



E3P
Taylor Road
Trafford Park
Urmston
Manchester
M41 7JQ

info@e3p.co.uk
www.e3p.co.uk

Manchester | London | Edinburgh

Ref: 13-887-L7
Date: 23rd June 2022

Landcare (East Manchester)
One St Peter's Square
Manchester
M2 3DE

Dear Sirs

FORMER MANOX SITE – MILES PLATTING MINE WATER DISPLACEMENT ASSESSMENT

E3P are appointed as Geotechnical Engineer by Landcare (East Manchester) to provide professional consultancy services as part of the regeneration of the subject site for a low rise residential end use.

Manchester City Council has granted planning permission (125596/FO/2019) for a *housing-led mixed use redevelopment comprising: a maximum of 410 new dwellings (Class C3); and comprising Class E (maximum floorspace 744 sq.m GIA in total); recreation open space and landscaping; and associated access off Hulme Hall Lane, Varley Street and Iron Street, infrastructure provision and car parking.*

A number of conditions specifically relate to ground conditions and the assessment of risk from historical pollution to the soil and groundwater and the subsequent proposals for remediation works to ensure the site is developed in a safe, economic and sustainable manner.

E3P has prepared this letter to address Condition 18a within the approved planning consent.

INTRODUCTION

The Environment Agency (EA) has requested that a conceptual model of the hydrogeology of the former Manox dye works site is developed in order to define the potential complex interaction between the on-site aquifers, aquitards and former mine workings. Shallow mine workings within the underlying Pennine Coal Measures will be subject to pressure grouting using a liquid OPC/PFA grout, which may cause grout or displaced groundwater (that may include acidic mine water) to discharge into local controlled waters.

SITE SUMMARY

TABLE 1.0 SITE DETAILS

Site Address	Former Manox Site, West of Hulme Hall Lane, Miles Platting, M40 7LD
National Grid Reference	E 395990, N 404200.
Site Area	7.2 Ha.

A site location plan is presented in Appendix III as Drawing 13-887-001 and included as a snapshot in Figure 1.0.

FIGURE 1.0 SNAPSHOT OF PROPOSED DEVELOPMENT SITE



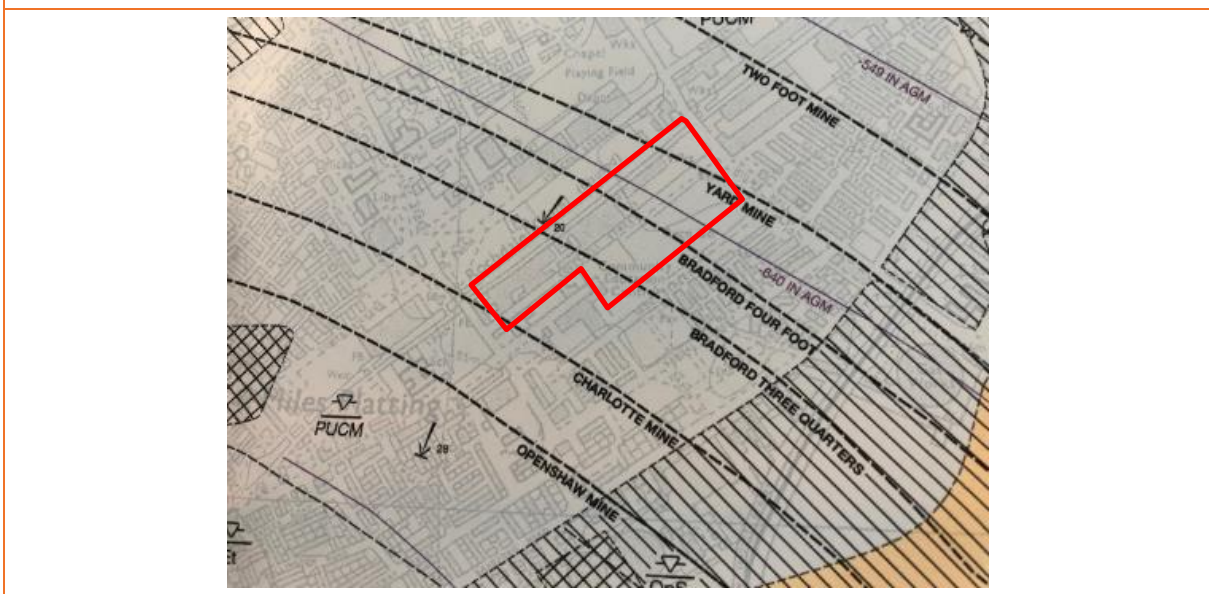
GEOLOGY

The British Geological Survey (BGS) map for the site, (1:50,000, Solid and Drift edition) and online records indicate that the site is underlain by the geological sequence presented in Table 2.0 with a snapshot of the geological mapping in Figure 2.0.

