



Report
Title:

Additional Investigation & Remediation Strategy

Project
Name:

Millfields Farm, Rusper



Report
Reference:

BRD4518-OR1-A

Date:

July 2025

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REPORT CONTROL SHEET

REPORT TITLE	ADDITIONAL INVESTIGATION & REMEDIATION STRATEGY
PROJECT	MILLFIELDS FARM, RUSPER
CLIENT	STONEBOND PROPERTIES

REPORT REFERENCE	ISSUE DETAIL	DATE	PREPARED BY	CHECKED BY
BRD4518-OR1-A	First Issue	22/07/2025	I Hibberd & A Leon	J Brockwell

BRD Environmental Limited

Geotechnical and Environmental Services

- Ground Investigation
- Japanese Knotweed Removal
- Soil, Water and Gas Testing
- Contamination Assessment
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Additional Site Investigation and Remediation Strategy
Millfields Farm, Rusper
BRD4518-OR1-A Add SI and Rem

REPORT LAYOUT

This report is divided into the following four sections: Summary Report, Technical Report, Supporting Information and Appendices.

SUMMARY REPORT

This expanded executive summary provides the main findings of the work undertaken in brief non-technical language. This section provides an overview of the key outcomes for the benefit of non-specialists and concludes with the main recommendations for any further work required. This section should only be relied upon in the context of the whole report and the detailed within the Technical Report should be referred to with respect to any design decisions.

TECHNICAL REPORT

The main report section is intended to provide the technical detail of the works completed and meet the information required by current guidance and practice. The Technical Report is written in a language that, in part, assumes knowledge of the subject matter so that it can be written in as concise a form as possible. Its primary audience is clients, peers, regulators and other professionals in related disciplines.

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APPENDICES

The final section of the report presents the factual data collected and employed as part of the preparation of the report.

APPENDIX 1 SITE PLANS & PHOTOGRAPHS

Site Location Plan	Ref.BRD4518-OP7-A
Site Walkover Photographs	Ref.BRD4518-OP6-A
Proposed Development Layout	'Proposed Site Layout - Land at Millfields Farm, Rusper, West Sussex' ECE Architecture, 7288-PL04, Rev H, 09.02.24
Exploratory Point Plan	Ref. BRD4518-OD1-A
Remediation Plan	Ref. BRD4518-OP4-A
Revised Conceptual Site Model	Ref. BRD4518-OP5-A

APPENDIX 2 EXPLORATORY HOLE RECORDS

Logs of trial pits.	Ref. TP101-TP112
Photographic records of trial pits.	Ref. BRD4518-OP3-A
Logs of boreholes.	Ref. WS101-WS105

APPENDIX 3 LABORATORY TEST RESULTS

DETS report 25-06069	17 x A4 pages
SPT report 47949_1	10 x A4 pages



SUMMARY REPORT- GENERAL INFORMATION

SUBJECT	COMMENTS
CURRENT SITE CONDITION	The site comprises a vacant farmyard formerly used for the training of horses, which is surrounded by grassed fields. Several single storey derelict buildings are present that were previously used as stables and for storage, along with a larger commercial style metal clad barn building.
PROPOSED DEVELOPMENT	It is proposed that the site will be developed for residential houses with associated roads and landscaping. To the south and east is proposed for public open space and drainage ponds. The site extends to the southeast with a thin strip of land proposed to be for the construction of a shallow swale connecting to a ditch.
HISTORICAL SUMMARY	Some minor development first occurred on site by the map edition from 1911, when some small unknown buildings were constructed adjacent to the central western site boundary. The remainder of the site was shown to be largely undeveloped farmland with several footpaths until the early 1970s when the central buildings, referred to as Millfields Farm, were constructed. Further buildings in the northern part of the farmyard and the larger commercial style building in the south were constructed by 2010. The remainder of the site appears to have been fields throughout the mapped history.
PUBLISHED GEOLOGY	The site is shown to be devoid of any superficial deposits. The entire site is underlain by the bedrock geology of the Weald Clay Formation - Mudstone.
ACTUAL GROUND CONDITIONS	The ground conditions encountered during the investigation works were generally in keeping with those encountered by the previous investigations with mostly shallow Made Ground identified in the farmyard area, along with Topsoil in the field areas. Deeper Made Ground soils were identified where soils have been imported to artificially raise levels in the south of the farmyard area. The underlying natural soils consisted of silty clays with occasional lenses of mudstone.
HYDROGEOLOGY	The site is situated upon unproductive strata associated with the Weald Clay Formation. The site is not located within a groundwater Source Protection Zone.
HYDROLOGY	The nearest main water course to the site is the River Mole which is located approximately 700m to the south. A number of ditches are present within the ancient woodland along the eastern boundary of the site. These run in a north-south direction before continuing south and ultimately connecting to the River Mole. The site is not in an area indicated to be at risk of flooding.

SUMMARY REPORT - GEOTECHNICAL

SUBJECT	COMMENTS
EXCAVATIONS	It should generally be possible to forward excavations employing normal equipment. The use of hydraulic breaking equipment will be required for removing existing sub-surface structures. Specific groundwater control unlikely to be required at this site.
SLOPE STABILITY	The slopes across the site are relatively shallow and show no obvious signs of instability. Any change in levels required by the development should be cut to a shallow slope or should be supported by appropriately designed and constructed retaining walls.
EARTHWORKS	It is likely that some earthworks will be required on site due to the existing site levels and the proposed development that will require some form of cut and fill to form development platforms.
PAVEMENT DESIGN	<u>Made Ground</u>: A preliminary design California Bearing Ratio (CBR) of less than 2% has been recommended. <u>Weald Clay Formation</u>: A preliminary design CBR of 3% has been recommended based on the clay plasticity.
SUB-SURFACE CONCRETE	<u>Made Ground</u>: Design Sulphate Class of DS-3 and Aggressive Chemical Environment for Concrete (ACEC) class of AC-2s applies. <u>Weald Clay Formation (for shallow foundations & piles)</u>: Design Sulphate Class of DS-1 and Aggressive Chemical Environment for Concrete (ACEC) class of AC-1s applies.
SOAKAWAYS	Site is not suitable for surface water disposal to soakaways or other forms of infiltration device.
FOUNDATIONS	
LIKELY FOUNDATION TYPE	Shallow strip or deeper trench fill footings bearing upon the clays soils of the Weald Clay Formation. Piled foundations may be required within the influence zones of existing trees.
VOLUME CHANGE POTENTIAL	Medium i.e. moderate swelling or shrinking with moisture content changes.
ESTIMATED FOUNDATION DEPTHS	The minimum footing depth required is 0.90m, but 1.25 m where required to allow for restricted new tree planting. Pile lengths to be determined by specialist piling contractor.
FOUNDATION HEAVE PROTECTION	Will be required for those plots located in close proximity to the boundary trees.

SUMMARY REPORT - CONTAMINATION ISSUES

SUBJECT	COMMENTS
SOIL RISKS TO HUMAN HEALTH	No risks to future residents have been identified in the northern field or in the majority of the existing agricultural fields within the proposed site boundary. Within the farmyard and immediate surrounding area, some contaminated Made Ground soils have been identified that present risks to future residents where they are exposed to these soils in future garden, landscaping and public open space areas. A localised contamination hotspot has also been identified in the eastern field.
ASBESTOS	The investigation completed to date has not encountered any asbestos fragments within the underlying soils, but there remains the potential for such fragments to be discovered. Low concentrations of asbestos fibres have been identified in the surface Made Ground soils in the northern farmyard area which will need to be managed by appropriately trained operatives during redevelopment of the site.
LANDFILL GAS	Ground gas protection measures are not required at this development.
RADON GAS	Radon gas protection measures are not required.
RISKS TO THE WATER ENVIRONMENT	No unacceptable contamination risks to water resources have been identified by this investigation.
RISKS TO BUILDING MATERIALS AND SERVICES	It is considered likely that 'barrier' pipes incorporating an aluminium foil layer or plastic wrapped metal pipes will be required for water supplies in the farmyard area, and potentially across the site.
REMEDIATION STRATEGY	To protect future residents from the identified soil contamination, a combination of contaminated soil removal and the placement of a clean capping solution is proposed in affected future garden and landscaping areas is proposed. A remediation strategy is presented within this report, which will need to be agreed with the relevant regulatory authorities prior to commencing any works.
GIANT HOGWEED	Giant Hogweed has been identified on site and no further works should be completed in the affected areas until a Giant Hogweed Management Plan has been developed and the recommendations within it actioned.

SUMMARY REPORT - KEY RECOMMENDATIONS

CONTAMINATION RECOMMENDATIONS

A formal remediation strategy is presented within this report, which should be agreed with the relevant regulatory authorities prior to commencing any works.

GEOTECHNICAL RECOMMENDATIONS

Consideration could be given to altering the development layout to reduce the influence of trees on foundation depths in order to avoid piling. If piled foundations are required, then it is possible that further deep boreholes for pile design will be necessary. This is because the previous investigation deep boreholes only reached a depth of 15m and so may not be acceptable for longer pile designs.

Once the areas of proposed earthworks cut are confirmed, further ground investigation will be required to classify materials for the Earthworks Specification. A Geotechnical Design Report (GDR) will be required to develop an Earthworks Specification for the cut and fill required for the development platforms.

It is considered that once the alignment and finished levels of adoptable roads has been determined, further targeted ground investigation will be required to meet the design California Bearing Ratio (CBR) requirements of the local highways authority.

1. INTRODUCTION TO TECHNICAL REPORT

1.1. CONTRACT DETAILS

CLIENT	Stonebond Properties (Chelmsford) Limited trading as Stonebond Properties.
SITE	Land situated at Millfields Farm in the village of Rusper, West Sussex.
CLIENT'S ADVISORS	BRD Environmental Limited (BRD) has been commissioned directly by the Client.
REPORT CONTEXT	It is understood that the Client intends to undertake residential redevelopment of the site.
REPORT TYPE	Additional geo-environmental site investigation (i.e. combined geotechnical ground investigation and Phase 2 contamination assessment) and a remediation strategy.
REPORT OBJECTIVES	The site has been the subject of the following previous ground investigations, with the reports referenced as follows: • 'Desk Study and Ground Investigation Report - Millfields Farm, Horsham Road, Rusper' T&P Regeneration Ltd, 2015Feb_MILL1356_DS&GI Report, Issue 1_V1, February 2025. • Geo-Environmental Assessment - Millfields Farm, Rusper' IDOM, GEA-22623-23-405, Rev C, Dated 24/04/2024. The purpose of this BRD report is to provide details of an additional investigation undertaken to refine the extents of the identified contamination and to then produce a remediation strategy to set out the necessary remediation and verification works. The report will then aim to address the requirements of the pre-commencement planning condition 4 (b) and 4 (c) of the Horsham District Council Planning Application reference DC/24/0699. In addition to this, further comments on the geotechnical assessment for the site will be provided to supplement the works already completed at the site.

1.2. SCOPE OF WORKS

The agreed scope of works was:

- Formal review of existing T&P Regen and IDOM desk study and site investigation reports.
- Initial site inspection visit to check access and investigation design, to locate & service previous monitoring wells and to identify any additional areas of potential contamination.
- Mobilisation to site and production of health and safety documentation.
- One day of windowless sampling using a percussive drilling rig to provide approximately 5No. boreholes to a nominal depth of 5m, ground conditions permitting. Undertake Standard Penetration Tests (SPT) at 1m intervals.

- One day of trial pitting using a mechanical excavator to provide approximately 10No. trial pits to a nominal depth of 1m-2m, ground conditions permitting. Allowance for the provision of a hydraulic breaker has been made.
- All exploratory points will be logged and sampled in general accordance with BS5930:2015+A1:2020 by supervising Geo-Environmental Consultant. In-situ geotechnical testing of fine soils using a Hand Shear Vane and/or Pocket Penetrometer.
- Determination of the accurate location and level of exploratory points by topographical grade GPS unit.
- Chemical testing of soil samples with the budget based on the following testing schedule:
 - 10No. Metals Suite - As, Cd, Cr, CrVI, Hg, Pb, Se, Cu, Ni and Zn.
 - 10No. Inorganics Suite - water soluble sulphate, pH, organic matter.
 - 10No. Speciated Polycyclic Aromatic Hydrocarbons (PAH).
 - 10No. Banded aliphatic/aromatic Total Petroleum Hydrocarbons (TPH).
 - 10No. Benzene, Toluene, Ethylbenzene, Xylene (BTEX) and Methyl Tertiary Butyl Ether (MTBE) compounds.
 - 10No. Asbestos quantification.
- Geotechnical testing as appropriate to the nature of the ground conditions encountered, but the budget is based on the following testing schedule:
 - 6No. Moisture content.
 - 6No. Plasticity indices.
 - 10No. pH and water soluble sulphate analysis - soil.
 - 10No. Total sulphate and sulphur analysis - soil.
- Provision of an additional investigation report and remediation strategy. Factual findings to include all exploratory point records and test results. Interpretative reporting to include an updated Generic Quantitative Contamination Risk Assessment (GQRA) and a remediation strategy, and an updated Geotechnical Assessment providing comments on pavement design, concrete classification and foundation design recommendations.

1.3. REPORT LIMITATIONS

Any site boundary lines depicted on plans included within this report are approximate only and do not imply legal ownership of land. Any observations of tree species, asbestos containing materials within structures or invasive weeds, does not constitute a formal survey of such features. The identification of such features is therefore tentative only. In the case of Japanese Knotweed and other non-aqueous invasive weeds, such as Giant Hogweed, BRD can undertake separate surveys for this plant undertaken by a Property Care Association qualified surveyor.

The report does not consider whether sensitive ecology or archaeology is present as these require consideration by professionals specialising in these matters. For excavations planned within six metres of a third part structure then separate professional advice should be sought in respect of the requirements of the Party Wall Act.

It should be recognised that the collection of desk study information may not be exhaustive and that other information pertinent to the site may be available.

The recommendations, interpretations and conclusions of this report are based solely on the ground conditions found at the exploratory holes. Due to the variability in the nature of ground, conditions between exploratory holes can only be interpreted and not defined. The description of the site and the ground conditions is accurate only for the dates of the field works. In particular, groundwater levels can vary due to seasonal and other effects.

The assessment and interpretation of contamination risks is based on the scope of works agreed with the Client together with the budgetary and programme constraints imposed. Further investigation, analysis and assessment of contamination may be required by regulators or other third parties with an interest in the site. An ecological risk assessment of contaminated soils is beyond the scope of this report. This report is concerned with assessing those contamination risks which apply to the future use of the site through the proposed development as part of the planning regime. The assessment does not consider the risk to current site users or continued future use of the site in its current state. If development of the site should occur that differs from that proposed, then the findings of the contamination assessment would need to be re-evaluated.

At the time of writing, detailed information on the proposed structure, such as detailed layout, loadings and serviceability limits, were not available. Accordingly, where geotechnical design advice is provided it is on the prescriptive basis allowed for by Eurocode 7: employing conventional and conservative design rules. The scope of this investigation excludes a formal slope stability study and any observations made regarding slopes are for information only.

2. SITE CHARACTERISTICS

2.1. SITE SETTING

SITE ADDRESS AND POST CODE	Millfields Farm, Rusper, Horsham, West Sussex, RH12 4PR.
NATIONAL GRID REFERENCE	520747E, 137043N

2.2. SITE DESCRIPTION

SUBJECT	COMMENTS
CURRENT SITE DESCRIPTION	The site comprises an irregularly shaped piece of land to the southeast of Rusper village. Access to the site is currently via a track located centrally on the western site boundary from Horsham Road. A further gated entrance is located on the northeastern site boundary from East Street. This gateway was blocked at the time of the investigation. The site comprises a vacant farmyard, formerly used for the training of horses, alongside fields or parts thereof. Several single storey derelict buildings are present in the southwestern area of the site, which were used as stables and for storage, along with a larger commercial-style metal clad building. Two outdoor horse training manège areas are also present in this area of the site. The previous IDOM report suggests that one of the site buildings was previously used for light vehicle maintenance. Vehicle parts with various oil and chemical substances were understood to have been stored at the eastern end of the stables. The majority of the farmyard area has a loose gravel surface with concrete floor slabs present beneath the site buildings. The manège area to the southwest is covered by a mixture of loose gravelly sands and the smaller circular are located centrally is covered by shredded rubber tyre mix. The field areas are laid to grass. The topography of the general area slopes down to the southeast, but site levels have been artificially raised in the area of the site buildings. This is most evident to the east of the larger commercial style building where the ground has been artificially raised above the surrounding ground levels to form a level platform. The site contains multiple mature trees and hedgerows on the boundaries. Notable trees include mature oaks and a row of large leylandii trees located on the northeastern site boundary. In the southern corner of the farmyard, the non-native invasive plant species, Giant Hogweed, has been identified.

SUBJECT	COMMENTS
SURROUNDING LAND USE	The site is situated in a mixed agricultural and residential area. Residential properties are located to the west and northeast of the site. To the north, south and west of the site are agricultural fields laid to grass. To the north, the fields are located beyond East Street. To the east of the site of the site are further agricultural fields and several small woodland areas. The proposed development plan identifies the woodland along the eastern boundary to be an ancient woodland.
PROPOSED DEVELOPMENT	It is proposed that the site will be developed with 43No. residential dwellings with associated roads and landscaping. To the south and east is proposed for public open space and drainage ponds. The site extends to the southeast with a thin strip of land proposed to be for the construction of a shallow swale connecting to a ditch.
HISTORICAL SUMMARY	A summary of the historical mapping provided in the previous investigations is provided below. The previous reports should be referred to for further details. The site was shown to be undeveloped farmland with several footpaths and an off-site windmill located adjacent to the central western boundary on the first available 1870-1875 map edition. By the 1897 map edition the windmill was no longer shown and some unknown buildings were then constructed off site near the central western boundary. The map edition from 1911 shows some unknown buildings to be present along the central western boundary which appear to be an extension of the off site buildings shown on the previous map edition from 1897. These buildings are named as Millfields. No further development occurred on site until the 1973 map edition, when Millfields Farm has been developed with several buildings located centrally within the farmyard area. A further building in the northern part of the farmyard and the larger commercial style building in the south was constructed by the 2010 map edition. The remainder of the site appears to have been fields throughout the mapped history. Off-site ponds were noted approximately 50m to the northeast of the site which were potentially infilled by 1977 map edition. <u>Google Earth Imagery</u> The aerial image from 2001 shows the current site buildings surrounded by fields. To the east of the larger southern building an area of mature trees is shown. The site appears to remain largely unchanged up to the aerial image from 2023. The 2024 and 2025 images are obscured by cloud cover.

