



Report prepared at

Land at Johnson Drive
Finchampstead
RG40 3NW

On behalf of

Palatine Homes Limited

Report reference

23-176.01

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Prepared by

Aviron Associates Limited

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Contents

1.0	PROJECT AND SITE INFORMATION	1
2.0	DESK STUDY REVIEW	5
3.0	REGULATORY INFORMATION, CONSULTATIONS AND OTHER	17
4.0	PRELIMINARY RISK ASSESSMENT	20
5.0	SITE INVESTIGATION WORK	27
6.0	LABORATORY ANALYSIS	34
7.0	ENVIRONMENTAL INTERPRETATIVE GUIDANCE	37
8.0	ASSESSMENT OF GEOCHEMICAL SOIL RESULTS	39
9.0	HAZARDOUS GROUND GAS MONITORING	42
10.0	REVISED RISK ASSESSMENT	45
11.0	GEOTECHNICAL ASSESSMENT	51
12.0	CONCLUSIONS AND RECOMMENDATIONS	62
13.0	PROJECT INSTRUCTION AND LIMITATIONS	64
14.0	REFERENCES AND OTHER SOURCES OF INFORMATION	67

Figures

1	Site Location Plan
2	Existing Site Layout Plan
3	Site Photographs
4	Site Photographs
5	Proposed Development Plan
6	Southern Testing Soil Contamination Identification Plan
7	Exploratory Hole Location Plan - Existing Site Layout
8	Exploratory Hole Location Plan - Proposed Development
9	Combined Soil Contamination Identification Plan

Appendices

- | | |
|-----|--|
| I | Exploratory Hole Logs and Photographs |
| II | Field Monitoring Results |
| III | Soil Contamination Results and Assessment Criteria |
| IV | Soil Geotechnical Results |

1.0 PROJECT AND SITE INFORMATION

1.1 APPOINTMENT

Aviron Associates Limited (Aviron) was retained by Palatine Homes Limited (the “Client”) to prepare a tier 1 Preliminary Risk Assessment (PRA) and complete a Site Investigation (SI) leading towards a tier 2 Generic Quantitative Risk Assessment (GQRA) of the following premises:

Land at Johnson Drive, Finchampstead, RG40 3NW (hereafter referred to as the “site”).

The PRA forms a tier 1 assessment by completing a desk-based study with site walkover to identify potential areas of contaminative concern associated with the proposed development of the site. The PRA will then form a preliminary Conceptual Site Model (CSM) with recommendations for any further investigation or risk assessment.

The PRA will be supplemented with information supplied by the Client including the following:

-  Southern Testing Environmental & Geotechnical (Southern Testing), Geoenvironmental Site Investigation Report (reference JT0117, dated October 2017)
-  STM Environmental Consultants (STM), Contaminated Land Risk Assessment, Phase I Desk Study Report (reference PH1-2022-0000101, dated 10 November 2022)

The SI will investigate the pollutant linkages established within the PRA in order to produce suitable data for the preparation of a tier 2 GQRA to refine the CSM and as necessary provide recommendations for any further investigation or tier 3 Detailed Quantitative Risk Assessment (DQRA). Alternatively, it may be possible to make remediation recommendations immediately following the GQRA. In addition, geotechnical issues shall be investigated to provide recommendations for new foundations, drainage and pavement design.

Aviron has relied upon information received from the Client and their agents as accurate, unless contradicted by written documentation or site observations.

1.2 THE SITE

Table 1.2 provides a summary of site details and surrounding area.

Table 1.2: Site Details	
Site Location	The site is located at the northern end of Johnson Drive, off Nine Mile Ride (B3430), approximately 2km to the north-east of Finchampstead. Figure 1 is presented as a Site Location Plan.
National Grid Ref.	Centred at 480592 165179.
Current Land Use	The site is split into two distinct areas, one in the north of the site accessed using a tree-lined gravel track leading off Johnson Drive in the south-west of the site, and the other in the south of the site via the garden of 6 Johnson Drive to the south. Northern two-thirds of the site: an area comprising disused land and woodland, used for the storage of a number of vehicles and stockpiles of building materials. Two buildings/workshops are also located in the south-east of this area. Southern third of the site: a section of the rear garden of the adjacent number 6 Johnson Drive, including landscaped borders and trees. An equestrian building is also located in the north-east of this area. Figure 2 is presented as the Existing Site Layout Plan. Figures 3 and 4 are presented as the Site Photographs.
Surrounding Land Use	The site is located within an urban area with homes to the south and west, and woodland to the north and east.
Proposed Land Use	The proposed development comprises the construction of five new detached homes and garages with private gardens, and an access road running along the northern boundary and into the centre of the site at two locations. Figure 5 is presented as the Proposed Development Plan.

1.3 SITE WALKOVER SURVEY

A site walkover survey was undertaken on 26 July 2023 and included an inspection of the site and surrounding area, where safe and accessible. The purpose of the survey is to identify any potential on-site or nearby contaminative activities or potential sources of land contamination.

Additionally, as part of the survey any features which may affect site re-development in terms of physical site and ground conditions were noted.

Table 1.3 provides a description of site features observed during the walkover survey and also current Ordnance Survey maps made available at the time of report writing.

Table 1.3: Summary of Site Walkover Survey

Physical Site Characteristics	
Existing Structures	Two single storey warehouse/workshop type buildings in the northern two-thirds of the site along the eastern boundary. The buildings are of block construction clad and roofed with corrugated metal sheeting. Wooden equestrian building in the southern two-thirds of the site along the eastern boundary.
Basements	None observed.
Visual Topography and Site Surfacing	The site slopes gently downwards from approximately 66.5 metres (m) above Ordnance Datum (AOD) in south to 63.3m AOD in the north, as noted on the Site Plan by Paul Edwards Architecture (reference 2554 - 14A, dated November 2022) supplied by the Client. With the exception of the gravel access track in the south-west and further gravel tracks through the centre of the site, the site is predominantly covered in grass/scrub. Bare earth is located around the equestrian building in the southern third of the site.
Retaining Structures and Slopes	None observed.
Drainage Issues	None observed.
Surface Waters	None observed.
Trees and Hedges	Significant number of mature trees, including numerous cypresses, oak, poplar and hedges around the northern, eastern and western site boundaries, as well within the southern third of the site.
Made and Infilled Ground	Slightly raised mounds observed locally across the north of the site and around a group of trees in the south, which could indicate the presence of made ground. Made ground should be anticipated beneath the buildings along the eastern boundary.
Contaminative Characteristics	
Above or Underground Storage Tanks and Drums	None observed.
Fuel Interceptors	None observed.
Waste Storage and Disposal	None observed.
Hazardous Material Storage and Use	None observed.
Asbestos Containing Materials (ACMs)	None observed. An asbestos survey is recommended prior to the redevelopment works.
Boiler Houses	None observed.
Sub-stations	None observed.

Table 1.3: Summary of Site Walkover Survey

Surface Staining	None observed.
Potentially Contaminative Activities	Limited contaminative activities associated with the storage of building materials including potential for undiscovered ACMs.

1.3.1 Summary of Physical Site Characteristics

Consideration should be made towards the make-up and competency of the underlying strata and the influence of trees on the proposed development buildings.

1.3.2 Summary of Contaminative Site Characteristics

No significant evidence of potentially contaminative activities, however the storage of a variety of building materials observed in the northern two-thirds of the site, may include the potential for undiscovered ACMs.

2.0 DESK STUDY REVIEW

Historical Ordnance Survey (OS) maps as part of a Groundsure report within STMs Contaminated Land Risk Assessment, Phase I Desk Study Report, were reviewed to determine the historical development of the site. Database information within the Groundsure report, which also includes reference to the hydrogeology, hydrology, subsidence and mining risk and ground gas hazards in the site area, is summarised in the following sections. A summary of the ground hazards for construction purposes is also included.

2.1 HISTORICAL REVIEW

Historical Ordnance Survey (OS) maps were reviewed, and the historical development of the site and the surrounding land is summarised in the following table.

Table 2.1: History of the Site and Surrounding Land		
Date (scale)	Site History	Surrounding Land History
1871 (1:2,500)	The earliest available historical mapping edition indicates that the site comprised undeveloped land set back from Nile Mile Ride.	The earliest available historical mapping indicates that the site is surrounded by undeveloped land and coniferous woodland. Nine Mile Ride is located approximately 60m to the south of the site. Residential premises marked as 'California' are located immediately south-west of the site. A well is marked amongst the premises. A rifle range is located 100m to the east. Brick kilns and a clay pit, as well as a saw mill and timber yard are located some 120m to the west of the site. The California Tramway is shown to have serviced these facilities.
1898 (1:10,560) 1899 (1:2,500)	The site is shown to have remained undeveloped; however, the western site boundary had been defined at this time.	Brick manufacture to the west of the site appears to have all but ceased.
1910 (1:10,560) 1911 (1:2,500)	The site is shown to have remained undeveloped.	The tramway to the west of the site is no longer marked. A number of ponds are evident within the area of the former brick kilns. The saw mill and timber yard appear to be in use still.
1932 (1:10,560) 1933 (1:2,500) 1938 (1:10,560) 1956 (1:10,560)	The site remained undeveloped; however, the eastern and southern site boundaries are shown to have been defined at this time. The site may have been contained within the grounds of a detached dwelling noted to the south-east.	Residential development noted immediately south of the site. A series of rear gardens to residential premises are also marked along the north-western site boundary.

Table 2.1: History of the Site and Surrounding Land		
Date (scale)	Site History	Surrounding Land History
		The rifle range to the east is no longer in use. Linear housing development noted along the length of Nine Mile Ride to the south. A drain is marked approximately 40m to the west of the site.
1964 (1:2,500) 1969 (1:10,000) 1973 (1:2,500)	The site is shown to have been located within the grounds of number 287 Nine Mile Ride. A small rectangular building is marked in the south-east of the site. The northern and western sections of the site are noted to have comprised coniferous and deciduous trees.	No notable changes identified in the nearby surrounding area.
1975 (1:10,000) 1977 (1:1,250) 1980 (1:10,000) 1988 (1:10,000) 1993 (1:1,250) 2001 (1:10,000) 2003 (1:1,250)	The site is shown in its current configuration, split between undeveloped land in the northern two-thirds and the rear garden of number 279a Nine Mile Ride (6 Johnson Close) in the southern third. A pond is marked in the north of the site. The small rectangular building in the south-east of the site is no longer marked.	Residential development noted to the south-west of the site along Tomlinson Drive.
2010 (1:1,250)	The site is shown in its current layout including two rectangular buildings inside the eastern boundary of the site. The pond is no longer marked.	No notable changes identified in the nearby surrounding area.
2023 ground investigation	The site is shown to have remained essentially the same. A wooden equestrian building is noted in the east of the site, within the rear garden of number 6 Johnson Drive.	No notable changes identified in the nearby surrounding area.
Note: All distances are approximate.		

2.1.1 Planning History

The following table 2.1.1 includes a summary of the planning history associated with the site, forming a number of the previous applications associated with 6 Johnson Drive, as held on the planning portal of Wokingham Borough Council.

A selection of the planning history, irrelevant of status is included where there is pertinent information available for the subject site.

Table 2.1.1: Summary of Planning History

Reference, Date	Status	Description of Planning Application
223592 09/06/2023	Approve	Full application for the erection of 5no. dwellings with double garages following removal/demolition of the existing outbuildings.
222138 18/01/2023	Approve	Householder application for proposed single storey detached outbuilding with roof lantern to the eastern boundary (Retrospective).
203433 10/12/2020	Breach alleged	Breach alleged without planning permission, the material change of use of the land to a mixed use including the external storage of builder's materials, plant and equipment, fencing, builder bulk bags, shipping containers, general/assorted waste products, inert waste and the like and the storage of motor vehicles, vehicle breaking, vehicle disassembly and the sale of vehicle parts. (Lead appeal 3264819/203432).
203432 10/12/2020	Breach alleged	Breach alleged: 1) On 15 October 2003, planning permission was granted with conditions by the Council under reference F/2003/9103 for the proposed erection of two storage buildings to replace seven existing storage buildings and open storage area. 2) It was noted in the officer planning report for F/2003/9103 that the two buildings would replace seven existing storage buildings and all of the surrounding open air storage. Condition 3 of the planning permission reiterated and reinforced this: No materials, containers or equipment shall be stored on the site outside buildings except for waste materials contained within suitable and sufficient waste containers for removal. Reason: In the interests of visual amenity. 3) The storage of items, equipment, plant and tools outside of the buildings hatched black on the attached plan occurs in breach of Condition 3 of F/2003/9103. Please refer to Enforcement Notice online. (Linked appeal 326827/203433).
183555 05/03/2019	Refused	Application for a certificate of existing lawful development for storage of builders plant and materials.
183548 04/03/2019	Refused	Application for a certificate of existing lawful development for storage of inert waste B-8.
172230 11/05/2018	Refused	Full planning application for the erection of 25no. dwellings (10 no. affordable) following removal of the existing use and buildings.
051373 05/10/2005	Refused	Application For Certificate of Lawful Existing Use For Storage Of Unregistered Motor Vehicles.
030610 15/10/2003	Approve	Proposed erection of 2 storage buildings to replace 7 existing storage buildings and open storage area.
020178 22/01/2003	Approve	Proposed erection of a detached garage/carport.
011001 01/05/2002	Appeal Dismissed	Outline application for the redevelopment of site from car storage to provide 30 dwellings including proportion of affordable housing.
011499 29/11/2001	Application Withdrawn	Outline application for the redevelopment of the site from car storage to provide 48 dwellings including proportion of affordable housing.

2.1.2 Anecdotal Evidence

No anecdotal evidence was available at the time of reporting.

2.1.3 Summary of Historical Landuses

A review of the historical Ordnance Survey maps show that the site remained undeveloped from the late 19th century until the 1930s when the site may have been contained within the grounds of an adjacent residential premises. The site is shown to have remained relatively unchanged until the construction of the recent buildings in the east.

The surrounding area comprises undeveloped land or woodland, followed by residential housing.

Commercial premises in the area included a former clay pit, brick kilns, saw mill and timber yard to the west, as well as a tramway.

Review of the Southern Testing Geoenvironmental Site Investigation Report of October 2017 indicates that at that time, the site was being used in part as a builder's yard, including the two buildings/workshops in the east, which were reputed to have been used to store building materials. Materials stored in the north and east of the site are noted to have included brick and concrete blocks and paviours, plastic pipes, gas canisters and scaffolding rods. At the time of the Southern Testing works a bund and stockpile were present in the north of the site which during Aviron's walkover of 26 July 2023 were no longer present.

The Southern Testing report and aerial photography also indicates that the central section of the site has been used for the storage of numerous vehicles. The Southern Testing report indicates that an above ground gas oil storage tank (AST) and a gas oil dispenser barrel was located adjacent the northern and southern elevations of the two buildings in the east of the site respectively. During the Aviron walkover of 26 July 2023 the oil tank and dispenser have been removed from site.

The more recent history of the site most likely as a builder's yard is confirmed in the planning history records as detailed in table 2.1.1 above, where reference is made to the 'proposed erection of two storage buildings to replace seven existing storage buildings and open storage area' in October 2003.

Subsequent breaches of planning permission were recorded in December 2020 that confirm the external storage of builder's materials, plant and equipment, fencing, builder bulk bags, shipping containers, general/assorted waste products, inert waste and the like and the storage of motor vehicles, vehicle breaking, vehicle disassembly and the sale of vehicle parts within the site.

2.2 GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

2.2.1 Anticipated Geology

Relevant geological information has been determined using the British Geological Survey (BGS) extract sheet 268 of Reading, which have been summarised in table 2.1.1 below.

Table 2.2.1: Anticipated Geology				
Stratum	Age	Possible Thickness (m)	Typical Description	Aquifer Status
Artificial/Made Ground None indicated on site	N/A	N/A	N/A	N/A
Superficial None indicated on site	N/A	N/A	N/A	N/A
Solid Bagshot Formation	Ypresian	Up to 45m	Fine to coarse grained sand that is frequently micaceous and locally clayey, with sparse glauconite and sparse seams of gravel	Secondary (A) aquifer

The Groundsure report indicates that there are superficial strata recorded approximately 160m to the north, comprising alluvium (a secondary (A) aquifer).

The BGS extract indicates that there is an area of 'infilled ground – artificial deposit' located approximately 260m to the west of the site at the location of the former clay pit and brick kilns.

The Groundsure report indicates that there is one reference to artificial ground within 250m of the site, comprising 'infilled ground' at a location 146m to the north-west.

The Groundsure report indicates that there are no landslips or faults recorded within 500m of the site.

2.2.2 Ground Conditions and Observations – Previous Ground Investigation by Southern Testing

The following table 2.2.2 summarises the ground conditions encountered during the ground investigation work undertaken at the site by Southern Testing and reported in October 2017.

Table 2.2.2: Summary of Ground Conditions		
Depth to Base	Soil Type	Description
0.15/0.4/0.5m	Topsoil	Sandy Topsoil with occasional gravel
0.2/0.4/0.9m	Made Ground	Slightly gravelly Sand and sandy Gravel of mixed lithologies
3.0m	Bagshot Formation	Generally medium dense fine and medium SAND Locally as stiff CLAY 0.5-1.5m (TP107), 0.4-2.5m (TP108)
Groundwater noted at 2.3-2.7m below ground level (bgl).		

The results of the laboratory testing undertaken as part of the works by Southern Testing indicate the following:

-  **Lead.** A localised elevated lead concentration of 400mg/kg was recorded in the topsoil sampled in TP103 at 0.2m bgl. However, Southern Testing deemed the absence of risk from lead given the mean concretion recorded for lead from the wider dataset.
-  **Polycyclic Aromatic Hydrocarbons.** A localised elevated benzo(a)pyrene concentration of 22mg/kg was recorded in the Made Ground sampled in HA101 at 0.1m bgl. However, Southern Testing deemed the absence of risk from benzo(a)pyrene given the presence of asphalt within the soil matrix.
-  **Asbestos.** Loose asbestos fibres (chrysotile & amosite) with concentration of <0.001% were recorded in the stockpile material in the north of the site.
-  **Asbestos.** Traces of loose asbestos fibres (chrysotile & amosite) with concentrations <0.001% were recorded in the sample from TP102 at 0.2m and TP103 at 0.2m. A hard asbestos cement fragment (chrysotile) with concentration 1.15% was recorded in TP101 at 0.1m.
-  **Petroleum Hydrocarbons.** Trace aliphatic and aromatic hydrocarbons detected (below the assessment criteria for residential with home-grown produce (1% SOM)) were recorded in the samples taken from the locations of the AST (HA101) and the gas oil barrel (HA102). Trace Total Petroleum Hydrocarbons (TPH) were recorded in the area of vehicle storage (TP107).

Figure 6 is presented as the Southern Testing Soil Contamination Identification Plan

2.2.4 Hydrogeology

The hydrogeology of the site has been determined by the solid geology of the Bagshot Formation, which is

classified by the Environment Agency as a secondary (A) aquifer. Secondary (A) aquifers comprise permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The bedrock geology is noted as being of 'medium' vulnerability and the flow mechanism as 'intergranular'.

Both the Groundsure report and the Environment Agency website (August 2023) indicate that the site is not located within an Environment Agency source protection zone (SPZ).

The Groundsure report indicates that the site is not located in a groundwater flooding susceptibility area.

The Groundsure report indicates that there are no references to groundwater abstraction licences for premises within 500m of the site, and no licences for 'potable water supply' for premises within 2000m of the site.

2.2.5 Hydrology

The nearest surface water feature (an inland river) comprises what appears to be the drain marked on the historical mapping at a location approximately 30m to the north-west of the site.

The Groundsure report indicates that there are no references to surface water abstraction licences for premises within 500m of the site, and no licences for 'potable water supply' for premises within 2000m of the site.

The site is not located in an area that is at risk of 'extreme flooding' or 'flooding' from rivers or sea without defences. The site is located in a Flood Zone 1, where there is a low risk of flooding.

The Groundsure report indicates that the north-western boundary of the site is located in an area where there is a risk of surface water flooding.

2.3 LANDFILLS AND GROUND GAS

The Groundsure report indicates that there are no landfill sites or waste sites located within a 250m search radius of the site.

The Groundsure report indicates that there is one reference to artificial ground within 250m of the site, comprising 'infilled ground', 146m to the north-west.

Table 2.3 summarises the gas risk for the site, based on the above information gained through the desk-based research. In accordance with current guidance (CIRIA C665), the gas generation potential for each source has

been individually assessed, with references to potential gassing risk made according to the following definitions: Negligible, Very Low, Low, Moderate, High and Very High. The definitions are explained in Section 10.0 of the guidance.

The objective of this exercise is to determine if potentially unacceptable ground gas risks exist, and whether further investigation and assessment is necessary.

Table 2.3: Preliminary Risk Assessment (PRA) - Ground Gas			
Potential Source	Risk	Risk Rating	Rationale
Made Ground (CO ₂ + CH ₄)	Human health Explosion	Very Low	Nominal Made Ground is anticipated, associated with the use of the site as a builder's yard. Substantial organic degradable material is not expected, and the risk of ground gas generation from Made Ground is considered to be very low.
Alluvial Strata (CO ₂ + CH ₄)	Human health Explosion	Very Low	Alluvial strata noted within 250m the site, at a location 160m to the north.
Landfills (CO ₂ + CH ₄)	Human health Explosion	Negligible	No landfill sites located within 250m of the site.
Infilled Ground + Burial Sites (CO ₂ + CH ₄)	Human health Explosion	Very Low	One reference to artificial ground and three references to surface ground workings within 250m of the site. Possible infilled ponds also noted in the vicinity of the site on the historical mapping.
Coal and Mining (CO ₂ + CH ₄)	Human health Explosion	Negligible	Not located in a non-coal mining area of Great Britain. The site is not located in a coal mining area. Mining not anticipated.
Radon	Human health	Very Low	<1% of homes above action level. Radon protection not required.
Soil Vapours	Human health Explosion	Very Low	No soil vapour risks identified given limited hydrocarbon impact to soils.
COMBINED RISK RATING = VERY LOW			

A Very Low risk from ground gas ingress and explosion is considered. Precautionary gas monitoring would be prudent.

2.4 GROUND STABILITY, NATURAL CAVITIES AND MINING HAZARDS

Table 2.4 indicates potential ground stability, natural cavities and mining hazards identified within the Groundsure report for the site.

These will be considered in terms of the proposed development and detailed in the following section 2.5, Preliminary Ground Hazards Summary.

Table 2.4: Ground Subsidence, Natural Cavities and Mining	
Hazard	Natural Ground Subsidence and Natural Cavities Hazard Rating
Shrink-Swell Clay	Negligible
Running Sands	Low
Potential for Compressible Ground Stability	Negligible
Potential for Collapsible Ground Stability	Very Low
Landslides	Very Low
Potential for Ground Dissolution	Negligible
Natural Cavities	None within 500m
Hazard	Mining and Ground Workings
BritPits	409m NW: Radical Farm Sand Pit. Sand; ceased.
Surface Ground Workings	180m SW: Brick Kilns 225m W: Unspecified Ground Workings 225m W: Unspecified Ground Workings
Underground Workings	None within 1000m
Historical Mineral Planning Areas	None within 500m
Non-Coal Mining	None within 1000m
Mining Cavities	None within 1000m
JPB Mining Areas	No records on site
Coal Mining	No records on site
Other mining/quarrying	No records detailing other mining/quarrying on-site

Information from the Groundsure report indicates that there is no worked ground within the site extents. The Groundsure report also indicates that there are no references to made ground or artificial ground within the

site extents.

The site is not affected by man-made mining cavities, nor is it located in a coal mining affected area. The site is not located within a non-coal mining area of Great Britain.

2.5 PRELIMINARY GROUND HAZARDS SUMMARY

The following Table 2.5 provides a summary of the preliminary ground hazards identified with the ground and groundwater conditions and historical site use as determined from the desk-based information accumulated within the PRA.

Table 2.5: Preliminary Ground Hazards Summary		
Ground Hazard	Plausible	Description
Topographic		
Site constraints	○	Restricted site access and substantial hard surfacing.
Slopes, embankments, cuttings	○	Foundation type and construction difficulties. Remedial measures to stabilise slopes, embankments and cuttings, and mitigate risks of landslides.
Man-made		
Filled ground/ made ground/ infilled basements	○	Foundation type and construction difficulties.
Existing foundations and below ground structures	○	Foundation type and construction difficulties. Obstructions to new construction. Influence of existing and adjacent foundations to new construction. Vibration associated with the construction technique.
Mining instability	○	Foundation type and construction difficulties. Appropriate mining investigation.
Ground chemistry	○	Sulphate and sulphide attack on buried concrete. Design to BRE DS-1. Expansive blast furnace slag.
Unexploded Ordnance	○	Detailed unexploded ordnance (UXO) risk assessment did not form part of our project instruction.
Geological		
Frost action	○	Susceptibility of soils affected at pavement and foundation formation. Provision of non-frost susceptible materials.

Table 2.5: Preliminary Ground Hazards Summary

Ground Hazard	Plausible	Description
Lateral soil instability	○	Foundation type and construction difficulties. Provision of temporary works – shoring.
Soft clays, silts and compressible soils	○	Foundation type and construction difficulties. Sufficient bearing resistance to support the proposed construction.
Shrinkable soils	○	Foundation type and construction difficulties. Influence of trees on foundation depths. Potential for desiccation to have occurred and heave protection. NHBC Standards Chapter 4.2, Building Near Trees.
Ground dissolution of soluble rocks	○	Foundation type and construction difficulties. Dynamic probing, torque readings.
Ground chemistry	○	Naturally occurring sulphate and sulphide attack on buried concrete. Design to BRE DS-1.
Hydrogeological/Hydrological		
Elevated or rising groundwater	○	Foundation type and construction difficulties. Provision of temporary works – dewatering (possibly well-points) in shallow excavations. Provision of temporary works – shoring. Running sand. Reduced bearing resistance. Ongoing serviceability of basements. Effectiveness of soakaway drainage.
Fluvial or coastal scour/erosion	○	Foundation type and construction difficulties. Remedial or preventative measures.
○ - Further action required. Potentially plausible hazard. ○ - Unlikely to represent a hazard, no further consideration required.		

The Bagshot Formation would ordinarily be suitable for the construction of conventional shallow foundations; however, limiting factors would include the consistency of the overlying soils, clay soils locally, the required bearing resistance of the proposed buildings, the influence of trees, excavation stability and seasonally high groundwater. Consideration may therefore need be given to supporting the proposed buildings on piled foundations.

A suitable ground investigation would confirm an appropriate foundation solution.

Shallow soakaway drainage is unlikely to be successful given the potential for impermeable clay soils anticipated at shallow depth.