TABLE 2.0 SUMMARY OF UNDERLYING GEOLOGY

GEOLOGICAL UNIT	CLASSIFICATION	DESCRIPTION	AQUIFER CLASSIFICATION
Drift	Glacial till.	SAND, CLAY and GRAVEL	Secondary undifferentiated
Solid	Pennine Upper Coal Measures Formation and South Wales	MUDSTONE, SILTSTONE, SANDSTONE	Secondary A aquifer

FIGURE 2.0 – EXTRACT OF 1:10,000 BGS MAPPING



SUMMARY OF E3P INTRUSIVE MINING INVESTIGATION

In due consideration of the potential presence of shallow mine workings beneath the site, E3P advanced a series of rotary open holes in accordance with Coal Authority Permission Ref: 19640 with a summary of the findings included in Table 3.0.

TABLE 3.0 ROTARY BOREHOLE SUMMARY

ROTARY BOREHOLE	DEPTH TO ROCKHEAD (m bgl)	DEPTH TO TOP/ (THICKNESS) OF COAL (m bgl)	EVIDENCE OF MINING ACTIVITY/SEAM	REMARKS
RB101	23.00	35.00 (0.40)	None	Coal inferred Yard sub-crop. 10xseam
RB102	24.00	45.50 (0.50)	None	Coal inferred Yard sub-crop. 10xseam. BH north of Braford Four feet sub-crop.
RB103	23.00	33.00 (0.50)	None	Coal inferred Yard sub-crop. 10xseam
RB104	27.00	39.00 (0.5)	None	Coal inferred Yard sub-crop. 10xseam.
RB105	27.00	31.00 (2.0)	None	Bradford Four Feet sub-crop. Thick coal and known to be worked. Insufficient rock cover.
RB106	26.00	34.00 (0.50)	None	Bradford Four Feet sub-crop. Thick coal and known to be worked. Possibly extracted and mine roof fallen.

ROTARY BOREHOLE	DEPTH TO ROCKHEAD (m bgl)	DEPTH TO TOP/ (THICKNESS) OF COAL (m bgl)	EVIDENCE OF MINING ACTIVITY/SEAM	REMARKS
				Insufficient rock cover.
RB107	31.90	41.90 (0.60)	None	Bradford Four Feet sub-crop. Thick coal and known to be worked. Possibly extracted and mine roof fallen. CA record Bradford Four Feet at 1.20m. Insufficient rock cover at this position.
RB108	31.00	Barren	None	Assume Bradford Four Feet dipping to greater depth or missing. Rock cover achieved. Bradford Three Quarter missing.
RB109	24.00	45.50 (0.50)	None	Possible Bradford Three Quarter. Sufficient Rock cover achieved. Charlotte sub-crop not identified. Possibly to north of inferred sub-crop.
RB110	31.50	33.50 (0.60) 45.00 (0.30)	None	Charlotte sub-crop. Bradford Three Quarter at 45m with sufficient rock cover.
RB111	25.30	27.70 (0.70)	None	Bradford Three Quarter. Insufficient rock cover.
RB112	26.00	Barren	None	Bradford Four Feet Missing. Assumed to be extracted.
RB113	29.90	41.30 (0.50)	None	Bradford three Quarter. 10xseam thickness achieved.
RB114	24.0	40.1 (0.60)	None	Bradford Four Feet. Sufficient rock cover.
RB115	22.80	40.00 (0.50)	None	Bradford Four Feet. Sufficient rock cover.
RB116	22.10	Barren	None	Bradford Four Feet either missing and extracted of BH north of sub crop.

E3P has reviewed the historical E3P Desk Study Coal Workings Risk Assessment, British Geological Survey (BGS) Geological Mapping and Coal Authority information, in addition to completing 16 No. 50m rotary boreholes to investigate shallow mine workings. A summary of the findings follows.