SUBJECT	COMMENTS
PUBLISHED GEOLOGY	The site is shown to be devoid of any superficial deposits. The entire site is shown to be underlain by the “Weald Clay Formation - Mudstone”. This typically consists of ‘Dark grey thinly-bedded mudstones (shales) and mudstones with subordinate siltstones, fine- to medium-grained sandstones, including calcareous sandstone, shelly limestones (the so called “Paludina Limestones”) and clay ironstone’s. Approximately 150m to the southeast of the site and towards the base of the sloping ground the “Weald Clay Formation - Limestone” outcrops.
RADON	Radon protection measures are not required.
HYDROGEOLOGY	The site is situated upon unproductive strata associated with the Weald Clay Formation. The site is not located within a groundwater Source Protection Zone.
HYDROLOGY	The nearest main water course to the site is the River Mole, which is located approximately 700m to the south. A number of ditches are present within the ancient woodland along the eastern boundary of the site. These run in a north-south direction before continuing south and ultimately connecting to the river Mole. The site is not in an area indicated to be at risk of flooding.

2.3. GIANT HOGWEED

As discussed above, Giant Hogweed has been identified in the southern corner of the farmyard.

Giant Hogweed is a non-native invasive plant that spreads to new areas exceptionally easily and causes harm to wildlife by outgrowing native species and also contains a toxic chemical within its sap which sensitises the skin and leads to severe blistering when exposed to sunlight. This reaction can recur for many years. It therefore represents a significant health and safety hazard.

Giant Hogweed relies solely on seeds for reproduction and spread, producing 30,000 to 50,000 viable seeds per umbel (flower part). In a natural state, the plant is biennial, growing from seed in the first year and typically taking between 2-5 years to reach flowering and then dying. However, if the plant is cut down before it produces seed, given sufficient time left that season, it will flower again and set seed. If it is too late in the season to flower, it will survive into the subsequent season(s), flowering and seeding in the following season.

After falling from the parent plant, the seeds accumulate and mature in the soil with the seed bank remaining active for at least at least 5 years, assuming no more seeds are allowed to fall from plants in subsequent years. However, in dense well-established stands, new seedlings may be found for up to 10 years or more after control measures commence.

Soils containing viable seeds can then be easily transported to new areas by excavator tracks, shoes, muddy wheels, etc.

Giant Hogweed is classified within the Wildlife and Countryside Act 1981 and an offence is committed “if any person plants or otherwise causes to grow in the wild any such classified plant”. It can therefore be considered a criminal offence to undertake any action that may cause the plant to spread or grow in a new area.

2.3.1. Extent of Infestation

The Giant Hogweed infestation was identified by BRD during the recent site investigation works and a limited survey of the site has identified that the Giant Hogweed is growing in the southwestern area of the site. The main growth is adjacent to the large commercial style building but it has also spread to the southeast into a horse training manège and an area of overgrown vegetation. Several plants have also been observed growing in the garden of the neighbouring property to the northwest in this area of the site.

Following discussions on site, it is understood that this Giant Hogweed infestation has been previously subject to some chemical treatment at the Client's instruction, however, details of these works are limited.

Based on the BRD site observations, there was evidence of chemically treated plant in some areas of the site, but healthy plant in others. Two of the plants were also noted to be flowering which could result in further spread this growing season. It is considered that the infestation has been present for a number of growing seasons as evidenced by the presence of dead plant canes. As a result, viable seeds could be present in the soils across a larger area than that observed to date.

2.3.2. Giant Hogweed Management Plan

To manage the identified infestation and protect persons during any current and future works on the site, it is recommended that a Giant Hogweed Management Plan is developed by an appropriately trained invasive weed specialist and the recommendations detailed in this plan actioned prior to the commencement of any further works in this area of the site.

As discussed above, any management works will need to include both the visible plant growth and also the potential viable seed bank within the surrounding surface soils.

The presence of the Giant Hogweed and its seed bank will have implications on demolition of the site buildings and any contaminated land remediation in this area of the site. Failure to act could also lead to delays in construction and inadvertent spread of the Giant Hogweed across a much larger area.

2.4. PREVIOUS INVESTIGATIONS

As discussed above, the following previous investigations have been completed at the site:

- 'Desk Study and Ground Investigation Report - Millfields Farm, Horsham Road, Rusper' T&P Regeneration Ltd, 2015Feb_MILL1356_DS&GI Report, Issue 1_V1, February 2015.
- Geo-Environmental Assessment - Millfields Farm, Rusper' IDOM, GEA-22623-23-405, Rev C, Dated 24/04/2024.

A summary of the findings from these investigations is provided below, but the full reports should be referred to for further details.

2.4.1. T&P Regeneration - 2015

The investigation included the excavation of eight trial pits (TP1 to TP8), including soakage testing in two of the pits.

2.4.1.1. *Ground Conditions*

The trial pits revealed the site to be underlain by limited Made Ground soils recorded to a maximum depth of 0.8m bgl in TP8 (centrally located within the farmyard). The remainder of the Made Ground soils were limited to a maximum depth of 0.5m bgl. The underlying soils consisted of 'Firm to stiff red brown mottled grey CLAY' considered to be representative of the Weald Clay Formation. These clays were proven to a maximum depth of 1.7m bgl.



Groundwater was not encountered during the investigation

Soakage testing was completed in trial pits TP1 and TP4 to a maximum depth of 1.6m bgl. This showed that the site was unsuitable for the use of soakaways.

2.4.1.2. Contamination

Regarding the contamination testing undertaken by T&P Regeneration, a summary table detailing the findings from both this investigation and the IDOM investigation is provided in Section 2.4.3 below.

A potential low gas risk was identified to the future residents from two nearby potential infilled ponds to the north of the site. However, as T&P Regeneration's report stated that the site was in an area requiring basic radon protection measures it was considered that the associated additional risk was negligible as this would provide a level of gas protection in any case.

However, based on the current UK Radon mapping, the radon assessment for the site shows that no radon protection measures are required. The potential low risk from gas might therefore need to be separately addressed.

In conclusion, T&P Regeneration recommended further investigation beneath the building footprints following demolition.

2.4.2. IDOM - 2024

The IDOM investigation was split into two parts, including the investigation of some soils imported to site by the previous owner and then the investigation of the wider site.

The main investigation works included the following:

- Two cable percussion boreholes (MBH101 and MBH102) to a depth of 15.0m bgl.
- Six shallow windowless sample probe holes (MWS101 to MWS106) to a depth of 5.0m bgl.
- Eight machine-dug trial holes (MTP101 to MTP108) to depths of between 2.7m and 3.0m bgl. and
- Ten Californian Bearing Ratio (CBR) tests (MCBR101 to MCBR110).

2.4.2.1. Main Investigation - Ground Conditions

Topsoil was proven to depths of between 0.2m bgl and 0.4m bgl within all the agricultural fields and was typically described as a 'gravelly sandy clay or a gravelly clayey sand with the gravel comprising of flint'.

A limited thickness of made ground was encountered in five of the exploratory hole locations (MTP102, MTP105, MTP108, MWS104 and MWS106) within the farmyard areas of the site. The thickness ranged between 0.20 and 0.65 m bgl and the soil typically comprised 'sandy gravel and gravelly sand. The gravels consisted of brick, concrete, chalk, tarmac and clinker with rarer inclusions of metal, tile and glass'. Cobbles of brick were also encountered in the made ground.

The Weald Clay Formation was encountered in all exploratory hole locations and typically described as a 'Stiff light orange, brown mottled bluish grey clay. A red / reddish brown colour was recorded in exploratory holes MWS101 and MWS103. Occasional claystone nodules were encountered in all exploratory locations and occasional selenite crystals were also noted. The Weald Clay Formation was often fissured and occasional bands of 'very weak to moderately weak mudstone' were also encountered.

Groundwater strikes were recorded in three exploratory point (MWS102 at 4.6m, MBH101 at 8.0m and MBH102 at 5.0m bgl). Additionally, a groundwater seepage was observed in MWS101 at 4.6m bgl. Groundwater was typically associated with claystone nodules and fissures in the Weald Clay Formation. The groundwater strike observed in MBH101 coincided with a lens of more sandy soil.

Some uncertainties have been noted in relation to the apparent mapped location of the exploratory holes and ground conditions identified. These are as follows:

- MBH102 is shown to have been drilled inside the building footprint, but the soil log shows topsoil over clay soils. An inspection of the floor slab in this building did not identify any areas to have been broken out for the drilling of a borehole. There were also no spoil mounds that would have been generated from drilling. The borehole has therefore clearly been drilled outside of this building.
- MBH101 recorded Made Ground soils to 0.7m bgl in the middle of a field. Whilst possible, it is considered that this is more likely a consequence of some Made Ground in the farmyard area.
- MWS104 and MTP103 were forwarded inside a building. Again, there is no evidence of any holes in these locations and access to the stated locations is very limited.

2.4.2.2. Main Investigation - Contamination

Contamination was identified in the near surface Made Ground soils and a summary is provided in the overall summary table in Section 2.4.3 below.

Groundwater testing from windowless sample borehole MWS101 recorded no elevated contaminant concentrations.

A total of 3No. gas monitoring visits were undertaken within the wells in windowless sample boreholes MWS101, MWS104 and MWS106. No significant gas concentrations were recorded with a maximum carbon dioxide concentration of 2.9% being recorded and no discernible methane concentrations.

2.4.2.3. Main Investigation - Geotechnical

Details of the geotechnical findings from the IDOM investigation are discussed further in Section 5 of this report, but the following potential uncertainties were identified:

- The investigation identified some surface soft spots at depths of 1.0m bgl in boreholes MWS102 and MBH101. However, in MWS102, the soils were recorded as firm at this depth, which does not necessarily imply a soft spot. In MBH101, the soft spot was likely associated with the Made Ground soils present at this depth.
- Further confirmation of the near surface concrete classification was required due to some variable results.

2.4.2.1. Investigation of Imported soils

Some imported soils have been placed to the east of the existing buildings, level with the current floor slabs and with a shallow slope down to the eastern edge.

Some 3No. trial pits (TP1 to TP3) were excavated in this material revealing Made Ground soils to depths of between 1.1m and 1.6m bgl. The Made Ground typically comprised 'soft brown and black gravelly sandy clay with gravel including fragments of brick, concrete, tarmac and clinker with inclusions of metal, glass and large blocks of timber'.

A slight peaty smell was recorded in TP1 and TP2 and a layer of black gravelly sandy clay was encountered at depths of between 0.3m and 0.5 m bgl.

The IDOM reports undertook waste acceptance criteria testing of these soils which confirmed that they were non-hazardous waste. The report considered it likely that the material was imported as a waste and that the soils were unlikely to be physically suitable for reuse on site.

2.4.3. Summary of Previous Soil Contamination - All Previous Investigations

The following table summarises those contaminants identified in the previous investigations to present potential cause for concern.

EXPLORATORY POINT	CONTAMINANT CONCENTRATION	COMMENTS
T&P Regeneration Investigation (2015)		
TP1 (GL to 0.2m)	Benzo(a)pyrene (BaP) 1.3mg/kg Amosite asbestos fibres present.	BaP elevated above water pipe assessment criteria. Asbestos quantification testing was not completed during the investigation so significance of fibres cannot be determined. The Made Ground soils extended from ground level to 0.2m bgl overlying natural clay soils.
TP7 (GL to 0.2m)	Copper 1220mg/kg	Not elevated against human health assessment criteria but potential implications to waste classification. Trial pit excavated in the southern manège and elevated metals may suggest the surface materials contain other elevated contaminants.
IDOM Investigation (2024)		
MWS104 (0.15m bgl)	Lead 280mg/kg BaP 3.5mg/kg Aliphatic TPH >C10-C21 14mg/kg Aromatic TPH >C10-C21 14mg/kg	Contamination identified in near surface gravelly Made Ground from ground level to 0.18m bgl. Soil contains tarmac, metal and glass. The lead and BaP concentrations exceed the assessment criteria for human health. The BaP and TPH concentrations exceed the water pipe assessment criteria.
MTP102 (0.25m)	BaP 1.1mg/kg	BaP elevated above water pipe assessment criteria.

EXPLORATORY POINT	CONTAMINANT CONCENTRATION	COMMENTS
MTP104 (0.2m bgl)	Polycyclic Aromatic Hydrocarbons (PAH) 1180mg/kg BaP 47mg/kg Total Petroleum Hydrocarbons (TPH) 2200mg/kg	Made Ground Topsoil with clinker located in the field area. Significant concentrations elevated above human health criteria have been recorded. Given the field location, this contamination is unexpected and warrants further investigation. Furthermore, these soils would be classified as hazardous waste.
Imported soils	Arsenic 91.5mg/kg Lead 248mg/kg BaP 1.9mg/kg	Elevated metals elevated above human health criteria as well as physically unsuitable soils have been identified in the imported soils. IDOM propose that the soils are likely to be unsuitable for re-use on site. BaP elevated above water pipe assessment criteria.

2.4.4. Discussion

Both previous investigations have identified some localised contamination within the farmyard area, but this would appear to be all limited to the near surface soils. The main areas of concern arising from the previous investigations are as follows:

- The significant contaminant concentrations recorded in trial pit MTP104. Such high concentrations would not typically be expected in topsoil with occasional clinker fragments.
- No quantification testing has been completed on the amosite asbestos encountered in trial pit TP1 (of the T&P Regeneration investigation) albeit that no further asbestos has been recorded elsewhere on site during both phases of investigation, suggesting any asbestos is a localised issue regardless.
- Only limited investigation of the manège areas has been completed. T&P Regeneration have recorded a high copper concentration and whilst not a risk to human health may present issues for waste disposal. In BRD's experience, the surfacing to manège areas often contains high concentrations of metals and the presence of elevated copper does suggest this is maybe an issue on this site.
- There is a high proportion of building cover and so some further contamination may be present beneath the footprints.
- A large quantity of contaminated and unsuitable waste soils appears to have been imported to site. These soils are located alongside the southeastern edge of the farmyard area.
- Made Ground soils to a depth of 0.7m bgl were identified in borehole MBH101 in the location of the eastern fields. The presence of these soils in the field area is unexpected.
- There appears to be some doubt as to the accuracy of the IDOM exploratory point plan as several of their exploratory points do not seemingly correlate with the ground conditions

reported on their logs. Borehole MBH101 being of particular concern. As such the location of some of the identified contamination is unknown.

2.5. PRELIMINARY CONCEPTUAL MODEL

2.5.1. Potential Contamination Sources

Based on the review of previous ground investigations, the following potential contamination sources have been identified:

- Near surface Made Ground soils around the farmyard area contaminated with Metals, PAHs, TPH and potentially asbestos.
- Localised hotspot of contaminated Made Ground Topsoil around trial pit MTP104 in the field area (albeit this is considered to be anomalous).

2.5.2. Invalid Contamination Linkages

The previous investigations have provided sufficient information to confirm that potential contamination risks to the underlying water environment and to future residents from the generation of soils gasses are invalid.

No contamination has been identified in the northern field area.

2.5.3. Preliminary Conceptual Model

The preliminary risks, based on the potential contaminant linkages, are detailed in the table below.

SOURCES AND CONTAMINANTS	PATHWAYS	RECEPTORS	POTENTIAL RISK
Contaminated near surface Made Ground soils in the farmyard area and in Topsoil at MTP104. Metals PAH TPH Asbestos	Ingestion Inhalation Consumption of home grown produce (1)	Residents	Moderate risk
	Direct contact (2)	Water supply pipes and building foundations	Low risk as the majority of the contamination has been identified in the near surface Made Ground, whereas the pipes would be laid in the underlying natural soils.

Based on the previous investigations, it is considered that further targeted investigation is required to delineate the extents of the identified contamination sources, which will in turn allow a remediation strategy to be developed. This further investigation is the subject of this report.

3. ADDITIONAL GROUND INVESTIGATION

3.1. INVESTIGATION DESIGN

METHODOLOGY	A combination of trial pits and shallow windowless sample boreholes were selected as the most appropriate investigation methods. Trial pits were selected as they expose more soils which enables a more reliable record of the ground conditions encountered, particularly to inspect the nature of the various surface Made Ground soils. Windowless samples were selected to confirm the properties of deeper soils to aid in the geotechnical assessment of the site, particularly in reference to the 'soft' spots identified by IDOM.	
DATES OF SITE WORKS	The main field works were undertaken on 23 rd and 24 th June 2025.	
CONSTRAINTS TO EXPLORATORY HOLE LAYOUT	Several live services are present across the site, most notably overhead power lines and drainage pipes crossing the fields and farmyard areas. No access was possible within the site buildings at this time. Post demolition investigation will therefore be needed to address any uncertainties beneath the building footprints. Due to the presence of the Giant Hogweed and to prevent any inadvertent spread of viable seeds across the remainder of the site, no machine excavated trial pits were undertaken within 15m of any identified hogweed plants. Borehole WS102 was undertaken in the hogweed affected area and all machinery, tools and operative's boots were inspected and cleaned before leaving this area.	
LAYOUT RATIONALE	SOURCE / FEATURE	EXPLORATORY HOLE
CONTAMINATION SOURCES TARGETED	Imported soils used to raise levels in the southeastern part of the farmyard	TP101, TP102 and TP103
	Manège areas	SS01, WS102 and TP104
	Asbestos, lead and PAH contamination (TP1 and MWS104)	TP106 and TP107
	PAH and TPH contamination (MTP104)	TP108, TP109
	Made Ground soils (MBH101)	TP110 and TP111
	Soils beneath existing concrete slab	TP112
GROUND FEATURES TARGETED	Confirmation of deeper ground conditions and geotechnical properties	WS101 to WS105
	Proposed new road location	TP105
	'Soft' spots identified by IDOM (MWS102 and MBH101)	WS103 to WS105 TP110 and TP111

CONTAMINATION SAMPLING PLAN	Based on the proposed end use, the sampling and analysis plan is more positively biased towards near surface Made Ground samples as these represent the soils most likely to be available to future site users and are those identified by the previous investigation works as being contaminated. Where applicable, the sampling has been focussed on soils displaying evidence of contamination as well as soils below or adjacent to such contamination to confirm the degree of migration, if any.
ANALYSIS PLAN	Based on the contaminants identified during the previous investigation works the samples for analysed for a suite of contaminants including heavy metals, asbestos, and polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene and xylene (BTEX).

3.2. BRD FIELDWORK

SURFACE SAMPLING	
REFERENCES	SS01
DEPTH RANGE	0.05m bgl
BACKFILL	The excavation was completed to allow for the sampling of the surface manège soils only.

TRIAL PITS	
REFERENCES	TP101 to TP113
DEPTH RANGE	From 0.6m to 1.8m bgl.
EXCAVATOR	Tracked 5 Tonne 360° excavator.
BACKFILL	All the trial pits were backfilled with arisings upon completion and compacted with rams of the excavator bucket.

WINDOWLESS SAMPLING BOREHOLES	
REFERENCES	WS101 to WS105
DEPTH RANGE	5.45m bgl.
RIG TYPE	Premier Drilling Rig.
INSTALLATION / BACKFILL	All boreholes were backfilled with arisings only.

