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Site:	Aintree University Hospital
Client:	VINCI
Ref:	GRM/P10738/PIISAR.1
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AINTREE UNIVERSITY HOSPITAL

PHASE II SITE APPRAISAL REPORT FOR VINCI

Project Ref:
P10738

Date:
January 2025

Prepared for:
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This report has been prepared in accordance with GRM's Accredited Quality Procedures

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Site Appraisal for Aintree University Hospital

SUMMARY OF RECOMMENDATIONS

Where further assessment is required it is indicated with a "Y" in the right hand column.		
Proposed Development	New hospital buildings of up to 3 storey, an electrical substation and soft landscaping / infrastructure.	
CONTAMINATION ASSESSMENT - REMEDIATION / WASTE DISPOSAL		
End Users	Currently, allow for 300mm of clean soil capping in soft landscaping. Additional chemical analysis (together with derivation of SSAC) and/or a change in TAC based on final site setting may allow for the need for remedial measures to be negated.	Y
Site Workers	No remediation required.	
Construction Materials	Appropriate concrete specification. Barrier water supply pipes required (to be confirmed by supply company).	Y
Groundwater	No remediation required.	
Surface Water	No remediation required.	
Waste Disposal	Preliminary Waste Classification: Non-Hazardous for relaid topsoil. Non-Hazardous for made ground. Inert for natural strata. Will need to be confirmed by receiving landfill.	Y
GEOTECHNICAL ASSESSMENT – FOUNDATIONS		
Ground Treatment Required	Excavate and recompact if ground bearing floor slabs are to be used.	Y
Main Bearing Strata	CLAY – Glacial Till.	
Nett Allowable Bearing Pressure	110kN/m ² for trench fill or pad foundations. To be confirmed by a specialist for piles.	Y
Rockhead	Not encountered, >22m begl.	
Tree Influence	Some. Extent to be confirmed by a tree survey.	Y
Volume Change Potential	Medium.	
Likely Foundation Types	Either Strip/Trench Fill, pads or piles, depending on structural loadings.	Y
Likely Foundation Depth Range	0.9m begl minimum, 2.0m begl maximum depths. Anticipate deepening in the footprint of former structures. To be confirmed by piling contractor.	Y
Excavation Hazards	Potential sub-structures in made ground from previous buildings, locally perched shallow groundwater.	
Floor Slab Types	Ground bearing likely to be the most cost effective.	Y
Gas Protection Requirements Radon and/or Landfill	No gas protection measures currently required. To be confirmed when gas monitoring is complete. No radon protection required.	Y
GEOTECHNICAL ASSESSMENT - GENERAL		
Slope Stability Risk	Very Low.	
Soakaways Potential	Not suitable.	
New Access Roads	DCPs in shallow Made Ground, generally >10%, and >5% in natural cohesive soils. Observational CBRs 2% to 4% in cohesive Glacial Till soils.	
Buried Concrete Class	DS - 1; AC- 1s; GEN-1 for unreinforced, RC35 for reinforced.	
Retaining Walls and Boundary Features	No existing or proposed.	
Further Assessment Targets	Review foundation recommendations following detailed development plans, and structural loadings. Additional chemical analysis (if proposed site setting is to remain the same) and the derivation of SSAC to determine whether the need for remedial measures can be negated.	Y
Other Comments	Significant buried services, some were encountered and not identified by previously supplied PAS128 survey.	Y



This summary is based on the full report that provides the detailed assessment of the ground risks affecting the development and how to manage them. It should not be used in isolation.

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1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Limited (GRM) has been appointed by VINCI (Client) to undertake a Phase II Site Appraisal. A previous desk study by GRM (Phase I Site Appraisal (Desk Study), GRM/P10738/DS.1, January 2025) formed Phase I of the assessment and allowed the geotechnical and geo-environmental setting of the site to be determined and the identification of areas of particular concern that required targeted investigation. The Phase II works reported within this document comprise the intrusive ground investigation, geotechnical testing and chemical analysis. The information gained from the Phase II works will be used to refine the conceptual model for the site and determine cost-effective development solutions.

This document is intended to provide information that will assist decision making by identifying and recommending solutions to ground engineering and contamination issues.

GRM Standard Limitations of Reporting are provided in Appendix A of this report.

The proposed development includes new hospital buildings, and an electrical substation with associated soft landscaping and infrastructure.

The information available at the current time, which is illustrated on the Proposed Development Footprint Drawing in Appendix B, indicates several structures up to 3 storeys in height with associated soft landscaping and infrastructure. The construction methods have not been indicated, but should more detailed development plans become available, the recommendations made in this report should be reviewed.

The ground investigation covered in this report, included an adjacent area to be developed with multi-storey car park, for which a separate Letter Report (ref: P10738 LET1, dated January 2025) will be issued.

Due to the investigation of both areas being undertaken concurrently, the laboratory test results and gas monitoring results contain information related to the adjacent site, which has not been considered in this assessment.

The Client has not informed GRM of any significant development hazards.

1.2 OBJECTIVES OF THE SITE APPRAISAL

The principal aims of the Phase II Site Appraisal are as follows:

- a) Obtain information, from easily accessible sources, about the soil and groundwater conditions within the area of the site.
- b) Determine the possible ground-related geotechnical and contamination hazards within the site boundaries that may affect the proposed development.
- c) Provide preliminary development recommendations.

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- d) Provide advice on further works required for the cost-effective reduction of risks to the development and procedures likely to satisfy regulators.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

2 PHASE I DESK STUDY SUMMARY

Project Name.	Aintree University Hospital.
Project Reference.	P10738.
Client.	VINCI.
Site Location (address).	Aintree Hospital is located approximately 7.3km north east of Liverpool city centre.
National Grid Reference.	The National Grid Reference (NGR) for the approximate centre of the development site is SJ 379 970.
Site Area (Ha).	Approximately 2.4
Summary of Proposed Development.	New hospital buildings, an electricity substation, hardstanding, and soft landscaping.
Client Supplied Information.	Development footprints for new structures.
Site Setting.	The site comprises an approximately rectangular parcel of land which is located within the hospital grounds and primarily used for car parking. The northern, eastern and southern boundaries are formed by various existing hospital buildings and car parks comprising hardstanding and limited soft landscaping. The western boundary is formed by treelines separating residential housing and gardens along the western border of the development site. The topography of the site is flat.
Site History.	Pre – 1893 The development site is shown to be part of a field. 1893 – 1906 Three hospital buildings are shown, now labelled as ‘City Hospital (Fever Wards)’. A fourth building is shown; however, it is not representative of the current layout of the development site. The existing road layout is shown to have developed. Treelines are shown to border the western site boundary. 1906 – 2010 Various small changes to the hospital buildings, with some smaller buildings now shown and one assumed demolished. 2010 onwards The hospital buildings are now longer shown, and assumed to have been demolished.
Geology.	Superficial deposits of Shirdley Hill Sand Formation comprising moderately to well-sorted, fine-grained sand, with mainly cohesive Glacial Till beneath. Solid geology of the Wilmslow Sandstone Formation.

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	The BGS boreholes suggest superficial deposits are present to at least 25m begl depth with the base not proven. The strata are described as firm to very stiff brown sandy clay with pebbles (boulder clay/glacial till). Archive information from previous work in the area by GRM confirms the presence of the Shirdley Hill Sand Formation to depths of between 0.40m to 3.50m below existing ground level (begl), these being underlain by cohesive Glacial Deposits to depths of at least 4.0m begl, the base of the Glacial Deposits not being confirmed.
Hydrogeology.	The BGS borehole records report water strikes between 5.0m and 8.5m below ground level in the Glacial Till; however, the groundwater level is likely to be subject to seasonal variations. Previous GRM investigations in the area report shallow groundwater between 0.90m and 4.0m begl. This is anticipated to be perched volumes contained within granular horizons in the largely cohesive Glacial Till. The Environment Agency has classified the underlying superficial strata (Shirdley Hill Sand Formation) as a Secondary A Aquifer and the underlying Solid strata (Wilmslow Sandstone Formation) as a Principal Aquifer. Any Glacial Till present is likely to be classified as a Secondary (Undifferentiated) Aquifer. The groundwater previously encountered by the BGS boreholes and local GRM investigation are likely to be indicative of perched volumes in the Glacial Till. Due to the largely cohesive nature of the Glacial Till, the groundwater contained within it is not considered to represent a viable receptor. Due to the presence of the Glacial Till, the hydraulic continuity between any groundwater contained with the Shirdley Hill Sand Formation and/or the perched volumes in the Glacial Till, and the deeper regional groundwater table anticipated to be present at depth in the Wilmslow Sandstone Formation, is considered limited, thus reducing the perceived risk to the Principal Aquifer. There are no recorded active groundwater abstraction licenses within 500m of the site. The site is recorded to be within a Zone 3 Total Catchment Groundwater Source Protection Zone relating to the Principal Aquifer (Wilmslow Sandstone Formation).

	However, as the risk to the Principal Aquifer is already considered very low, due to the presence of the largely cohesive Glacial Till above it, the perceived risk to the Groundwater Source Protection Zone is also considered very low.
Hydrology.	The only identified local surface water feature comprises; Fazakerley Brook situated 221m to the south (flowing to the south); however, given the distance the brook is not considered a viable receptor for any site derived contamination, should any be present. There are no nearby surface water or potable water abstraction licenses recorded.
Flooding.	The BGS suggests the site is underlain by the Shirdley Hill Sand Formation and is within an area of potential groundwater flooding related to Clearwater Flooding (unconfined aquifer) and that the confidence level is low. Although the site is within 250m of an indicative fluvial floodplain, the Environment Agency's Internet based flood risk maps suggest there is no risk from river flooding. The highest risk on site from the Risk of Flooding from Rivers and the Sea (RoFRaS) rating is very low. A Flood Risk Assessment (FRA) is required for this site as it is over 1ha in size.
Mining and Quarrying.	The site is not within an area recorded to require a Mining Remediation Authority, formally the Coal Authority, mining report. There are no shallow coal bearing strata illustrated on the geological mapping data; therefore, the risk from shallow coal mining is considered to be negligible. The site is not within the area defined by the Brine Compensation Board and no soluble strata are recorded at shallow depth beneath the site. There is no evidence of any non-coal mineral extraction having taken place within, or close to, the site area.
Environmental Information.	There are no recorded landfill or waste sites within influencing distance. Various environmental permits are recorded relating to keeping, using and disposal of radioactive materials. These are likely related to the hospital activities and therefore subject to rigorous regulation. These activities therefore pose a negligible risk to the development.

	A historical laundry is recorded adjacent to the eastern part of the area of interest for this report up until 1967; this is assumed to have served the hospital. The laundry represents a potential source of solvents and volatile organic compounds (VOCs). Railway station approximately 250m to the north, however due to the distance, this poses a negligible risk to the site.
UXO Risk.	The detailed UXO assessment included in the Desk Study, concludes that the risk associated with allied unexploded ordnance is considered negligible. The risk of encountering German and anti-aircraft unexploded ordnance on site is considered to be low, accordingly, precautions are recommended when undertaking intrusive groundworks such as site investigations and construction works. This usually takes the form of a tool box talk, based on the identified level of risk.
Potential Soil Contamination Sources.	Made ground from previous development. Solvents and VOCs associated with former laundry. Asbestos associated with existing and historic buildings.
Potential Ground Gas Sources (including Radon).	Made ground from previous development.

The Phase I Ground Hazard Diagram is presented in Appendix D.

2.1 PHASE I CONCEPTUAL SITE MODEL

HUMAN HEALTH			
Source	Pathway	Receptor	Level of Risk
Potentially contaminated made ground associated with previous development. Potential VOCs from adjacent former laundry.	Indoor and outdoor inhalation of soil dust, vapours and asbestos fibres, the ingestion of, and dermal contact with, contaminated soil and soil dust.	End users.	Low to Medium.
		Construction and Maintenance Workers.	
Potentially contaminated made ground associated with previous development.	Inhalation of ground gas.	End users.	Low.
Potentially contaminated made ground associated with previous development. Potential VOCs from adjacent former laundry.	Water pipes.	End users.	Low.

CONTROLLED WATERS			
Potentially contaminated made ground associated with previous development. Potential VOCs from adjacent former laundry. Former off-site laundry.	Leaching of contaminants and vertical migration to the groundwater.	Secondary A Aquifer (Shirdley Hill Sand Formation).	Very Low.
	Leaching of contaminants and vertical migration to the groundwater (risk reduced due to intervening cohesive strata).reduced due to intervening cohesive strata).	Principal Aquifer and Source Protection Zone.	Very Low.

3 PHASE II GROUND INVESTIGATION

3.1 FIELDWORK

The ground investigation has been designed in accordance with the general comments outlined in Appendix A (iv).

The ground investigation fieldwork was conducted between 27th November and 13th December 2024, with groundwater/gas monitoring visits continuing after that period.

The investigation area was largely contained inside an area of security hoarding (painted blue), and an area of existing car park, to the north west of the hoarding. The area immediately east of the hoarding, is covered by the aforementioned separate letter report.

A total of 25no. exploratory holes (10no. trial pits, 3no. BRE soakaway testing locations, 9no. windowless sample boreholes, 5no. DCP tests and 4no. cable percussion boreholes) were progressed, to depths ranging between 0.60m and 22.0m below existing ground level (begl).

A planned location (WS04) in the north western corner of the blue hoarded area, was not attempted as no safe location could be found when setting out. This was due to the CAT scan detecting buried services in the area.

Locations; BH04, WS01, WS02, WS03, WS04, WS09 and WS10 were untaken during a weekend shift, as these are located within the area of existing car parking. DCP testing was undertaken beneath the hardstanding in the shallow made ground of the window sample boreholes.

An appreciation was gained of the made ground present beneath the footprints of the now demolished buildings. However, as the extent of the demolition works was unknown e.g. whether the services had been disconnected/removed was unknown, it was not considered appropriate to mass excavate the footprints.

The exploratory hole location plan and exploratory hole logs are presented in Appendix E and Appendix F respectively.

The Detailed UXO Assessment by 1st Line defence (included in Appendix G), found the site to be at a moderate risk from UXO, therefore on site supervision was not required at the investigation stage of the project, but recommended a briefing prior to starting the construction works.

Various piles of building materials and other hospital related equipment were present within the blue hoarding. None of these were considered to constrain the investigation works, but will require relocation/disposal as part of the proposed development.

Six gas and water monitoring standpipes were installed during the site works, and the rationale for these works are discussed fully in Section 6. A Gas Monitoring Plan, illustrating the locations of the standpipes, is presented in Appendix H. The standpipes will need to remain in place until 1st March 2025. Once the regulators have approved the conclusion of the final ground gas risk assessment, the Client should inform GRM so that advice can be provided with regard to the decommissioning of them. Should the Client choose not to proceed with the site, then GRM should be contacted to determine whether decommissioning works are required to protect sensitive receptors.

3.2 PROVEN GROUND

The following ground conditions were encountered during the investigation fieldwork:

- Relaid Topsoil
- Made Ground
- Shirdley Hill Sand
- Glacial Till

3.2.1 Relaid Topsoil

Relaid Topsoil was encountered in some holes, to a maximum depth of 0.70 m begl with a general thickness of 0.30m. This strata comprised brown slightly clayey fine to coarse SAND, with occasional anthropogenic materials e.g. brick fragments.

3.2.2 Made Ground

Made ground was encountered in nine holes, to depths ranging between 0.50m and 1.1m begl.

Various types of made ground were observed:

- Various types of surface hardstanding was encountered within the area of existing car parking.
- Soft medium strength brown sandy gravelly clay. Found in BH03, BH04, TP01, TP09 and TP10, to depths of up to 0.70m and was generally 0.30m thick. This made ground is likely to be from previous site development.
- Dense fine to coarse angular gravel of limestone. Generally only found in the existing car parking area, in WS02, WS03, WS09, and WS10 to depths of up to 1.1m and was generally 0.50m thick. This made ground is likely to be a sub-base for the hardstanding.

No asbestos contaminating materials have been observed during the investigation works to date.

3.2.3 Shirdley Hill Sand

These strata were encountered in fourteen holes, beneath the Relaid Topsoil to a maximum depth of 1.50m begl, and typically less than 1.0m thick. These strata were generally encountered, but were not laterally or vertically consistent, and was locally absent.

These deposits generally comprised: grey and light brown, fine to coarse sand. The sands encountered were typically loose.

3.2.4 Glacial Till

These strata were encountered in all holes beneath the topsoil, made ground/or Shirdley Hill Sand, to a maximum depth of 22.0m begl but the base was not proven.

Standard Penetration Test N-values in the cohesive strata generally ranged between 8 and 25, but were locally as high as 50 and low as 3.

Hand shear vane measurements in the cohesive strata from between 1.0-3.0m begl recorded shear strengths generally between 100 and 146kPa, but locally as low as 65kPa.

Utilising the empirical relationship formulated by Stroud (1974) where undrained shear strength is related to SPT N-values and a factor based on plasticity, and considering the hand shear vane results, these strata are typically medium to high strength, but locally low strength at shallower depths, which is anticipated to be due to silty partings.

The SPT results and approximate strengths with depth are summarised below:

Depth	N Value range	Strength
1.0	3 – 8	Low
2.0	7 – 15	Medium
3.0	4 – 12	Low to medium
4.0	6 – 15	Medium
5.0	5 – 18	Medium to high
6.5	12 – 19	Medium to high
8.0	14 – 22	Medium to high
9.5	19 - 28	High
11.0	20 - 46	High
12.5	23 - 27	High
14.0	21 – 28	High
15.5	24 – 26	High
17.0	26 – 50	High
18.5	23 – 50	High
20.0	33 – 45	Very High

3.3 CONTAMINATION OBSERVATIONS

No visual or olfactory evidence of potential contamination was encountered during the fieldwork and monitoring.

3.4 GROUNDWATER OBSERVATIONS

Groundwater was struck in the exploratory holes BH01 at 1.80m, BH02 at 7.50m, BH03 at 1.0m, WS06 at 2.60m, WS09 at 0.45m, WS10 at 2.0m, SA03 at 0.70m, TP03 at 0.60m, TP06 at 1.20m and TP07 at 1.0m.

The groundwater encountered was mainly within the Glacial Till, locally in WS09 in the made ground, and in the Shirdley Hill Sand in WS10.

Two groundwater monitoring visits have been conducted and the results of the monitoring are reported in Appendix I. In summary, groundwater was recorded at depths of 0.1m begl to 3.6m begl.

Long term monitoring of groundwater levels has not been conducted as part of this investigation and interpreted levels are approximate and may be dependent on seasonal variations.

Due to the lack of groundwater data for the site it has not been possible to accurately determine the groundwater flow direction beneath the site. However, the groundwater flow is considered to be to the south, towards Fazakerley Brook.

3.5 GROUND GAS AND VAPOURS

Ground gases are discussed in full in Section 6. In summary, the concentrations of ground gases recorded to date are presented in Appendix J and summarised below:

- Methane has not been detected.
- Carbon dioxide between 0.0%v/v and 1.70%v/v.
- Oxygen between 18.2%v/v and 20.2%v/v.

No flow has been noted during the monitoring completed to date.

3.6 SUMMARY OF FIELDWORK OBSERVATIONS

The fieldwork has revealed/confirmed the following:

Significant Features identified during fieldwork
Made Ground – potential source of soil contamination and ground gas. Cohesive Natural Strata – deepened foundations (in association with trees). Groundwater – excavation hazard. Buried services – require disconnection and or diversion. Variable strata – deepen new foundations to consistent strata. Existing hardstanding – development constraint, requires breaking out and disposal. No significant elevated ground gas concentrations recorded at this stage – gas protection measures not currently required.

4 LABORATORY ANALYSES RATIONALE

4.1 CHEMICAL LABORATORY ANALYSIS

Chemical laboratory analyses were selected to provide the parameters necessary to make an initial assessment of potentially contaminated soils and/or waters, for the budgetary design of the development. The choice of contamination testing was based on the Phase I assessment, identified past uses of the site, site observations and comprised:

- 5no. samples (3no. Relaid Topsoil and 2no. of Made Ground) were analysed for a general suite of contaminants (metals, inorganics and speciated PAH).
- 5no. samples (3no. Relaid Topsoil and 2no. of Made Ground) were analysed for banded aliphatic and aromatic hydrocarbons (TPHCWG).
- 5no. samples (3no. Relaid Topsoil and 2no. of Made Ground) have been screened for the presence of asbestos.

Various other potential contaminants identified in earlier work have been ruled out of the testing suites. These include:

- VOCs and SVOCs (solvents from historical Laundry) as no tell-tale odours were detected. Specifically, TP03 and TP09 were progressed adjacent to the eastern boundary (closest to the historical laundry), and no evidence of any readily mobile contamination was noted.
- Additionally, the relevant samples were screened using a PID during detailed logging, this not returning any results of interest.

Whilst made ground have been identified at the site, the Shirdley Hill Sand Formation has been confirmed to generally be very thin (i.e. less than 1m thick) and does not contain a contiguous body of groundwater. The underlying Glacial Till has been confirmed to be predominantly cohesive and extends to a significant depth, thus demonstrating its lack of viability in terms of being a potential receptor and its ability to effectively act as an aquiclude for the underlying Principal Aquifer. The risk to controlled water is therefore considered negligible and soil leachate testing has not been undertaken.

The chemical analysis results are presented in Appendix J, and include BH05 from the adjacent site to the east (proposed MSCP).

Samples not used for testing will be stored for a month after issue of this report and then disposed of, unless the client requests in writing that they be kept.

4.2 GEOTECHNICAL LABORATORY TESTING

Geotechnical soils testing has been undertaken as part of the ground investigation including the following:

- 7no. samples of Glacial Till underwent Atterberg Limits (PI) classification.
- 7no. samples of Glacial Till underwent pH and water soluble sulphate testing.

Geotechnical tests were selected to provide the parameters necessary for the budgetary design of the development including foundations and infrastructure.

The geotechnical test results are presented in Appendix K, and summarised in Section 10.2. This also includes BH05 from the adjacent site to the east (proposed MSCP).

5 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH (SOIL)

5.1 INTRODUCTION

The proposed development includes new hospital buildings, including an electrical substation, and soft landscaping.

The desk study and fieldwork have not revealed any significant sources of contamination on this site, accordingly testing has only been carried out to provide parameters for the reuse of soils.

Various sources of contamination have been put forward in earlier text and summarised in the Phase I conceptual model. The material on site identified as being the most likely to be contaminated is the Relaid Topsoil and made ground.

The rationale for the end use specific Tier 1 Acceptance Criteria (TAC) used by GRM is outlined in Appendix A (vi) and for this site the chemical analysis results are being compared against the TAC for residential end use without plant uptake. The use of residential without plant uptake TAC is considered to be a suitably conservative option, as threshold values for a hospital end use are not generally available. In order to adopt a conservative approach a Soil Organic Matter (SOM) content of 1% has been used to assess the Relaid Topsoil and made ground.

A copy of the thresholds used in this assessment is presented in Appendix L.

To provide an initial assessment, the results have been assessed to determine whether benzo(a)pyrene could be used as a surrogate marker in the assessment of carcinogenic risks posed by genotoxic PAHs in soils. It is recommended that such assessments should be based upon toxicological benchmarks derived from the data for two coal tar mixtures presented by Culp et al. (1998) and as described in the Public Health England document “Contaminated land information sheet: risk assessment approaches for polycyclic aromatic hydrocarbons (PAHs)”, dated 2017. The graphs completed show that benzo(a)pyrene can be used as a surrogate marker for genotoxic PAHs, with the exception of naphthalene, for the made ground. GRM’s TACs use published C4SL values which are based on minimal risk levels and have been confirmed to be suitable for use in a planning context by the UK Government. Other commercially available values have been published and have been used where C4SLs are not available.

A copy of the PAH profile graphs and GRM thresholds used in this assessment are presented in Appendix M.

5.2 RISK TO END USERS

The chemical analysis results are presented in Appendix J.

Whilst the number of samples tested is considered sufficient to characterise the Relaid Topsoil and made ground, it is not considered appropriate to carry out statistical analysis on this data set. Therefore the results have been compared directly against the TAC. The results of the hydrocarbons have also been assessed separately.

5.2.1 Analysis of Soil Contamination Data

GRM General Suite – Relaid Topsoil

The concentrations of most of the contaminants are below the relevant TAC for residential end use without plant uptake, with the exception of lead in TP02 which recorded a value of 380mg/kg which marginally exceeds the threshold of 310mg/kg.

GRM General Suite - Made Ground

The concentrations of most of the contaminants are below the relevant TAC for residential end use without plant uptake, with the exception of benzo(a)pyrene in TP05 which recorded a value of 6.7mg/kg, which marginally exceeds the threshold of 5.3mg/kg.

Petroleum Hydrocarbons

The concentrations of all of the hydrocarbon bands are below the relevant TAC for residential end use with plant uptake.

Asbestos

The screening for asbestos did not reveal the presence of such contamination in the samples analysed.

5.2.2 Water Supply Pipes

It is considered that, based on the UKWIR guidance, the concentrations of contaminants recorded to date (specifically the hydrocarbons) are such that Barrier water supply pipes are likely to be required for the site. However, it is recommended that the local water supply company for the site be contacted to confirm their requirements with regard to pipe materials.

5.2.3 Summary of Risk to End Users

Given the marginal exceedances recorded, and the assessment criteria TAC being a conservative option, when compared to the proposed development, the contamination identified is considered to pose a low risk to the end users of the proposed development, but it still requires consideration.

Initially, more chemical analysis is recommended to determine the extent of the elevated contamination already identified, and to general site specific assessment thresholds for lead and benzo(a)pyrene. Until this is undertaken, it is recommended that it be assumed that remedial measures are required to protect end users.

It should be noted that, should the final development proposals results in a site setting that is more in line with a commercial development, then this is likely to result in remedial action not being required.

5.3 RISK TO SITE WORKERS

The investigation has not revealed any specific risk to site workers; however, the general comments outlined in Appendix A (vii) should be considered when site specific risk assessments are completed.

6 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH (GROUND GAS)

The gas risk assessment methodology used by GRM is outlined in Appendix A (v).

As the proposed land use is classed as moderate sensitivity; 5no. 35mm and 2no. 50mm diameter gas/water monitoring standpipes have been installed across the site (BH02, BH04, WS05, WS06, WS08 and WS10). The response zones have been targeted at the natural strata, as no significant thicknesses of made ground were encountered by the investigation to date. Although the monitoring locations were not directly beneath the footprints of the former buildings, they are considered close enough to investigate any gas potentially generated from the anticipated made ground beneath them.

Based on BS8576:2013 *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds*, the gas hazard is considered very low and so the monitoring programme will comprise six visits over three months.

To date two visits have been conducted; therefore, only an initial assessment of the local gas regime has been undertaken at this stage and further visits will be required to complete the monitoring program. A separate gas addendum letter report will be issued following the completion of the full monitoring program.

The gas monitoring results to date, are presented in Appendix I, and summarised in Section 3.5.

The gas monitoring has been undertaken using a Gas Data GFM436.

The primary guidance document to determine if protection measures are required is BS8485:2015+A1:2019 *Code of practice for the design of protective measures from methane and carbon dioxide ground gases for new buildings*. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Screening Value (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors such as gas concentrations.

As the recorded flow rate has been consistently zero and methane concentrations have been consistently below the monitor's lower limit of detection a default flow rate of 0.1l/hr and a default methane concentration of 0.1%v/v have been used in the following assessment.

Using the default flow rate of 0.1l/hr and the default methane concentration of 0.1%v/v a Q_{hg} of 0.0001l/hr has been calculated for methane. Using the default flow rate of 0.1l/hr and the maximum carbon dioxide concentration of 1.7%v/v, a Q_{hg} of 0.0017l/hr has been calculated for carbon dioxide. On this basis the GSV for the site is determined as 0.0017l/hr.

Therefore, as the maximum concentration of methane is <1%v/v, the maximum concentration of carbon dioxide is <5%, and the GSV is <0.07l/hr, the site has been assessed as 'Characteristic Situation 1' as outlined in BS8485:2015+A1:2019, for which gas protection measures are not required.

The desk study risk assessment determined that no radon protection measures are required.

6.1 SUMMARY OF RISK FROM GAS

The investigation has not revealed any specific risk to end users from ground gas and gas protection measures are not anticipated to be required.

7 QUANTITATIVE RISK ASSESSMENT - CONTROLLED WATERS

The methodology, rationale and guidance GRM have used to assess the risk to controlled waters is set out in Appendix A (viii).

The desk study identified the primary receptors for this site have been identified as the underlying Secondary A Aquifer (Shirdley Hill Sand Formation) and Principal Aquifer (with associated Source Protection Zone). The primary pathway for the Shirdley Hill Sand Formation is infiltration. It was considered that the Principal Aquifer would be protected, to a degree, from the likely cohesive Glacial Till above.

A significant source of contamination has not been identified at the site, no visual or olfactory evidence of contamination was observed, and additionally, no elevated PID readings were recorded during sample screening.

The Shirdley Hill Sand Formation has been confirmed to generally be very thin (i.e. less than 1m thick) and does not contain a contiguous body of groundwater. The underlying Glacial Till has been confirmed to be predominantly cohesive and extends to a significant depth, thus demonstrating its lack of viability in terms of being a potential receptor and its ability to effectively act as an aquiclude for the underlying Principal Aquifer. The risk to controlled water is therefore considered negligible and soil leachate testing has not been undertaken, and further assessment is not considered necessary.

7.1 SUMMARY OF RISK TO CONTROLLED WATERS

The risk to controlled waters is considered negligible.

8 PHASE II CONCEPTUAL SITE MODEL

HUMAN HEALTH			
Source	Pathway	Receptor	Remedial Solution
Locally elevated lead and benzo(a)pyrene.	Indoor and outdoor inhalation of soil/soil dust, ingestion of, and dermal contact with contaminated soil and soil dust.	End users.	Allow for 300mm soil capping layer in areas of soft landscaping. Further chemical analysis, generation of SSAC and/or confirmation of the true setting may allow this to be not required.
		Construction workers.	
Limited Made Ground.	Inhalation of carbon dioxide/methane.	End users.	No gas protection measures required (to be confirmed following completion of the gas monitoring).
Hydrocarbons in the near surface soils.	Migration of contamination through leaks and joints, degradation of water pipe materials.	End Users.	Barrier water supply pipes and clean backfill required (to be confirmed by water supply company).

CONTROLLED WATERS			
A significant source of contamination has not been identified.	Leaching of contaminants and vertical migration to the groundwater – restricted by cohesive strata.	Principal Aquifer (Wilslow Formation – beneath Glacial Till) and Source Protection Zone.	No remediation required.
	Infiltration, but deposits are very thin and do contain significant groundwater.	Secondary A Aquifer (Shirdley Hill Sand Formation)	

9 REMEDIATION

9.1 RECOMMENDED REMEDIAL MEASURES AND VALIDATION REQUIREMENTS

9.1.1 Protection of End Users

Soil Contamination

Locally elevated lead and benzo(a)pyrene contamination has been identified, when residential without plant uptake assessment thresholds have been applied.

Currently it is recommended that a 300mm clean capping layer is allowed for in soft landscaped areas. However, this requirement should be reviewed once detailed development plans have been appraised, as a less stringent criteria such as commercial/industrial end use would remove the requirement for soil capping. Similarly, if the current assumed site setting is considered appropriate, additional chemical analysis to generate a site specific threshold values for lead and benzo(a)pyrene may also remove the requirement for soil capping.

Any materials imported for use to construct the growing medium will require chemical validation to confirm that they are suitable for use. Samples of these materials will need to be analysed for a suite of contaminants including metals, inorganics, speciated PAHs and other contaminants such as, speciated hydrocarbons and asbestos depending on the source. The number of samples that require analysis will depend on the source of the materials. Typically an analysis rate three samples per source applies for generated and virgin soils respectively. It is also recommended that the topsoil be subjected to analysis to BS3882 to confirm that it conforms to this standard. A typical analysis rate of one sample per 5,000m³ is considered appropriate for this.

Should any material suspected of being significantly contaminated be encountered during the redevelopment of the site, GRM can be contacted to undertake additional investigation if necessary. The local Environmental Health Officer should be contacted and informed of any additional remedial work required.

Ground Gas

Gas protection measures are not required for the proposed development.

9.1.2 Protection of Site Workers

The risk to site workers from the identified soil contamination is negligible. No remedial measures are required. However the use of suitable PPE and adoption of appropriate working protocols should be enforced during the ground works stage of construction.

9.1.3 Protection of Controlled Waters

The risk to controlled waters is negligible and no remedial measures are required.

9.1.4 Protection of Water Pipes

It is considered that, based on the UKWIR guidance, the concentrations of contaminants recorded to date (specifically the hydrocarbons) are such that Baarrier water supply pipes will be required for the site. However, it is recommended that the local water supply company for the site be contacted to confirm their requirements with regard to pipe materials.

9.2 REMEDIAL STRATEGY

A Remedial Strategy is currently required, but could be negated following additional assessment.

Following your review of this document, we would recommend that a copy of it be forwarded to the Local Authority for comment and approval, prior to commencing development of the site. The Local Authority may choose to include other consultees as part of the planning process (such as the Environment Agency).

Consultation should be undertaken at the earliest possible opportunity to avoid abortive or delayed works.

9.3 DISPOSAL AND CLASSIFICATION

The Relaid topsoil will be classified as Non-Hazardous Waste and, due to its organic content, may not be suitable for disposal at an Inert landfill.

Based on the Waste Classification Report (Appendix N) it is considered that the made ground will be classed as Non-Hazardous Waste. Early consultation with the relevant landfill sites over their particular acceptance criteria may produce cost savings. Reference should be made to the relevant notes presented in Appendix A (x).

The natural strata underlying the site should be suitable for disposal at an Inert landfill site, although further testing (including WAC analysis) may be required to confirm this. Natural soils may be suitable for re-use on-site and consideration should be given to retaining this material on-site. Alternatively, it may be sold as a commodity to off-set construction costs.

Care should be taken to keep natural arisings separate from the made ground and free from construction materials, as natural soils mixed with made ground and construction materials may attract additional disposal costs.

Although not identified during the site works, visible asbestos containing materials (ACMs) within soils will result in the soils being classified as Hazardous Waste. Visible ACMs should be removed, employing appropriate health and safety protocols and where possible should be undertaken prior to disposal.

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It is recommended that any materials to be exported are stockpiled and tested to confirm disposal rates, as this may be more cost effective than using the results contained within this report.

Where site-won materials (i.e. made ground or contaminated natural soils) are to be re-used on site, or materials are to be imported, it is recommended that this should be carried out under a Materials Management Plan produced in accordance with the CL:AIRE Definition of Waste Code of Practice. This document should be approved by a CL:AIRE-registered Qualified Person prior to excavation of materials, and be maintained throughout the duration of the project. A Verification Report should be produced on completion of the project in order to confirm the control and recording of material movements around or between sites in accordance with current waste management legislation and guidance.

10 GEOTECHNICAL ASSESSMENT

10.1 INTRODUCTION

The Client proposes to develop the site with new hospital buildings and an electrical substation of up to 3 storeys in height, with associated soft landscaping and infrastructure.

The site requires provision of a UXO briefing for construction works by way of a tool box talk.

In addition to the site specific comments below reference should be made to the general comments relating to the Geotechnical Assessment listed in Appendix A (xi to xvi).

10.2 GEOTECHNICAL TESTING

Geotechnical testing has been carried out both on site and in the laboratory; the results of this testing are provided on the logs in Appendix F, and in Appendix K. These results are summarised in the tables below:

Made Ground

Insitu Testing:

Test Parameter	Range of Results
Equivalent CBR from DCP	Generally above 10%

Glacial Till

Insitu Testing:

Test Parameter	Range of Results
SPT 'N' values	3 to 50, typically 15 to 20 and generally increasing with depth
Hand Shear Vanes	Typically 100 to 146kPa, but locally as low as 65kPa.
Equivalent CBR from DCP	Generally above 4%

Laboratory Testing:

Test Parameter	Range of Results
Plasticity Index	12 to 24%

10.3 ENGINEERING GROUND TREATMENT

The near surface soils were generally firm under foot during the intrusive investigation. It is therefore considered unlikely that pre-treatment of the surface soils will be required for any small plant/personnel movements.

If a piled foundation solution is adopted then a suitable working platform (piling mat) will be required (see Section 10.7 below). It is recommended that the design of the working platform is carried out as soon as possible. The working platform certificate requires signing by the Principal Contractor for the site. An allowance for this, and responsibility for the design of the platform (estimated at 450mm thick if constructed without reinforcement), should be made in tender packages and site programmes.

10.4 EXCAVATION CONDITIONS

Excavation of the materials encountered during the ground investigation should be easily achieved using conventional hydraulic excavation techniques. A breaker or similar plant may be required where hard standing or existing foundations are encountered.

From the ground investigation undertaken, it is likely that excavations will be generally stable in the short term. Some materials such as granular soils and made ground are liable to collapse without warning. This situation is likely to be exacerbated by water ingress. Therefore, instability may be experienced in the medium to long term.

It is considered unlikely that dewatering will be required for shallow short-term excavations. The observed groundwater conditions suggest that only simple dewatering techniques (e.g. sump pumping) will be needed to control water ingress. Care should be taken to ensure that dewatering does not lead to settlement of soils below existing structures or services on or off-site.

10.5 EXISTING STRUCTURES / SUBSTRUCTURES

There are no existing structures on the site. However, there may be old foundations or other buried structures from the previous site use (e.g. associated with demolished buildings), that have not been identified from this investigation.

There are numerous buried services across the site, with unrecorded services also encountered during the investigation undertaken.

10.6 FOUNDATIONS

At this stage, detailed development plans are not available, and the structural loadings of the new structures are not known. The following should be reviewed, once detailed development plans become available.

The Relaid Topsoil, untreated made ground and Shirdley Hill Sand are considered unsuitable as a bearing stratum and all new foundations should be carried down through them to found on the more competent and consistent, natural cohesive strata.

For design purposes, the site is underlain by medium volume change potential cohesive strata, but due to the thickness of the unsuitable strata a minimum foundation depth of 1.0m begl should be assumed.

There are trees along and within the site boundaries and any new foundations within the zone of influence of these trees will need to be deepened in line with recognised guidance such as NHBC Standards Chapter 4.2. Based on the trees tentatively identified on site and the footprint of the proposed development, it is considered that all the proposed structures will be affected by tree influence to some degree. The resultant foundation depths can only be determined by a tree survey and tree influence drawing. The Foundation Zone Plan presented in Appendix O, provide an estimation of the lateral and vertical extent of tree influence, based on the assumptions made. This should not be used for design purposes, as a tree survey is required.

New foundations that are within the footprint of former structures may require deepening, and the extent of which can only be determined on site.

The ultimate foundation solutions will depend on the nature of each of the proposed structures and their loads, but the various options for consideration are provided below.

TRENCH FILL

Based on the above, it is considered likely that trench fill foundations, founded on the natural cohesive strata could be suitable for lightly loaded and/or smaller storey traditionally built structures. Foundation depths of between 0.9m begl and 2.0m begl may be expected.

The natural cohesive soils encountered, at anticipated foundation depths, were generally at least medium strength. It is anticipated that a nett allowable bearing pressure of at least 110kN/m² should be available for conventional strip or trench fill footings. This will allow line loads up to 50kN/m to be taken on footings 450mm wide and 66kN/m on footings 600mm wide. This should result in total settlements of not more than 20mm, keeping differential settlements within acceptable limits.

Heave precautions will be required where the foundations lie within the heave zone of trees as defined in a recognised standard such as NHBC Standards Chapter 4.2. Foundations should be remote from the direct action of tree roots, and should not be constructed so close to trees as to significantly damage their root systems.

Wider footings may be required for higher point/line loads such as at party walls etc. Should wider footings be required for higher point/line loads, GRM should be contacted for further advice.

PILES

Should the loadings are some of the proposed buildings be considered too high for traditional foundations, piled foundations are likely to be the primary suitable alternative.

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A piling specialist will need to be approached to provide pile dimensions and safe pile capacities. Consideration should be given to nearby structures and infrastructure and achieving sufficient penetration to resist heave, when choosing the appropriate pile type. Given the lack of shallow rock and relatively low SPT values recorded within the Glacial Till strata, it is recommended that, if a piled foundation solution is used, that CFA piles no longer than 15m are considered. If piles deeper than 15m are designed, then additional deeper investigation boreholes will be required, to depths greater than 5m beyond the deepest pile length.

Whilst piled foundations would end bear beneath the influence of trees, the piles and ring beams should be designed to resist potential heave, down-drag and negative skin friction.

A testing regime and objectives of the works will need agreeing with regulatory and warranting bodies prior to works. The pile design will need to be justified to the warranting bodies and the justification should be included within the piling contract.

Consideration should be given to potential obstructions beneath former buildings and other substructures. Liaison with the demolition contractor should be undertaken, and if the substructures have not been grubbed out, an allowance should be made for either removing them, or pre-boring the piles within the footprint of the former buildings.

PADS

Should some of the proposed buildings be steel frame in nature, then pads could be considered. It is considered that the Glacial Till should have a nett allowable bearing pressure of at least 110kN/m². It is therefore considered that 1m by 1m square pads should be suitable to support a maximum column load of 110kN.

The Glacial Till will also be suitable to support a maximum line load of 66N based on 600mm wide strip foundations (for connecting walls).

The effect of trees will also need to be considered during pad foundation design.

If the loads and/or depths due to other geotechnical hazards are considered to not lend themselves to the use of pad foundations bearing directly onto the Glacial Till, then consideration will need to be given to the use of piles (supporting the pads or otherwise).

10.7 FLOOR SLABS

For developments such as this, it is likely to be more cost effective to excavate and re-compact the footprint of the proposed new structures including a suitable curtilage, and use ground bearing floor slabs. This option assumes no requirement for gas protection measures and that the depth of excavation and backfill material will take account of tree influence.

The proposed electrical substation will likely have a bespoke design combining the foundations and floor slab, and the proposed footprint on the current development plan, will be affected by tree influence. The effects of tree influence should be considered in the foundation design.

Old substructures should be removed to at least 0.5m below any new floor slabs to prevent the formation of 'hard spots'.

If a working platform is used as part of the foundation solution, it should be engineered to a suitable standard and subject to proposed levels and tree influence may be, to enable it to form a base for a ground bearing floor slab.

10.8 BURIED CONCRETE

Based on the recorded water soluble sulphate and pH levels in the soils below the site and assuming static groundwater conditions, in accordance with requirements of BRE Special Digest 1 (2005), 'Concrete in Aggressive Ground', the Design Sulphate Class for buried concrete at the site should be assumed as DS-1 and the ACEC Class as AC-1s.

For unreinforced trench fill foundations with a width of greater than 450mm, the classifications above equate to a concrete designated as GEN1 in BS8500 and RC35 for reinforced foundations.

The results of the water soluble sulphate and pH testing are presented in Appendix K.

10.9 SLOPE STABILITY AND RETAINING STRUCTURES

The site is topographically flat, and the area surrounding the site is also flat. Therefore, there is no significant risk of slope instability occurring on the site at present gradients.

10.10 SEDIMENT MANAGEMENT

Given the sloping site topography, mitigation measures should be implemented to prevent the run off of sediment and potential pollution into any surface water, during the construction and earthworks process. Reference should be made to CIRIA C532 'Control of Water Pollution from Construction Sites'.

10.11 SOAKAWAY DRAINAGE

Soakaway tests were attempted, in line with the methodology in BRE365, in the Glacial Till strata present across the site, in 3no. locations; SA01, SA02 and SA03 (replaced with TP02 due to shallow groundwater encountered in SA03). A plan showing the approximate locations of the tests is presented in Appendix E.

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The tests were abandoned on the 1st test, due to insufficient infiltration achieved within the first 24 hour period, with all tests recording minimal infiltration beyond the initial fill level.

