tabor
Project No.:	Q1218
BH/TP No.:	WS01
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Analyser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
74.91	A	50mm standpipe	5.60	1.60 - 5.60

[illegible]

Page 1 of 1

Project Name:	Cwmavon, Heol Tabor
Project No.:	Q1218
BH/TP No.:	WS02
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Analyser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
74	A	50mm standpipe	5.00	1.00 - 5.00

[illegible]