3.3. LABORATORY TESTING

GEOTECHNICAL TESTING	
The soil samples for geotechnical testing were forwarded to the laboratory of Soil Property Testing Ltd with pH and sulphate analysis undertaken at the laboratory of DETS Ltd. The geotechnical testing suite is detailed below. The UKAS accreditation of the individual test methods is shown on the laboratory test report included in the Appendices.	
TEST	NUMBER OF SAMPLES TESTED
Moisture content.	6
Liquid and plastic limits.	6
pH and Water soluble Sulphate.	10
Total Sulphur and Sulphate.	10

SOIL CHEMICAL TESTING	
The soil samples for contamination and/or chemical geotechnical testing were forwarded to the laboratory of DETS Ltd and the testing suite is detailed below. The UKAS or MCERTS accreditation of the individual test methods is shown on the laboratory test report included in the Appendices.	
SOIL TESTS	NUMBER OF SAMPLES TESTED
Arsenic, Cadmium, Chromium, Chromium VI, Copper, Lead, Mercury, Nickel, Selenium, Zinc.	13
Speciated Polycyclic Aromatic Hydrocarbons (PAH).	13
Total Petroleum Hydrocarbons (TPH) with full carbon banding and aliphatic/aromatic split.	7
Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) plus Methyl Tert Butyl Ether (MTBE).	7
Organic Matter.	13
Asbestos Quantification.	8

4. GROUND CONDITIONS

4.1. OVERVIEW

The ground conditions encountered during the investigation works were generally in keeping with those encountered by the previous investigations with mostly shallow Made Ground identified in the farmyard area alongside Made Ground Topsoil and Topsoil in the field areas. Deeper Made Ground soils were identified where the soils have been imported to artificially raise levels in the southeastern part of the farmyard.

Underlying the Made Ground soils, the clay soils of the Weald Clay Formation were encountered across the site.

Details of the various stratigraphic units are given in the following sections.

4.2. TOPSOIL AND MADE GROUND TOPSOIL

Outside of the farmyard area, Topsoil and a slightly reworked Made Ground Topsoil were encountered at surface. The reworked Topsoil typically contained occasional brick fragments.

Made Ground Topsoil was encountered in WS103 to WS105 and TP110 and TP111 to a maximum depth of 0.3m bgl. These soils were typically described as 'MADE GROUND TOPSOIL: Grass over light brown dry slightly gravelly silty clay. Gravel of fine to medium subangular brick'.

Topsoil was encountered in trial pit TP108 to 0.25m bgl and described as 'Grass over brown dry sandy silty slightly gravelly clay. Gravel of fine tabular mudstone'.

4.2.1. Made Ground Topsoil - MTP104

Trial pit MTP104 could be identified by a trial pit scar at the surface and therefore BRD trial pits TP108 and TP109 could be excavated either side of this location with a good degree of certainty.

In trial pit TP108, Topsoil was proven to 0.25m bgl overlying natural clay soils. In trial pit TP109, Made Ground Topsoil was proven to 0.25m bgl, which contained rare brick fragments but with no evidence of clinker. As such, it would appear that the soils reported in MTP104 are either very localised or erroneous.

4.3. ARTIFICIAL GROUND

4.3.1. Manège areas

Two manège areas are present on site, with a large rectangular area at the south of the site and a smaller circular area located centrally within the farmyard.

In the southern area, the surface soils consisted of a 'Light brown slightly gravelly fine sand. Gravel of fine to medium subangular to angular brick and concrete with abundant fragments of plastic and rubber'. These soils were 0.1m in thickness and were then underlain by reworked chalk gravel to 0.3m bgl and brick gravel to 0.4m bgl.

In the circular area, the surface soils were described as a 'Loose light brown gravelly sand. Gravel of fine to coarse subangular to subrounded flint with fragments of plastic and rubber tyre'. These soils were also 0.1m in thickness and were underlain by a sandy gravel of flint and granite to 0.2m bgl and then a 'Firm grey organic silty clay with slight organic odour' to 0.3m bgl.

Beneath these shallow Made Ground layers, the clay soils of the Weald Clay Formation were then proven in both locations.

4.3.2. Imported Soils

Trial pits TP101 to TP103 were excavated in the southeast corner of the farmyard, where soils have been reportedly imported to artificially raise levels.

Made Ground soils were encountered in all 3No. trial pits and to depths ranging from 1.0m bgl in TP103 to 1.3m bgl in TP102. The Made Ground typically consisted of a reworked Made Ground Topsoil to a maximum depth of 0.5m bgl overlying Made Ground clay soils.

The Made Ground Topsoil was typically described as 'brown dry very gravelly sandy clay. Gravel of fine to coarse and cobbles of subangular to angular brick, concrete, clinker and fragments of metal, ceramic and plastic'. It should be noted that this soil was different to the Made Ground Topsoil encountered in the field areas of the site.

The underlying Made Ground soils encountered in TP102 between depths of 0.5m and 1.3m bgl were typically described as 'Soft to firm dark grey and black in places gravelly sandy silty clay with slight natural organic odour. Gravel of fine to coarse and cobbles of brick, concrete and some fragments of timber and half bricks'. Further slightly organic soils were also encountered in TP103 at depths reigning from 0.6m to 1.0m bgl.

4.3.3. Made Ground - MBH101

Trial pits TP110 and TP111 were excavated in the location of borehole MBH101 to determine the extent of Made Ground soils previously identified by IDOM as this appeared anomalous given its location in the field area. No similar Made Ground soils were identified with natural stiff clay soils being encountered at shallow depths beneath the topsoil cover.

Given the presence of organic Made Ground soils encountered in BRD trial pits TP102, TP103 and TP112 in the farmyard area, it is considered that the MBH101 was most likely drilled in this location, not in the field as shown.

4.3.4. Farmyard Building Areas

Trial pit TP112 was excavated through the concrete hardstanding located around the site buildings. The concrete was proven to a thickness of 0.1m and contained 5mm reinforcing bar.

Beneath the hardstanding, Made Ground soils to a depth of 1.1m bgl were proven, consisting of 'Very soft gravelly clay with metal and clinker' to 0.6m bgl overlying a 'Soft gravelly clay with slight organic odour' to 1.1m bgl.

4.3.5. Northern Farmyard Area

Given the apparent inaccuracy of the IDOM investigation plan, trial pits TP106 and TP107 were positioned in the most likely location of previous exploratory holes TP1 and MWS104, where elevated lead, PAH and asbestos were identified.

TP106 and TP107 both encountered a thin covering of Made Ground soils to depths of 0.25m and 0.2m bgl, respectively, overlying natural clay soils. The Made Ground soils were described as 'Loose brown silty sandy gravel in a topsoil matrix. Gravel of fine to coarse subangular to angular flint, brick, concrete, tarmac, limestone with some half to whole bricks, glass and abundant rootlets'. It is considered that these soils are similar to those encountered by the previous holes.

4.4. **SUPERFICIAL DEPOSITS**

As with the previous investigations, superficial deposits were not encountered in any of the BRD exploratory holes.

4.5. BEDROCK

4.5.1. Weald Clay Formation

The bedrock soils of the Weald Clay Formation was proven in all of the BRD exploratory holes and to a maximum depth of 5.45m bgl in the windowless sample boreholes.

These soils were typically described as 'Stiff light brown slightly sandy silty CLAY'. Within all boreholes, distinct layers of 'Extremely weak thinly laminated MUDSTONE' were encountered at various depths.

At depths of approximately 4.0m bgl in the boreholes, the clay soils were typically described as a 'Very stiff / hard dark grey with some brown fissured silty CLAY'. Occasional selenite crystals were recorded in these deeper soils.

4.6. GEOTECHNICAL COMMENTS

4.6.1. Natural Soils

In the northeastern field, the near surface clay soils were noted to be very dry to depths of between 0.5m and 0.7m bgl, presumably due to the recent extended period of dry weather.

One of the purposes of the boreholes in this area was to investigate the reported presence of the 'soft' spots apparently identified in the IDOM report at depths of around 1.0m bgl. However, the BRD boreholes in these locations found the soils at this depth to be either firm or firm to stiff. The in-situ testing also confirmed no soft soils. On this basis and given IDOM's own in-situ testing, it is considered that these 'soft' spots have been mis-reported and the natural clay soils are instead consistent and competent.

4.6.2. Made Ground Soils

In the location of the imported Made Ground soils in the southeastern area of the farmyard (TP101, TP102 and TP103) and in trial pit TP112 forwarded beneath the concrete hardstanding, Made Ground has been identified to depths in excess of 1.0m bgl. This will dictate deepened footings and road construction in this area.

The imported Made Ground soils will also likely be unstable along the eastern edge of this artificially raised area. This could result in construction issues should existing levels be maintained during development.

4.7. CONTAMINATION OBSERVATIONS

Other than the deeper Made Ground discussed above, the Made Ground elsewhere across the site was shallow and only extended to depths of around 0.3m bgl. Therefore, in those areas where remediation is warranted it would only require shallow excavations.

The presence of near surface PAHs and TPH in the farmyard area as identified by the previous investigations is considered likely to be due to the presence of clinker and tarmac in the surface Made Ground. Such contamination is intrinsic to the soils and not likely to be in a leachable form and therefore the underlying natural soils will not likely be significantly impacted.

The surface material in the circular manège area is an imported specific product for this purpose and therefore could potentially be re-used for similar activities off site. This would avoid any waste classification implications if it had to be disposed of as muckaway.

As identified by the IDOM investigation, BRD would concur that the imported soils used to raise levels are physically unsuitable to remain in proposed garden and landscaping areas due to the high volume of waste materials incorporated in them.

4.8. OBSERVED GROUNDWATER BEHAVIOUR

Groundwater was not encountered whilst forwarding any of the BRD exploratory holes.

5. GEOTECHNICAL PROPERTIES

5.1. WEALD CLAY FORMATION

5.1.1. Index Property Testing

SOIL TYPE	Weald Clay Formation.
WATER CONTENT	24.6% to 32.4% (6No. samples)
LIQUID LIMIT	58% to 77% (6No. samples)
PLASTIC LIMIT	23% to 30% (6No. samples)
PLASTICITY INDEX (I_p)	33% to 52% (6No. samples)
MODIFIED I_p	Not applicable as no oversize particles present.
NHBC CLASS	Medium volume change potential.
COMMENT	A total of 14No. samples of Weald Clay Formation were previously tested by IDOM, with Plasticity Index (I_p) values ranging between 19% and 44%. Similar results have been recorded by this additional investigation. Combining both phases of investigation gives an average I_p of 35%, which is considered representative of the Weald Clay Formation. It is worth noting that dry soils have been recorded at shallow depths in trial pit TP105 and borehole WS101. These dry soils are a consequence of the exceptional dry weather in the first half of 2025. The moisture content recorded in these soils is not considered to be representative of their natural state.

5.1.2. Standard Penetration Tests (SPTs)

A total of 25No. SPTs were carried out in the natural clay soils recorded across the site. It is worth noting that one test was within a claystone bed in borehole WS101 at 1.2m depth, where a N-value of 42 was recorded.

The remainder of the tests were carried out in clay soils and N-values between 7 and >50 (refusal) were recorded indicating firm to hard clay soil type. Typically, N-values increase with depth and below 2m depth were indicative of very stiff soils ($N > 16$). Hard soils type ($N > 32$) were recorded below about 4m depth.

One single SPT in WS105 was finished at 50 blows as the test was unable to penetrate the required 300mm. Below is the correlated N_{300} value for this test:

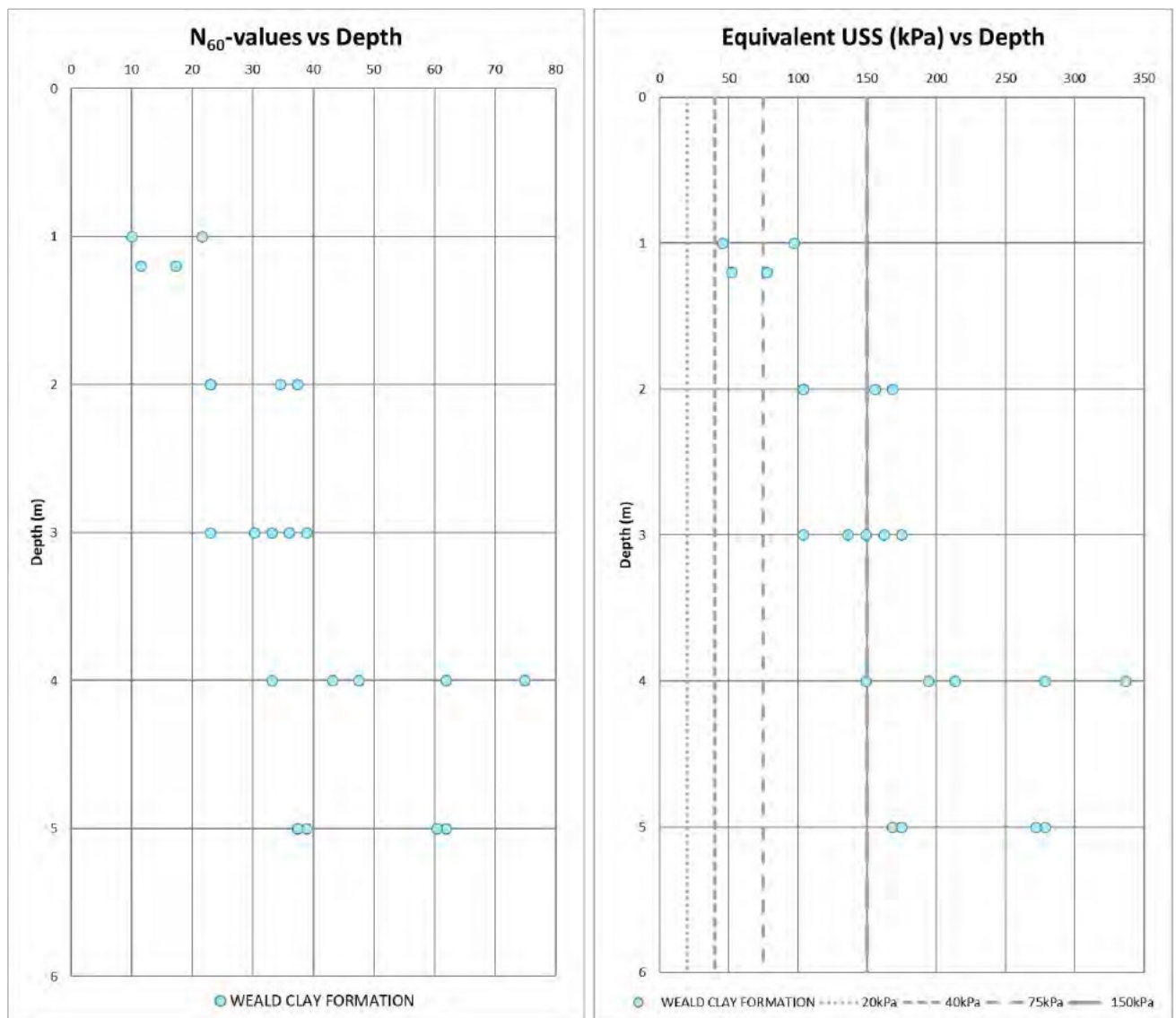
CORRELATED SPT N-VALUES >50				
HOLE	DEPTH (m bgl)	N	PENETRATION (mm)	N_{300}
WS105	4.0	50	290	52

5.1.3. Undrained Shear Strength

The SPT N-values have been corrected to N_{60} -values and then correlated to an equivalent undrained shear strength (c_u) using the approach by Stroud (1985) based upon a relationship of $c_u=4.5N_{60}$, derived from an average I_p of 35%. A hammer efficiency value for the windowless sample rig of $Er=83.6\%$ based on the annual calibration certificate provided by the sub-contractor.

The equivalent undrained shear strength values for the Weald Clay Formation at 1m depth range between 45kPa and 97kPa, indicating medium to high strength soil type. Between 2 and 3m depth, equivalent undrained shear strength values range between 104kPa and 175kPa, indicating high to very high strength. Between 4 and 5m depth, equivalent undrained shear strength values range between 149kPa and 337kPa, indicating very high to extremely high strength soil type.

The following charts show the distribution with depth of the N_{60} values recorded in every borehole together with the derived equivalent undrained shear strength values.



Shear Vane testing from the trial pits recorded undrained shear strength of between 50kPa and 122kPa in the Weald Clay. However, the highest strength values, >100kPa, were recorded from the dry soils at shallow depths and these are not considered to be representative of the natural soil state given their desiccated nature (as discussed above). Excluding these results, an average strength value of 65kPa has been determined indicating medium strength soils.

Undrained shear strengths of 88kPa and >125kPa were recorded with the Hand Pocket Penetrometer tests in the boreholes, averaging 118kPa, indicating high strength soil type.

Given this data, an undrained shear strength value of $c_u = 65\text{kPa}$ is considered to be representative of this soil at typical foundation depths.

5.1.4. Shearing Resistance

BS8004:2015 allows for the estimation of the critical state effective angle of shearing resistance (ϕ') based on the soils Plasticity Index (eq: $\phi' = 42 - 12.5 \log_{10} I_P \pm 6$). Therefore, based on the plasticity index recorded, this is considered to be $\phi' = 21^\circ$.

6. GEOTECHNICAL ASSESSMENT

6.1. INTRODUCTION

The following advice and recommendations are based on the construction of 43No. low-rise, two to three storeys, residential properties will be located along the north and western halves of the site. The proposed development layout plan is included in Appendix 1. From assessment of the nature of the ground conditions and the type of proposed structures, it is considered that the situation generally falls within EC7 Geotechnical Category 1, but some aspects maybe Category 2.

Should the nature of the development be changed then the results of this investigation would need to be reviewed and reassessed.

6.2. EXCAVATIONS

STABILITY	Any excavation requiring man entry should be battered back to a safe angle, supported by an appropriate proprietary trench support system or adequately shored to provide safe working conditions. Shoring to any excavation requiring man entry must be designed by a suitably qualified and experienced engineer. Any support system will require regular inspection as detailed in published guidelines to ensure the excavation support is adequate and appropriate for the ground conditions present. It is anticipated that narrow trench excavations will remain relatively stable and open for short periods, but minor spalling of side walls could still occur. Where deep Made Ground is present it is anticipated that excavations will be prone to sidewall collapse and will require temporary support to remain open.
EQUIPMENT	It should be possible to progress excavations with conventional equipment. The removal of sub-surface structures following demolition will require the use of hydraulic breaking equipment.
GROUNDWATER CONTROL	Specific groundwater control is unlikely to be required at this site. Limited pumping from sumps or bailing out may be required to deal with slight seepages or surface water ingress during periods of inclement weather.

6.3. SLOPE STABILITY

The area covered by farmyard and associated hardstanding is relatively flat. The proposed development in this area will extend beyond this flat section and levels will need to be raised to meet the general elevation of this area. Therefore, some re-profiling earthworks will be required.

Elsewhere, gentle slopes of between 6% and 7%, i.e. 14H:1V to 17H:1V, have been recorded showing no obvious signs of instability.