The results show that the Glacial Till is not suitable for the disposal of surface water using a soakaway drainage system. These deposits are encountered across the whole site and will be present from the near surface.

Although not present in the test locations, the Shirdley Hill Sand strata is considered to be too sporadic and thin, to support a soakaway drainage system.

An alternative drainage system should be considered for the disposal of surface water. It may be possible to renew the drainage network for the previous site development.

10.12 NEW ACCESS ROADS

Site observations suggest that natural cohesive materials will have CBR values of between 2% and 4%, when suitably drained. The shallow made ground and Shirdley Hill Sand will provide CBR values of <3%. Proof rolling and the improvement of soft spots may result in increased CBR values and the incorporation of a geotextile grid into sub-base layers may allow for reduced capping thickness. Lower CBR values should be expected following inclement weather.

Dynamic Cone Penetrometer (DCP) testing was carried out across the site at five locations. A plan showing the test locations, together with the probe logs is provided in Appendix E.

Site observations should be confirmed by in situ or laboratory testing in accordance with the adopting Local Authority's preference.

11 ONGOING WORKS

Gas and groundwater monitoring visits are currently ongoing.

12 FURTHER INVESTIGATION

Further investigation, to determine more accurately the effect of some of the identified hazards on the development, is recommended. This includes the following:

Works That GRM Can Complete

- Should the development proceed it is recommended that further testing is conducted for waste disposal characterisation.
- More chemical is recommended, to generate site specific threshold values for lead and benzo(a)pyrene (assuming that current assumed site setting is considered appropriate).
- Review of the more detailed development plans when available.

Works That A Specialist Will Need To Complete

- Tree survey.

A copy of this report should be submitted to the Planning Department of the Local Authority/Local Authority EHO for review, if planning conditions exist for this site.

13 CONCLUSIONS

Assuming compliance with all the recommendations contained within this report (for abridged version see 'Summary of Recommendations' table at the beginning of the report) the site is suitable for the proposed development.

Based on the evidence currently available the site is assessed as being of low risk for geotechnical hazards and low risk for contamination hazards.



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GENERAL APPRAISAL COMMENTS

i INFORMATION SOURCES

Where available the following sources have been used for the identification and assessment of potential ground hazards:

- Relevant British Standards
- British Geological Survey (BGS) Geology Map Scale 1:10,000 for local area
- British Geological Survey (BGS) Geology Map Scale 1:50,000/1:63,320
- BGS Memoir
- BGS Borehole Records: <https://mapapps2.bgs.ac.uk/geoindex/home.html>
- BGS online viewer: <https://geologyviewer.bgs.ac.uk>
- Magic Groundwater Vulnerability Maps
- Historical Ordnance Survey (OS) Maps
- Environmental Data Report
- Environment Agency Website: <http://www.environment-agency.gov.uk/>
- Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR, 2010.
- Coal Authority Records / Coal Mining Report
- DEFRA/Environment Agency Contaminated Land publications and DoE Industry Profiles
- BRE Guide BR211 (2023), 'Radon: Guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects)'
- UK HSA Radon Maps: <https://www.ukradon.org/information/ukmaps>
- CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'
- BS8485:2015 +A1: 2019, 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'
- Other technical references used throughout this document are detailed in the text.

ii CONTAMINANTS OF CONCERN

The DoE Industry Profiles are normally used to assess likely contaminants from past land use and potential nearby industrial sources. For land uses where no profile is available, likely contaminants of concern are selected by GRM based on past experience of similar sites, a general screening suite of contaminants covered by CLEA and common contaminants from the Industry Profiles.

- | | | |
|------------|-------------------|--|
| · Arsenic | · Copper | · Water soluble sulphate |
| · Cadmium | · Nickel | · PAH (polycyclic aromatic hydrocarbons) |
| · Chromium | · Zinc | |
| · Lead | · Phenols | |
| · Mercury | · cyanide (total) | |
| · Selenium | · pH | |

Asbestos and PCBs are listed in the vast majority of profiles. PCBs are listed as the profiles expect electricity substations and switch boxes on all industrial sites. There is the potential for asbestos containing material to be mixed up with made ground, following any demolition works.

iii CONCEPTUAL MODEL METHODOLOGY

The consideration of contamination is based upon the principles of risk assessment, using the 'source-pathway-receptor' model in order to establish the presence, or potential presence, of a pollutant linkage.

To create a risk, contamination must have the potential to cause harm to susceptible targets or receptors such as humans, the water environment or the built environment. The potential for harm to occur requires three conditions to be satisfied to form a pollutant linkage:

- The presence of substances that may cause harm (SOURCE).
- The presence of a target which may be harmed (RECEPTOR).
- The existence of a plausible migration route between the source and the receptor (PATHWAY).

In the absence of a plausible pollutant linkage there is no risk. Where a potential linkage is identified in order for it not to pose a risk to the identified receptor it must be broken.

iv INTRUSIVE INVESTIGATION SAMPLING METHODOLOGY

The ground investigation (including fieldwork, sampling, monitoring and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection and the proposed development layout (where available). All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

The exploratory holes have been positioned and advanced to depths to determine the general ground/groundwater/gas conditions below the site. A general grid pattern has been adopted, where possible, to provide sufficient information based on the current proposed layout scheme. Some holes have been targeted at particular hazards identified in the Phase I assessment. The resultant exploratory hole density is considered to be commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

v GROUND GAS RISK ASSESSMENT METHODOLOGY

Gas monitoring programmes undertaken by GRM are designed to broadly comply with the recommendations outlined in CIRIA Report C665 'Assessing risks posed by hazardous ground gas to buildings' (2007) and BS8576 'Guidance on Investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs) (2013).

To assess the risks posed by ground gases such as radon, carbon dioxide and methane, the relevant current guidance has been used. For radon the site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings (including supplementary advice for extensions, conversions and refurbishment projects) (BR211: 2023)'. For methane and carbon dioxide the primary guidance document used to determine if protection measures are required is *BS8485:2015 Code of practice for the design of protective measures from methane and carbon dioxide ground gases for new buildings*. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Flow Rate (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors such as gas concentrations.

Where flow is not recorded during the monitoring a default flow rate of 0.1l/hr will be used in the assessment to produce a positive result.

vi HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

Guidance contained in the Environment Agency's CLEA Reports has been used to assess the risks posed to human health.

For residential developments that include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land with plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered including the consumption of home-grown vegetables.

For residential developments that do not include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land without plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered except the consumption of home-grown vegetables. For commercial/industrial developments the default Tier 1 Assessment Criteria (TAC) for 'commercial/industrial' are used, i.e. a female with a start age class of sixteen and an end age class of eighteen. All pathways are considered except the consumption of home-grown vegetables.

The TAC used by GRM include Category 4 Screening Levels (C4SLs) published by DEFRA, values calculated by GRM using the CLEA v1.071 risk assessment, and values and Suitable for Use Levels (S4UL) developed by LQM/CIEH. The TAC used in the assessment are selected based on the lowest site specific SOM values returned as part of the chemical analysis.

Where soil chemical analysis results are found to exceed the TAC, Site-Specific Risk Assessments may be undertaken using the CLEA v1.071 risk assessment software using the age classes and pathways described above.

vii RISK TO SITE WORKERS – GENERAL COMMENTS

The risks to site workers are similar to those posed to site end users, although likely to be less severe due to the site workers' shorter exposure to the identified contamination. However, site workers (particularly groundworkers) are more likely to come into direct contact with contaminated soils due to the nature of their work. On this basis ground and construction workers should be provided with basic Personal Protective Equipment based on the site's general health and safety risk assessment, but including as a minimum safety footwear, gloves and overalls.

A site specific risk assessment should be carried out for all hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should identify any measures required to further reduce risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

Demolition and dismantling of existing structures on the site must be carried out to a safe and acceptable standard, in accordance with current UK guidance and best practice. Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any demolition.

Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

viii CONTROLLED WATERS RISK ASSESSMENT METHODOLOGY

Where the desk study and fieldwork do not reveal a potential source of contamination no leachate or groundwater testing will be performed. Where a potential source is identified the testing will comprise leachate testing on the material considered most likely to pose a risk, groundwater testing will be undertaken if water is present at shallow depth.

The UK Drinking Water Standards (UKDWS) or Environmental Quality Standards (EQS) are usually adopted for comparison with the leachate/groundwater test results. When the most sensitive receptor is considered to be the aquifer (groundwater) UKDWS will be adopted as the Initial Tier 1 screening values.

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Where the most sensitive receptor is a surface water feature the EQS values will be used as Initial Tier I Screening values.

ix CONSTRUCTION MATERIALS RISK ASSESSMENT METHODOLOGY

The 'screening levels' adopted for the assessment of risk to construction materials are taken from the following documents:

- UK Water Industry Research (UKWIR) Contamination thresholds for sub-surface water pipes, for the protection of buried pipes.
- Building Research Establishment (BRE) Special Digest SD1 (2005), 'Concrete in Aggressive Ground', for the protection of buried concrete.

x WASTE DISPOSAL, SITE WASTE MANAGEMENT PLANS AND MATERIAL MANAGEMENT PLANS

Under current Waste Management Regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The chemical analysis results included in this report should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous, then the site will need to be registered with the Environment Agency prior to the movement of the waste. Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

All materials removed from the site will be classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated. All waste removed to landfill will attract Landfill Tax.

The developer/builder is likely to be classed as the waste producer and therefore, has a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. GRM can assist in the production of Material Management Plans under the CL:AIRE Definition of Waste: Code of Practice. The DoWCoP enables:

- The direct transfer and re-use of clean naturally occurring soil materials between sites, and
- The re-use of both contaminated and uncontaminated materials on their site of origin and between sites within defined Cluster projects.

GRM can also undertake the role of Qualified Person and submit the DoW CoP project Declaration.

Likewise making the site as volume neutral as possible will reduce the costs of development. Whilst not a statutory requirement, Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

xi GEOTECHNICAL ASSESSMENT GENERAL COMMENTS

Where finished floor levels of proposed structures have not been provided by the Client, then for the purposes of initial assessment, GRM will assume that finished levels will not vary appreciably from the existing ground levels. If the depths of any underground engineering works (i.e. sewers, pumping stations etc.) are unknown they will not be taken in to account in the assessment and it will be assumed that any such works will not compromise foundation or ground stability.

Should the development proposals or finished levels be different from these assumptions then the comments/recommendations in the Geotechnical Assessment may require revising.

It should be noted that the results of window sampling and/or cable percussive boreholes may not give a true indication of a soils actual engineering properties (i.e. stability, mass structure etc). GRM consider that that prior to development trial pitting should be undertaken to confirm the recommendations in the Geotechnical Assessment.

xii GEOTECHNICAL ASSESSMENT – ENGINEERING GROUND TREATMENT

Near surface soils have the potential to be disturbed by weathering and site traffic. Precautions should always be taken to avoid this, as excessive disturbance may leads to more onerous floor slab designs, road cap thickness and increased amounts of off-site disposal etc.

Near surface soils may need treatment or reinforcing to allow safe movement of construction plant and labour. An assessment by the contractor should be undertaken once the type of machinery/plant needed to complete the development is known.

xiii GEOTECHNICAL ASSESSMENT – EXCAVATIONS

Excavation instability (over-break) can result in damage to existing services or structures (e.g. foundations, roads or boundary walls/fences) both on and off-site, as well as increased foundation concrete costs. In order to minimise this, all excavations deeper than 1.2m deep (or any excavation within 1.5m of any existing structure or service) should be supported. Full support should be provided to the full depth of all near vertically sided excavations in made ground, soft and very soft clays and granular soils. A reduction to intermediate support should be acceptable within firm and stiffer natural clays.

Wherever possible, man entry into excavations should be prevented; however, where this is not possible, entry to, and time spent in, excavations should be kept to a minimum.

The build program should be tailored to reflect the impact that deep excavations through potentially unstable strata can have on adjacent properties, so that they are not undermined.

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times. Reference should be made to HSE construction information sheet No. 8 (Revision 1) 'Safety in Excavations'.

Care should be taken to ensure that falls from excavation faces do not adversely affect the integrity of foundation concrete.

If contaminated water enters excavations it should be removed and transported to an appropriate treatment facility by a suitably licensed carrier before construction begins.

xiv GEOTECHNICAL ASSESSMENT – SUBSTRUCTURES

Where practicable, existing buried construction should be fully removed; however, if this is not practicable all new foundations should be carried down to fully penetrate it and it should be broken well away from all new structures.

There may be existing structures and/or infrastructure in close proximity to the proposed development. New build foundations may be constructed next to pavements with existing underground services beneath them, or excavations may be required near existing footings associated with adjacent properties. These potential hazards need to be taken into consideration when designing foundations and the groundworker needs to be made aware of their potential impact during the redevelopment works. Foundations close to existing underground services or buildings may require alternative foundation techniques (such as piling) to protect the integrity of these structures.

The contractor for the works should carry them out in such a fashion so as to not cause excessive overbreak, concrete usage or undermine existing buildings/roads/ services that are to be retained.

xv **GEOTECHNICAL ASSESSMENT – SOAKAWAYS**

Soakaway testing in trial pits by GRM is broadly carried out in accordance with BRE DG 365 (2016). The testing comprises the excavation of a test pit to a suitable depth, and the placement of water into the pit. The level of water present is then monitored over time. For borehole installations, the permeability testing (falling head/rising head) is undertaken in accordance with BS5930.

If it is decided to proceed with the use of soakaway drainage, then the following general points should be noted:

- Soakaways should not be placed so that water can be discharged through potentially contaminated made ground.
- The Environment Agency may require soakaways to be sealed systems such that only roof run off falls to soakaway.
- Interceptors are likely to be required for soakaways for highway drainage. The adopting authority for the highways should be consulted at the earliest opportunity regarding the use of soakaways for highways drainage.
- Consideration of site levels and slopes should be taken into account during the design.
- The construction of all soakaways should be in accordance with the current building regulations.
- Soakaways should not be placed within 5m of a proposed building.
- Placement of soakaways needs to be considered so as to avoid ponding of water down slope.
- The base of a soakaway should not be below the highest recorded water level.
- The Environment Agency prefer 1m of dry soil to be present between the base of a soakaway and the water table to provide attenuation for contamination.

xvi **GEOTECHNICAL ASSESSMENT – FOUNDATIONS**

If soft or hard spots are encountered during foundation excavation then they should be replaced with suitably compacted material or the footings deepened to suitable strata, to avoid differential settlement.

If strata of differing bearing character (e.g. sand and clay) are encountered at foundation levels within the excavations for a single plot then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (e.g. piles or vibro-replacement).

NOTES ON LIMITATIONS

General

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

GRM Development Solutions Limited accepts no responsibility or liability for:

- a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and
- b) the consequences of this document being used by any third party with whom an agreement has not been executed.

Phase I Environmental Audits/ Desk Studies

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and as considered necessary and appropriate to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits (Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as provisional only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. Whilst exploratory testing is intended to gain an accurate representation of the site, the very nature of sampling and testing is such that it cannot ensure that all localised conditions are detected.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects. The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.



The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.



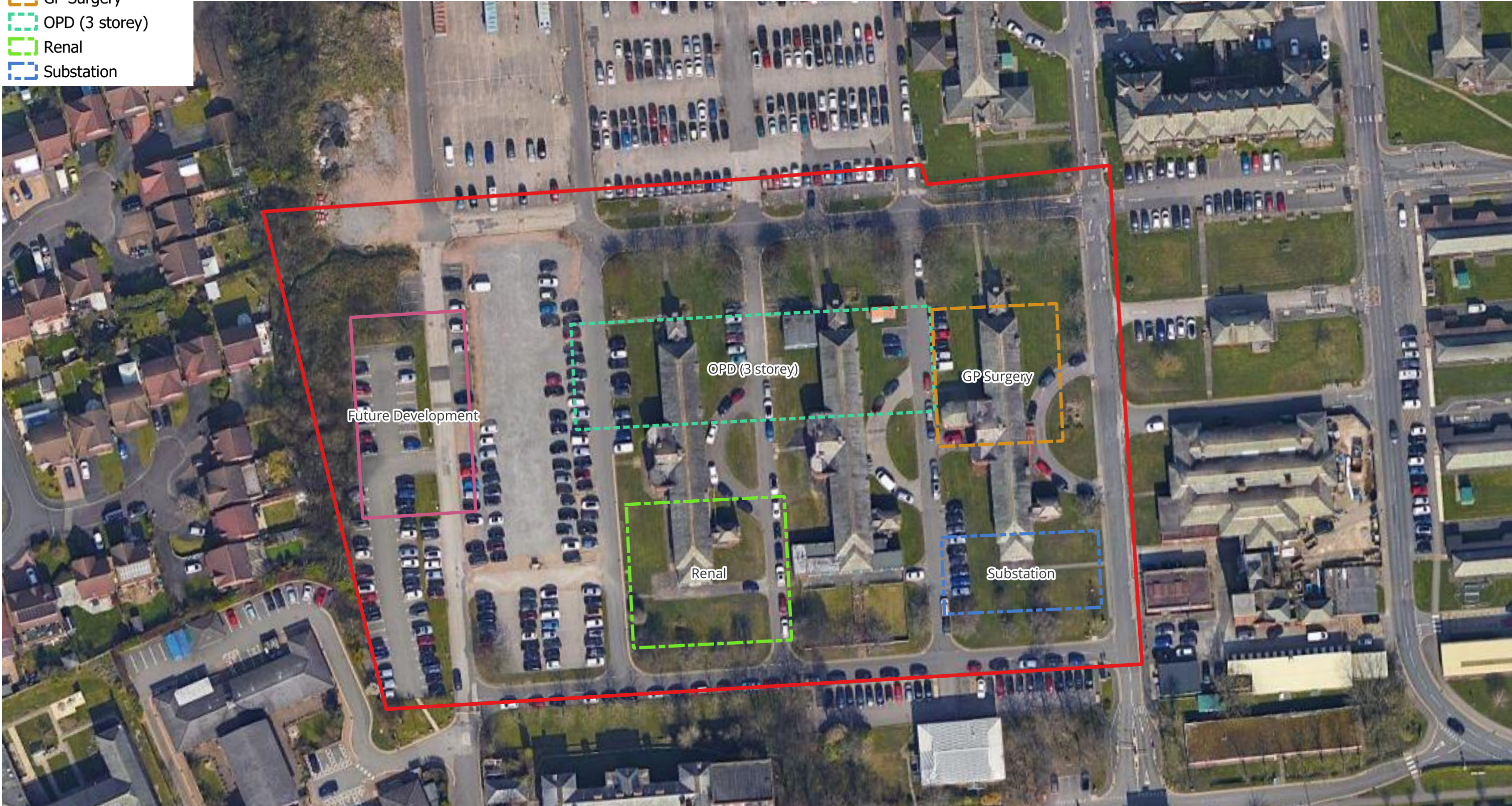
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- Site Boundary -
- Building Footprints
- Future Development
- GP Surgery
- OPD (3 storey)
- Renal
- Substation



NOTES:

CLIENT: AJP / VINCI CONSTRUCTION

PROJECT: AINTREE HOSPITAL

TITLE: Proposed Development Footprint Drawing

PROJECT No: P10738

DATE: JAN 2025

DESIGN/DRAWN: RJH

DRAWING NUMBER: 002

ISSUE: FINAL

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NOTES:

Notes

 Site Boundary

CLIENT:

AJP / VINCI CONSTRUCTION

PROJECT:

AINTREE HOSPITAL

TITLE:

SITE BOUNDARY PLAN

PROJECT No:

P10738

DATE:

JAN 2025

DESIGN/DRAWN:

RJH

DRAWING NUMBER:

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ISSUE:

FINAL

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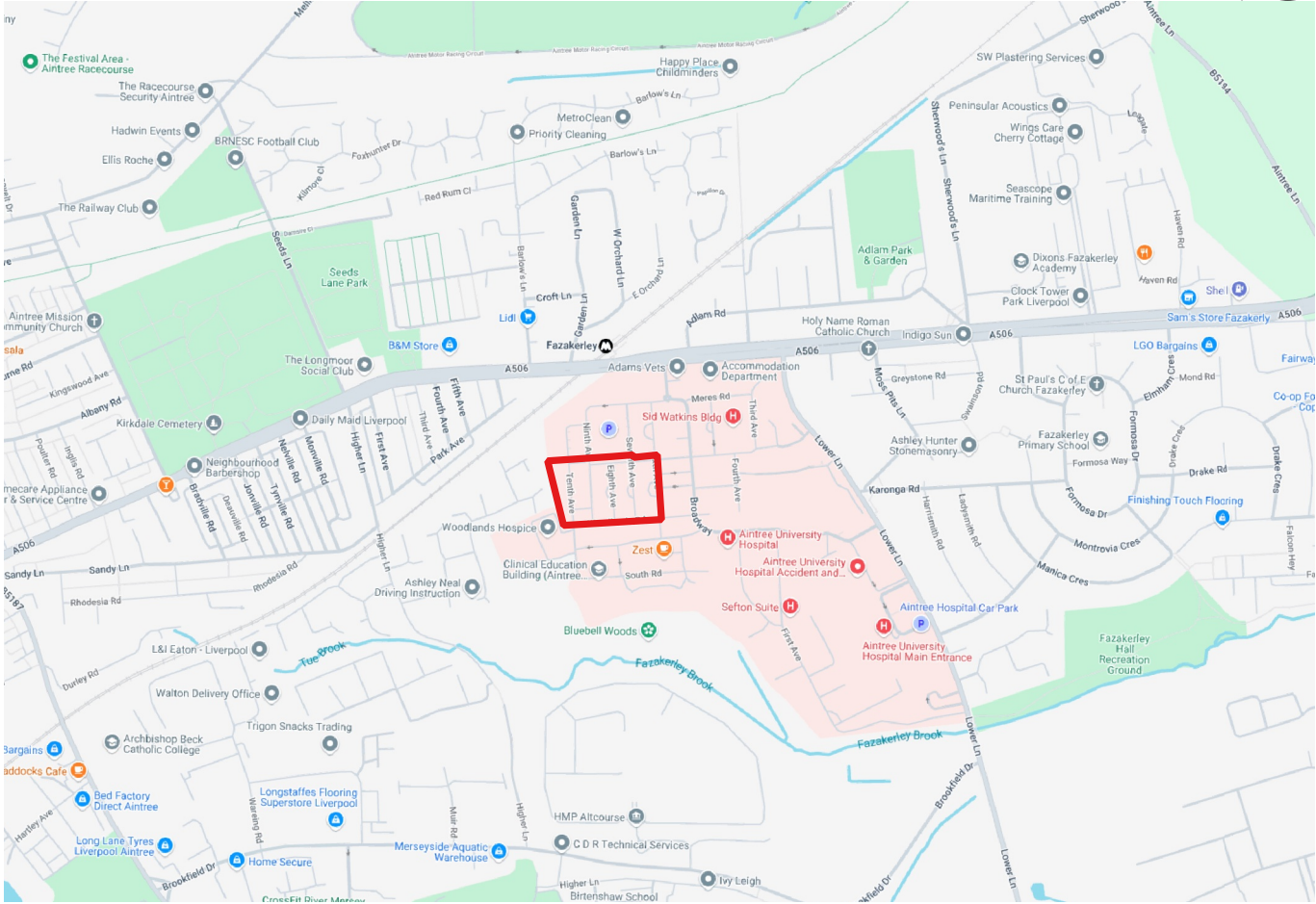
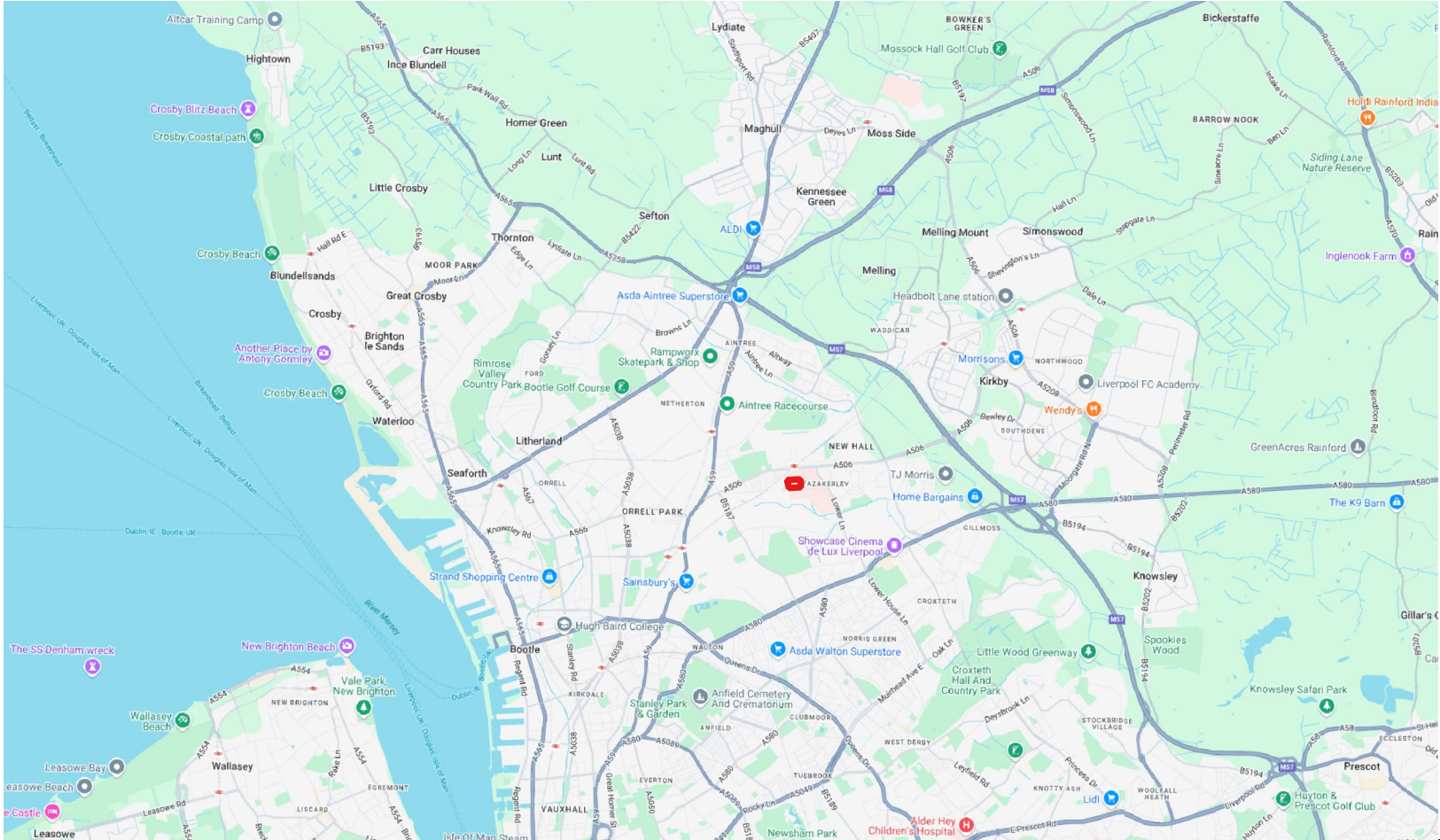


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KEY

Site Boundary



NOTES:

CLIENT:

A J P / VINCI CONSTRUCTION

PROJECT:

AINTREE HOSPITAL

TITLE:

Site Location Plan

PROJECT No:

P10738

DATE:

JAN 2025

DESIGN/DRAWN:

AW

DRAWING NUMBER:

001

ISSUE:

FINAL

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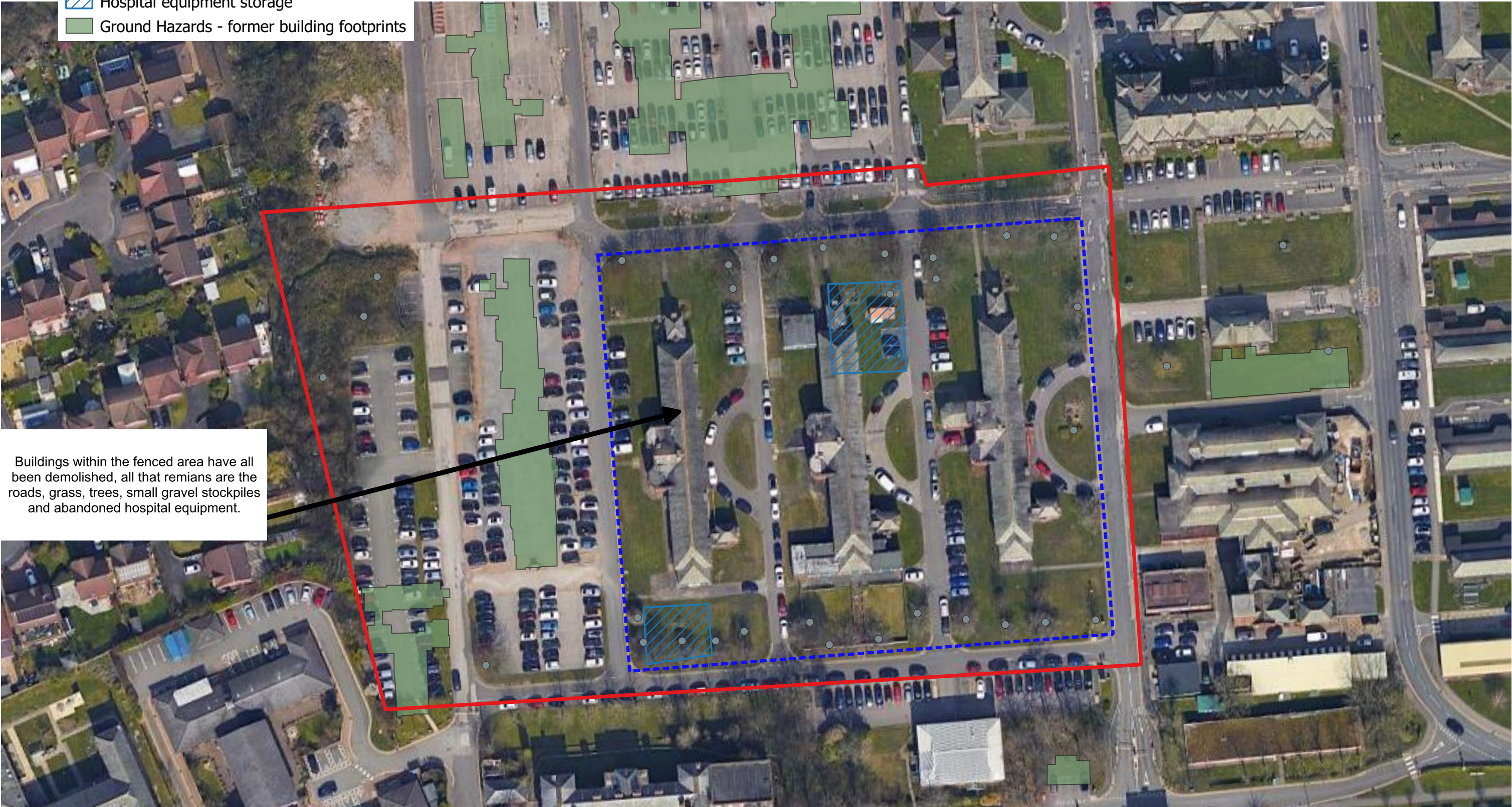
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KEY

- Site Boundary
- Trees
- Hoarding Line
- Hospital equipment storage
- Ground Hazards - former building footprints



NOTES:

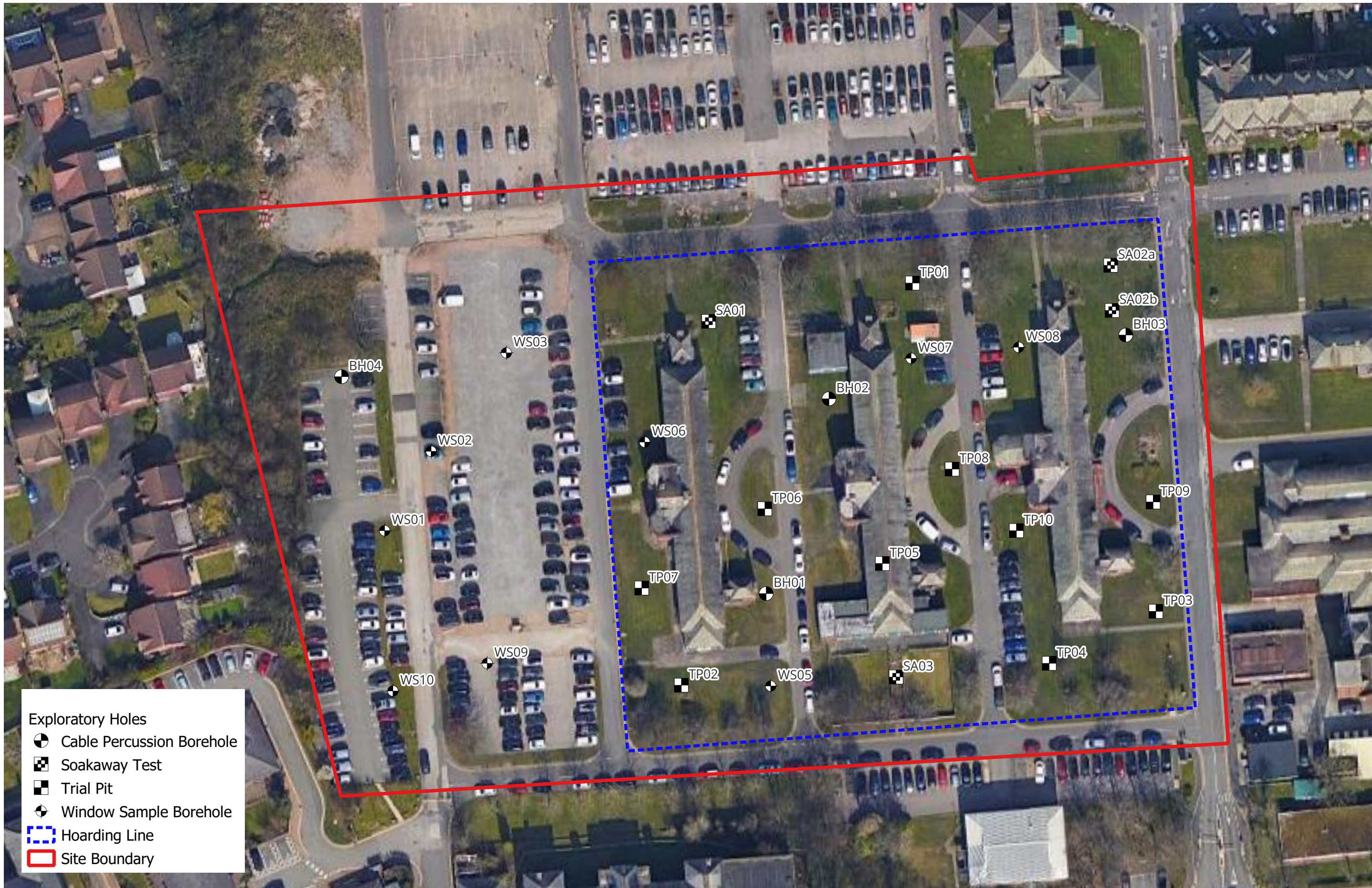
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PROJECT:	AINTREE HOSPITAL	DRAWING NUMBER: 4	ISSUE: FINAL		
TITLE:	Site Hazard Plan	© GRM Development Solutions Ltd © Crown Copyright. AL 100014100			



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Exploratory Holes

-  Cable Percussion Borehole
-  Soakaway Test
-  Trial Pit
-  Window Sample Borehole
-  Hoarding Line
-  Site Boundary

NOTES:

Notes

CLIENT:

AJP / VINCI CONSTRUCTION

PROJECT:

AINTREE HOSPITAL

TITLE:

EXPLORATORY HOLE LOCATION PLAN

PROJECT No:

p10738

DATE:

JAN 2025

DESIGN/DRAWN:

RJH

DRAWING NUMBER:

004

ISSUE:

FINAL

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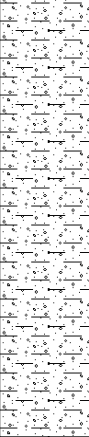
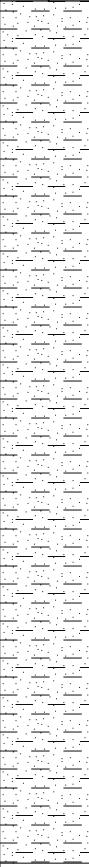
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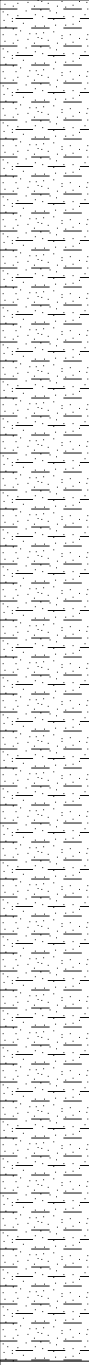


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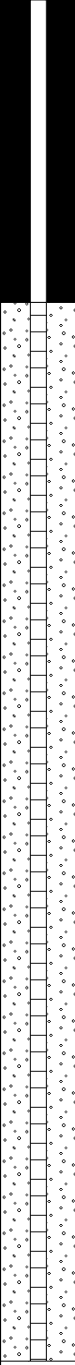
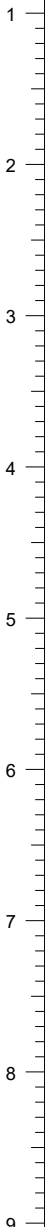
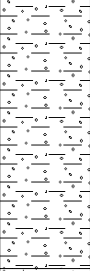
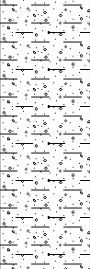
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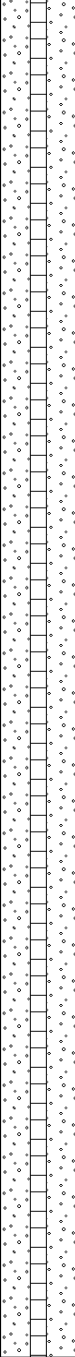
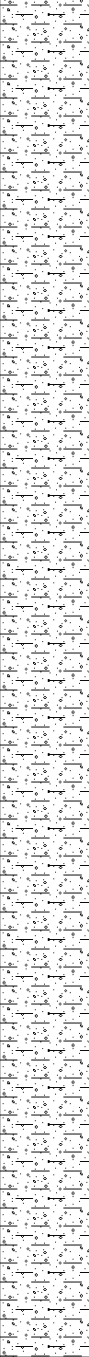
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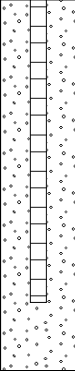
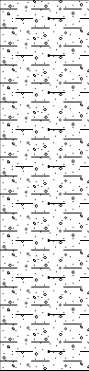
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH01 Sheet 1 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337908 E 397041 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		1.00 - 1.45 1.00	SPTLS S	3 (,1/,1,1,1)	0.40			DAMP. Brown, slightly sandy, clayey GRAVEL with rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to angular of brick, ceramics, mudstone and chert. RELAIID TOPSOIL	1
		2.00 - 2.45 2.00	SPTLS S	N=7 (1,1/1,1,2,3)					
		3.00 - 3.45 3.00	SPTLS S	N=4 (1,1/1,1,1,1)	3.30			DAMP. Very soft, brown mottled grey slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL	2
		4.00 - 4.45 4.00	SPTLS S	N=6 (1,1/2,1,2,1)					
		5.00 - 5.45 5.00	SPTLS S	N=5 (1,1/1,1,2,1)					
		6.50 - 6.95 6.50	SPTLS S	N=12 (1,2/2,3,3,4)					
		8.00 - 8.45 8.00	SPTLS S	N=14 (2,2/3,3,4,4)					
							Firm to stiff, medium to high strength, brown mottled grey, slightly sandy CLAY with occasional gravel. and silty partings. Gravel is fine to coarse, rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL	4	
									5
									6
									7
									8
									9
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top	Duration	Remarks			
Groundwater Remarks: Waterstrikes at 0.90, 1.80m, 12.30 and 16.70m depths.									
General Remarks: Hand dug service clearance pit from GL to 1.20m				Casing Diameter by Depth					
				Depth Base	Diameter	Remarks			
				19.50	150				
Hole Started: 09/12/2024		Hole Complete: 11/12/2024		Version: FINAL		Scale: 1:50			

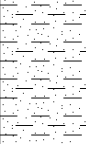
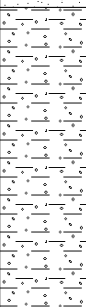
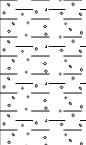
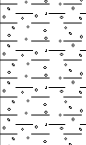
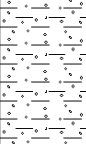
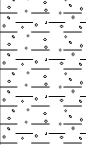
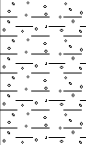
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH01 Sheet 2 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337908 E 397041 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		9.50 - 9.95 9.50	SPTLS S	N=21 (2,2/3,4,7,7)				Firm to stiff, medium to high strength, brown mottled grey, slightly sandy CLAY with occasional gravel. and silty partings. Gravel is fine to coarse, rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL	
		11.00 - 11.45 11.00	SPTLS S	N=20 (2,3/3,4,6,7)					
		12.50 - 12.95 12.50	SPTLS S	N=23 (2,3/4,5,6,8)					
		14.00 - 14.45 14.00	SPTLS S	N=28 (3,5/5,6,7,10)					
		15.50 - 15.95 15.50	SPTLS S	N=26 (2,3/5,5,7,9)					
		17.00 - 17.45 17.00	SPTLS S	N=33 (3,5/7,7,9,10)					
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Groundwater Remarks: Waterstrikes at 0.90, 1.80m, 12.30 and 16.70m depths.		General Remarks: Hand dug service clearance pit from GL to 1.20m		Hole Started: 09/12/2024	
Hole Complete: 11/12/2024				Version: FINAL		Scale: 1:50			

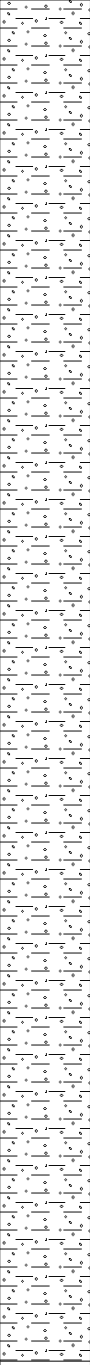
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole				Borehole No. BH01 Sheet 3 of 3	
Site Name: Sefton Road, Aintree Univeristy Hospital								Ground Level (mAOD)	
Client: VINCI						GRM Project Ref: P10738		Coordinates 337908 E 397041 N	
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		18.50	S	50 (25 for 10mm/50 for 20mm)	18.50			Firm to stiff, medium to high strength, brown mottled grey, slightly sandy CLAY with occasional gravel. and silty partings. Gravel is fine to coarse, rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL Stiff to very stiff, high strength, brown mottled grey, slightly sandy CLAY with low cobble content and occasional gravel. Gravel is fine to coarse, rounded to sub-angular of mudstone, sandstone and chert. Cobbles are sub-rounded of mudstone and sandstone. GLACIAL TILL	19
		20.00 - 20.45 20.00	SPTLS S	N=33 (3,4/5,8,9,11)	20.45				20
								End of Borehole at 20.450m	21
									22
									23
									24
									25
									26
									27
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top		Duration		Remarks	
Groundwater Remarks: Waterstrikes at 0.90, 1.80m, 12.30 and 16.70m depths.				Casing Diameter by Depth					
				Depth Base		Diameter		Remarks	
General Remarks: Hand dug service clearance pit from GL to 1.20m				19.50		150			
Hole Started: 09/12/2024		Hole Complete: 11/12/2024		Version: FINAL		Scale: 1:50			