3.0 REGULATORY INFORMATION, CONSULTATIONS AND OTHER

Unless otherwise stated regulatory database information has been obtained from the Groundsure report included within the STM report

3.1 STATUTORY REGISTERS AND AUTHORISATIONS

Table 3.1 includes the statutory registers and authorisations that relate to the site and surrounding area. Pertinent registers and authorisations will be used in conjunction with the desk-based review to determine the preliminary environmental risk.

Table 3.1: Statutory Registers and Authorisations		
Item	0 – 250m	251 – 500m
Sites Determined as Contaminated Land	0	0
Notification of Installations Handling Hazardous Substances (NIHHS) Facilities and Control of Major Accident Hazards Facilities (COMAH)	0	0
Regulated Explosive Sites	0	0
Hazardous Substance Storage/Usage	0	0
Historical Licensed Industrial Activities (IPC)	0	0
Licensed Industrial Activities (Part A (1))	0	0
Licensed Pollutant Release (Part A (2)/B)	0	0
Radioactive Substance Authorisations	0	0
Licensed Discharges to Controlled Waters	64m SE – Sewage Discharges (Queens Brook) 64m SE – Sewage Discharges (Queens Brook)	278m S – Sewage Discharges (Bracklesham Beds) 307m S – Sewage Discharges (Bracklesham Beds) 461m S – Sewage Discharges (Bracklesham Beds)
Pollutant Release to Surface Waters	0	0
Pollutant Release to Public Sewer	0	0
List 1 Dangerous Substances	0	0
List 2 Dangerous Substances	0	0

Table 3.1: Statutory Registers and Authorisations		
Item	0 – 250m	251 – 500m
Pollution Incidents	0	0
Pollution Inventory Substances	0	0
Pollution Inventory Waste Transfers	0	0
Pollution Inventory Radioactive Waste	0	0
Fuel Stations	0	0
Contemporary Trade Directory Entries	No Contemporary Trade Directory Entries within the site, however, the following within 250m: 56m S – Electricity sub-station 112m SE – Garden Goods 157m SE – Electricity sub-station 193m W – Baking and confectionary 241m W – Electricity sub-station 242m W – Electricity sub-station	
National Grid High Voltage Underground Electricity Transmission Cables	0	0
National Grid High Pressure Gas Transmission Pipelines	0	0
Item	Immediate Vicinity	
Sensitive Land Uses	No sensitive land uses within the immediate vicinity. The site is located in a nitrate vulnerable zone in connection with the Emm Brook.	

3.2 CONSULTEES

3.2.1 Local Authority - Contaminated Land Officer

The Local Environmental Health Department has not been contacted as part of our project instruction.

3.2.2 Local Authority - Building Control Officer

The Local Planning Authority Building Control Officer has not been contacted as part of our project instruction.

3.2.3 Local Authority - Petroleum Officer

The Local Planning Authority Petroleum Officer has not been contacted as part of our project instruction.

3.2.4 Environment Agency - Contaminated Land and Groundwater

The Contaminated Land and Groundwater Team of Environment Agency has not been contacted as part of our project instruction.

3.2.5 Coal Authority and Mining Searches UK

The Coal Authority and Mining Searches UK have not been contacted as part of our project instruction.

4.0 PRELIMINARY RISK ASSESSMENT

4.1 METHODOLOGY

A tier 1 PRA and CSM have been prepared in accordance with the technical approach on Land Contamination Risk Management (LCRM), which replaced 'CLR11'. Possible hazards identified by a potential source of contamination and sensitive receptors have been assessed via a source-pathway-receptor (SPR) model in accordance with current UK protocols. A risk may only exist where a plausible SPR linkage is viable and where the quantity or concentration of a contaminant (source) is sufficient to cause harm. Under the statutory definition "Contamination" may only exist where contaminants pose a risk of harm to a receptor. Risk may be defined as a function of the likelihood and severity of any adverse effects resulting from a contamination event in accordance with CIRIA C552. A summary of how risk is derived and the associated definition is presented in tables 4.1.1 and 4.1.2.

Table 4.1.1: Risk Ratings Matrix				
	Consequence			
Probability	Severe	Medium	Mild	Minor
High Likelihood	Very high risk	High risk	Moderate Risk	Moderate/low risk
Likely	High risk	Moderate Risk	Moderate/low risk	Low risk
Low Likelihood	Moderate Risk	Moderate/low risk	Low risk	Very low risk
Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Table 4.1.2: Risk Ratings Definition	
Risk Rationale	Definition
Very high risk	A high probability that severe harm could occur to determined receptor from identified contaminant - OR - evidence exists that severe harm to receptor is currently occurring. Urgent investigation and remediation should be considered. If demonstrated this risk is likely to result in substantial liability.
High risk	Harm is likely to occur to determined receptor from identified contaminant. Urgent investigation and short-term risk minimisation remediation followed by longer term fit for purpose remediation should be considered. If demonstrated this risk is likely to result in substantial liability.
Moderate Risk	It is possible that harm could occur to a determined receptor from identified contaminant. It is relatively unlikely that any harm would be severe or should harm occur it is likely to be relatively mild.
Moderate/low risk	It is possible that harm could occur to a determined receptor from identified contaminant. It is unlikely that any harm would be severe or should harm occur it is probable to be relatively mild.
Low risk	It is possible that harm could occur to a determined receptor from identified contaminant. It is unlikely that such harm, if indeed present, would at worst be mild.
Very low risk	There is a low possibility that harm could occur to a receptor. In such event the harm would not be severe.

4.2 POTENTIAL SOURCES OF CONTAMINATION

Based on the desk-study and walkover survey completed, table 4.2 presents a summary of the potential sources identified.

Table 4.2: Potential Sources		
Source	Description	Key Contaminants of Concern
1. Site-wide soil contamination	Risk of soil contamination within the site associated with recent use as a builder's yard, and the presence of Made Ground.	Metals, hydrocarbons (TPH/PAH), asbestos.
2. Local soil contamination	Risk of soil contamination from ACMs in the existing buildings and the AST and oil barrel.	Metals, hydrocarbons (TPH/PAH), asbestos.
3. Asbestos	Risk of Asbestos Containing Soils (ACS) and Asbestos Containing Materials (ACMs) from former and existing buildings.	Asbestos.
4. Ground gases/vapours	Low risk of hazardous ground gases is anticipated given the made ground and vapour risk from the AST and oil barrel	Hazardous ground gas. Complete monitoring.
TPH – Total Petroleum Hydrocarbons PAH – Polycyclic Aromatic Hydrocarbons Contaminated groundwater is not considered a source based on the site investigation findings of Southern Testing and Aviron's desk based study and walkover inspection.		

4.3 PATHWAYS

A pathway is one or more routes or means that a receptor can be exposed to, or affected by, a contaminant.

Table 4.3: Plausible Pathways
On-Site and Locally
Direct contact; to humans and infrastructure
Underlying geology/hydrogeology; shallow solid geology comprising secondary (A) aquifer
Inhalation and ingestion
Surface run-off/drainage

4.4 RECEPTORS

A receptor is either a living organism, a group of organisms, an ecological system, controlled waters or property that could be harmed or polluted by a contaminant. Table 4.4 examines the potential receptors.

Table 4.4: Potential Receptors			
Receptor	Description	Comments	Plausible
Construction workers	Groundworkers and general construction works	Construction works proposed within the site	Yes
End users	Occupants of the proposed development	Gardens proposed across the site.	Yes
Adjacent land users	Occupants of surrounding residencies	Adjacent residential dwellings which could be affected by run-off or migration.	Yes
Soft landscaping	Areas of new planting including lawns	Gardens proposed across the site.	Yes
Water supply pipes	Plastic pipework for potable water supply to housing may be affected if laid in contaminated soils	New supply required for redevelopment.	Yes
Buildings & infrastructure	Buried concrete for new foundations may be in contact with aggressive ground (sulphur attack)	New building works proposed.	Yes
Groundwater	Controlled waters (aquifers) beneath the site	Site underlain by secondary (A) aquifer. Site not located in a SPZ. No potable water abstraction within 2000m.	Yes
Surface waters	Controlled water such as lakes, streams, rivers or coastal waters	Drain (inland river) within the vicinity.	Yes
Ecological receptors	Sensitive areas of ecological significance defined under Part 2A of EPA 1990	Site is semi-rurally located, but no sensitive ecological receptors in the immediate vicinity.	No

4.5 SUMMARY OF POLLUTANT LINKAGES FOR PROPOSED LAND USE - INITIAL CSM

The initial CSM is based upon the proposed site end use and the information currently consulted relating to various risk sources and plausible pollutant linkages and is presented within table 4.5.

Table 4.5: Initial Conceptual Site Model (for plausible pollutant linkage pathways)						
Source	Receptor	Pathway	Probability	Consequence	Risk & Justification	Linkage No.
Source 1 Site-wide soil contamination	Construction workers	Direct contact	Likely	Medium	Moderate <i>Note 1.</i> Site occupied with storage buildings. Potential for made ground and contaminants associated with the recent builder's yard site use. Potential asbestos arising from building materials.	1

Table 4.5: Initial Conceptual Site Model (for plausible pollutant linkage pathways)

Source	Receptor	Pathway	Probability	Consequence	Risk & Justification	Linkage No.
	End users	Direct contact	Likely	Medium	Moderate <i>See Note 1.</i>	2
	Adjacent land users	Direct contact via run-off	Low likelihood	Medium	Moderate/Low <i>Note 2.</i> The site is underlain by secondary (A) aquifer. Recent use as a builder's yard. No evidence of die-back of vegetation or abnormal surfacing towards adjacent land users.	3
	Soft landscaping	Root uptake	Low likelihood	Medium	Moderate/Low <i>Note 3.</i> Although a potential for made ground and asbestos deposition has been identified, the pathway is not applicable for there to be a contaminant pathway.	4
	Water supply pipes	Direct contact	Low likelihood	Medium	Moderate/Low <i>Note 2.</i>	5
	Buildings & infrastructure	Direct contact	Low likelihood	Medium	Moderate/Low <i>Note 2.</i>	6
	Groundwater	Migration through hydrogeology	Unlikely	Mild	Very Low <i>Note 4.</i> The site is underlain by secondary (A) aquifer, with clay interbeds. No significant soil contamination identified by Southern Testing.	7
	Surface waters	Run-off Migration through hydrogeology	Unlikely	Mild	Very Low <i>See Note 4.</i>	8
Source 2 Local soil contamination	Construction workers	Direct contact	Low likelihood	Medium	Moderate/Low <i>Note 5.</i> Local sources identified such as the former AST.	9
	End users	Direct contact	Low likelihood	Medium	Moderate/Low <i>See Notes 2+ 5.</i>	10
	Adjacent land	Direct contact via	Low	Medium	Moderate/Low	11

Table 4.5: Initial Conceptual Site Model (for plausible pollutant linkage pathways)

Source	Receptor	Pathway	Probability	Consequence	Risk & Justification	Linkage No.
	users	run-off	likelihood		<i>See Notes 2 + 5.</i>	
	Soft landscaping	Root uptake	Low likelihood	Medium	Moderate/Low <i>See Notes 3 + 5.</i>	12
	Water supply pipes	Direct contact	Low likelihood	Medium	Moderate/Low <i>See Notes 2 + 5.</i>	13
	Buildings & infrastructure	Direct contact	Low likelihood	Medium	Moderate/Low <i>See Notes 2 + 5.</i>	14
	Surface waters	Migration through hydrogeology	Unlikely	Mild	Very Low <i>See Note 4.</i>	15
	Surface waters	Run-off Migration through hydrogeology	Unlikely	Mild	Very Low <i>See Note 4.</i>	16
Source 3 Asbestos	Construction workers	Inhalation	Likely	Medium	Moderate <i>Note 6.</i> Potential for ACMs from previous and existing buildings. Southern Testing report and debris identified in soils.	17
	End users	Inhalation	Likely	Medium	Moderate <i>See Note 6.</i>	18
	Adjacent land users	Inhalation	Unlikely	Mild	Very Low <i>Note 7.</i> Potential for ACMs from previous and existing buildings. Distance and dispersion in outdoor air limits risk.	19
Source 4 Ground gases and Soil vapours (on/off site source)	Construction workers	Inhalation of vapours/gas	Unlikely	Mild	Low <i>Note 8.</i> Sources of ground gas identified within the site (made ground, alluvium, infilled ground, soil vapours).	20
	End users	Inhalation of vapours/gas	Low likelihood	Mild	Low <i>See Note 8, though indoor occupancy increases risk.</i>	21

The overall environmental risk classification for the site is considered to be generally **MODERATE/LOW** and as such pollutant linkages resulting in a low risk or greater should be investigated in a suitable manner. Where risks are considered to be very low, further investigation is not considered necessary.

4.5 CONSIDERATIONS FOR SITE INVESTIGATION

Table 4.5 provides a summary risk to outline further investigation in order complete the risk assessment.

Table 4.5: Environment Risk Actions		
Media	Investigative Action	Risk Summary
Soils	Complete site-wide soil contamination and soil asbestos testing.	Risk to construction workers, end users and adjacent land users in the event of soil contamination. Construction workers should wear appropriate PPE.
		Risk to soft landscaping in the event of physically unsuitable strata and phytotoxic elements.
		Risk to water supply in the event of soil contamination.
		Risk to buildings and infrastructure from sulphate attack.
Local Soils	Complete soil contamination testing adjacent the contaminative features of interest including AST and oil barrel.	Risk to construction workers, end users and adjacent land users in the event of soil contamination. Construction workers should wear appropriate PPE.
		Risk to soft landscaping in the event of physically unsuitable strata and phytotoxic elements.
		Risk to water supply in the event of soil contamination.
		Risk to buildings and infrastructure from sulphate attack.
Ground Gas	Install monitoring wells and complete hazardous ground gas and vapour monitoring.	Risk to end users.

To assess the Moderate/Low risk the following analysis should be completed:

-  Aviron's "ES-1" of laboratory analysis shall be applied to future site investigations which includes; arsenic, barium, cadmium, total chromium, copper, nickel, zinc, lead, mercury, selenium, water soluble boron, total cyanide, total sulphate, water soluble sulphide, speciated Polycyclic Aromatic Hydrocarbons (PAH), speciated Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) and Methyl Tert-Butyl Ether (MTBE), organic matter, total phenols, pH and asbestos. **Provides broad analysis of common soil contaminants.**

 Waste Acceptance Criteria (WAC). To determine the classification of excess soils for off-site disposal.

The listed suite of analysis is considered suitable and will provide a screening for the majority of commonly found soil contaminants, which shall be followed through into the site investigation.

5.0 SITE INVESTIGATION WORK

5.1 METHOD STATEMENT AND SITE INVESTIGATION APPROACH

A method statement detailing how the site investigation was to be conducted was produced in accordance with current statutory guidance, best practices and the Client's instructions.

A health and safety plan was completed before site work commenced. Site investigation staff were briefed on the potential contaminants likely to be encountered, and the appropriate personal protective equipment (PPE) to be adopted for this type of investigation.

The site investigation was conducted in accordance with British Standards; BS5930:2015+A1 'Code of Practice for Ground Investigation', BS1377-1:2016 'Methods of test for soils for Civil Engineering Purposes' and BS10175:2011+A2:2017 'Investigation of Potentially Contaminated sites'.

5.2 SITE INVESTIGATION METHODS

Section 4.5 prepared an initial CSM where pollutant linkages with a greater risk than low would require suitable investigation.

Table 5.2 presents what it considered to be a suitable method and rationale of investigation which was completed 26 and 27 July 2023.

Table 5.2: Rationale of Site Investigation Positions		
Location	Rationale	Monitoring Well
	Window Sample (WS) Boreholes	
WS1	South-west of the site beneath the proposed building in Plot 5, to determine ground conditions and enable soil sampling. Positioned for spatial coverage and potential impact of adjacent trees.	Gas and groundwater monitoring well installed to 4.0m.
WS2	South-east of the site beneath the proposed building in Plot 4, to determine ground conditions and enable soil sampling. Positioned for spatial coverage and potential impact of removed trees.	Gas and groundwater monitoring well installed to 4.0m.
WS3	Centre of the site in front of the proposed building in Plot 3, to determine ground conditions and enable land contamination assessment/testing. Positioned for spatial coverage and as a control borehole located remote from known trees.	Not installed.
WS4	West of the site to the rear of the proposed building in Plot 3, to determine ground conditions and enable land contamination assessment/testing. Positioned for spatial coverage and in area of former car storage.	Not installed.

WS5	North-west of the site between the proposed building and garage in Plot 1, to determine ground conditions and enable soil sampling. Positioned for spatial coverage and potential impact of adjacent trees.	Gas and groundwater monitoring well installed to 2.0m.
WS6	North-east of the site beneath the proposed building in Plot 2, to determine ground conditions and enable soil sampling. Positioned for spatial coverage and potential impact of adjacent trees.	Not installed.
	Machine and hand excavated trial pits (TP)	
TP1	South-west of the site in the soft landscaped area, and rear garden of Plot 5, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
TP2	South-east of the site in the soft landscaped area, and rear garden of Plot 4, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
TP3	South-east of the site adjacent the wooden equestrian building, and side garden of Plot 4, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
TP4	East of the site in the former car storage area, and rear garden of Plot 3, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
TP5	East of the site in the former car storage area, and rear garden of Plot 3, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
TP6	West of the site in the former car storage area, and front garden of Plot 3, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
TP7	Centre-north of the site in the former car storage area, and front garden of Plot 1, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
TP8	Centre-north of the site in the former builder's yard, and rear garden of Plot 1, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
TP9	North of the site in the former builder's yard, and rear garden of Plot 2, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
TP10	North of the site in the former builder's yard, and rear garden of Plot 2, to determine shallow ground conditions and enable land contamination assessment/testing.	Not installed.
	Hand Auger (HA) Boreholes	
HA1	South-east of the site adjacent the storage building/workshop of the former builder's yard, and former oil dispenser, as well as the side garden of Plot 4, to enable land contamination assessment/testing.	Not installed.

HA2	South-east of the site inside the storage building/workshop of the former builder's yard, and rear garden of Plot 3, to enable land contamination assessment/testing.	Not installed.
HA3	East of the site adjacent the storage building/workshop of the former builder's yard, and rear garden of Plot 3, to enable land contamination assessment/testing.	Not installed.
HA4	East of the site inside the storage building/workshop of the former builder's yard, and proximity of former above ground gas oil storage tank, as well as the front garden of Plot 2, to enable land contamination assessment/testing.	Not installed.

Exploratory Hole Location Plans are enclosed as **Figures 7 and 8**.

All intrusive locations were pre-cleared prior to the ground investigation works using Ground Penetrating Radar (GPR), Cable Avoidance Tool (CAT) and tracing of manhole covers, which was completed to endeavour service avoidance during this exercise.

5.2.1 Window Sample Drilling

Window sample boreholes WS1 to WS6 were drilled to depths of 5.0m bgl using an Archway Dart drilling rig.

The purpose of the window sampling was to evaluate ground conditions at shallow depths, collect soil samples for geochemical and geotechnical laboratory analysis and to determine soil strength by means of SPTs.

The action of window sampling also enables the installation of monitoring wells to determine standing groundwater levels and ground gas testing.

Standard Penetration Tests were undertaken at 1m intervals to depths of 5.0m bgl within the boreholes in accordance with BS EN SO 22476-3 "Standard Penetration Test 2005".

Disturbed soil samples were also collected from bored arisings for geochemical and geotechnical laboratory tests which are further discussed within section 6.0.

Hand penetrometer readings were also taken at 0.25m depth intervals, or where appropriate, to determine the shear strength profile within the fine soils encountered beneath the site.

5.2.2 Trial Pitting

Ten trial pits were excavated either using hand tools (TP1-TP3) in the rear garden of number 6 Johnson Drive or using a 2.5 tonne tracked 360-degree excavator (TP4-TP10) in the former builder's yard.

The trial pits were excavated at relatively shallow depths of up to 1.9m bgl, to enable soil sampling and laboratory testing for screening for human health risk assessment.

The trial pits complement the window sample boreholes targeting specific areas of the site and to assess the overlying ground conditions.

A composite sample was taken from TP1 (0.2m) and TP5 (0.1m) and added to the samples in HA1 (0.2m) and HA2 (0.3m) for Waste Acceptance Criteria (WAC) analysis.

5.2.3 Hand Auger Boreholes

Four hand auger boreholes (HA1-HA4) were drilled using a hand auger at shallow depths of up to 1.0m bgl, to enable soil sampling and laboratory testing for screening for human health risk assessment.

The hand auger boreholes complement the window sample boreholes and trial pits and were targeted at the specific area of the storage sheds/workshops in the east of the site, to assess the ground conditions and collect soil samples for geochemical laboratory analysis.

A composite sample was taken from HA1 (0.2m) and HA2 (0.3m) and added to the samples in TP1 (0.2m) and TP5 (0.1m) for Waste Acceptance Criteria (WAC) analysis.

5.2.3 Dynamic Cone Penetrometer (DCP/TRL)

Six Dynamic Cone Penetrometer (DCP) tests (DCP1-DCP6) were undertaken to determine design parameters (California Bearing Ratio, or CBR) for road pavement construction in accordance with the Transport Research Laboratory (TRL), commencing at ground level, to a depth of 0.9 m bgl.

The tests were undertaken at the locations included in **Figures 7 and 8**.

5.3 GROUND CONDITIONS

The exploratory hole logs and photographs are presented within **Appendix I**.

Detailed strata descriptions are shown on the respective exploratory hole logs though in general ground conditions comprise:

-  MADE GROUND and reworked TOPSOIL noted to depths of between 0.3m and 0.4m bgl, extending to greater depths of between 0.5m and 1.2m bgl at the locations of TP3, TP9, HA2 and HA4.

- 🌿 Overlying horizon of firm and stiff, silty very sandy CLAY (Bagshot Formation) to depths of between 0.6m and 2.9m bgl. The CLAY soils extend to relatively shallow depths of between 0.6m and 1.2m bgl in the north of the site, extending to 1.5m and 1.6m bgl in the centre of the site, and to maximum encountered depths of 2.9m and 2.8m bgl in WS1 and WS2 respectively, in the south of the site. Partings of coarse sand were observed within the CLAY horizon.
- 🌿 The CLAY horizon was noted to extend to depths of 1.5m bgl in TP107 in the centre of the site and 2.5m bgl (TP108) in the south of the site in the Southern Testing trial pits excavated across the site in 2017.
- 🌿 Medium dense becoming dense and very dense silty fine to medium SAND (Bagshot Formation) to the termination depths of drilling of up to 5.0m bgl. The coarse soils were noted to be clayey and very clayey locally, with occasional clay partings with depth.

5.3.1 Field Observations

No discernible odours or staining were noted during the ground investigation works in the soils encountered across the site.

Roots and rootlets were recorded routinely across the site during the site investigation work to depths of up to 0.9m bgl.

5.4 GROUNDWATER LEVELS

5.4.1 Groundwater Levels: During Site Investigation Works

Groundwater was encountered during the site investigation works completed on 26 and 27 July 2023 at the depths detailed in table 5.4.1 below.

Table 5.4.1: Groundwater During Investigation		
Location	Depth – bgl (during GI)	Comments
WS1	Dry to 5.0m bgl	The groundwater encountered is expected to represent the secondary (A) aquifer of the Bagshot Formation.
WS2	Dry to 5.0m bgl	
WS3	3.4m bgl, no rise after 20 minutes	
WS4	3.4m bgl, no rise after 20 minutes	
WS5	Dry to 5.0m bgl	

Table 5.4.1: Groundwater During Investigation		
Location	Depth – bgl (during GI)	Comments
WS6	Dry to 4.7m bgl	The groundwater encountered is expected to represent the secondary (A) aquifer of the Bagshot Formation.
TP1-TP10	Dry to depths of up to 1.9m bgl	
HA1-HA4	Dry to depths of up to 1.0m bgl	

5.4.2 Groundwater and Gas Monitoring Wells

Selected boreholes were converted to monitoring wells to enable standing groundwater level monitoring and ground gas monitoring. Wells were installed into 101mm diameter window sample boreholes using 63mm external diameter and 50mm internal diameter HDPE standpipe.

Table 5.4.2 describes the construction of the wells.

Table 5.4.2: Monitoring Well Construction			
Location	Depth of plain pipe and bentonite seal (m)	Response zone; depth of slotted pipe with gravel screen (m)	Depth of install (m)
WS1	Ground level (GL)-1.0	1.0-4.0	4.0
WS2	GL-1.0	1.0-4.0	4.0
WS5	GL-1.0	1.0-2.1	2.1

5.4.3 Groundwater and Gas Post-Investigation Monitoring

In all instances and prior to completing groundwater monitoring and field measurements bulk ground gases and soil vapours were monitored using a GFM 435 Gas Analyser and miniRAE Photon-Ionisation Detector (PID) on the dates shown in table 5.4.3, which provides standing level groundwater ‘dips’ during post-investigation monitoring.

Table 5.4.3: Groundwater Monitoring Depths			
Location / Date	Depth – (m) bgl WS1	Depth – (m) bgl WS2	Depth – (m) bgl WS5
4 August 2023	3.67	4.01	Dry to 2.1
11 August 2023	3.43	3.84	Dry to 2.1

Further to comments regarding groundwater made within table 5.4.1 it is likely the water encountered represents the secondary (A) aquifer of the Bagshot Formation.

Ground gas monitoring is discussed in section 9.0 of this report.

Field monitoring sheets are enclosed in **Appendix II**.

6.0 LABORATORY ANALYSIS

6.1 SOIL GEOCHEMICAL TESTING

Table 6.1 details the soil samples which were collected and submitted for geochemical analysis.