Any change in levels required should be cut to a slope no greater than one in four (vertical : horizontal - 14°) which should provide reasonable long term stability. It should be noted that shallower slopes may be required for other reasons such access in gardens. Alternatively, changes in level should be supported by appropriately designed and constructed retaining walls.

6.4. EARTHWORKS

Existing topography is such that it is likely that some form of cut and fill earthworks will be required to form development platforms. Controlled filling will likely be required for the main road construction and to extend the area of development beyond the boundaries of the farmyard. An Earthworks Specification should be developed for the Contractor to work in accordance with informed by a Geotechnical Design Report (GDR).

Where a Method based specification is adopted then it is an inherent requirement of such an approach that professional supervision of the contractor is needed.

Some of the soil classification which has been undertaken as part of this investigation will assist in the preparation of an earthworks specification. However, further classification tests will be required to develop the earthworks specification.

Whilst the filling needs to be undertaken in a controlled engineered manner that will greatly reduce settlement, the settlement of fill cannot be avoided entirely. In addition, where ground levels are raised the natural soils will undergo consolidation settlement from the imposed loading of the fill materials. Such settlements would be in addition to settlements arising from any imposed structural loads. It would therefore be prudent to delay construction by several weeks in areas of deep fill (say greater than 1.0m as a guide) to allow the immediate component of settlement to be completed. The thicker the fill, the longer the delay required.

Substantial earthworks cut operations can cause stress relief heave of the natural ground. Such unloading cannot be countered and so a delay to construction by a several weeks in areas of deep cut (say greater than 2.0m as a guide) to allow the immediate uplift to occur is recommended. The deeper the cut, the longer delay required.

6.5. SOAKAWAY DESIGN ADVICE

Soakage tests were not within the scope of the ground investigation as the previous ground investigation has already proved the lack of infiltration of the soils recorded across the site. Therefore, it is considered that the disposal of collected surface water to soakaways will not be feasible at this site due to the cohesive nature and proved low permeability of the underlying soils.

6.5.1. Attenuation Basins

It is noted on the masterplan that basins for the temporary storage of water are proposed in the southern valley feature.

The attenuation basins are located in areas of low permeability clay and so will not require a liner.

6.6. PAVEMENT CONSTRUCTION

6.6.1. Private roads, drives and parking areas

Due to the depth of the Made Ground covering the farmyard area, it is recommended that a preliminary design California Bearing Ratio (CBR) of less than 2% is assumed at this stage in that part of the site. In particular, areas such as the imported soils material immediately to the east of the large barn in the south, will need cut and fill earthworks to create a suitable formation for road construction.

For natural clay soils across the site, BRD is of the opinion that a design CBR of 3% is appropriate based upon the plasticity of the clay at the site. Whilst IDOM had proposed a design CBR of 4%, this does not consider all of the soil classification properties.

6.6.2. Adoptable Roads

A new estate road will be constructed across the site. For small developments, a minimum of 3No. laboratory CBR tests are required to meet West Sussex County Council requirements. Previous ground investigation carried out by IDOM undertook 3No. laboratory CBR tests from soils recovered across the site. However, the material tested was collected at relatively shallow depths of 0.2m to 0.3m and included root fragments. It is likely that near surface Topsoil was included in the material tested and so the validity of the results is questionable.

Therefore, it is considered that once the alignment and finished levels of adoptable roads has been determined, then further targeted ground investigation will be required to meet the design CBR requirements of the local highways authority.

6.6.3. General recommendations

The cohesive deposits will be prone to rapid degradation during wet weather working and this should be avoided where possible.

Increased road pavement construction thickness should be anticipated where paved areas cross over ground disturbed by the removal of the existing structures.

All unsuitable soils, such as topsoil or desiccated soils, should be removed from beneath proposed paved areas. The exposed sub-grade formation should then be proof rolled to reveal any excessively soft or compressible zones and any such features identified also removed by excavation. Where unsuitable materials are removed, the resultant voids should be filled in layers with appropriately compacted suitable granular fill. To reduce the loss of granular construction materials into the sub-grade, consideration should be given to utilising a geotextile starter layer across the formation level.

6.7. SUB-SURFACE CONCRETE

6.7.1.1. *Sulphate and pH*

	MADE GROUND			
	Sulphate		pH	
Characteristic Value	1,600 mg/l		7.0 units	
Justification	Mean of highest 20% results rounded to nearest 100mg/l.		Mean of lowest 20% results.	
	No. of tests	Results Range	No. of tests	Results Range
Soil	10	<10 - 1,630 mg/l	10	6.7 - 7.8 units
Groundwater	-	N/A	-	N/A
Total Potential Sulphate	-	Not tested as pyrite geologically unlikely.		

WEALD CLAY FORMATION - SHALLOW FOUNDATIONS (UP TO 2.5M DEPTH BELOW EXISTING GROUND LEVEL - BEGL)				
Sulphate			pH	
Characteristic Value	100 mg/l			6.1 units
Justification	Mean of highest 20% results rounded to nearest 100mg/l			Mean of lowest 20% results.
	No. of tests	Results Range	No. of tests	Results Range
Soil	13	<10 - 173 mg/l	13	5.3 - 8.3 units
Groundwater	-	N/A	-	N/A
Total Potential Sulphate	10	(*) Not applicable as pyrite unlikely in the samples tested.		

(*) Deeper testing carried out by IDOM recorded a maximum Total Potential Sulphate of 8.79% and potentially pyritic soils in six out of eleven samples, however, these all relate to soils tested below 4m depth.

6.7.1.2. Aggressive Chemical Environment for Concrete (ACEC) Class

Classification of the ACEC has been undertaken in accordance with the BRE SD1:2005 Concrete in Aggressive Ground.

MADE GROUND	
SITE / SOIL CATEGORY	Brownfield.
DESIGN SULPHATE CLASS	DS-3
GROUNDWATER REGIME	Static.
ACEC CLASS	AC-2s

WEALD CLAY FORMATION - SHALLOW FOUNDATIONS (UP TO 2.5M BEGL)	
SITE / SOIL CATEGORY	Natural ground.
DESIGN SULPHATE CLASS	DS-1
GROUNDWATER REGIME	Static.
ACEC CLASS	AC-1s
COMMENTS	Static groundwater conditions have been selected as groundwater is expected to be permanently below the lowest level of proposed construction.

WEALD CLAY FORMATION - DEEP FOUNDATIONS (>2.5M BEGL)	
SITE / SOIL CATEGORY	Natural ground containing pyrite.
DESIGN SULPHATE CLASS	DS-4 (but DS-1 for pile design).
GROUNDWATER REGIME	Static.
ACEC CLASS	AC-4s (but AC1s for pile design).
COMMENTS	Concrete in pyritic ground that is initially low in soluble sulphate does not have to be designed to withstand a high potential sulphate class unless ground disturbance is such that pyrite may be oxidised. This may prompt a change in construction e.g. employing piled foundations instead of trench fill footings. The restriction to DS-4 has been applied.

6.8. ADDITIONAL FOUNDATION RECOMMENDATIONS

BRD concurs with the previous IDOM investigation assessment that the site is suitable for the adoption of shallow strip/trench fill footings.

Foundations should be taken through Made Ground/topsoil to bear upon the clay soils of the Weald Clay Formation. Within the zones of influence of the trees, deepened trench fill foundations are considered generally appropriate. However, where plots are located close to the trees and hedges, piled foundations may need to be considered if trench fill foundations are too deep to be economic or practical to construct.

Where existing structures are to be demolished it is difficult to predict potential footing depths as the demolition works and foundation removal are likely to disturb the soils and therefore locally over deepened footings should be anticipated in areas of former structures. Deeper trench fill footings should be assumed in the farmyard area after existing building foundation removals and to penetrate the Made Ground from making level ground for the barns.

This additional investigation has targeted those areas of low strength soils identified in boreholes MBH101 and MWS102 from the IDOM investigation. However, it is considered that the location of borehole MBH101 was mistaken, as near surface ground conditions recorded in this area have been proved completely different to those recorded in the borehole. It is considered that the borehole was in fact located in the farmyard area and therefore, the slightly lower strength soils recorded at 1.2m depth are a consequence of the disturbance from the Made Ground.

Borehole MWS102 is located in the northernmost field. BRD's additional boreholes WS103 and WS104 in that area have recorded similar soil strength at 1m depth to those recorded in borehole MWS102. Therefore, a limited bearing pressure of 110kPa is considered appropriate for foundations up to 1m wide for plots located in this area.

For the remainder of the site, IDOM recommended a bearing pressure of 150kPa. BRD view this value to be slightly high but is still considered to be satisfactory and is supported by the information from this additional ground investigation.

The Weald Clay Formation has been shown to have a medium volume change potential when assessed against NHBC standards and therefore the minimum foundation depth required is 0.90m, but 1.25 m where required to allow for restricted new tree planting. Under the NHBC Standards, foundation depths have to be increased if they are within the influence zone of felled trees,

existing trees or proposed tree planting. It should be noted that where trees are in groups the resulting competition for resources can lead to deeper root systems than allowed for in the NHBC Standards. In any event, foundations should be taken below any roots encountered in foundation trench excavation. Where the required foundation depth varies around a structure, this can be accommodated by forming steps in the foundation as per NHBC Standards.

Based on a brief analysis, it is likely that several plots will require foundations deeper than 2.5m depth, such as Plots 3 or Plots 12 to 19, based on the supplied development layout. Deep trench fill footings to about 2.5m depth are likely required for Plots 35 and 43.

Where foundation depths exceed 1.50m in clay soils and are within the zone of influence of existing or felled trees or where foundations cut through tree roots, a compressible void former will be required against the internal faces of new foundations in order to accommodate potential long term soil heave. Such precautions against heave should be designed and constructed in accordance with NHBC Standards.

The excavator must be set up with care and operated correctly to ensure trench walls are vertical and base horizontal as any slight inclination will result in eccentric loading on deep trench fill footings.

A number of trees and tree stumps are located across the site. It will be necessary to remove all unwanted trees, stumps and root structures prior to commencing with the development. Any resultant void should be backfilled accordingly with respect to the preferred foundation design.

Due to the depth of Made Ground and the presence of clay soils, BRD recommend the use of fully suspended ground floors slabs designed to NHBC Standards. The floor construction will not have to incorporate radon or ground gas protection measures.

6.9. RECOMMENDATIONS FOR FURTHER GEOTECHNICAL WORK

Consideration could be given to altering the development layout to reduce the influence of trees on foundation depths in order to avoid piling. If piled foundations are required, then it is possible that further deep boreholes for pile design will be necessary. This is because the deep boreholes in the previous IDOM investigation only reached a depth of 15m and so may not be acceptable for longer pile designs.

Once the areas of proposed earthworks cut are confirmed, then further ground investigation will be required to classify materials for an Earthworks Specification. A Geotechnical Design Report (GDR) will be required to develop an Earthworks Specification for the cut and fill required for the development platforms.

It is considered that once the alignment and finished levels of adoptable roads has been determined, further targeted ground investigation will be required to meet the design California Bearing Ratio (CBR) requirements of the local highways authority.

7. RISK ESTIMATION - SOILS

7.1. HUMAN HEALTH

In the first instance, the results have been assessed against the Generic Assessment Criteria (GAC) for residential land use as this is appropriate for the proposed form of development. The results summarised in the table below are from the BRD investigation only, but with the results from all phases of investigation discussed in the subsequent sections of the report.

CONTAMINANT	UNITS	NUMBER OF TESTS	MAXIMUM CONCENTRATION	GAC	NUMBER EXCEEDING GAC
Arsenic	mg/kg	13	18	37	0
Cadmium	mg/kg	13	7.4	22	0
Chromium (total)	mg/kg	13	40	910	0
Chromium (hexavalent)	mg/kg	13	<2	21	0
Copper	mg/kg	13	3360	2,400	1
Lead	mg/kg	13	636	200	1
Mercury	mg/kg	13	<1	11	0
Nickel	mg/kg	13	24	180	0
Selenium	mg/kg	13	<2	250	0
Zinc	mg/kg	13	775	3,700	0
pH	Units	13	5.3 to 8.1	<5-10>	0
Naphthalene	mg/kg	13	0.18	2.3	0
Acenaphthylene	mg/kg	13	0.25	170	0
Acenaphthene	mg/kg	13	4.15	210	0
Fluorene	mg/kg	13	3.12	170	0
Phenanthrene	mg/kg	13	32.7	95	0
Anthracene	mg/kg	13	9.9	2,400	0
Fluoranthene	mg/kg	13	45.4	280	0
Pyrene	mg/kg	13	38.2	620	0
Benzo(a)anthracene	mg/kg	13	18.4	7.2	0
Chrysene	mg/kg	13	15.4	15	1
Benzo(b)fluoranthene	mg/kg	13	15.4	2.6	3
Benzo(k)fluoranthene	mg/kg	13	6.59	77	0
Benzo(a)pyrene	mg/kg	13	14.2	2.2	3
Indeno(1,2,3-cd)pyrene	mg/kg	13	6.85	27	0
Dibenzo(a,h)anthracene	mg/kg	13	1.54	0.24	3
Benzo(ghi)perylene	mg/kg	13	5.87	320	0
TPH Aliphatic C5-C6	mg/kg	7	<0.01	42	0
TPH Aliphatic C6-C8	mg/kg	7	<0.05	100	0
TPH Aliphatic C8-C10	mg/kg	7	<2	27	0
TPH Aliphatic C10-C12	mg/kg	7	<2	130	0
TPH Aliphatic C12-C16	mg/kg	7	5	1,100	0

CONTAMINANT	UNITS	NUMBER OF TESTS	MAXIMUM CONCENTRATION	GAC	NUMBER EXCEEDING GAC
TPH Aliphatic C16-C35	mg/kg	7	187	65,000	0
TPH Aliphatic C35-C44	mg/kg	7	69	65,000	0
TPH Aromatic C5-C7	mg/kg	7	<0.01	70	0
TPH Aromatic C7-C8	mg/kg	7	<0.05	130	0
TPH Aromatic C8-C10	mg/kg	7	<2	34	0
TPH Aromatic C10-C12	mg/kg	7	<2	74	0
TPH Aromatic C12-C16	mg/kg	7	<2	140	0
TPH Aromatic C16-C21	mg/kg	7	29	260	0
TPH Aromatic C21-C35	mg/kg	7	299	1,100	0
TPH Aromatic C35-C44	mg/kg	7	74	1,100	0
Benzene	mg/kg	7	<0.002	0.87	0
Toluene	mg/kg	7	<0.005	130	0
Ethylbenzene	mg/kg	7	0.003	47	0
Xylene (total of all types)	mg/kg	7	0.01	56	0
Methyl Tert Butyl Ether (MTBE)	mg/kg	7	<0.005	49	0
Asbestos Quantification	%	8	0.04	0.001	1
Hydrocarbon Vapour (PID)	ppm	7	0.0	50	0

DISCUSSION OF RESULTS

LEAD

Manège Areas

During the BRD investigation, a single elevated lead concentration of 636mg/kg, which is above the GAC of 200mg/kg, was recorded in the surface manège material in TP104 at 0.05m bgl.

Imported Soils

The previous IDOM investigation identified an elevated lead concentration of 248mg/kg in the imported soils area, but BRD trial pits TP101, TP102 and TP103 did not identify any elevated lead in these soils.

Northern Farmyard

In the northern section of the farmyard, the IDOM investigation identified an elevated lead concentration of 280mg/kg in the surface Made Ground soils. However, trial pit TP1 (T&P Regeneration) and BRD trial pits TP106 and TP107 did not identify any elevated lead within these soils.

COPPER

Manège Areas

During the BRD investigation, a single elevated copper concentration of 3360mg/kg, which is above the GAC of 2400mg/kg, was recorded in the surface manège material in TP104 at 0.05m bgl.

During the T&P investigation, a copper concentration of 1220mg/kg was recorded in the southern sandy manège area. The BRD sample of these surface soils also recorded a similar elevated copper concentration of 708mg/kg. However, neither of the samples are elevated above their respective GAC.



ARSENIC	<u>Imported Soils</u> During the IDOM investigation, a single elevated arsenic concentration of 91.5mg/kg, which is above the GAC of 37mg/kg, was recorded in the imported soils. However, BRD trial pits TP101, TP102 and TP103 did not identify any elevated arsenic in these soils.
PAH	<u>Northern Farmyard</u> The BRD investigation has recorded several elevated PAH compounds within the near surface soils in trial pits TP106 and TP107. The BaP concentrations at these locations were 11.8mg/kg and 7.29mg/kg, respectively. Analysis of the underlying natural soils in TP106 recorded no elevated concentrations of PAHs. The previous investigations recorded some PAHs above the water supply pipe GAC in MWS104 and TP1, but the concentrations were not elevated above the GAC for human health. The BRD concentrations are considered to be typical of the presence of tarmac and clinker in these soils. As the underlying natural soils were proven to be uncontaminated, it confirms a lack of leachable contamination. <u>Imported Soils</u> The BRD investigation has recorded several elevated PAH compounds in the near surface imported soils in TP102 with a BaP concentration of 14.2mg/kg, which is elevated above the GAC of 2.2mg/kg. The recorded concentrations are again considered to be due to the presence of tarmac in these soils. In BRD trial pits TP101 and TP103 where similar soils were tested, no elevated concentrations of PAHs were recorded above their respective GAC and none of the previous IDOM trial pits recorded any elevated concentrations either. <u>Field - MTP104</u> Significantly elevated concentrations of PAHs were recorded in the reworked topsoil in MPT104 during the previous IDOM investigation. However, no elevated concentrations of PAHs were recorded in the two BRD trial pits (TP108 or TP109) located either side of this location. Some trace PAH concentrations were recorded in TP108 with the BaP concentration being elevated above the GAC for the water pipe specification. No contamination was identified in the underlying natural soils present from 0.4m bgl. The source of the contamination identified by IDOM is unknown but given that the BRD trials pit were located at either end of the IDOM pit, the extent of the contamination has been confirmed to be highly localised.
TPH	During the BRD investigation, none of the TPH compounds are elevated above the human health GAC. <u>Field - MTP104</u> It should be noted that no elevated TPH concentrations were recorded in trial pits TP108 or TP109, where elevated concentrations of TPH had been previously recorded by IDOM.
BTEX & MTBE	None of the BTEX or MTBE compounds are elevated above the human health assessment criteria.

ASBESTOS	<u>Northern Farmyard</u> T&P Regeneration trial pit TP1 identified amosite asbestos fibres in the near surface Made Ground in this area, however, there was no associated quantification testing to determine how widespread these fibres were. Within the surrounding BRD trial pits TP106 and TP107, no elevated asbestos was identified. <u>Central Farmyard</u> BRD trial pit TP112 recorded Amosite and Chrysotile asbestos fibre bundles at a concentration of 0.04% in the Made Ground soils at 0.4m bgl. BRD employed the JIWG 'Decision support tool for the qualitative risk ranking of work activities and receptors involved in or exposed to asbestos in soil and Construction & Demolition materials' (Version 2, February 2017) for the sample from trial pit TP112. This confirmed the risk ranking as being a medium risk.
PHYSICALLY UNSUITABLE SOILS	Whilst not a contamination issues, the near surface Made Ground soils in the northern farmyard area, the imported soils areas and the central manège area are considered to be physically unsuitable to remain regardless of the contaminant concentrations recorded.