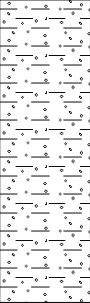
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH02 Sheet 1 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337921 E 397081 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		1.00 - 1.45 1.00	SPTLS S	N=7 (1,2/1,2,2,2)	0.30			Brown, gravelly CLAY. Gravel is fine to coarse, sub-rounded to angular of brick, ceramics, mudstone and chert. RELAID TOPSOIL	
		2.00 - 2.45 2.00	SPTLS S	N=15 (2,2/3,3,4,5)	2.10		Firm, medium strength, brown mottled grey, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to angular of mudstone, sandstone and chert. GLACIAL TILL		
		3.00 - 3.45 3.00	SPTLS S	N=6 (1,1/2,1,2,1)			Firm, medium to high strength, brown, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, rounded to angular of mudstone and sandstone. GLACIAL TILL		
		4.00 - 4.45 4.00	SPTLS S	N=9 (1,1/2,2,2,3)					
		5.00 - 5.45 5.00	SPTLS S	N=9 (2,2/3,2,2,2)					
		6.50 - 6.95 6.50	SPTLS S	N=12 (2,1/2,3,3,4)					
		8.00 - 8.45 8.00	SPTLS S	N=14 (2,3/3,3,4,4)			<i>Clay becomes high strength beyond 8.0m.</i>		
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top		Duration		Remarks	
Groundwater Remarks: Waterstrikes at 7.70m, 10.90 and 16.60m depths.				Casing Diameter by Depth		Depth Base		Diameter	
General Remarks: Hand dug service clearance pit from GL to 1.20m				19.60		150		Remarks	
Hole Started: 11/12/2024		Hole Complete: 13/12/2024		Version: FINAL		Scale: 1:50			

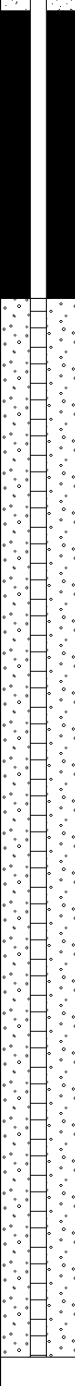
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH02 Sheet 2 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337921 E 397081 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		9.50 - 9.95 9.50	SPTLS S	N=28 (3,4/6,7,7,8)				Firm, medium to high strength, brown, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, rounded to angular of mudstone and sandstone. GLACIAL TILL	10
		11.00 - 11.45 11.00	SPTLS S	N=46 (4,5/5,7,13,21)					11
		12.50 - 12.95 12.50	SPTLS S	N=25 (3,3/3,6,7,9)					12
		14.00 - 14.45 14.00	SPTLS S	N=21 (3,3/4,5,5,7)					13
		15.50 - 15.95 15.50	SPTLS S	N=25 (2,4/4,6,7,8)					14
	17.00 - 17.45 17.00	SPTLS S	N=50 (5,7/50 for 285mm)			15			
									16
									17
									18
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top		Duration		Remarks	
Groundwater Remarks: Waterstrikes at 7.70m, 10.90 and 16.60m depths.									
General Remarks: Hand dug service clearance pit from GL to 1.20m				Casing Diameter by Depth					
				Depth Base		Diameter		Remarks	
				19.60		150			
Hole Started: 11/12/2024		Hole Complete: 13/12/2024		Version: FINAL		Scale: 1:50			

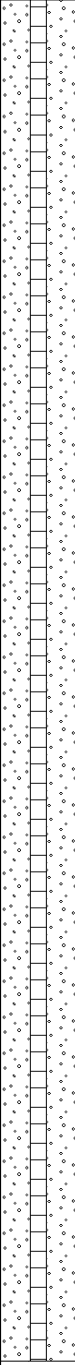
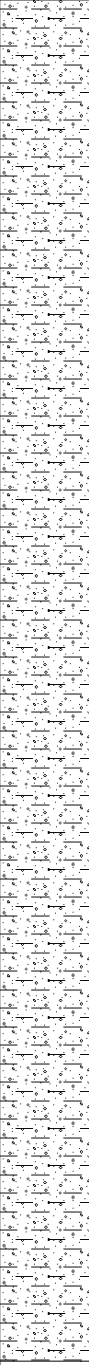
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH02 Sheet 3 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337921 E 397081 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		18.50 - 18.95 18.50	SPTLS S	N=48 (7,8/10,13,13,12)	20.45			Firm, medium to high strength, brown, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, rounded to angular of mudstone and sandstone. GLACIAL TILL	19
		20.00 - 20.45 20.00	SPTLS S	N=45 (25 for 135mm/14,7,9,15)					
								End of Borehole at 20.450m	21
									22
									23
									24
									25
									26
									27
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top		Duration		Remarks	
Groundwater Remarks: Waterstrikes at 7.70m, 10.90 and 16.60m depths.									
General Remarks: Hand dug service clearance pit from GL to 1.20m				Casing Diameter by Depth					
				Depth Base		Diameter		Remarks	
				19.60		150			
Hole Started: 11/12/2024		Hole Complete: 13/12/2024		Version: FINAL		Scale: 1:50			

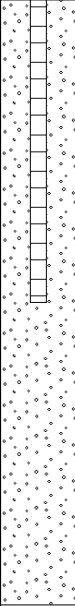
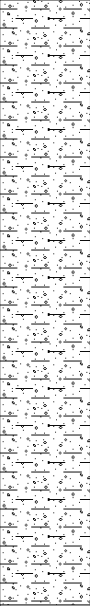
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH03 Sheet 1 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337983 E 397095 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
					0.30			Brown, slightly clayey fine to coarse SAND with rootlets. RELAIID TOPSOIL	
		1.20 - 1.65 1.20	SPTLS S	N=8 (1,1/2,2,2,2)	1.00			Soft, medium strength, brown, slightly sandy, gravelly CLAY with occasional re-bar. Gravel is fine to coarse, sub-rounded to sub-angular of brick, mudstone, sandstone and chert. MADE GROUND	1
		2.00 - 2.45 2.00	SPTLS S	N=8 (1,2/2,2,2,2)	2.00			Soft, medium strength, brown, sandy CLAY. GLACIAL TILL	2
		3.00 - 3.45 3.00	SPTLS S	N=12 (2,2/3,3,3,3)				Firm to stiff, medium to high strength, brown, gravelly CLAY. Gravel is fine to coarse, rounded to sub-angular of mudstone sandstone and chert. GLACIAL TILL <i>Stiffness and gravel content increase as depth of hole progresses.</i>	3
		4.00 - 4.45 4.00	SPTLS S	N=15 (2,3/3,4,4,4)				<i>Clay becomes high strength after 4.0m</i>	4
		5.00 - 5.45 5.00	SPTLS S	N=18 (3,4/4,5,4,5)					5
		6.00 - 6.45 6.00	SPTLS S	N=19 (3,4/4,5,5,5)					6
		7.50 - 7.95 7.50	SPTLS S	N=22 (4,4/5,5,6,6)					7
		9.00 - 9.45	SPTLS						8
								9	
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top		Duration		Remarks	
Groundwater Remarks: water stroke at 1.0m depth.									
General Remarks: Hand dug service clearance pit from GL to 1.20m.				Casing Diameter by Depth					
				Depth Base		Diameter		Remarks	
				19.50		150			
Hole Started: 05/12/2024		Hole Complete: 06/12/2024		Version: FINAL		Scale: 1:50			

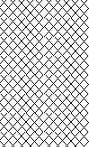
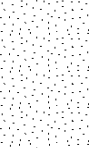
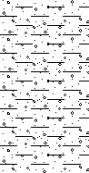
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH03 Sheet 2 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337983 E 397095 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		9.00	S	N=20 (4,5/4,5,5,6)				Firm to stiff, medium to high strength, brown, gravelly CLAY. Gravel is fine to coarse, rounded to sub-angular of mudstone sandstone and chert. GLACIAL TILL	
		10.50 - 10.95 10.50	SPTLS S	N=23 (3,5/5,6,6,6)					10
		12.00 - 12.45 12.00	SPTLS S	N=24 (4,5/5,6,6,7)					11
		13.50 - 13.95 13.50	SPTLS S	N=25 (4,5/6,6,6,7)					12
		15.00 - 15.45 15.00	SPTLS S	N=24 (4,6/5,6,6,7)					13
		16.50 - 16.95 16.50	SPTLS S	N=26 (5,6/6,7,6,7)					14
		18.00 - 18.45	SPTLS						15
									16
									17
									18
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top		Duration		Remarks	
Groundwater Remarks: water stroke at 1.0m depth.				Casing Diameter by Depth					
				Depth Base		Diameter		Remarks	
General Remarks: Hand dug service clearance pit from GL to 1.20m.				19.50		150			
Hole Started: 05/12/2024		Hole Complete: 06/12/2024		Version: FINAL		Scale: 1:50			

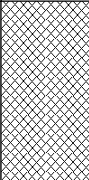
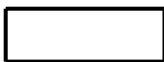
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH03 Sheet 3 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337983 E 397095 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		18.00	S	N=26 (5,6/6,6,7,7)	20.00			Firm to stiff, medium to high strength, brown, gravelly CLAY. Gravel is fine to coarse, rounded to sub-angular of mudstone sandstone and chert. GLACIAL TILL	19
		19.50 - 19.95 19.50	SPTLS S	N=27 (5,6/7,6,7,7)					
								End of Borehole at 20.000m	20
									21
									22
									23
									24
									25
									26
									27
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top		Duration		Remarks	
Groundwater Remarks: water stroke at 1.0m depth.				Casing Diameter by Depth					
				Depth Base		Diameter		Remarks	
General Remarks: Hand dug service clearance pit from GL to 1.20m.				19.50		150			
Hole Started: 05/12/2024		Hole Complete: 06/12/2024		Version: FINAL		Scale: 1:50			

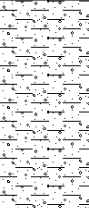
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH04 Sheet 1 of 3				
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)				
Client: VINCI					GRM Project Ref: P10738		Coordinates 337820 E 397086 N				
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	SPT Value							
		0.20						Brown, sandy, clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to angular of brick, mudstone and chert. RELAIID TOPSOIL CONCRETE MADE GROUND	1		
		0.55									
		1.00									
		1.20 - 1.65 1.20	SPTLS S	3 (1,1/,1,1,1)					Greyish light brown fine to coarse SAND. SHIRDLEY HILL SAND FORMATION		
		2.00 - 2.45 2.00	SPTLS S	N=8 (1,2/2,2,2,2)					Firm, medium to high strength, brown slightly gravelly, sandy CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL <i>Gravel content increases as depth of hole progresses.</i>	2	
		3.00 - 3.45 3.00	SPTLS S	N=11 (2,2/3,3,2,3)					Clay becomes high strength beyond 4.0m.	3	
		4.00 - 4.45 4.00	SPTLS S	N=15 (2,3/4,4,3,4)						4	
		5.00 - 5.45 5.00	SPTLS S	N=17 (2,3/4,4,4,5)						5	
		6.00 - 6.45 6.00	SPTLS S	N=18 (2,4/4,5,4,5)						6	
7.50 - 7.95 7.50	SPTLS S	N=18 (3,4/4,4,5,5)						7			
9.00 - 9.45	SPTLS								8		
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details							
Equipment: Dando 2000		Groundwater Remarks: Water entering borehole believed to be from below casing. Casing was tight on surge whilst advancing.		General Remarks: Hand dug service clearance pit from GL to 1.20m.		Casing Diameter by Depth					
				Depth Top				Duration		Remarks	
				Depth Base				Diameter		Remarks	
				15.00				150			
Hole Started: 01/12/2024		Hole Complete: 02/12/2024		Version: FINAL		Scale: 1:50					

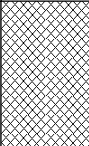
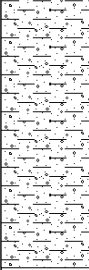
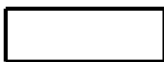
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH04 Sheet 2 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337820 E 397086 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		9.00	S	N=19 (2,3/4,5,5,5)				Firm, medium to high strength, brown slightly gravelly, sandy CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL	
		10.50 - 10.95 10.50	SPTLS S	N=23 (3,4/5,6,6,6)					
		12.00 - 12.45 12.00	SPTLS S	N=27 (3,5/5,7,7,8)					
		13.50 - 13.95 13.50	SPTLS S	N=24 (3,5/5,5,7,7)					
		15.00 - 15.45 15.00	SPTLS S	N=24 (4,4/5,6,6,7)					
		16.50 - 16.95 16.50	SPTLS S	N=26 (3,5/5,6,7,8)					
		18.00 - 18.45	SPTLS						
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top		Duration		Remarks	
Groundwater Remarks: Water entering borehole believed to be from below casing. Casing was tight on surge whilst advancing.				Casing Diameter by Depth					
General Remarks: Hand dug service clearance pit from GL to 1.20m.									
Hole Started: 01/12/2024		Hole Complete: 02/12/2024		Depth Base 15.00		Diameter 150		Remarks	
Version: FINAL				Scale: 1:50					

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Cable-Percussion Borehole			Borehole No. BH04 Sheet 3 of 3		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337820 E 397086 N		
Install	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	SPT Value					
		18.00	S	N=23 (4,5/4,6,6,7)	22.00			Firm, medium to high strength, brown slightly gravelly, sandy CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL	19
		19.50 - 19.95 19.50	SPTLS S	N=26 (5,5/6,6,7,7)					
								21	
								22	
							End of Borehole at 22.000m	23	
								24	
								25	
								26	
								27	
Crew: Macklin Geotech Ltd.		Logger: SW		Chiselling Details					
Equipment: Dando 2000				Depth Top		Duration		Remarks	
Groundwater Remarks: Water entering borehole believed to be from below casing. Casing was tight on surge whilst advancing.				Casing Diameter by Depth					
				Depth Base		Diameter		Remarks	
General Remarks: Hand dug service clearance pit from GL to 1.20m.				15.00		150			
Hole Started: 01/12/2024		Hole Complete: 02/12/2024		Version: FINAL		Scale: 1:50			

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No SA01 Sheet 1 of 1		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738			Coordinates 337897 E 397098 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.50			Brown, slightly clayey, slightly gravelly SAND with rootlets and rare cobbles. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to angular of brick, ceramics, mudstone, sandstone and chert. RELAID TOPSOIL		
				1.00			Greyish light brown fine to coarse SAND. SHIRDLEY HILL SAND FORMATION		
				1.60			Firm, light brown, slightly sandy, gravelly CLAY. Gravel is rounded to sub angular of mudstone, sandstone and chert. GLACIAL TILL		
				End of Pit at 1.600m					
Date Excavated: 27/11/2024			Groundwater Observations:						
Date Backfilled: 28/11/2024			No groundwater encountered.						
Shoring: N/A									
Stability: Stable									
Plant Used: 3CX			Trial Pit Dimensions (m):		Reason for termination of Trial Pit:				
Logged by: SW			0.60  1.50		Target Depth Achieved				
General Remarks:									
Relative density is approximate and determined by observation only.									
Version: FINAL									
Scale: 1:25									

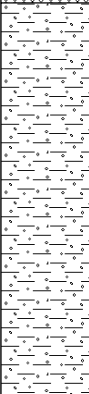
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No SA02 (A) Sheet 1 of 1		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738			Coordinates 337980 E 397109 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.60			Soft, brown, slightly sandy CLAY with rootlets. Sand is fine to coarse. RELAIID TOPSOIL		
							End of Pit at 0.600m		
1 2 3 4									
Date Excavated: 27/11/2024				Groundwater Observations:					
Date Backfilled: 27/11/2024				No groundwater encountered.					
Shoring: N/A									
Stability: Stable									
Plant Used: 3CX				Trial Pit Dimensions (m):		Reason for termination of Trial Pit:			
Logged by: SW				0.60  1.20		Buried gas main warning tape encountered.			
General Remarks: Buried gas mains warning tape encountered at 0.6m. Pit was repositioned to a location further south.									
Relative density is approximate and determined by observation only.				Version: FINAL			Scale: 1:25		

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No SA02 (B) Sheet 1 of 1		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738			Coordinates 337981 E 397100 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.30			Soft, brown, slightly sandy CLAY with rootlets. Sand is fine to coarse. RELAIID TOPSOIL		
				1.00			Firm, yellowish brown, slightly gravelly, sandy CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL		
							Firm to stiff, light brown, slightly sandy CLAY. GLACIAL TILL		
				1.60			End of Pit at 1.600m		
							1		
							2		
							3		
							4		
Date Excavated: 27/11/2024				Groundwater Observations:					
Date Backfilled: 28/11/2024				No groundwater encountered.					
Shoring: N/A									
Stability: Stable									
Plant Used: 3CX				Trial Pit Dimensions (m):		Reason for termination of Trial Pit:			
Logged by: SW				0.60  1.50		Target Depth Achieved			
General Remarks:									
Relative density is approximate and determined by observation only.				Version: FINAL			Scale: 1:25		

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No SA03 Sheet 1 of 1		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738			Coordinates 337935 E 397023 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.50		 DAMP. Soft, brown, slightly sandy, gravelly CLAY with occasional rootlets and rare cobbles. Sand is fine to coarse. Gravel is sub-rounded to angular of brick, ceramics and mudstone. RELAIID TOPSOIL <i>Brick cobbles at 0.4m.</i>	1 2 3 4		
				1.40		 Stiff, brown, sandy, gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL <i>Water strike at 0.7m</i>			End of Pit at 1.400m
Date Excavated: 27/11/2024				Groundwater Observations:					
Date Backfilled: 28/11/2024				Water strike at 0.7m					
Shoring: N/A									
Stability: Stable									
Plant Used: 3CX				Trial Pit Dimensions (m):		Reason for termination of Trial Pit:			
Logged by: SW				0.60  1.50					
General Remarks:									
Relative density is approximate and determined by observation only.				Version: FINAL			Scale: 1:25		

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No TP01 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)	
Client: VINCI					GRM Project Ref: P10738		Coordinates 337939 E 397106 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Brown, slightly sandy CLAY with rootlets. Sand is fine to coarse. RELAID TOPSOIL	
	0.40	ES		0.60			Brown, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of brick, sandstone and mudstone. MADE GROUND	
	0.70	D		0.80			Greyish light brown fine to coarse SAND. SHIRDLEY HILL SAND FORMATION	
							Stiff to very stiff, high strength, orangish brown mottled grey, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone and sandstone. GLACIAL TILL	
	1.40		HVP=113					
	2.20		HVP=127					
	2.40	D						
				3.00				
							End of Pit at 3.000m	
Date Excavated: 28/11/2024				Groundwater Observations:				
Date Backfilled: 28/11/2024				No groundwater encountered.				
Shoring: N/A								
Stability: Stable								
Plant Used: JCB 3CX				Trial Pit Dimensions (m):		Reason for termination of Trial Pit:		
Logged by: SW				0.60  1.50		Target Depth Achieved		
General Remarks:								
Relative density is approximate and determined by observation only.				Version: FINAL		Scale: 1:25		

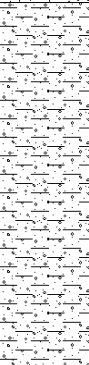
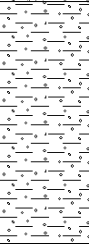
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No TP02 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)	
Client: VINCI					GRM Project Ref: P10738		Coordinates 337891 E 397022 N	

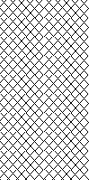
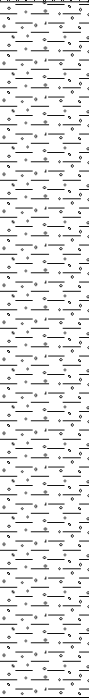
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.00		HVP=100	0.30		 Brown, slightly, sandy, slightly clayey GRAVEL with rare cobbles. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to angular of brick, ceramics, mudstone and chert. Cobbles are angular of primarily brick with some larger ceramic fragments. RELAID TOPSOIL	1	
				1.60		 Firm, high strength, brown mottled grey, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of sandstone, mudstone and chert. GLACIAL TILL	2	
						End of Pit at 1.600m	3	
							4	

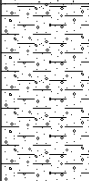
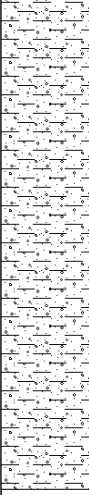
Date Excavated: 27/11/2024		Groundwater Observations:	
Date Backfilled: 28/11/2024		No groundwater encountered.	
Shoring: N/A			
Stability: Stable			
Plant Used: JCB 3CX		Reason for termination of Trial Pit:	
Logged by: SW		Target Depth Achieved	

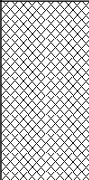
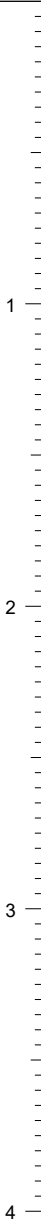
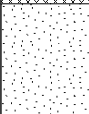
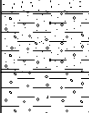
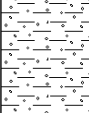
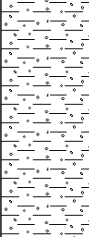
General Remarks: Trial pit was used for additional soakaway testing.	
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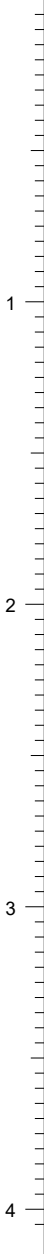
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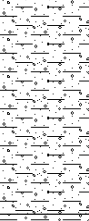
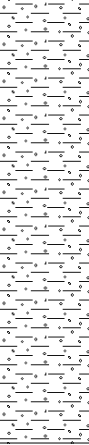
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No TP04 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)	
Client: VINCI					GRM Project Ref: P10738		Coordinates 337967 E 397027 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES	HVP=90	0.30			Brown, slightly sandy CLAY with rootlets. RELAID TOPSOIL	
	0.40	D		0.50			Greyish light brown fine to coarse SAND. SHIRDLEY HILL SAND FORMATION	
				1.70			Firm, brown mottled grey, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse of mudstone, sandstone and chert. GLACIAL TILL	
	1.90							
	2.10	D		2.50			Stiff, high strength, brown mottled grey, slightly gravelly CLAY. Gravel is fine to coarse of mudstone, sandstone and chert. GLACIAL TILL	
							End of Pit at 2.500m	
Date Excavated: 27/11/2024				Groundwater Observations:				
Date Backfilled: 27/11/2024				No groundwater encountered.				
Shoring: N/A								
Stability: Stable								
Plant Used: JCB 3CX				Trial Pit Dimensions (m):		Reason for termination of Trial Pit:		
Logged by: SW				0.60  1.50		Target Depth Achieved		
General Remarks:								
Relative density is approximate and determined by observation only.				Version: FINAL		Scale: 1:25		

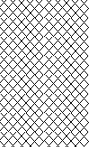
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No TP05 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)	
Client: VINCI					GRM Project Ref: P10738		Coordinates 337932 E 397047 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.60			Brown, slightly clayey, GRAVEL with a low cobble content. Gravel is fine to coarse, sub-angular to angular of brick, ceramics, mudstone and chert. Cobbles are angular of primarily brick with some larger ceramic fragments. RELAIID TOPSOIL	
							Stiff to very stiff, high strength, brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL	
	1.20	D						
	1.70		HVP=122					
	2.00		HVP=147					
2.60	D		2.90			End of Pit at 2.900m		
Date Excavated: 28/11/2024			Groundwater Observations:					
Date Backfilled: 28/11/2024			No groundwater encountered.					
Shoring: N/A								
Stability: Stable								
Plant Used: JCB 3CX			Trial Pit Dimensions (m):		Reason for termination of Trial Pit:			
Logged by: SW			0.60  1.50		Target Depth Achieved			
General Remarks:								
Relative density is approximate and determined by observation only.								
Version:			FINAL			Scale: 1:25		

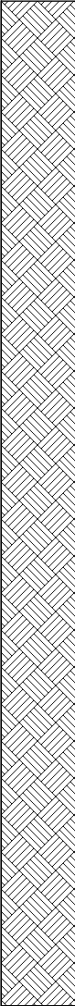
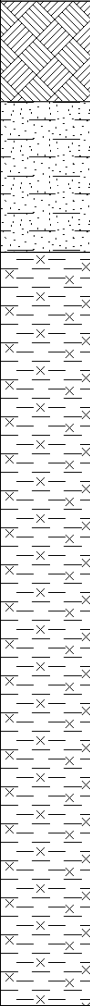
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No TP06 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)	
Client: VINCI					GRM Project Ref: P10738		Coordinates 337908 E 397058 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.30			Soft, brown, slightly sandy CLAY with rootlets. Sand is fine to coarse. RELAIID TOPSOIL	
	0.50	D		0.60			Greyish light brown, fine to coarse SAND. SHIRDLEY HILL SAND FORMATION	
							Stiff to very stiff, high strength, orangish brown mottled grey, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone and sandstone. GLACIAL TILL	
	1.40	D	HVP=103				Occasional interbedded, light brown, sand lenses holding water at 1.2m causing water ingress and pit instability.	
	1.60							
	2.30		HVP=137					
2.70	D		2.80			End of Pit at 2.800m		
Date Excavated: 28/11/2024			Groundwater Observations:					
Date Backfilled: 28/11/2024			Water strike at 1.2m. Water is held within sand lenses between the clay strata.					
Shoring: N/A								
Stability: Slightly Unstable			Trial Pit Dimensions (m):		Reason for termination of Trial Pit:			
Plant Used: JCB 3CX			0.60 		Water ingress and sand lenses causing pit to become unstable and walls to collapse.			
Logged by: SW			1.50					
General Remarks:								
Relative density is approximate and determined by observation only.				Version: FINAL		Scale: 1:25		

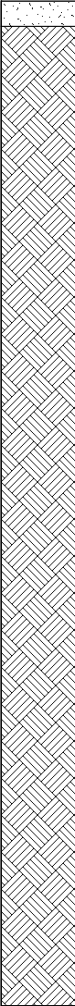
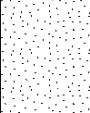
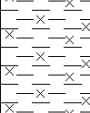
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No TP07 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)	
Client: VINCI					GRM Project Ref: P10738		Coordinates 337883 E 397042 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES	HVP=146	0.60			Brown, slightly sandy, slightly clayey GRAVEL with rare cobbles. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to angular of brick, ceramics, mudstone and chert. Cobbles are angular of primarily brick with some larger ceramic fragments. RELAIID TOPSOIL	
	0.80	D				Greyish light brown fine to coarse SAND. SHIRDLEY HILL SAND FORMATION		
	1.20	D				Interbedded, light brown, sand lens holding water at 1.0m causing water ingress and pit instability.		
	1.90					Soft to firm brown, sandy, gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL		
	2.40	D				Firm, high strength, brown, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL		
End of Pit at 2.500m								
Date Excavated: 28/11/2024			Groundwater Observations:					
Date Backfilled: 28/11/2024			Water strike at 1.0m. Water is held within sand lenses between the clay strata.					
Shoring: N/A								
Stability: Unstable								
Plant Used: JCB 3CX			Trial Pit Dimensions (m):			Reason for termination of Trial Pit:		
Logged by: SW			0.60  1.50			Water ingress and sand lenses causing pit to become unstable and walls to collapse.		
General Remarks:								
Relative density is approximate and determined by observation only.				Version: FINAL		Scale: 1:25		

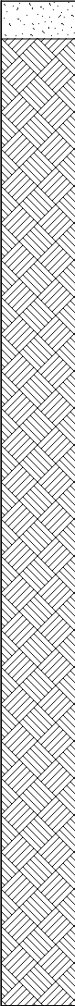
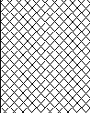
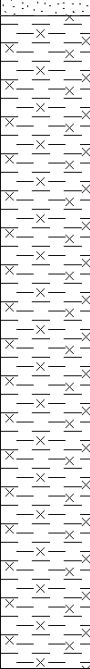
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No TP08 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)	
Client: VINCI					GRM Project Ref: P10738		Coordinates 337947 E 397067 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.30		Soft, brown, slightly sandy CLAY with rootlets and rare brick fragments. Sand is fine to coarse. RELAID TOPSOIL		
	0.80					Stiff, high strength, orangish brown mottled grey, slightly gravelly, CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL		
	1.90	D	HVP=143	3.00		Clay becomes very stiff after 1.5m.		
	2.30					End of Pit at 3.000m		
Date Excavated: 28/11/2024			Groundwater Observations:					
Date Backfilled: 28/11/2024			No groundwater encountered.					
Shoring: N/A								
Stability: Stable								
Plant Used: JCB 3CX			Trial Pit Dimensions (m):		Reason for termination of Trial Pit:			
Logged by: SW			0.60  1.50		Target Depth Achieved			
General Remarks:								
Relative density is approximate and determined by observation only.								
Version: FINAL					Scale: 1:25			

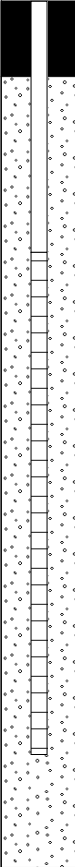
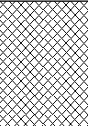
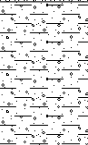
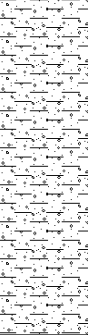
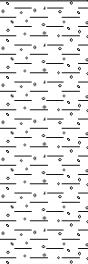
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Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738		Coordinates 337990 E 397060 N		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	ES		0.30			Soft, brown, slightly sandy, CLAY with rootlets. RELAID TOPSOIL		1
				0.60			Firm, brown, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to angular of brick, mudstone and chert. MADE GROUND		
	0.70	D		0.80			Greyish light brown, fine to coarse SAND SHIRDLEY HILL SAND FORMATION		
	1.30	D	HVP=87	1.60			Stiff, brown mottled grey, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub- angular of mudstone, sandstone and chert. GLACIAL TILL		2
	1.60						Very stiff, high strength, brown mottled grey, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL		
	2.00								
	2.70	D	HVP=103	3.10					3
			End of Pit at 3.100m						
									4
Date Excavated: 27/11/2024				Groundwater Observations:					
Date Backfilled: 27/11/2024				No groundwater encountered.					
Shoring: N/A									
Stability: Stable									
Plant Used: JCB 3CX				Trial Pit Dimensions (m):		Reason for termination of Trial Pit:			
Logged by: SW				0.60  1.50		Target Depth Achieved			
General Remarks:									
Relative density is approximate and determined by observation only.									
Version:				FINAL			Scale: 1:25		

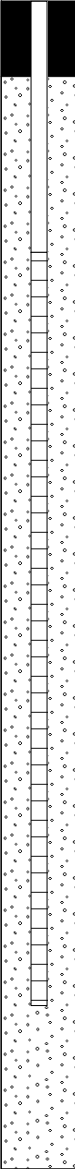
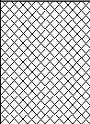
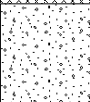
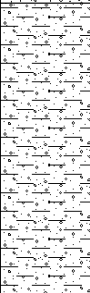
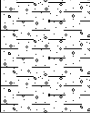
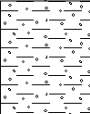
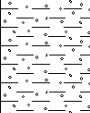
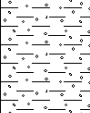
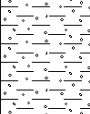
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No TP10 Sheet 1 of 1		
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)		
Client: VINCI					GRM Project Ref: P10738			Coordinates 337961 E 397054 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.30	ES	HVP=114	0.50			Brown, slightly clayey, GRAVEL with a low cobble content. Gravel is fine to coarse, sub-angular to angular of brick, ceramics, mudstone and chert. Cobbles are angular of primarily brick with some larger ceramic fragments. RELAIID TOPSOIL		
	0.80	D		0.70			Firm, brown, gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of brick, mudstone, sandstone and chert. MADE GROUND <i>Land drain encountered at 0.6m.</i>		
	2.10	D		3.10			Firm, high strength, brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL		
	2.50								
							End of Pit at 3.100m		
Date Excavated: 27/11/2024			Groundwater Observations:						
Date Backfilled: 27/11/2024			No groundwater encountered.						
Shoring: N/A									
Stability: Stable									
Plant Used: JCB 3CX			Trial Pit Dimensions (m):		Reason for termination of Trial Pit:				
Logged by: SW			0.60						
General Remarks: Land drain encountered at 0.6m water ingress sealed and excavation continued.									
Relative density is approximate and determined by observation only.				Version: FINAL		Scale: 1:25			

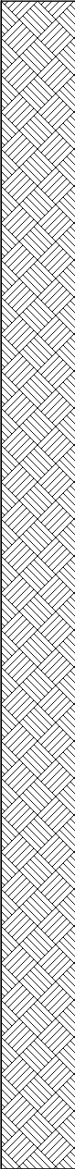
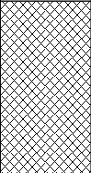
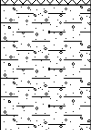
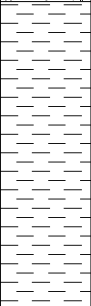
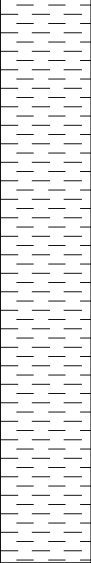
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole				Borehole No WS01 Sheet 1 of 1		
Site Name: Sefton Road, Aintree Univeristy Hospital								Ground Level (mAOD) 26.81		
Client: VINCI					GRM Project Ref: P10738			Coordinates 337828 E 397051 N		
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth	Type	SPT Result						
					0.40	26.41		Grass over dark brown, clayey SAND. Sand is fine to coarse. TOPSOIL		
		0.60	D						Loose, brown and dark brown, clayey SAND. Sand is fine to medium. SHIRDLEY HILL SAND FORMATION	
		1.10	D			1.00		25.81	Soft becoming stiff, low strength becoming high strength, reddish-brown mottled grey, silty CLAY. GLACIAL TILL	
		1.20	S	N=7 (2,1/1,2,2,2)						
		1.80	D							
		2.00	S	N=15 (2,2/4,4,3,4)					Becoming firm, medium strength at 2.0m.	
		2.20	D						Becoming slightly gravelly at 2.40m. Gravel is fine, subangular to subrounded quartzite.	
		2.80	D							
		3.00	S	N=14 (3,3/3,4,3,4)						
		3.50	D							
		4.00	S	N=16 (3,4/4,3,4,5)	4.00	22.81		Becoming stiff, high strength at 4.0m. End of Borehole at 4.000m		
Crew: Macklin Geotech Ltd				Logger: JB			Weather: Overcast			
Equipment: Tracked windowless sampling rig										
Reason for termination of borehole: Target depth achieved										
Groundwater Remarks: No groundwater encountered										
General Remarks: Hand-dug service clearance pit from GL to 1.20m										
Hole Started: 01/12/2024		Hole Complete: 01/12/2024		Version: FINAL			Scale: 1:31			

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS02 Sheet 1 of 1			
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD) 26.57			
Client: VINCI					GRM Project Ref: P10738			Coordinates 337841 E 397066 N		
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth	Type	SPT Result						
					0.05	26.52		Strong, black TARMACADAM/ASPHALT. MADE GROUND	1	
					0.15	26.42				
		0.30	ES						Dense, grey, slightly sandy GRAVEL. Gravel is fine to coarse, angular to subangular limestone. Sand is fine to coarse. Geotextile membrane at base. MADE GROUND	
					0.50	26.07				
		0.80	D						Loose, brown and dark brown, slightly gravelly, clayey SAND. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular brick and concrete. MADE GROUND	
					1.00	25.57				
		1.20	D	N=5 (2,1/1,1,1,2)				Loose, brown mottled orangish-brown SAND. Sand is fine to medium. SHIRDLEY HILL SAND FORMATION		
		1.20	S							
		1.80	D					Soft becoming firm, low strength becoming medium strength, reddish-brown mottled grey, silty CLAY. GLACIAL TILL		
		2.00	S	N=10 (2,1/2,2,3,3)						
2.50	D					Becoming slightly gravelly at 1.70m. Gravel is fine to coarse, subangular to subrounded quartzite and mudstone. Becoming firm, medium strength at 1.80m.				
3.00	S	N=11 (2,2/2,3,3,3)								
3.50	D					1no. subrounded cobble of granite at 2.20m.				
4.00	S	N=16 (3,3/4,4,4,4)								
				4.00	22.57	End of Borehole at 4.000m			4	
									5	
Crew: Macklin Geotech Ltd				Logger: JB			Weather: Sunny			
Equipment: Tracked windowless sampling rig										
Reason for termination of borehole: Target depth achieved										
Groundwater Remarks: No groundwater encountered										
General Remarks: Hand-dug service clearance pit from GL to 1.20m										
Hole Started: 01/12/2024		Hole Complete: 01/12/2024		Version: FINAL		Scale: 1:31				

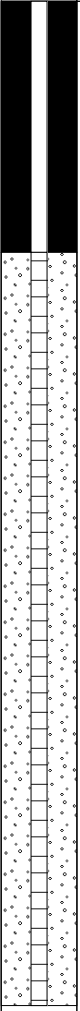
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS03 Sheet 1 of 1			
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD) 26.34			
Client: VINCI					GRM Project Ref: P10738			Coordinates 337847 E 397087 N		
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth	Type	SPT Result						
					0.05	26.28		Strong, black TARMACADAM/ASPHALT. MADE GROUND	1	
					0.15	26.18				
		0.50	ES						Dense, grey, slightly sandy GRAVEL. Gravel is fine to coarse, angular to subangular limestone. Sand is fine to coarse. Geotextile membrane at base. MADE GROUND	
		1.20	S	N=7 (1,2/2,1,2,2)	1.10	25.24		Loose, brown and dark brown SAND. Sand is fine to medium. SHIRDLEY HILL SAND FORMATION		
		1.50	D		1.40	24.94				
		2.00	D	N=11 (2,3/3,2,3,3)				Firm, medium strength, reddish-brown mottled grey, silty CLAY with rare fine to medium, subangular to rounded gravel of quartzite and mudstone. GLACIAL TILL	2	
		2.00	S							
		2.50	D							
3.00	D	N=15 (3,3/3,4,4,4)						3		
3.00	S									
4.00	D	N=14 (3,3/3,4,3,4)	4.00	22.34				4		
4.00	S									
									5	
Crew: Macklin Geotech Ltd				Logger: JB			Weather: Overcast			
Equipment: Tracked windowless sampling rig										
Reason for termination of borehole: Target depth achieved										
Groundwater Remarks: No groundwater encountered										
General Remarks: Hand-dug service clearance pit from GL to 1.20m										
Hole Started: 01/12/2024		Hole Complete: 01/12/2024			Version: FINAL		Scale: 1:31			

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS05 Sheet 1 of 1			
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)			
Client: VINCI					GRM Project Ref: P10738			Coordinates 337909 E 397021 N		
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth	Type	SPT Result						
					0.50			Brown, slightly clayey fine to coarse SAND with rootlets. RELAID TOPSOIL		
		1.00	S	N=11 (3,2/2,3,3,3)				DAMP. Soft, medium strength, brown, slightly gravelly, slightly sandy CLAY. Gravel is fine to coarse, sub-rounded of mudstone, sandstone and chert. GLACIAL TILL <i>Material recorded as WET at 1.0m</i>		
		2.00	S	N=16 (2,4/4,4,4,4)		2.40				
		3.00	S	N=19 (5,5/5,5,4,5)		3.45			Soft to firm, high strength, brown, slightly gravelly CLAY. Gravel is sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL	
									End of Borehole at 3.450m	
Crew: Macklin Geotech Ltd.				Logger: SW			Weather: Overcast			
Equipment: Archway Dart										
Reason for termination of borehole: Target Depth Achieved										
Groundwater Remarks: Recovered material was wet at 1.0m										
General Remarks: Hand-dug service clearance pit from GL to 1.20m										
Hole Started: 04/12/2024		Hole Complete: 04/12/2024			Version: FINAL		Scale: 1:31			

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS06 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD)	
Client: VINCI					GRM Project Ref: P10738		Coordinates 337883 E 397073 N	
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description
		Depth	Type	SPT Result				
		0.50						Brown, slightly clayey fine to coarse SAND with abundant rootlets. RELAID TOPSOIL
		0.90						Greyish light brown, slightly gravelly fine to coarse SAND. Gravel is fine to medium, rounded to sub-rounded of sandstone. SHIRDLEY HILL SAND FORMATION
		1.20	S	N=8 (1,2/2,2,2,2)				DAMP. Soft, medium strength, brown, slightly gravelly, slightly sandy CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL
		2.20	S	N=13 (2,3/3,3,3,4)				Clay becomes firm between 2.1m and 2.5m
		2.50						Soft to firm, high strength, brown, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone and chert. GLACIAL TILL
		3.20	S	N=21 (4,4/5,5,5,6)				Recovered material was wet between 2.6m and 2.7m Clay becomes firm beyond 3.0m
		4.20	S	N=22 (6,5/6,6,5,5)				
		4.65						End of Borehole at 4.650m
Crew: Macklin Geotech Ltd.					Logger: SW		Weather: Overcast	
Equipment: Archway Dart								
Reason for termination of borehole: Target Depth Achieved								
Groundwater Remarks: Recovered material was wet between 2.6m and 2.7m.								
General Remarks: Hand-dug service clearance pit from GL to 1.20m								
Hole Started: 04/12/2024		Hole Complete: 04/12/2024		Version: FINAL		Scale: 1:31		

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole				Borehole No WS07 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital								Ground Level (mAOD)	
Client: VINCI						GRM Project Ref: P10738		Coordinates 337939 E 397090 N	
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	SPT Result					
		0.65	S	N=11 (2,2/3,3,3,2)	0.70			Soft, brown, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to angular of brick, ceramics, mudstone and chert. RELAID TOPSOIL	
		1.20	S	N=20 (4,4/4,5,5,6)	1.20			Firm, medium strength, brown mottled grey, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone, sandstone and chert. GLACIAL TILL	
		2.20	S	N=23 (5,4/5,6,6,6)				Firm, medium to high strength, brown mottled grey CLAY with rare mudstone and chert gravel fragments. GLACIAL TILL	
		3.20	S	N=13 (1,2/2,3,4,4)				Clay becomes stiff from 2.4m onwards.	
		4.20	S	N=20 (3,4/4,5,5,6)	4.65			End of Borehole at 4.650m	
Crew: Macklin Geotech Ltd.				Logger: SW		Weather: Overcast			
Equipment: Archway Dart									
Reason for termination of borehole: Target Depth Achieved									
Groundwater Remarks: No groundwater encountered.									
General Remarks: Hand-dug service clearance pit from GL to 1.20m									
Hole Started: 04/12/2024		Hole Complete: 04/12/2024		Version: FINAL		Scale: 1:31			

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS10 Sheet 1 of 1	
Site Name: Sefton Road, Aintree Univeristy Hospital							Ground Level (mAOD) 27.07	
Client: VINCI					GRM Project Ref: P10738		Coordinates 337831 E 397021 N	

Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth	Type	SPT Result						
		0.40	ES		0.30	26.77		Grass over dark brown SAND. Sand is fine to coarse. RELAIID TOPSOIL		
		0.60			0.60	26.47				Loose, dark brown, slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular concrete, brick and sandstone. MADE GROUND
		0.90			0.90	26.17				
		1.20	D	N=0 (0,0/0,0,0,0)				Very soft becoming firm, very low strength becoming medium strength, dark brown, silty, very sandy CLAY. Sand is fine to coarse. SHIRDLEY HILL SAND FORMATION		
		1.20	S							
		1.50	D							
		2.00	D	N=12 (1,1/3,3,3,3)				Water strike at 2.0m.		
		2.00	S							
		2.50	D							
		2.90	D			2.80	24.27			Firm, medium strength, reddish-brown, slightly sandy, slightly gravelly, silty CLAY. Sand is fine to coarse. Gravel is fine, subangular to subrounded mudstone and quartzite. GLACIAL TILL 3.0m to 4.0m - No recovery. SPT sample from 4.0m to 4.45m is clay as above. GLACIAL TILL
3.00	S	N=13 (3,2/3,3,4,3)								
3.00			3.00	24.07						
4.00	D	N=15 (2,3/3,4,4,4)	4.00	23.07			End of Borehole at 4.000m			
4.00	S									