Table 6.1: Soil Geochemical Testing			
Location	Strata Sampled	Objective	Analysis
HA1 (0.2m)	Made Ground	Shallow sample to determine baseline concentrations of Made Ground adjacent the building/workshop (east coverage).	ES-1
HA4 (0.3m)	Made Ground	Shallow sample to determine baseline concentrations of Made Ground inside the building/workshop (east coverage).	ES-1
TP1 (0.2m)	Made Ground	Shallow sample to determine baseline concentrations of Made Ground (south-west coverage).	ES-1
TP5 (0.1m)	Made Ground	Shallow sample to determine baseline concentrations of Made Ground (east coverage).	ES-1
TP6 (0.4m)	Natural Clay	Sample to determine baseline concentrations of Natural Clay at depth (west coverage).	ES-1
TP9 (0.5m)	Made Ground	Shallow sample to determine baseline concentrations of Made Ground (north coverage).	ES-1
WS1 (0.1m))	Reworked Topsoil	Shallow sample to determine baseline concentrations of Reworked Topsoil (south-west coverage).	ES-1
WS2 (0.2m)	Reworked Topsoil	Shallow sample to determine baseline concentrations of Reworked Topsoil (south-east coverage).	ES-1
WS2 (0.45m)	Natural Clay	Sample to determine baseline concentrations of Natural Clay at depth (south-east coverage).	ES-1
WS3 (0.7m)	Natural Clay	Sample to determine baseline concentrations of Natural Clay at depth (central coverage).	ES-1
WS4 (0.3m)	Reworked Topsoil	Shallow sample to determine baseline concentrations of Reworked Topsoil (west coverage).	ES-1
WS5 (0.2m)	Reworked Topsoil	Shallow sample to determine baseline concentrations of Reworked Topsoil (north-west coverage).	ES-1
WS5 (0.9m)	Natural Clay	Sample to determine baseline concentrations of Natural Clay at depth (north-west coverage).	ES-1
WS6 (0.2m)	Reworked Topsoil	Shallow sample to determine baseline concentrations of Reworked Topsoil (north-east coverage).	ES-1
COMP (0.1-0.3m) HA1/HA2/TP1/TP5	Made Ground	Composite Made Ground sample to determine classification for waste disposal. Sampled from HA1, HA2, TP1 and TP5.	WAC

Chemical sampling and testing targeted the overlying units of reworked Topsoil, Made Ground and natural Clay strata whereby virtue of surface deposition, historical contaminants are most likely to be recorded. The purpose of sampling slightly deeper natural strata is to generate a baseline understanding of natural soil chemistry and to understand phytotoxic elements at depths of root growth.

The analytical suites were chosen to provide a suitable screening in accordance with the potential contaminants identified within the site conceptualisation presented within section 4.5.

Soil samples for environmental quality analysis were sent to i2 Analytical Limited.

6.2 SOIL GEOTECHNICAL TESTING

A programme of geotechnical laboratory testing was undertaken at Geo Site & Testing Services Limited and Eurofins Chemtest Limited. Testing was completed on the fine and coarse soils encountered beneath the site. The test procedures used were generally in accordance with the methods described in BS1377:1990. Details of testing used are provided in table 6.2.

Table 6.2: Soil Geotechnical Testing		
Test	Standard	Number of Samples
GSTL Atterberg Limits (and Moisture Content) <i>The objective of Atterberg limits and moisture content testing is to determine plasticity and volume change potential of fine (clay and silt) soils and the potential for desiccation to have occurred</i>	BS1377: 1990: Part 2: Clause 3.2, 4.5, 5.0	12 (12)
GSTL Particle Size Distribution (PSD) <i>The objective of PSD testing is to determine grading of coarse (sand and gravel) soils</i>	BS1377: 1990: Part 2: Clause 9.2	4
Eurofins Chemtest Aviron LC Suite - pH, water soluble sulphate, total sulphate & total sulphur <i>To enable concrete classification to be specified</i>	UKAS accredited	18 (including 14 within the Suite 1 analysis)

6.3 SOIL SAMPLING PROTOCOL

All soil samples were collected from bored or excavated arisings using a trowel and following Aviron's standard protocols for soil sampling. To avoid cross contamination, the sampling equipment was cleaned using de-ionised water after each sample was retrieved.

Clean latex gloves were used each time a soil sample was collected, and all samples were placed into clean sterilised jars for submission to the UKAS/MCERTS accredited laboratory.

All sample containers were labelled on-site immediately prior to filling. These samples were identified by a label placed on the body of each container and the following information was recorded; site name, date collected, unique sample number, soil sample depth.

Samples for geochemical analysis were then placed into a cool box containing ice packs to maintain refrigerated conditions following collection and transport to the laboratory. Ice packs were changed every twenty-four hours where necessary to maintain cool conditions and suppress volatiles.

7.0 ENVIRONMENTAL INTERPRETATIVE GUIDANCE

7.1 GENERIC QUANTITATIVE RISK ASSESSMENT

The purpose of a tier 2 GQRA is to determine the suitability of the site for proposed development and end use.

The site investigation shall collect soil samples whereby determinant chemical measured in the soil through laboratory analysis have been compared with guidance values which are appropriate to the receptor under consideration. The guidance values or screening criteria applied shall be industry adopted generic values which following a screening of the laboratory analysis shall determine whether or not a site is contaminated, as defined under Part IIA of the EPA 1990 and specification in regard of the proposed development and identified receptors.

Where exceedances of guidance values or recorded a GQRA is can be used to appraise risk and make recommendations in regard of further investigation, remediation and/or tier 3 Detailed Quantitative Risk Assessment (DQRA).

7.2 GUIDANCE USED FOR ASSESSING SOIL CONTAMINATION

Aviron has followed the technical approach on Land Contamination Risk Management (LCRM), accessed on gov.uk website and other available guidance to assess contaminant concentrations.

Details of the methodology and Aviron's position on the adoption of guidance values is outlined below.

The available chemical data, from soil samples tested, is sorted into appropriate datasets depending on sampling regime and ground conditions. An initial GQRA is completed using the relevant and industry available screening criteria and where appropriate, statistical modelling. Risks to human health shall be initially assessed by comparing soil chemical data against various published screening criteria. These have been sourced from the following and in order of preference:

-  Category 4 Screening Levels (C4SLs) prepared by the Department of Environmental Food and Rural Affairs (DEFRA) and published March 2014.
-  Phase 2 C4SLs prepared by CL:AIRE and published May 2021.
-  Suitable 4 Use Levels (S4ULs) prepared by Land Quality Management/Chartered Institute of Environmental Health (LQM/CEIH) and published December 2014. LQM acknowledgement for use of S4ULs. *"Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3275. All rights reserved"*.

- 🌱 Soil Guidance Values (SGVs) prepared by the Environment Agency (EA)/DEFRA and published 2009.
- 🌱 Soil Generic Assessment Criteria (GAC) prepared by Environment Industries Commission (EIC)/Association of Geotechnical and Geoenvironmental Specialists (AGS)/Contaminated Land: Application In Real Environments (CL:AIRE) and published 2010.

Aviron have adopted the above hierarchy in response to LCRM recommendations.

7.3 GUIDANCE USED FOR THE ASSESSMENT OF HAZARDOUS GROUND GAS

The principal influence for causing the migration of landgas in the ground is changes to barometric pressure. The most onerous landgas emission conditions on a site are usually observed following days of low or rapidly falling barometric pressure below 1000 millibars (mb).

Monitoring is usually performed over a period of several weeks or months in order to increase the chances of visiting the site on days when the conditions for monitoring worst-case results are correct. Gas monitoring results collected solely during high pressure conditions (>1000mb) may not provide a true value for worst case emission rates from the site.

Methane is produced by a number of processes, which can be biological or chemical in nature. The principal process is from the biogenic decay of organic material and is commonly found associated with landfill and organic marsh deposits or river silts. Methane can also be found associated with coal workings. It is explosive at concentrations of between 5 and 15%, with 5% being termed the lower explosive limit (LEL).

In assessing the risks from hazardous ground gas, reference has been made to the guidance from BS 8485:2015 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' and CIRIA Report C665 'Assessing risks posed by hazardous ground gases to buildings' 2007 which adopts a risk characterisation strategy based on the maximum flow (L/hour) and maximum steady stated concentration (% v/v) of methane and carbon dioxide from a site to derive gas screening values (GSV) in litres/hour which are comparable with the Modified Wilson and Card classification (shown in Table 8.5 of C665) for any site which isn't intended to be developed as low-rise housing with vented underfloor void.

It is noted gas monitoring is precautionary.

8.0 ASSESSMENT OF GEOCHEMICAL SOIL RESULTS

Development proposed include predominantly private gardens and therefore the residential with homegrown produce from the guidance listed in section 7.2 shall be selected.

In order to select the appropriate Soil Organic Matter (SOM) value for appraisal of PAH and TPH the mean average SOM value was determined from the laboratory dataset and accordingly the 2.5% SOM value was selected.

Laboratory certificates of chemical analysis are presented in **Appendix III** along with the chemical assessment criteria.

8.1 ASSESSMENT OF SOIL GEOCHEMICAL RESULTS

Table 8.1 provides a summary of the results for each sample analysed when compared to the relevant assessment criteria.

Table 8.1 : Summary of Geochemical Results				
Location	Strata	Determinant	Measured Conc. (mg/kg)	Guidance Conc. (mg/kg)
HA1 (0.2m)	Made Ground	Benzo(a)anthracene	8.3	7.2
		Benzo(b)fluoranthene	11	2.6
		Benzo(a)pyrene	7.5	2.7
		Dibenzo(a,h)anthracene	1.8	0.28
HA4 (0.3m)	Made Ground	Benzo(b)fluoranthene	3.2	2.6
		Benzo(a)pyrene	3.0	2.7
		Dibenzo(a,h)anthracene	0.59	0.28
TP1 (0.2m)	Made Ground	All determinants recorded at acceptable concentrations	n/a	n/a
TP5 (0.1m)	Made Ground	Benzo(b)fluoranthene	3.6	2.6
		Benzo(a)pyrene	3.3	2.7
		Dibenzo(a,h)anthracene	0.68	0.28
TP6 (0.4m)	Natural Clay	All determinants recorded at acceptable concentrations	n/a	n/a
TP9 (0.5m)	Made Ground	All determinants	n/a	n/a

		recorded at acceptable concentrations		
WS1 (0.1m)	Reworked Topsoil	All determinants recorded at acceptable concentrations	n/a	n/a
WS2 (0.2m)	Reworked Topsoil	All determinants recorded at acceptable concentrations	n/a	n/a
WS2 (0.45m)	Natural Clay	All determinants recorded at acceptable concentrations	n/a	n/a
WS3 (0.7m)	Natural Clay	All determinants recorded at acceptable concentrations	n/a	n/a
WS4 (0.3m)	Reworked Topsoil	All determinants recorded at acceptable concentrations	n/a	n/a
WS5 (0.2m)	Reworked Topsoil	All determinants recorded at acceptable concentrations	n/a	n/a
WS5 (0.9m)	Natural Clay	All determinants recorded at acceptable concentrations	n/a	n/a
WS6 (0.2m)	Reworked Topsoil	All determinants recorded at acceptable concentrations	n/a	n/a
COMP (0.1-0.3m) HA1/HA2/TP1/TP5	Made Ground	Suggests inert waste landfill*	n/a	n/a
Notes: Barium EIC Generic Acceptance Criteria (EIC GAC) is 1300mg/kg (Residential) Chromium is assumed to be chromium II (not chromium IV). Waste soil classification should be confirmed by submitting all chemical results to a licensed waste management operator for formal waste classification.				

8.2 DISCUSSION OF SOIL GEOCHEMICAL EXCEEDANCES

With the exception of PAH, which has been recorded at elevated concentrations within the Made Ground sampled at HA1, HA4 and TP5 all concentrations of remaining chemical soil determinants, including metals, semi-metals, TPH and asbestos are acceptable.

It is considered the presence of PAH at HA1, HA4 and TP5 in the east of the site by the existing workshops is a result of asphalt (road plainings) which have been used to create a surfacing in front of the workshops. Southern Testing, at position HA101, recorded a similar result and observation.

At three positions (TP101, TP102 and TP103) as shown in **Figures 6 and 9** Southern Testing (in 2017) have recorded ACMs and Asbestos Containing Soils (ACS) containing two types of asbestos (chrysotile and amosite). TP101, TP102 and TP103 are located in the north of the site where building materials/rubble (were and) are stored in an area which shall become rear gardens to Plots 1 and 2. Contrary to the results recorded by Southern Testing, Aviron collected three samples of Made Ground in the northern area of the site at triangulated positions WS5, WS6 and TP9; which all recorded the absence of asbestos and acceptable determinant concentrations. It maybe, that following post-2017 earthworks (involving the removal of a bund and stockpile) after Southern Testing completed their investigation the earthworks disturbed and dispersed asbestos fibres from situ.

Figure 9 is enclosed as enclosed as Combined Soil Contamination Plan which enable the following remedial works to be suggested:

-  **Asphalt Removal.** Removal of all asphalt/road plaining type material/Made Ground within the east of the site (HA1, HA4, TP5 and HA101) by the existing workshops towards the bottom of Plot 3 rear garden.
-  **Asbestos Screening.** The Made Ground in the north of the site is unlikely to be physically suitable for new planting. It is recommended that prior to forming the gardens of Plots 1 and 2 in the north of the site a watching brief is made to inspection, screen and as necessary sample in-situ soils for asbestos content. Alternatively the entire Made Ground unit (average thickness ~0.3m) can be removed and replaced with 'clean' imported Topsoil.

Once the above recommendations are appraised, a suitable Remediation Action Plan should be prepared for approval by the Local Planning Authority.

9.0 HAZARDOUS GROUND GAS MONITORING

9.1 STRATEGY

As previously presented within table 5.4.2 monitoring well installations were constructed in order to provide ground gas monitoring following the outcome of the preliminary ground gas assessment within section 2.3.

The installation of the monitoring wells have suitable response zones to enable the capture of ground gases which may possibly migrate through granular and fractured units beneath proposed homes. Each monitoring well was completed with a 1m thick bentonite seal from ground level to prevent atmospheric influence.

9.2 MONITORING

The presence of soil vapours was determined prior to bulk ground gas monitoring using a MiniRAE Photon Ionisation Detector (PID) from RAEs Systems. The presence of hazardous bio-gases including methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) was determined using a GFM Infra-Red Gas Analyser from Ribble Enviro Limited. The flow rate and atmospheric pressure, in millibars (mb), was also measured during the monitoring process. Depth to groundwater was measured using an electronic dip meter.

Monitoring work was completed on the dates specified within table 9.2 which also summarises weather conditions and atmosphere pressure. To determine rising or falling pressures local 'online' weather trends from the Met Office and/or the monitoring apparatus were consulted.

Table 9.2: Background Gas Monitoring Data				
Date	Atmospheric Pressure	Rising/Falling Pressure?	Worst Case Conditions?	Groundwater above response zone?
4 August 2023	1012mB	Falling	No	No
31 March 2023	1013mB	Steady	No	No

Note 2 of C665 indicates 'worst case' conditions occur during falling and sub-1000mB atmospheric pressures. Section 5.5.1 of C665 indicates 'worst case' conditions are likely to occur during weather conditions such as rainfall, frost or dry weather.

9.3 MONITORING

Table 9.3 summaries the results obtained which are enclosed in **Appendix II**.

Table 9.3: Summary of Monitoring Results			
Gas	Measured Conc. Range (% v/v)		Comments
	Low	High	
CH ₄	0.0 (<0.1)	0.0 (<0.1)	Methane was not detected (<0.1%) and thus is below the guidance value of 1% at which point the characteristic situation is advised to increase to CS2.
CO ₂	0.4	2.8	Carbon dioxide has been detected at concentrations below the guidance value of 5% at which point the characteristic situation is advised to increase to CS2.
O ₂	17.8	20.1	Oxygen has been recorded at ambient concentrations, above 16% the point where it is considered there is potential for asphyxiation.
Vapour*	0.3	2.8	Very low (PID) concentrations have been recorded. This concurs with the ground conditions and geochemical laboratory results suggesting the absence of soil vapour risk to new homes.

*vapour concentration in parts per million (ppm)

Monitoring positions remained constant and intact. No replacement monitoring positions were installed during the period of this project. No damage was observed to the monitoring wells during works.

It is considered the integrity of the monitoring wells has not been compromised as there is no evidence of surface damage which may affect the underlying installations. There is a bentonite seal within the bored annulus preventing escape of ground gases and entry of atmospheric gases. The gas valve remained closed prior to all monitoring occasions so passive venting of ground gas is unlikely to have occurred as site visits were unannounced.

9.4 INTERPRETATION OF DATA

Under normal use of the site (i.e. above ground), the risk presented by methane and carbon dioxide is dependent on both the concentrations and the rate of flow. In accordance with Wilson and Card methodology specified in the CIRIA C655 document, Gas Screening Values (GSV) were determined using the formula below.

GSV =	(Maximum steady concentration / 100) x Flow rate
GSV measured in litres per hour (l/hr)	Maximum steady concentration measured in percent (%) Flow rate measured in l/hr.

Based on the maximum concentrations and flows recorded, the **GSV** for **methane** was **0.0 L/hr** and the **GSV** for **carbon dioxide** was **0.0 l/hr**.

Based on the GSV for carbon dioxide which is below 0.07l/h, along with the maximum recorded concentrations for carbon dioxide (<5%) and methane (<1%) the site is considered to fall within Characteristic Situation 1.

It is highly unlikely gas protection shall be required for the new units based on:

- 📍 the limited potential source of risk following the preliminary risk assessment;
- 📍 the GSV for carbon dioxide and methane is between 0.07l/h and 0.7l/h;
- 📍 the maximum concentrations carbon dioxide and methane are below 5% and 1% respectively;
- 📍 no abnormal ground conditions were recorded during the investigation;
- 📍 the monitoring dataset did not encounter worst-case conditions. Professional opinion suggests that given flow rates and gaseous concentrations these are unlikely to sufficiently increase such that the Characteristic Situation increases.

Nonetheless to following a minimal level of good practice at least a final round of monitoring should be completed which captures worst-case conditions.

10.0 REVISED RISK ASSESSMENT

10.1 REVISED SOURCES OF CONTAMINATION

Following completion of the site investigation and interpretation of test results the following sources of contamination are considered to exist.

Table 10.1: Revised Sources		
Source	Description	Key Contaminants of Concern
1. Site-wide soil contamination	Soil contamination is considered to be local to the north and east of the site.	n/a
2. Local soil contamination	Soil contamination is shown to exist within the north of the site where building rubble/waste was stored and in the east of the site where road planing were used to surface the area by workshops.	North – asbestos East - PAH
3. Asbestos	Risk of Asbestos Containing Soils (ACS) and Asbestos Containing Materials (ACMs) from former and existing buildings.	Asbestos – potentially in soils in the north of the site.
4. Groundwater	Site is underlain by secondary aquifer	No abnormal ground conditions. Concentrations of Topsoil, Made Ground and natural strata across the site are broadly acceptable in term of risk to controlled waters.
5. Ground gases/vapours	Potential for ground gas generation.	Two rounds of ground gas monitoring have been completed which have recorded acceptable gases concentrations and GSV. Gas protection is unlikely to be required, however, as a precaution a single round of worst-case monitoring should be completed when barometric pressure falls below 1000mB.

10.2 REVISED CONCEPTUAL SITE MODEL

Following interpretation of the laboratory results, site dynamics and the revision of potential soil contaminants within table 10.1 a revised conceptual model has been prepared and is presented in table 10.2. Where sources of contamination are not no longer consider present (table 10.1) the pollutant linkages examined within the initial conceptual site model shall be omitted from the revised conceptual site model to limit the 'length' of the model.

Table 10.2: Refined Conceptual Site Model (for plausible pollutant linkage pathways)

Source	Receptor	Pathway	Probability	Consequence	Risk & Justification	Linkage No.
Source 1 Site-wide soil contamination	Construction workers	Direct contact	Unlikely	Mild	Low <i>Note 9.</i> Soil contamination is considered to be local to the north (possible ACS) and east (PAH) of the site.	1
	End users	Direct contact	Unlikely	Mild	Low <i>See Note 9.</i>	2
	Adjacent land users	Direct contact via run-off	Unlikely	Mild	Low <i>See Note 9.</i>	3
	Soft landscaping	Root uptake	Unlikely	Mild	Low <i>See Note 9.</i>	4
	Water supply pipes	Direct contact	Unlikely	Mild	Low <i>See Note 9.</i>	5
	Buildings & infrastructure	Direct contact	Unlikely	Mild	Low <i>See Note 9.</i>	6
	Groundwater	Migration through hydrogeology	Unlikely	Mild	Low <i>See Note 9.</i>	7
	Surface waters	Run-off Migration through hydrogeology	Unlikely	Mild	Low <i>See Note 9.</i>	8
Source 2 Local PAH soil contamination (east of site)	Construction workers	Direct contact	Likely	Mild	Moderate/Low <i>Note 10.</i> Local PAH within road plainings in the east of the site by the workshops. Prepare Remediation Action Plan	9
	End users	Direct contact	Likely	Medium	Moderate <i>See Note 10.</i> Prepare Remediation Action Plan	10
	Adjacent land users	Direct contact via run-off	Low likelihood	Mild	Low <i>See Note 10.</i>	11

Table 10.2: Refined Conceptual Site Model (for plausible pollutant linkage pathways)

Source	Receptor	Pathway	Probability	Consequence	Risk & Justification	Linkage No.
	Soft landscaping	Root uptake	Likely	Medium	Moderate <i>See Note 10.</i>	12
	Water supply pipes	Direct contact	Low likelihood	Mild	Low <i>See Note 10.</i>	13
	Buildings & infrastructure	Direct contact	Low likelihood	Mild	Low <i>See Note 10.</i>	14
	Surface waters	Migration through hydrogeology	Unlikely	Mild	Very Low <i>See Note 10.</i>	15
	Surface waters	Run-off Migration through hydrogeology	Unlikely	Mild	Very Low <i>See Note 10.</i>	16
Source 3 Asbestos	Construction workers	Inhalation	Low likelihood	Medium	Moderate/Low <i>Note 11. Potential for ACMs from previous and existing buildings. Southern Testing report and debris identified in soils. However, ACS not identified by Aviron.</i> Prepare Remediation Action Plan	17
	End users	Inhalation	Low likelihood	Medium	Moderate <i>See Note 11.</i> Prepare Remediation Action Plan	18
	Adjacent land users	Inhalation	Unlikely	Mild	Very Low <i>See Note 11.</i> Distance and dispersion in outdoor air limits risk.	19
Source 4 Ground gases and Soil vapours (on/off site source)	Construction workers End users	Inhalation of vapours/gas	Unlikely	Mild	Very Low Two rounds of monitoring have been completed which have recorded acceptable concentrations of carbon dioxide and methane; along with acceptable GSVs. Gas protection measures unlikely for new home given	20

Table 10.2: Refined Conceptual Site Model (for plausible pollutant linkage pathways)

Source	Receptor	Pathway	Probability	Consequence	Risk & Justification	Linkage No.
					distance to site, intersecting infrastructure and underlying Clay limiting gaseous migration. Complete worst-case ground gas monitoring to confirm Characteristic Situation (CS1).	

10.3 RISK COMMENTARY

10.3.1 Contamination Risk from Soil to Human Health – Construction Workers

With the exception of ‘suspected’ asbestos fibres in the north of the site, concentrations of soil determinants are unlikely to present a short-term exposure risk to adult construction workers, specifically from the dermal contact, ingestion and inhalation pathways. Nonetheless it is customary to advise that groundworkers should ensure suitable PPE is worn as a precaution during development which would include:

-  Gloves to prevent dermal contact with any contaminated soils. It is advised that disposable latex gloves are worn beneath the outer ‘work’ gloves.
-  To prevent ingestion of contaminated soils construction workers should avoid putting hands or objects in their mouth whilst on-site.
-  To prevent ingestion of contaminated soils prior to eating or drinking, construction workers should ensure their hands are properly washed, rinsed and dried.
-  To prevent inhalation of contaminated soils and **asbestos fibres** construction workers should wear dust masks on dry and windy days **and when working around the northern section of the site face-fit P3 filter masks**. On damp or wet still days the risk of dust inhalation is low.
-  **An Asbestos Management Plan and where necessary a Remediation Action Plan should be prepared. This preparation of these plans may benefit from further sampling and testing; ideally once carefully managed site clearance has been completed.**

10.3.2 Contamination Risk from Soil to Human Health – End Users

Figure 9 is enclosed as enclosed as Combined Soil Contamination Plan which indicates potential risks to end users are from:

-  **PAH.** Detected within the east of the site (HA1, HA4, TP5 and HA101) by the existing workshops towards the bottom of Plot 3 rear garden. The impacted Made Ground (asphalt/road plaining type material) shall require removal from site and verification of the remaining soils in the bottom of Plot 3 garden.
-  **Asbestos.** ACS may exist within the soil in the north of the site where Plots 1 and 2 shall have their gardens and as a result residual fibres may present a risk to end users. It is recommended that prior to forming the gardens of Plots 1 and 2 in the north of the site a watching brief is made to inspection, screen and as necessary sample in-situ soils for asbestos content. Alternatively, the entire Made Ground unit (average thickness ~0.3m) can be removed and replaced with 'clean' imported Topsoil.

Once the above recommendations are appraised, a suitable **Remediation Action Plan** should be prepared for approval by the Local Planning Authority.

10.3.3 Contamination Risk from Soil to Human Health – Domestic Water Supply

Special design for domestic water supply are unlikely. However, to be certain, it is advised that the report should be provided to the local water authority to ensure the correct materials are chosen for water supply pipes. Following the formal withdrawal of WRAS Guidance Note No. 9-04-03 (October 2002), it is recommended that the following reference should be consulted:

Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21 by the UK Water Industry Research Ltd (UKWIR) ; ISBN: 1 84057 5697

Generally, all services should be placed within dedicated runs, and then backfilled with clean imported material.

10.3.4 Contamination Risk from Soils to Controlled Waters

Geological mapping indicated that the site to be underlain by a secondary aquifer.

Given that sources of contamination were not identified in the investigation there is not considered to be a risk to controlled waters.

10.3.5 Contamination Risk from Groundwater

Contaminated groundwater is not considered to exist beneath the site, based on the absence of widespread soil contamination and the lack of locally contaminative activities.

10.3.6 Risk from Ground Gas

No potential ground gas risks were determine following the preliminary risk assessment. To further evaluate ground gas risk two rounds of monitoring have been completed within the project timeframe which have recorded acceptable GSV and maximum concentrations within in site. The concentrations recorded suggest Characteristic Situation 1 (CS-1), which would not require ground gas protection to new homes.

To ensure the hypothesis that ground protection is not required **it is recommended a worst-case visit is completed.**

11.0 GEOTECHNICAL ASSESSMENT

This section provides a geotechnical assessment in connection with the proposed development as described above and considers the GEO Limit State: failure or excessive deformation of the ground, in accordance with EN 1997 Eurocode 7: Geotechnical Design (and the UK National Annex to Eurocode 7) where applicable.

It is assumed for the purposes of this assessment that the finished ground floor levels of the proposed development buildings are the same as the ground level at each of the exploratory hole locations.

The assessment of the stability of any slopes or retaining structures across or adjacent the site, the requirement for additional retaining structures and the requirements for cut and fill that may be required to facilitate construction is outside the scope of this report.

Where applicable the following assessment includes bearing resistance assuming conventional construction only and no allowances have been made for interaction between existing adjacent foundations and proposed foundations or loads.

Eurocode 7 Section 2.1 Basis for Geotechnical Design indicates that for each geotechnical design situation it shall be verified that no limit state is exceeded. Geotechnical design requirements have been established by three Geotechnical Categories, 1, 2 and 3. For the purpose of this assessment the development is Geotechnical Category 2: which include conventional types of structure and foundation with no exceptional risk or difficult or loading conditions. Designs for structures in Geotechnical Category 2 should normally include quantitative geotechnical data and analysis to ensure that the fundamental requirements are satisfied. Routine procedures for field and laboratory testing and for design and execution may be used for Geotechnical Category 2 designs.