7.2. WATER ENVIRONMENT

It is not appropriate to consider human health assessment criteria for human health in relation to the risk to the water environment, but currently there are no generic soil assessment criteria in respect of the water environment. In the absence of any groundwater sampling data, the soil results are assessed on the basis of professional judgement.

The contaminant concentrations recorded in the soils at the site are not considered to be at such levels that they would present any significant risk to the underlying water environment. The PAH contamination has been shown to be an intrinsic part of the soil, i.e. a tarmac or clinker fragment, rather than any leachable contamination, therefore, this does not present any cause for concern to the water environment even if an aquifer were present.

However, it is noted that the underlying clay soils and the classification of Unproductive Strata means that there is no identified risk to the underlying water environment and the pollutant linkage is considered to be invalid.

A single water sample was analysed from borehole MWS101 during the IDOM investigation. This did not identify any elevated concentrations of contaminants. The groundwater from MWS101 was presumably from a localised pocket of perched water, either within claystone nodules or from surface water ingress and therefore not representative of groundwater in any case.

7.3. BUILDING MATERIALS

The results summarised in the table below are from the BRD investigation only with the results from all phases of investigation discussed in the subsequent sections of the report

CONTAMINANT	UNITS	NUMBER OF TESTS	MAXIMUM CONCENTRATION	GAC	NUMBER EXCEEDING GAC
pH	units	23	5.3 to 8.3	<5.5	1
Sulphate (w/s)	mg/l	23	1630	500	4
Sum of Aliphatic TPH >C10-C21 + Aromatic TPH >C10-C21 above detection limits	mg/kg	7	285	10	2
Sum of Aliphatic TPH >C21-C34 + Aromatic TPH >C10-C35 above detection limits	mg/kg	7	658	500	1
Sum of BTEX + MTBE above detection limits	mg/kg	7	0.013	0.1	0
Naphthalene	mg/kg	13	0.18	0.5	0
Benzo(a)pyrene	mg/kg	13	14.2	0.5	6

RESULTS EXCEEDING BUILDING MATERIALS ASSESSMENT CRITERIA	
BENZO(A)PYRENE	The concentrations of the Polycyclic Aromatic Hydrocarbon (PAH) benzo(a)pyrene recorded are above the limits for the use of conventional polyethylene (PE) water supply pipes. The majority of these elevated concentrations are limited to the near surface Made Ground soils limited to depths of around 0.3m bgl with the underlying natural soils confirmed to be uncontaminated. In trial pit TP102 the deeper imported soils at 0.8m bgl recorded an elevated concentration of 1.55mg/kg which is elevated above the GAC. Whilst the deep Made Ground is sporadic and limited in extent, it is considered likely that the use of protective 'barrier' water supply pipes will be required at this development for the farmyard area. Due to the absence of contamination within the field areas, conventional plastic pipes could be suitable for the remaining areas proposed for redevelopment, however, some local water supply companies do not allow for differing pipe specification.
WATER SOLUBLE SULPHATE	Concentrations of water soluble sulphate and pH are such that they could detrimentally impact sub-surface concrete. The impact on concrete mix design is a geotechnical issue that is considered separately and so no further comment is made on these results within this contamination assessment.
pH	

8. RISK EVALUATION

8.1. REVISED CONCEPTUAL MODEL

The revised conceptual site model plan is presented in Appendix 1.

INVALID CONTAMINANT LINKAGES	Following the completion of various phases of investigation works, the potential contamination linkages to the water environment or from the generation of landfill gasses and hydrocarbon vapours are considered to be invalid.
VALID CONTAMINANT LINKAGES	The investigations completed to date have identified the near surface soils to be contaminated with heavy metals, PAHs, TPH and asbestos, albeit that some of these contamination sources are localised and/or limited to shallow Made Ground soils.
LIMITATIONS AND UNCERTAINTIES	Due to access restrictions, it was not possible to undertake any exploratory holes under the building footprints, however, such investigation is proposed as part of the remediation strategy following demolition of the site. The location of some of the exploratory holes completed as part of the IDOM investigation have been shown to be inaccurate. Whilst every effort has been made to determine the actual location of the exploratory holes, there remains some uncertainty about the accuracy of their works.

8.2. UPDATED CONTAMINATION RISK ASSESSMENT

The contamination linkages identified in the revised conceptual site model will now be evaluated as to their severity:

SOURCES AND CONTAMINANTS	PATHWAYS (REFERENCE FROM MODEL)	RECEPTORS	POTENTIAL RISK
Contaminated near surface Made Ground soils and in Topsoil at MTP104 Metals PAH TPH Asbestos	Ingestion Inhalation Consumption of home grown produce (1)	Residents	Moderate risk - Farmyard area & MTP104 Negligible risk - Northern fields (excluding MTP104)
	Direct contact (2)	Water supply pipes and building foundations	Low risk - Farmyard area Negligible risk - Northern fields

The contamination risks that are presented to the various receptor groups are discussed further in the following sections:

SOIL RISKS TO HUMAN HEALTH

The investigation completed to date has identified elevated concentrations of heavy metals, PAHs and TPH in the northern farmyard area, in the location of the imported soils in the south of the site, the central manège and in a localised area of the existing field in trial pit MTP104. These soils are considered to present a moderate risk to future residents should they remain in future garden and landscaping areas following redevelopment of the site.

Most of these soils (all except MTP104) have also been identified as being physically unsuitable to remain in future garden and landscaping areas regardless of the levels of contamination identified.

Asbestos fibres have been identified in the Made Ground soils in trial pits TP112 and TP1 and are considered to present a moderate risk to human health where future residents are exposed to these soils. Whilst it is relatively easy to release asbestos fibres when working with building materials and/or debris consisting of asbestos insulation, asbestos coatings and Asbestos Insulation Board, in most circumstances similar materials in the ground are unlikely to give rise to equivalent airborne fibre releases and, consequently, the potential risk to human health from exposure to and inhalation of asbestos fibres will be significantly lower.

GROUND GAS RISKS

No risks from ground gases have been identified at the site.

RISK TO WATER ENVIRONMENT

No risks to the water environment have been identified at the site.

RISK TO BUILDING MATERIALS AND SERVICES

No risks to services have been identified at the site in the northern field area proposed for redevelopment.

Around the farmyard area, elevated PAH have been identified in the Made Ground soils. The presence of hydrocarbons can denature and permeate plastic services, which is a particular concern for water supply pipes. This could lead to both the taste and quality of drinking water supplies being compromised. This associated risk can be easily managed through the use of hydrocarbon resistant pipes, for example plastic 'barrier' pipes incorporating an aluminium foil layer or metal pipes. It should be noted that the water pipe specification should always be confirmed with the local water supply company as they may insist on such protective pipes regardless of the level of contamination or remediation.

8.3. RISK MANAGEMENT

8.3.1. Introduction

Based on all the investigations completed to date, the soils in the northern field and the majority of the proposed areas of public open space are uncontaminated and suitable for the proposed redevelopment of the site.

Within the farmyard and a localised area of the field, contaminated soils have been identified which present potential risks to both future residents and to the use of conventional water supply pipes. Remedial works will be required to address these issues as part of the redevelopment of the site.

Giant Hogweed has also been identified in the south of the site, which is harmful to both humans and animals. A Giant Hogweed Management Plan will need to be developed for the site and actioned before any further works are completed in the affected area of the site.

8.3.2. Further Contamination Assessment

Whilst there are some areas where some further investigation is required, for example under the building footprints and to delineate the asbestos contamination in TP112, this requires the demolition to be completed.

As the remediation strategy can be developed without this information, it is therefore proposed that this further investigation is incorporated into the remediation strategy for the site. The remediation strategy is presented in Section 10 of this report.

9. SOIL RE-USE AND WASTE SOIL DISPOSAL

9.1. OVERVIEW

It is considered that uncontaminated soil and other naturally occurring material excavated in the course of construction activities is not waste, on the proviso that the material will be used only on site for the purposes of construction in its natural state. Accordingly, the planned re-use of such soils on site to form the development landform that has been determined through the planning process is excluded from waste regulation by the Waste Framework Directive (2008).

Made Ground and other materials such as recycled aggregate are also not waste unless they are discarded, intended to be discarded or required to be discarded.

Any soils that are surplus to requirements and/or are unsuitable for re-use and need to be disposed of from site are recognised as 'waste' according to the Environment Agency and the European Waste Framework Directive.

Giant Hogweed is present on site which is a controlled waste. If removed from site, the plant and impacted soils will need to be disposed at a landfill able to accept such waste.

To allow the transfer of surplus soil for use at other developments, it is recommended that a Materials Management Plan (MMP) is formulated in general accordance with the CLAIRE 'Definition of Waste: Development Industry Code of Practice'. Such a MMP is also of use for the re-use of the excavated materials on site, such as for:

- Demonstrating that stockpiled soils have a use.
- Facilitating the import of soils if there is a shortfall of fill material.

It is a legal requirement to correctly assess and classify waste. There are specific technical requirements for waste sampling such that it is proportionate to the volume of the waste type in question and its nature. The preliminary waste assessment provided below is based only upon the available data and may not be sufficient to adequately classify the waste.

9.2. TOPSOIL

Topsoil should be viewed as a resource rather than a waste. As the majority of the topsoil across the field areas is suitable for residential garden use in terms contamination, it should be stripped and any surplus reused on other developments. It should be noted that topsoil, even if uncontaminated, is unlikely to constitute 'inert waste' due to its high organic matter content.

The suitability of the topsoil for re-use is considered in this report only in respect of contamination issues. For consideration of the quality of the topsoil for re-use then a Topsoil Resource Survey with appropriate testing could be commissioned. Such a survey will inform a topsoil management plan.

9.3. SUB-SOIL

It is considered that the natural sub-soils disposed of from the site would be classified as 'non-hazardous waste' and would be characterised for disposal to landfill as 'inert waste'.

However, the chemical results should be forwarded to the proposed landfill site and the waste classification confirmed prior to disposing of any surplus soils. Waste Acceptance Criteria (WAC) testing of the soils will also be required where the soil is to be disposed of at a landfill permitted to accept inert waste. The waste code from the European Waste Catalogue (EWC) 2002 for the soils would be 17 05 04 'Soil and Stones, not containing dangerous substances'.

It is considered that the identified contaminated soils disposed of from the site would be classified as 'non-hazardous waste' and as such the waste will require pre-treatment prior to off-site disposal e.g. by selective excavation. The chemical results should be forwarded to the proposed landfill site and the waste classification confirmed prior to disposing of any surplus soils. The waste code from the European Waste Catalogue (EWC) 2002 for the soils would be 17 05 03 'Soil and Stones, containing dangerous substances'. It should be noted that the WAC testing of the imported soils completed by IDOM confirms that these soils fail the inert waste WAC limits.

It is considered that the topsoil in the location of MTP104 of from the site would be classified as 'hazardous waste'. Such waste will require pre-treatment prior to off-site treatment or disposal e.g. by selective excavation and further testing. Waste Acceptance Criteria (WAC) testing of the soils for disposal will also be required if the soil is to be disposed of to landfill. The waste code from the European Waste Catalogue (EWC) 2002 for the soils would be 17 05 03 'Soil and Stones, containing dangerous substances'. Given the limited extent of these materials, it may be prudent to excavate the soils and re-test them to confirm their waste classification prior to off-site disposal.

The investigations to date have only identified loose asbestos fibres and the recorded concentrations are such that they would be classified as 'non-hazardous waste'. Should any visible asbestos be identified in the subsequent post demolition investigations, this material would be classified as hazardous waste.

If disposed of from site, the surface materials in the central manège would be classified as hazardous waste for disposal to landfill. The recycling of shredded or granulated tyres is a permitted activity where the materials are used within a horse manège. The European Waste Catalogue (EWC) 2002 for this material would be 19 12 04 'shredded or granulated end-of-life tyres'. An U8 exemption allows the use of waste materials (that do not need treating) for a specific purpose to reduce the use of virgin or non-waste materials. Considering this, rather than disposal to landfill there is the potential that this material could be reused at a similar off-site horse training facility. This would offer a practicable and sustainable reuse of this material as long as the requirements of the U8 exemption are met.

The Giant Hogweed plants and soils potentially containing viable seeds are a controlled waste and if removed from site need to be disposed at a landfill willing to accept such waste.

10. REMEDIATION STRATEGY

10.1. INTRODUCTION

The overall aim of a remediation strategy is to design the remediation works necessary to mitigate the potentially unacceptable contamination risks identified through the various desk study and investigation reports. The remediation process begins with development of the remediation objectives and the options appraisal process, although the appraisal process must be proportionate to the degree and extent of remediation required. A verification plan will need to be documented that can be implemented as the remediation works are completed.

The processes of remediation design, implementation and verification comprise:

- Definition of remediation objectives.
- Appraisal of the options for remediation and selection of a preferred strategy.
- Planning and implementation of the preferred strategy.
- Long term monitoring and maintenance.
- Preparation of a verification report.

The previous assessment has identified the unacceptable contamination risks. The remediation strategy must present a clear methodology for managing the risks associated with each pollutant linkage that has been identified.

10.2. IDENTIFIED CONTAMINATION RISKS

From the previous contamination assessment, the following pollutant linkages have been identified:

- The surface Made Ground soils in the northern farmyard area contains elevated concentrations of PAHs, TPH and lead and is not suitable to remain in future garden and landscaping areas within the proposed development.
- The imported soils present in the southern part of the farmyard are contaminated with PAHs, lead and arsenic and are not suitable to remain in future garden and landscaping areas within the proposed development. These soils are also considered to be physically unsuitable to remain in future garden and landscaping areas.
- The surface material in the central manège is contaminated with lead and copper and is not suitable to remain in future garden and landscaping areas within the proposed development.
- The Made Ground Topsoil in trial pit MTP104 is contaminated with PAH and TPH and is not suitable to remain in the area of proposed open space.
- The elevated TPH and PAH concentrations within the Made Ground across the farmyard area presents a risk to the use of conventional plastic water supply pipes.

10.3. PROPOSED DEVELOPMENT

With reference to the proposed development layout included in Appendix 1, the identified contamination will affect the following areas:

- Northern farmyard - Plots 16 and 17 and the adjacent area of landscaping.
- Imported Soils - Plot 27 and an area proposed for public open space and road construction.
- Central manège - Plot 20 and an area proposed for public open space and road construction.
- Trial pit MTP104 - Public open space.

A Remediation Plan showing the location of the identified contamination on the development layout is included in Appendix 1.

10.4. OBJECTIVES

On some sites, a range of objectives may be established in response to the different nature of the risks associated with different pollutant linkages. These fall into the following three categories:

- Contamination remediation objectives must be based on the conceptual model for the site and must define the desired end condition. They can be qualitative or quantitative but must always relate to the risk assessment. Contamination related objectives are the most important of the three types of objectives and wherever possible, should drive the selection of a remediation option.
- Engineering related objectives consider the need for improvement, maintenance or modification of the engineering properties of the physical ground conditions on a site. Improvements in stability of the site or changes in ground levels may be required in order to construct the proposed development.
- Management related objectives often relate to the aspects of the remediation process itself, but also to the site after remediation has been completed. For example, the costs of a particular remediation option may exceed the budget making the project not financially viable. Programme constraints may conflict with the use of particular remediation technology. On sites where there are existing buildings or structures to be retained, remediation activities will have to be designed and carried out to avoid unnecessary disruption.

Accordingly, all three categories of objectives need to be considered in developing the strategy.

The remediation objectives for this project are as follows:

- To ensure that future residents are not exposed to contaminated soils within future garden landscaped areas and areas of public open space.
- To ensure the water supply pipes will not be adversely affected by any contamination.
- To complete the remediation works in a timely, sustainable and cost effective manner.
- To conform with current guidance regarding contamination and remediation and to gain regulatory and warranty provider approval.

10.5. REMEDIATION OPTIONS APPRAISAL

10.5.1. Introduction

Having identified the remediation objectives, an appraisal of potentially suitable remediation options must be carried out. Conceptually, remediation action will involve breaking the pollutant linkage or linkages by use of one or more of the following methods:

- Source control: technical action to either, remove or in some way modify the source(s) of the contamination for example excavation or bioremediation.
- Pathway control: technical action to reduce the ability of the contaminant source to pose a threat to receptors by inhibiting or controlling the pathway for example cover systems or gas membranes.
- Receptor control: non-technical actions or controls that alter the likelihood of receptors coming into contact with the contaminants, for example altering the site layout.

A wide range of different techniques can be used individually or in combination in order to break a pollutant linkage. The options appraisal will consider a technique's effectiveness in dealing with the contaminants of concern but will also give consideration of the wider circumstances of the site.

10.5.2. Mitigation options for risk to Human Health

In respect of the identified contamination on site, the following remedial options have been considered:

- Excavation of the contaminated Made Ground soils in their entirety to expose the underlying natural soils.
- Placing a 0.6m thick, clean soil capping layer on top of the existing Made Ground soils in proposed garden and landscaping areas. This option would result in site levels being raised. Finished floor levels will also need to be raised by a similar amount.
- Removal of the Made Ground soils to 0.6m in proposed private gardens to allow for the replacement with an appropriate thickness of a clean soil capping layer. This will maintain the same levels as present.
- Removal of the Made Ground soils to 0.3m in proposed landscaping and public open space areas to allow for the replacement with an appropriate thickness of a clean soil capping layer. This will maintain the same levels as present.

It should be noted that the contaminated soils can remain beneath future buildings and hardstanding such as roads without presenting any risk to the future residents.

An assessment of each area requiring remediation will now be completed to determine the most appropriate remediation solution.

10.5.2.1. Northern Farmyard Area - Plots 16 and 17 and the adjacent area of landscaping

The overall depth of Made Ground soils across the northern farmyard area is limited to 0.3m bgl. The placement of a 0.6m clean capping layer in this area of the site would result in a significant increase in proposed levels to accommodate this and is unlikely to be a practicable remediation solution. Given the shallow thickness of the Made Ground, the removal of the Made Ground soils in its entirety to expose the underlying natural soils would offer the most viable remediation solution.

10.5.2.2. Imported Soils - Plot 27, Public Open Space and Road Construction.

The Made Ground soils in this area of the site extend to depths more than 1.0m bgl and therefore the excavation and removal of these soils in their entirety would result in the disposal of large volumes of soils alongside significant disposal costs. This option is therefore is not considered to be a viable solution.