Crew: Macklin Geotech Ltd		Logger: JB		Weather: Sunny	
Equipment: Tracked windowless sampling rig					
Reason for termination of borehole: Target depth achieved					
Groundwater Remarks: Water strike at 2.0m					
General Remarks: Hand-dug service clearance pit from GL to 1.20m					
Hole Started: 01/12/2024		Hole Complete: 01/12/2024		Version: FINAL	
				Scale: 1:31	

DYNAMIC CONE PENETRATION TEST RESULTS



Contract Name Aintree

Contract No P10738

Start Depth mm 64

Test Location

Client: 0

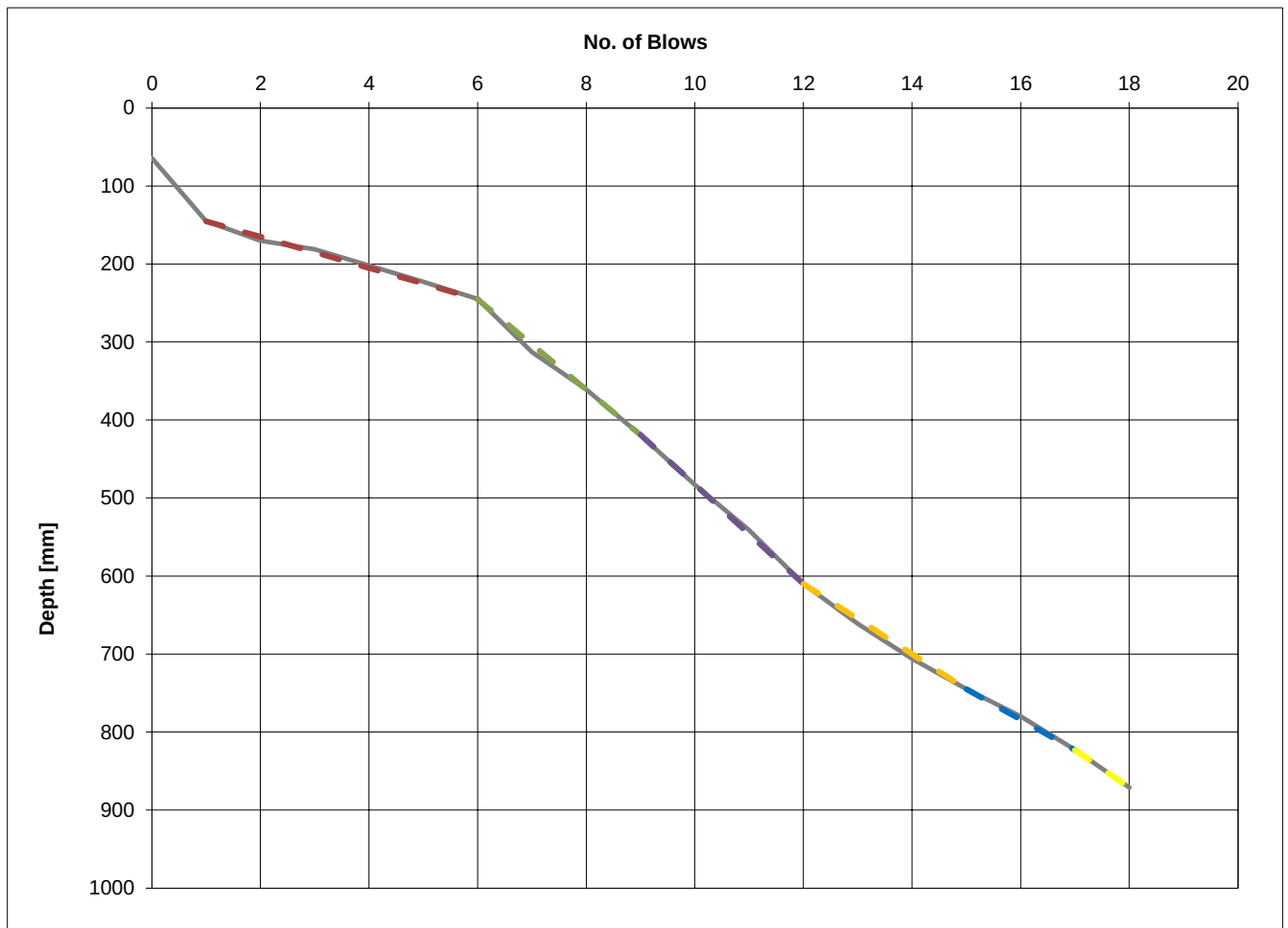
Final Depth mm: 871

WS01

Engineer: 0

Date 01/12/2024

Equipment: Labquip DCP



CBR RESULTS

TEST No	Depth m		CBR Value %
	From	To	
CBR 1	0.00	0.25	12.7
CBR 2	0.25	0.42	4.1
CBR 3	0.42	0.61	3.7
CBR 4	0.61	0.75	5.4
CBR 5	0.75	0.82	6.3
CBR 6	0.82	0.87	5.0

CBR Calculated using TRL equation

$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \text{ Log}_{10}(\text{mm/blow})$

Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data.
Transport and Road Research Laboratory, 1990

DYNAMIC CONE PENETRATION TEST RESULTS



Contract Name Aintree

Contract No P10738

Client: 0

Engineer: 0

Equipment: Labquip DCP

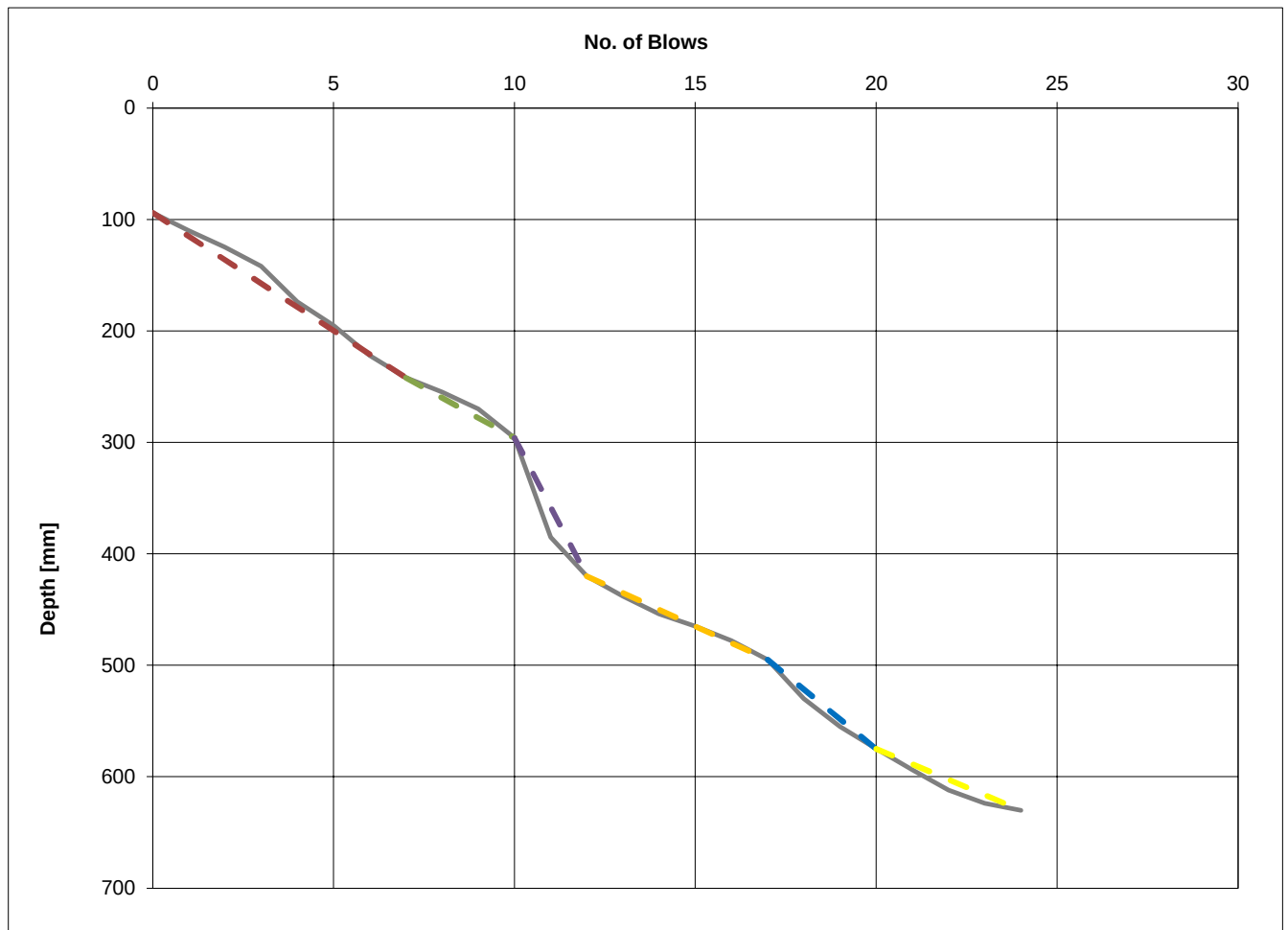
Start Depth mm 94

Final Depth mm: 630

Date 01/12/2024

Test Location

WS02



CBR RESULTS

TEST No	Depth m		CBR Value %
	From	To	
CBR 1	0.00	0.24	12.0
CBR 2	0.24	0.30	14.2
CBR 3	0.30	0.42	3.8
CBR 4	0.42	0.50	17.3
CBR 5	0.50	0.58	9.4
CBR 6	0.58	0.63	18.9

CBR Calculated using TRL equation

$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \text{ Log}_{10}(\text{mm/blow})$

Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data.
Transport and Road Research Laboratory, 1990

DYNAMIC CONE PENETRATION TEST RESULTS



Contract Name Aintree

Contract No P10738

Client: 0

Engineer: 0

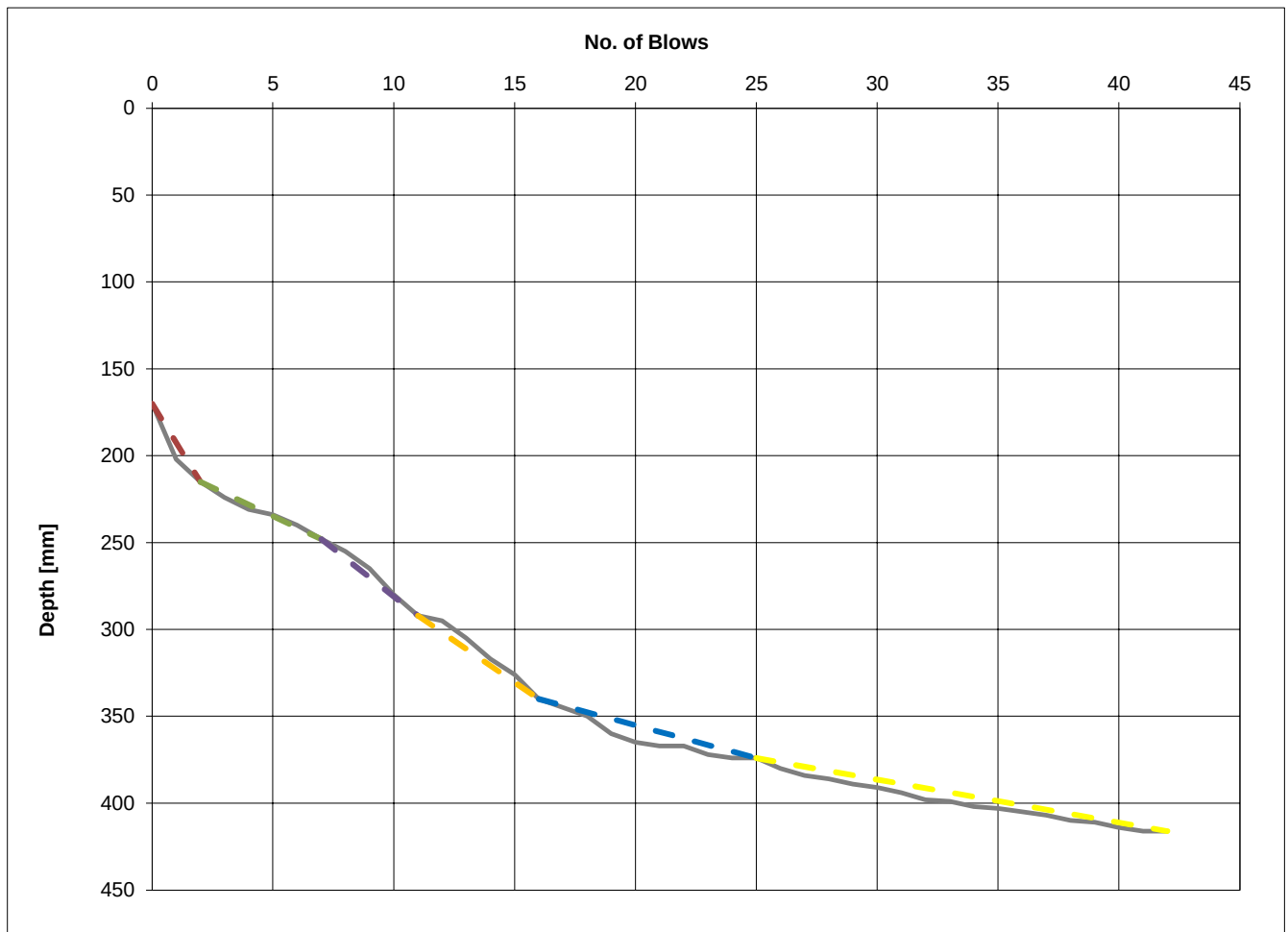
Equipment: Labquip DCP

Start Depth mm 170

Final Depth mm: 416

Date 01/12/2024

Test Location
WS03



CBR RESULTS

TEST No	Depth m		CBR Value %
	From	To	
CBR 1	0.00	0.22	11.2
CBR 2	0.22	0.25	41.1
CBR 3	0.25	0.29	23.9
CBR 4	0.29	0.34	27.7
CBR 5	0.34	0.37	74.1
CBR 6	0.37	0.42	116.1

CBR Calculated using TRL equation

$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \text{ Log}_{10}(\text{mm/blow})$

Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data.
Transport and Road Research Laboratory, 1990

DYNAMIC CONE PENETRATION TEST RESULTS



Contract Name Aintree

Contract No P10738

Start Depth mm 243

Test Location

Client: 0

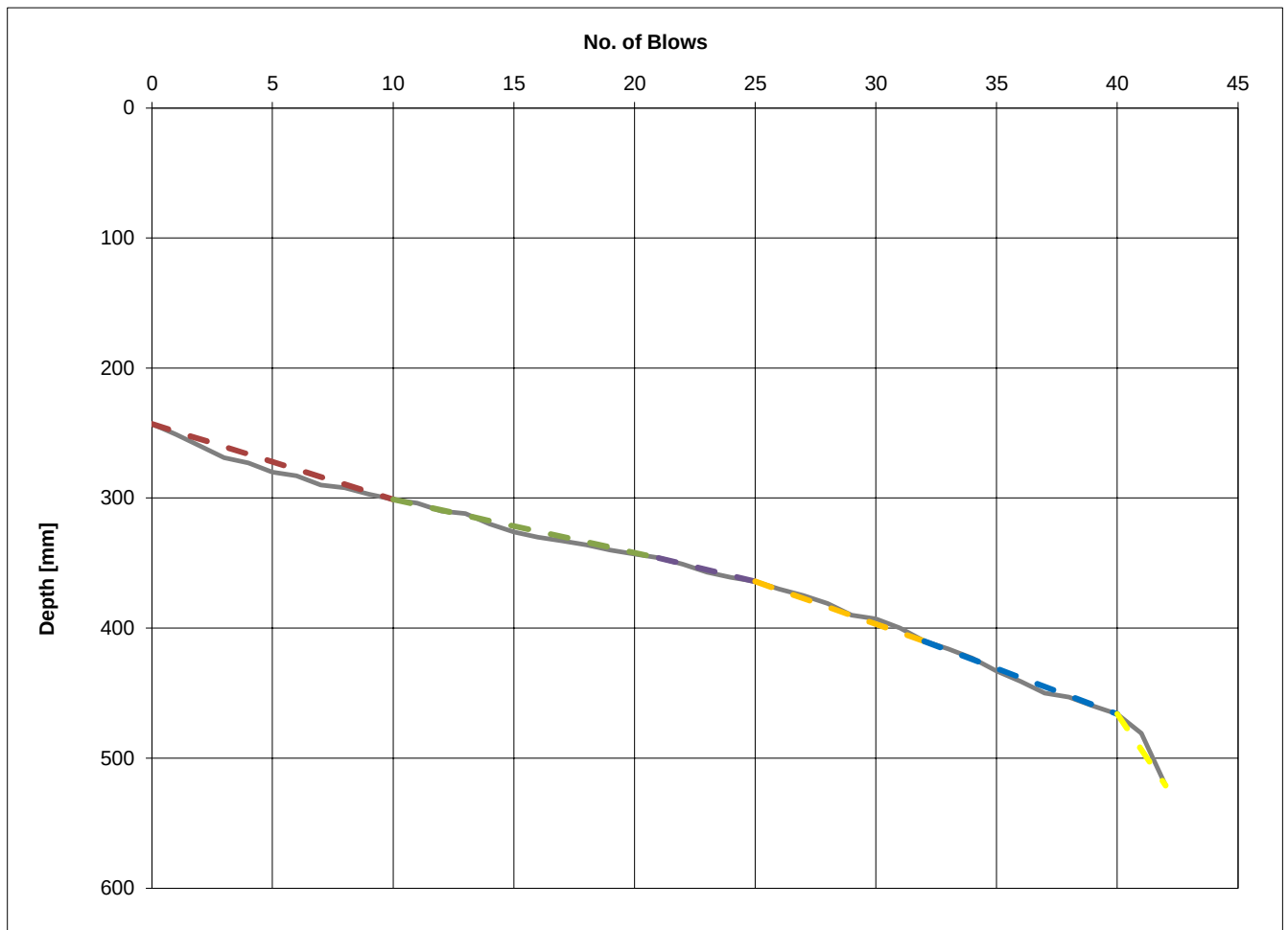
Final Depth mm: 521

WS09

Engineer: 0

Date 01/12/2024

Equipment: Labquip DCP



CBR RESULTS

TEST No	Depth m		CBR Value %
	From	To	
CBR 1	0.00	0.30	47.1
CBR 2	0.30	0.35	68.1
CBR 3	0.35	0.36	61.6
CBR 4	0.36	0.41	41.3
CBR 5	0.41	0.47	38.6
CBR 6	0.47	0.52	9.1

CBR Calculated using TRL equation

$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \text{ Log}_{10}(\text{mm/blow})$

Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data.
Transport and Road Research Laboratory, 1990

DYNAMIC CONE PENETRATION TEST RESULTS



Contract Name Aintree

Contract No P10738

Start Depth mm 60

Test Location

Client: 0

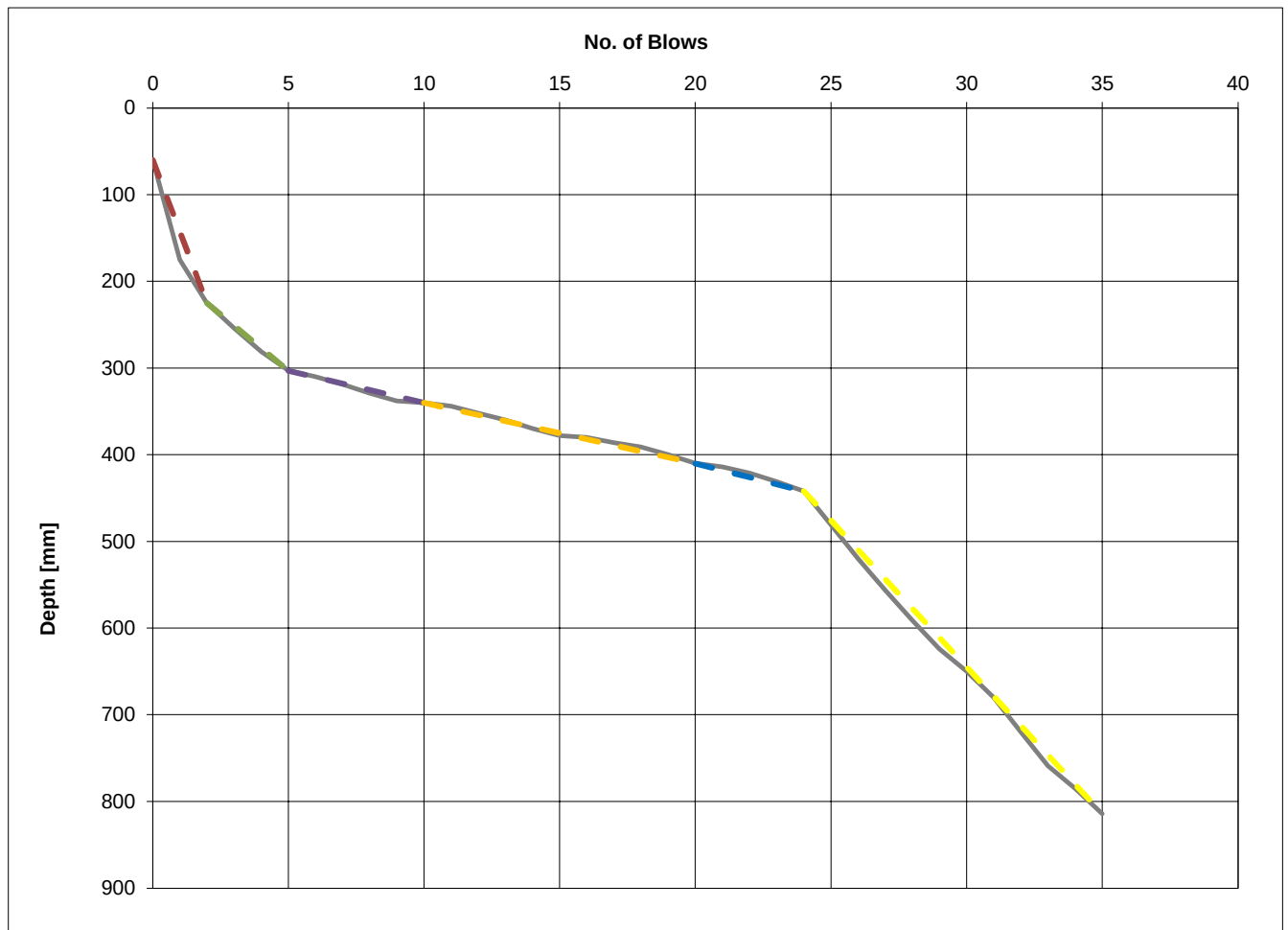
Final Depth mm: 814

WS10

Engineer: 0

Date 01/12/2024

Equipment: Labquip DCP



CBR RESULTS

TEST No	Depth m		CBR Value %
	From	To	
CBR 1	0.00	0.23	2.8
CBR 2	0.23	0.30	9.6
CBR 3	0.30	0.34	36.4
CBR 4	0.34	0.41	38.6
CBR 5	0.41	0.44	33.5
CBR 6	0.44	0.81	7.3

CBR Calculated using TRL equation

$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \text{ Log}_{10}(\text{mm/blow})$

Reference

Overseas Road Note 8. A users manual for a program to analyse dynamic cone penetrometer data.
Transport and Road Research Laboratory, 1990



A P P E N D I X G

Land Appraisal | Environmental | Geotechnical | Design | Mining | Inspections

GRM Development Solutions Limited, Laurus House, First Avenue, Centrum 100, Burton upon Trent, Staffs DE14 2WH
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Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	Aintree University Hospital, Liverpool
Client	GRM Development Solutions Ltd
Site Address	Aintree University Hospital, Liverpool, L9 7LN
Report Reference	DA9796b-00
Date	21 st November 2024
Author	JA
Quality Assurance	AB
Final Check	AT

1st Line Defence

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Web www.1stlinedefence.co.uk Company Reg No. 07717863



1ST LINE DEFENCE



Executive Summary

Site Location and Description

The site is located in Fazakerley, approximately 6km north-east of the centre of Liverpool.

Recent aerial imagery dating from 2023 suggests that the Aintree University Hospital structures previously situated on site have recently been demolished. The site currently comprises areas of vacant open ground, as well as Sixth, Seventh, Eighth, Ninth and Tenth Avenue and an area of car park in the west. Sefton Road and Woodlands Road run along the northern and southern boundaries of the site respectively.

Hospital infrastructure borders the site to the east and south, while an area of car parking is situated to the north and residential housing is located to the west.

The site is approximately centred on the OS grid reference: **SJ 3789997065**.

Proposed Works

The nature and extent of proposed works are not known at this stage.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the site to be underlain by Wilmslow Sandstone Formation, of the Triassic period. Superficial deposits include Shirdley Hill Sand Formation, of the Quaternary period.

Site-specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that there is an overall **Low Risk** from German and anti-aircraft unexploded ordnance at the site of proposed works. There is an assessed **Negligible Risk** from Allied unexploded ordnance.

The Risk from German Air-Delivered UXO

- During WWII, the site was located within the County Borough of Liverpool. According to official Home Office bombing statistics, this borough sustained an overall moderate-high density of bombing, with an average of 91.5 items of ordnance recorded per 1,000 acres. Luftwaffe Target Mapping highlights several targets across the city, including Fazakerley Hospital and Sanatorium, within which the site was located.
- Local written records highlight two bombing incidents at the hospital. The first, in September 1940, affected the Nurses' Home, which is believed to have been situated immediately south of the site. The second, a parachute mine falling on the west wing of Fazakerley Sanatorium, occurred in October 1940. Neither of these bomb strikes are anticipated to have affected the site boundary.
- Following the bombing incidents mentioned above, both the Nurses' Home and the west wing of Fazakerley Sanatorium are noted as sustaining damage, with the latter of the two being described as 'demolished'. This is visible in 1946 aerial imagery and wartime ground level imagery. However, no damage is recorded to any of the buildings within the site, which all appear intact and undamaged in post-war imagery.
- Due to the site's mixed composition, the ground cover is not anticipated to have been homogenous across the site. Generally, evidence of UXO is likely to have been spotted, reported and dealt with in areas of the site comprising hospital buildings. Areas of the site comprising undeveloped, soft and vegetated ground are anticipated to have been less conducive to spotting evidence of UXO, such as bomb entry holes which could be as small as 20cm in diameter.
- Owing to the fact that the site comprised a number of hospital buildings within the grounds of Fazakerley Hospital, access and observation of the site are anticipated to have been relatively frequent, with the site likely to have been subject to specific post-raid checks.

- No positive evidence has been found to suggest that the site was subject to any bombing during WWII. Given the site's undamaged appearance in post-war aerial imagery, it is anticipated that access across the site would have remained frequent throughout the war. As such, it is not considered likely that any evidence of UXBs would have gone unnoticed and unrecorded. As such, the site has been assessed to hold an overall **Low Risk** from UXO contamination.

The Risk from Allied UXO

- No evidence could be found to indicate that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA.
- The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding air delivered ordnance.

Post-WWII Redevelopment

- Since WWII, all hospital structures have been removed, with the west of the site now comprising a car park. The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the Aintree University Hospital, Liverpool site:

Activity	Recommended Risk Mitigation Measure
All Works	• UXO Risk Management Plan • Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.



Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti-Aircraft
HE	High Explosive
IB	Incendiary Bomb
JSEODOC	Joint Services Explosive Ordnance Disposal Operation Centre
LAA	Light Anti-Aircraft
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
NFF	National Filling Factory
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD2	Anti-personnel "Butterfly Bomb"
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	Flying Bomb (Doodlebug)
V-2	Long Range Rocket
WAAF	Women's Auxiliary Air Force
X	Exploded

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1st Line Defence Limited®

Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Aintree University Hospital, Liverpool

Client: GRM Development Solutions Ltd

1. Introduction

1.1. Background

1st Line Defence has been commissioned by GRM Development Solutions Ltd to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at Aintree University Hospital, Liverpool.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in CIRIA C681, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry.'

2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at Aintree University Hospital, Liverpool. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The likelihood that the site was contaminated with UXO.
2. The likelihood that UXO remains on the site.
3. The likelihood that UXO may be encountered during the proposed works.
4. The likelihood that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German air delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives and Liverpool Record Office.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by GRM Development Solutions Ltd.
- Available material from 33 Engineer Regiment (EOD) Archive (part of 29 Explosive Ordnance and Disposal and Search Group).
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

3. Background to Bombing Records

3.1. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are, to a degree, subjective. To counter this, a range of sources have been consulted, presented and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3.2. German Bombing Records

During WWII, bombing records were generally gathered locally by the police, Air Raid Precaution (ARP) wardens and military personnel. These records typically contained information such as the date, the location, the amount of damage caused and the types of bombs that had fallen during an air raid. This information was made either through direct observation or post-raid surveys. The Ministry of Home Security Bomb Census Organisation would then receive this information, which was plotted onto maps, charts, and tracing sheets by regional technical officers. The collective record set (regional bomb census mapping and locally gathered incidents records) would then be processed and summarised into reports by the Ministry of Home Security Research and Experiments Branch. The latter were tasked with providing the government 'a complete picture of air raid patterns, types of weapons used and damage caused- in particular to strategic services and installations such as railways, shipyards, factories and public utilities.'

The quality, detail and nature of record keeping could vary considerably between provincial towns, boroughs and cities. No two areas identically collated or recorded data. While some local authorities maintained records with a methodical approach, sources in certain areas can be considerably more vague, dispersed, and narrower in scope. In addition, the immediate priority was mostly focused on assisting casualties and minimising damage at the time. As a result, some records can be incomplete and contradictory. Furthermore, many records were even damaged or destroyed in subsequent air raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Whereas records of attacks on military or strategic targets were often maintained separately and have not always survived.

3.3. Allied Records

During WWII, considerable areas of land were requisitioned by the War Office for the purpose of defence, training, munitions production and the construction of airfields. Records relating to military features vary and some may remain censored. Within urban environments datasets will be consulted detailing the location of munition production as well as wartime air and land defences. In rural locations it may be possible to obtain plans of military establishments, such as airfields, as well as training logs, record books, plans and personal memoirs. As with bombing records, every reasonable effort will be made to access records of, and ascertain any evidence of, military land use. However, there are occasions where such evidence is not available, as records may not be accessible, have been lost/destroyed, or simply were not kept in the first place.

4. UK Regulatory Environment and Guidelines

4.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

4.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation for parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

4.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

4.4. CIRIA C681

In 2009, the Construction Industry Research and Information Association (CIRIA) produced a guide to the risk posed by UXO to the UK construction industry (CIRIA C681). CIRIA is a neutral, independent and not-for-profit body, linking organisations with common interests and facilitating a range of collaborative activities that help improve the industry.

The publication provides the UK construction industry with a defined process for the management of risks associated with UXO from WWI and WWII air bombardment. It is also broadly applicable to the risks from other forms of UXO that might be encountered. It focuses on construction professionals' needs, particularly if there is a suspected item of UXO on site, and covers issues such as what to expect from a UXO specialist. The guidance also helps clients to fulfil their legal duty under CDM 2015 to provide designers and contractors with project specific health and safety information needed to identify hazards and risks associated with the design and construction work. This report conforms to this CIRIA guidance and to the various recommendations for good practice referenced therein. It is recommended that this document is acquired and studied where possible to allow a better understanding of the background to both the risk assessment process and the UXO issue in the UK in general.

4.5. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

5. The Role of Commercial UXO Contractors and The Authorities

5.1. Commercial UXO Specialists

The role of a UXO Specialist (often referred to as UXO Consultant or UXO Contractor) such as 1st Line Defence, is defined in CIRIA C681 as the provision of expert knowledge and guidance to the client on the most appropriate and cost-effective approach to UXO risk management at a site.

The principal role of UXO Specialists is to provide the client with an appropriate assessment of the risk posed by UXO for a specific project, and identify and carry out suitable methodology for the mitigation of any identified risks to reduce them to an acceptable level.

The requirement for a UXO Specialist should ideally be identified in the initial stages of a project, and it is recommended that this occur prior to the start of any detailed design. This will enable the client to budget for expenditure that may be required to address the risks from UXO, and may enable the project team to identify appropriate techniques to eliminate or reduce potential risks through considered design, without the need for UXO specific mitigation measures. The UXO Specialist should have suitable qualifications, levels of competency and insurances.

Please note 1st Line Defence has the capability to provide a complete range of required UXO risk mitigation services, in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

5.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal Operation Centre (JSEODOC) to arrange for investigation and/or disposal. Within the Metropolitan Police Operational Area, SO15 EOD will be tasked to any discovery of suspected UXO. The request for Explosive Officer (Expo) support is well understood and practiced by all Metropolitan Boroughs. The requirement for any additional assets will then be coordinated by the Expo if required.

In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on the EOD teams' judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. The speed of response varies; authorities may respond immediately or in some cases it may take several days for the item of ordnance to be dealt with. Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high-risk situations. If there are regular UXO finds on a site the JSEODOC may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

6. The Site

6.1. Site Location

The site is located in Fazakerley, approximately 6km north-east of the centre of Liverpool. Hospital infrastructure borders the site to the east and south, while an area of car parking is situated to the north and residential housing is located to the west.

The site is approximately centred on the OS grid reference: **SJ 3789997065**.

Site location maps are presented in **Annex A**.

6.2. Site Description

Recent aerial imagery dating from 2023 suggests that the Aintree University Hospital structures previously situated on site have recently been demolished. The site currently comprises areas of vacant open ground, as well as Sixth, Seventh, Eighth, Ninth and Tenth Avenue and an area of car park in the west. Sefton Road and Woodlands Road run along the northern and southern boundaries of the site respectively.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

7. Scope of the Proposed Works

7.1. General

The nature and extent of proposed works are not known at this stage.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the site to be underlain by Wilmslow Sandstone Formation, of the Triassic period. Superficial deposits include Shirdley Hill Sand Formation, of the Quaternary period.

8.2. Site-Specific Geology

Site-specific geotechnical data was not provided by the client during the production of this report.

9. Site History

9.1. Introduction

The purpose of this section is to identify the composition of the site pre and post-WWII. It is important to establish the historical use of the site, as this may indicate the site's relation to potential sources of UXO as well as help with determining factors such as the land use, groundcover, likely frequency of access and signs of bomb damage.

9.2. Summary of the Historical Background of the Site

The site is located within the grounds of Aintree University Hospital. This facility initially opened in 1906 as City Hospital North, Fazakerley, and specialised in treating infectious diseases.¹ The hospital comprised nine wards and four isolation blocks for around 350 patients, including 25 beds for patients with TB, as well as an administration block, kitchen block, nurses home, laundry, dispensary, mortuary, doctors house and porters lodge.

During WWI, the hospital was renamed 1st Western General, and treated wounded soldiers. In 1920, the Fazakerley Sanatorium was opened following a delay due to the war. The Sanatorium, to the south of the original City Hospital, housed 245 pulmonary TB patients across several wards and pavilions.² In WWII the hospital again treated injured soldiers under the name 1st Western General.

In the two decades following WWII, the Sanatorium became Aintree Hospital, and the original City Hospital became Fazakerley Infectious Hospital in 1947, Fazakerley Hospital in 1968, and Fazakerley District General Hospital in 1974.³ More recently, the two have combined to form Aintree University Hospital.

9.3. Ordnance Survey Historical Maps

Relevant historical maps were obtained for this report and are presented in **Annex D**. See below for a summary of the site history shown on acquired mapping.

Pre-WWII		
Date	Scale	Description
1927	1:2,500	This map shows the site to comprise three large hospital buildings and a smaller building in the north-west. Further hospital structures border the site to the north, east and south, while open land is situated to the west.

Post-WWII		
Date	Scale	Description
1955-59	1:2,500	This map shows the majority of the site to have remained the same, however the smaller structure in the north-west has now been expanded and further small buildings have been developed in the south-west. Hospital infrastructure continues to border to the north, east and south.

9.4. Pre-WWII Photography of the Site

Pre-WWII aerial photography has been obtained from the Aerofilms collection available from Britain From Above. This imagery provides a view of the site in 1935 (see **Annex E**). See below for a description:

Pre-WWII Aerial Photography	
Date	Description
1935	This image, taken in 1935, shows the site to comprise three large buildings and two smaller structures within the grounds of Fakazerley Hospital. Additional hospital buildings are situated to the north, east and south of the site.

¹ <https://lostliverpool.blogspot.com/2008/02/history-of-university-hospital-aintree.html>

² <https://historicengland.org.uk/services-skills/education/educational-images/fazakerley-sanatorium-and-isolation-hospital-liverpool-11976>

³ Bob Edwards' Liverpool Picture Book Project, *Fazakerley Hospital*

10. Introduction to German Air Delivered Ordnance

10.1. General

During WWI and WWII, the UK was subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place. This occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this section of the report will concern German air delivered ordnance dropped during WWII, although WWI bombing will also be considered.

10.2. Generic Types of WWII German Air Delivered Ordnance

To provide an informed assessment of the hazards posed by any items of unexploded ordnance that may remain in situ on site, the table below provides information on the types of German air delivered ordnance most commonly used by the Luftwaffe during WWII. Images and brief summaries of the characteristics of these items of ordnance are listed in **Appendices i-iii**.

Generic Types of WWII German Air Delivered Ordnance		
Type	Frequency	Likelihood of Detection
High Explosive (HE) bombs	In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see Annex F). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded smaller bomb. UXBs therefore present the greatest risk to present-day intrusive works.
1kg Incendiary bombs (IB)	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII.	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could easily go unnoticed.
Large Incendiary bombs (IB)	These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Aerial or Parachute mines (PM)	These were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs would generally have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
Anti-personnel (AP) bomblets	These were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

10.3. Failure Rate of German Air Delivered Ordnance

It has been estimated that 10% of WWII German air delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945, bomb disposal teams reportedly dealt with a total of 50,000 explosive items of 50kg, over 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, see press articles in **Annex G**.

10.4. UXB Ground Penetration

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.
- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

10.4.1. The J-Curve Principle

J-curve is the term used to describe the characteristic curve commonly followed by an air delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly, however, is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be higher in certain conditions (see **Annex F**).

10.4.2. WWII UXB Ground Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were drawn predicting the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1,000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

10.4.3. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters should be used:

- WWII geology – Wilmslow Sandstone Formation
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the limitations of site-specific geotechnical information provided for the purpose of this report. An assessment can be made once further information becomes available or by an UXO Specialist on-site.

10.5. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1, known as the flying bomb or pilotless aircraft, and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

Although these weapons caused considerable damage, their range was limited by their position of deployment across Europe and as a result the vast majority of V-weapon strikes were directed against targets in the south-east of England, predominantly in the London Boroughs and Home Counties. This limitation of capability meant targets in north-west England were generally too far to be considered for V-weapon strikes by the Luftwaffe. The risk from V-weapons is therefore considered negligible and will not be further addressed in this report.

11. The Likelihood of Contamination from German Air Delivered UXBs

11.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. The objective of these raids was to unnerve the British public, to destroy strategic targets and to ultimately attempt to coerce Britain's capitulation from the war. A WWI map of air raids and naval bombardments across the UK was consulted, see **Annex H**. This source does not record any bombing incidents in Liverpool.

WWI bombs were generally smaller and dropped from a lower altitude than those used in WWII. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density, the risk from WWI UXBs is considered low and will not be further addressed in this report.

11.2. World War II Bombing of the County Borough of Liverpool

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII the site was located within the County Borough of Liverpool, which sustained an overall moderate-high density of bombing, as represented by bomb density data figures below. Liverpool was the UK's largest west-coast port, with said port being a key location for Allied imports into Britain. Luftwaffe Target Mapping highlights several other non-port targets, including Fazakerley Hospital and Sanatorium, within which the site was located (see **Annex I**).

Records of bombing incidents in the civilian areas of the district were typically collected by Air Raid Precautions wardens and collated by Civil Defence personnel. Some other organisations, such as port and railway authorities, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents are presented in the following sections.

11.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German air delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the County Borough of Liverpool between 1940 and 1945.

Record of German Ordnance Dropped on the County Borough of Liverpool		
Area Acreage		27,321
Weapons	High Explosive bombs (all types)	2,332
	Parachute mines	117
	Oil bombs	50
	Phosphorus bombs	0
	Fire pots	0
	Pilotless aircraft (V-1)	0
	Long range rocket bombs (V-2)	0
Total		2,499
Number of Items per 1,000 acres		91.5
Source: Home Office Statistics		
This table does not include UXO found during or after WWII.		

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were similarly designed to inflict damage and injury. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous. Although Home Office statistics did not record these types of ordnance, both should not be overlooked when assessing the general risk to personnel and equipment.

11.4. Liverpool Bomb Census Tracings

Several tracings of bomb strikes were obtained from The National Archives for the Liverpool Docklands and their surroundings. These tracings show buildings that were hit by bombing, and were likely traced from historical OS maps of the time. As they were traced, they do not show buildings that were not affected and the scale of approximate quality. The tracings were analysed, and those that affected the site area are presented in **Annex J** and described below.

Liverpool Bomb Census Tracings	
Date Range	Comments
21 st -22 nd December 1940	No bombs are recorded within or directly bordering the site. Two 50kg bombs, one of which unexploded, are recorded approximately 300m west of the site.

11.5. Hand Drawn Map of Bomb Damage in Liverpool

A hand drawn map with areas of damage plotted within the city of Liverpool was obtained from the Liverpool Record Office. It is believed to be an enlarged photograph of a pin-board map from the period. The map covers the entire County Borough of Liverpool, and it is thus difficult to exactly pinpoint areas of damage when magnified. The section showing the area of the site is presented in **Annex K**.

Hand Drawn Map of Bomb Damage in Liverpool	
Date Range	Comments
Presumed 1940-45	The site has been placed as accurately as possible on this map, although the small scale of the map means the exact site boundary is difficult to place. It suggests that the site area itself was not subject to any direct areas of damage. However, serious damage is recorded to the north of the site, along Longmoor Lane, and to the east of the site within the grounds of Fazakerley Isolation Hospital. Both of these are recorded approximately 200m from the site.

11.6. Summary of Air Raid Incidents

A summary of air raid incidents across Liverpool was available from the Liverpool Record Office. This record gives a brief list of air raid incidents to have occurred between 1940-41. Relevant sections of this record are presented in **Annex L** and transcribed below.

Summary of Air Raid Incidents	
Date	Comments
18 th -19 th September 1940	Heavy damage through whole of Liverpool....Nurses' Home, Fazakerley, damaged.
17 th -18 th October 1940	West wing Fazakerley Sanatorium demolished, and one patient killed.

11.7. Merseyside at War – Day-by-Day Diary

A day-by-day account regarding bombing incidents in Merseyside was obtained from Merseyside at War by Rodney Whitworth.⁴ It provided the date and time and time of bombing raids, as well as the types of bomb used and the damage caused; relevant damage is highlighted in bold. A summary of the relevant written records is presented in the table below.

Merseyside at War	
Date	Comments
17 th October 1940	In a brief raid on the 17 th of October, extensive damage was caused to a hospital, two schools and private houses in the West Derby area. The west wing of Fazakerley Sanatorium was demolished , killing a patient; and in the Smithdown Road area an unexploded bomb was found in the yard of the Morrison School.

⁴ Whitworth, R., *Merseyside at War: A Day-to-Day Diary of the 1940-1941 Bombing* (1st ed.). Scouse Press, 1988

11.8. Fazakerley Hospital Online History

An account of the history of Fazakerley Hospital and Sanatorium was consulted from an online source.⁵ This provides significant detail on the operations of the hospital, but also includes a reference to bombing sustained by the hospital in 1940. This section is transcribed below.