11.1 GROUND MODEL

The following table 11.1 provides the ground model for the site as determined from ground conditions encountered during the site investigation works.

Table 11.1: Ground Model				
Stratum	Description	Top of Stratum (m bgl)	Bottom of Stratum (m bgl)	Average Thickness (m)
Reworked TOPSOIL	Silty sandy gravelly CLAY	0.0	0.2 - 0.5	0.31
MADE GROUND	Various	0.0	0.2 - 1.2	0.49

Table 11.1: Ground Model				
Stratum	Description	Top of Stratum (m bgl)	Bottom of Stratum (m bgl)	Average Thickness (m)
CLAY	Silty sandy CLAY	0.2 - 0.5	0.6 - 2.9	1.37
CLAY	Silty fine to medium SAND	0.6 - 2.9	5.0	-
Notes				
Sand parting within the CLAY soils. Clay partings at depth within the SAND soils.				
Groundwater				
Groundwater at depths of between 3.43m and 3.84m bgl during return monitoring, August 2023.				

11.2 FOUNDATION DESIGN CONCEPT

The ground model and the following considerations will need to be taken in account in determining the foundation solution for the proposed development buildings:

- 🌳 Medium volume change potential CLAY soils and the influence of trees; a number of oak, cypresses and poplar trees are located around the site.
- 🌳 Desiccated CLAY soils overlying the site to depths of up to 2.5m bgl.
- 🌳 Adequate bearing resistance to support the proposed development buildings.
- 🌳 Excavation stability in SAND soils as well as CLAY soils with sand partings, and possibly elevated seasonal groundwater.

The CLAYS soils present at relatively shallow depth beneath the site are of low and intermediate plasticity showing low and medium-volume change potential, above SAND of negligible volume change potential.

Assumed maximum 'characteristic action' (or line load) of 130kN/m run on conventional shallow foundations 1.0m wide on firm to stiff CLAY at depths of between 1.0m and 2.5m bgl may be acceptable for the proposed development buildings subject to the above considerations.

An assumed maximum 'characteristic action' (or line load) of 150kN/m run on conventional shallow foundations 1.0m wide on medium dense SAND at depths of between 1.0m and 2.5m bgl, may also be acceptable for the proposed development buildings subject to the above considerations.

It is assumed that the 'characteristic action' comprises a vertical permanent action. Further information regarding the permanent actions and variable actions (making up the 'characteristic actions') applied to the foundations may be required along with confirmation of the foundation type and foundation dimensions.

11.2 EXCAVATION CONDITIONS

Excavation of the materials encountered during the ground investigation should be achieved using conventional hydraulic excavation techniques.

11.2.1 Temporary Works

From the ground investigation undertaken, excavations in the natural coarse (SAND) soils are not expected to remain stable in the short term. Due to the MADE GROUND, coarse soils as well as CLAY soils with sand partings, and the requirement for excavations to facilitate the construction in potentially elevated seasonal groundwater, care should be taken to ensure that instability of excavations does not affect existing structures and services (e.g. foundations, roads, boundary walls or buildings) both on and off-site, and temporary support is expected to be required in order to achieve this.

Further advice should therefore be sought from the appointed structural engineer and specialist contractor regarding temporary works. General guidance can be found within CIRIA Report 97: Trenching Practice, dated 2001.

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

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times.

11.2.2 Dewatering

Groundwater was encountered during the ground investigation works at a depth of 3.4m bgl in WS3 and WS4 (as of July 2023). Groundwater was also encountered in the standpipes in WS1, WS2 and WS5 during the return monitoring at depths as shallow as 3.43m bgl (as of August 2023). The groundwater is likely to represent the secondary (A) aquifer of the Bagshot Formation.

On the basis of the data obtained; dewatering is not expected to be required in shallow excavations beneath the site (as of July/August 2023).

Groundwater is expected to rise in wetter winter months, and ongoing groundwater monitoring is recommended to determine the seasonal groundwater level below the site.

Consideration should be given to a summer build programme when groundwater is expected to be lower.

11.3 EXISTING SERVICES/SUBSTRUCTURES

Due to the historical development of the site and site environs, existing services or sub-structures should be anticipated.

Where foundations or obstructions are encountered during excavations for the proposed foundations, all new foundations should be extended downwards to fully penetrate all redundant former construction.

11.4 BEARING STRATA

As discussed below, there is a potential for desiccation to have occurred to depths of up to 2.5m bgl in the exploratory holes undertaken. Consideration should therefore be given to extending foundations beneath the desiccated zone. Foundations should also be extended beneath MADE GROUND noted locally to extend to depths of up to 1.2m bgl.

Bearing resistance for the firm to stiff CLAY and medium dense SAND soils at depths of between 1.0m and 2.5m bgl are provided below pending confirmation of the required foundation actions, foundations widths, foundation depths and tolerable settlement.

11.4.1 Atterberg Limits and Material Properties

Atterberg limits tests conducted on the fine soils and fine fraction overlying the site at depths of between 1.0m and 3.0m bgl indicate that the Bagshot Formation comprises inorganic CLAY of low and intermediate plasticity (CL/CI). The modified plasticity index was determined to be between 13% and 26% indicating soils of low and medium volume change potential.

For the purposes of this assessment and in accordance with NHBC Standards Chapter 4.2, Building Near Trees, the overlying clay soils across the site are classified as being of medium-volume change potential.

The results of particle size distribution analysis indicate that with depth, the coarse soils sampled of the Bagshot Formation comprise clayey and very clayey silty fine to medium SAND of negligible volume change potential.

11.4.2 Desiccation

Using the ratio of the moisture content (MC) to the liquid limit (LL) (an empirical indicator of desiccation, after Driscoll, 1983), the test results indicate that the overlying clay soils across the site are potentially desiccated (MC:LL ratio 0.37-0.46) to depths of up to 1.5m bgl locally (WS1, WS2, WS3 and WS4). An assessment in accordance with BRE Digest 412 Desiccation in Clay Soils 1996, also indicates that the shear strength, moisture content and liquidity index profiles are shown to be inconsistent between the sampling points indicating that desiccation is likely to have occurred locally to depths of up to 2.5m bgl.

Desiccated fine soils (silt and clay) result from moisture being withdrawn from the soil, typically by root action. Heave forces occur following the re-hydration of these soils, by swelling on account of increased moisture content.

Moisture content within fine soils can increase due to seasonal weather variations (rain) and also the removal of trees, whereby moisture is no longer being drawn from the soil by root action. The effect of heave is increased when trees are removed. The upward heave force can lift foundations causing structural damage (cracking of masonry, movement of door/window frames). Conversely during periods of dry weather, the moisture content reduces causing fine soils to shrink and the upward heave force to reduce; in such an event the foundation (re)settles. To remove the risk of continued and abnormal movement beneath the base of new foundations due to swelling and shrinking of fine soils the foundations should be placed beneath the desiccated zone.

Consideration should therefore be given to extending foundations beneath the desiccated zone in clay soils, to between 1.5m and 2.5m bgl.

Mitigation measures to prevent heave in the fine soils encountered across the site should be incorporated into the below ground construction.

The soil sampling and testing undertaken provides for a preliminary assessment only based on limited sampling and testing locations. To enable a comprehensive desiccation assessment, consideration should be given to additional soil sampling, in-situ testing and profiling and laboratory analysis including soil suction tests.

11.4.3 Design Parameters

Characteristic values for design parameters for the strata encountered beneath the site are included in Table 11.4.3 below.

Table 11.4.3: Design Parameters			
Stratum	Volume Change Potential	Unit Weight - γ_{rk} (kN/m ³)	Critical State Angle of Friction - $\phi'_{cv,k}$ (degrees)
CLAY	Medium	18-19	30
SAND	Negligible	19	32

A characteristic value of undrained shear strength ($C_{u,k}$) of 65kN/m² has been assumed for the firm to stiff CLAY at the anticipated foundation level of 1.0-2.5m bgl. The characteristic value of undrained shear strength was derived using the results of the empirical relationships between C_u and the SPT N_{60} value ($N_{60}=15$, Er 72%, SPT hammer reference, Dart 311), plasticity index after Stroud M.A and the results of laboratory testing. (The Standard Penetration Test in Insensitive Clays and Soft Rocks, Proceedings of the European Symposium on Penetration Testing, 2, 367-376 (1975).

A characteristic value of the angle of shearing resistance (ϕ) of 32° has been determined for the SAND strata at a minimum depth of 1.0m bgl. The characteristic value of the angle of shearing resistance was derived using the relationship between ϕ and the SPT N_{60} value ($N_{60}=15$) after Peck, Hanson and Thornburn (Foundation Engineering, 1967). Bearing capacity factors determined by Vesic (Analysis of Ultimate Loads of Shallow Foundations, 1973) have been applied.

Geotechnical laboratory material property test results are presented within **Appendix IV**.

11.5 TREE INFLUENCE ON FOUNDATIONS

When considering the influence of trees on foundations, the material properties of the strata beneath the site and the distance and species of the trees to the foundations are the determining factors.

For the purposes of this assessment the CLAY soils overlying the site are classified as being of medium-volume change potential, and an adjustment to foundation depths is therefore required in accordance with NHBC Standards Chapter 4.2, Building Near Trees, 2021.

Reference to the Site Plan, and a Tree Survey by MJC Tree Services Limited (reference MJC-22-0206, dated 25 November 2022) supplied by the Client indicates that a number of high water demand trees, including oak, cypresses and poplar species are located around the site, that will require foundations to be extended to greater depths due to their proximity to some of the proposed plots.

For illustrative purposes only and assuming high water demand trees and medium volume change potential soils, foundations would be required to maximum depths of approximately 1.8m bgl (Plot 1), 2.5m bgl (Plot 1 garage), 2.1m bgl (Plot 2), 1.9m bgl (Plot 3), 1.5m bgl (Plot 3 garage), 3.25m bgl (Plot 4), 2.8m bgl (Plot 4 garage), 2.0m bgl (Plot 5) and 2.6m bgl (Plot 4 garage) using the NHBC depth tables. Depths below 2.5m bgl have been extrapolated. Where SAND soils are encountered at shallower depths, no further adjustment to the foundation depths determined is required.

Mitigation measures to prevent heave in the overlying CLAY soils encountered across the site should be incorporated into the below ground construction.

Should roots or desiccated soils be encountered during the groundworks, and/or previously unidentified trees or tree stumps encountered during the site preparation works, foundations should be extended beneath the roots/desiccated soils and/or the depth adjusted to accommodate the species of tree/tree stump encountered. A record of the findings associated with roots, desiccated soils and trees/tree stumps should be kept during the groundworks phase.

Mitigation measures to protect existing tree species during the construction process will also need to be considered.

11.6 FOUNDATION TYPE, DEPTH AND ALLOWABLE BEARING PRESSURE

11.6.1 Trench Fill/Strip Foundations

Should the requirements of temporary works be overcome, conventional shallow foundations in the firm to stiff CLAY and medium dense SAND at depths of between 1.0m and 2.5m bgl may be viable for the proposed development buildings. Where foundations are required to depths in excess of 2.5m bgl, for example in Plot 4 and Plot 5 due to the influence of trees, a piled foundation solution may be required.

Foundations should be extended beneath Made Ground locally, and the desiccated zone of up to 2.5m bgl locally.

Using an assumed maximum vertical characteristic action of 130kN/m run and 150kN/m run, and Design Approach 1 of Eurocode 7 (checking for a limit state of rupture or excessive deformation), Combination 1 and Combination 2 are both satisfied where the vertical design action (V_d) is less than the design value of the vertical bearing resistance (R_d) in each case. The GEO limit state requirement is therefore satisfied.

It is assumed that the action is vertical, and it is also assumed that the base of the foundations and the ground surface are horizontal. The vertical design actions include the trench fill foundations, assumed to be a maximum thickness of 2.5m, and also accounts for overburden.

The vertical characteristic action of **130kN/m run** and **150kN/m run** corresponds to the bearing resistance in Table 11.6.1 of **130kN/m²** and **150kN/m²** when applied to trench fill foundations 1.0m wide constructed in firm to stiff **CLAY** and medium dense **SAND** at depths of 1.0m to 2.5m bgl, in the area of the proposed development buildings. The serviceability state is satisfied with the total settlement being restricted to **25mm**.

Table 11.6.1: Bearing Resistance				
Strata Type / Plot	Depth BGL (m)	Footing Width (m)	Bearing Resistance (kN/m ²)	Comment
Firm to stiff CLAY	1.0-2.5	1.0	130	Adjustment to foundation depths also required in accordance with NHBC 4.2 Building Near Trees.
Medium dense SAND	1.0-2.5	1.0	150	
Foundations below 2.5m bgl may require piles. Where CLAY soils are encountered, the following (unsurveyed) adjustments to foundation depths would apply in accordance with the pertinent trees noted and NHBC guidance. Where SAND soils are encountered at shallower depths, no further adjustment to the foundation is required.				
Plot 1	Main building; T28 foundations to 1.8m, T30 foundations to 1.4m. Garage; T28 footings to 2.5m. SAND at 0.8-1.1m in WS5, TP7, TP8.			
Plot 2	Main building; W31 foundations to 2.1m. SAND at 0.6-1.1m in WS6, TP5, TP10.			
Plot 3	Main building; G32 foundations to 1.9m. Garage; G32 footings to 1.5m. SAND at 0.8-1.6m in WS3, WS4, TP6.			
Plot 4	Main building; G32 foundations to 3.25m. Garage; G32 footings to 2.8m. SAND at 2.8m in WS2.			
Plot 5	Main building; G32 foundations to 2.0m. Garage; G32 footings to 2.6m. SAND at 2.9m in WS1.			

The total settlement beneath trench fill foundations 1.0m wide is anticipated to be up to 25mm for the CLAY and SAND soils encountered. Mitigation measures to accommodate differential movement between foundations spanning CLAY and SAND soils should be included in the structural design.

Please note that increasing foundation widths will result in an increase in the total settlement anticipated.

Notwithstanding the above it is recommended that the formation beneath each section of the proposed re-development works is inspected to assess the competency of the bearing strata prior to pouring of foundation concrete. The formation should not be allowed to soften due to surface water, rainwater or groundwater ingress prior to pouring of foundation concrete.

It should be noted that the design actions and design layout/dimensions of the proposed works have not been supplied and the above bearing resistance accounts for conventional construction only. The moments resulting in eccentricity of loadings, and the settlement, sliding and overturning and the requirements for propping would need to be considered in the design of any retaining structures.

It should also be noted that the above recommendations have been made using data in window sample boreholes WS1-WS6, trial pits TP1-TP10 and hand auger boreholes HA1-HA4 completed.

11.6.2 Piled Foundations

Should the depth of construction of up to 2.5m bgl locally, potentially deeper within the influence of trees in Plots 4 and 5, or the issues of temporary works in elevated seasonal groundwater be deemed uneconomical for conventional construction, a piled foundation solution may be required.

The advice of a piling specialist should be sought to determine the working loads of their proprietary piling technique when considering the ground and groundwater conditions encountered beneath the site, and the health and safety implications of working within the confines of the site and adjacent neighbouring properties.

Consideration should be given to undertaking additional ground investigation work such as cable and percussion drilling to a depth suitable to enable piled foundation design.

11.6.3 Floor Slab

Due to the potential for desiccation to have occurred, it is recommended that the ground floor slabs beneath the proposed development buildings are suspended on ground beams.

Mitigation measures to prevent heave in the overlying fine soils encountered should also be incorporated into the below ground construction.

11.7 CONCRETE CLASSIFICATION

In accordance with Building Research Establishment (BRE) Special Digest 1: 2005 - Concrete in Aggressive Ground, the following laboratory test data has been used to derive classifications for buried concrete (Table C1, natural ground locations) beneath the site:

 Soluble Sulphate (2:1 extract)	– 0.01 to 0.025g/l
 pH	– 5.1 to 8.2
 Total Sulphate SO ₄	– 0.011 – 0.094%
 Total Sulphur	– 0.01 – 0.17%
 Total Potential Sulphate	– 0.03 – 0.51%
 Oxidisable Sulphide	< 0.3% to 0.42%

“BRE guidance suggests that ‘if significant number of determination of oxidisable sulphides is above 0.3%, then use the results of total potential sulphate to determine the concrete class”.

Oxidisable sulphide has been calculated above 0.3% SO₄ in the Made Ground sample tested in HA1 at 0.2m bgl and exceeds the threshold where the concrete classification is based on oxidisable sulphide and total potential sulphate.

Based on the results obtained for soluble sulphate the Design Sulphate (DS) Class for shallow buried concrete beneath the site is DS-1. For foundations above the groundwater level, the Aggressive Chemical Environment for Concrete (ACEC) Class is AC-1s. For foundations below the groundwater level the ACEC Class is AC-2z.

Based on the results obtained for total potential sulphate, and where the Made Ground around HA2 is used as backfill against foundations, the DS Class would be DS-2 and the ACEC, AC-1s, where foundations are above the groundwater level.

It should be noted that additional considerations for the determination of concrete class and appropriate aggregate use are set out in BRE Special Digest 1. These are considerations specific to the soil type, the proposed development and the type of concrete foundations to be used at the site.

Laboratory results for the pH, sulphate and sulphur testing are included within **Appendix III**.

11.8 PAVEMENT DESIGN

The results of DCP/TRL testing indicate CBR values typically reducing (bottoming out) to ~ 3.0% (DCP4), as the DCP probe penetrated the overlying surface.

A preliminary CBR value of 3% is therefore assumed for road pavement construction. It is recommended that in-situ CBR tests are undertaken at road pavement formation level (once known) to confirm the preliminary CBR value determined.

The results of DCP testing are enclosed in **Appendix IV**.

11.9 SOAKAWAY DRAINAGE

The feasibility of shallow soakaway drainage has been reported to the Client under a separate cover by Lanmor Consulting.

12.0 CONCLUSIONS AND RECOMMENDATIONS

This tier 1 PRA desk study and Site Investigation including tier 2 GQRA has provided an assessment of the site's history, geo-environmental setting and an evaluation of ground conditions.

12.1 ENVIRONMENTAL

Table 12.1 summarises the pertinent environmental risks providing advice on further works and assessment.

Table 12.1: Environment Risk Summary			
Medium	Item	Risk Description	Comments/Recommendations
Soils	1	Local PAH contamination within Made Ground in the east of the site around existing workshops.	Prepare Remediation Action Plan to remove local unit of PAH impacted Made Ground at the bottom of Plot 3 rear garden.
	2	ACS detected in the north of the site (Plot 1 and 2 gardens) in 2017 but not in 2023.	An Asbestos Management Plan and where necessary a Remediation Action Plan should be prepared. This preparation of these plans may benefit from further sampling and testing; ideally once carefully managed site clearance has been completed.
	3	Potential for undiscovered soil contamination during workshop removal	Prepare a Discovery Strategy and enact watching brief during site clearance.
	4	Any imported Topsoil should be chemically suitable for use in private gardens.	Import suitable Topsoil (BS3882) to sustain planting.
	5	Ensure material encountered is suitable for desired water main.	Consult local water authority prior to water main installation.
Ground Gas	6	Ingress of hazardous ground gases (CH ₄ + CO ₂) into new homes and depleted oxygen.	Gas monitoring results at the time of issue are acceptable, however, worst-case conditions have not been captured during the fine summer period. Unlikely ground gas protection is necessary however complete at least a final round of worst-case monitoring to conclude.
Groundwater	n/a	Ground conditions are not considered to present a notable risk to groundwater or controlled waters.	n/a.

Once the above risks have been evaluated/implemented the environmental risk assessment can be considered complete and the development suitable for occupancy.

12.2 GROUND HAZARDS SUMMARY

This report and the Clients preferred foundation solution should be presented to the Local Authority or appropriate build warranty provider for approval prior to construction.

Table 12.2 summarises the pertinent Ground Hazards Summary.

Table 12.2: Ground Hazards Summary		
Construction Issue	Ground Hazard	Recommendation
Below Ground Obstructions	Foundations and filled ground should be anticipated at shallow depth beneath the site from the historical development.	Shallow obstructions likely to be removed with conventional excavation plant and hydraulic breaking equipment.
Foundations	Conventional shallow foundation solution subject to the requirements of temporary works and foundations depths of up to 2.5m bgl, possibly deeper due to trees. Shallow excavations in MADE GROUND and coarse soils and CLAY with sand partings unlikely to be stable in the short term. Ground water at depths as shallow as circa 3.4m bgl (July/August 2023). Groundwater expected to rise and fall seasonally.	Bearing resistance of 130kN/m² and 150kN/m² may be acceptable for trench fill foundations at 1.0-2.5m bgl in firm to stiff CLAY and medium dense SAND respectively. Foundations may however be required in excess of 2.5m bgl locally due to the influence of trees, therefore a piled foundation solution should be considered. Dewatering unlikely to be required (July/August 2023) in shallow excavations, however, programme ongoing seasonal groundwater monitoring. Shoring of excavations expected to be required. Overlying CLAY soils encountered are of medium volume change potential (NHBC Chapter 4.2, Building Near Trees) above SAND of negligible volume change potential.
Floor Slabs	Suspended	Heave protection required in overlying shallow CLAY soils.
Buried Concrete	Low to moderately aggressive ground conditions encountered.	Concrete classification determined generally as DS-1, AC-1s/AC-2z.
Drainage	Feasibility of soakaway drainage reported by Lanmor Consulting.	
Pavements	Preliminary design CBR value of 3.0% assumed.	Consider in-situ CBR tests at road pavement formation level once known.
Abnormals	A piled foundation solution may be required in Plot 4 and Plot 5.	Consider cable and percussion drilling to a depth suitable to enable piled foundation design.

13.0 PROJECT INSTRUCTION AND LIMITATIONS

13.1 SCOPE OF WORKS

The following scope of work was undertaken to an agreed brief set out in Aviron's proposal and involves the following:

-  Undertake one day of window sample boreholes to depths of up to 5.0m bgl, including SPTs at 1m intervals.
-  Install three of the boreholes with monitoring pipe to enable return gas and groundwater readings.
-  Machine and hand trial pitting to enable a visual assessment of soils at relatively shallow depth and to enable spatial and targeted soil sampling to enhance the human health risk assessment.
-  Hand augering and targeted soil sampling to complement the human health risk assessment.
-  DCP/TRL testing to determine road pavement design parameters.
-  Log the strata within each exploratory hole noting any water strikes.
-  Collect disturbed soil samples from exploratory holes and submit for geochemical laboratory tests to determine the presence or absence of soil contaminants, and geotechnical material property tests to enable foundation recommendations and allow roadway and drainage design.
-  All soil samples shall be collected in accordance with the instruction and ground conditions and submitted to UKAS/MCERTS accredited laboratories for testing.
-  Prepare an interpretative GERA report to interpret ground conditions with respect to potential environmental risks and provide recommendations for foundation design and engineering parameters.

Aviron has relied upon information received from the Client and their agents as accurate, unless contradicted by written documentation or site observations.

13.2 PUBLISHED GUIDANCE

This report follows the technical approach presented on Land contamination risk management (LCRM), accessed on gov.uk website. The guidance replaced the Contaminated Land Report 11 (CLR11) "Model Procedures for the Management of Land Contamination" prepared by the Environment Agency in 2004.

CLR11, which was withdrawn in 2020, provided guidance on the application of management processes when assessing potentially contaminated land.

This project and report have been designed to fulfil the information requirements set out in LCRM.

This report is additionally prepared in accordance with current guidance notes, standards and practices as set out by the Environment Agency and statutory organisations in order to establish potential and significant contaminant linkages as defined in Part IIA of the Environmental Protection Act 1990.

13.3 LIMITATIONS

Aviron's scope of work has been designed to meet the timeframe and as such it may follow that further work would be prudent upon evaluation of the ground conditions. The scope of work provided shall provide a view of site conditions and understanding of potential geo-environmental risks and possible mitigation procedures.

The information used in this report has been derived from the site investigation, which in turn were based on known current and historical land uses identified at the site and surrounding area, available to Aviron at the time of the investigation.

Intrusive points chosen relate to the data collected and the risk assessment and recommendations will rely on these points only. It therefore follows that some areas of the site will not be examined. It is always possible that some areas not investigated may contain conditions which would be impossible to determine due to lack of evidence or time and budget restrictions.

This report provides recommendations for foundation design based upon the ground conditions encountered and where possible makes predictions for possible variations in ground conditions. However, it is always possible that not all variations in ground conditions can be accounted for and shall also be dependent upon design loadings and foundation construction techniques used. It should be acknowledged that ground conditions may vary from intrusive point to intrusive point and without undertaking continuous investigation it is impossible to entirely understand variations in ground conditions. Our recommendations should therefore not supersede the project's Consulting Structural and Civil Engineers design.

This report comprises a Ground Investigation Report in accordance with BS EN 1997-2, unless otherwise stated. This report does not constitute a Geotechnical Design Report (BS EN 1997-2) and geotechnical recommendations in this report are for guidance only.

A survey and an assessment of invasive species such as Himalayan Balsam and Japanese Knotweed is beyond the scope of this report.

Should changes in legislation, statutory requirements or industry practices occurred following issue of this report, this report should be viewed in light of these changes.

Should a notable time period elapse between the date issue of this report and the date of application of this report changes to site dynamics may occur and in particular the site inspection notes may no longer be applicable should any change of use occur to the site in the interim.