Where the contamination is located within areas of proposed open space, there is the potential that site levels could be raised to allow for the placement of a 0.3m capping layer, however, this is subject to the finished levels in this area.

Where these contaminated soils extend into the garden area of Plot 27, the capping thickness should be increased to 0.6m.

10.5.2.3. Central Manège - Plot 20 and majority of the area proposed for public open space and road construction.

The identified contaminated Made Ground located in the central manège area is a distinctive layer of plastic and shredded rubber tyre that extends to a depth of 0.1m bgl only. Given its potential to be re-used in a similar manège, it is considered that this should be scraped up and removed from site in its entirety.

10.5.2.4. Trial Pit MTP104

The identified contamination has been confirmed to be limited to the Made Ground Topsoil and to a depth of 0.3m bgl.

Whilst the use of capping solutions to raise levels by 0.3m may offer viable remediation solution in this area of the site, given the proposed capping would end up being a raised mound it would not be practicable solution.

Therefore, given the shallow depth and small volume of soils requiring remediation, it is considered that the most appropriate solution would be the removal of these soils in their entirety. As discussed in the waste disposal section of this report, it would be prudent to stockpile these soils and re-test them to confirm their waste classification prior to disposal.

10.5.3. Mitigation options for risk to Building Materials and Services

Based on the PAH and TPH concentrations recorded in the farmyard area only, the requirement for barrier pipes will likely be dictated by the local water supply company and therefore there is no requirement to consider any other remediation options in this regard.

The water pipe specification for the field areas should also be confirmed with the local water supply company as they sometimes insist on the same pipe specification to be used across the development, regardless of any differences in contamination.

10.6. GENERAL

10.6.1. Liaison with Regulatory Authorities

Prior to commencing with any remediation works, this investigation and strategy shall be agreed with the planning department of the Local Authority, warranty providers and the organisation undertaking the Building Control function in order to confirm that the investigation completed to date is satisfactory and that the remediation strategy is acceptable.

During the remedial works, the appointed consultant will continue to liaise directly with the regulatory authorities. They will be consulted over any deviation from the remediation strategy and their representatives will be welcome to visit the site on any occasion throughout the site works.

10.6.2. Professional Supervision

Where complete removal is recommended, it is considered that full time attendance during the works would be required by a suitably qualified Geo-environmental Consultant.

For the placement of a capping solution, it is considered that only part time supervision of the works by a suitably qualified and experienced environmental consultant will be required. The consultant will need to attend site on sufficient occasions to ensure that a sufficient thickness of uncontaminated soils have been placed for the capping solution and that barrier water pipes have been installed. The detail on the proposed capping solution is provided in the following sections.

10.6.3. Safety

The remediation and subsequent construction of the new development will fall within the remit of the Construction (Design and Management) Regulations 2015. Adherence to these regulations provides a framework for the management of health and safety during the redevelopment of the site.

10.6.4. Photographic Surveys

Photographs shall be taken throughout the remediation works and copies included within the verification report.

10.6.5. Material Management Plan

The CL:AIRE document 'Definition of Waste: Development Industry Code of Practice' (Version 2, March 2011) should be considered for the movement of soils on site. The materials movement plan may need to cover both the re-use of materials onsite and also the eventual import of topsoil/sub-soil for future gardens and landscaping.

10.7. FURTHER INVESTIGATION

In order to address the identified uncertainties, some further investigation is planned following demolition of the site buildings. This investigation will include machine excavated trial pits along with chemical testing of the excavated soils beneath the building footprint in order to confirm that the underlying soils are all in keeping with the findings of the previous investigations.

During this further investigation, the asbestos fibre contamination identified in trial pit TP112 will also be delineated through some additional pits excavated in and around this location.

It is considered likely that any identified contamination can be managed by the proposed remediation options already set out in Section 10.5.2. If not, any deviation from the remediation strategy will require regulatory approval.

10.8. PROPOSED REMEDIATION WORKS

The table below summarises the proposed remediation works at each area requiring remedial measures. The details of these works are provided on the Remediation Plan included in Appendix 1.

REMEDATION AREA	CONTAMINATION DEPTH	PROPOSED REMEDIATION WORKS
Northern farmyard	Approximately 0.3m bgl and underlain by natural soils.	Removal of the contaminated soils in their entirety to expose the underlying natural soils.
Imported soils in the southeastern farmyard area of the site	Contamination extends to depths in excess of 1.0m bgl.	Excavation and removal of contaminated soil to accommodate the proposed capping layers. - Gardens to Plot 27 - Placement of 0.6m thick capping layer. - Landscaping & Public Open space - Placement of 0.3m capping layer.
Central manège	Contaminated material extends to a depth of 0.1m bgl.	Removal of the contaminated surface materials in their entirety.
MTP104 - Surface topsoil	Contaminated soils extend to 0.3m bgl.	Removal of the contaminated soils in their entirety to expose the underlying natural soils.

10.8.1. Asbestos in Soils

During any excavation works within the Made Ground soils across the site, there is the potential that asbestos containing materials, in particular asbestos cement fragments, could be encountered.

This is a common occurrence on brownfield sites and competent contractors should have procedures for addressing the associated risks. All below ground operatives would be expected to have asbestos awareness training, so that they can identify any suspected asbestos and inform site management so it can be appropriately dealt with. The appointed groundworks contractor should employ at least one worker on site who is qualified in 'Non-Licensed Work' with asbestos.

10.8.1.1. *Soils containing Asbestos Fibres*

During the T&P investigation, Amosite asbestos fibres were identified in the Made Ground soils in TP1, but no quantification testing was completed. Subsequent BRD trial pits in this area did not identify any additional asbestos fibres.

In BRD trial pit TP112, Amosite and Chrysotile asbestos fibres were identified in the Made Ground soils at a concentration of 0.004%. This area requires further delineation to confirm the extent of the asbestos contaminated soils.

For any works involving this soil, BRD has employed the JIWG 'Decision support tool for the qualitative risk ranking of work activities involved in or exposed to asbestos in soil and Construction & Demolition materials' (Version 2, February 2017) for the sample from trial pit TP112. This confirmed that the works would be classified as 'Non-Licensed Work' with asbestos.

During the remediation of the contaminated soils in the northern farmyard area and in the location of TP112, the soil stripping works should be completed with the following control measures:

- Operatives trained in 'Non-Licensed Work' with asbestos.
- EN140 with P3 filter half mask.
- Manual/localised dust suppression.
- Localised and basic personal decontamination facilities.

10.8.1.2. Potential for Asbestos Fragments within Made Ground

If suspected asbestos fragments are encountered, works in the area should cease. If the fragments are non-licensed (e.g. cement asbestos) then a qualified worker should remove the asbestos fragments by hand picking with appropriate controls in place. Bagged collected fragments should be stored securely and eventually disposed of from site as hazardous waste. The controlled hand picking of fragments is consistent with current industry practice and, if done correctly, complies with obligations under The Control of Asbestos Regulations 2012.

Providing that the asbestos contamination within the Made Ground is found to be occasional non-licensed fragments within the soil matrix, then the procedures described above will suffice and no other treatment options need to be considered. Should any larger pockets of asbestos fragments, in particular materials with a greater risk of fibre release, be encountered then its removal may require more specialist licensed contractors and expert advice should be sought.

In addition to this, measures to protect the health and safety of site workers should always be implemented including use of appropriate personal protective equipment, education and good hygiene procedures.

10.8.2. General Procedures and Constraints for Soil Excavation

10.8.2.1. Excavation of Contaminated Soils

All contaminated soils will be excavated to stockpile ready for loading on to tipper trucks for off-site disposal. Contaminated soils will be stockpiled on plastic sheeting to avoid cross contamination of underlying soils.

Soils of differing nature will be segregated by selective excavation. Where contaminated soils appear to differ from that anticipated from the investigation data and may be uncontaminated, these soils will be stockpiled separately and samples taken for analysis.

Contaminated soil will be removed as far as is reasonably practicable. Constraints to the excavation of contamination at the site include:

- Excavation that potentially affects the stability of structures to be retained will not be undertaken i.e. excavation adjacent to the site boundaries in particular where significant changes in levels with neighbouring properties may occur.
- All excavations are to be undertaken by mechanical equipment and thus may be limited by the constraints of the plant, e.g. access of such equipment.
- Utility services to be retained and protected may limit the extent of mechanical excavation.
- The presence of boundary trees may limit the excavation by the need to protect the root systems.

10.8.2.2. *Excavation of Clean Soils*

As part of the main phase of construction works, there may be excavations undertaken for other reasons that will generate clean natural soils. Soils that have been identified as clean from investigation data can be re-used potentially as part of the clean soil remedial capping solution or as general fill within the development.

10.8.3. Placement of Clean Capping Layer

There should be sufficient soils on site to form the clean capping layers, with both uncontaminated topsoil and subsoil present that could be re-used. If soils are required to be imported to site, they will need to be proven to be suitable for a residential setting. Representative samples of all soil types must therefore be submitted for a general contamination suite, as set out in the following Verification Plan (Section 11).

It is important that the provision of the capping layer is integrated into the construction process so that once the layer is placed, it is not disturbed by subsequent construction activities e.g. digging drainage runs. The installation of the capping layer will take place after construction of the foundations and service trenches thus minimising the risk of cross contamination.

The Remediation Plan in Appendix 1 shows details of the areas requiring capping. It should be noted that the building footprints and areas of permanent hardstanding, such as, roads, access paths and patios, will not require any capping as their construction will provide a necessary barrier to the underlying soils.

10.8.3.1. *Private Gardens*

For private garden areas, the capping shall extend to an overall thickness of at least 600mm with the upper 150mm consisting of topsoil. Beneath this surface topsoil layer, the remainder of the capping should comprise 450mm of topsoil or subsoil overlying a geotextile membrane at the base to act as a separation / marker layer to prevent mixing with the underlying soils.

10.8.3.2. *Communal Landscaping / Open Space*

For areas of communal landscaping / open space / limited front garden areas, the capping shall extend to an overall thickness of at least 300mm with the upper 150mm consisting of topsoil. Beneath this surface topsoil layer, the remainder of the capping should comprise 150mm of topsoil or subsoil overlying a geotextile membrane at the base to act as a separation / marker layer to prevent mixing with the underlying soils.

10.8.4. Water Supply Pipes

The barrier water supply pipes will be fitted by specialist contractors.

10.9. PREVIOUSLY UNIDENTIFIED CONTAMINATION

Although various phases of investigations have been undertaken on the site, there remains the potential for further unidentified contaminated soil being exposed during the future construction works.

In the first instance, if any anomalous material or unexpected / unidentified contamination is encountered during course of construction, then the following “discovery strategy” process is set out below:

- The potential for uncovering potential contamination / anomalous materials should be communicated as part of the general construction site induction undertaken to all site workers / operatives.
- Any “discovery” is to be reported to the Site Manager immediately and works at that location are to halt. The Site Manager / Client’s representative is then to consult with BRD in the first instance. Depending on the type, nature and extent of the discovery, it may be necessary to continue to halt works in that location. This shall be reviewed on a case specific basis and in conjunction with consultation with the Client.
- A BRD Consultant shall attend the site to record the location, extent and nature of the discovery and, where necessary, will undertake appropriate sampling and/or supervision of any immediate remedial works.
- If warranted, BRD shall discuss the “discovery” with the Local Authority and if considered necessary, arrange to meet their representative on site. It should be noted that some minor / straightforward contamination finds will just be dealt with without any regulatory involvement, e.g. removal of a pocket of some asbestos fragments or ashy material, etc.
- Where more significant remediation is required, approval will be sought from the Local Authority.
- All the remediation / verification works to address the discovery will be documented within the main remediation verification report to be produced at the completion of the works.

This discovery strategy will be retained on site by the Site Manager and it is their responsibility to follow it and act on any potentially anomalous material or unexpected / unidentified contamination encountered during the course of the development.

11. VERIFICATION PLAN

11.1. INTRODUCTION

The verification plan for the remediation works will be completed in a phased approach as and when the remedial works are completed. The details of the proposed verification works are described in the following sections.

11.2. REMOVAL OF CONTAMINATED SOILS

Where contaminated soils are to be removed in their entirety, the removal should be verified by an experienced Geo-Environmental Consultant to ensure that the works have been completed in accordance with this remediation strategy.

In the location of the northern farmyard, verification will be completed on a visual basis only as the Made Ground is distinctive and the remedial excavation should result in the natural clay soils being exposed at the base and faces of the excavation.

In the location of the central manège, this material is again distinctive and its removal can be verified on a visual basis only.

In the location of MTP104, verification of the removal of the contaminated topsoil will require confirmatory testing of the base and faces of the resultant excavation. The soils should be analysed for both TPH and PAH and the results assessed against the generic assessment criteria detailed in section 7.1 of this report to confirm removal of the contamination.

Copies of waste transfer tickets and disposal records for the contaminated soils will be provided for inclusion within the verification report.

11.3. REMOVAL OF MADE GROUND TO ACCOMMODATE CAPPING

In areas requiring capping, the remediation solution is the placement of the capping layer itself rather than the removal of the Made Ground to accommodate it. There is therefore no requirement to supervise this element of the works.

Copies of waste transfer tickets and disposal records for the contaminated soils will be provided for inclusion within the verification report.

11.4. PLACEMENT OF CAPPING LAYER

The confirmed placement of the capping layer to the required thickness and makeup will be verified by a Geo-Environmental Consultant through the excavation of hand dug inspection pits undertaken through the placed soils. Either 600mm in private garden areas or 300mm in landscaping areas, of clean soil placed on a geotextile membrane will be confirmed. If underlying natural clay soils are exposed then there is no requirement for the full capping thickness as the Made Ground is confirmed to have been removed.

The purpose of the geotextile membrane at the base of the capping layer is to act as a separation / marker layer to prevent the mixing of the placed capping soils with the underlying soils. It does not need to provide any further level of protection nor does it need to display any warning signs of the like.

11.5. TESTING OF IMPORTED TOPSOIL AND SUB-SOIL

It is unlikely that any soils will be required to be imported to site to from the clean capping layers as sufficient soils will be generated from uncontaminated areas on site.

However, if needed then any imported topsoil or subsoil imported to site will require testing for the following suite to confirm that they are suitable for use in a residential garden setting.

CONTAMINANT	UNITS	ASSESSMENT CRITERIA
Arsenic	mg/kg	37
Cadmium	mg/kg	11
Chromium (hexavalent)	mg/kg	6
Chromium (total)	mg/kg	910
Copper	mg/kg	2,400
Lead	mg/kg	200
Mercury	mg/kg	11
Nickel	mg/kg	180
Selenium	mg/kg	250
Zinc	mg/kg	3,700
pH	Units	<5-10>
Naphthalene	mg/kg	2.3
Acenaphthylene	mg/kg	170
Acenaphthene	mg/kg	210
Fluorene	mg/kg	170
Phenanthrene	mg/kg	95
Anthracene	mg/kg	2,400
Fluoranthene	mg/kg	280
Pyrene	mg/kg	620
Benzo(a)anthracene	mg/kg	7.2
Chrysene	mg/kg	15
Benzo(b)fluoranthene	mg/kg	2.6
Benzo(k)fluoranthene	mg/kg	77
Benzo(a)pyrene	mg/kg	2.2
Indeno(1,2,3-cd)pyrene	mg/kg	27
Dibenzo(a,h)anthracene	mg/kg	0.24
Benzo(ghi)perylene	mg/kg	320

The testing rate should be at a minimum of one test per 100m³ of topsoil/subsoil and at least three results should be provided for each soil source. Test results should ideally be provided by the soil supplier to provide confidence that the source is uncontaminated. In any case samples will be taken in-situ of the placed soil on site by the attending geo-environmental consultant. Sample density may need to be increased depending upon the consistency of the material and nature of the source. Alternatively, if a well-defined greenfield source is adopted then the sample density may be decreased.

It is not proposed to undertake TPH testing on imported soils as the source will likely be greenfield or a reputable topsoil supplier and as such petroleum hydrocarbons would not be expected.

If topsoil is imported from another development site, then this should be in accordance with a U1 waste exemption registered with the Environment Agency or a Material Movement Plan developed in accordance with “The Definition of Waste: Development Industry Code of Practice” Version 2, Contaminated Land: Applications in Real Environments (CL:AIRE), March 2011.

It should also be noted that any imported granular materials, such as crushed concrete or aggregate, do not require any verification sampling from a human health perspective.

11.6. WATER SUPPLY PIPES

Verification of the installation of barrier water supply pipes will be via the local water supply company, however, will also be via visual confirmation and supporting photographic evidence during inspection visits undertaken by the BRD Geo-Environmental Consultant.

11.7. VERIFICATION REPORT

Upon completion of the remediation works, BRD shall prepare a remediation verification report, including commentary on the following:

- Evidence of the removal of the contaminated soils.
- Evidence of suitable capping thickness within all of the required areas.
- Details on the contaminated Made Ground material removal from site and copies of waste tickets for soils removed from site.
- Details on any deviation from the remediation strategy.
- Confirmation of the suitability of any imported soils.
- Confirmation on protective water pipe installation.
- Photographic records.

The verification report will conclude with a statement confirming the site is fit for its intended use in respect of contamination.

12. HEALTH AND SAFETY FILE INFORMATION

12.1. INTRODUCTION

The aim of the following sections is to present pertinent Health and Safety information that has arisen from the current investigation/survey works discussed in this report. The aim is to identify health and safety controls that may be necessary during any subsequent maintenance, refurbishment, demolition or construction works. The information is not exhaustive and stems only from the aspects identified within the scope of the works undertaken by BRD.

Where BRD has been appointed as a Principal Contractor, then this information shall form the Health and Safety Files as required by the Construction Design and Management (CDM) Regulations 2015.

Reports are always forwarded to the Client and they shall be responsible for ensuring this safety information is disseminated to those who need it.

The works undertaken by BRD are detailed in the previous sections of this report.

12.2. HAZARDS

12.2.1. Contamination

Whilst contamination assessment was not included in the scope of the investigation, no olfactory or visual evidence of significant contamination was encountered during the works.

Contaminated soils are present at the site within the surface Made Ground. Construction workers will be at risk where they are exposed to these soils and groundwater, for example during demolition, utility services work and foundation construction. During the redevelopment of the site, the presence of contaminated soils should be considered within health and safety plans. Measures to protect the health and safety of site workers should be implemented including use of appropriate personal protective equipment, education and good hygiene procedures.

If during the redevelopment any anomalous material is encountered that is different to the conditions revealed by this investigation, then expert environmental advice should be sought. Section 10.9 of this report sets out a discovery strategy.

12.2.2. Asbestos

12.2.2.1. *Buildings*

In accordance with Health and Safety Executive (HSE) guidance, a 'Refurbishment Demolition Survey' (RDS) should be undertaken to identify whether or not asbestos containing materials are present in the existing structure(s) prior to demolition or refurbishment. The results of the survey should then be used to plan for the safe management, removal and disposal of asbestos containing materials from the existing buildings and infrastructure should such materials be present.