Fazakerley Hospital Online History	
Date	Comments
17 th October 1940	The Male Pavilion, known as West Block, was hit by a 750lbs demolition bomb which exploded on impact. There were two casualties, one fatal.

11.9. WWII-Era Photography

WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England). As well as this, ground level photography was obtained from an online source.⁶ This photography provides a record of the potential composition of the site and surroundings during the war, as well as its condition immediately following the war (see **Annex M-N**).

WWII-Era Photography	
Date/Title	Description
1 st April 1946 Annex M	This image, taken in 1946, shows the composition of the site after the end of WWII. The site can be seen to comprise a number of hospital buildings within the grounds of Fazakerley Hospital. No obvious signs of damage can be seen within or bordering the site. Approximately 100m south, significant damage can be seen to the Male Pavilion West Block, which was subject to bombing in October 1940. Based on available information, it is believed that the Nurses Home, referred to as damaged within written records, was located immediately south of the site. This building does not appear to be damaged, however if the damage was not severe, it is likely to have been repaired in the time between the incident and this image being taken.
Ground Level Image of Male Pavilion West Block Annex N	This image provides a more detailed look at the damage sustained by the Male Pavilion West Block, observable in the previous image. A section of the building is destroyed, leaving a large gap in the middle of the structure.

⁵ <https://fazakerleyhistory.blogspot.com/>

⁶ <https://fazakerleyhistory.blogspot.com/>

11.10. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records, and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

11.11. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (now part of 29 EOD & Search Group) no longer processes commercial requests for information. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works.

If any relevant information is received at a later date, GRM Development Solutions Ltd will be advised.

11.12. Evaluation of German Air Delivered UXO Records

German Air Delivered UXO Records Summary	
Factors	Conclusion
Density of Bombing <i>It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High bombing density could allow for error in record keeping due to extreme damage caused to the area.</i>	During WWII, the site was located within the County Borough of Liverpool. According to official Home Office bombing statistics, this borough sustained an overall moderate-high density of bombing, with an average of 91.5 items of ordnance recorded per 1,000 acres. Luftwaffe Target Mapping highlights several targets across the city, including Fazakerley Hospital and Sanatorium, within which the site was located. Local written records highlight two bombing incidents at the hospital. The first, in September 1940, affected the Nurses' Home, which is believed to have been situated immediately south of the site. The second, a parachute mine falling on the west wing of Fazakerley Sanatorium, occurred in October 1940. Neither of these bomb strikes are anticipated to have affected the site boundary.
Damage <i>If buildings or structures on a site sustained bomb or fire damage, any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same or later raids.</i>	Following the bombing incidents mentioned above, both the Nurses' Home and the west wing of Fazakerley Sanatorium are noted as sustaining damage, with the latter of the two being described as 'demolished'. This is visible in 1946 aerial imagery and wartime ground level imagery. However, no damage is recorded to any of the buildings within the site, which all appear intact and undamaged in post-war imagery.
Ground Cover <i>The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.</i>	Due to the site's mixed composition, the ground cover is not anticipated to have been homogenous across the site. Generally, evidence of UXO is likely to have been spotted, reported and dealt with in areas of the site comprising hospital buildings. Areas of the site comprising undeveloped, soft and vegetated ground are anticipated to have been less conducive to spotting evidence of UXO, such as bomb entry holes which could be as small as 20cm in diameter.
Access Frequency <i>UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied.</i>	Owing to the fact that the site comprised a number of hospital buildings within the grounds of Fazakerley Hospital, access and observation of the site are anticipated to have been relatively frequent, with the site likely to have been subject to specific post-raid checks.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

12. Introduction to Allied Ordnance

12.1. General

Many areas across the UK may be at risk from Allied UXO because of both wartime and peacetime military use. Typical military activities and uses that may have led to a legacy of military UXO at a site include former minefields, home guard positions, anti-aircraft emplacements, training and firing ranges, military camps, as well as weapons manufacture and storage areas.

Although land formerly used by the military was usually subject to clearance before returned to civilian use, items of UXO are sometimes discovered and can present a potential risk to construction projects.

It should be highlighted that there is no evidence that the site formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Despite this, urban areas, such as the location of the site, can be at risk from buried unexploded anti-aircraft projectiles fired during WWII – as addressed below.

12.2. Defending the UK From Aerial Attack

During WWII the War Office employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

Active Defences	Passive Defences
• Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids.

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

12.3. Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

Anti-Aircraft Artillery				
Item	Description			
HAA	These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers. They often fired large HE projectiles, which were usually initiated by integral fuzes, triggered by impact, area, time delay or a combination of aforementioned mechanisms.			
LAA	These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m.			
Variations in HAA and LAA Ammunition	Gun type	Calibre	Shell Weight	Shell Dimensions
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm
	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
Z-AA	Rockets were commonly designed to destroy heavily armoured military vehicles (anti-tank weapon). The device contains an explosive head (warhead) that can be accelerated using internal propellants to an intended target. Anti-aircraft rocket batteries were also utilised as part of air defence measures.			

The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding air delivered ordnance. Unexploded anti-aircraft projectiles could essentially have fallen indiscriminately anywhere within range of the guns. The chance of such items being observed, reported and removed during the war depends on factors such as land use, ground cover, damage and frequency of access – the same factors that govern whether evidence of a UXB is likely to have been noted. More information about these factors with regards to this particular site can be found in the German Air Delivered Ordnance section of this report.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Appendix iv**.

13. The Likelihood of Contamination from Allied Ordnance

13.1. Introduction

There are several factors that may serve to either affirm, increase, or decrease the level of risk within a site with a history of military usage. Such factors are typically dependent upon the proximity of the proposed area of works to training activities, munition productions and storage, as well as its function across the years.

This section will examine the history of the proposed site and assess to what degree, if any, the site could have become contaminated as a result of the military use of the surrounding area.

13.2. Evaluation of Contamination Risk from Allied UXO

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

Allied UXO Records Summary	
Sources of Allied UXO Contamination	Conclusion
Military Camps	1 st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences <i>Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.</i>	1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 2.2km south-west of the site. Despite this distance the maximum effective range of an AA projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are generally analogous to those regarding German air delivered ordnance.
Home Guard Activity <i>The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.</i>	Evidence of Home Guard activity is often difficult to locate, owing to the ad-hoc nature of Home Guard activity within each local area. Such training was often conducted on a small scale at the discretion of individual commanders and as such was seldom recorded officially. As such, no positive evidence could be found to confirm the presence of HG units within proximity to the site.
Defensive Positions <i>Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.</i>	There is no evidence of any pillbox, emplacement or other defensive features formerly located on or bordering the site footprint.
Training or firing ranges	No evidence of training or firing ranges could be found within the site or surrounding area.
Defensive Minefields	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.
Military Related Airfields	The site was not situated within the perimeters or vicinity of a military airfield.

14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German air delivered and Allied ordnance. Factors such as the risk of UXO initiation, remaining, and encountering will be discussed later in the report.

UXO Contamination Summary	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, Luftwaffe reconnaissance imagery, official Home Office bombing statistics, Bomb Census tracings, a hand drawn bomb damage map, a summary of air raid incidents, anecdotal and published accounts, and WWII-era aerial and ground level photography of the site. The record set is of generally adequate quality. Although no comprehensive record set covering Liverpool is known to have survived the war intact, the fact that the site was situated within Fazakerley Hospital means that this report was able to consult histories of the facility, making up for the shortcomings of the official record set.
German Air-Delivered Ordnance	- During WWII, the site was located within the County Borough of Liverpool. According to official Home Office bombing statistics, this borough sustained an overall moderate-high density of bombing, with an average of 91.5 items of ordnance recorded per 1,000 acres. Luftwaffe Target Mapping highlights several targets across the city, including Fazakerley Hospital and Sanatorium, within which the site was located. - Local written records highlight two bombing incidents at the hospital. The first, in September 1940, affected the Nurses' Home, which is believed to have been situated immediately south of the site. The second, a parachute mine falling on the west wing of Fazakerley Sanatorium, occurred in October 1940. Neither of these bomb strikes are anticipated to have affected the site boundary. - Following the bombing incidents mentioned above, both the Nurses' Home and the west wing of Fazakerley Sanatorium are noted as sustaining damage, with the latter of the two being described as 'demolished'. This is visible in 1946 aerial imagery and wartime ground level imagery. However, no damage is recorded to any of the buildings within the site, which all appear intact and undamaged in post-war imagery. - Due to the site's mixed composition, the ground cover is not anticipated to have been homogenous across the site. Generally, evidence of UXO is likely to have been spotted, reported and dealt with in areas of the site comprising hospital buildings. Areas of the site comprising undeveloped, soft and vegetated ground are anticipated to have been less conducive to spotting evidence of UXO, such as bomb entry holes which could be as small as 20cm in diameter. - Owing to the fact that the site comprised a number of hospital buildings within the grounds of Fazakerley Hospital, access and observation of the site are anticipated to have been relatively frequent, with the site likely to have been subject to specific post-raid checks. - No positive evidence has been found to suggest that the site was subject to any bombing during WWII. Given the site's undamaged appearance in post-war aerial imagery, it is anticipated that access across the site would have remained frequent throughout the war. As such, it is not considered likely that any evidence of UXBs would have gone unnoticed and unrecorded. As such, the site has been assessed to hold an overall Low Risk from UXO contamination.
Allied Ordnance	- No evidence could be found to indicate that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. - The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding air delivered ordnance.

15. The Likelihood that UXO Remains

15.1. Introduction

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

15.2. UXO Clearance

1st Line Defence has found no evidence in the public domain or within internal records that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from the 33 EOD Regiment Archive (now part of 29 EOD & Search Group). It should also be noted that in addition to 29 EOD & Search Group archival information, 1st Line Defence also do not currently have access to data that may be relevant including 5131(BD)SQN Archive, SD Training Technical Advisory Section (TAS) and MACA Records (bomb disposal callouts).

If such information is available at a later date, it is recommended that it be reviewed as it will assist with understanding both levels and types of contamination likely to be present, and may indicate risk reduction in certain areas.

15.3. Post-War Redevelopment

Since WWII, all hospital structures have been removed, with the west of the site now comprising a car park.

The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

16. The Likelihood of UXO Encounter

16.1. Introduction

For UXO to pose a risk at a site, there should be a means by which any potential UXO might be encountered on that site.

The likelihood of encountering UXO on the site of proposed works would depend on various factors, such as the type of UXO that might be present and the intrusive works planned on site. In most cases, UXO is more likely to be present below surface (buried) than on surface.

In general, the greater the extent and depth of intrusive works, the greater the risk of encountering. The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

Generally speaking, the risk of encountering any type of UXO will be minimal for any works planned within the footprint and down to the depth of post-war foundations and excavations.

16.2. Encountering Air Delivered Ordnance

Since an air delivered bomb may come to rest at any depth between just below ground level and its maximum penetration depth, there is a chance that such an item (if present) could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level as well as at depth.

17. The Likelihood of UXO Initiation

17.1. Introduction

UXO does not spontaneously explode. Older UXO devices will require an external event/energy to create the conditions for detonation to occur. The likelihood that a device will function can depend on a number of factors including the type of weaponry, its age and the amount of energy it is struck with.

17.2. Initiating Air Delivered Ordnance

Unexploded bombs do not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur.

In recent decades, there have been a number of incidents in Europe where Allied UXBs have detonated, and incidents where fatalities have resulted. There have been several hypotheses as to the reason why the issue is more prevalent in mainland Europe – reasons could include the significantly greater number of bombs dropped by the Allied forces on occupied Europe, the preferred use by the Allies of mechanical rather than electrical fuzes, and perhaps just good fortune. The risk from UXO in the UK is also being treated very seriously in many sectors of the construction industry, and proactive risk mitigation efforts will also have affected the lack of detonations in the UK.

There are certain construction activities which make initiation more likely, and several potential initiation mechanisms must be considered:

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clock	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

18. Consequences of Initiation/Encounter

18.1. Introduction

The repercussions of the inadvertent detonation of UXO during intrusive ground works, or if an item or ordnance is interfered with or disturbed, are potentially profound, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. However, if appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low.

The consequences of encountering UXO can be particularly notable in the case of high-profile sites (such as airports and train stations) where it is necessary to evacuate the public from the surrounding area. A site may be closed for anything from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve significant loss of production.

18.2. Consequences of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

19. 1st Line Defence Risk Assessment

19.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

19.2. Assessed Risk Level

1st Line Defence has assessed that there is an overall **Low Risk** from German and anti-aircraft unexploded ordnance at the site of proposed works. There is an assessed **Negligible Risk** from Allied unexploded ordnance.

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs		✓		
German 1kg Incendiary Bombs		✓		
Anti-Aircraft Artillery Projectiles		✓		
Allied Land Service and Small Arms Ammunition	✓			

Please note – although the risk from unexploded ordnance on this site has been assessed as 'Low', this does not mean there is 'no' risk of encountering UXO. This report has been undertaken with due diligence, and all reasonable care has been taken to access and analyse relevant historical information. By necessity, when dealing historical evidence, and when making assessments of UXO risk, various assumptions have to be made which we have discussed and justified throughout this report. Our reports take a common-sense and practical approach to the assessment of risk, and we strive to be reasonable and pragmatic in our conclusions.

It should however be stressed that if any suspect items are encountered during the proposed works, 1st Line Defence should be contacted for advice/assistance, and to re-assess the risk where necessary. The mitigation measures outlined in the next section are recommended as a minimum precaution to alert ground personnel to the history of the site, what to look out for, and what measures to take in the event that a suspect item is encountered. It should also be noted that the conclusions of this report are based on the scope of works outlined in the 'Proposed Works' section of this report. Should the scope of works change or additional works be proposed, 1st Line Defence should be contacted to re-evaluate the risk.

20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at Aintree University Hospital, Liverpool:

Recommended Risk Mitigation Measures	
Activity	Recommended Risk Mitigation Measure
All Works	UXO Risk Management Plan It is recommended that a site-specific plan for the management of UXO risk be written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc. Contact 1st Line Defence for help/more information. Site Specific UXO Awareness Briefings to all personnel conducting intrusive works. As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited

21st November 2024

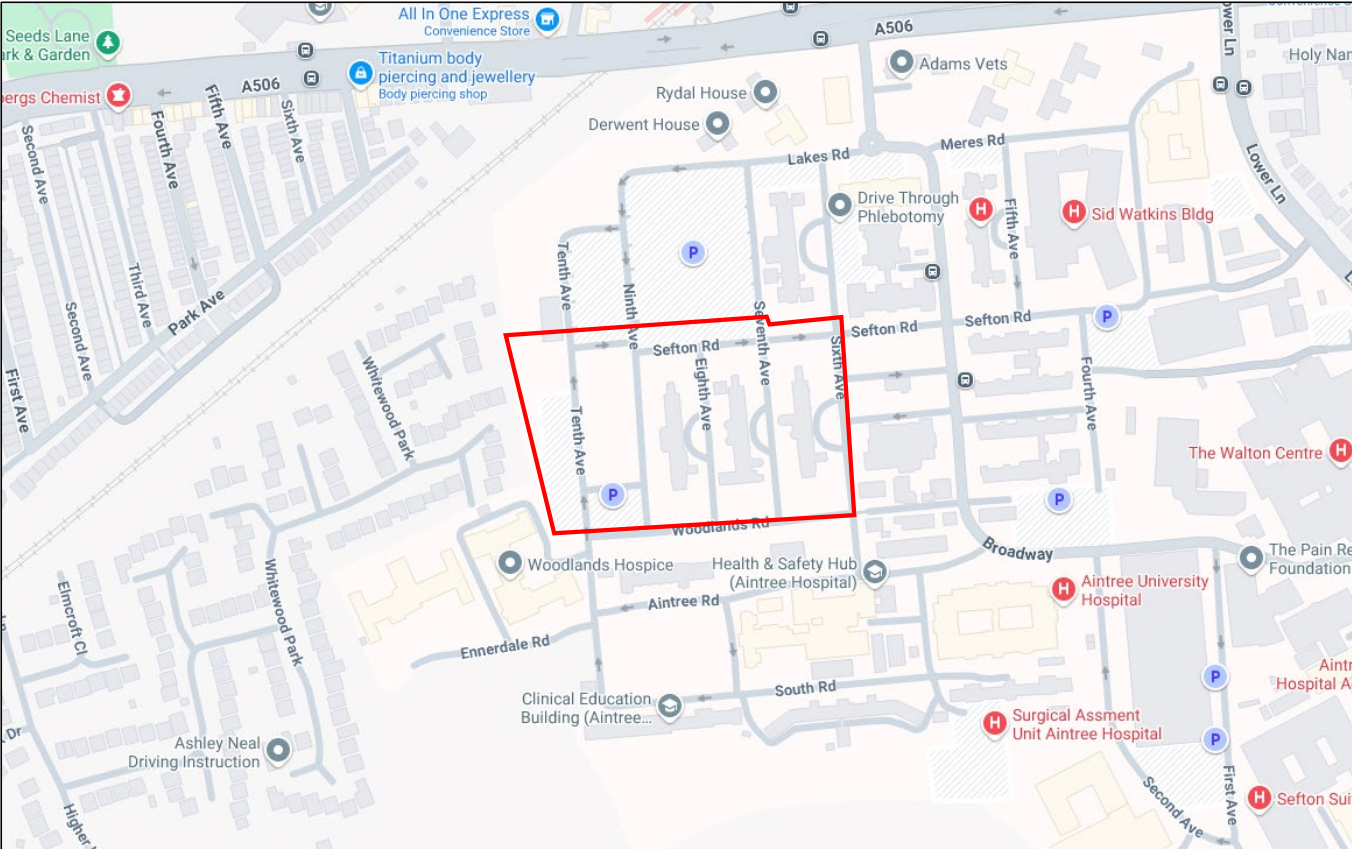
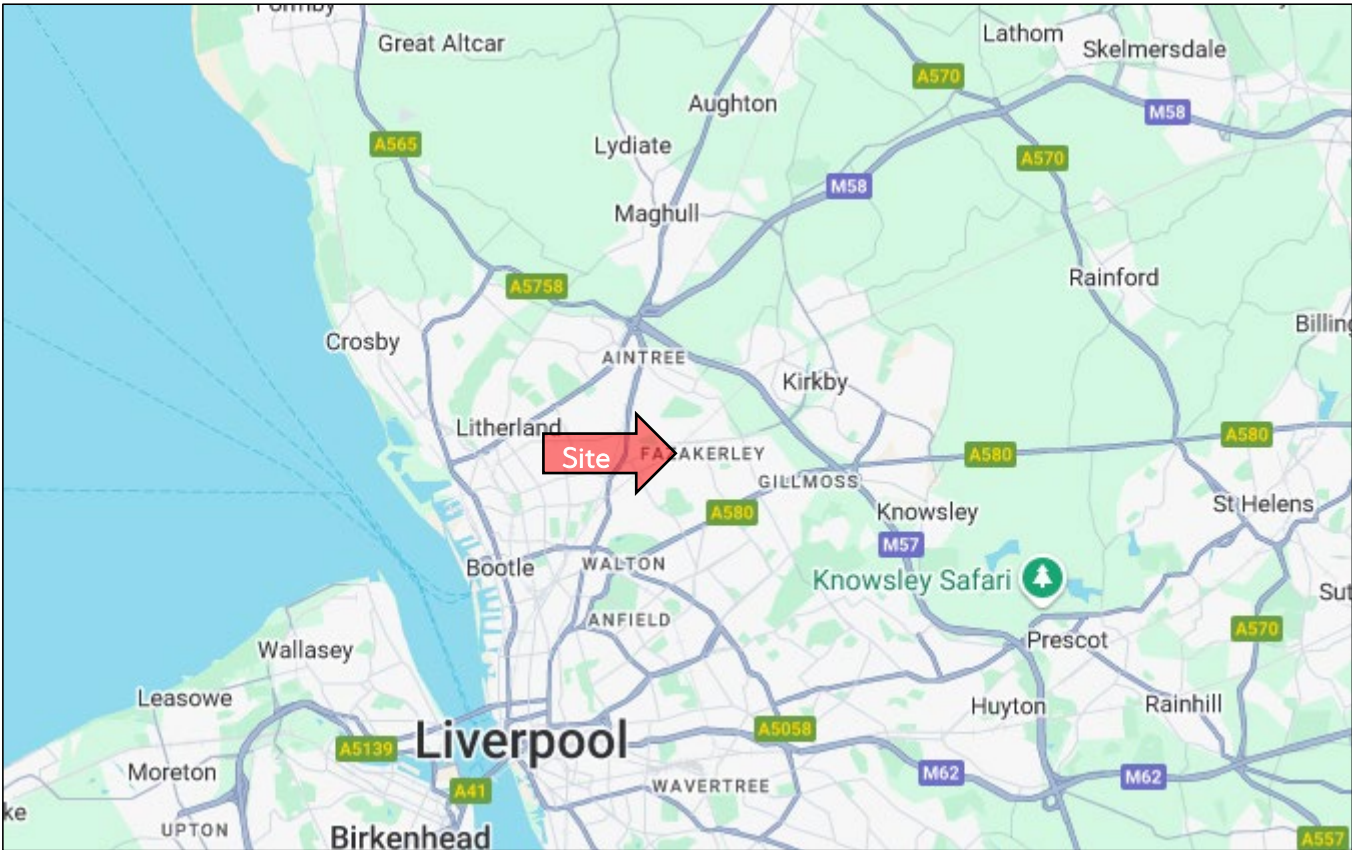
This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

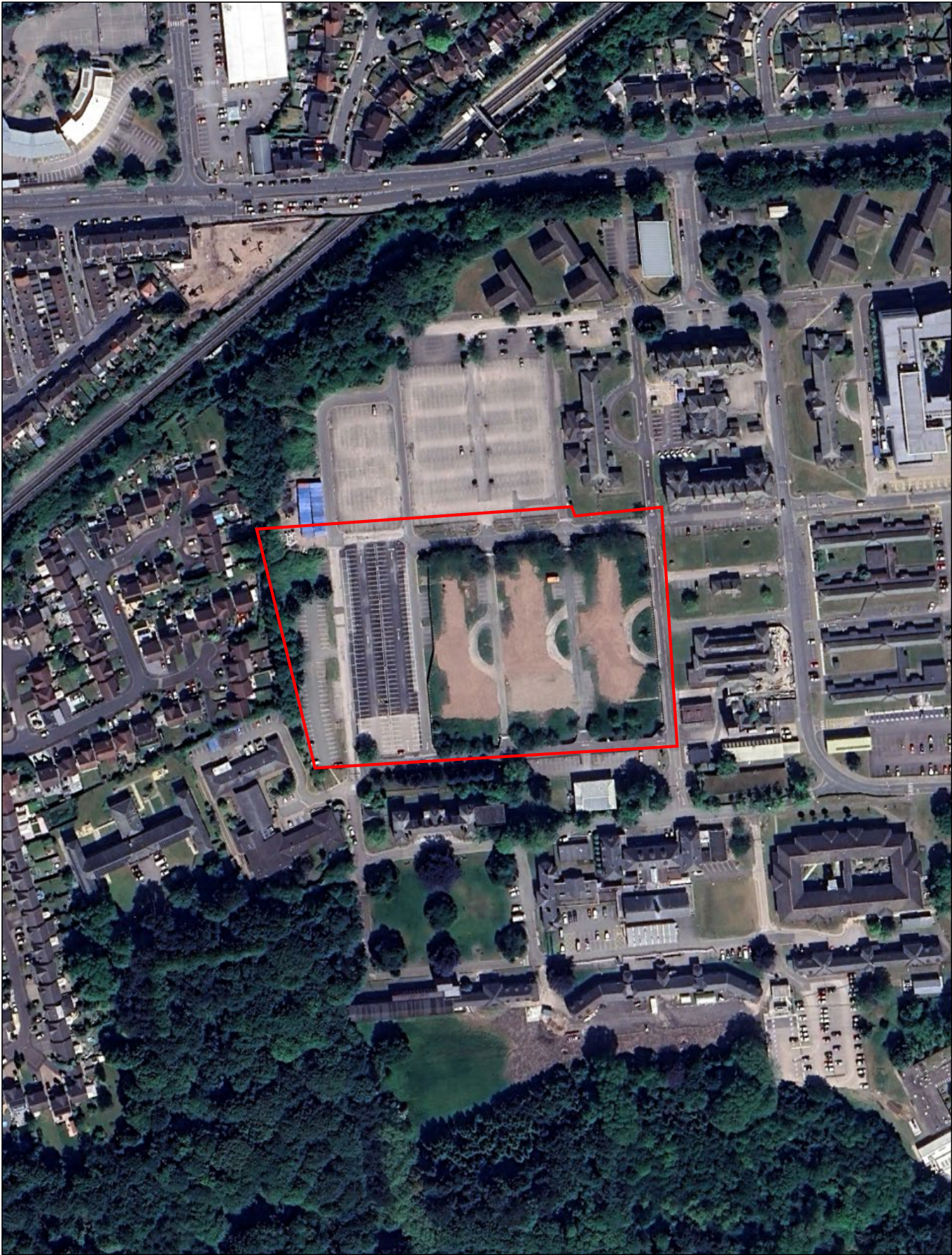
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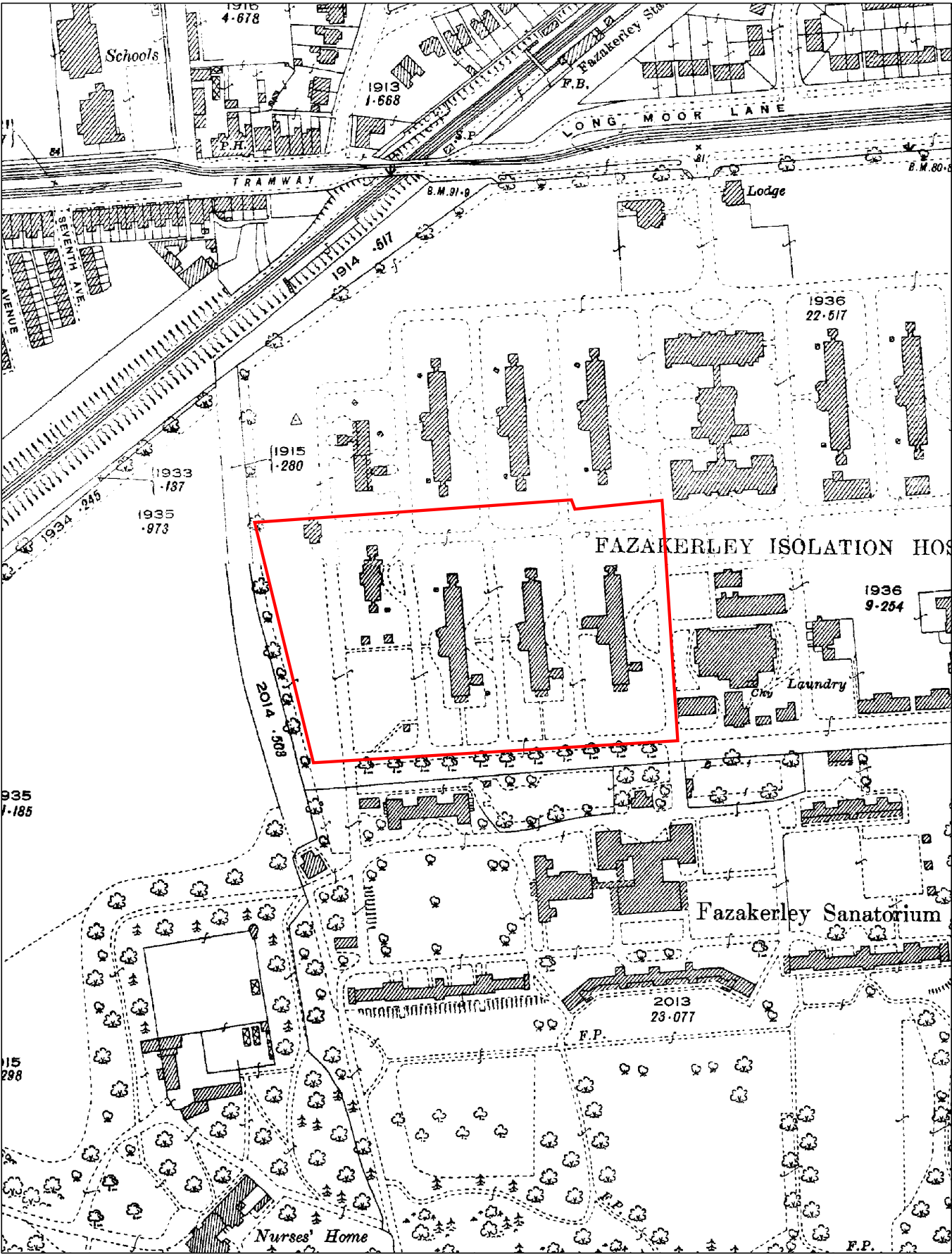
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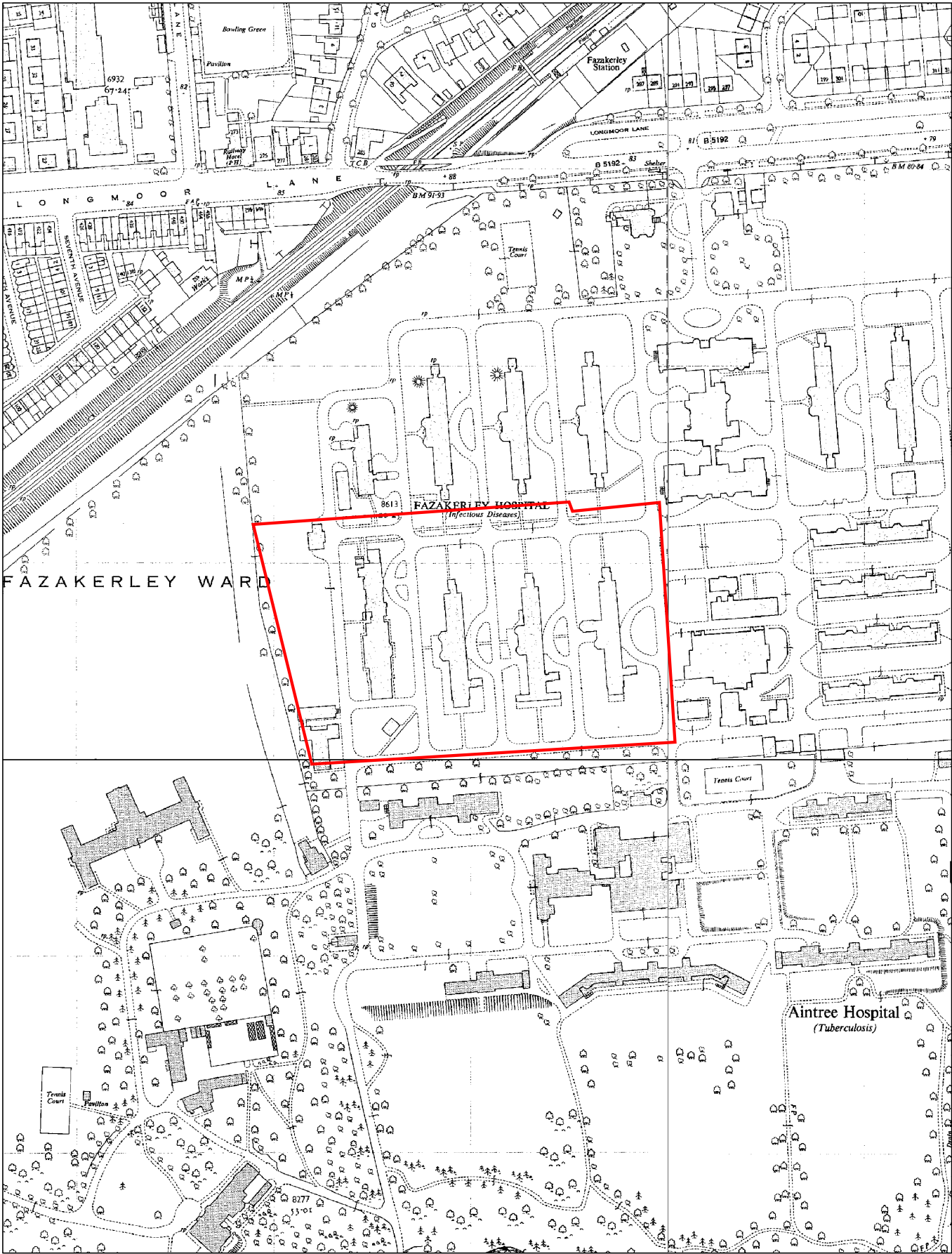
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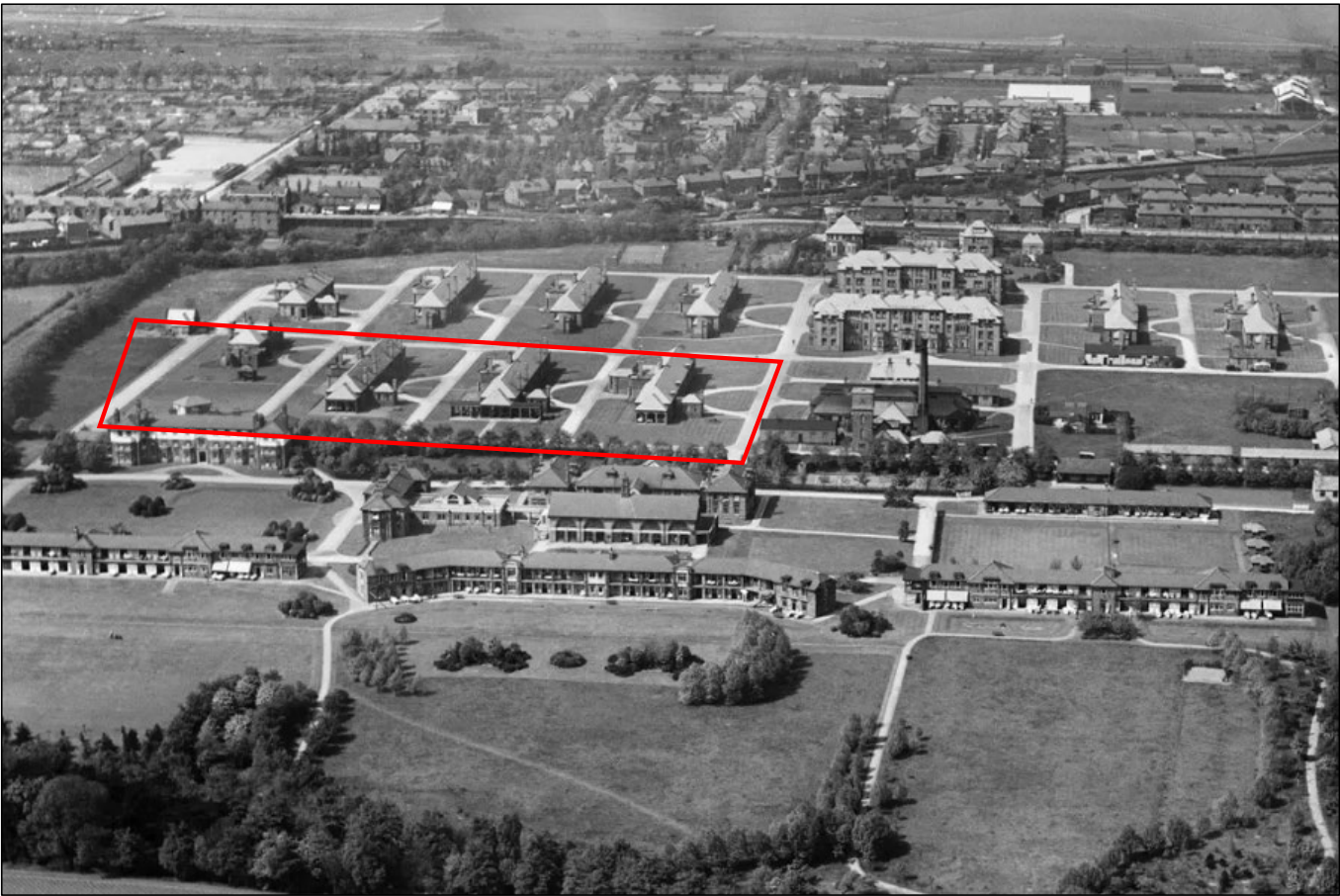
Project: Aintree University Hospital, Liverpool

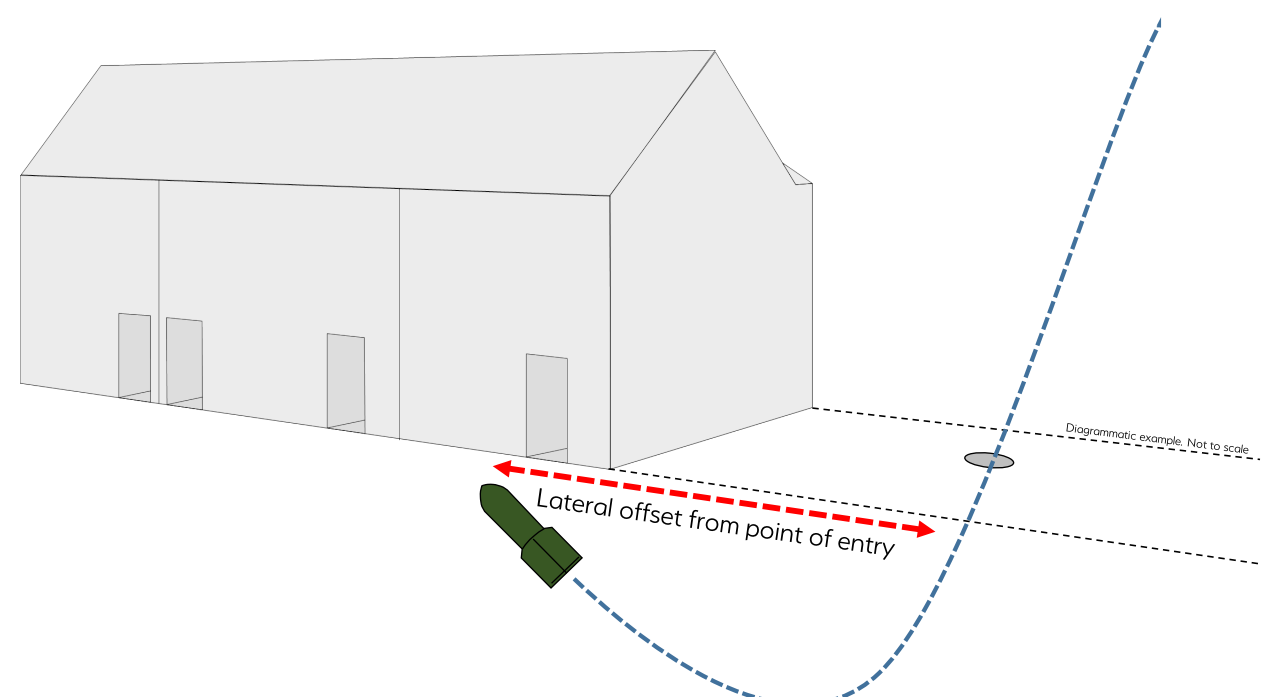
Ref: DA9796b-00

Source: Landmark Maps

Approximate site boundary







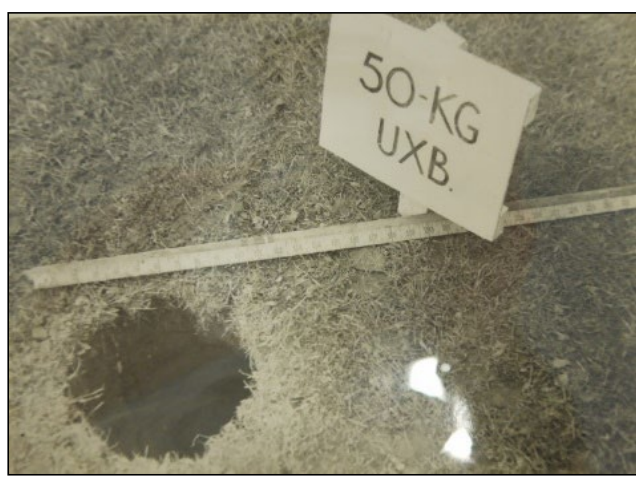




Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites.

The photograph **above** shows a 250kg unexploded bomb found in Bermondsey in 2015, pointing upwards, demonstrating 'J-curve'.

One of the most common scenarios for UXO going unnoticed was when a UXB fell into a 'bomb site' (such as the area shown **Top Left**), the entry hole of the bomb obscured by any debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).





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Source: Various sources

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BBC

NEWS

WW2 bomb found near London City Airport blown up



An unexploded World War Two bomb found near London City Airport has been detonated.

The 500kg device was discovered at the King George V Dock on Sunday during planned work at the airport.

It was closed and all flights were cancelled on Monday after an exclusion zone was put in place.

The detonation, which took place off Shoeburyness, Essex, was postponed on Tuesday because of high winds and dangerous conditions for divers.

The 1.5m-long German bomb - which was found in a bed of silt, 15m underwater - was carefully removed from the Thames and placed in a secure location a mile away from the coast of Essex.

500kg German HE Bomb, February 2018

BBC

NEWS

Great Yarmouth: Huge blast after unplanned WW2 bomb detonation



A World War Two bomb found in Great Yarmouth has detonated while work was being done to defuse it, causing a huge blast that was heard for miles.

Army specialists were attempting to disarm it when there was an unplanned detonation at about 17:00 GMT.

People on social media said they heard a loud bang and felt buildings shake 15 miles (24km) away.

There have been no reports of injuries among the Army, emergency services or the public, Norfolk Police said.

Cordons were put in place when the bomb was first discovered close to two gas pipes on Tuesday, and work began to make it safe.

250kg German HE Bomb, February 2023

BBC

NEWS

Exeter WW2 bomb is detonated after homes evacuated



More than 2,600 households and 12 university halls of residence were cleared before the 2,200lb (1,000kg) device **was destroyed** on Saturday.

Police said the blast left a crater about the size of a double-decker bus.

Police have reported large pieces of metal debris hitting buildings and said some properties in the 100m (330ft) exclusion zone had sustained "structural damage".



1000kg German HE bomb, February 2021

BBC

NEWS

Plymouth unexploded WW2 bomb: Thousands of people displaced



A 500kg (1,102lb) German World War Two bomb that forced the evacuation of thousands of people in Plymouth has been detonated at sea.

The unexploded device was **found in a garden** on St Michael Avenue on Tuesday, sparking four days of disruption.

On Friday police closed roads and rail and bus services were stopped as the bomb was transported 1.4 miles (2.3km) through the city's streets.

The device was taken by boat beyond the breakwater and detonated at 21:51 GMT.



500kg German HE Bomb, February 2024

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.



BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

1st March 2013

SPIEGEL ONLINE

Blast Kills One

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.