- ✿ The Coal Authority and BGS highlight the presence of known workings within the Bradford Four Feet and Bradford Three Quarter coal sub-crops beneath the site. All coal in the area dips in a south-westerly direction beneath the site.
- ✿ A recorded mine shaft is located to the east of the site.
- ✿ The intrusive ground investigations completed during this phase of works, comprising fifteen deep rotary boreholes has not identified any voids or evidence of shallow mine workings. However due the age of the workings and effective pressure of the overburden, partial collapse is considered highly probable.
- ✿ The Yard coal sub-crop appears to be further north than the CA conjectured position, possibly beyond the site boundary with sufficient rock (10 x seam thickness) cover achieved in the boreholes drilled by E3P.
- ✿ Workings are known to be present in the Bradford Four Feet coal sub-crop dating to the 16th century. Rotary boreholes identify a thick seam of coal in places, with the seam being reduced or missing within other boreholes. It is likely that the reduced thickness is indicative of coal that could not be fully extracted from the mine with subsequent roof collapse, with other areas where it is removed almost in its entirety.
- ✿ The Bradford Three Quarter Coal sub-crop is also recorded to have been worked beneath the site and while no losses in flush or voids are identified within the limited number of site investigation boreholes, the variable thickness and absence of the seam in locations infers historical workings.
- ✿ The Charlotte coal sub-crop is identified in the south west, again this seam appears to have a reasonable (workable) thickness and therefore proof drilling and grouting is required.
- ✿ Mine stabilisation works are required across the three identified coal sub-crops where insufficient rock cover is present overlying the known workings to mitigate perceived ground stability risk in accordance with The Coal Authority permission process and detailed geotechnical design to be prepared in accordance with CIRIA 758.
- ✿ Given the known mining legacy and proven shallow mine workings in historical investigation works, it is highly likely that other unrecorded mine entries exist within the curtilage of the site and immediate surrounding area. It will therefore be necessary to allow for a watching brief during earthworks and ensure inclusion of a suitable mechanism for grouting and capping of any such feature and subsequent amendment to a development layout in the event that an unrecorded mine entry underlies a residential structure.
- ✿ Mine entry 386399-007 will require stabilisation by pressure grouting and the construction of specialist grout capping solution.

HYDROGEOLOGY

The site hydrogeology is reasonably well understood; there have been multiple phases of intrusive Ground investigations that have characterised the hydrogeological regime which is critical in the development of a robust conceptual site model and informed risk based assessment in respect to the potential for the chemicals to migrate and impact a controlled water receptor.

By way of an overview, the hydrogeology can be identified as a singular perched water body confined by the low permeability glacial clay at the near surface.

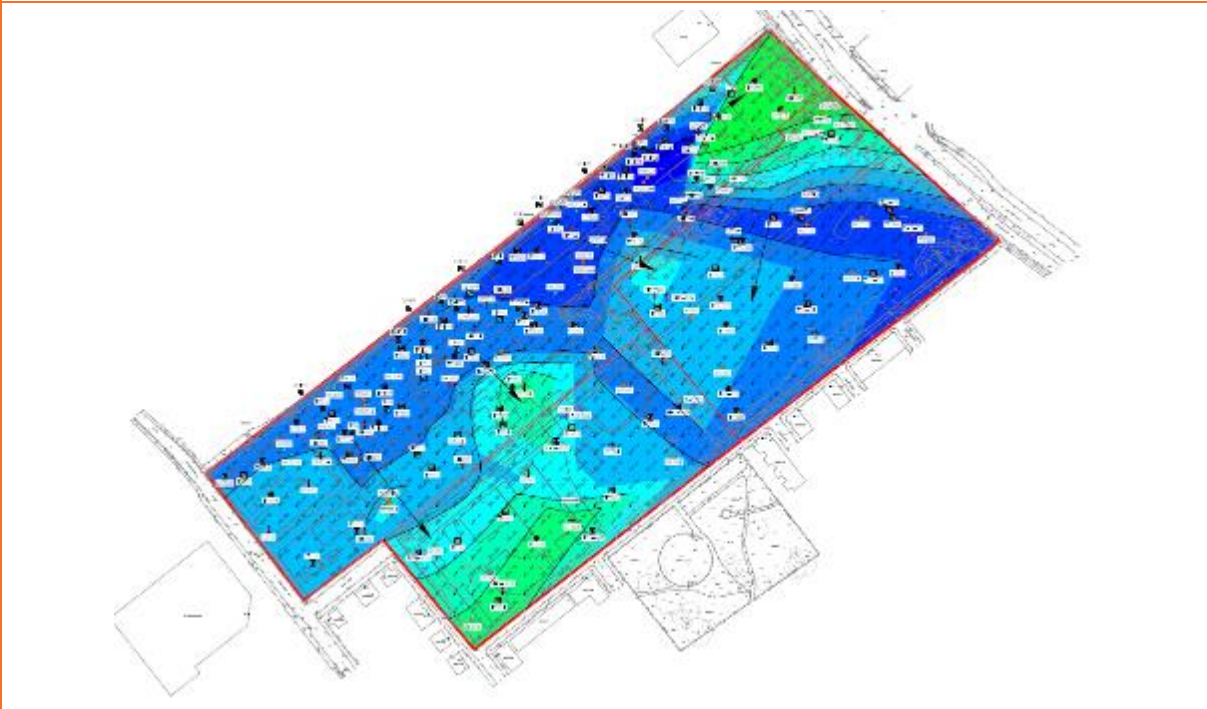
There is no viable aquifer within the superficial drift deposits due to the confining overlying glacial till that limits the potential for precipitation ingress into permeable stratum.