14.0 REFERENCES AND OTHER SOURCES OF INFORMATION

Previous Reports

Southern Testing Environmental & Geotechnical, Geoenvironmental Site Investigation Report (reference JT0117, dated October 2017)

STM Environmental Consultant, Contaminated Land Risk Assessment, Phase I Desk Study Report (reference PH1-2022-0000101, dated 10 November 2022)

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BS EN ISO 22475-1:2006 Geotechnical investigation and testing - Sampling Methods and Groundwater Measurements

BS EN ISO 22476-3:2005 Standard Penetration Test

BS EN 1997-1:2004+A1:2013 Eurocode 7 Geotechnical Design Part 1 General Rules

BS EN 1997-2:2007 Eurocode 7 Geotechnical Design Part 2 Ground Investigation and Testing

NA to BS NA+A1:2014 to EN 1997-1.2004+A1:2013 UK National Annex to Eurocode 7 Geotechnical Design Part 1 General Rules

NA to BS EN 1997-2.2007 UK National Annex to Eurocode 7 Geotechnical Design Part 2 Ground Investigation and Testing

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SR7: Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values, Science Report SC050021/SR7, Environment Agency, November 2008

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Vesic. 1973. Analysis of Ultimate Loads of Shallow Foundations

Figures

- 1 Site Location Plan
- 2 Existing Site Layout Plan
- 3 Site Photographs
- 4 Site Photographs
- 5 Proposed Development Plan
- 6 Southern Testing Soil Contamination Identification Plan
- 7 Exploratory Hole Location Plan - Existing Site Layout
- 8 Exploratory Hole Location Plan - Proposed Development
- 9 Combined Soil Contamination Identification Plan



Legend



Approximate Development Site Boundary

Landscape/Wildlife Corridor

Notes

Figure 1

Drawing Title

Site Location Plan

Project Number 23-176.01

Project Title

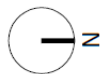
Land at Johnson Drive, Finchampstead, RG40 3NW

Drawn by OB

Checked by JB

Scale NTS





Legend

-  Approximate Development Site Boundary
-  Landscape/Wildlife Corridor
-  Photo Direction

Notes

Figure 2

Drawing Title

Existing Site Layout Plan

Project Number 23-176.01

Project Title

Land at Johnson Drive, Finchampstead,
RG40 3NW

Drawn by OB

Checked by JB

Scale NTS





Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6

Legend

Notes

Taken 26 July 2023

Figure 3

Drawing Title

Site Photographs

Project Number 23-176.01

Project Title

Land at Johnson Drive, Finchampstead, RG40 3NW

Drawn by OB

Checked by JB

Scale NTS





Photo 7



Photo 8



Photo 9



Photo 10

Legend

Notes

Taken 26 July 2023

Figure 4

Drawing Title

Site Photographs

Project Number 23-176.01

Project Title

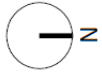
Land at Johnson Drive, Finchampstead, RG40 3NW

Drawn by OB

Checked by JB

Scale NTS





Legend



Approximate Development Site Boundary



Landscape/Wildlife Corridor

Notes

Figure 5

Drawing Title

Proposed Development Plan

Project Number 23-176.01

Project Title

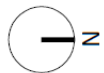
Land at Johnson Drive, Finchampstead, RG40 3NW

Drawn by OB

Checked by JB

Scale NTS





Legend

-  Approximate Development Site Boundary
-  Landscape/Wildlife Corridor
-  ST Contamination Identification

Notes

Southern Testing (ST) locations are approximate.

Figure 6

Drawing Title

Southern Testing Soil Contamination Identification Plan

Project Number 23-176.01

Project Title

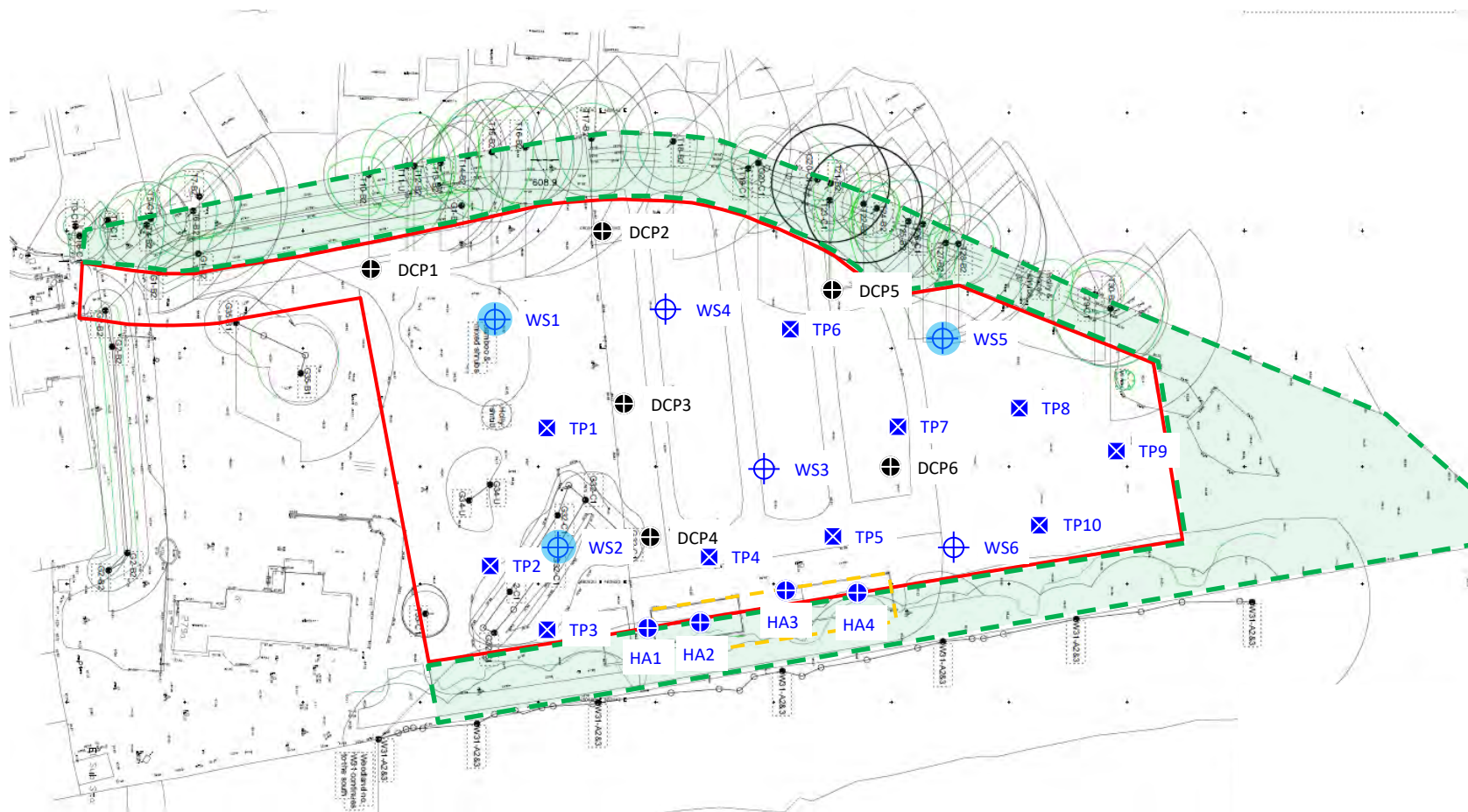
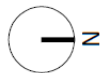
Land at Johnson Drive, Finchampstead, RG40 3NW

Drawn by OB

Checked by JB

Scale NTS





Legend

- Window Sample Borehole
- Monitoring Well
- Trial Pit
- DCP/CBR
- Core and Hand Auger

Notes

Figure 7

Drawing Title

Exploratory Hole Location Plan -
Existing Layout

Project Number 23-176.01

Project Title

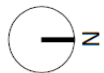
Land at Johnson Drive, Finchampstead,
RG40 3NW

Drawn by OB

Checked by JB

Scale NTS





Legend

-  Window Sample Borehole
-  Monitoring Well
-  Trial Pit
-  DCP/CBR
-  Core and Hand Auger

Notes

Figure 8

Drawing Title

Exploratory Hole Location Plan -
Proposed Development

Project Number 23-176.01

Project Title

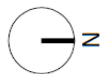
Land at Johnson Drive, Finchampstead,
RG40 3NW

Drawn by OB

Checked by JB

Scale NTS





Legend

-  Window Sample Borehole
-  Trial Pit
-  Core and Hand Auger
-  ST Contamination Identification
-  Avron Contamination Identification
-  Avron 'Uncontaminated' Location

Notes

Figure 9

Drawing Title

Combined Soil Contamination
Identification Plan

Project Number 23-176.01

Project Title

Land at Johnson Drive, Finchampstead,
RG40 3NW

Drawn by OB

Checked by JB

Scale NTS



Appendices

- I Exploratory Hole Logs and Photographs
- II Field Monitoring Results
- III Soil Contamination Results and Assessment Criteria
- IV Soil Geotechnical Results

Appendix

I Exploratory Hole Logs and Photographs



WINDOW SAMPLE LOG

Site:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No.	23-176.01	Borehole:	WS1
Client:	Palatine Homes Limited	Start:	26/07/2023	End:	26/07/2023
Method/Plant Used:	WS Rig (Archway Dart) - AD1	Co-ordinates:	NT	Ground Level:	NT

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests			SPT Results						Notes
				Depth	No	Type	75mm	75mm	75mm	75mm	75mm	N' Value	
Soft light brown silty very sandy gravelly CLAY with rootlets and rare angular brick fragments. Gravel is fine to medium sub-angular to rounded of flint. (Reworked TOPSOIL)		(0.2) 0.2		0.1	1	ES							
Firm to stiff and stiff light grey, yellowish and orange brown silty very sandy CLAY with partings of orange coarse sand. Rootlets to 0.7m. [BAGSHOT FORMATION]		(2.7)											
				1.0	2	D/SPT	3	3	4	4	5	5	18
				1.25									HP 11+
				1.5	3	D							HP 11+
				1.75									HP 7.9
				2.0	4	D/SPT	2	2	3	3	4	4	14
				2.25									HP 7.0
Medium dense light grey and orange brown mottled clayey silty fine to coarse SAND. [BAGSHOT FORMATION]		2.9 (0.9)		2.5	5	D							HP 7.4
				2.75									HP 5.5
Medium dense orange brown slightly silty fine SAND. [BAGSHOT FORMATION]		3.8 (1.2)		3.0	6	D/SPT	2	3	4	6	7	7	24
				4.0	7	SPT	2	2	2	2	2	4	10
... becomes very dense		5.0		5.0	8	SPT	10	12	12	18	16	4	50 for 235mm

Casing record			Chiselling records			Water level observations (depths in metres below gl)					
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
26/07/2023	-	-				26/07/2023		-	-		
Remarks									By		
Hand service pit to 1.0m. Groundwater not encountered. No visual or olfactory evidence of contamination. Gas and groundwater monitoring installation to 4.0m.							Logged	AC			
SPT: Standard Penetration Test, HP: Hand Penetrometer, B: Bulk Sample, D: Disturbed Sample, R: Root Sample							Checked	JB			Scale 01:25



WINDOW SAMPLE LOG

Site:				Project No.		Borehole:	
Land at Johnson Drive, Finchampstead, RG40 3NW				23-176.01		WS2	
Client:				Start:		End:	
Palatine Homes Limited				26/07/2023		26/07/2023	
Method/Plant Used:				Co-ordinates:		Ground Level:	
WS Rig (Archway Dart) - AD1				NT		NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests			SPT Results							Notes
				Depth	No	Type	75mm	75mm	75mm	75mm	75mm	75mm	N' Value	
Soft light brown silty very sandy gravelly CLAY with rootlets and rare brick fragments. Gravel is fine to medium sub-angular to rounded of flint. (Reworked TOPSOIL)		(0.4)		0.2	1	ES								
Firm to stiff light grey, yellowish and orange brown silty very sandy CLAY with partings of orange coarse sand. Rootlets to 0.8m. [BAGSHOT FORMATION]		(2.4)												
				0.55	2	ES								HP 11+
				0.75										HP 11+
				1.0	3	D/SPT	3	3	3	3	4	5	15	HP 11+
				1.25										HP 11+
				1.5	4	D								HP 11+
				1.75										HP 11+
Medium dense light grey and orange brown mottled clayey silty fine to medium SAND. [BAGSHOT FORMATION]		(2.2)		2.0	5	D/LC/SPT	2	2	4	3	4	4	15	HP 11+
				2.25										HP 11+
				2.5		D								HP 11+
				3.0	5	SPT	4	4	4	5	6	6	21	
				4.0	6	SPT	2	22	2	3	4	4	13	
... becomes very dense		5.0		5.0	6	SPT	3	7	9	10	10	10	39	

Casing record			Chiselling records			Water level observations (depths in metres below gl)					
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
26/07/2023	-	-				26/07/2023		-	-		
Remarks									By		
Hand service pit to 1.0m. Groundwater not encountered. No visual or olfactory evidence of contamination. Gas and groundwater monitoring installation to 4.0m.							Logged	AC			
SPT: Standard Penetration Test, HP: Hand Penetrometer, B: Bulk Sample, D: Disturbed Sample, R: Root Sample							Checked	JB			Scale 01:25



WINDOW SAMPLE LOG

Site: Land at Johnson Drive, Finchampstead, RG40 3NW				Project No. 23-176.01	Borehole: WS3
Client: Palatine Homes Limited			Start: 26/07/2023	End: 26/07/2023	Sheet: 1 of 1
Method/Plant Used: WS Rig (Archway Dart) - AD1		Co-ordinates: NT		Ground Level: NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests			SPT Results						Notes
				Depth	No	Type	75mm	75mm	75mm	75mm	75mm	N' Value	
Soft light brown silty very sandy gravelly CLAY with rootlets and rare brick fragments. Gravel is fine to medium sub-angular to rounded of flint. (Reworked TOPSOIL)		(0.3)											
		0.3											
Firm to stiff light grey, yellowish and orange brown silty very sandy CLAY with partings of orange coarse sand. Rootlets to 0.8m. [BAGSHOT FORMATION]		(1.2)		0.5									HP 11+
				0.7	1	ES							HP 11+
				1.0	2	D/SPT	2	2	3	4	4	6	HP 11+
				1.25									HP 11+
		1.5		1.5	3	D							HP 11+
Medium dense light grey and orange brown mottled clayey silty fine to coarse SAND. [BAGSHOT FORMATION]		(1.7)											
				2.0	4	D/SPT	2	3	3	3	3	4	13
				3.0	5	D/SPT	2	3	4	3	4	4	15
		3.2											
Medium dense orange brown slightly silty fine SAND. [BAGSHOT FORMATION]		(1.5)											
				4.0	6	D/SPT	2	4	6	4	6	10	26
... becomes very dense													
		4.7		4.7	7	D/SPT	8	9	12	13	16	9	50 for 255mm

Casing record			Chiselling records			Water level observations (depths in metres below gl)					
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
26/07/2023	-	-				26/07/2023	3.40	-	-	3.40	
Remarks									By		
Hand service pit to 1.0m. Groundwater encountered at 3.40m. No visual or olfactory evidence of contamination.									Logged	AC	
									Checked	JB	
SPT: Standard Penetration Test. HP: Hand Penetrometer. B: Bulk Sample. D: Disturbed Sample. R: Root Sample											



WINDOW SAMPLE LOG

Site:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No.	23-176.01	Borehole:	WS4
Client:	Palatine Homes Limited	Start:	26/07/2023	End:	26/07/2023
Method/Plant Used:	WS Rig (Archway Dart) - AD1	Co-ordinates:	NT	Ground Level:	NT

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests			SPT Results							Notes
				Depth	No	Type	75mm	75mm	75mm	75mm	75mm	75mm	N' Value	
Soft light brown silty very sandy gravelly CLAY with rare brick fragments. Gravel is fine to medium sub-angular to rounded of flint. (Reworked TOPSOIL)		(0.4)		0.3	1	ES								
Firm to stiff light grey, yellowish and orange brown silty very sandy CLAY with partings of orange coarse sand.		0.4												
		(1.2)		0.5	2	D								HP 11+
				0.75										HP 11+
				1.0	3	D/SPT	2	2	3	4	4	4	15	HP 11+
				1.25										HP 11+
Medium dense light grey and orange brown mottled clayey silty fine to coarse SAND. Very sandy CLAY partings 3.0-3.2m. [BAGSHOT FORMATION]		1.6		1.5	4	D								HP 9.9
		(1.6)												
				2.0	5	D/LC/SPT	2	3	4	4	4	4	16	
				2.5	6	D								
Medium dense orange brown slightly silty fine SAND. [BAGSHOT FORMATION]		3.2		3.0	7	D/SPT	2	2	4	4	4	5	17	
		(1.6)												
				3.5	8	D								
				4.0	9	D/SPT	2	2	3	4	6	7	20	
... becomes very dense		4.8		4.5	10	D								
				4.8	11	D/SPT	5	7	8	9	15	18	50	for 285mm

Casing record			Chiselling records			Water level observations (depths in metres below gl)						
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
26/07/2023	-	-				26/07/2023	3.40	-	-	3.40		
Remarks									By			
Hand service pit to 1.0m. Groundwater encountered at 3.40m. No visual or olfactory evidence of contamination.									Logged	AC		
									Checked	JB		Scale 01:25
SPT: Standard Penetration Test. HP: Hand Penetrometer. B: Bulk Sample. D: Disturbed Sample. R: Root Sample												



WINDOW SAMPLE LOG

Site:				Project No.		Borehole:	
Land at Johnson Drive, Finchampstead, RG40 3NW				23-176.01		WS5	
Client:				Start:		End:	
Palatine Homes Limited				26/07/2023		26/07/2023	
						1 of 1	
Method/Plant Used:			Co-ordinates:			Ground Level:	
WS Rig (Archway Dart) - AD1			NT			NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests			SPT Results							Notes
				Depth	No	Type	75mm	75mm	75mm	75mm	75mm	75mm	N' Value	
Soft light brown silty very sandy gravelly CLAY with rootlets and rare brick fragments. Gravel is fine to medium sub-angular to rounded of flint. (Reworked TOPSOIL)		(0.3) 0.3		0.15	1	ES								
Firm light grey, yellowish and orange brown silty very sandy CLAY with partings of orange coarse sand. [BAGSHOT FORMATION]		(0.8) 1.1		0.9 1.0	2 3	ES D/SPT	3	5	6	7	8	7	28	
Medium dense light grey and orange brown mottled clayey silty fine to medium SAND. Very sandy CLAY partings 2.5-3.0m. [BAGSHOT FORMATION]		(2.0) 3.1		2.0	4	SPT	3	4	5	5	6	6	22	
				2.5		D								
				3.0	5	SPT	3	3	4	4	3	3	14	
Medium dense becoming dense orange brown slightly silty fine SAND. [BAGSHOT FORMATION]		(0.9) 4.0		3.5		D								
				3.7	6	SPT	7	9	9	10	8	9	36	
Dense dark grey fine SAND. [BAGSHOT FORMATION]		4.1		4.1	6	SPT	5	6	6	7	11	12	36	

Casing record			Chiselling records			Water level observations (depths in metres below gl)					
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
26/07/2023	-	-				26/07/2023		-	-		
Remarks									By		
Hand service pit to 1.0m. Groundwater not encountered. No visual or olfactory evidence of contamination. Gas and groundwater monitoring installation to 2.0m.							Logged	AC			
SPT: Standard Penetration Test, HP: Hand Penetrometer, B: Bulk Sample, D: Disturbed Sample, R: Root Sample							Checked	JB			Scale 01:25



WINDOW SAMPLE LOG

Site:				Project No.		Borehole:	
Land at Johnson Drive, Finchampstead, RG40 3NW				23-176.01		WS6	
Client:				Start:		End:	
Palatine Homes Limited				26/07/2023		26/07/2023	
Method/Plant Used:				Co-ordinates:		Ground Level:	
WS Rig (Archway Dart) - AD1				NT		NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests			SPT Results						Notes
				Depth	No	Type	75mm	75mm	75mm	75mm	75mm	N' Value	
Soft light brown silty very sandy gravelly CLAY with rootlets and rare brick fragments. Gravel is fine to medium sub-angular to rounded of flint. (Reworked TOPSOIL)		(0.3) 0.3		0.2	1	ES							
Firm light grey, yellowish and orange brown silty very sandy CLAY with partings of orange coarse sand. Rootlets to 0.8m. [BAGSHOT FORMATION]		(0.8) 1.1		1.0	2	SPT	5	5	4	6	5	5	20
Medium dense light grey and orange brown mottled clayey silty fine to coarse SAND. Very sandy CLAY partings 1.5-2.0m. [BAGSHOT FORMATION]		(2.0) 2.8		1.5	3	D							
				2.0	4	D/SPT	3	4	4	5	5	4	18
Medium dense orange brown slightly silty fine SAND. [BAGSHOT FORMATION]		(1.5) 4.3		3.0	5	LC/SPT	3	3	5	6	6	5	22
				4.0	6	SPT	2	4	5	7	8	9	29
Dense dark grey fine SAND. [BAGSHOT FORMATION]		(0.4) 4.7		4.7	7	SPT	6	8	7	8	11	13	39

Casing record			Chiselling records			Water level observations (depths in metres below gl)						
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
26/07/2023	-	-				26/07/2023		-	-			
Remarks									By			
Hand service pit to 1.0m. Groundwater not encountered. No visual or olfactory evidence of contamination. Gas and groundwater monitoring installation to 2.0m.								Logged	AC			
								Checked	JB			Scale 01:25
SPT: Standard Penetration Test, HP: Hand Penetrometer, B: Bulk Sample, D: Disturbed Sample, R: Root Sample												



Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
0.30	0.30	1.10	27/07/2023	-	-	-	-	
						By		
					Logged	AC		
					Checked	OB	Scale 01:25	



Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
0.20	0.20	1.00	27/07/2023	-	-	-	-	
						By		
					Logged	AC		
					Checked	OB	Scale 01:25	



TRIAL PIT LOG

Project: Land at Johnson Drive, Finchampstead, RG40 3NW				Project No. 23-176.01		Trial Pit: TP3							
Client: Palatine Homes Limited			Start: 27/07/2023		End: 27/07/2023		Sheet: 1 of 1						
Method/Plant Used: Hand Tools		Co-ordinates: NT			Ground Level: NT								
Description of Strata	Legend	Depth (m bgl) (thickness)	Well Constr.	Samples/Tests									Laboratory Test Details
				Depth	No	Type							
Light grey silty sandy gravelly CLAY. Gravel is fine to medium sub-angular to rounded of flint. Brick fragments. Roots. (REWORKED TOPSOIL)		(0.5)											
Light grey pale yellow locally orange clayey slightly silty fine to medium SAND. Roots to 0.9m. (BAGSHOT FORMATION)		0.5 (0.5)											
		1.0											

Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
0.25	0.25	1.00	27/07/2023	-	-	-	-	
Remarks Roots noted to 0.9m bgl. No groundwater encountered in trial pit. No visual or olfactory evidence of contamination. Trial pit backfilled with arisings.						By		
						Logged	AC	
						Checked	OB	Scale 01:25



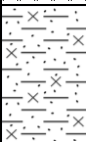
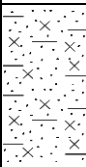
TRIAL PIT LOG

Project:		Land at Johnson Drive, Finchampstead, RG40 3NW				Project No.		23-176.01		Trial Pit:		TP4			
Client:		Palatine Homes Limited				Start:		27/07/2023		End:		27/07/2023			
Method/Plant Used:		2.5T Excavator				Co-ordinates:		NT				Ground Level:		NT	
Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests									Laboratory Test Details		
				Depth	No	Type									
Brown dark grey silty sandy gravelly CLAY. Gravel is fine to medium sub-angular to rounded of type 1 and flint. Large brick fragments. (MADE GROUND)		(0.3)													
		0.3													
Firm light grey locally orange very sandy silty CLAY. Pockets of fine to coarse orange pale yellow sand. (BAGSHOT FORMATION)		(0.8)													
		1.1													
Light grey orange pale yellow slightly silty clayey fine to medium SAND. (BAGSHOT FORMATION)		(0.3)													
		1.4													

Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
1.20	0.35	1.40	27/07/2023	-	-	-	-	
Remarks No roots present in trial pit. No groundwater encountered in trial pit. No visual or olfactory evidence of contamination. Trial pit backfilled with arisings.						By		
						Logged	AC	
						Checked	OB	Scale 01:25



TRIAL PIT LOG

Project: Land at Johnson Drive, Finchampstead, RG40 3NW							Project No. 23-176.01		Trial Pit: TP5				
Client: Palatine Homes Limited					Start: 27/07/2023		End: 27/07/2023		Sheet: 1 of 1				
Method/Plant Used: 2.5T Excavator			Co-ordinates: NT				Ground Level: NT						
Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests									Laboratory Test Details
				Depth	No	Type							
Brown dark grey silty sandy gravelly CLAY. Gravel is fine to medium sub-angular to rounded of type 1 and flint. Large brick fragments. Roots to 0.2m. (MADE GROUND)		(0.2)		0.1	1	ES							
Firm light grey locally orange very sandy silty CLAY. Pockets of fine to coarse orange pale yellow sand. (BAGSHOT FORMATION)		(0.7)											
		0.9											
Light grey orange pale yellow slightly silty clayey fine to medium SAND. (BAGSHOT FORMATION)		(0.7)											
		1.6											

Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
1.20	0.35	1.60	27/07/2023	-	-	-	-	
Remarks Roots noted to 0.2m bgl. No groundwater encountered in trial pit. No visual or olfactory evidence of contamination. Trial pit backfilled with arisings.						By		
						Logged	AC	
						Checked	OB	
								Scale 01:25



TRIAL PIT LOG

Project: Land at Johnson Drive, Finchampstead, RG40 3NW						Project No. 23-176.01		Trial Pit: TP6	
Client: Palatine Homes Limited						Start: 27/07/2023		End: 27/07/2023	
Method/Plant Used: 2.5T Excavator						Co-ordinates: NT		Ground Level: NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests									Laboratory Test Details
				Depth	No	Type							
Brown dark grey silty sandy gravelly CLAY. Gravel is fine to medium sub-angular to sub-rounded of flint and rarely type one. Whole bricks. (MADE GROUND)		(0.2)		0.2	1	ES							
Firm light grey locally orange very sandy silty CLAY. Pockets of fine to coarse orange pale yellow sand. (BAGSHOT FORMATION)		(0.6)											
		0.8											
Light grey orange pale yellow slightly silty clayey fine to medium SAND. (BAGSHOT FORMATION)		(1.0)											
		1.8											

Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
1.40	0.35	1.80	27/07/2023	-	-	-	-	

Remarks No roots present in trial pit. No groundwater encountered in trial pit. No visual or olfactory evidence of contamination. Trial pit backfilled with arisings.	By	
	Logged	AC
	Checked	OB
		Scale 01:25



TRIAL PIT LOG

Project: Land at Johnson Drive, Finchampstead, RG40 3NW						Project No. 23-176.01		Trial Pit: TP7	
Client: Palatine Homes Limited						Start: 27/07/2023		End: 27/07/2023	
Method/Plant Used: 2.5T Excavator						Co-ordinates: NT		Ground Level: NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Constr.	Samples/Tests									Laboratory Test Details
				Depth	No	Type							
Brown dark grey silty sandy slightly gravelly CLAY. Gravel is fine to medium sub-angular to rounded of flint. Fine brick fragments. Rootlets to 0.2m. (REWORKED TOPSOIL)		(0.2)											
Firm light grey locally orange very sandy silty CLAY. Pockets of fine to coarse orange pale yellow sand. (BAGSHOT FORMATION)		(1.0)											
...band of fine to coarse pale yellow sand at 0.3m to 0.35m.		1.2											
Light grey orange pale yellow slightly silty clayey fine to medium SAND. (BAGSHOT FORMATION)		(0.5)											
		1.7											

Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
1.20	0.35	1.70	27/07/2023	-	-	-	-	
Remarks Rotlets noted to 0.2m bgl. No groundwater encountered in trial pit. No visual or olfactory evidence of contamination. Trial pit backfilled with arisings.						By		Scale 01:25
						Logged	AC	
						Checked	OB	



TRIAL PIT LOG

Project: Land at Johnson Drive, Finchampstead, RG40 3NW						Project No. 23-176.01		Trial Pit: TP8	
Client: Palatine Homes Limited						Start: 27/07/2023		End: 27/07/2023	
Method/Plant Used: 2.5T Excavator						Co-ordinates: NT		Ground Level: NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests									Laboratory Test Details
				Depth	No	Type							
Dark brown dark grey humic silty sandy gravelly CLAY. Gravel is fine to medium sub-angular to rounded of flint. Buried plastic waste. Roots to 0.2m. (REWORKED TOPSOIL)		(0.25)											
		0.25											
Firm light grey locally orange very sandy silty CLAY. Pockets of fine to coarse orange pale yellow sand. (BAGSHOT FORMATION)		(0.55)											
		0.8											
Light grey orange pale yellow slightly silty clayey fine to medium SAND. (BAGSHOT FORMATION)		(1.1)											
		1.9											

Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
1.10	0.35	1.90	27/07/2023	-	-	-	-	
Remarks Roots noted to 0.2m No groundwater encountered in trial pit. No visual or olfactory evidence of contamination. Trial pit backfilled with arisings.						By		Scale 01:25
						Logged	AC	
						Checked	OB	



TRIAL PIT LOG

Project: Land at Johnson Drive, Finchampstead, RG40 3NW				Project No. 23-176.01		Trial Pit: TP9		
Client: Palatine Homes Limited			Start: 27/07/2023		End: 27/07/2023		Sheet: 1 of 1	
Method/Plant Used: 2.5T Excavator		Co-ordinates: NT			Ground Level: NT			

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests									Laboratory Test Details
				Depth	No	Type							
Soft to firm and firm brown grey silty sandy gravelly CLAY. Gravel is fine to medium sub-angular to sub-rounded of flint and type 1. Whole bricks. Frequent concrete rubble. (MADE GROUND) ...solid concrete from 0.5m to 1.2m (excavated around)		(1.2)		0.5	1	ES							
		1.2											
Light grey orange pale yellow slightly silty clayey fine to medium SAND. (BAGSHOT FORMATION)		(0.2) 1.4											

Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
1.60	0.50	1.40	27/07/2023	-	-	-	-	

Remarks No roots present in trial pit. No groundwater encountered in trial pit. No visual or olfactory evidence of contamination. Trial pit backfilled with arisings.						By		Scale 01:25
						Logged	AC	
						Checked	OB	



TRIAL PIT LOG

Project: Land at Johnson Drive, Finchampstead, RG40 3NW						Project No. 23-176.01		Trial Pit: TP10	
Client: Palatine Homes Limited						Start: 27/07/2023		End: 27/07/2023	
Method/Plant Used: 2.5T Excavator						Co-ordinates: NT		Ground Level: NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests									Laboratory Test Details
				Depth	No	Type							
Grey brown silty sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to rounded of flint. Rootlets to 0.1m. (REWORKED TOPSOIL)		(0.3)											
Firm light grey locally orange very sandy silty CLAY. Pockets of fine to coarse orange pale yellow sand. (BAGSHOT FORMATION)		(0.3)											
Light grey orange pale yellow slightly silty clayey fine to medium SAND. (BAGSHOT FORMATION)		(1.2)											
		1.8											

Dimensions (m)			Water level observations (depths in metres below gl)					
Length	Width	Depth	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
1.00	0.35	1.80	27/07/2023	-	-	-	-	
Remarks Rootlets noted to 0.1m bgl. No groundwater encountered in trial pit. No visual or olfactory evidence of contamination. Trial pit backfilled with arisings.						By		Scale 01:25
						Logged	AC	
						Checked	OB	



HAND AUGER LOG

Site: Land at Johnson Drive, Finchampstead, RG40 3NW				Project No: 23-176.01	Borehole: HA1
Client: Palatine Homes Limited			Start: 26/07/2023	End: 26/07/2023	Sheet: 1 of 1
Method/Plant Used: Hand Tools	Co-ordinates: NT			Ground Level: NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests									Notes
				Depth	No	Type							
Grey brown silty sandy gravelly CLAY. Gravel is fine to medium sub-angular to rounded of flint. Large brick fragments. Roots to 0.3m. (MADE GROUND)		(0.4)		0.2	1	ES							
		0.4											
Firm light grey locally orange very sandy silty rarely gravelly CLAY. Gravel is fine to coarse sub-rounded to rounded of flint. Pockets of fine to coarse orange pale yellow sand. (BAGSHOT FORMATION)		(0.6)											
		1.0											

Casing record			Chiselling records			Water level observations (depths in metres below gl)					
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
26/07/2023						26/07/2023	1.00	1.00	Standing	1.00	
Remarks									By		
Standing water at 1.0m bgl. No visual or olfactory evidence of contamination. Roots noted to 0.3m. Pit backfilled with arisings.									Logged	AC	
									Checked	OB	
SPT: Standard Penetration Test, HP: Hand Penetrometer, B: Bulk Sample, D: Disturbed Sample											



HAND AUGER LOG

Site: Land at Johnson Drive, Finchampstead, RG40 3NW				Project No. 23-176.01	Borehole: HA2
Client: Palatine Homes Limited			Start: 26/07/2023	End: 26/07/2023	Sheet: 1 of 1
Method/Plant Used: Hand Tools and core drill		Co-ordinates: NT		Ground Level: NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests									Notes
				Depth	No	Type							
Concrete. (MADE GROUND)		(0.2) 0.2											
Dark grey silty sandy gravelly CLAY. Gravel is fine to medium sub-rounded to rounded of flint. Tarmac rubble. Large brick fragments. (MADE GROUND)		(0.3) 0.5											
Orange silty sandy clayey GRAVEL. Gravel is fine to medium sub-angular to rounded of flint. (BAGSHOT FORMATION)		(0.2) 0.7											
Firm light grey locally orange very sandy silty rarely gravelly CLAY. Gravel is fine to coarse sub-rounded to rounded of flint. Pockets of fine to coarse orange pale yellow sand. (BAGSHOT FORMATION)		(0.3) 1.0											

Casing record			Chiselling records			Water level observations (depths in metres below gl)						
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
26/07/2023						26/07/2023	-	-	-	Dry		
Remarks									By			
No groundwater encountered. No visual or olfactory evidence of contamination. No roots present in pit. Pit backfilled with arisings.									Logged	AC		
									Checked	OB		Scale 01:25
									SPT: Standard Penetration Test, HP: Hand Penetrometer, B: Bulk Sample, D: Disturbed Sample			



HAND AUGER LOG

Site: Land at Johnson Drive, Finchampstead, RG40 3NW				Project No. 23-176.01	Borehole: HA4
Client: Palatine Homes Limited			Start: 26/07/2023	End: 26/07/2023	Sheet: 1 of 1
Method/Plant Used: Hand Tools and core drill		Co-ordinates: NT		Ground Level: NT	

Description of Strata	Legend	Depth (m bgl) (thickness)	Well Cnstr.	Samples/Tests									Notes
				Depth	No	Type							
Concrete. (MADE GROUND)		(0.1) 0.1		0.3	1	ES							
Dark grey brown silty sandy gravelly CLAY. Gravel is fine to medium sub-angular to rounded of flint. Fine brick fragments. Tarmac rubble. (MADE GROUND)		(0.45) 0.55											
Firm grey light brown silty sandy gravelly CLAY. Gravel is fine to medium sub-angular to rounded of flint. (RELIC TOPSOIL)		(0.25) 0.8											

Casing record			Chiselling records			Water level observations (depths in metres below gl)					
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
26/07/2023						26/07/2023	-	-	-	Dry	
Remarks									By		
No groundwater encountered. No visual or olfactory evidence of contamination. No roots present in pit. Pit backfilled with arisings.									Logged	AC	
									Checked	OB	
SPT: Standard Penetration Test. HP: Hand Penetrometer. B: Bulk Sample. D: Disturbed Sample											



WS1 arisings



WS2 arisings



WS3 arisings



WS4 arisings



WS5 arisings



WS6 arisings



HA1 arisings



HA2 arisings



HA3 arisings



HA4 arisings



TP1



TP2



TP3



TP1 arisings



TP2 arisings



TP3 arisings



TP4



TP5



TP6



TP4 arisings



TP5 arisings



TP6 arisings



TP7



TP8



TP9



TP7 arisings



TP8 arisings



TP9 arisings



TP10



TP10 arisings

Appendix

II Field Monitoring Results

MONITORING DATA SHEET

SITE Land at Johnson Drive, Finchampstead, RG40 3NW
PROJECT 23-176.01



VISIT NUMBER 1
DATE 04/08/2023

EQUIPMENT GFM436 + MiniRAE
TAKEN BY AC

Record of Stable Concentrations										Interpretation		
Location	Time	Flow (l/h)	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	Baro. Pres. (mB)	PID (ppm)	Water (m bgl)	Base Well (m bgl)	CH4 GSV (l/h)	CO2 GSV (l/h)	CS
Site	9:40am	n/a	0.0	0.0	20.6	1012	0.0	n/a	n/a	n/a	n/a	n/a
WS1	10:40am	0.0	0.0	2.0	18.4	1012	2.8	3.67	4.04	0	0	CS-1
WS2	11:16am	0.0	0.0	0.4	20.1	1012	0.9	4.01	4.13	0	0	CS-1
WS5	10:00am	0.0	0.0	2.8	17.8	1012	1.4	dry	2.10	0	0	CS-1

Weather Observations						Pressure Observations				Notes	
State of Ground	Cloud Cover	Wind	Rain	Air Temperature °C		Source	Pressure Records		Trend		
						Metoffice	Location	Odiham	Falling		
Dry	Clear	Calm	None	Before	16	GFM436	Time	07:00	Steady	Worst case conditions? (<1000mB and Falling)	
Moist	Sunny	Light	Slight				Pressure	1017	Rising		
Wet	Slight	Moderate	Moderate	After	16						
Snow	Cloudy	Strong	Heavy								
Frozen	Overcast										
	Fog/Mist										

MONITORING DATA SHEET

SITE Land at Johnson Drive, Finchampstead, RG40 3NW
PROJECT 23-176.01



VISIT NUMBER 2
DATE 11/08/2023

EQUIPMENT GFM436 + MiniRAE
TAKEN BY AC

Record of Stable Concentrations										Interpretation		
Location	Time	Flow (l/h)	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	Baro. Pres. (mB)	PID (ppm)	Water (m bgl)	Base Well (m bgl)	CH4 GSV (l/h)	CO2 GSV (l/h)	CS
Site	2:10pm	n/a	0.0	0.0	20.6	1013	0.0	n/a	n/a	n/a	n/a	n/a
WS1	2:32pm	0.0	0.0	1.3	19.0	1013	0.7	3.43	4.04	0	0	CS-1
WS2	2:45pm	0.0	0.0	0.9	19.5	1013	0.3	3.84	4.13	0	0	CS-1
WS5	2:20pm	0.0	0.0	1.3	18.4	1013	1.3	Dry	2.10	0	0	CS-1

Weather Observations						Pressure Observations				Notes	
State of Ground	Cloud Cover	Wind	Rain	Air Temperature °C		Source	Pressure Records		Trend		
						Metoffice	Location	Henley	Falling		
Dry	Clear	Calm	None	Before	24	GFM436	Time	07:00	Steady	Worst case conditions? (<1000mB and Falling)No	
Moist	Sunny	Light	Slight			After	24		Pressure		
Wet	Slight	Moderate	Moderate								
Snow	Cloudy	Strong	Heavy								
Frozen	Overcast										
	Fog/Mist										

Appendix

III Soil Contamination Results and Assessment Criteria



2183

Amended Report

Report No.:	23-25721-2		
Initial Date of Issue:	11-Aug-2023	Date of Re-Issue:	18-Aug-2023
Re-Issue Details:	This report has been revised and directly supersedes 23-25721-1 in its entirety		
Client	Aviron Associates Ltd		
Client Address:	Badgemore House Badgemore Park Gravel Hill Reading Henley on Thames RG9 4NR		
Contact(s):	David Norman James Burkitt Orlando Blackwell		
Project	23-176.01 Land at Johnson Drive		
Quotation No.:		Date Received:	31-Jul-2023
Order No.:	23-176.01	Date Instructed:	31-Jul-2023
No. of Samples:	19		
Turnaround (Wkdays):	15	Results Due:	18-Aug-2023
Date Approved:	18-Aug-2023		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: 23-176.01 Land at Johnson Drive

Client: Aviron Associates Ltd	Chemtest Job No.:				23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721
Quotation No.:	Chemtest Sample ID.:				1681560	1681561	1681562	1681563	1681564	1681565	1681566	1681567	1681568
Order No.: 23-176.01	Client Sample Ref.:				1	2	3	4	5	6	7	8	9
	Sample Location:				HA1	HA4	TP1	TP5	TP6	TP9	WS1	WS2	WS2
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.3	0.2	0.1	0.4	0.5	0.1	0.2	0.55
	Date Sampled:				27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023
	Asbestos Lab:				DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	8.0	9.1	11	11	11	10	13	10	11
pH	U	2010		4.0	8.2	7.9	6.9	7.5	7.7	7.5	6.9	6.9	6.7
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	0.50	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.025	< 0.010	< 0.010	< 0.010
Total Sulphur	U	2175	%	0.010	0.17	0.081	0.019	0.087	0.017	0.025	0.017	0.024	0.012
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.50	< 0.50
Sulphate (Total)	U	2430	%	0.010	0.094	0.041	0.036	0.058	0.023	0.034	0.032	0.054	0.019
Arsenic	U	2455	mg/kg	0.5	12	6.7	6.6	8.9	5.8	5.0	3.3	4.9	7.7
Barium	U	2455	mg/kg	0	100	67	26	110	57	37	16	67	22
Cadmium	U	2455	mg/kg	0.10	0.20	< 0.10	< 0.10	< 0.10	0.27	< 0.10	< 0.10	0.14	< 0.10
Chromium	U	2455	mg/kg	0.5	14	10	8.9	15	7.1	7.5	6.6	8.5	23
Copper	U	2455	mg/kg	0.50	13	7.4	8.0	11	5.1	14	5.0	12	6.4
Mercury	U	2455	mg/kg	0.05	0.06	0.07	0.08	0.06	0.05	0.05	< 0.05	0.08	< 0.05
Nickel	U	2455	mg/kg	0.50	11	4.7	3.2	4.7	2.7	3.1	3.0	3.6	3.2
Lead	U	2455	mg/kg	0.50	38	38	41	71	39	65	79	190	19
Selenium	U	2455	mg/kg	0.25	1.4	0.29	0.26	0.86	0.25	< 0.25	< 0.25	0.28	0.40
Zinc	U	2455	mg/kg	0.50	66	69	47	52	26	81	28	120	21
Aliphatic VPH >C5-C6	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic VPH >C8-C10	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12	U	2690	mg/kg	2.00	5.2	3.2	3.6	4.7	3.3	3.2	3.3	3.6	4.2
Aliphatic EPH >C12-C16	U	2690	mg/kg	1.00	3.7	2.0	1.2	2.3	2.0	1.4	1.3	1.6	3.0
Aliphatic EPH >C16-C21	U	2690	mg/kg	2.00	2.4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	2.4	< 2.0
Aliphatic EPH >C21-C35	U	2690	mg/kg	3.00	3.1	5.0	4.4	5.1	4.5	3.9	3.9	5.3	< 3.0
Aliphatic EPH >C35-C40	N	2690	mg/kg	10.00	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Total Aliphatic EPH >C10-C35	U	2690	mg/kg	5.00	14	11	10	14	10	8.9	9.6	13	9.7
Total Aliphatic EPH >C10-C40	N	2690	mg/kg	10.00	14	11	10	14	10	< 10	< 10	13	< 10
Aromatic VPH >C5-C7	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: 23-176.01 Land at Johnson Drive

Client: Aviron Associates Ltd	Chemtest Job No.:				23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721
Quotation No.:	Chemtest Sample ID.:				1681560	1681561	1681562	1681563	1681564	1681565	1681566	1681567	1681568
Order No.: 23-176.01	Client Sample Ref.:				1	2	3	4	5	6	7	8	9
	Sample Location:				HA1	HA4	TP1	TP5	TP6	TP9	WS1	WS2	WS2
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.3	0.2	0.1	0.4	0.5	0.1	0.2	0.55
	Date Sampled:				27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023
	Asbestos Lab:				DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD									
Aromatic EPH >C12-C16	U	2690	mg/kg	1.00	2.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21	U	2690	mg/kg	2.00	110	9.1	3.7	6.6	3.1	3.9	4.3	5.6	2.9
Aromatic EPH >C21-C35	U	2690	mg/kg	2.00	370	92	34	96	23	20	33	41	10
Aromatic EPH >C35-C40	N	2690	mg/kg	1.00	160	41	3.8	82	3.6	2.0	2.6	3.3	2.0
Total Aromatic EPH >C10-C35	U	2690	mg/kg	5.00	480	100	38	100	26	24	37	47	13
Total Aromatic EPH >C10-C40	N	2690	mg/kg	10.00	650	140	42	180	30	26	40	50	15
Total VPH >C5-C10	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35	U	2690	mg/kg	10.00	500	110	48	120	36	33	47	60	23
Total EPH >C10-C40	N	2690	mg/kg	10.00	660	150	52	200	40	35	50	63	25
Organic Matter	U	2625	%	0.40	14	3.7	2.3	5.2	3.6	2.0	1.7	2.8	0.49
Naphthalene	U	2700	mg/kg	0.10	0.60	0.63	< 0.10	0.90	< 0.10	0.98	< 0.10	1.4	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	0.97	0.37	< 0.10	0.41	< 0.10	0.26	< 0.10	0.30	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	0.49	0.17	< 0.10	0.29	< 0.10	0.14	< 0.10	0.11	< 0.10
Fluorene	U	2700	mg/kg	0.10	0.28	< 0.10	< 0.10	0.13	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	5.3	0.63	< 0.10	1.1	< 0.10	0.13	< 0.10	0.18	< 0.10
Anthracene	U	2700	mg/kg	0.10	1.9	0.33	< 0.10	0.53	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	15	2.4	< 0.10	3.5	< 0.10	0.28	< 0.10	0.45	< 0.10
Pyrene	U	2700	mg/kg	0.10	13	2.6	< 0.10	3.2	< 0.10	0.40	< 0.10	0.53	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	8.3	1.6	< 0.10	2.6	< 0.10	1.3	< 0.10	0.50	< 0.10
Chrysene	U	2700	mg/kg	0.10	8.7	1.6	< 0.10	2.5	< 0.10	0.46	< 0.10	0.46	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	11	3.2	< 0.10	3.6	< 0.10	0.44	< 0.10	0.31	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	3.9	1.2	< 0.10	1.5	< 0.10	0.16	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	7.5	3.0	< 0.10	3.3	< 0.10	0.75	< 0.10	0.79	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	6.7	2.1	< 0.10	2.0	< 0.10	0.12	< 0.10	0.21	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	1.8	0.59	< 0.10	0.68	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	6.3	2.2	< 0.10	2.4	< 0.10	0.27	< 0.10	0.34	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	92	23	< 2.0	29	< 2.0	5.7	< 2.0	5.6	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Phenols	U	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: 23-176.01 Land at Johnson Drive

Client: Aviron Associates Ltd	Chemtest Job No.:				23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721
Quotation No.:	Chemtest Sample ID.:				1681569	1681570	1681571	1681572	1681573	1681574	1681575	1681576
Order No.: 23-176.01	Client Sample Ref.:				10	11	12	1	2	3	4	5
	Sample Location:				WS2	WS3	WS3	WS4	WS4	WS5	WS5	WS6
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				2.0	0.7	3.0	0.3	2.0	0.2	0.9	0.2
	Date Sampled:				27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023
	Asbestos Lab:					DURHAM		DURHAM		DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD								
ACM Type	U	2192		N/A		-		-		-	-	-
Asbestos Identification	U	2192		N/A		No Asbestos Detected		No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	10	15	16	11	13	7.1	13	11
pH	U	2010		4.0	5.7	6.2	5.1	5.7	6.2	6.4	5.6	6.7
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		< 0.40		< 0.40		< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Sulphur	U	2175	%	0.010	0.014	< 0.010	0.016	0.029	< 0.010	0.014	0.025	0.025
Cyanide (Total)	U	2300	mg/kg	0.50		< 0.50		< 0.50		< 0.50	< 0.50	< 0.50
Sulphate (Total)	U	2430	%	0.010	0.044	0.020	0.058	0.056	0.046	0.045	0.012	0.058
Arsenic	U	2455	mg/kg	0.5		9.1		4.2		3.7	9.5	7.1
Barium	U	2455	mg/kg	0		32		21		26	9	39
Cadmium	U	2455	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	0.22
Chromium	U	2455	mg/kg	0.5		38		6.4		6.2	13	8.1
Copper	U	2455	mg/kg	0.50		15		4.7		4.0	6.4	8.7
Mercury	U	2455	mg/kg	0.05		0.05		0.05		0.05	< 0.05	0.16
Nickel	U	2455	mg/kg	0.50		13		2.5		2.5	1.8	4.2
Lead	U	2455	mg/kg	0.50		11		25		24	8.6	79
Selenium	U	2455	mg/kg	0.25		0.60		< 0.25		< 0.25	0.35	0.25
Zinc	U	2455	mg/kg	0.50		24		19		21	10	110
Aliphatic VPH >C5-C6	U	2780	mg/kg	0.05		< 0.05		< 0.05		< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	U	2780	mg/kg	0.05		< 0.05		< 0.05		< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	U	2780	mg/kg	0.05		< 0.05		< 0.05		< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	N	2780	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	< 0.10
Aliphatic VPH >C8-C10	U	2780	mg/kg	0.05		< 0.05		< 0.05		< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	U	2780	mg/kg	0.25		< 0.25		< 0.25		< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12	U	2690	mg/kg	2.00		3.1		< 2.0		3.1	3.4	2.2
Aliphatic EPH >C12-C16	U	2690	mg/kg	1.00		1.8		< 1.0		1.1	1.3	1.5
Aliphatic EPH >C16-C21	U	2690	mg/kg	2.00		< 2.0		< 2.0		< 2.0	< 2.0	< 2.0
Aliphatic EPH >C21-C35	U	2690	mg/kg	3.00		< 3.0		8.9		5.2	< 3.0	7.6
Aliphatic EPH >C35-C40	N	2690	mg/kg	10.00		< 10		< 10		< 10	< 10	< 10
Total Aliphatic EPH >C10-C35	U	2690	mg/kg	5.00		5.8		12		9.4	< 5.0	13
Total Aliphatic EPH >C10-C40	N	2690	mg/kg	10.00		< 10		12		< 10	< 10	13
Aromatic VPH >C5-C7	U	2780	mg/kg	0.05		< 0.05		< 0.05		< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	U	2780	mg/kg	0.05		< 0.05		< 0.05		< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	U	2780	mg/kg	0.05		< 0.05		< 0.05		< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	U	2780	mg/kg	0.25		< 0.25		< 0.25		< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12	U	2690	mg/kg	1.00		< 1.0		< 1.0		< 1.0	< 1.0	< 1.0

Results - Soil

Project: 23-176.01 Land at Johnson Drive

Client: Aviron Associates Ltd	Chemtest Job No.:				23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721	23-25721
Quotation No.:	Chemtest Sample ID.:				1681569	1681570	1681571	1681572	1681573	1681574	1681575	1681576
Order No.: 23-176.01	Client Sample Ref.:				10	11	12	1	2	3	4	5
	Sample Location:				WS2	WS3	WS3	WS4	WS4	WS5	WS5	WS6
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				2.0	0.7	3.0	0.3	2.0	0.2	0.9	0.2
	Date Sampled:				27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023	27-Jul-2023
	Asbestos Lab:					DURHAM		DURHAM		DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD								
Aromatic EPH >C12-C16	U	2690	mg/kg	1.00		< 1.0		< 1.0		< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21	U	2690	mg/kg	2.00		3.4		4.5		< 2.0	2.5	7.6
Aromatic EPH >C21-C35	U	2690	mg/kg	2.00		4.7		47		21	3.1	58
Aromatic EPH >C35-C40	N	2690	mg/kg	1.00		< 1.0		3.3		3.2	2.4	4.8
Total Aromatic EPH >C10-C35	U	2690	mg/kg	5.00		8.1		51		22	5.6	65
Total Aromatic EPH >C10-C40	N	2690	mg/kg	10.00		< 10		55		25	< 10	70
Total VPH >C5-C10	U	2780	mg/kg	0.50		< 0.50		< 0.50		< 0.50	< 0.50	< 0.50
Total EPH >C10-C35	U	2690	mg/kg	10.00		14		63		32	10	78
Total EPH >C10-C40	N	2690	mg/kg	10.00		14		67		35	13	83
Organic Matter	U	2625	%	0.40		0.45		4.0		1.7	< 0.40	2.3
Naphthalene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	0.24
Anthracene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	0.11
Fluoranthene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	0.69
Pyrene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	0.96
Benzo[a]anthracene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	1.8
Chrysene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	0.71
Benzo[b]fluoranthene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	0.87
Benzo[k]fluoranthene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	0.38
Benzo[a]pyrene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	0.56
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0		< 2.0		< 2.0		< 2.0	< 2.0	6.3
Benzene	U	2760	µg/kg	1.0		< 1.0		< 1.0		< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0		< 1.0		< 1.0		< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0		< 1.0		< 1.0		< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0		< 1.0		< 1.0		< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0		< 1.0		< 1.0		< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0		< 1.0		< 1.0		< 1.0	< 1.0	< 1.0
Total Phenols	U	2920	mg/kg	0.10		< 0.10		< 0.10		< 0.10	< 0.10	< 0.10