A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

23rd October 2006

WWII bomb injures 17 at Hattingen construction site



Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

19th September 2013

BBC NEWS

World War II bomb kills three in Germany



A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

2nd June 2010



June 2006

WW1 bomb found in garden in Walton, Liverpool by gardener

🕒 21 May 2016 | [Liverpool](#)



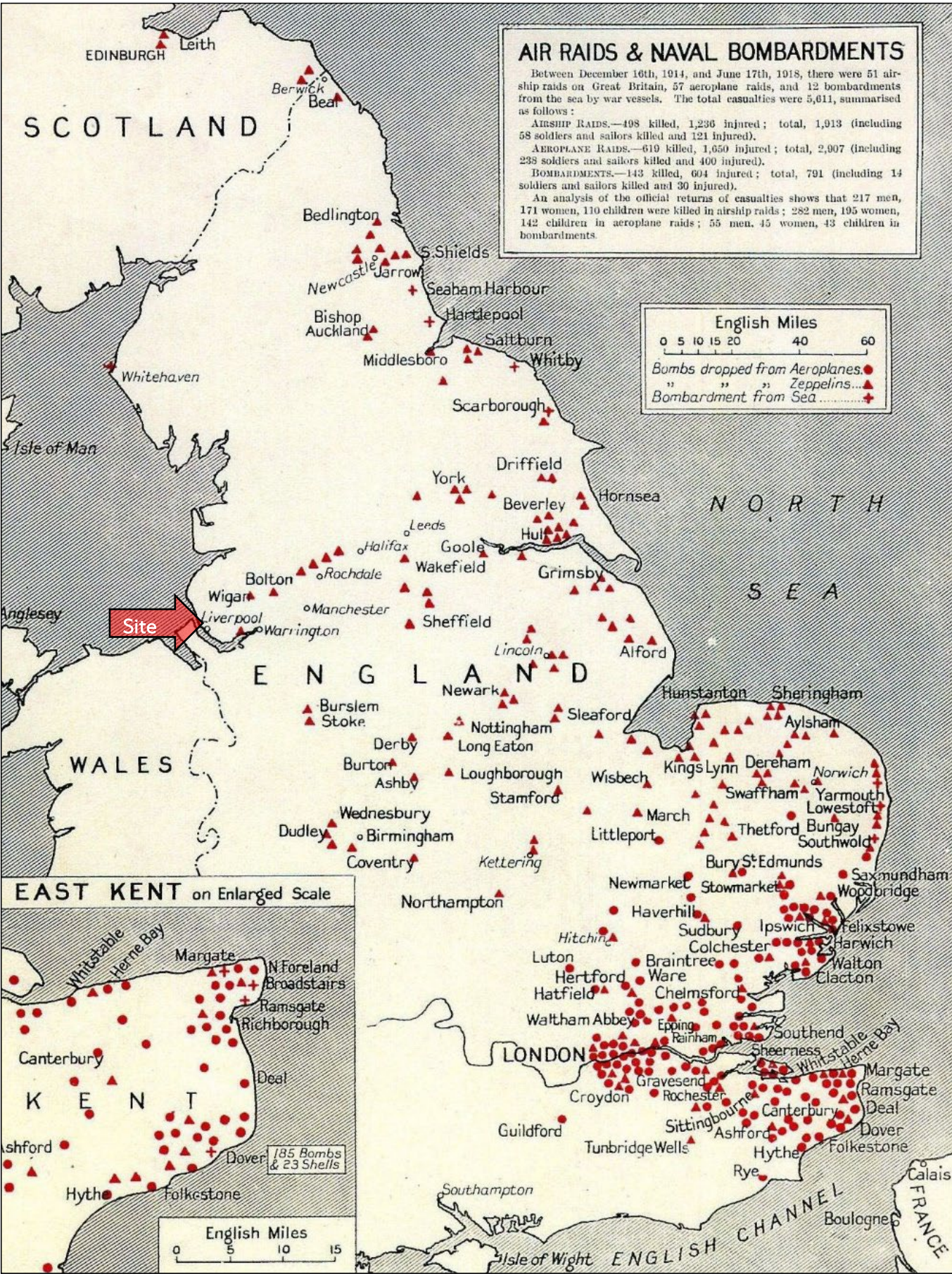
An unexploded World War One bomb was found in a garden prompting an evacuation of homes

An unexploded World War One bomb discovered in a garden in Liverpool has been "safely detonated" in a nearby park, said police.

Police said a gardener found the device at a property on Byng Road, Walton at 16:20 BST on Friday and 20 homes were evacuated.

It was moved to Walton and Clubmoor recreation ground where it was made safe in a controlled explosion three hours later.

All residents have now returned home.



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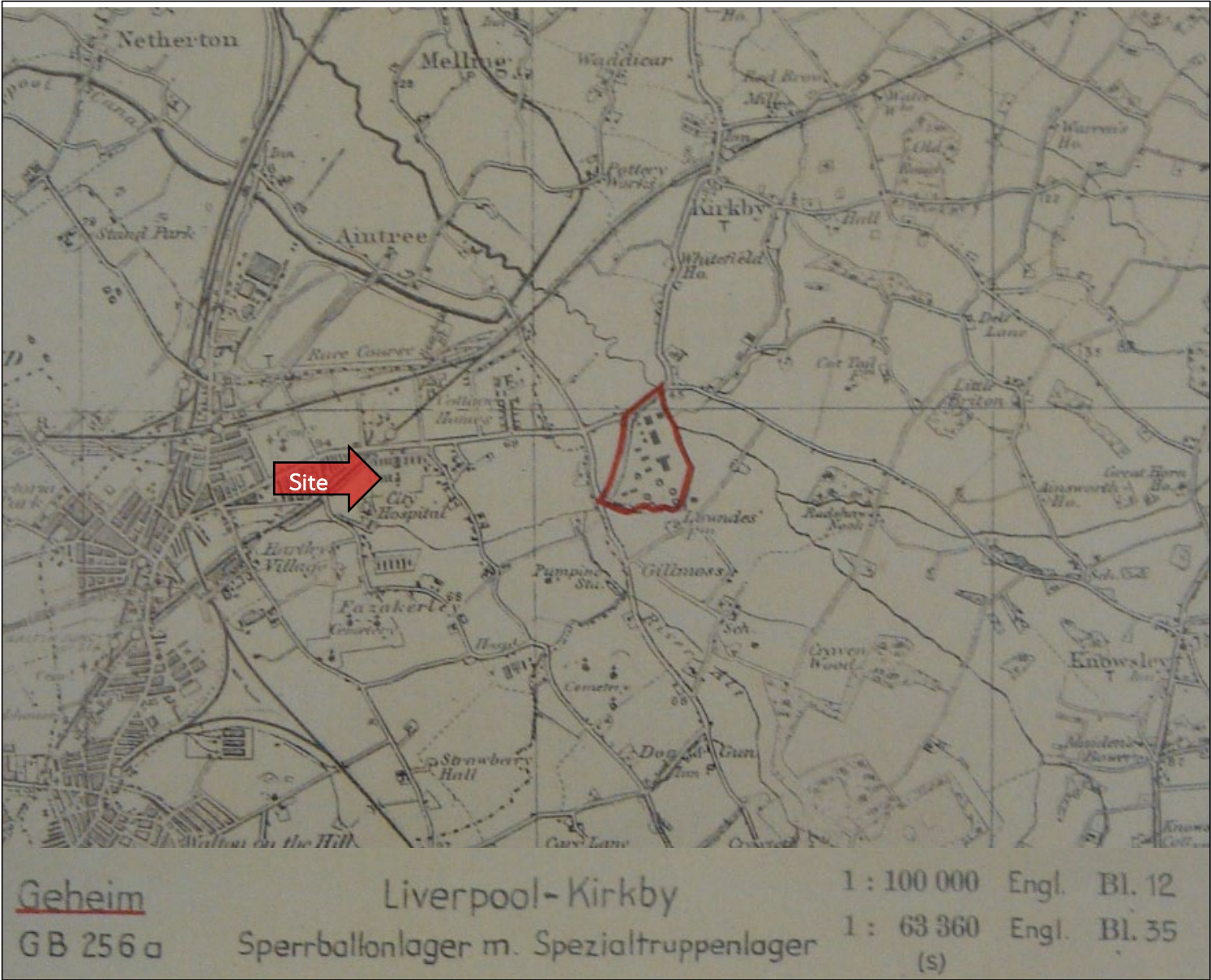
Source: J. Morris, German Air Raids on Britain

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Luftwaffe Photograph, 1st October 1940



Translation: Liverpool – Kirkby. Barrage Balloon Camp/Special Group Camp

The Barrage Balloon Site was located approximately 1.5km east of the site.



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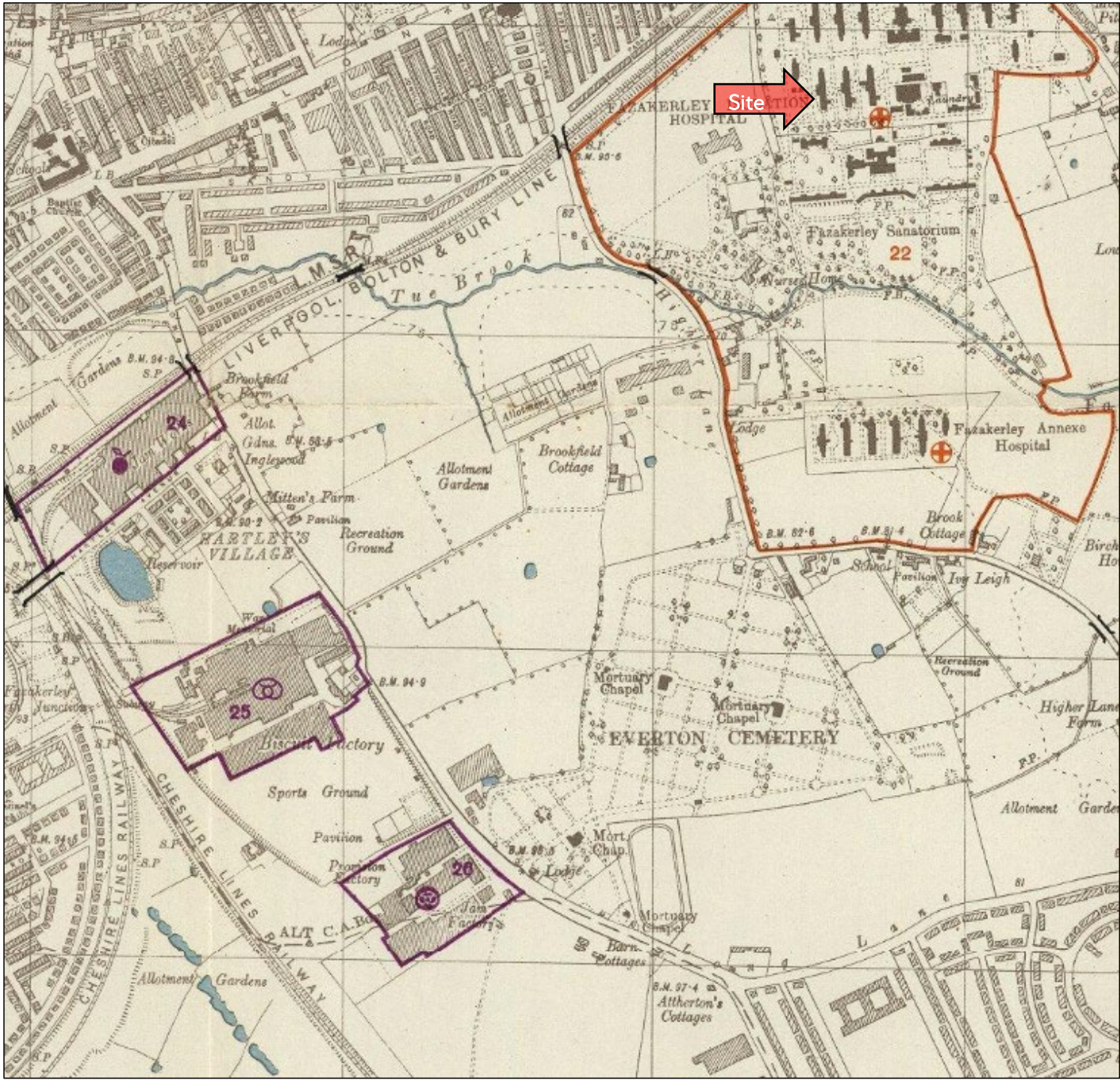
Source: Nigel J. Clarke, "Adolf Hitler's Home Counties Holiday Snaps"

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Wehrmacht Target Mapping, 1941

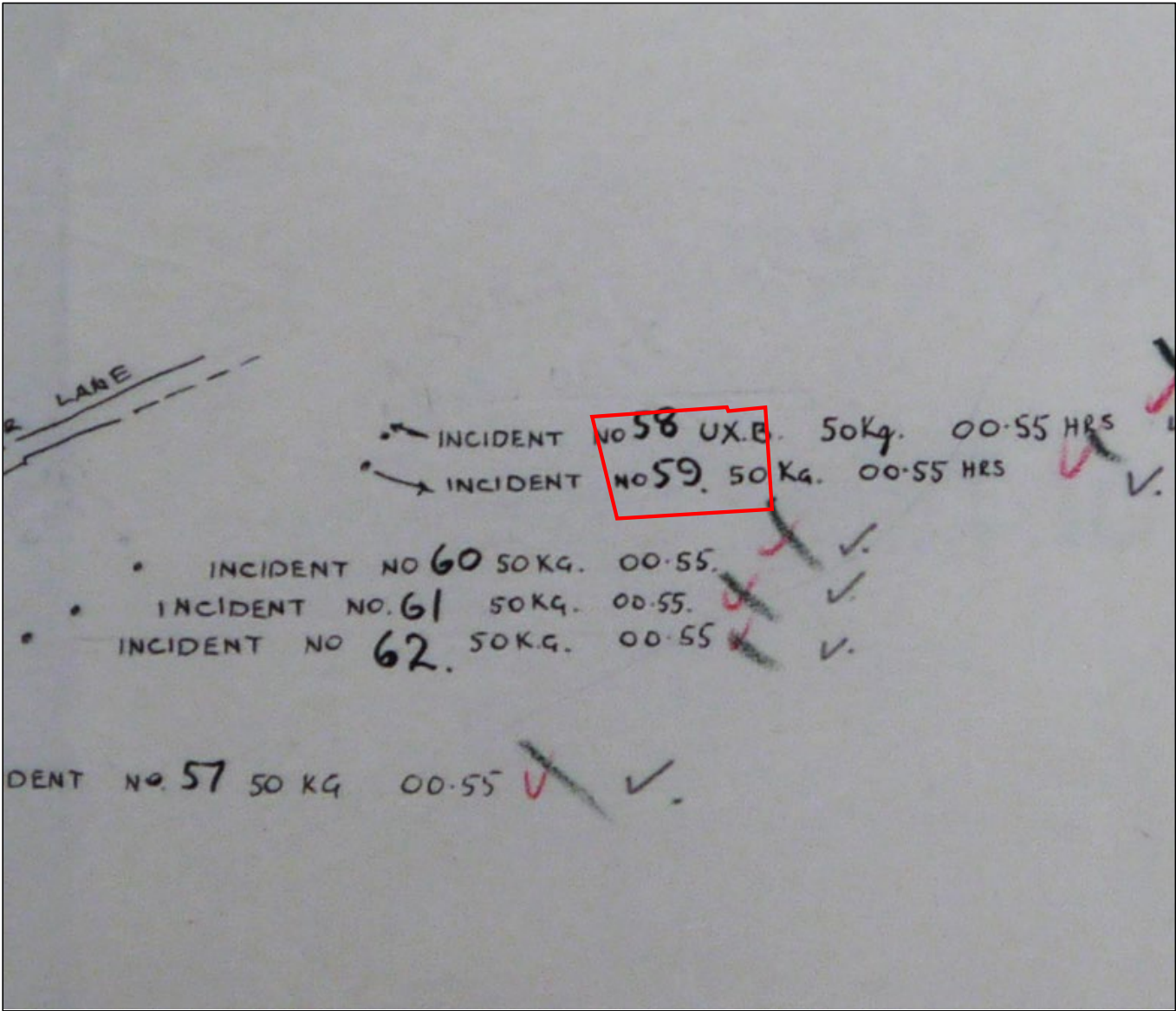


Designated Targets Approximate Translation

- 18 – Marshalling Yard Aintree
- 22- Fazakeley Hospital and Sanatorium
- 23 – Brickyards
- 24 – Jam Factory (Hartley's)
- 25 – Biscuit Factory (Jacob's Biscuit Factory)
- 26 – Food Factory
- 27 – Railway Workshops and Marshalling hotline Fazakerley of the L.M. & S.R.

18	Verschiebebahnhof Aintree
22	Fazakerley Spital und Sanatorium
23	Ziegeleien
24	Marmeladenfabrik
25	Keksfabrik
26	Lebensmittelfabrik
27	Eisenbahnwerkstätten und Verschiebebahnhof Fazakerley der L. M. & S. R.





● HE Bomb Strike



18/19 Sept. R. 19.41 W. 01.04	Heavy damage through whole of Liverpool. Walton Prison hit by H.E., trapping several people. Railway lines damaged Brownlow Street and St. Michaels Station, Southwood Road. A.T.M. Coy., work impeded for few hours by U.X.B. Nurses' Home, Fazakerley, damaged.
-------------------------------------	---

17/18 Oct. P. 21.12 R. 21.19 W. 22.39	West wing Fazakerley Sanatorium demolished, and one patient killed. H.E. damage to dwelling houses West Derby. U.X.B. yard of Morrison School.
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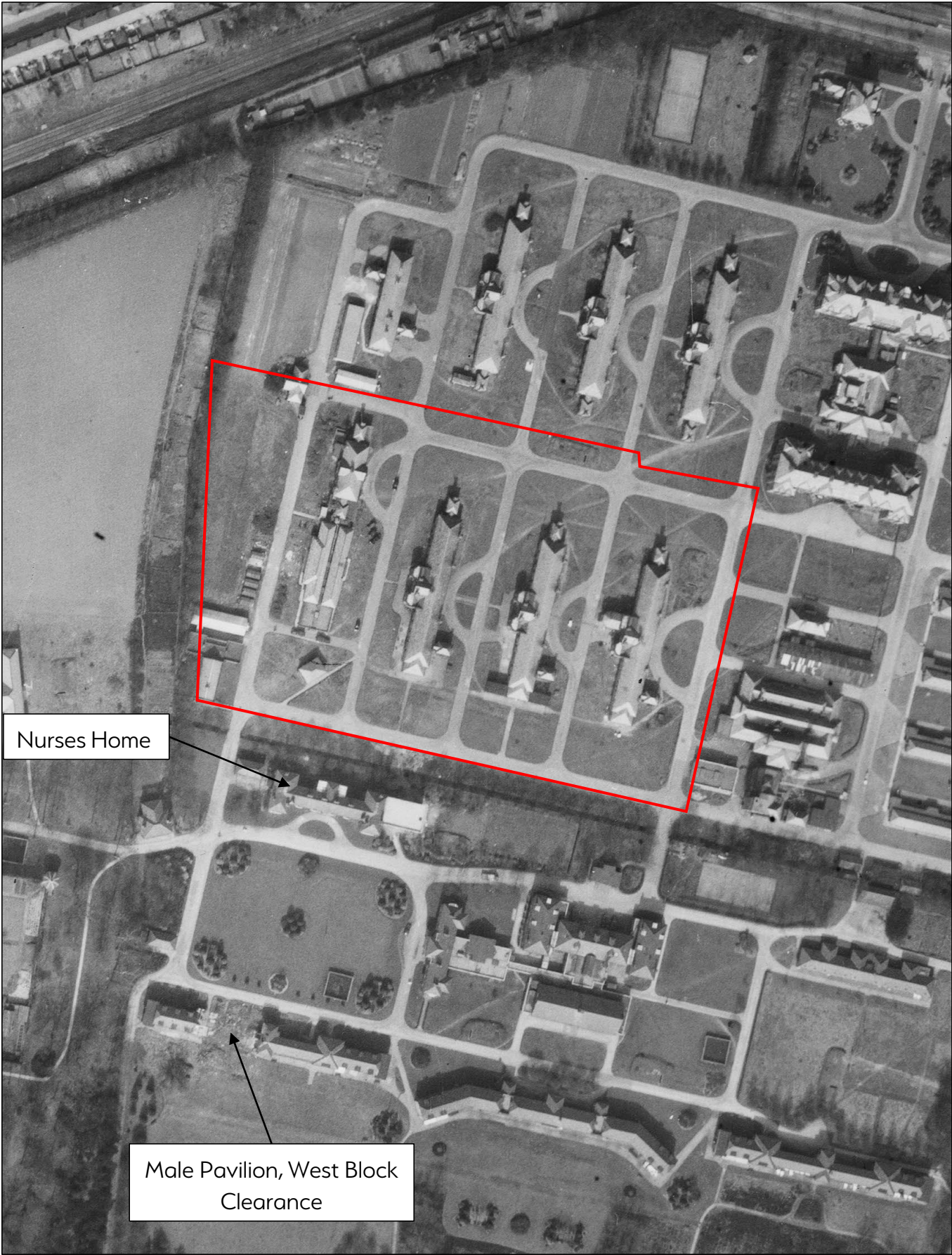
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Project: Aintree University Hospital, Liverpool

Ref: DA9796b-00

Source: Liverpool Record Office



Nurses Home

Male Pavilion, West Block
Clearance



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Project: Aintree University Hospital, Liverpool

Ref: DA9796b-00

Source: National Monuments Record Office (Historic England)

— Approximate site boundary

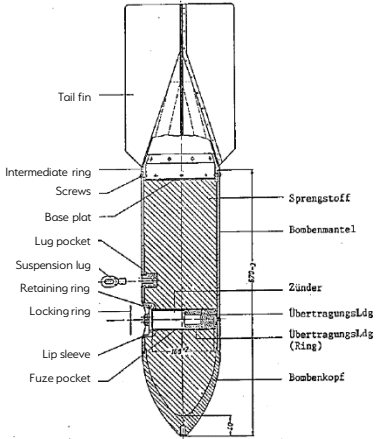


N



SC 50kg High Explosive Bomb

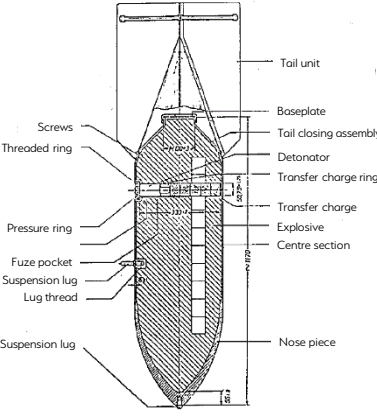
Bomb Weight	40-54kg (88-119lb)
Explosive Weight	25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.





SC 250kg High Explosive Bomb

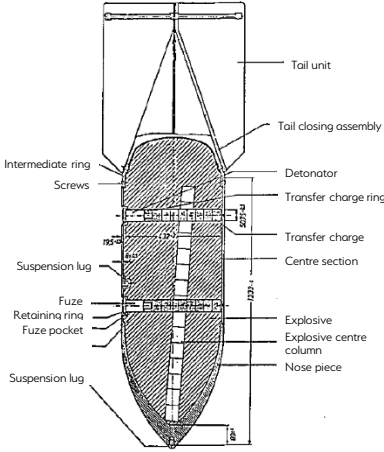
Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug, or dive-bomber).

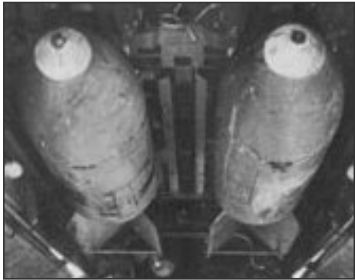




SC 500kg High Explosive Bomb

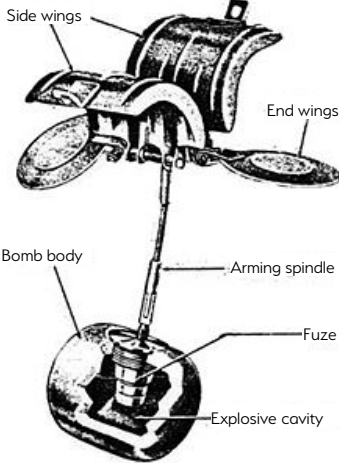
Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations; hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, Trialene. Bombs recovered with Trialene filling have cylindrical paper-wrapped pellets, 1-15/16in. in length and diameter.





SD2 Anti-Personnel 'Butterfly Bomb'

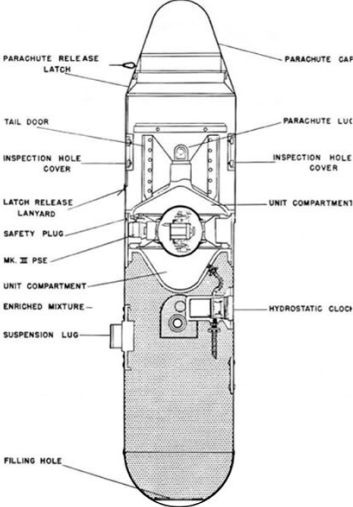
Bomb Weight	Approx. 2kg (4.41lb)
Explosive Weight	Approx. 7.5oz (225 grams) of Amatol surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	Designed as an anti-personnel/fragmentation weapon. They were delivered by air, being dropped in containers of 23-144 sub-munitions that opened at a predetermined height, thus scattering the bombs.
Remarks	Quite rare. First used against Ipswich in 1940, but were also dropped on Kingston upon Hull, Grimsby and Cleethorpes in June 1943, amongst various other targets in UK. As the bombs fell the outer case flicked open via springs which caused four light metal drogues with a protruding 5 inch steel cable to deploy in the form of a parachute & wind vane, which armed the device as it span.





Parachute Mine (Luftmine B / LMB)

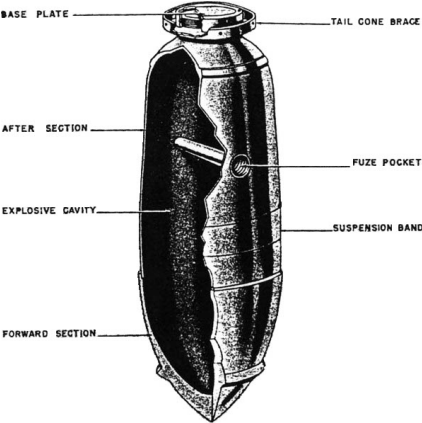
Bomb Weight	Approx. 990kg (2176lb)
Explosive Weight	Approx. 705kg (1,554lb)
Fuze Type	Impact/time delay/hydrostatic pressure fuze
Dimensions	2.64m x 0.64m (3.04m with parachute housing)
Use	Against civilian, military and industrial targets. Used as blast bombs and designed to detonate above ground level to maximise damage to a wider area.
Remarks	Deployed a parachute when dropped in order to control its descent. Had the potential to cause extensive damage within a 100m radius.



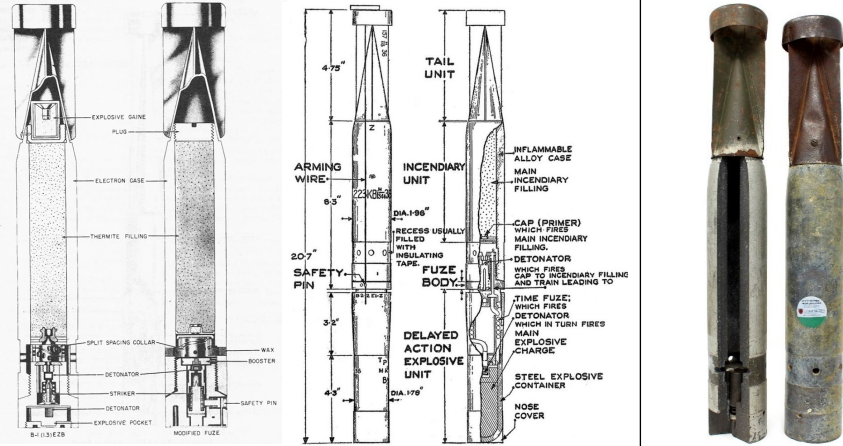


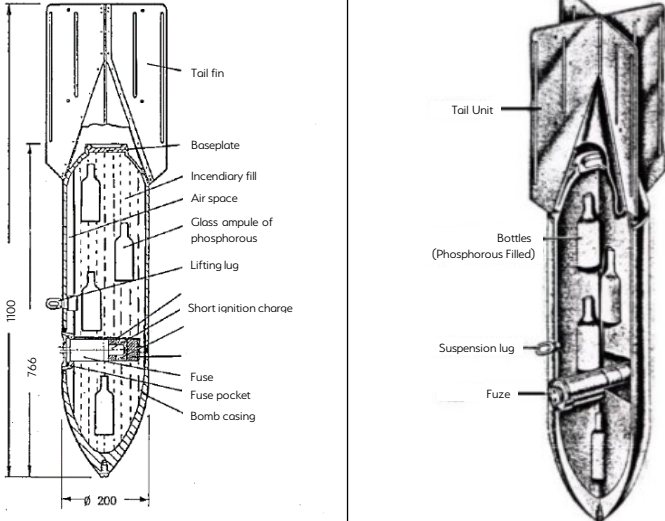
SC 1000kg High Explosive Bomb

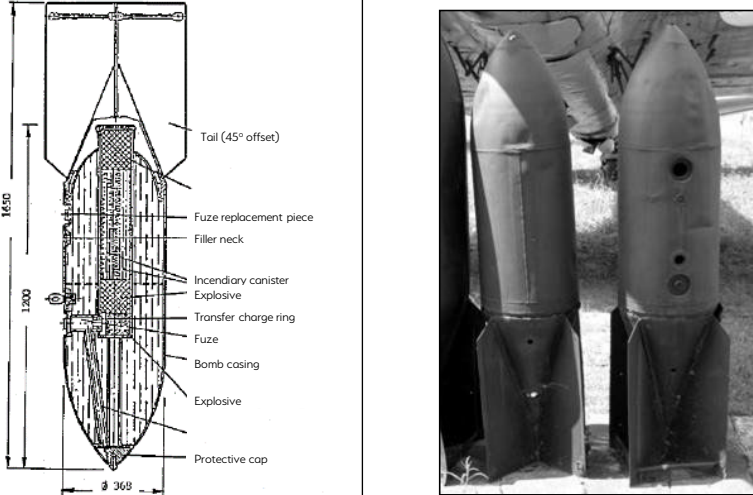
Bomb Weight	Approx. 993-1027kg (2,189-2,264lb)
Explosive Weight	Approx. 530-620kg (1168-1367lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (110 x 25.8in)
Body Diameter	654mm (18.5in)
Use	SC-type bombs were General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses, they are usually of three-piece welded construction.

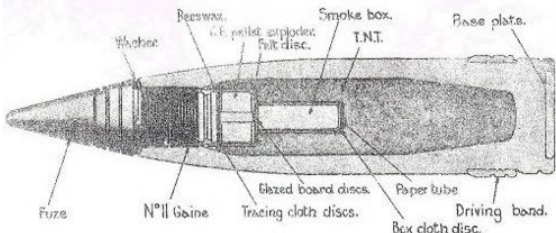


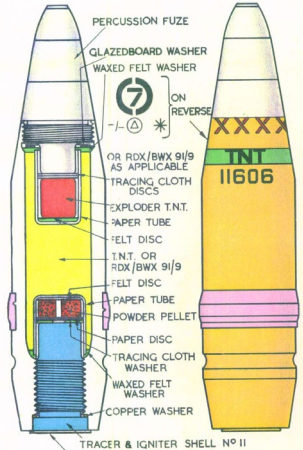


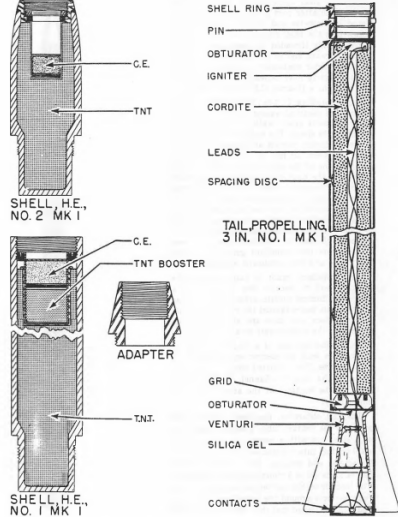
1kg Incendiary Bomb		
Bomb Weight	Approx. 1.0 - 1.3kg (2.2 and 2.9lb)	
Explosive Weight	Approx. 680g (1.5lb) Thermite 8-15gm Explosive Nitropenta	
Fuze Type	Impact fuze	
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)	
Body Diameter	50mm (1.97in)	
Use	As incendiary – dropped in clusters on towns and industrial complexes.	
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.	

C50 A Incendiary Bomb		
Bomb Weight	Approx. 41kg (90.4lb)	
Explosive Weight	Approx. 0.03kg (0.066lb)	
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%	
Fuze Type	Electrical impact fuze	
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)	
Use	Against any targets where an incendiary effect is required.	
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture.	

Flam C-250 Oil Bomb		
Bomb Weight	480-520kg (1,058-1,146lb)	
Explosive Weight	250-260kg (551-573lb)	
Fuze Type	Electrical impact/mechanical time delay fuze	
Bomb Dimensions	1957 x 640mm (77 x 25.2in)	
Body Diameter	470mm (18.5in)	
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.	
Remarks	40/60 or 50/50 Amatol TNT, Triallene. Bombs recovered with Triallene filling have cylindrical paper-wrapped pellets, 1-15/16in. in length and diameter.	

3.7 Inch QF Anti-Aircraft Projectile			 
Projectile Weight	28lb (12.6 kg)		
Explosive Weight	2.52lbs		
Fuze Type	Mechanical Time Fuze		
Dimensions	3.7in x 14.7in (94mm x 360mm)		
Rate of Fire	10 to 20 rounds per minute		
Use	The 3.7in AA Mks 1-3 were the standard Heavy Anti-Aircraft guns of the British Army and were commonly used on the Home Front.		
Ceiling	30,000ft to 59,000ft		

40mm Bofors Projectile				
Projectile Weight	1.96lb (0.86kg)			
Explosive Weight	300g (0.6lb)			
Fuze Type	Impact Fuze			
Rate of Fire	120 rounds per minute			
Projectile Dimensions	40 x 180mm			
Ceiling	23,000ft (7000m)			
Remarks	Light quick fire high explosive anti-aircraft projectile. Each projectile fitted with small tracer element. If no target hit, shell would explode when tracer burnt out. Designed to engage aircraft flying below 2,000ft.			

3in Unrotated Projectile (UP) Anti-Aircraft Rocket ("Z" Battery)			
HE Projectile Weight	3.4kg (7.6lb)		
Explosive Weight	0.96kg (2.13lb)		
Filling	High Explosive – TNT. Fitted with aerial burst fuzing		
Dimensions of projectile	236 x 83mm (9.29 x 3.25in)		
Remarks	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. Shell consists of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor.		

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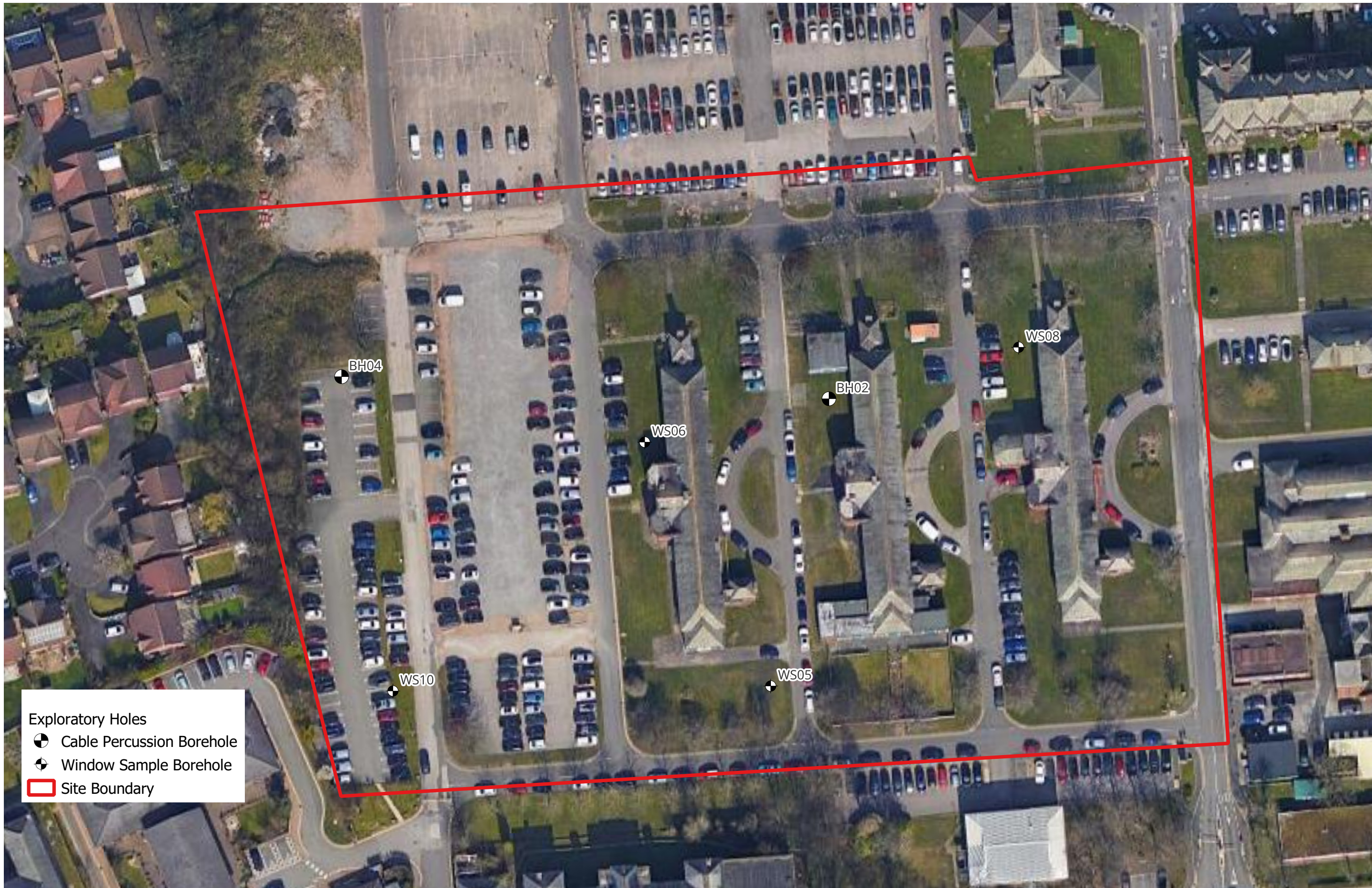
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Exploratory Holes

-  Cable Percussion Borehole
-  Window Sample Borehole
-  Site Boundary

NOTES:

Notes

CLIENT:

AJP / VINCI CONSTRUCTION

PROJECT:

AINTREE HOSPITAL

TITLE:

GAS MONITORING PLAN

PROJECT No:

P10738

DATE:

JAN 2025

DESIGN/DRAWN:

RJH

DRAWING NUMBER:

006

ISSUE:

FINAL

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In-Situ Gas Monitoring Results

Project Name	Sefton Road, Aintree Hospital
Project Number	10738
Client	Alan Johnston Partnership Ltd
Date	19/12/2024
Weather	Partly Sunny
Atmospheric Pressure (mb)	1004
Pressure Trend	Rising
Equipment	Gas Data GFM436
Operator	James Wardle

Ground Gas													
Well ID	Response Zone			Methane		CO2		Oxygen		Gas Flow		PID Reading	
	mbegl			%v/v		%v/v		%v/v		l/h		ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
BH02	2.0	18.0	NS	0.0	0.0	0.6	0.6	18.2	18.2	0.0	0.0	0.0	0.0
BH04	2.0	18.0	NS	0.0	0.0	0.7	0.7	19.4	19.4	0.0	0.0	0.2	0.2
BH05	2.0	20.0	NS	0.0	0.0	0.7	0.7	19.0	19.0	0.0	0.0	0.0	0.0
WS05	1.0	2.0	NS	0.0	0.0	0.0	0.0	19.4	19.4	0.0	0.0	0.0	0.0
WS06	1.0	3.0	NS	0.0	0.0	0.0	0.0	19.6	19.6	0.0	0.0	0.0	0.0
WS08	1.0	2.0	NS	0.0	0.0	0.4	0.4	20.0	20.0	0.0	0.0	0.0	0.0
WS10	1.0	3.0	NS	0.0	0.0	0.4	0.4	20.2	20.2	0.0	0.0	0.0	0.0
WS15	1.0	2.0	NS	0.0	0.0	1.2	1.2	18.7	18.7	0.0	0.0	0.0	0.0

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
3.6	19.7
1.4	20.6
1.7	22.9
0.2	2.9
0.6	4.0
0.5	2.9
0.7	3.6
2.8	3.1

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.= 5% Flammable Gas)		
N.D.	Not Detected	a	Methane => 1% v/v
N.R.	Not Recorded	b	Carbon Dioxide =>5% v/v
PID	Photo-Ionising Detector	MG	Made Ground
%	By volume	NS	Natural Strata

Ground Material Key

NS Natural Strata

Key

Response Zone Flooded



In-Situ Gas Monitoring Results

Project Name	Sefton Road, Aintree Hospital
Project Number	10738
Client	Alan Johnston Partnership Ltd
Date	03/01/2025
Weather	Sleet
Atmospheric Pressure (mb)	1019
Pressure Trend	Steady
Equipment	Gas Data GFM436
Operator	James Wardle

Ground Gas													
Well ID	Response Zone			Methane		CO2		Oxygen		Gas Flow		PID Reading	
	mbegl			%v/v		%v/v		%v/v		l/h		ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
BH02	2.0	18.0	NS	0.0	0.0	0.4	0.4	18.8	18.8	0.0	0.0	Not Recorded	
BH04	2.0	18.0	NS	0.0	0.0	0.8	0.8	19.6	19.6	0.0	0.0	Not Recorded	
BH05	2.0	20.0	NS	0.0	0.0	1.4	1.4	18.8	18.8	0.0	0.0	Not Recorded	
WS05	1.0	2.0	NS	0.0	0.0	0.5	0.5	19.7	19.7	0.0	0.0	Not Recorded	
WS06	1.0	3.0	NS	0.0	0.0	0.7	0.7	19.2	19.2	0.0	0.0	Not Recorded	
WS08	1.0	2.0	NS	0.0	0.0	1.7	1.7	19.1	19.1	0.0	0.0	Not Recorded	
WS10	1.0	3.0	NS	0.0	0.0	0.5	0.5	20.1	20.1	0.0	0.0	Not Recorded	
WS15	1.0	2.0	NS	0.0	0.0	1.5	1.5	19.0	19.0	0.0	0.0	Not Recorded	

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
1.1	19.6
0.7	20.5
0.9	22.5
0.1	2.9
0.3	4.0
0.3	2.9
0.4	3.5
1.7	3.1

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.= 5% Flammable Gas)
N.D.	Not Detected
N.R.	Not Recorded
PID	Photo-Ionising Detector
%	By volume

a	Methane => 1% v/v
b	Carbon Dioxide =>5% v/v
MG	Made Ground
NS	Natural Strata

Ground Material Key

NS	Natural Strata
----	----------------

Key

	Response Zone Flooded
--	-----------------------



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4161

**GRM Development Solutions**

Laurus House
First Avenue
Centrum 100
Burton Upon Trent
DE14 2WH

Analytical Test Report: E24/01579/GRM - 24-53468

Your Project Reference:	Aintree University Hospital, Liverpool P10738		
Your Order Number:	P10738	Samples Received / Instructed:	03/12/2024 / 04/12/2024
Report Issue Number:	1	Sample Tested:	04/12 to 12/12/2024
Samples Analysed:	6 sample(s)	Report issued:	12/12/2024

Signed



James Gane
Analytical Services Manager
CTS Group

Notes:**General**

This report shall not be reproduced except in full

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Samples will be retained for 14 days after issue of this report with the exception of the asbestos test portion which is held for 6 months unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with CTS method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Asbestos

Please note: Where further analysis is required samples identified as containing asbestos are screened and tested on an as received basis. No correction is made for moisture content and these results are not covered by our accreditation

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

UKAS accreditation on waters only covers the Ground water and Surface water matrices