12.2.2.2. *Soils*

Asbestos fibres have been identified in the Made Ground soils on site and there is the potential for further asbestos containing materials to be encountered during the demolition and redevelopment of the site.

Details on the proposed management of the asbestos in soils is detailed in Section 10.8.1 of this report and should be referred to for further details.

12.2.3. Giant Hogweed

Giant Hogweed has been identified on site and no further works should be completed in the affected areas until a Giant Hogweed Management Plan has been developed and the recommendations within it actioned.

12.2.4. Other Issues

During the BRD works the following safety hazards were identified:

- There is evidence that the site is subject to trespass. Measures to secure the site should be taken so that trespassers are not at risk from the existing state of the site.
- There are multiple slip, trip and fall hazards around the site.

12.3. EXISTING STRUCTURES

BRD recommend that advice on existing structures is gained from a qualified and experienced Building Surveyor or Structural Engineer.

12.4. HAZARDOUS MATERIALS

BRD did not construct anything with hazardous materials.

Any soils to be imported to the site, in particular topsoil, should be tested to confirm their suitability in the development.

12.5. UTILITY SERVICES

The utility services plans held by the Client should be referred to.

REPORT SPECIFIC REFERENCES

- British Geological Survey sheet 302 “Horsham” Solid and Drift edition (1:50,000) published 1972.
- ‘Desk Study and Ground Investigation Report - Millfields Farm, Horsham Road, Rusper’ T&P Regeneration Ltd, 2015Feb_MILL1356_DS&GI Report, Issue 1_V1, February 2025.
- Geo-Environmental Assessment - Millfields Farm, Rusper’ IDOM, GEA-22623-23-405, Rev C, Dated 24/04/2024.

SUPPORTING INFORMATION

GROUND INVESTIGATION

Exploratory holes are logged by an experienced Geo-Environmental Consultant in general accordance with 'Code of practice for site investigations' BS5930:2015+A1:2020 (BSi, 2020). Soil samples for chemical and geotechnical analysis are taken from the exploratory holes at intervals dictated by the nature of the soils and the objectives of the investigation.

Where stated on the logs of inspection pits, trial pits or boreholes (where insitu testing has not been undertaken), the relative density of coarse (sand and gravel) soils is tentative only. Such assessments of density are on the basis of visual inspection only taking into consideration such factors as drilling rates, stability of pit side walls, appearance and behaviour under excavation.

Where Chalk strata is encountered it is logged and graded in general accordance with CIRIA guidance 'C574 - Engineering in Chalk' (CIRIA, 2002). It should be recognised that where percussive drilling methods are employed, the structure of the Chalk is destroyed and therefore the grading stated on such logs is either tentative or absent where it is not possible to assess the grade.

Hand Dug Inspection Pits

Hand tools are used to forward shallow inspection pits as a cost effective method of describing and sampling near surface soils. The technique is also used where exposure of existing footings is required. The depth reached by such techniques is a function of the nature of the ground and generally does not exceed 1.5m

Trial Pits

Mechanically excavated trial pits allow detailed inspection of near surface ground due to the large volume of soil exposed. A wheeled backhoe loader is the usual machine for digging trial pits that are typically 3 to 4.5m deep, 0.5m wide and 3m long. It is worth noting that due to the disturbance of the ground, this technique will leave visible pits scars, localised surface disturbance and may leave a mound of soils that can settle over time.

Windowless Sampling Boreholes

This type of borehole is formed by a small tracked dynamic percussion drilling rig with samples retrieved in thin plastic liners within the narrow diameter steel sampling tubes. Borehole depths of up to 5m are typical, but in exceptional circumstances up to 15m depth can be achieved. This is the smallest type of rig that is capable of undertaking Standard Penetration Tests (SPTs).

Hand Held Window Sampling

Hand held window sampling is a useful method of drilling narrow diameter boreholes particularly where access is difficult. Hand held mechanical percussive hammers are used to drive the sampling tube into the ground. The soil samples are collected within the hollow metal sampling tubes and inspected via the open window along one side. Window sampling boreholes can be forwarded to depths of 3m to 6m depending upon ground conditions.

Cable Percussive Boreholes

This form of drilling involves repetitive dropping of a tube into the soil under its own weight from a tripod support. The sample is obtained from the clay cutter head in fine soils or a bailer for wet granular soils. As the borehole progresses SPTs can be undertaken and relatively

undisturbed samples can be obtained. Typically these boreholes are 15 to 25m deep, but depths of double that can be achieved in soils, but only thin weak rock layers can be penetrated.

Rotary Boreholes

Where competent rock is required to be drilled then rotary drilling techniques are required. The drilling rigs can vary in size from small tracked units to larger units mounted on four wheel drive trucks. Rotary open hole drilling techniques break the rock into small fragments and so recovery of any samples is limited. In contrast, rotary coring generally retrieves excellent samples. Some rigs also allow dynamically driven windowless sampling to be undertaken through soil layers. There are no practical limits to the depths that this drilling method can achieve.

Dynamic Probing

Dynamic probing comprises a sectional rod with a sacrificial cone at the base of slightly larger diameter than the rod. The rod is driven into the ground by a constant mass falling through a set distance. The number of blows required to forward the rod per 100mm is then recorded and presented in a graph of N_{10} values. The standard applicable to dynamic probing is 'BS EN ISO 22476-2:2005 Incorporating corrigendum no. 1, Geotechnical investigation and testing – Field testing – Part 2: Dynamic probing' (BSi, 2007).

Static Cone Penetration Tests

Cone Penetration Tests (CPT) consist of pushing a conical 60° cone into the ground at a constant rate and recording the force required to do this. Sensors in the cone record other information and this data can be correlated to a number of different geotechnical parameters.

Dynamic Penetrometer

The Transport Research Laboratory Dynamic Cone Penetrometer (TRL DCP) uses an 8 kg hammer dropping through a height of 575mm to drive a 60° cone of 20mm maximum diameter into the ground. The depth driven either per blow or per several blows is recorded. The strength of each of the soil layer encountered is then calculated by converting the penetration rate into an approximate California Bearing Ratio (CBR) value employing the correlation proposed by TRL.

Light Weight Deflectometer

The falling Light Weight Deflectometer (LWD) test is a dynamic plate load test. It is a surface testing instrument and does not involve any penetration of the underlying soils. The plate used is 300mm diameter and so the results achieved are effectively an average of the ~450mm to 600mm soils beneath the plate. The LWD result can be correlated to a California Bearing Ratio (CBR) value and BRD's experience is that these results compare well with other insitu CBR test methods.

Gas Monitoring

Gas monitoring is undertaken with a portable gas monitor for Oxygen, Methane, Carbon Dioxide, Hydrogen Sulphide and Carbon Monoxide together with recording of atmospheric pressure and any flow rate.

Vapour Monitoring

Headspace tests and monitoring for Volatile Organic Compounds (VOC) or Semi Volatile Organic Compounds (SVOC) is undertaken using a Photo Ionisation Detector (PID). The MiniRAE models used have a 10.6 eV lamp calibrated for isobutylene. The PID is useful tool to indicate the presence of a wide range of volatile compounds, but only provides semi-quantitative data as different compounds provide a different response and thus the reading is not a true reflection of the actual concentration present.

Low PID readings can be recorded in natural uncontaminated organic soils or even as a result of atmospheric pollution. It is generally accepted by consultants and regulators that recorded values in excess 50 parts per million (ppm) represents the presence of organic compound pollutants and in excess of 100 ppm such contamination may be significant.

The headspace test procedure involves the collection of a sample of suspected contaminated soils and placing within a sample bag. A tight seal to the bag is formed with a similar volume of air trapped to that of the soil and the sample is left for fifteen minutes to allow volatilisation of any contaminants. The bag is then pierced by, and sealed around, the sample probe of the PID and a reading taken.

Borehole well monitoring is undertaken by connecting the PID directly to the gas tap on the monitoring well installation.

Groundwater Level Monitoring

Groundwater levels are recorded with an electronic dip meter that has a detector end that is lowered into the borehole well. An audible signal is made when water is reached and the depth recorded from the graduated tape used to lower the detector. Where there is potential for a separate Light Non Aqueous Phase Liquid (LNAPL) to be present floating on the groundwater an oil/water interface meter is used in preference to a conventional dip meter so that any such floating product can be detected.

Geotechnical Sampling

BRD schedule a range of geotechnical testing as appropriate to the identified ground conditions, available budget and the proposed development. Different types of soil samples are obtained as appropriate to the ground conditions and planned testing.

SAMPLE TYPE	LOG SYMBOL	DESCRIPTION
Disturbed	D	Small disturbed soil samples of about 1 to 2 kg are collected in plastic bags.
Bulk	B	Large disturbed bulk samples up to about 20 to 30 kg are collected in plastic bags
Undisturbed	U	'Undisturbed' samples generally collected in plastic or metal tubes within cable percussive boreholes of 100mm diameter for samples of fine soils of firm to stiff consistency. Can also be representative of samples taken by cutting plastic sample liners from windowless sampling drilling methods. It is recognised that such samples do not generally meet Eurocode sample quality requirements for the tests commonly employed. However, given the wealth of experience with these sampling methods this continues to be a common approach in United Kingdom practice particularly for less sensitive developments where more expensive sampling techniques are not economically justifiable.
Undisturbed	UT	A thin walled steel sampler developed by Archway Engineering called a UT100 in an attempt to gain better quality samples of soft to firm fine soils when using cable percussive drilling methods.

Contamination Sampling

BRD schedule contamination testing as appropriate to the ground conditions, available budget, potential contaminants and the proposed development. Samples are collected in single use laboratory supplied containers.

Soil samples are retrieved in plastic containers and/or amber glass jars with a lined plastic cap. Contamination samples are indicated by a 'J' on exploratory hole logs.

Water samples are collected in plastic bottles and/or amber glass jars with a lined plastic cap then placed in cool boxes together with freezer packs. Water samples are indicated by a 'W' on exploratory hole records, but generally such samples are not tested as testing from dedicated monitoring wells is preferred for sample quality reasons.

Samples retrieved from the exploratory holes are dispatched to the laboratory by overnight courier. Where samples cannot be transported directly from site they are temporarily stored in the BRD dedicated sample storage facility which includes refrigeration where necessary. The individual accreditation of the test methods is detailed in the laboratory test report.

GEOTECHNICAL ASSESSMENT

Under Eurocode 7 (EC7) the following risk ranking is applied to geotechnical projects:

GEOTECHNICAL CATEGORY	DESCRIPTION
1	<i>Small and relatively simple structures for which it is possible to ensure that the fundamental requirements will be satisfied on the basis of experience and qualitative geotechnical investigations with negligible risk. For example, straightforward ground conditions, local experience, no excavation below the water table unless this will be straight forward.</i>
2	<i>Conventional types of structures and foundations. No difficult soil or loading conditions. Quantitative geotechnical data and laboratory testing. Routine procedures for field and laboratory testing. Conventional structures and no exceptional geotechnical risk. For example, spread, raft and piled foundations, retaining walls, bridge piers and abutments, embankments, ground anchors, tunnels and excavations.</i>
3	<i>Those structures not in Categories 1 and 2 such as very large or unusual structures, structures involving abnormal risks, or unusual or exceptionally difficult ground or loading conditions. Structures in highly seismic areas. Structures in areas of probable site instability or persistent ground movements that require separate investigation or special measures.</i>

GEOTECHNICAL PARAMETERS

Soakage Tests

Soakage tests comprise the filling of a test pit with water and recording the time taken for the water to drain away. The tests are undertaken in general accordance with 'Digest DG 365: Soakaway design' (BRE, 2016). The test pits are usually gravel filled for safety with a slotted vertical pipe through which water observations are made. Water is generally supplied by a tanker to allow fast filling of the pits with water. Compliant tests are filled and allowed to drain near empty three times.

Standard Penetration Tests

The standard penetration test (SPT) determines the resistance of soils at the base of a borehole to the dynamic penetration of a split barrel sampler and the recovering of disturbed samples for identification purposes. In gravelly soils and some soft rocks a solid cone is used in preference to the sampler.

The basis of the test consists in driving a sampler by dropping a hammer of 63.5 kg mass on from a height of 760 mm. The number of blows (N value) necessary to achieve a penetration of the sampler of 300 mm is recorded. The test is described in 'Geotechnical investigation and testing – Field testing – Part 3: Standard penetration test - BS EN ISO 22476-3:2005 Incorporating corrigendum no. 1' (BSi, 2007).

The uncorrected N values of the SPT tests are recorded upon the borehole logs together with a record of blows for each 75mm test portion including the seating blows. Where the full test depth cannot be achieved due to refusal on hard stratum, the number of blows and the distance achieved is recorded and the N value given as >50. The abbreviation SPT(c) is used on the logs indicates that the test was performed with a solid cone rather than a split spoon sampler.

It is necessary to apply a correction to the N values to account for the effects of energy delivery using the equation: $N_{60} = \frac{E_r}{60} N$ where E_r is the energy ratio of the specific test equipment.

In the case of tests in sand, for the effects of overburden and rod length the equation is modified to $N_{60} = \frac{E_r}{60} \times \lambda \times C_N \times N$ where λ is the correction factor for energy losses due to the rod length and C_N is the correction factor for vertical stress due to overburden of the soil.

Sulphate

In order to compare the laboratory soil test results with 'Concrete in aggressive ground. BRE Special Digest 1: 2005' (BRE, 2005) laboratory results are converted to SO_4 mg/l. Laboratory results expressed as SO_3 g/l and are multiplied by a factor of 1200 to express the results as SO_4 mg/l.

Index Property Tests

In accordance with National House Building Council (NHBC) 'Standards Chapter 4.2 - Building near trees', the laboratory plasticity indexes are assessed against their volume change potential. The Modified Plasticity Index is defined as the Plasticity Index of the soil multiplied by the percentage of particles with a nominal diameter of less than 425µm. Whilst the NHBC Standards were developed for residential buildings, the advice is equally applicable to a large number of other types of low rise structures.

Hand Shear Vane

The undrained shear strength of the fine (i.e. clay) soils at the site can be established using hand shear vane apparatus. Usually three readings are taken at every depth tested and the uncorrected results recorded on the exploratory point log. Shear vane readings from depths below 1m depth in trial pits are from tests performed on excavated soil. In accordance with Eurocode 7 – Geotechnical design – Part 2: Ground investigation and testing EN 1997-2:2007 the results should be corrected. BRD employ only simple correction methods as the more complex correction methodologies imply undue accuracy to a test that has distinct disadvantages and limitations.

Pocket Penetrometers

The Pocket Penetrometer is a lightweight instrument for use by field personnel to check visual classification of soils. It is a simple test and there is inherent uncertainty related to the small volume of soil being tested and so the results should be used with appropriate caution. Pocket penetrometers are calibrated in terms of unconfined compressive strength and once converted to undrained shear strength (divide by two) the results are further reduced by a factor of 1.5 - 2.0 as the device tends to overestimate strengths.

<i>Instrument Reading (uncompressive strength in kg/cm²)</i>	<i>Indicative Undrained Shear Strength (kN/m²)</i>	<i>Indicative Consistency</i>	<i>Indicative strength</i>
1.0	25 - 33	Soft	Low
1.5	38 - 50	Soft to firm	Low to medium
2.0	50 - 67	Firm	Medium
2.5	63 - 83	Firm to stiff	Medium to high
3.5	88 - 116	Stiff	High
4.5	113 - 150	Stiff to very stiff	High to very high

CONTAMINATION ASSESSMENT METHODOLOGY

UK Policy

The UK Government's policy in relation to land affected by historic contamination is based on a 'suitable for use' approach. The approach recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land and a wide range of other factors, such as the underlying geology of the site. Contamination risks therefore need to be assessed on a site-by-site basis. The 'suitable for use' approach limits requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to either the current use or future use of the land.

The three main drivers for contamination assessment and remediation are:

- *Voluntary action.*
- *Development as part of the planning regime.*
- *Regulatory action to mitigate unacceptable risks e.g. Part 2A of the Environmental Protection Act 1990.*

Contaminant Linkages

For a contamination risk to exist there must be a 'contaminant linkage' from the source (contaminant or pollutant) via a pathway (the route from contaminant to receptor) to a receptor (the entity that could be harmed). The absence of a source, pathway or receptor breaks the contaminant linkage and therefore no contamination risk exists.

Contamination is typically present at a site (in the ground and/or in the underlying groundwater) as a result of a historic or current industrial use, usually as a result of leaks, spills or disposal of residues, wastes and excess raw materials from the industrial processes. Contamination may also be present due to:

- *The deliberate application of chemicals e.g. the spraying of herbicide/pesticide.*
- *Migration of pollutants from adjacent land.*
- *Naturally occurring processes e.g. elevated concentrations of particular heavy metals associated with specific geological strata.*
- *Atmospheric deposition.*

Conceptual Site Model

The conceptual site model can be defined as a textual or graphical representation of the identified contaminant linkages for a given site. The model forms the basis for designing the investigation as the aim will be to target all of the potential contaminant linkages to determine, through the subsequent phases of risk assessment, whether or not they pose an actual risk.

It is important that the conceptual site model is updated with new information as the various investigation, risk assessment and remediation works are completed.

Technical Guidance

The technical and legal framework for contamination assessment is complex. The process adopted through this report for assessing contamination risks is in general accordance with the following guidance, as listed below:

- 'Investigation of Potentially Contaminated Sites - Code of Practice - BS 10175:2011+A2:2017', (BSi, 2017).
- Land Contamination Risk Management (LCRM) website, (Environment Agency, 2023).
- 'Guidance for the safe development of housing on land affected by contamination - R&D66: 2008', (NHBC/Environment Agency, 2008).

Land Contamination Risk Management: Stage 1 Risk Assessment

In line with the technical guidance, the contamination risk assessment follows a series of steps for each tier of risk assessment:

- *Identify the hazard* - A preliminary stage of risk assessment concerned with identifying and characterising the contamination source that may be associated with a particular site.
- *Assess the hazard* - Use a source-pathway-receptor (S-P-R) linkage approach to find out if there is the potential for unacceptable risk.
- *Estimate the risk* - predict what degree of harm or pollution might result and how likely it is to occur by using the tiered approach to risk assessment.
- *Evaluate the risk* - Decide whether a risk is unacceptable, taking into account the nature and scale of the risk estimates, any uncertainties associated with the assessment and the broad costs and benefits of taking action to mitigate risks.