Results - 2 Stage WAC

Project: 23-176.01 Land at Johnson Drive

Chemtest Job No: 23-25721							Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 1687608							Limits			
Sample Ref:							Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Sample ID: Composite Sample										
Sample Location: HA1,HA2,TP1,TP5										
Top Depth(m): 0.10										
Bottom Depth(m): 0.30										
Sampling Date: 27-Jul-2023										
Determinand	SOP	Accred.	Units							
Total Organic Carbon	2625	U	%				0.88	3	5	6
Loss On Ignition	2610	U	%				5.1	--	--	10
Total BTEX	2760	U	mg/kg				[C] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg				< 0.10	1	--	--
TPH Total WAC	2670	U	mg/kg				[C] 340	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg				43	100	--	--
pH	2010	U					8.4	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.013	--	To evaluate	To evaluate			
Eluate Analysis			2:1 mg/l	8:1 mg/l	2:1 mg/kg	Cumulative mg/kg 10:1	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg			
Arsenic	1455	U	0.0010	0.0010	0.0019	0.0095	0.5	2	25	
Barium	1455	U	0.077	0.071	0.15	0.72	20	100	300	
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5	
Chromium	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.5	10	70	
Copper	1455	U	0.0045	0.0032	0.0090	0.0077	2	50	100	
Mercury	1455	U	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.01	0.2	2	
Molybdenum	1455	U	0.0007	0.0005	0.0013	0.0048	0.5	10	30	
Nickel	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.4	10	40	
Lead	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.5	10	50	
Antimony	1455	U	0.0005	< 0.0005	0.0011	0.0009	0.06	0.7	5	
Selenium	1455	U	0.0008	0.0008	0.0017	0.0081	0.1	0.5	7	
Zinc	1455	U	0.013	0.007	0.025	0.075	4	50	200	
Chloride	1220	U	27	27	54	270	800	15000	25000	
Fluoride	1220	U	0.24	0.22	< 1.0	2.2	10	150	500	
Sulphate	1220	U	19	19	38	190	1000	20000	50000	
Total Dissolved Solids	1020	N	370	370	740	3700	4000	60000	100000	
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-	
Dissolved Organic Carbon	1610	U	3.3	3.8	< 50	< 50	500	800	1000	

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	9.1

Leachate Test Information	
Leachant volume 1st extract/l	0.333
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.298

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1687608		Composite Sample	HA1,HA2,TP1,T P5	27-Jul-2023	C	Plastic Bag

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8–C10 Aromatics: >C5–C7,>C7–C8,>C8–C10	Water extraction / Headspace GCxGC FID detection
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



**Residential with Homegrown Produce
Soil Screening Values
Private Gardens**

Determinant	1% SOM (mg/kg)	2.5% SOM (mg/kg)	6% SOM (mg/kg)	Criteria	Determinant	1% SOM (mg/kg)	2.5% SOM (mg/kg)	6% SOM (mg/kg)	Criteria
METALS, SEMI-METALS, INORGANICS + PAH (SUITE 1)					Pyrene	620	1200	2000	LQM S4UL
Arsenic	37	37	37	C4SL/LQM S4UL	Phenols	78	0.98	1.1	LQM S4UL
Boron	290	290	290	LQM S4UL	TOTAL PETROLEUM HYDROCARBONS				
Cadmium	11	11	11	LQM S4UL	Benzene	0.087	0.17	0.37	LQM S4UL
Chromium III	910	910	910	LQM S4UL	Toluene	130	290	660	LQM S4UL
Chromium IV	6	6	6	LQM S4UL	Ethylbenzene	47	110	260	LQM S4UL
Copper	2,400	2,400	2,400	LQM S4UL	o-xylene	60	140	330	LQM S4UL
Mercury	1.2	1.2	1.2	LQM S4UL	m-xylene	59	140	320	LQM S4UL
Nickel	180	180	180	LQM S4UL	p-xylene	56	130	310	LQM S4UL
Lead	200	200	200	LQM S4UL	Aliphatic EC 5-6	42	78	160	LQM S4UL
Selenium	250	250	250	LQM S4UL	Aliphatic EC >6-8	100	230	530	LQM S4UL
Zinc	3,700	3,700	3,700	LQM S4UL	Aliphatic EC >8-10	27	65	150	LQM S4UL
Free Cyanide	34	34	34	ATRISK	Aliphatic EC >10-12	130	330	760	LQM S4UL
Acenaphthene	210	510	1100	LQM S4UL	Aliphatic EC >12-16	1,100	2400	4300	LQM S4UL
Acenaphthylene	170	420	920	LQM S4UL	Aliphatic EC >16-35	65,000	92000	110000	LQM S4UL
Anthracene	2,400	5400	11000	LQM S4UL	Aliphatic EC >35-44	65,000	92000	110000	LQM S4UL
Benzo(a)anthracene	7.2	11	13	LQM S4UL	Aromatic EC 5-7 (benzene)	70	140	300	LQM S4UL
Benzo(a)pyrene	2.2	2.7	3	LQM S4UL	Aromatic EC >7-8 (toluene)	130	290	660	LQM S4UL
Benzo(b)fluoranthene	2.6	3.3	3.7	LQM S4UL	Aromatic EC >8-10	34	83	190	LQM S4UL
Benzo(ghi)perylene	320	340	350	LQM S4UL	Aromatic EC >10-12	74	180	380	LQM S4UL
Benzo(k)fluoranthene	77	93	100	LQM S4UL	Aromatic EC >12-16	140	330	660	LQM S4UL
Chrysene	15	22	27	LQM S4UL	Aromatic EC >16-21	260	540	930	LQM S4UL
Dibenz(ah)anthracene	0.24	0.28	0.3	LQM S4UL	Aromatic EC >21-35	1,100	1500	1700	LQM S4UL
Fluoranthene	280	560	890	LQM S4UL	Aromatic EC >35-44	1,100	1500	1700	LQM S4UL
Fluorene	170	400	860	LQM S4UL	Aromatic EC >44-70	1,600	1800	1900	LQM S4UL
Indeno(123-cd)pyrene	27	36	41	LQM S4UL	ASBESTOS				
Naphthalene	2.3	5.6	13	LQM S4UL	None Detectable				Aviron Adopted Value
Phenanthrene	95	220	440	LQM S4UL					

Appendix

IV Soil Geotechnical Results



2788

Laboratory Report



A PHENNA GROUP COMPANY

Contract Number: 67923

Client Ref: **23-176.01**Client PO: **23-176.01**Date Received: **31-07-2023**Date Completed: **07-08-2023**Report Date: **07-08-2023**

Client: **Aviron Associates LTD**
58 Herschel St, Slough
SL1 1PG

This report has been checked and approved by:



Brendan Evans
 Office Administrator

Contract Title: **Land at Johnson Drive, Finchampstead, RG40 3NW**For the attention of: **Orlando**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	12
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	12
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	4
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This test report/certificate shall not be reproduced except in full, without the approval of GEO Site & Testing Services Ltd. Any opinions or interpretations stated - within this report/certificate are excluded from the laboratories UKAS accreditation.

Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)
 Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)
 Wayne Honey (Human Resources/ Health and Safety Manager)

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number 67923

Borehole/Pit No. WS4

Project Name Land at Johnson Drive, Finchampstead, RG40 3NW

Sample No.

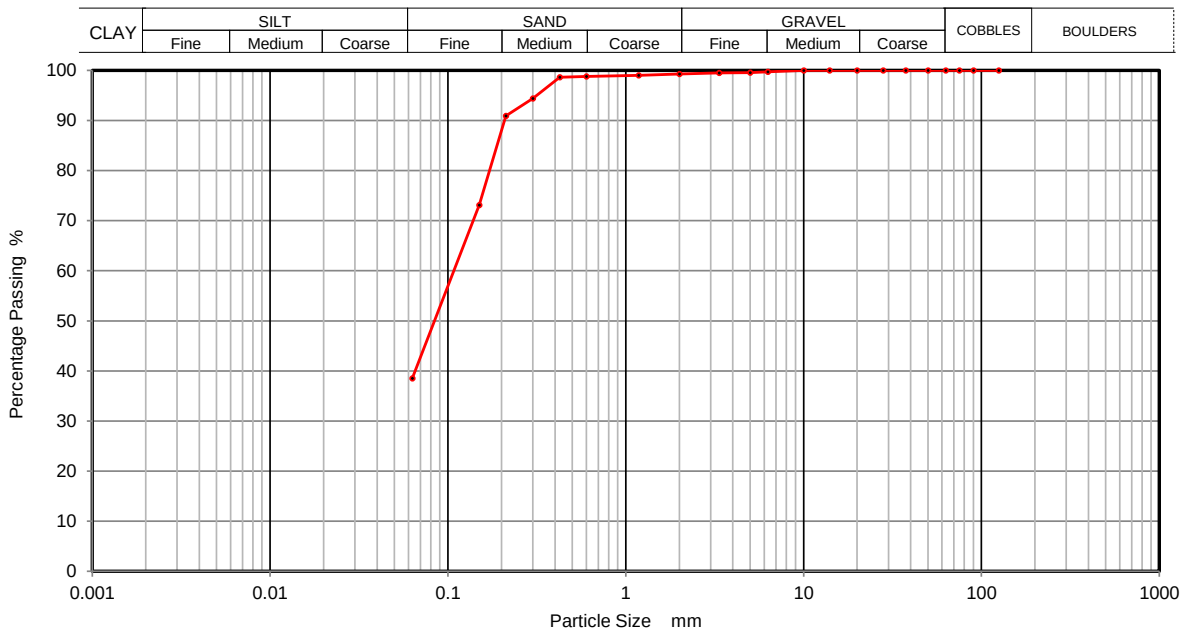
Soil Description Brown slightly gravelly fine to coarse sandy SILT/CLAY

Depth Top 3.00

Depth Base

Date Tested 03/08/2023

Sample Type D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	99		
0.6	99		
0.425	99		
0.3	94		
0.212	91		
0.15	73		
0.063	39		

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	60
Silt and Clay	39

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator

David Edwards



**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 67923

Borehole/Pit No. WS5

Project Name Land at Johnson Drive, Finchampstead, RG40 3NW

Sample No.

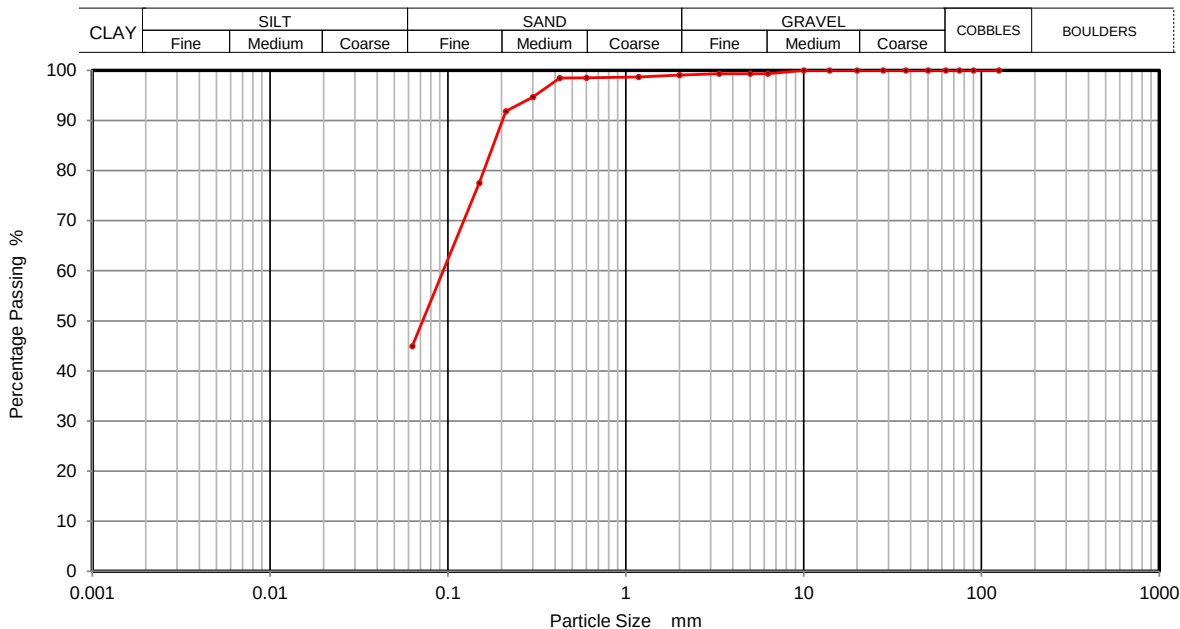
Soil Description Brown slightly gravelly fine to coarse sandy SILT/CLAY

Depth Top 2.50

Depth Base

Date Tested 03/08/2023

Sample Type D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	99		
2	99		
1.18	99		
0.6	99		
0.425	98		
0.3	95		
0.212	92		
0.15	77		
0.063	45		

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	54
Silt and Clay	45

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards



**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 67923

Borehole/Pit No. WS6

Project Name Land at Johnson Drive, Finchampstead, RG40 3NW

Sample No.

Soil Description

Brown grey fine to coarse sandy SILT/CLAY

Depth Top

1.50

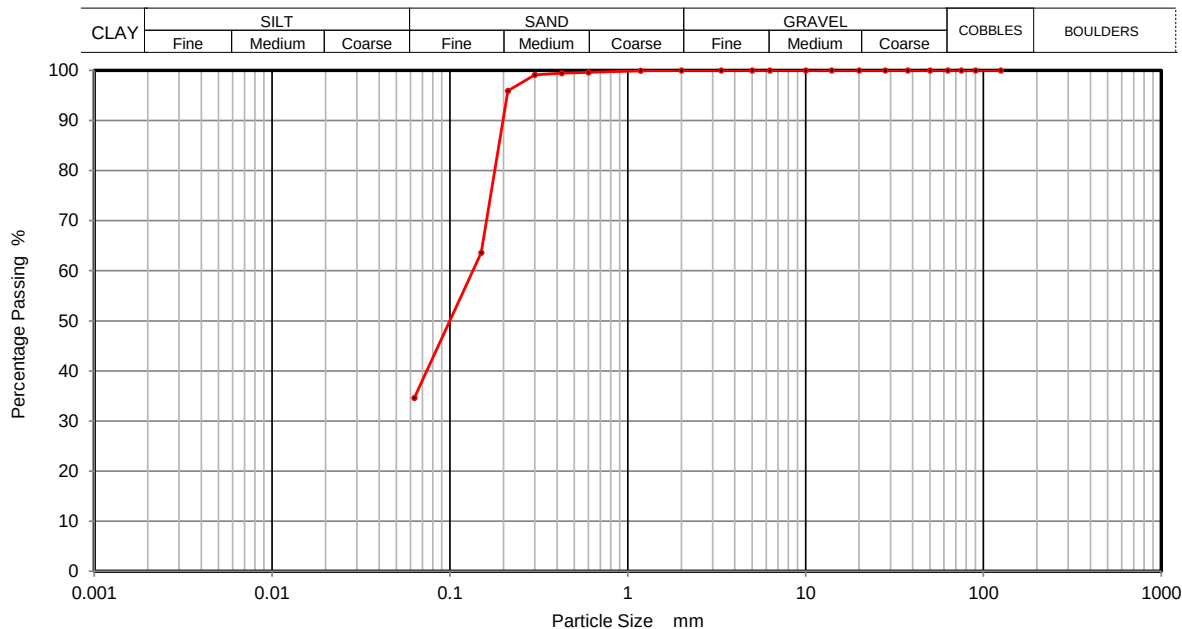
Depth Base

Date Tested

03/08/2023

Sample Type

D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	99		
0.212	96		
0.15	64		
0.063	35		

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	65
Silt and Clay	35

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards



**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 67923

Borehole/Pit No. WS6

Project Name Land at Johnson Drive, Finchampstead, RG40 3NW

Sample No.

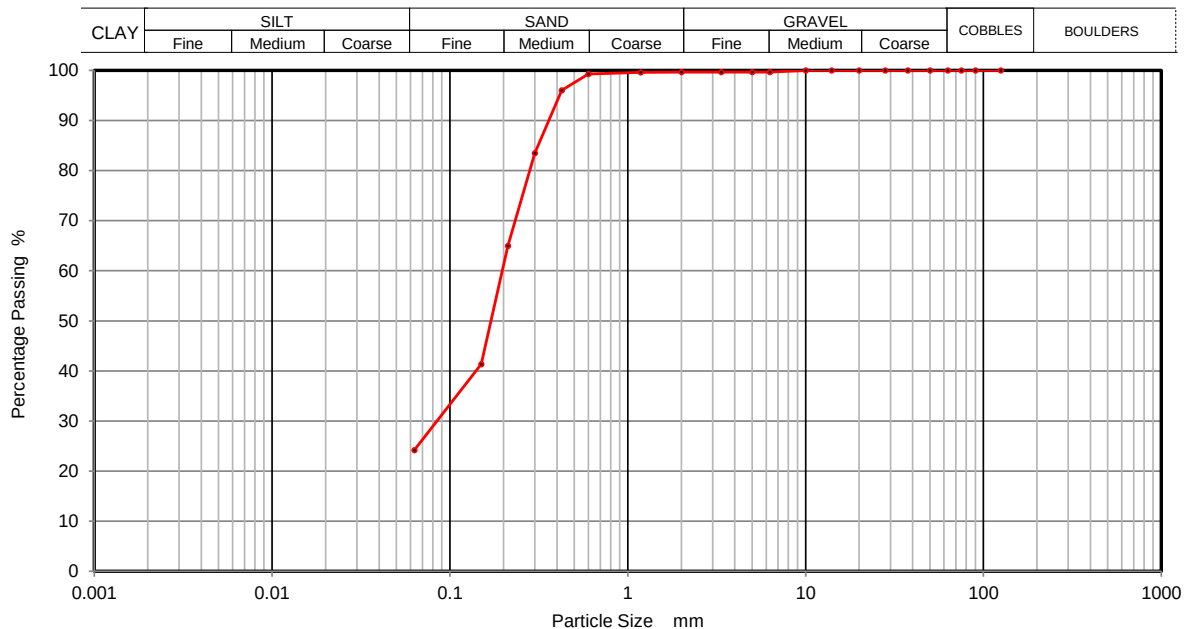
Soil Description Brown silty/clayey fine to coarse SAND

Depth Top 2.00

Depth Base

Date Tested 03/08/2023

Sample Type D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	96		
0.3	84		
0.212	65		
0.15	41		
0.063	24		

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	76
Silt and Clay	24

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator

David Edwards



2788



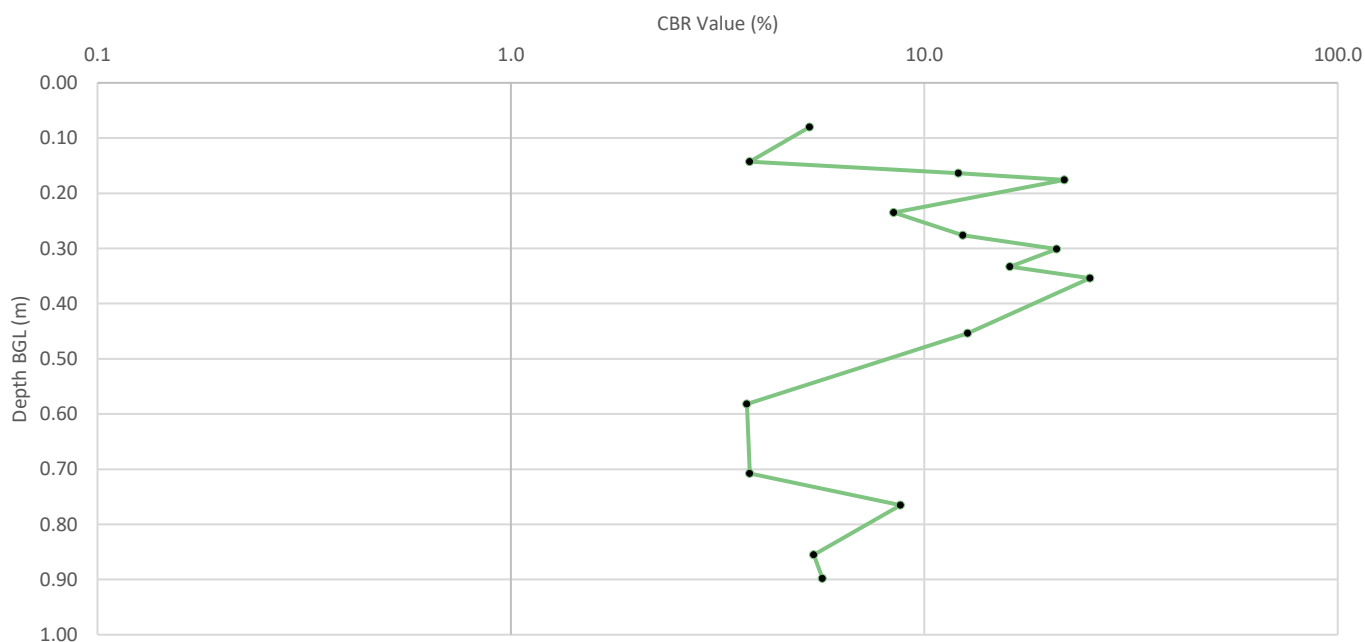
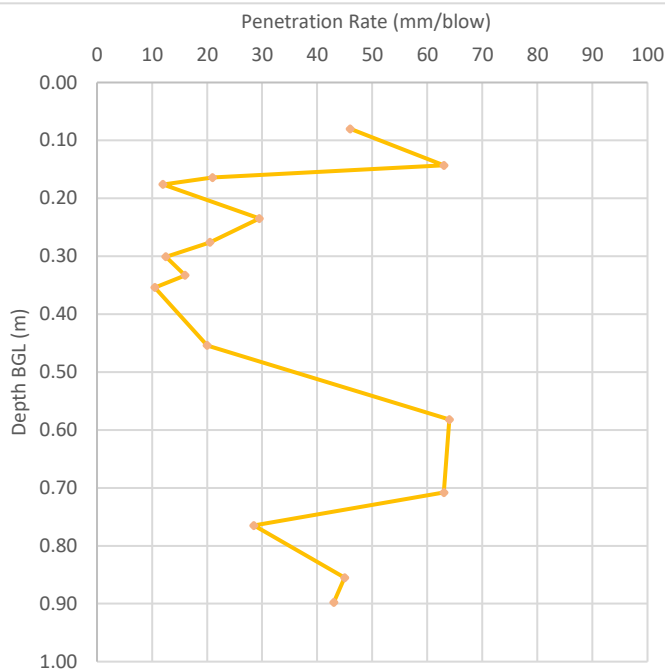
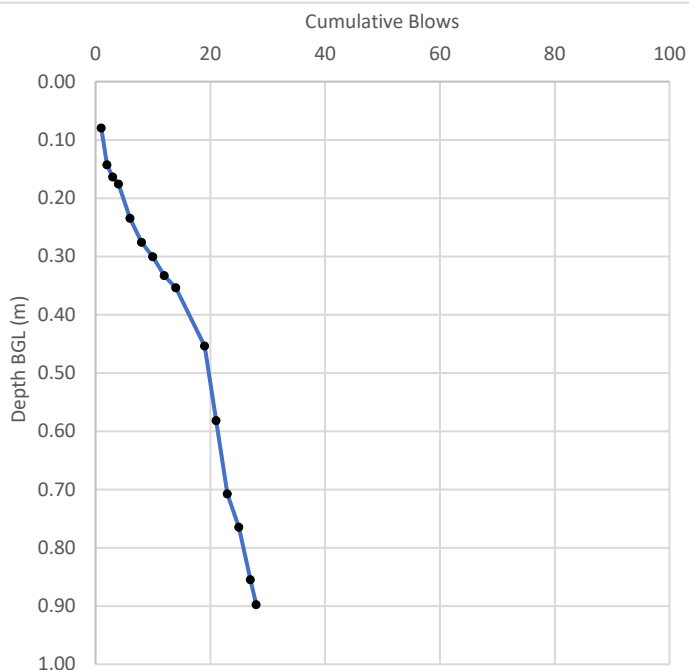
Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP1
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:		Zero Error (mm):	Approx AOD (m):		
Rough ground		35			

[illegible]



Dynamic Cone Penetrometer

Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP1
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:	Rough ground	Zero Error (mm):	35	Approx AOD (m):	





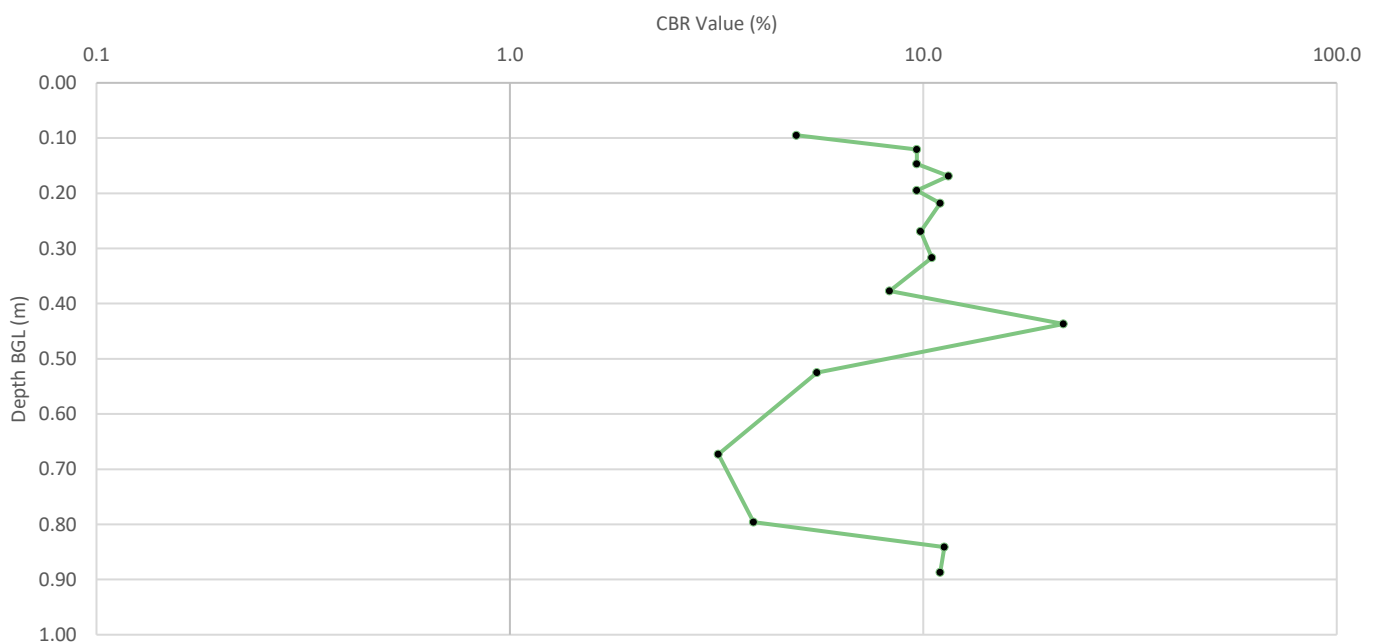
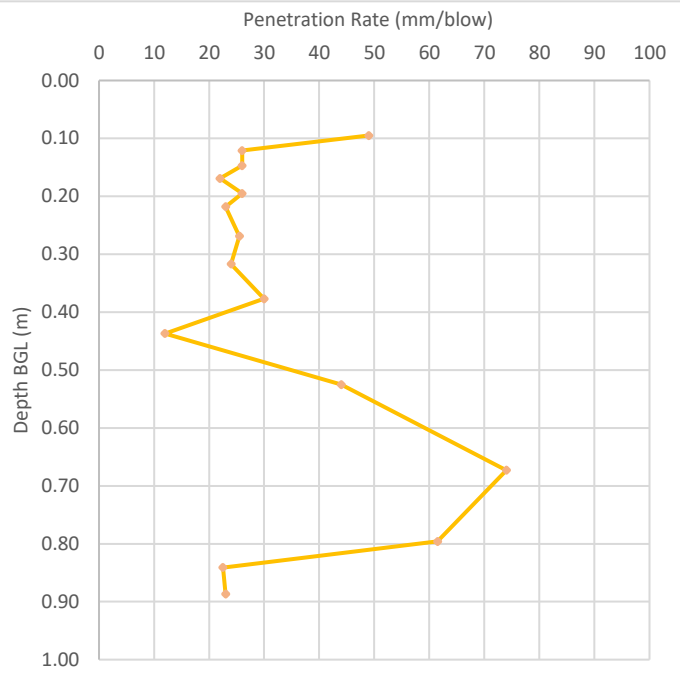
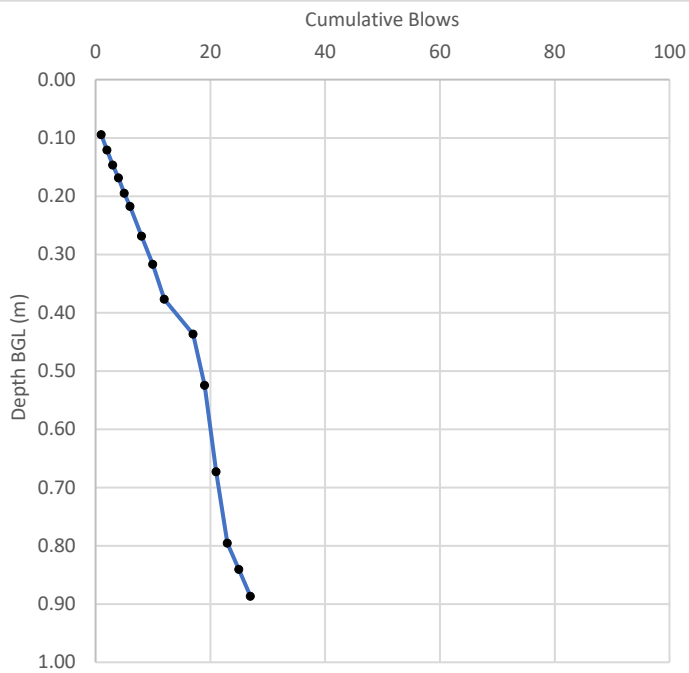
Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP2
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:		Zero Error (mm):	Approx AOD (m):		
Rough ground		35			