Date of Issue: 05.12.2024

Issued by: J. Gane

Issue No: 4

Rev No: 20



4161



E24/01579/GRM - 24-53468

 Project Reference - Aintree University Hospital,
 Liverpool P10738

Analytical Test Results - Solid

Lab Reference			424750	424751	424752	424753	424754	424755
Client Sample ID			WS02	WS09	TP05	BH05	TP02	SA2
Client Sample Location			-	-	-	-	-	-
Client Sample Type			ES	ES	ES	ES	ES	ES
Client Sample Number			-	-	-	-	-	-
Depth - Top (m)			0.30	0.50	0.20	0.50	0.10	0.20
Depth - Bottom (m)			0.30	0.50	0.20	0.50	0.10	0.20
Date of Sampling			-	-	-	-	-	-
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Clay	Clay	Clay	Clay	Clay
Determinant	Units	Accreditation						
Arsenic	(mg/kg)	MCERTS	11	< 10	11	14	17	19
Cadmium	(mg/kg)	MCERTS	0.7	0.6	0.9	0.7	1.0	1.0
Chromium (Total)	(mg/kg)	UKAS	13	4.8	17	11	15	8.4
Copper	(mg/kg)	MCERTS	44	25	31	58	44	67
Lead	(mg/kg)	MCERTS	110	65	220	120	380	240
Mercury	(mg/kg)	UKAS	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
Nickel	(mg/kg)	MCERTS	24	18	29	29	32	30
Selenium	(mg/kg)	u	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Zinc	(mg/kg)	MCERTS	84	78	390	53	310	96
Total Phenols	(mg/kg)	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cyanide (Total)	(mg/kg)	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chromium (Hexavalent)	(mg/kg)	u	< 1.0	< 1.0	< 1.0	< 1.0	1.5	< 1.0
pH	pH Units	MCERTS	8.0	10.3	8.5	8.6	8.4	7.9
Sulphate (Water soluble as SO ₄)	(mg/l)	u	17	230	1500	71	1300	37
Acenaphthene	(mg/kg)	MCERTS	< 0.20	< 0.20	1.3	1.5	0.74	0.03
Acenaphthylene	(mg/kg)	UKAS	< 0.20	< 0.20	0.46	< 0.20	0.17	0.04
Anthracene	(mg/kg)	UKAS	0.32	0.45	3.7	1.9	1.5	0.09
Benzo (a) anthracene	(mg/kg)	MCERTS	1.5	1.3	7.0	1.9	2.9	0.50
Benzo (a) pyrene	(mg/kg)	MCERTS	2.0	1.4	6.7	1.7	2.8	0.61
Benzo (b) fluoranthene	(mg/kg)	MCERTS	2.3	1.7	7.6	1.8	3.2	0.78
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	1.6	0.95	4.1	0.96	1.7	0.41
Benzo (k) fluoranthene	(mg/kg)	MCERTS	0.83	0.66	2.9	0.68	1.2	0.28
Chrysene	(mg/kg)	MCERTS	1.4	1.2	6.7	1.7	2.6	0.54
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	0.31	< 0.20	0.82	< 0.20	0.38	0.09
Fluoranthene	(mg/kg)	MCERTS	2.7	2.7	17	5.5	6.8	0.95
Fluorene	(mg/kg)	MCERTS	< 0.20	< 0.20	1.1	1.8	0.51	< 0.02
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	1.3	0.81	3.7	0.83	1.4	0.36
Naphthalene	(mg/kg)	MCERTS	< 0.20	< 0.20	0.69	0.63	0.46	< 0.02
Phenanthrene	(mg/kg)	MCERTS	0.86	1.3	13	7.0	5.6	0.34
Pyrene	(mg/kg)	MCERTS	2.7	2.5	16	4.9	6.3	0.93
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	19	16	93	33	38	6.0
SOM (via TOC)	(%)	UKAS	3.6	2.0	3.0	5.5	4.2	6.5
Asbestos	-	UKAS	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected



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E24/01579/GRM - 24-53468

Project Reference - Aintree University Hospital,
Liverpool P10738

Analytical Test Results - VPH / EPH

Lab Reference	424750	424751	424752	424753	424754	424755
Client Sample ID	WS02	WS09	TP05	BH05	TP02	SA2
Client Sample Location	-	-	-	-	-	-
Client Sample Type	ES	ES	ES	ES	ES	ES
Client Sample Number	-	-	-	-	-	-
Depth - Top (m)	0.30	0.50	0.20	0.50	0.10	0.20
Depth - Bottom (m)	0.30	0.50	0.20	0.50	0.10	0.20
Date of Sampling	-	-	-	-	-	-
Time of Sampling	-	-	-	-	-	-
Sample Matrix	Clay	Clay	Clay	Clay	Clay	Clay
Determinant	Units	Accreditation				
Benzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01	< 0.01
Toluene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01	< 0.01
Ethylbenzene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01	< 0.01
m&p Xylene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	< 0.02
o-Xylene	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01	< 0.01
MTBE	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C ₅ to C ₆ [HS_MS_1D_AL]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06	< 0.06
Aliphatic >C ₆ to C ₈ [HS_MS_1D_AL]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06	< 0.06
Aliphatic >C ₈ to C ₁₀ [HS_MS_1D_AL]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06	< 0.06
Aliphatic >C ₁₀ to C ₁₂ [EH_2D_AL]	(mg/kg)	MCERTS	< 1.0	1.7	1.4	< 1.0
Aliphatic >C ₁₂ to C ₁₆ [EH_2D_AL]	(mg/kg)	MCERTS	1.5	6.2	5.0	1.5
Aliphatic >C ₁₆ to C ₂₁ [EH_2D_AL]	(mg/kg)	MCERTS	2.2	7.6	3.1	1.3
Aliphatic >C ₂₁ to C ₃₅ [EH_2D_AL]	(mg/kg)	MCERTS	5.5	27	9.8	7.1
Aliphatic >C ₃₅ to C ₄₀ [EH_2D_AL]	(mg/kg)	MCERTS	1.6	18	3.2	1.6
Aromatic >C ₅ to C ₇ [HS_MS_1D_AR]	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C ₇ to C ₈ [HS_MS_1D_AR]	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C ₈ to C ₁₀ [HS_MS_1D_AR]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06	< 0.06
Aromatic >C ₁₀ to C ₁₂ [EH_2D_AR]	(mg/kg)	MCERTS	< 1.0	< 1.0	1.8	< 1.0
Aromatic >C ₁₂ to C ₁₆ [EH_2D_AR]	(mg/kg)	MCERTS	< 1.0	3.6	15	4.9
Aromatic >C ₁₆ to C ₂₁ [EH_2D_AR]	(mg/kg)	MCERTS	7.8	15	58	12
Aromatic >C ₂₁ to C ₃₅ [EH_2D_AR]	(mg/kg)	MCERTS	21	53	88	23
Aromatic >C ₃₅ to C ₄₀ [EH_2D_AR]	(mg/kg)	MCERTS	5.6	28	13	3.2
Total >C ₅ to C ₄₀ [EH_2D+HS_1D_Total]	(mg/kg)	MCERTS	45	160	200	59
						150
						33



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**E24/01579/GRM - 24-53468****Project Reference - Aintree University Hospital, Liverpool P10738****Sample Descriptions**

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
424750	WS02	-	ES	-	Brown slightly gravelly silty clay	16	17	78
424751	WS09	-	ES	-	Brown very gravelly silty clay with frequent brick fragments rootlets	14	38	40
424752	TP05	-	ES	-	Brown slightly gravelly silty clay with occasional brick fragments rootlets	19	21	89
424753	BH05	-	ES	-	Brown silty clay with occasional rootlets	19	0.2	100
424754	TP02	-	ES	-	Brown very gravelly silty clay with occasional brick fragments rootlets	21	43	87
424755	SA2	-	ES	-	Brown silty clay with frequent rootlets	25	< 0.1	100



4161



7 - 11 Harding Street
Leicester
LE1 4DH

E24/01579/GRM - 24-53468

Project Reference - Aintree University Hospital, Liverpool P10738

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
424750	WS02	-	ES	-	PAHAR - 1/10 dark colour extract
424751	WS09	-	ES	-	VPH/BTEX - Sample taken from container with headspace. PAHAR - 1/10 dark colour extract
424752	TP05	-	ES	-	VPH/BTEX - Sample taken from container with headspace. PAHAR - 1/10 dark colour extract
424753	BH05	-	ES	-	VPH/BTEX - Sample taken from container with headspace.
424754	TP02	-	ES	-	VPH/BTEX - Sample taken from container with headspace.
424755	SA2	-	ES	-	VPH/BTEX - Sample taken from container with headspace.



E24/01579/GRM - 24-53468

Project Reference - Aintree University Hospital, Liverpool P10738

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
SKALARCNS	MS - CL - Cyanide by Skalar	As received	Passing 10mm test sieve	Determination of cyanide (total / free / complex) in soil using a Skalar segmented flow analyser
SKALARHCS	MS - CL - Hexavalent Chromium by Skalar	As received	Passing 10mm test sieve	Determination of hexavalent chromium in soil using Skalar segmented flow analyser
ICPMETS	MS - CL - ICP Metals	Air dried	Passing 10mm test sieve	Determination of metals in soils via ICP
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
PAHASRDS	MS - CL - PAH (As Received)	As received	Passing 10mm test sieve	Determination of Polyaromatic hydrocarbons in soil via GC-MS
SKALARPHS	MS - CL - Phenols by Skalar	As received	Passing 10mm test sieve	Determination of total phenols in soil using Skalar segmented flow analyser
TOCS	MS - CL - TOC Eltra	Air Dried	Passing 10mm test sieve	Determination of Total Organic Carbon in soils
GCXGCS	MS - CL - TPH & EPH by GCXGC	As received	Passing 10mm test sieve	Determination of TPH and EPH in soils via GCxGC-FID
CWGS	Calculation from VPH-S and EPH-S	As received	Passing 10mm test sieve	Determination of TPH CWG (Volatile Petroleum Hydrocarbons and Extractable Petroleum Hydrocarbons) in soils via Headspace-GC-MS and GC-GC-FID respectively
VPHS	MS - CL - VPH	As received	Passing 10mm test sieve	Determination of VPH in soils via Headspace-GC-MS
ASB	MS - AS - Asbestos	-	-	Fibre identification is in accordance with in house documented methods which are based on the procedure documented in the HSE Document HSG 248 "Asbestos: The analysts guide for sampling, analysis and clearance procedures"
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis

E24/01579/GRM - 24-53468

Project Reference - Aintree University Hospital, Liverpool P10738

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided

W - No time of sampling provided for water sample

C - Received in inappropriate container

H - Contains headspace

T - Temperature on receipt exceeds storage temperature

R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
424750	WS02	-	ES	-		A
424751	WS09	-	ES	-		A
424752	TP05	-	ES	-		A
424753	BH05	-	ES	-		A
424754	TP02	-	ES	-		A
424755	SA2	-	ES	-		A



E24/01579/GRM - 24-53468

Project Reference - Aintree University Hospital, Liverpool P10738

HWOL TPH Acronym Index

Acronym	Description
HS	Headspace Analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics and Aromatics
AL	Aliphatics Only
AR	Aromatics Only
2D	GC-GC - Double Coil Gas Chromatography
#1	EH_Total but with humics mathmatically subtracted
#2	EH_Total but with fatty acids mathmatically subtracted
_	Operator - underscore to separate acronyms (except for +)
+	Operator to indicate cumlative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry



A P P E N D I X K

Land Appraisal | Environmental | Geotechnical | Design | Mining | Inspections

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TEST REPORT

Client GRM Development Solutions Ltd

Address Laurus House
1st Avenue
Centrum 100
Burton-on-Trent
Staffordshire
DE14 2WH

Contract Aintree

Job Number MRN 25004/5

Date of Issue 07 January 2025

Page 1 of 10

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted.
- 5 The results included within the report are representative of the samples submitted for analysis.
- 6 This certificate should not be reproduced, except in full, without the express permission of the laboratory.



Andrew House, Hadfield Street, Dukinfield, Cheshire SK16 4QX Tel: 0161 475 0870
Email: enquiries@murrayrix.com Website: www.murrayrix.com

Also at: London: 020 8523 1999

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MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD

PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

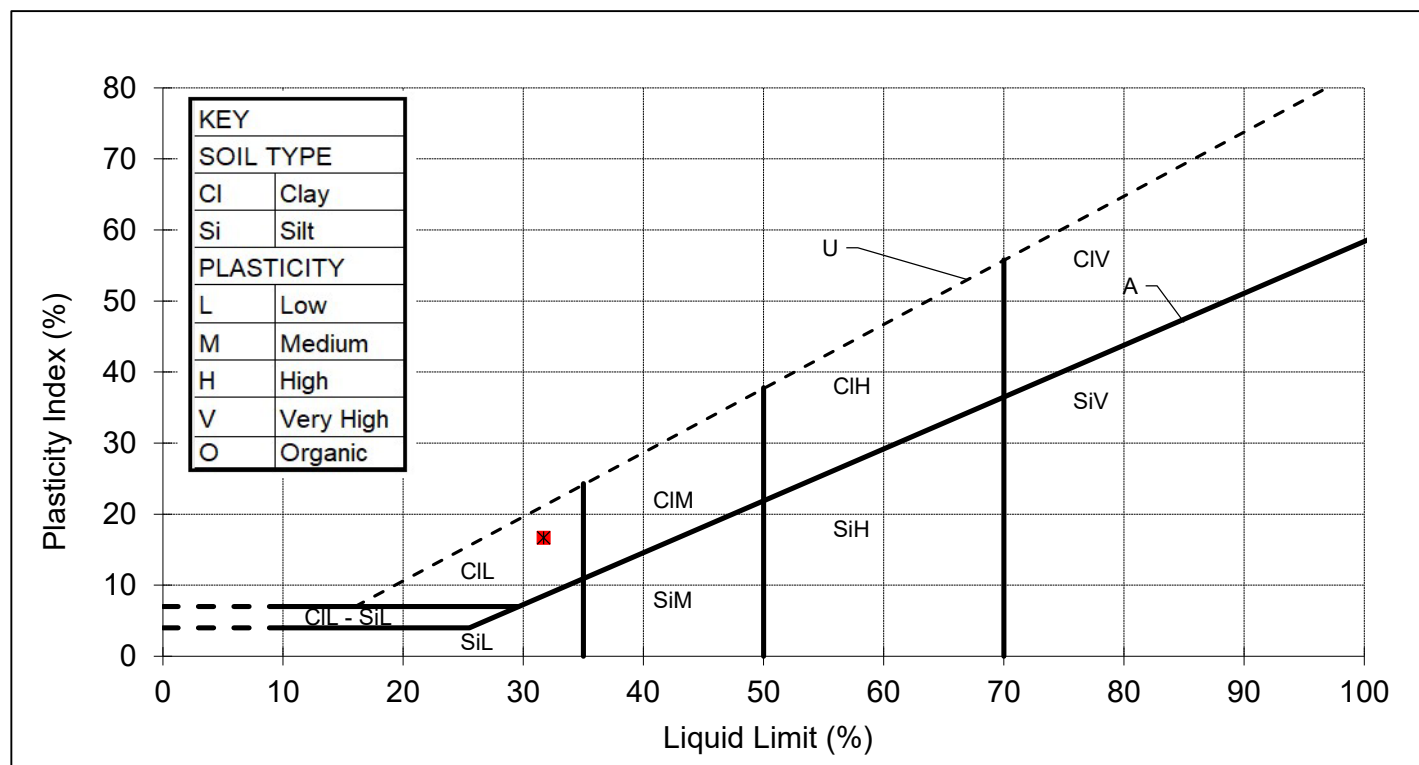
CLIENT	GRM Development Solutions Ltd
SITE	Aintree
JOB NUMBER	MRN 25004/5

SAMPLE LABEL	TP03 @ 0.9m	DATE SAMPLED	Not advised
SAMPLE No.	614701	DATE RECEIVED	12-Dec-24
DATE TESTED	13-Dec-24	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Water Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	20.0	31.8	1.002	
Determination 2 (avg)	19.8	31.5		

Natural Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
18.5	32	15	17	94



REMARKS

SIGNED

NAME

O.P. Davies BA (Hons)
(Director / Head of Laboratory)

DATE

07-Jan-25

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PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

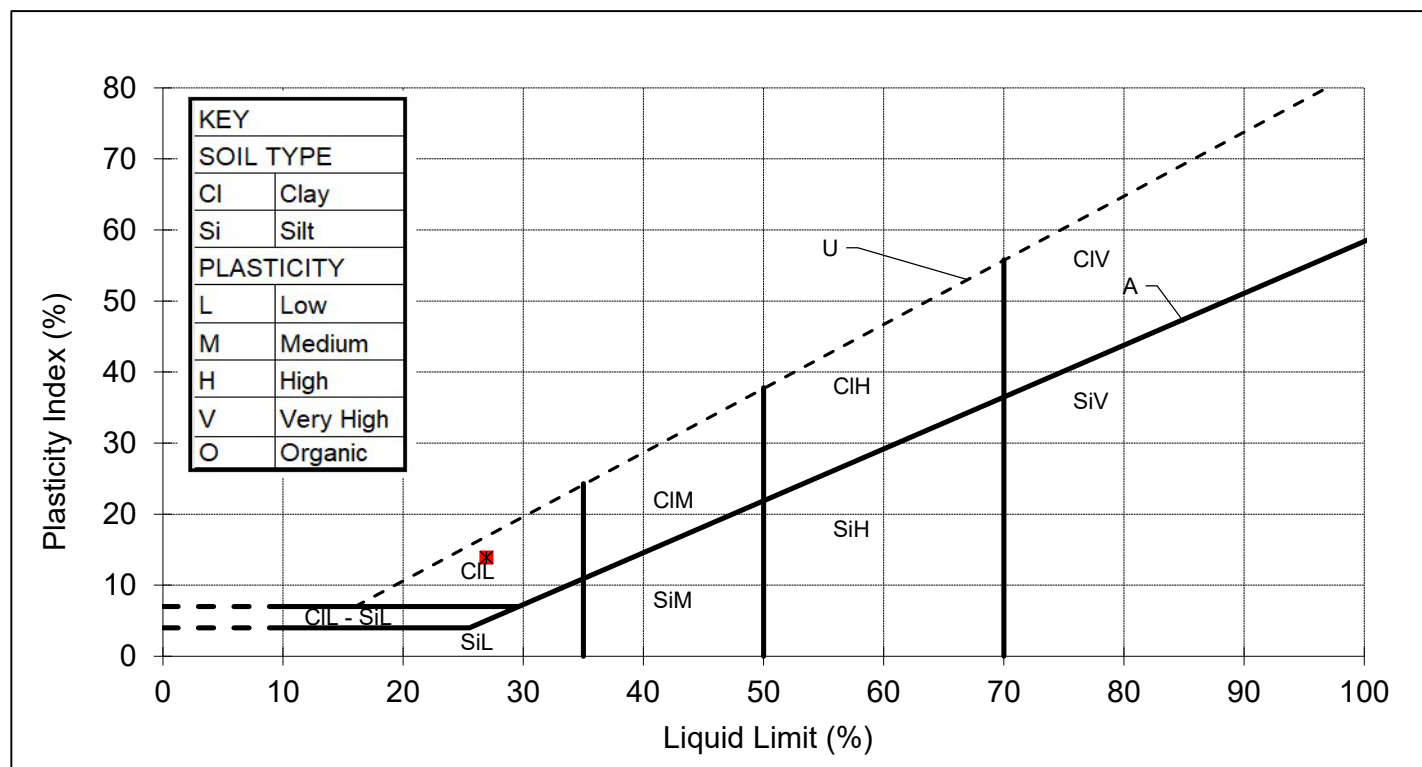
CLIENT	GRM Development Solutions Ltd
SITE	Aintree
JOB NUMBER	MRN 25004/5

SAMPLE LABEL	BH05 @ 1.2-1.65	DATE SAMPLED	Not advised
SAMPLE No.	614702	DATE RECEIVED	12-Dec-24
DATE TESTED	13-Dec-24	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Water Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	18.6	26.4	1.022	
Determination 2 (avg)	18.5	26.3		

Natural Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
22.5	27	13	14	94



REMARKS

SIGNED

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(Director / Head of Laboratory)

DATE

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PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

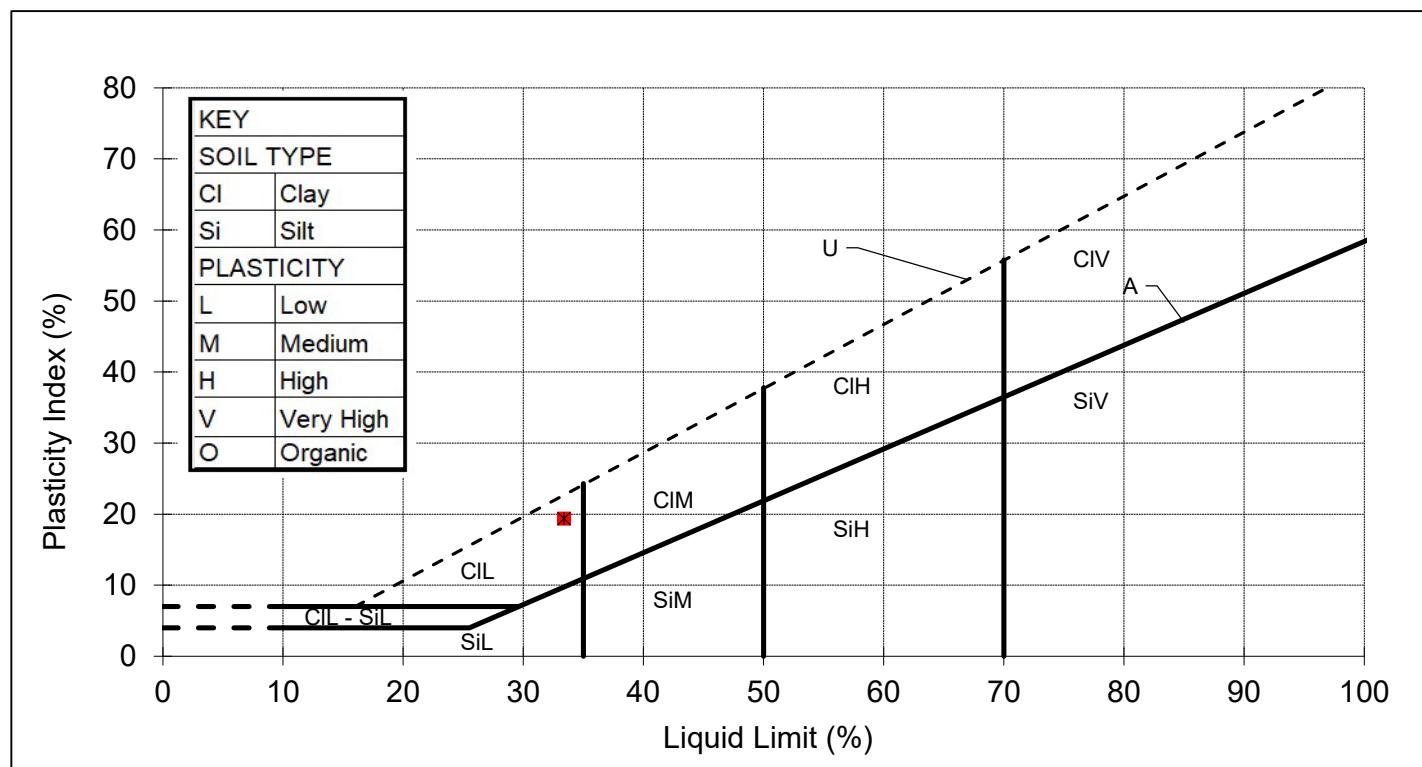
CLIENT	GRM Development Solutions Ltd
SITE	Aintree
JOB NUMBER	MRN 25004/5

SAMPLE LABEL	SA2 @ 1.4m	DATE SAMPLED	Not advised
SAMPLE No.	614703	DATE RECEIVED	12-Dec-24
DATE TESTED	13-Dec-24	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)	Water Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	20.2	33.3	
Determination 2 (avg)	20.4	33.8	

Natural Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
19.5	33	14	19	91



REMARKS

SIGNED

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O.P. Davies BA (Hons)
(Director / Head of Laboratory)

DATE

07-Jan-25

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TEL 0161 475 0870



TEST CERTIFICATE

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD

PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

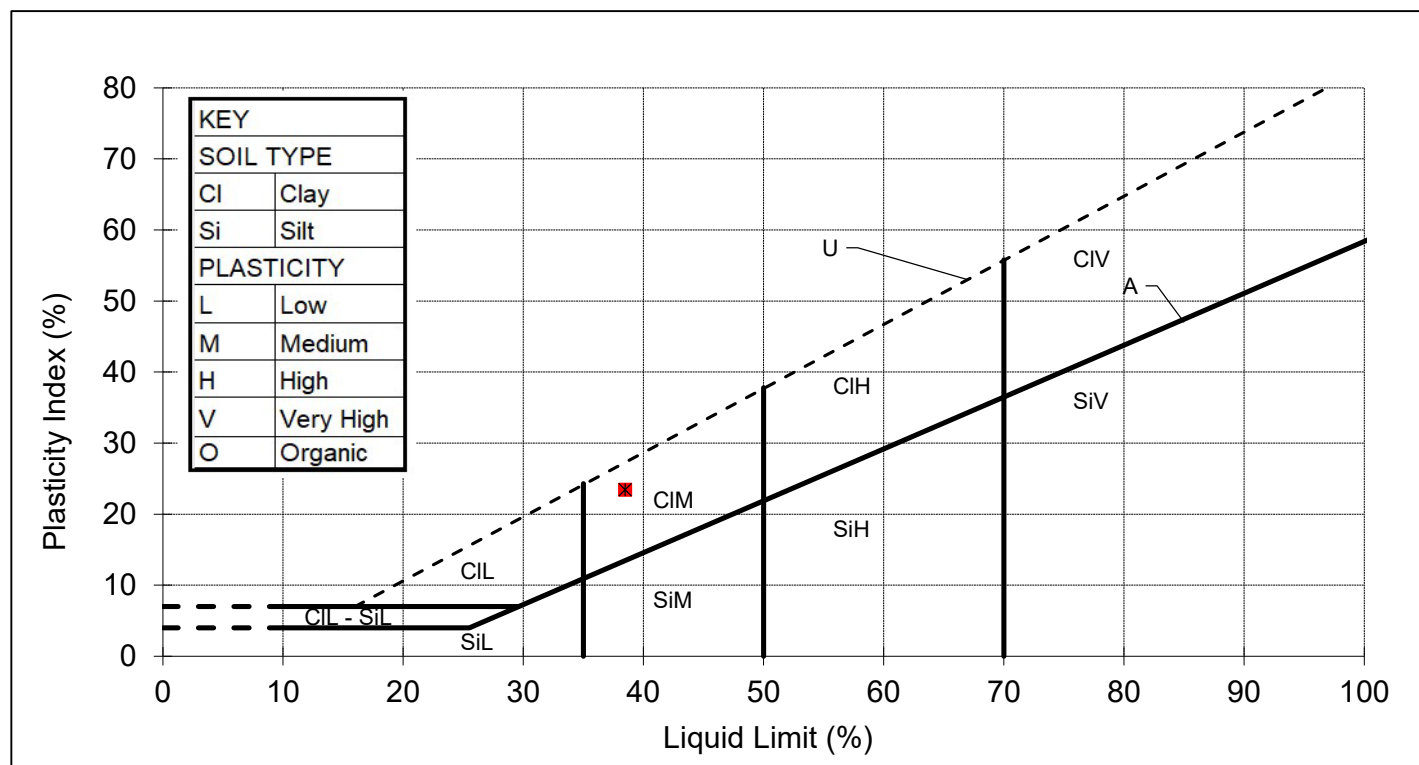
CLIENT	GRM Development Solutions Ltd
SITE	Aintree
JOB NUMBER	MRN 25004/5

SAMPLE LABEL	WS02 @ 1.8m	DATE SAMPLED	Not advised
SAMPLE No.	614704	DATE RECEIVED	12-Dec-24
DATE TESTED	13-Dec-24	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Water Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	18.5	37.5	1.027	
Determination 2 (avg)	18.5	37.4		

Natural Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
17.3	38	15	23	92



REMARKS

SIGNED

NAME

O.P. Davies BA (Hons)
(Director / Head of Laboratory)

DATE

07-Jan-25

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PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

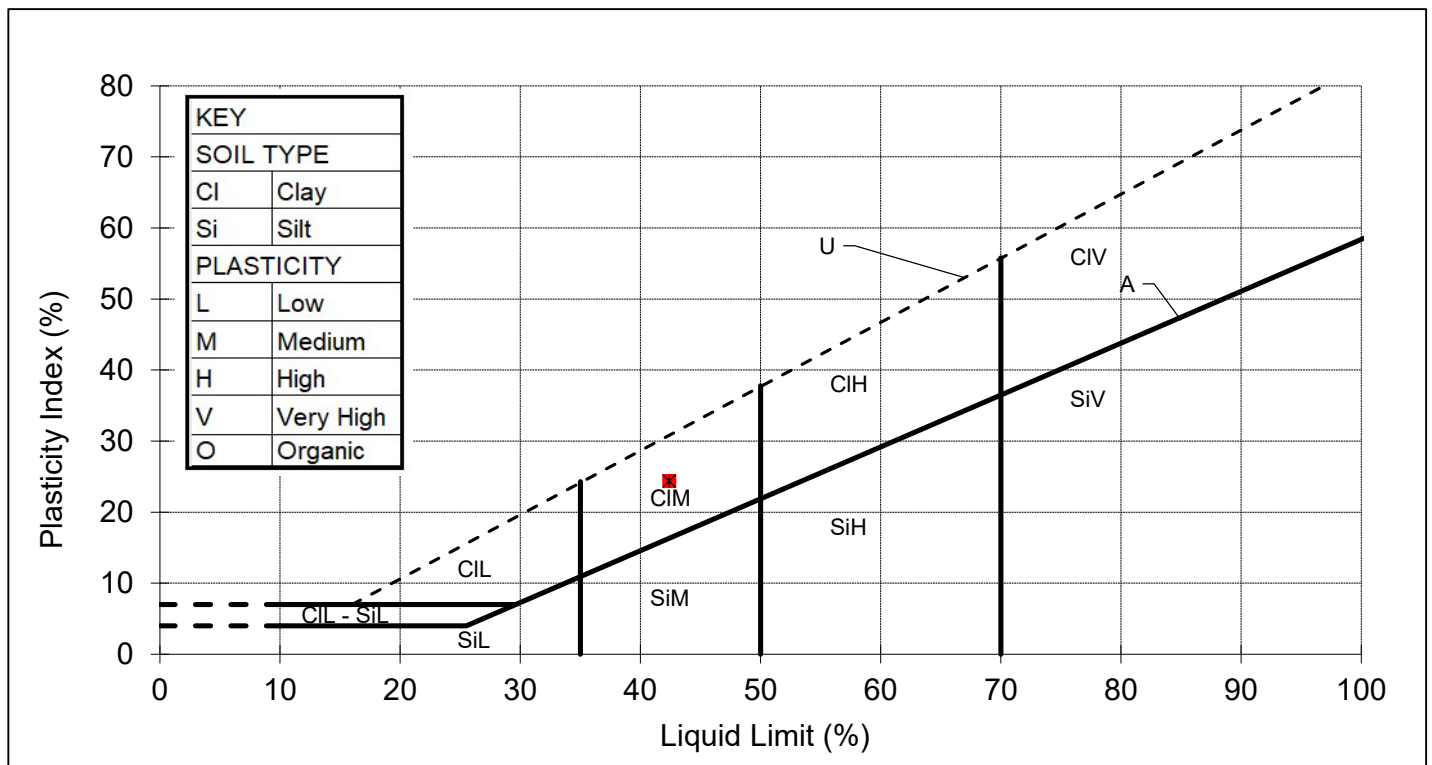
CLIENT	GRM Development Solutions Ltd		
SITE	Aintree		
JOB NUMBER	MRN 25004/5		

SAMPLE LABEL	WS03 @ 1.5m	DATE SAMPLED	Not advised
SAMPLE No.	614705	DATE RECEIVED	12-Dec-24
DATE TESTED	13-Dec-24	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Water Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	19.8	42.2	1.007	
Determination 2 (avg)	19.5	42.0		

Natural Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
26.0	42	18	24	90



REMARKS

SIGNED

NAME

O.P. Davies BA (Hons)
(Director / Head of Laboratory)

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07-Jan-25

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PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

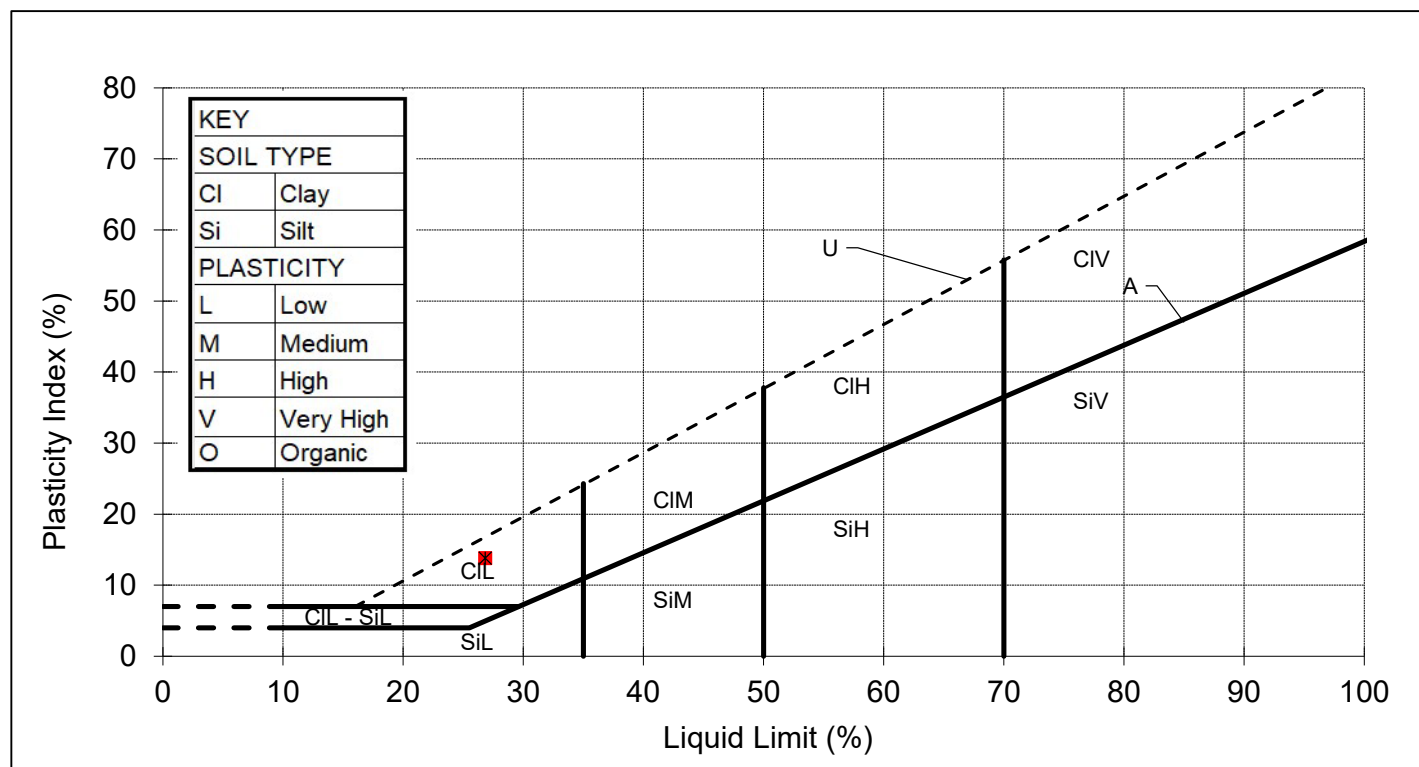
CLIENT	GRM Development Solutions Ltd		
SITE	Aintree		
JOB NUMBER	MRN 25004/5		

SAMPLE LABEL	WS10 @ 1.5m	DATE SAMPLED	Not advised
SAMPLE No.	614706	DATE RECEIVED	12-Dec-24
DATE TESTED	13-Dec-24	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Water Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	21.5	27.5	0.979	
Determination 2 (avg)	21.2	27.3		

Natural Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
19.6	27	13	14	95



REMARKS

SIGNED

NAME

O.P. Davies BA (Hons)
(Director / Head of Laboratory)

DATE

07-Jan-25

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PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

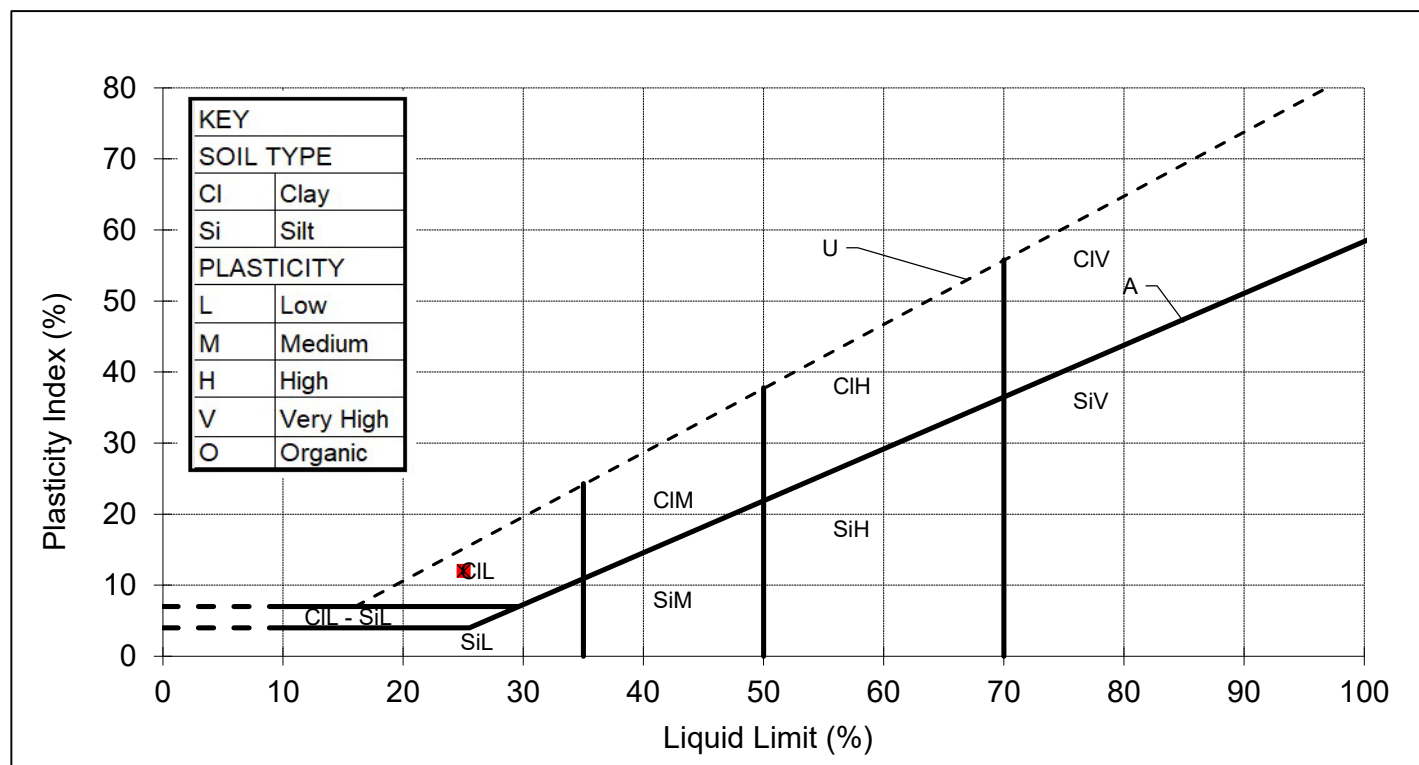
CLIENT	GRM Development Solutions Ltd
SITE	Aintree
JOB NUMBER	MRN 25004/5

SAMPLE LABEL	TP07 @ 1.2m	DATE SAMPLED	Not advised
SAMPLE No.	614707	DATE RECEIVED	12-Dec-24
DATE TESTED	13-Dec-24	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)	Water Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	23.5	26.2	
Determination 2 (avg)	23.2	26.0	

Natural Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
15.0	25	13	12	90



REMARKS

SIGNED

NAME

O.P. Davies BA (Hons)
(Director / Head of Laboratory)

DATE

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TEL 0161 475 0870



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PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5

WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

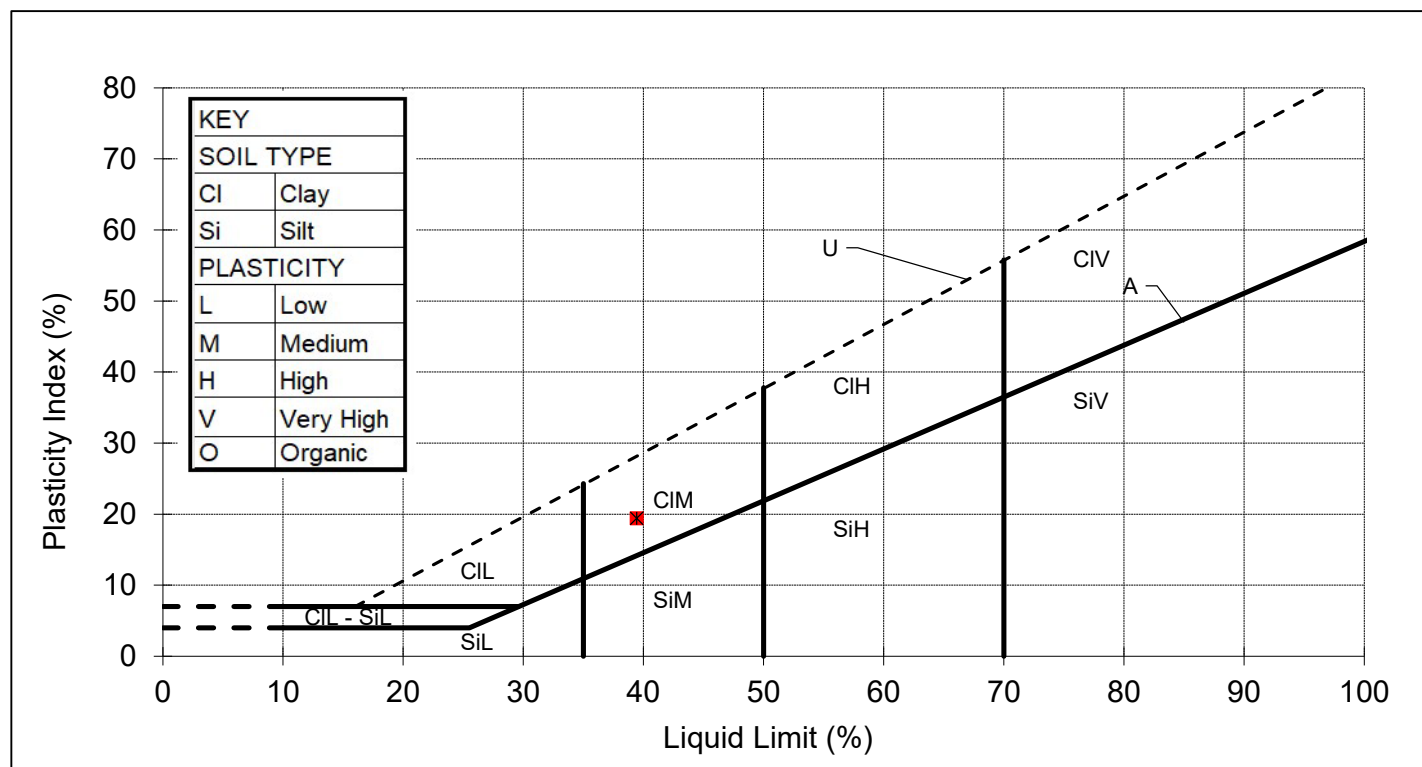
CLIENT	GRM Development Solutions Ltd
SITE	Aintree
JOB NUMBER	MRN 25004/5

SAMPLE LABEL	SA01 @ 1.4m	DATE SAMPLED	Not advised
SAMPLE No.	614708	DATE RECEIVED	12-Dec-24
DATE TESTED	13-Dec-24	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)	Water Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	20.4	39.8	
Determination 2 (avg)	20.3	39.5	