The underlying Pennine Coal Measures is classified as a Secondary A Aquifer. E3P has extrapolated the available groundwater data to inform the preparation of updated groundwater flow modelling for the site as detailed within the drawings discussed below.

It would appear that there is a perched groundwater body that is discontinuous and confined by the low permeability clay soil directly underlying the Made Ground at AOD circa 58.00 m to 57.50 m in the northern sector falling to circa 54.00 m in the south.

Extensive groundwater flow direction modelling confirms a southward flow of perched groundwater from all previous phases of investigation, this flows the depth to low permeability glacial till. Conjectured groundwater flow within the perched body is detailed within E3P modelling 13-877-025 (attached) as indicated in Figure 3.0 below.

FIGURE 3.0 – CONJECTURED PERCHED GROUNDWATER FLOW



Scaled cross sections within E3P models 13-887-014/015 (attached) and included as Figure 4.0 confirm the perched groundwater flow is determined by the shallow low permeability clay which dictates groundwater flow by topographic variance.

FIGURE 4.0 – PERCHED GROUNDWATER FLOW – SCALED CROSS SECTION



The Rochdale Canal is measured at circa 57.80 m AOD which is a similar hydraulic level to that of the perched groundwater in the northern sector of the site, or potentially slightly higher. However, the groundwater is defined as a perched and confined water body.

The Canal is constructed within the glacial till with its base estimated at 56.50 m AOD with masonry walls to the periphery and site boundary.

It is concluded that the most likely scenario is the Rochdale Canal lining and integrity is compromised, however given the volume of water and hydraulic pressure, the canal may well be contributing to the perched groundwater flow that is modelled to be moving to the south away from this feature as a receptor.

it is possible that shallow conduits (former drains) and overland surface flow will be leaving the subject site and entering the canal at a higher elevation, however the general flow is away from the canal with this feature providing some form of base flow to perched water migration.

This hypothesis is supported by the presence of dissolved phase compounds that are known to be present in the canal and are identified within the perched water 'smear' zone within the subject site (carbon disulphide) by way of an example.

In summary the hydrogeological regime is characterised as a singular shallow perched water body confined by the low permeability clay. There are no identifiable aquifers within the superficial drift deposits or rock formations that would be a consideration for this site.

THE INFLUENCE OF MINING

The impact of mining is likely to have some form of significance as shafts and roadways would have connected areas of workings that with dewatering pumping would have altered the directions of groundwater flow. It is understood that there was extensive shallow coal mining beneath much of the site which are overlain by significant depths of glacial till deposits.

Where dewatering was undertaken as part of the mining operations, once the last mine had closed, this would have allowed the groundwater in the workings to recover. There has been no evidence in the investigations undertaken to date of any artesian groundwater in the identified shaft or workings.

GROUTING

It is proposed to grout the shallow mine workings in the Pennine Coal Measures to enable the stabilisation of the mine workings prior to redevelopment. There is concern that the general outflow may emerge at the surface (onsite and offsite) and in the local watercourses.

The areas where grouting is proposed is show in Figure 5.0. It is likely that the shallow workings are only interconnected on a limited basis as the mining may have been undertaken by different companies at the time and it is assumed that mining was from mine shafts rather than drifts.