[illegible]



Dynamic Cone Penetrometer

Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP2
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:	Rough ground	Zero Error (mm):	35	Approx AOD (m):	





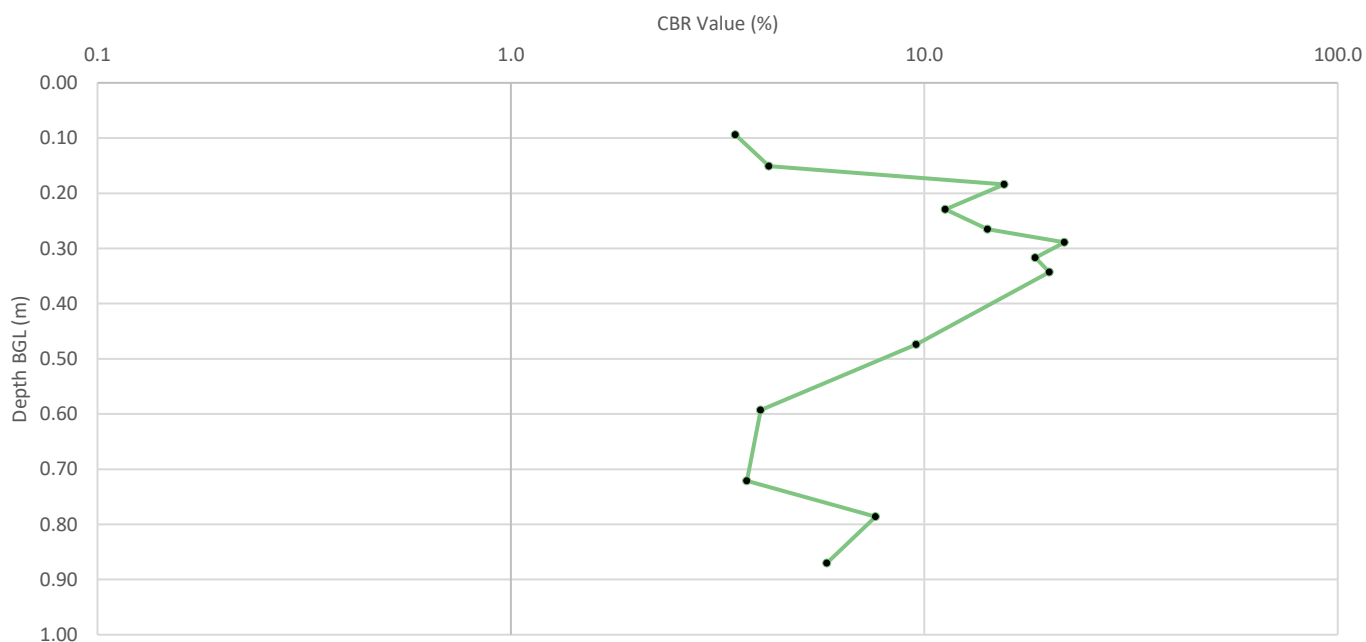
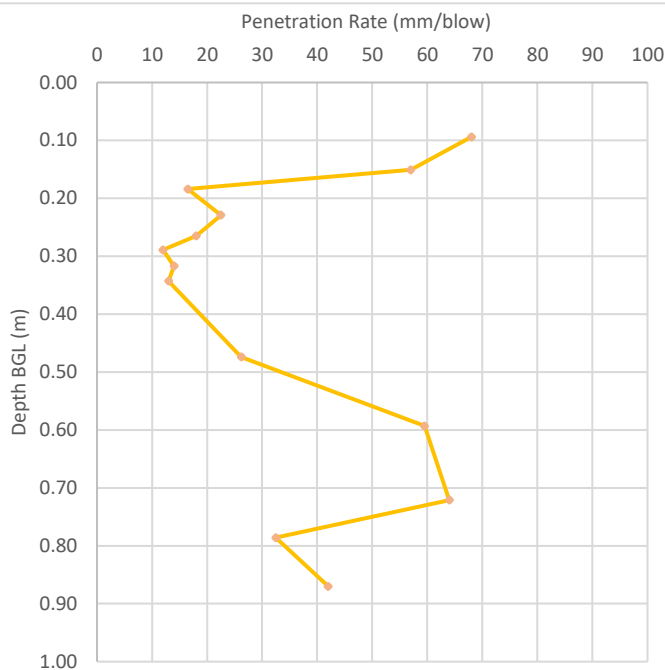
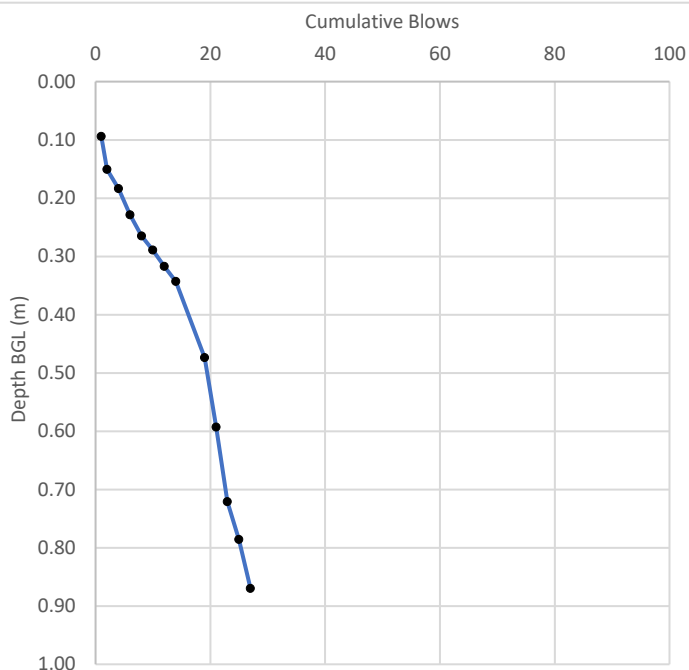
Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP3
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:		Zero Error (mm):	Approx AOD (m):		
Rough ground		35			

[illegible]



Dynamic Cone Penetrometer

Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP3
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:	Rough ground	Zero Error (mm):	35	Approx AOD (m):	





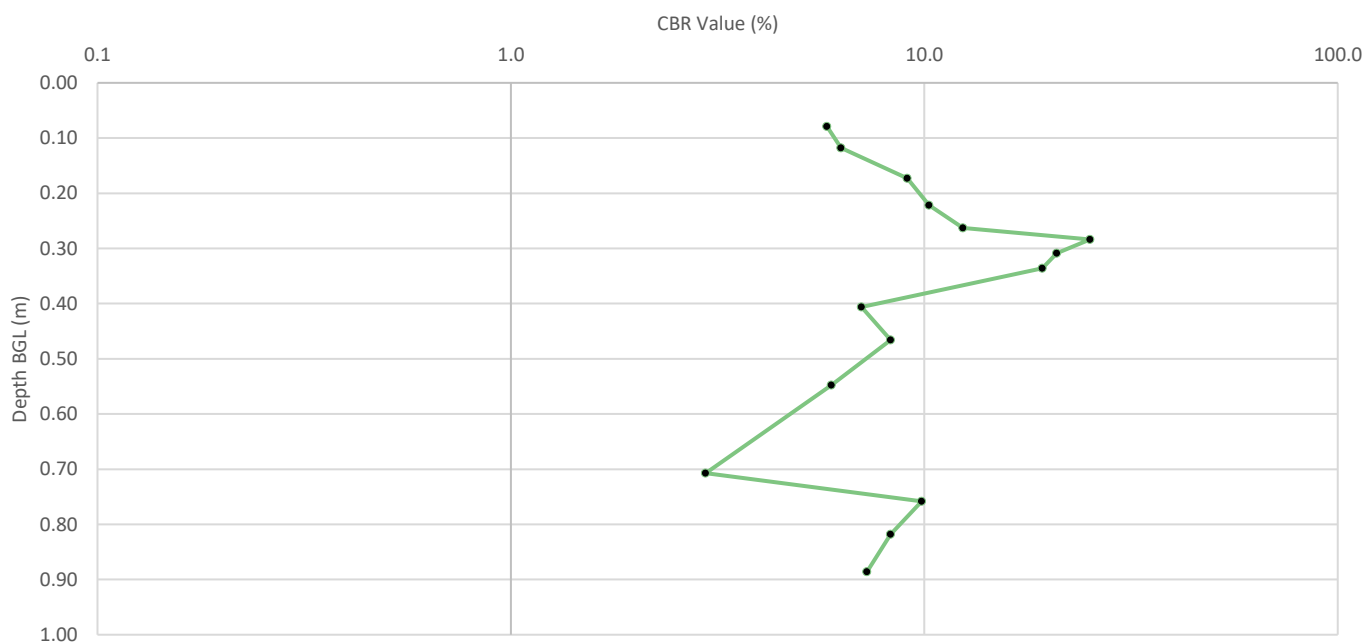
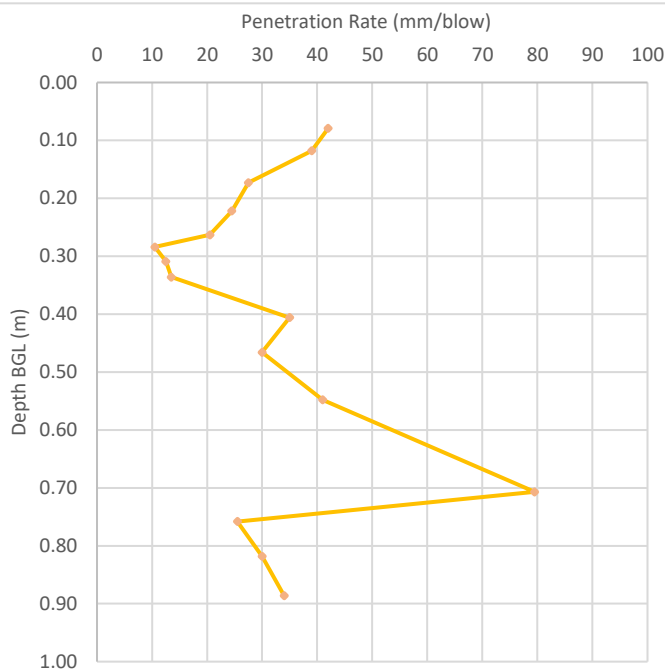
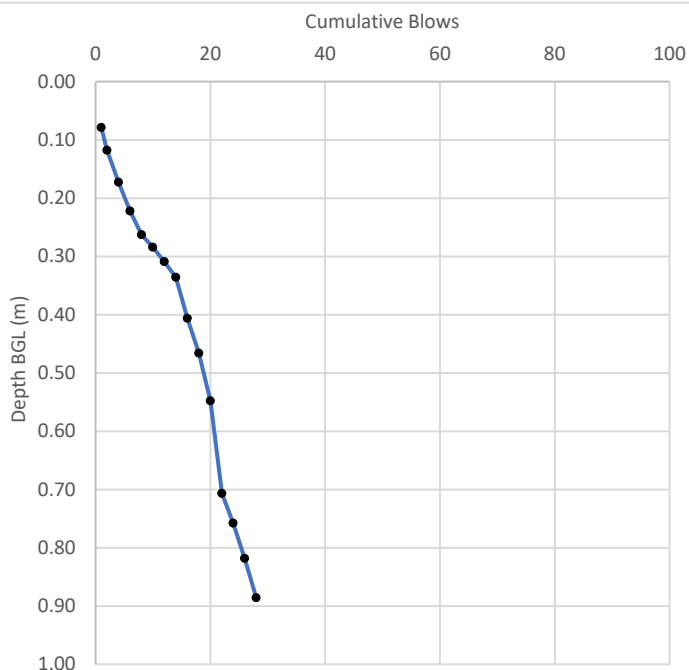
Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP4
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:		Zero Error (mm):	Approx AOD (m):		
Rough ground		35			

[illegible]



Dynamic Cone Penetrometer

Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP4
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:	Rough ground	Zero Error (mm):	35	Approx AOD (m):	





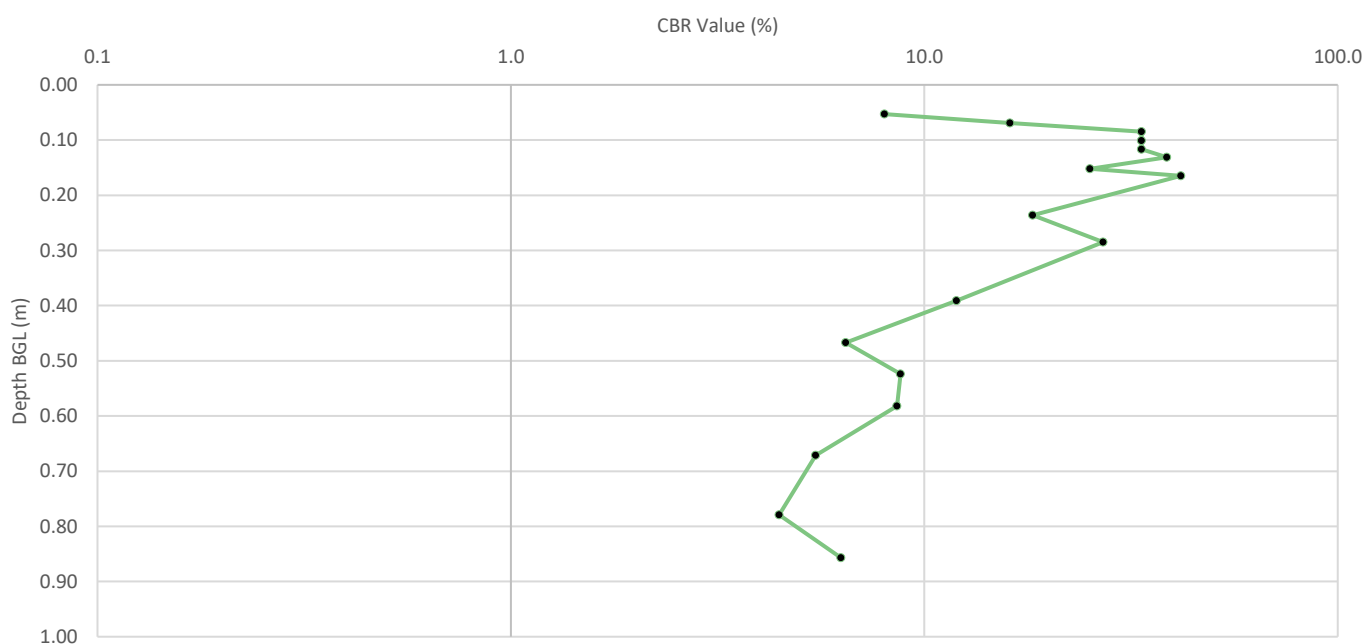
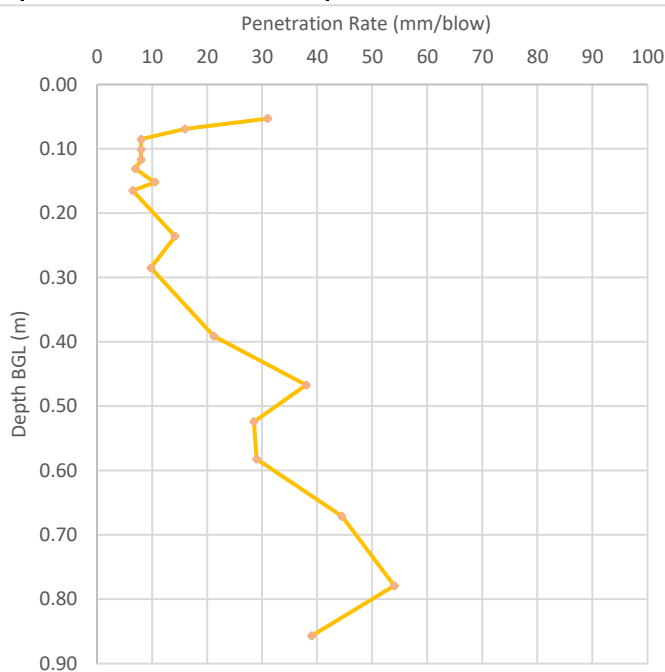
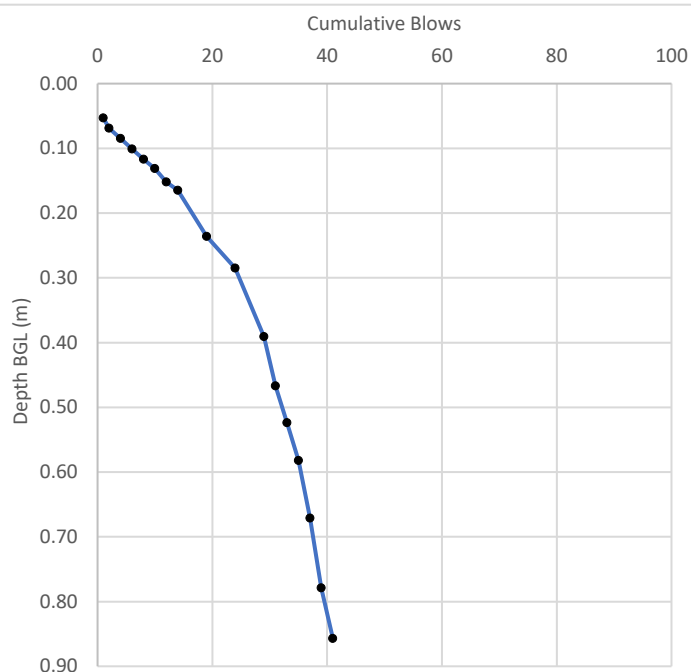
Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP5
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:		Zero Error (mm):	Approx AOD (m):		
Rough ground		35			

[illegible]



Dynamic Cone Penetrometer

Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP5
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:	Rough ground	Zero Error (mm):	35	Approx AOD (m):	





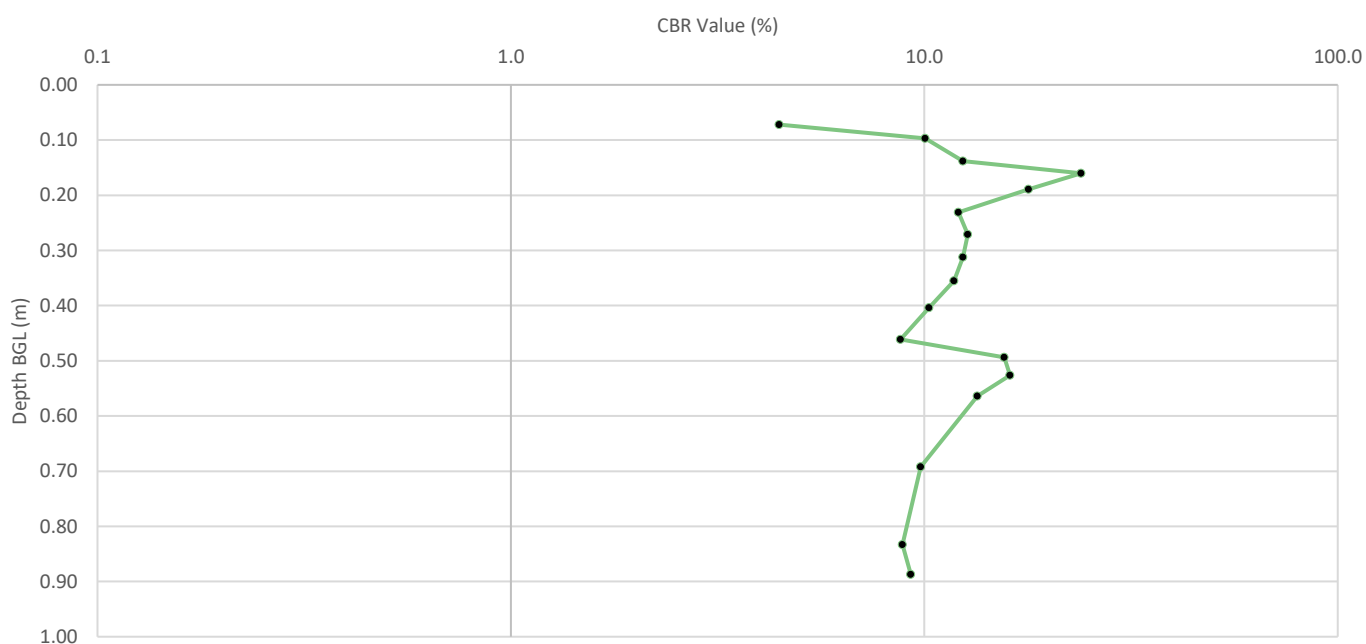
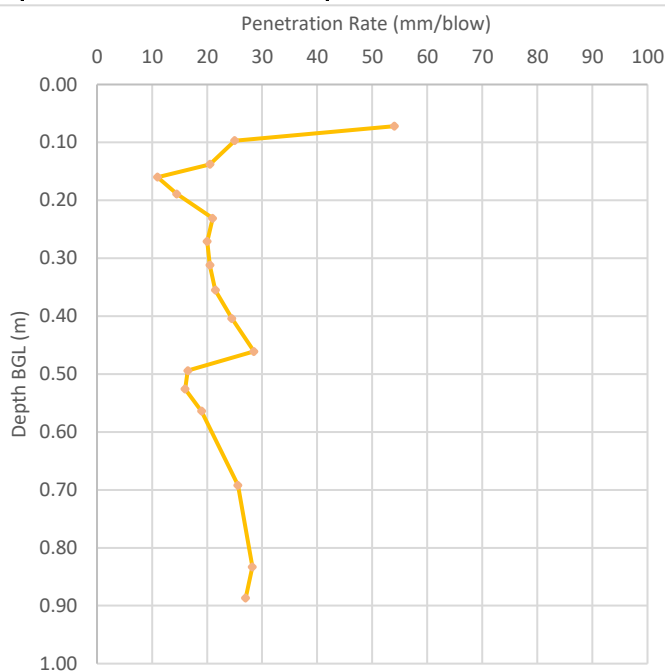
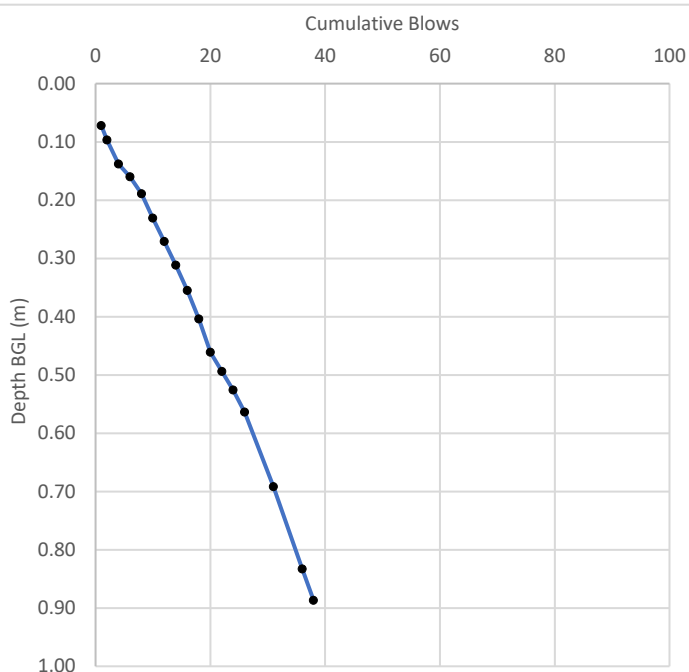
Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP6
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:		Zero Error (mm):	Approx AOD (m):		
Rough ground		35			

[illegible]



Dynamic Cone Penetrometer

Project:	Land at Johnson Drive, Finchampstead, RG40 3NW	Project No:	23-176.01	DCP Location:	DCP6
Client:	Palatine Homes Limited	Operator:	AC / DN	Date:	27/07/2023
Surface Conditions & Observations:	Rough ground	Zero Error (mm):	35	Approx AOD (m):	



AVIRON ASSOCIATES LIMITED

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Our clients choose Aviron to plan, design and manage their Ground Investigations and Land Remediation Schemes assisting in land procurement to deliver engineering requirements, discharge planning and ensure their sites are suitable, developable and sustainable.

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