Natural Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
27.1	39	20	19	84



REMARKS

SIGNED

NAME

O.P. Davies BA (Hons)
(Director / Head of Laboratory)

DATE

07-Jan-25

MURRAY RIX
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TEL 0161 475 0870

TEST CERTIFICATE
DETERMINATION OF WATER-SOLUBLE SULPHATE IN SOIL
& DETERMINATION OF THE pH VALUE
BS 1377-3:2018+A1:2021, Cl. 7.3 & Cl. 12

CLIENT	GRM Development Solutions Ltd
SITE	Aintree
JOB NUMBER	MRN 25004/5

DATE TESTED	13-Dec-24	DATE SAMPLED	Not advised
SAMPLED BY	Client	DATE RECEIVED	12-Dec-24
PRE-TREATMENT	Air Dried	ADVISED SOURCE	Site Investigation Samples

Sample Number	Sample Label	Material	% Ret. 2mm	pH Value	Water Soluble Sulphate as SO ₄ (mg/l)
614601	TP03 @ 0.9m	Brown silty slightly sandy slightly gravelly CLAY	2	7.2	190
614702	BH05 @ 1.2-1.65	Brown silty slightly sandy slightly gravelly CLAY	3	7.8	140
614703	SA2 @ 1.4m	Brown silty slightly sandy slightly gravelly CLAY	7	7.5	90
614704	WS02 @ 1.8m	Brown silty slightly sandy slightly gravelly CLAY	5	7.4	130
614705	WS03 @ 1.5m	Brown silty slightly sandy slightly gravelly CLAY	7	7.4	70
614706	WS10 @ 1.5m	Brown silty slightly sandy slightly gravelly CLAY	2	7.1	180
614707	TP07 @ 1.2m	Brown silty slightly sandy slightly gravelly CLAY	8	7.3	110
614708	SA01 @ 1.4m	Brown silty slightly sandy slightly gravelly CLAY	12	6.7	320

REMARKS

SIGNED



NAME

O.P. Davies BA (Hons)
(Director / Head of Laboratory)

DATE

07-Jan-25



A P P E N D I X L

Land Appraisal | Environmental | Geotechnical | Design | Mining | Inspections

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www.grm-uk.com | info@grm-uk.com | 01283 551249 Company No. 3099018 (England), VAT Reg. No. 658 1005 48

	GRM TIER 1 ASSESSMENT CRITERIA		
LAND USE	Residential without Plant Uptake		
CONTAMINANT	Metals and Inorganic Compounds		
^a Arsenic	40		
^a Cadmium	150		
^b Chromium III	910		
^a Chromium VI	21		
^a Lead	310		
^{b/c} Mercury	11		
^b Selenium	430		
^b Nickel	180		
^b Phenols	690		
^b Copper	7100		
^b Zinc	40000		
^d Cyanide	34		
	Organic Compounds		
BTEX	1% SOM	2.5% SOM	6% SOM
^a Benzene	0.89	1.64	3.3
^b Toluene	880	1900	3900
^b Ethylbenzene	83	190	440
^b <i>o</i> - xylene	88	210	480
^b <i>m</i> - xylene	82	190	450
^b <i>p</i> - xylene	79	180	430
Non Genotoxic PAHs			
^b Acenaphthene	3000	4700	6000
^b Acenaphthylene	2900	4600	6000
^b Anthracene	31000	35000	37000
^b Fluoranthene	1500	1600	1600
^b Fluorene	2800	3800	4500
^b Naphthalene	2.3	5.6	13
^b Phenanthrene	1300	1500	1500
^b Pyrene	3700	3800	3800
Genotoxic PAHs			
^{a/e} Benzo(a)pyrene	5.3	5.3	5.3
ALIPHATIC HYDROCARBONS			
^b C5-C6	42	78	160
^b C6-C8	100	230	530
^b C8-C10	27	65	150
^b C10-C12	130	330	770
^b C12-C16	1100	2400	4400
^b C16-35	65000	92000	110000
AROMATIC HYDROCARBONS			
^b C5-7 (benzene)	370	690	1400
^b C7-8 (toluene)	860	1800	3900
^b C8-C10	47	110	270
^b C10-C12	250	590	1200
^b C12-C16	1800	2300	2500
^b C16-C21	1900	1900	1900
^b C21-C35			

Notes

- a C4SL - SP1010 (2014) - Benzene (2.5% SOM) and Benzo(a)pyrene values (1% and 2.5% SOM) have been calculated using default C4SL parameters in CLEA v1.071
- b LQM/CIEH S4UL values (2015). Publication number S4UL3066.
- c S4UL for inorganic Hg used.
- d Atkins ATRISKsoil Value
- e Benzo(a)pyrene is a surrogate marker for the 8 genotoxic PAHs (Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Ideno(1,2,3-cd)pyrene)

All values in mg/kg unless otherwise stated

GRM TAC 02-2024



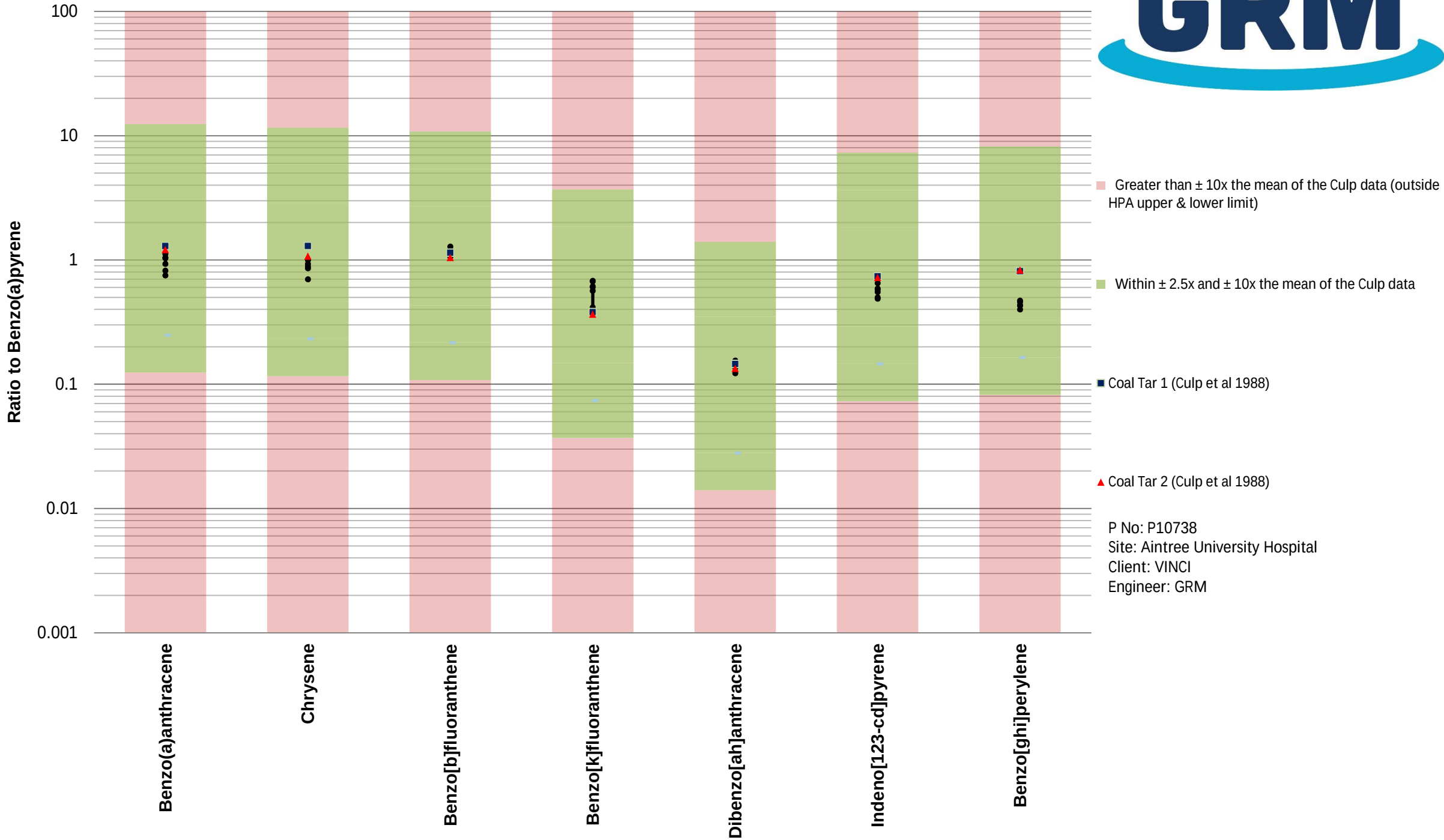
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TPC
TPC
TPC
TPC
TPC

PAH Mixture Analysis





A P P E N D I X N

Land Appraisal | Environmental | Geotechnical | Design | Mining | Inspections

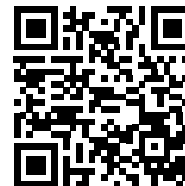
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www.grm-uk.com | info@grm-uk.com | 01283 551249 Company No. 3099018 (England), VAT Reg. No. 658 1005 48

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

- understand the origin of the waste
- select the correct List of Waste code(s)
- confirm that the list of determinands, results and sampling plan are fit for purpose
- select and justify the chosen metal species (Appendix B)
- correctly apply moisture correction and other available corrections
- add the meta data for their user-defined substances (Appendix A)
- check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in **pale yellow**.



QCW0D-NA2FT-6ZE63

Report is invalid if pages are removed.

Job name

P10738 - Aintree University Hospital

Description/Comments

Project

P10738

Site

Aintree University Hospital

Classified by

Name: **George Salloway**
Date: **13 Jan 2025 12:00 GMT**
Telephone: **01283 551 249**
Company: **GRM Development Solutions Ltd**
Laurus House
First Avenue
Burton on Trent
DE14 2WH

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:

CERTIFIED

Course

Hazardous Waste Classification
Most recent 3 year Refresher

Date

06 Dec 2018
03 Dec 2024

Next 3 year Refresher due by Dec 2027

Purpose of classification

2 - Material Characterisation

Address of the waste

Aintree University Hospital

Post Code **N/A**

SIC for the process giving rise to the waste

41201 Construction of commercial buildings

Description of industry/producer giving rise to the waste

Construction Industry.

Description of the specific process, sub-process and/or activity that created the waste

Foundation arisings, soil generated from landscaping.

Description of the waste

Made Ground.



Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	WS02	0.30	Non Hazardous		3
2	WS09	0.50	Non Hazardous		5
3	TP05	0.20	Non Hazardous		7
4	BH05	0.50	Non Hazardous		9
5	TP02	0.10	Non Hazardous		11
6	SA2	0.20	Non Hazardous		13
7	WS13	0.20	Non Hazardous		15
8	WS15	0.30	Non Hazardous		17

Related documents

#	Name	Description
1	GRM Validation Suite - WM3 V1.2.GB	waste stream template used to create this Job

Report

Created by: George Salloway

Created date: 13 Jan 2025 12:00 GMT

Appendices	Page
Appendix A: Classifier defined and non GB MCL determinands	19
Appendix B: Rationale for selection of metal species	20
Appendix C: Version	21

Classification of sample: WS02

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS02	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.30 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
16% (dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 16% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				11 mg/kg	1.32	12.52	mg/kg	0.00125 %	✓	
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium sulfide }			1	0.7 mg/kg	1.285	0.776	mg/kg	0.0000603 %	✓	
	048-010-00-4	215-147-8	1306-23-6								
3	chromium { chromium(III) oxide (worst case) }				13 mg/kg	1.462	16.38	mg/kg	0.00164 %	✓	
		215-160-9	1308-38-9								
4	copper { dicopper oxide; copper (I) oxide }				44 mg/kg	1.126	42.706	mg/kg	0.00427 %	✓	
	029-002-00-X	215-270-7	1317-39-1								
5	lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	110 mg/kg		94.828	mg/kg	0.00948 %	✓	
	082-001-00-6										
6	mercury { mercury dichloride }				<2.5 mg/kg	1.353	<3.384	mg/kg	<0.000338 %		<LOD
	080-010-00-X	231-299-8	7487-94-7								
7	nickel { nickel dihydroxide }				24 mg/kg	1.579	32.679	mg/kg	0.00327 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8 mg/kg	1.405	<11.24	mg/kg	<0.00112 %		<LOD
	034-002-00-8										
9	zinc { zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); [1] zinc sulphate (anhydrous) [2] }				84 mg/kg	4.398	318.471	mg/kg	0.0318 %	✓	
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]								
10	phenol				<1 mg/kg		<1	mg/kg	<0.0001 %		<LOD
	604-001-00-2	203-632-7	108-95-2								
11	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
	006-007-00-5										
12	pH				8 pH		8	pH	8pH		
			PH								
13	acenaphthene				<0.2 mg/kg		<0.2	mg/kg	<0.00002 %		<LOD
		201-469-6	83-32-9								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
14	acenaphthylene	205-917-1	208-96-8		<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
15	anthracene	204-371-1	120-12-7		0.32 mg/kg		0.276 mg/kg	0.0000276 %	✓	
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	1.5 mg/kg		1.293 mg/kg	0.000129 %	✓	
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	2 mg/kg		1.724 mg/kg	0.000172 %	✓	
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	2.3 mg/kg		1.983 mg/kg	0.000198 %	✓	
19	benzo[ghi]perylene	205-883-8	191-24-2		1.6 mg/kg		1.379 mg/kg	0.000138 %	✓	
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	0.83 mg/kg		0.716 mg/kg	0.0000716 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	1.4 mg/kg		1.207 mg/kg	0.000121 %	✓	
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.31 mg/kg		0.267 mg/kg	0.0000267 %	✓	
23	fluoranthene	205-912-4	206-44-0		2.7 mg/kg		2.328 mg/kg	0.000233 %	✓	
24	fluorene	201-695-5	86-73-7		<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		1.3 mg/kg		1.121 mg/kg	0.000112 %	✓	
26	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
27	phenanthrene	201-581-5	85-01-8		0.86 mg/kg		0.741 mg/kg	0.0000741 %	✓	
28	pyrene	204-927-3	129-00-0		2.7 mg/kg		2.328 mg/kg	0.000233 %	✓	
29	TPH (C6 to C40) petroleum group		TPH		45 mg/kg		38.793 mg/kg	0.00388 %	✓	
Total:								0.0591 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
●	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No free phase product present.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.00388%)

Classification of sample: WS09

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS09	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.50 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
14%	
(dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 14% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				<10 mg/kg	1.32	<13.203 mg/kg	<0.00132 %			<LOD
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium sulfide }			1	0.6 mg/kg	1.285	0.676 mg/kg	0.0000526 %	✓		
	048-010-00-4	215-147-8	1306-23-6								
3	chromium { chromium(III) oxide (worst case) }				4.8 mg/kg	1.462	6.154 mg/kg	0.000615 %	✓		
		215-160-9	1308-38-9								
4	copper { dicopper oxide; copper (I) oxide }				25 mg/kg	1.126	24.691 mg/kg	0.00247 %	✓		
	029-002-00-X	215-270-7	1317-39-1								
5	lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	65 mg/kg		57.018 mg/kg	0.0057 %	✓		
	082-001-00-6										
6	mercury { mercury dichloride }				<2.5 mg/kg	1.353	<3.384 mg/kg	<0.000338 %			<LOD
	080-010-00-X	231-299-8	7487-94-7								
7	nickel { nickel dihydroxide }				18 mg/kg	1.579	24.939 mg/kg	0.00249 %	✓		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8 mg/kg	1.405	<11.24 mg/kg	<0.00112 %			<LOD
	034-002-00-8										
9	zinc { zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); [1] zinc sulphate (anhydrous) [2] }				78 mg/kg	4.398	300.911 mg/kg	0.0301 %	✓		
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]								
10	phenol				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	604-001-00-2	203-632-7	108-95-2								
11	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884 mg/kg	<0.000188 %			<LOD
	006-007-00-5										
12	pH				10.3 pH		10.3 pH	10.3 pH			
			PH								
13	acenaphthene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %			<LOD
		201-469-6	83-32-9								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
14	● acenaphthylene	205-917-1	208-96-8		<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
15	● anthracene	204-371-1	120-12-7		0.45 mg/kg		0.395 mg/kg	0.0000395 %	✓	
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	1.3 mg/kg		1.14 mg/kg	0.000114 %	✓	
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	1.4 mg/kg		1.228 mg/kg	0.000123 %	✓	
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	1.7 mg/kg		1.491 mg/kg	0.000149 %	✓	
19	● benzo[ghi]perylene	205-883-8	191-24-2		0.95 mg/kg		0.833 mg/kg	0.0000833 %	✓	
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	0.66 mg/kg		0.579 mg/kg	0.0000579 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	1.2 mg/kg		1.053 mg/kg	0.000105 %	✓	
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
23	● fluoranthene	205-912-4	206-44-0		2.7 mg/kg		2.368 mg/kg	0.000237 %	✓	
24	● fluorene	201-695-5	86-73-7		<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
25	● indeno[123-cd]pyrene	205-893-2	193-39-5		0.81 mg/kg		0.711 mg/kg	0.0000711 %	✓	
26	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
27	● phenanthrene	201-581-5	85-01-8		1.3 mg/kg		1.14 mg/kg	0.000114 %	✓	
28	● pyrene	204-927-3	129-00-0		2.5 mg/kg		2.193 mg/kg	0.000219 %	✓	
29	● TPH (C6 to C40) petroleum group		TPH		160 mg/kg		140.351 mg/kg	0.014 %	✓	
Total:								0.0599 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
●	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No free phase product present.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.014%)

Classification of sample: TP05

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
TP05	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.20 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
19%	
(dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 19% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number							
1		arsenic { arsenic trioxide }			1	11 mg/kg	1.32	12.205 mg/kg	0.00122 %	✓	
		033-003-00-0	215-481-4	1327-53-3							
2		cadmium { cadmium sulfide }			1	0.9 mg/kg	1.285	0.972 mg/kg	0.0000756 %	✓	
		048-010-00-4	215-147-8	1306-23-6							
3		chromium {  chromium(III) oxide (worst case) }				17 mg/kg	1.462	20.879 mg/kg	0.00209 %	✓	
			215-160-9	1308-38-9							
4		copper { dicopper oxide ; copper (I) oxide }				31 mg/kg	1.126	29.33 mg/kg	0.00293 %	✓	
		029-002-00-X	215-270-7	1317-39-1							
5		lead {  lead compounds with the exception of those specified elsewhere in this Annex }			1	220 mg/kg		184.874 mg/kg	0.0185 %	✓	
		082-001-00-6									
6		mercury { mercury dichloride }				<2.5 mg/kg	1.353	<3.384 mg/kg	<0.000338 %		<LOD
		080-010-00-X	231-299-8	7487-94-7							
7		nickel { nickel dihydroxide }				29 mg/kg	1.579	38.492 mg/kg	0.00385 %	✓	
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8 mg/kg	1.405	<11.24 mg/kg	<0.00112 %		<LOD
		034-002-00-8									
9		zinc { zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); [1] zinc sulphate (anhydrous) [2] }				390 mg/kg	4.398	1441.337 mg/kg	0.144 %	✓	
		030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]							
10		phenol				<1 mg/kg		<1 mg/kg	<0.0001 %		<LOD
		604-001-00-2	203-632-7	108-95-2							
11		cyanides {  salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884 mg/kg	<0.000188 %		<LOD
		006-007-00-5									
12		pH				8.5 pH		8.5 pH	8.5 pH		
				PH							
13		acenaphthene				1.3 mg/kg		1.092 mg/kg	0.000109 %	✓	
			201-469-6	83-32-9							

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
14	acenaphthylene	205-917-1	208-96-8		0.46 mg/kg		0.387 mg/kg	0.000387 %	✓	
15	anthracene	204-371-1	120-12-7		3.7 mg/kg		3.109 mg/kg	0.000311 %	✓	
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	7 mg/kg		5.882 mg/kg	0.000588 %	✓	
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	6.7 mg/kg		5.63 mg/kg	0.000563 %	✓	
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	7.6 mg/kg		6.387 mg/kg	0.000639 %	✓	
19	benzo[ghi]perylene	205-883-8	191-24-2		4.1 mg/kg		3.445 mg/kg	0.000345 %	✓	
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	2.9 mg/kg		2.437 mg/kg	0.000244 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	6.7 mg/kg		5.63 mg/kg	0.000563 %	✓	
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.82 mg/kg		0.689 mg/kg	0.000689 %	✓	
23	fluoranthene	205-912-4	206-44-0		17 mg/kg		14.286 mg/kg	0.00143 %	✓	
24	fluorene	201-695-5	86-73-7		1.1 mg/kg		0.924 mg/kg	0.000924 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		3.7 mg/kg		3.109 mg/kg	0.000311 %	✓	
26	naphthalene	601-052-00-2	202-049-5	91-20-3	0.69 mg/kg		0.58 mg/kg	0.000058 %	✓	
27	phenanthrene	201-581-5	85-01-8		13 mg/kg		10.924 mg/kg	0.00109 %	✓	
28	pyrene	204-927-3	129-00-0		16 mg/kg		13.445 mg/kg	0.00134 %	✓	
29	TPH (C6 to C40) petroleum group		TPH		200 mg/kg		168.067 mg/kg	0.0168 %	✓	
Total:								0.199 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
●	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No free phase product present.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.0168%)

Classification of sample: BH05

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
BH05	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.50 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
19%	
(dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 19% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
1		arsenic { arsenic trioxide }			1	14	mg/kg	1.32	15.533	mg/kg	0.00155 %	✓	
		033-003-00-0	215-481-4	1327-53-3									
2		cadmium { cadmium sulfide }			1	0.7	mg/kg	1.285	0.756	mg/kg	0.0000588 %	✓	
		048-010-00-4	215-147-8	1306-23-6									
3		chromium {  chromium(III) oxide (worst case) }			1	11	mg/kg	1.462	13.51	mg/kg	0.00135 %	✓	
			215-160-9	1308-38-9									
4		copper { dicopper oxide; copper (I) oxide }			1	58	mg/kg	1.126	54.875	mg/kg	0.00549 %	✓	
		029-002-00-X	215-270-7	1317-39-1									
5		lead {  lead compounds with the exception of those specified elsewhere in this Annex }			1	120	mg/kg		100.84	mg/kg	0.0101 %	✓	
		082-001-00-6											
6		mercury { mercury dichloride }			1	<2.5	mg/kg	1.353	<3.384	mg/kg	<0.000338 %		<LOD
		080-010-00-X	231-299-8	7487-94-7									
7		nickel { nickel dihydroxide }			1	29	mg/kg	1.579	38.492	mg/kg	0.00385 %	✓	
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }			1	<8	mg/kg	1.405	<11.24	mg/kg	<0.00112 %		<LOD
		034-002-00-8											
9		zinc { zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); [1] zinc sulphate (anhydrous) [2] }			1	53	mg/kg	4.398	195.874	mg/kg	0.0196 %	✓	
		030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
10		phenol			1	<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		604-001-00-2	203-632-7	108-95-2									
11		cyanides {  salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }			1	<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
		006-007-00-5											
12		pH			1	8.6	pH		8.6	pH	8.6 pH		
				PH									
13		acenaphthene			1	1.5	mg/kg		1.261	mg/kg	0.000126 %	✓	
			201-469-6	83-32-9									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
14	acenaphthylene	205-917-1	208-96-8		<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
15	anthracene	204-371-1	120-12-7		1.9 mg/kg		1.597 mg/kg	0.00016 %	✓	
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	1.9 mg/kg		1.597 mg/kg	0.00016 %	✓	
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	1.7 mg/kg		1.429 mg/kg	0.000143 %	✓	
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	1.8 mg/kg		1.513 mg/kg	0.000151 %	✓	
19	benzo[ghi]perylene	205-883-8	191-24-2		0.96 mg/kg		0.807 mg/kg	0.0000807 %	✓	
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	0.68 mg/kg		0.571 mg/kg	0.0000571 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	1.7 mg/kg		1.429 mg/kg	0.000143 %	✓	
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
23	fluoranthene	205-912-4	206-44-0		5.5 mg/kg		4.622 mg/kg	0.000462 %	✓	
24	fluorene	201-695-5	86-73-7		1.8 mg/kg		1.513 mg/kg	0.000151 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.83 mg/kg		0.697 mg/kg	0.0000697 %	✓	
26	naphthalene	601-052-00-2	202-049-5	91-20-3	0.63 mg/kg		0.529 mg/kg	0.0000529 %	✓	
27	phenanthrene	201-581-5	85-01-8		7 mg/kg		5.882 mg/kg	0.000588 %	✓	
28	pyrene	204-927-3	129-00-0		4.9 mg/kg		4.118 mg/kg	0.000412 %	✓	
29	TPH (C6 to C40) petroleum group		TPH		59 mg/kg		49.58 mg/kg	0.00496 %	✓	
Total:								0.0515 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
●	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No free phase product present.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.00496%)

Classification of sample: TP02

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
TP02	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.10 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
21%	
(dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 21% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
1		arsenic { arsenic trioxide }			1	17	mg/kg	1.32	18.55	mg/kg	0.00186 %	✓	
		033-003-00-0	215-481-4	1327-53-3									
2		cadmium { cadmium sulfide }			1	1	mg/kg	1.285	1.062	mg/kg	0.0000826 %	✓	
		048-010-00-4	215-147-8	1306-23-6									
3		chromium {  chromium(III) oxide (worst case) }				15	mg/kg	1.462	18.118	mg/kg	0.00181 %	✓	
			215-160-9	1308-38-9									
4		copper { dicopper oxide ; copper (I) oxide }				44	mg/kg	1.126	40.941	mg/kg	0.00409 %	✓	
		029-002-00-X	215-270-7	1317-39-1									
5		lead {  lead compounds with the exception of those specified elsewhere in this Annex }			1	380	mg/kg		314.05	mg/kg	0.0314 %	✓	
		082-001-00-6											
6		mercury { mercury dichloride }				<2.5	mg/kg	1.353	<3.384	mg/kg	<0.000338 %		<LOD
		080-010-00-X	231-299-8	7487-94-7									
7		nickel { nickel dihydroxide }				32	mg/kg	1.579	41.772	mg/kg	0.00418 %	✓	
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8	mg/kg	1.405	<11.24	mg/kg	<0.00112 %		<LOD
		034-002-00-8											
9		zinc { zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); [1] zinc sulphate (anhydrous) [2] }				310	mg/kg	4.398	1126.741	mg/kg	0.113 %	✓	
		030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
10		phenol				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		604-001-00-2	203-632-7	108-95-2									
11		cyanides {  salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
		006-007-00-5											
12		pH				8.4	pH		8.4	pH	8.4 pH		
				PH									
13		acenaphthene				0.74	mg/kg		0.612	mg/kg	0.0000612 %	✓	
			201-469-6	83-32-9									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
14	acenaphthylene	205-917-1	208-96-8		0.17 mg/kg		0.14 mg/kg	0.000014 %	✓	
15	anthracene	204-371-1	120-12-7		1.5 mg/kg		1.24 mg/kg	0.000124 %	✓	
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	2.9 mg/kg		2.397 mg/kg	0.00024 %	✓	
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	2.8 mg/kg		2.314 mg/kg	0.000231 %	✓	
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	3.2 mg/kg		2.645 mg/kg	0.000264 %	✓	
19	benzo[ghi]perylene	205-883-8	191-24-2		1.7 mg/kg		1.405 mg/kg	0.00014 %	✓	
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	1.2 mg/kg		0.992 mg/kg	0.0000992 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	2.6 mg/kg		2.149 mg/kg	0.000215 %	✓	
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.38 mg/kg		0.314 mg/kg	0.0000314 %	✓	
23	fluoranthene	205-912-4	206-44-0		6.8 mg/kg		5.62 mg/kg	0.000562 %	✓	
24	fluorene	201-695-5	86-73-7		0.51 mg/kg		0.421 mg/kg	0.0000421 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		1.4 mg/kg		1.157 mg/kg	0.000116 %	✓	
26	naphthalene	601-052-00-2	202-049-5	91-20-3	0.46 mg/kg		0.38 mg/kg	0.000038 %	✓	
27	phenanthrene	201-581-5	85-01-8		5.6 mg/kg		4.628 mg/kg	0.000463 %	✓	
28	pyrene	204-927-3	129-00-0		6.3 mg/kg		5.207 mg/kg	0.000521 %	✓	
29	TPH (C6 to C40) petroleum group		TPH		150 mg/kg		123.967 mg/kg	0.0124 %	✓	
Total:								0.173 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
●	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: **1000 mg/kg (0.1%)**
because: **No free phase product present.**

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.0124%)

Classification of sample: SA2

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
SA2	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.20 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
25%	
(dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 25% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
1		arsenic { arsenic trioxide }			1	19	mg/kg	1.32	20.069	mg/kg	0.00201 %	✓	
		033-003-00-0	215-481-4	1327-53-3									
2		cadmium { cadmium sulfide }			1	1	mg/kg	1.285	1.028	mg/kg	0.00008 %	✓	
		048-010-00-4	215-147-8	1306-23-6									
3		chromium {  chromium(III) oxide (worst case) }				8.4	mg/kg	1.462	9.822	mg/kg	0.000982 %	✓	
			215-160-9	1308-38-9									
4		copper { dicopper oxide ; copper (I) oxide }				67	mg/kg	1.126	60.348	mg/kg	0.00603 %	✓	
		029-002-00-X	215-270-7	1317-39-1									
5		lead {  lead compounds with the exception of those specified elsewhere in this Annex }			1	240	mg/kg		192	mg/kg	0.0192 %	✓	
		082-001-00-6											
6		mercury { mercury dichloride }				<2.5	mg/kg	1.353	<3.384	mg/kg	<0.000338 %		<LOD
		080-010-00-X	231-299-8	7487-94-7									
7		nickel { nickel dihydroxide }				30	mg/kg	1.579	37.908	mg/kg	0.00379 %	✓	
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8	mg/kg	1.405	<11.24	mg/kg	<0.00112 %		<LOD
		034-002-00-8											
9		zinc { zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); [1] zinc sulphate (anhydrous) [2] }				96	mg/kg	4.398	337.761	mg/kg	0.0338 %	✓	
		030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
10		phenol				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
		604-001-00-2	203-632-7	108-95-2									
11		cyanides {  salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
		006-007-00-5											
12		pH				7.9	pH		7.9	pH	7.9 pH		
				PH									
13		acenaphthene				0.03	mg/kg		0.024	mg/kg	0.0000024 %	✓	
			201-469-6	83-32-9									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
14	acenaphthylene	205-917-1	208-96-8		0.04 mg/kg		0.032 mg/kg	0.0000032 %	✓	
15	anthracene	204-371-1	120-12-7		0.09 mg/kg		0.072 mg/kg	0.0000072 %	✓	
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	0.5 mg/kg		0.4 mg/kg	0.00004 %	✓	
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	0.61 mg/kg		0.488 mg/kg	0.0000488 %	✓	
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	0.78 mg/kg		0.624 mg/kg	0.0000624 %	✓	
19	benzo[ghi]perylene	205-883-8	191-24-2		0.41 mg/kg		0.328 mg/kg	0.0000328 %	✓	
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	0.28 mg/kg		0.224 mg/kg	0.0000224 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	0.54 mg/kg		0.432 mg/kg	0.0000432 %	✓	
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.09 mg/kg		0.072 mg/kg	0.0000072 %	✓	
23	fluoranthene	205-912-4	206-44-0		0.95 mg/kg		0.76 mg/kg	0.000076 %	✓	
24	fluorene	201-695-5	86-73-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.36 mg/kg		0.288 mg/kg	0.0000288 %	✓	
26	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
27	phenanthrene	201-581-5	85-01-8		0.34 mg/kg		0.272 mg/kg	0.0000272 %	✓	
28	pyrene	204-927-3	129-00-0		0.93 mg/kg		0.744 mg/kg	0.0000744 %	✓	
29	TPH (C6 to C40) petroleum group		TPH		33 mg/kg		26.4 mg/kg	0.00264 %	✓	
Total:								0.0707 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
●	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No free phase product present.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.00264%)

Classification of sample: WS13

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS13	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.20 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
23%	
(dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 23% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number								
1		arsenic { arsenic trioxide }			1	12 mg/kg	1.32	12.881 mg/kg	0.00129 %	✓		
		033-003-00-0	215-481-4	1327-53-3								
2		cadmium { cadmium sulfide }			1	0.8 mg/kg	1.285	0.836 mg/kg	0.000065 %	✓		
		048-010-00-4	215-147-8	1306-23-6								
3		chromium { chromium(III) oxide (worst case) }				11 mg/kg	1.462	13.071 mg/kg	0.00131 %	✓		
			215-160-9	1308-38-9								
4		copper { dicopper oxide; copper (I) oxide }				52 mg/kg	1.126	47.599 mg/kg	0.00476 %	✓		
		029-002-00-X	215-270-7	1317-39-1								
5		lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	100 mg/kg		81.301 mg/kg	0.00813 %	✓		
		082-001-00-6										
6		mercury { mercury dichloride }				<2.5 mg/kg	1.353	<3.384 mg/kg	<0.000338 %		<LOD	
		080-010-00-X	231-299-8	7487-94-7								
7		nickel { nickel dihydroxide }				24 mg/kg	1.579	30.82 mg/kg	0.00308 %	✓		
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8 mg/kg	1.405	<11.24 mg/kg	<0.00112 %		<LOD	
		034-002-00-8										
9		zinc { zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); [1] zinc sulphate (anhydrous) [2] }				200 mg/kg	4.398	715.11 mg/kg	0.0715 %	✓		
		030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]								
10		phenol				<1 mg/kg		<1 mg/kg	<0.0001 %		<LOD	
		604-001-00-2	203-632-7	108-95-2								
11		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884 mg/kg	<0.000188 %		<LOD	
		006-007-00-5										
12		pH		PH		8 pH		8 pH	8pH			
13		acenaphthene				8.1 mg/kg		6.585 mg/kg	0.000659 %	✓		
			201-469-6	83-32-9								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
14	acenaphthylene	205-917-1	208-96-8		0.44 mg/kg		0.358 mg/kg	0.0000358 %	✓	
15	anthracene	204-371-1	120-12-7		13 mg/kg		10.569 mg/kg	0.00106 %	✓	
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	24 mg/kg		19.512 mg/kg	0.00195 %	✓	
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	24 mg/kg		19.512 mg/kg	0.00195 %	✓	
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	27 mg/kg		21.951 mg/kg	0.0022 %	✓	
19	benzo[ghi]perylene	205-883-8	191-24-2		14 mg/kg		11.382 mg/kg	0.00114 %	✓	
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	9.7 mg/kg		7.886 mg/kg	0.000789 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	23 mg/kg		18.699 mg/kg	0.00187 %	✓	
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	3.2 mg/kg		2.602 mg/kg	0.00026 %	✓	
23	fluoranthene	205-912-4	206-44-0		68 mg/kg		55.285 mg/kg	0.00553 %	✓	
24	fluorene	201-695-5	86-73-7		5.1 mg/kg		4.146 mg/kg	0.000415 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		12 mg/kg		9.756 mg/kg	0.000976 %	✓	
26	naphthalene	601-052-00-2	202-049-5	91-20-3	2.4 mg/kg		1.951 mg/kg	0.000195 %	✓	
27	phenanthrene	201-581-5	85-01-8		56 mg/kg		45.528 mg/kg	0.00455 %	✓	
28	pyrene	204-927-3	129-00-0		61 mg/kg		49.593 mg/kg	0.00496 %	✓	
29	TPH (C6 to C40) petroleum group		TPH		510 mg/kg		414.634 mg/kg	0.0415 %	✓	
Total:								0.162 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
●	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No free phase product present.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.0415%)

Classification of sample: WS15

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS15	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.30 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
9.9%	
(dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 9.9% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
1		arsenic { arsenic trioxide }			1	14	mg/kg	1.32	16.819	mg/kg	0.00168 %	✓	
	033-003-00-0	215-481-4	1327-53-3										
2		cadmium { cadmium sulfide }			1	1.8	mg/kg	1.285	2.105	mg/kg	0.000164 %	✓	
	048-010-00-4	215-147-8	1306-23-6										
3		chromium {  chromium(III) oxide (worst case) }			1	7.8	mg/kg	1.462	10.373	mg/kg	0.00104 %	✓	
		215-160-9	1308-38-9										
4		copper { dicopper oxide; copper (I) oxide }			1	52	mg/kg	1.126	53.272	mg/kg	0.00533 %	✓	
	029-002-00-X	215-270-7	1317-39-1										
5		lead {  lead compounds with the exception of those specified elsewhere in this Annex }			1	80	mg/kg		72.793	mg/kg	0.00728 %	✓	
	082-001-00-6												
6		mercury { mercury dichloride }			1	<2.5	mg/kg	1.353	<3.384	mg/kg	<0.000338 %		<LOD
	080-010-00-X	231-299-8	7487-94-7										
7		nickel { nickel dihydroxide }			1	22	mg/kg	1.579	31.619	mg/kg	0.00316 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]										
8		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }			1	<8	mg/kg	1.405	<11.24	mg/kg	<0.00112 %		<LOD
	034-002-00-8												
9		zinc { zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); [1] zinc sulphate (anhydrous) [2] }			1	79	mg/kg	4.398	316.138	mg/kg	0.0316 %	✓	
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]										
10		phenol			1	<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
	604-001-00-2	203-632-7	108-95-2										
11		cyanides {  salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }			1	<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
	006-007-00-5												
12		pH			1	8.4	pH		8.4	pH	8.4 pH		
			PH										
13		acenaphthene			1	3.2	mg/kg		2.912	mg/kg	0.000291 %	✓	
		201-469-6	83-32-9										

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
14	acenaphthylene	205-917-1	208-96-8		0.29 mg/kg		0.264 mg/kg	0.0000264 %	✓	
15	anthracene	204-371-1	120-12-7		6.3 mg/kg		5.732 mg/kg	0.000573 %	✓	
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	15 mg/kg		13.649 mg/kg	0.00136 %	✓	
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	17 mg/kg		15.469 mg/kg	0.00155 %	✓	
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	19 mg/kg		17.288 mg/kg	0.00173 %	✓	
19	benzo[ghi]perylene	205-883-8	191-24-2		11 mg/kg		10.009 mg/kg	0.001 %	✓	
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	7.1 mg/kg		6.46 mg/kg	0.000646 %	✓	
21	chrysene	601-048-00-0	205-923-4	218-01-9	15 mg/kg		13.649 mg/kg	0.00136 %	✓	
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	2.3 mg/kg		2.093 mg/kg	0.000209 %	✓	
23	fluoranthene	205-912-4	206-44-0		38 mg/kg		34.577 mg/kg	0.00346 %	✓	
24	fluorene	201-695-5	86-73-7		1.8 mg/kg		1.638 mg/kg	0.000164 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		9.2 mg/kg		8.371 mg/kg	0.000837 %	✓	
26	naphthalene	601-052-00-2	202-049-5	91-20-3	0.82 mg/kg		0.746 mg/kg	0.0000746 %	✓	
27	phenanthrene	201-581-5	85-01-8		22 mg/kg		20.018 mg/kg	0.002 %	✓	
28	pyrene	204-927-3	129-00-0		36 mg/kg		32.757 mg/kg	0.00328 %	✓	
29	TPH (C6 to C40) petroleum group		TPH		560 mg/kg		509.554 mg/kg	0.051 %	✓	
Total:								0.122 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
●	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: No free phase product present.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group (conc.: 0.051%)

Appendix A: Classifier defined and non GB MCL determinands

• **chromium(III) oxide (worst case)** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database

Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H332, Acute Tox. 4; H302, Eye Irrit. 2; H319, STOT SE 3; H335, Skin Irrit. 2; H315, Resp. Sens. 1; H334, Skin Sens. 1; H317, Repr. 1B; H360FD, Aquatic Acute 1; H400, Aquatic Chronic 1; H410

• **lead compounds with the exception of those specified elsewhere in this Annex**

GB MCL index number: 082-001-00-6

Description/Comments: Least-worst case: IARC considers lead compounds Group 2A; Probably carcinogenic to humans; Lead REACH Consortium, following MCL protocols, considers many simple lead compounds to be Carcinogenic category 2

Additional Hazard Statement(s): Carc. 2; H351

Reason for additional Hazards Statement(s):

20 Nov 2021 - Carc. 2; H351 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium

www.reach-lead.eu/substanceinformation.html. Review date 29/09/2015

• **salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex**

GB MCL index number: 006-007-00-5

Description/Comments: Conversion factor based on a worst case compound: sodium cyanide

Additional Hazard Statement(s): EUH032 >= 0.2 %

Reason for additional Hazards Statement(s):

20 Nov 2021 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

• **pH** (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: None.

• **acenaphthene** (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319, STOT SE 3; H335, Skin Irrit. 2; H315, Aquatic Acute 1; H400, Aquatic Chronic 1; H410, Aquatic Chronic 2; H411

• **acenaphthylene** (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H302, Acute Tox. 1; H330, Acute Tox. 1; H310, Eye Irrit. 2; H319, STOT SE 3; H335, Skin Irrit. 2; H315

• **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319, STOT SE 3; H335, Skin Irrit. 2; H315, Skin Sens. 1; H317, Aquatic Acute 1; H400, Aquatic Chronic 1; H410

• **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 23 Jul 2015

Hazard Statements: Aquatic Acute 1; H400, Aquatic Chronic 1; H410

• **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Acute Tox. 4; H302, Aquatic Acute 1; H400, Aquatic Chronic 1; H410

• **fluorene** (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351

• **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

• **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

• **TPH (C6 to C40) petroleum group** (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on risk phrases

cadmium {cadmium sulfide}

Worst case species based on risk phrases

chromium {chromium(III) oxide (worst case)}

Insufficient hexavalent chromium recorded.

copper {dicopper oxide; copper (I) oxide}

Most likely common species

lead {lead compounds with the exception of those specified elsewhere in this Annex}

Insufficient hexavalent chromium recorded.

mercury {mercury dichloride}

Worst case species based on risk phrases

nickel {nickel dihydroxide}

Worst case species based on risk phrases

selenium {selenium compounds with the exception of cadmium sulposelenide and those specified elsewhere in this Annex}

Worst case species based on risk phrases

zinc {zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); [1] zinc sulphate (anhydrous) [2]}

Insufficient hexavalent chromium recorded.

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Worst case species

Appendix C: Version

HazWasteOnline Classification Engine: **WM3 1st Edition v1.2.GB - Oct 2021**

HazWasteOnline Classification Engine Version: 2025.7.6439.11737 (07 Jan 2025)

HazWasteOnline Database: 2025.7.6439.11737 (07 Jan 2025)

This classification utilises the following guidance and legislation:

WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020

The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020

GB MCL List - version 1.1 of 09 June 2021

GB MCL List v2.0 - version 2.0 of 20th October 2023

GB MCL List v3.0 - version 3.0 of 11th January 2024

GB MCL List v4.0 - version 4.0 of 2nd March 2024

GB MCL List v5.0 - version 5.0 of 26th June 2024



A P P E N D I X O

Land Appraisal | Environmental | Geotechnical | Design | Mining | Inspections

GRM Development Solutions Limited, Laurus House, First Avenue, Centrum 100, Burton upon Trent, Staffs DE14 2WH
www.grm-uk.com | info@grm-uk.com | 01283 551249 Company No. 3099018 (England), VAT Reg. No. 658 1005 48

KEY

- Tree heave zone 9approx.)
- Site Boundary
- Building Footprints
 - Future Development
 - GP Surgery
 - OPD (3 storey)
 - Renal
 - Substation



NOTES:

CLIENT:	A J P / VINCI CONSTRUCTION
PROJECT:	AINTREE HOSPITAL
TITLE:	Foundation Zone Plan

PROJECT No:	P10738	DATE:	JAN 2025	DESIGN/DRAWN:	RJH
DRAWING NUMBER:	005	ISSUE:	FINAL	© GRM Development Solutions Ltd © Crown Copyright. AL 100014100	



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