FIGURE 5.0 – AREA OF GROUTING REQUIRED



For the most part it is assumed that the workings were the pillar-and-stall method which in areas may have suffered collapse however it should be assumed that cavities remain and there will be a degree of grout take which could potentially result in grout, contaminated groundwater and acid mine drainage to travel both up and down the dip of the coal seams. That being said, given the depth and topography of the site, there has been no feasible potential for water to emanate at the surface identified.

The most vulnerable locations are along the adjacent Rochdale canal that is believed to be in hydraulic continuity with the site (but not necessarily draining the site). It should also be noted that due to the direction of dip (and depth of the workings), which is perpendicular to the Rochdale Canal, there is no theoretical possibility of an instance where grouting of the workings will result in grout rising over 30m to ground level and subsequently entering the watercourse.

Where the worked coal seams are directly overlain by Made Ground it will depend on the nature of these materials on whether or not the grout appears at the ground surface, however it is more likely that all workings/subcrops are covered by glacial till which will resist the grout movement.

A detailed specification for the consolidation of mine workings will be completed for the project, which will state there is a requirement for monitoring at the canal to ensure there is no perpendicular flow through the shallow Made Ground and drift geology.

Temporary casing will be installed within the drift to a depth of circa 30m bgl (and deeper). This will ensure that there will be no grout leakage at the near surface (for the canal receptor) or within the superficial drift deposits.

It should also be noted that there are no records of mine flooding and there are no deeper workings present which could theoretically flooded causing a rise in groundwater levels in the area. It is also considered that the low permeability drift deposits will act as a confining stratum that will limit any groundwater movement.

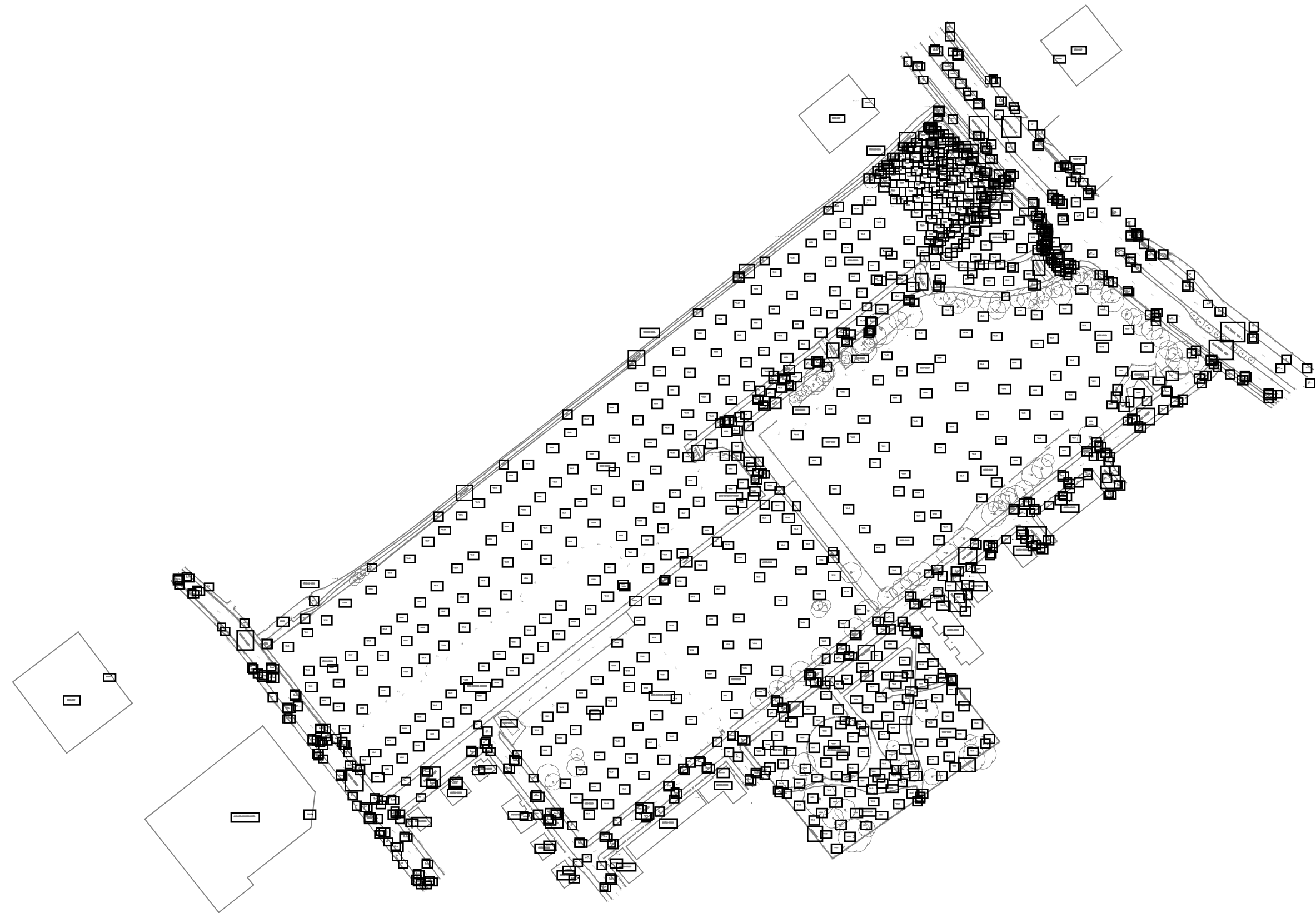
In conclusion, based on the geological and hydrogeological information reviewed, E3P does not consider there to be an instance where grouting the mine workings will result in grout travelling along the subcrops and appearing at ground level or affecting the adjacent controlled water receptors. The coal workings are very deep which alongside a level topography, removes the potential risk of grout (and contaminated groundwater) to rise.

I trust this information is satisfactory to your requirements, and should I be able to be of any further assistance, please do not hesitate to contact me.

Yours sincerely,

For and on behalf of E3P Ltd

Stephanie Cox
Director



Notes:					
P1	-	14.01.2020	DRAFT	HM	MD
Phase	Revision	Date	Issue	Drawn	Checked

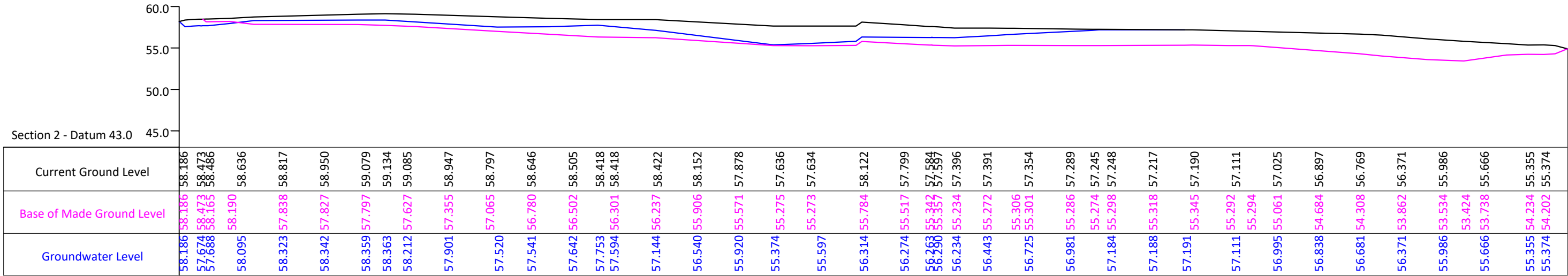
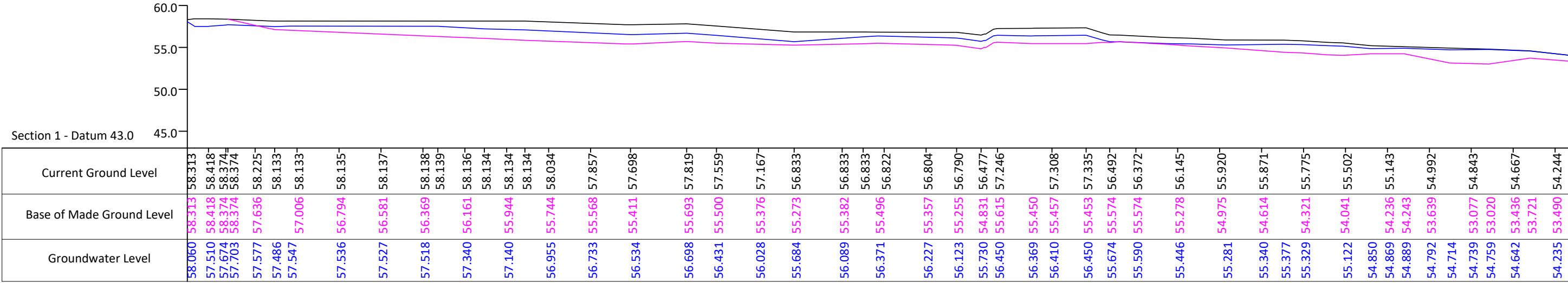
Client:
Engie
Job Title:
Manox

Job No:
13-887
Drawing No:
002
Date:
14.01.2020
Scale:
NTS
Drawing Title:
Site Location



Environmental Engineering
Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.



Notes:					
P1	-	13.02.2020	DRAFT	CB	MD
Phase	Revision	Date	Issue	Drawn	Checked

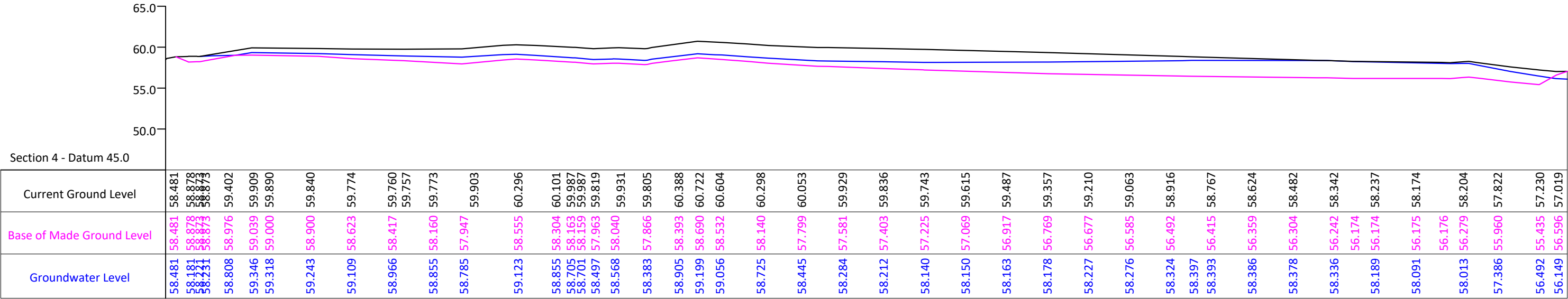
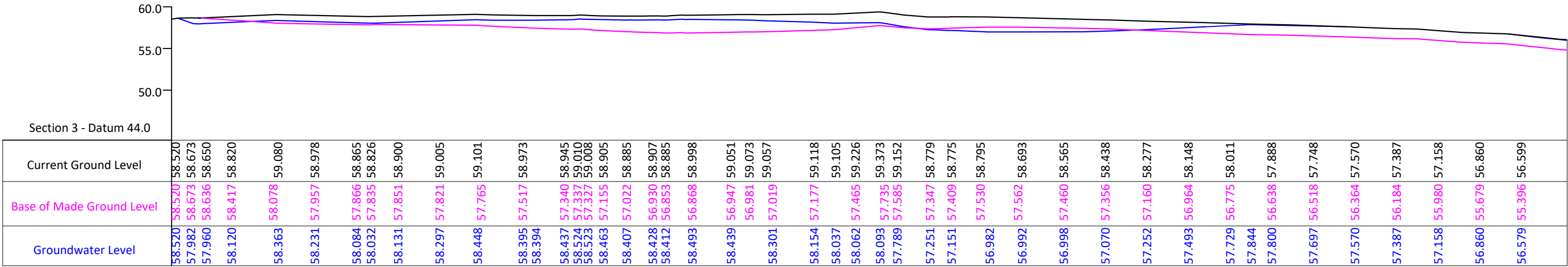
Client:	Engie
Job Title:	Manox

Job No:	13-887
Drawing No:	014
Date:	13.02.2020
Scale:	1:500 @ A3
Drawing Title:	Section 1 & 2



Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.



Notes:					
P1	-	13.02.2020	DRAFT	CB	MD
Phase	Revision	Date	Issue	Drawn	Checked

Client:	Engie
Job Title:	Manox

Job No:	13-887	Date:	13.02.2020
Drawing No:	015	Scale:	1:500 @ A3
Drawing Title:	Section 3 & 4		



Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.