The separate staged tiers of risk assessment are as follows:

TIER	DESCRIPTION
TIER 1: PRELIMINARY RISK ASSESSMENT	Generally limited to desk based research and a site walkover survey (site reconnaissance) to develop an initial conceptual site model and identify what risks, if any, are likely to be presented by the site. Occasionally it may include assessment of a limited exploratory ground investigation or previous investigation data.
TIER 2: GENERIC QUANTITATIVE RISK ASSESSMENT	This phase is concerned with establishing whether contamination is present, usually through intrusive ground investigation, and then evaluating the magnitude of the associated risks with test results compared to generic assessment criteria.
TIER 3: DETAILED QUANTITATIVE RISK ASSESSMENT	To further evaluate risks the development of site-specific assessment criteria are values for concentrations of contaminants derived using risk estimation models

Risk Classification

The objective of risk assessment is to identify the nature and magnitude of the potential risks and should be based on a consideration of both:

- The likelihood/probability of an event [taking into account both the presence of the hazard and receptor and the integrity of the pathway].
- The severity of the potential consequence [taking into account both the potential severity of the hazard and the sensitivity of the receptor].

There is a need for a logical, transparent and repeatable system in defining the categories of severity of consequence and likelihood as well as for the risk itself and therefore the following risk rating matrix is employed:

		SEVERITY OF CONSEQUENCE			
		SEVERE	MEDIUM	MILD	MINOR
PROBABILITY	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	Negligible Risk
	UNLIKELY	Moderate/Low Risk	Low Risk	Negligible Risk	Negligible Risk

These risk classifications are defined as follows:

- **Very High Risk** - There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
- **High Risk** - Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
- **Moderate Risk** - It is possible that without appropriate remediation action harm could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.
- **Low Risk** - It is possible that harm could arise to a designated receptor from an identified hazard. It is likely that, at worst if any harm was realised any effects would be mild.
- **Negligible Risk** - The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

This risk assessment matrix and classification system is based on guidance produced by Department for Environment, Food and Rural Affairs (Defra) and the Environment Agency in connection with contaminated land assessment.

TIER 2 RISK ESTIMATION - SOILS

Introduction to Soil Human Health Generic Assessment Criteria (GAC)

The Environment Agency (EA) and Department of Environment Food and Rural Affairs (DEFRA) had previously issued revised guidance following the consultation about the DEFRA publication 'Assessing risks from land contamination - a proportionate approach. Soil Guideline Values: the Way Forward'. This resulted in a revised version of the Contaminated Land Exposure Model (CLEA) model (version 1.06) and a few of the previously published Soil Guideline Values (SGVs) were revised.

The main legislative driver for dealing with historical land affected by contamination is Part 2A of the Environmental Protection Act 1990. Revised Statutory Guidance to support Part 2A was published in April 2012. This Guidance introduced a new four-category system for classifying land under Part 2A for cases of a Significant Possibility of Significant Harm to human health, 1 where Category 1 includes land where the level of risk is clearly unacceptable and Category 4 includes land where the level of risk posed is acceptably low. The impact assessment for the new Statutory Guidance stated "The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land". The C4SLs are still derived using the CLEA model, but adopt a slightly different approach to toxicological assessment and exposure modelling.

In March 2014, the outcome of 'SP1010 - Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - Final Project Report' (CL:AIRE) was published. Due to slightly ambiguous wording within this report, Lord de Mauley, Parliamentary Under Secretary, DEFRA wrote to all local authorities on 3 September 2014 to confirm that the published C4SLs were final and that they can be used in risk assessment undertaken under the planning regime.

Whilst there are proposals for the industry to develop C4SLs for other contaminants, these have only produced limited results to date. BRD do not believe that C4SLs could be developed by a single organisation with sufficient confidence. BRD has therefore employed other, more conservative guidance based on the CLEA model (detailed below) within this assessment for compounds where C4SLs are not available. However, it should be noted that the results of this investigation may need to be reinterpreted as new C4SLs become available.

Due to the limited number of published C4SL values at this time, the Chartered Institute of Environmental health (CIEH) and Land Quality Management Ltd (LQM) have produced Generic Assessment Criteria (GAC) known as Suitable for Use Levels (S4ULs), for use in contaminated land human health risk assessment. These S4ULs (2014) have been derived for a large number of substances using the current CLEA model and are therefore consistent with current guidance. They also incorporate the revised exposure parameters as adopted by the C4SL programme, but have not adopted the revised toxicological approach adopted by the C4SLs and so remain a more conservative assessment criteria. The substances for which SGVs were previously published have also been revised as new S4ULs in light of the new exposure parameters proposed by the C4SL programme, and therefore effectively replace the existing SGVs.

In addition, in December 2009, other GAC for less common substances were produced by the Environmental Industries Commission (EIC), The Association of Geotechnical and Geoenvironmental Specialists (AGS) and Contaminated Land: Applications in Real Environments (CL:AIRE) using the CLEA model. These are referred to as the EIC/AGS/CLAIRE GAC.

In summary, C4SLs have been used where these are available. For those substances where C4SLs have yet to be issued, then the S4ULs have been adopted or in some cases, the EIC/AGS/CLAIRE GAC. All of the previously produced SGVs have now either been withdrawn, or superseded by the respective C4SLs or S4ULs.

The only exception to this approach is the PAH compound benzo(a)pyrene (BaP) where a C4SL guideline value has been produced, whereas BRD has adopted the S4UL value. The C4SL for BaP relates to its use as a surrogate marker compound representing all of the genotoxic PAH compounds as a mixture, rather than this individual compound. BRD has therefore adopted the compound specific S4UL value as the initial screening value, for consistency with the other PAH compounds before then employing the C4SL is necessary.

It should be noted that unless otherwise stated, all the assessment criteria adopted within this report have been derived based on a sandy loam soil at pH 7 and the values quoted are for a conservative soil organic matter content of 1% where applicable (i.e. organic contaminants).

Human Health - Soil Generic Assessment Criteria

The results of the soils analysis have been compared to generic assessment criteria for the default exposure scenarios comprising either residential land with plant uptake, residential land without plant uptake, or commercial/industrial land use. The criteria values selected are listed in the table below and full details on the source are referred to above. Where deemed appropriate, the results have also been assessed with reference to the required statistical tests presented within CL:AIRE Professional Guidance: 'Comparing Soil Contamination Data with a Critical Concentration'.

ANALYSIS	GENERIC ASSESSMENT CRITERIA (mg/kg unless stated)			SOURCE
	RESIDENTIAL WITH PLANT UPTAKE	RESIDENTIAL WITHOUT PLANT UPTAKE	COMMERCIAL / INDUSTRIAL	
Arsenic	37	40	640	C4SL
Cadmium	22	150	410	
Chromium (total) ⁵	910	910	8,600	S4UL
Chromium VI	21	21	49	C4SL
Lead	200	310	2,330	
Mercury*	11	15	320	S4UL
Selenium	250	430	12,000	
Nickel	180	180	980	
Copper	2400	7,100	68,000	
Zinc	3,700	40,000	730,000	
pH	<5 - 10> units			Professional judgement
Naphthalene	2.3	2.3	190	S4UL
Acenaphthylene	170	2,900	83,000	
Acenaphthene	210	3,000	84,000	
Fluorene	170	2,800	63,000	
Phenanthrene	95	1,300	22,000	
Anthracene	2,400	31,000	520,000	
Fluoranthene	280	1,500	23,000	
Pyrene	620	3,700	54,000	
Benzo(a)anthracene	7.2	11	170	
Chrysene	15	30	350	
Benzo(b)fluoranthene	2.6	3.9	44	
Benzo(k)fluoranthene	77	110	1,200	
Benzo(a)pyrene	2.2	3.2	35	
Indeno(1,2,3-cd)pyrene	27	45	500	
Dibenzo(a,h)anthracene	0.24	0.31	3.5	S4UL
Benzo(ghi)perylene	320	360	3,900	
TPH Aliphatic C5-C6	42	42	3,200	
TPH Aliphatic C6-C8	100	100	7,800	
TPH Aliphatic C8-C10	27	27	2,000	
TPH Aliphatic C10-C12	130	130	9,700	
TPH Aliphatic C12-C16	1,100	1,100	59,000	
TPH Aliphatic C16-C35	65,000	65,000	1,600,000	

ANALYSIS	GENERIC ASSESSMENT CRITERIA (mg/kg unless stated)			SOURCE
	RESIDENTIAL WITH PLANT UPTAKE	RESIDENTIAL WITHOUT PLANT UPTAKE	COMMERCIAL / INDUSTRIAL	
TPH Aliphatic C35-C44	65,000	65,000	1,600,000	
TPH Aromatic C5-C7	70	370	26,000	
TPH Aromatic C7-C8	130	860	56,000	
TPH Aromatic C8-C10	34	47	3,500	
TPH Aromatic C10-C12	74	250	16,000	
TPH Aromatic C12-C16	140	1,800	36,000	
TPH Aromatic C16-C21	260	1,900	28,000	
TPH Aromatic C21-C35	1,100	1,900	28,000	
TPH Aromatic C35-C44	1,100	1,900	28,000	
Benzene	0.87	3.3	98	C4SL
Toluene	130	880	56,000	S4UL
Ethylbenzene	47	83	5,700	
Xylene [^]	56	79	5,900	
MTBE	49	73	7,900	EIC/AGS/CL:AIRE GAC

Notes:

* The S4UL for methyl mercury has been adopted as the worst case mercury compound as generally there is no desk study evidence to suggest the potential for elemental mercury on the majority of sites.

[^] The lowest S4UL of either p-xylene, o-xylene or m-xylene has been adopted for each land use as a conservative measure.

⁵ S4UL for Chromium III adopted, as in the absence of Chromium VI it is likely that all of the chromium will be in this form as these are the two most common and stable forms of chromium in the soil environment.

Where no GAC is available, any concentrations exceeding the laboratory limit of detection are identified and discussed in more detail.

Water Environment - Soil Generic Assessment Criteria

There are no UK published Generic Assessment Criteria for soil test results in respect of the risk to the water environment and therefore risk estimation is on the basis of the professional judgement and experience of BRD to employ values that are a reasonable concentration above which concern for water resources is valid.

The Total PAH GAC employed is the sum of the 16No. priority PAH compounds regularly tested for in contaminated land analysis (i.e. US EPA 16PAHs). BRD employ a soil screening based upon the total PAH limit for 'inert waste' of 100mg/kg. The rationale is based on PAHs are recognised to be generally of low solubility and the risk to the water environment is correspondingly low.

In respect of Total Petroleum Hydrocarbons, BRD employ a value of 500 mg/kg as a screening value in comparison to the sum of the component aliphatic and aromatic TPH carbon bands. The employed soil screening value is based upon:

- In common with some other consultants, the professional judgement and experience of BRD suggests that this value is a reasonable concentration above which concern for water resources is valid. The rationale is based on the fact that lower concentrations of fuel based contaminants are more likely to naturally degrade than migrate any great distance.
- BRD is aware of regional Environment Agency groundwater and contaminated land teams historically employing 500 mg/kg as a screening value for considering whether or not TPH could represent a risk to water resources.
- The value mirrors the mineral oil Waste Acceptance Criteria limits for what is considered 'inert waste'.

Should elevated contaminants that pose a potential risk to the water environment be identified then site specific assessment criteria should be developed.

Building Materials and Services - Soil Generic Assessment Criteria

Some hydrocarbon compounds are known to both attack and permeate through certain plastic pipe materials, with the primary concern being the degradation and tainting of water supplies. The UK Water Industry Research (UKWIR) has therefore produced a document 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' (ref. 10/WM/03/21) that specifies threshold criteria for the adoption of 'standard' polythene (PE) or PVC pipes, protective barrier pipe and ductile iron/steel/copper pipes.

The UKWIR threshold assessment criteria from Table 3.1 of this document for standard PE pipes have been employed. It should be noted that the approach taken by UKWIR is very conservative, and both the document and research are flawed. However, it is these values that are being using to specify water pipe materials and therefore it is appropriate to consider them.

The UKWIR guidance is particularly flawed in respect of the chemical analysis it expects as it seeks a limit of detection that is generally below limits that are reasonable or commonly employed in contaminated land assessment. The UKWIR seeks that where a substance is below the limit of detection it should be taken as being present at half this concentration. For the larger suite of chemicals where the limit is against a sum of compounds, this approach would mean that a sample of virgin sub-soil from a greenfield site with absolutely no contamination would actually fail the criteria for using standard PE pipes. To avoid this situation, BRD have adopted the approach of summing only those compounds detected above their respective limits of detection.

In terms of building materials, the primary concern is in respect of concrete as certain commonly occurring natural ground conditions can adversely impact on buried concrete as discussed in 'Special digest 1:2005 Concrete in aggressive ground', BRE, 2005.

ANALYSIS	GENERIC ASSESSMENT CRITERIA	SOURCE
pH	<5.5	BRE Special Digest 1:2005
Sulphate (w/s)	500 mg/l	BRE Special Digest 1:2005
Sum of any VOC above detection limits	0.5 mg/kg	Relevant compounds adapted from UKWIR Table 3.1
Sum of SVOC + Aliphatic TPH >C5-C10 + Aromatic TPH >C5-C10 above detection limits	2 mg/kg	
Sum of Aliphatic TPH >C10-C21 + Aromatic TPH >C10-C21 above detection limits	10 mg/kg	
Sum of Aliphatic TPH >C21-C34 + Aromatic TPH >C10-C35 above detection limits	500 mg/kg	
Sum of BTEX + MTBE above detection limits	0.1 mg/kg	
Phenols	2 mg/kg	
Cresols and chlorinated phenols	2 mg/kg	
Naphthalene	0.5 mg/kg	
Benzo(a)pyrene	0.5 mg/kg	

TIER 2 RISK ESTIMATION - SURFACE WATER AND GROUNDWATER

The initial assessment of the contamination risk to groundwater is by comparing dissolved groundwater concentrations with screening values (GAC) that are protective of surface water resources. Surface waters are supplied with a baseflow from groundwater and so shallow groundwater often enters the surface water. It is therefore appropriate to compare groundwater to these GAC.

The reference source for the target concentrations is generally the Environment Agency's maximum allowable concentration Environmental Quality Standard (EQS) (as accessed February 2025: <https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit#screening-tests-freshwaters>), the Water Supply (Water Quality) Regulations 2016 (WSR) and the DW1/DW2 criteria from the Surface Water (Abstraction for drinking water)(classification) Regulations 1996. The target concentrations are outlined in the table below.

The 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies'. CL:AIRE, 2017 has also been used as reference source for the values.

ANALYSIS	GENERIC ASSESSMENT CRITERIA (GAC)	SOURCE
Arsenic	50 µg/l	DW1 (& EQS annual average)
Cadmium	50 µg/l	DW1
Chromium (total)	32 µg/l	EQS
Chromium (VI)	3.4 µg/l	EQS
Copper	50 µg/l	DW1
Nickel	34 µg/l	EQS
Lead	14 µg/l	EQS
Mercury	1 µg/l	WSR
Selenium	10 µg/l	WSR
Zinc	10.9 mg/l	EQS annual average bioavailable
Cyanide	50 µg/l	WSR
pH	6 to 9 units	-
Benzene	50 µg/l	EQS
Toluene	380 µg/l	EQS
Ethylbenzene	300 µg/l	WHO guideline
Xylene	30 µg/l	EQS (annual average)
Methyl tert-butyl ether (MTBE)	15 µg/l	Taste and odour threshold.
Naphthalene	130 µg/l	EQS
Benzo(a)pyrene	0.27 µg/l	EQS
Total PAH	-	Benzo(a)pyrene can be considered as a marker for the other PAHs
TPH Aliphatic C5-C6	15,000 µg/l	World Health Organization (WHO) guide values for TPHCWG fractions in drinking water
TPH Aliphatic C6-C8	15,000 µg/l	
TPH Aliphatic C8-C10	300 µg/l	
TPH Aliphatic C10-C12	300 µg/l	
TPH Aliphatic C12-C16	300 µg/l	
TPH Aromatic C5-C7	10 µg/l	
TPH Aromatic C7-C8	700 µg/l	
TPH Aromatic C8-C10	300 µg/l	
TPH Aromatic C10-C12	90 µg/l	
TPH Aromatic C12-C16	90 µg/l	
TPH Aromatic C16-C21	90 µg/l	
TPH Aromatic C21-C35	90 µg/l	

TIER 2 RISK ESTIMATION - GROUND GAS

Introduction

A variety of potentially hazardous gases occur naturally in the ground environment. Microbial decay of organic matter under anaerobic conditions and geological processes can lead to the generation of Methane and Carbon Dioxide, but can also include traces gases such as Hydrogen sulphide and Carbon monoxide.

Methane is a colourless and odourless gas that has the hazardous properties of being flammable and, at certain air/Methane mixtures, explosive. Methane has a low toxicity, but can be a simple asphyxiant due to the displacement of oxygen.

Carbon Dioxide is a colourless, odourless and non-combustible gas that has the hazardous property of being a highly toxic chemical. At concentrations of 3% by volume, shortness of breath and headaches will occur becoming acute by 6%. At levels of above 10% by volume headache, visual distortion, tremors and rapid loss of consciousness occur. Concentrations of Carbon Dioxide above 22% by volume are likely to be fatal. The effects of Carbon Dioxide poisoning are made more severe if there is accompanying reduction in oxygen concentrations.

Hydrogen sulphide is a colourless and flammable gas that has an odour of rotten eggs. It is important to that the sense of smell is over powered at higher concentrations. The gas is toxic and can be an asphyxiant.

Carbon monoxide is a colourless, odourless and explosive gas in air mixtures that has the hazardous property of being a highly toxic chemical.

Radon is a naturally occurring colourless and odourless gas that is radioactive. It is formed by the radioactive decay of radium which in turn is derived from the radioactive decay of uranium, both of which are minerals that can be found in many soil types. Whilst it is recognised that the air inside every building contains radon, some buildings built in certain defined areas of the country might have unacceptably high concentrations and require special precautions to be taken. The maps contained within BRE211:2015 'Radon: guidance on protective measures for new buildings' identify areas where no radon protection measures are necessary or where higher concentrations are present that either basic or full radon protection measures are required to be fitted to all new buildings, extensions or refurbishments.

Basis of Gas Assessment

In order to classify the level of risk and need, if any, for gas protection measures at a site with the potential for a gas problem, consideration of each of the following is necessary:

- The source of the gas.*
- The generation potential of the gas.*
- The location of the source and the geological setting.*
- Boreholes flow rate and estimated surface emission rate.*
- The nature of the proposed development.*
- Confidence in the knowledge of the gas regime.*

The gas assessment is made with reference to 'C665 - Assessing risks posed by hazardous ground gases to buildings', (CIRIA, 2007) and 'BS8485:2015+A1:2019 - Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' (BSI, 2019).

Gas Screening Value

The methods within CIRIA C665 and BS8485 both use the gas concentrations together with the borehole flow rates to define a characteristic situation for a site based on the limiting borehole gas volume flow for Methane and Carbon Dioxide. This limiting borehole gas volume flow is called the Gas Screening Value (GSV) and is expressed below:

$$\text{Gas Screening Value (l / hr)} = \text{borehole flow rate (l/hr)} \times \text{gas concentration (fraction)}$$

The calculation of GSV is completed for both Methane and Carbon Dioxide and then the 'worse case' maximum values are used in the assessment. The assessment is to determine the gas regime at the site is dependent upon the nature of the development.

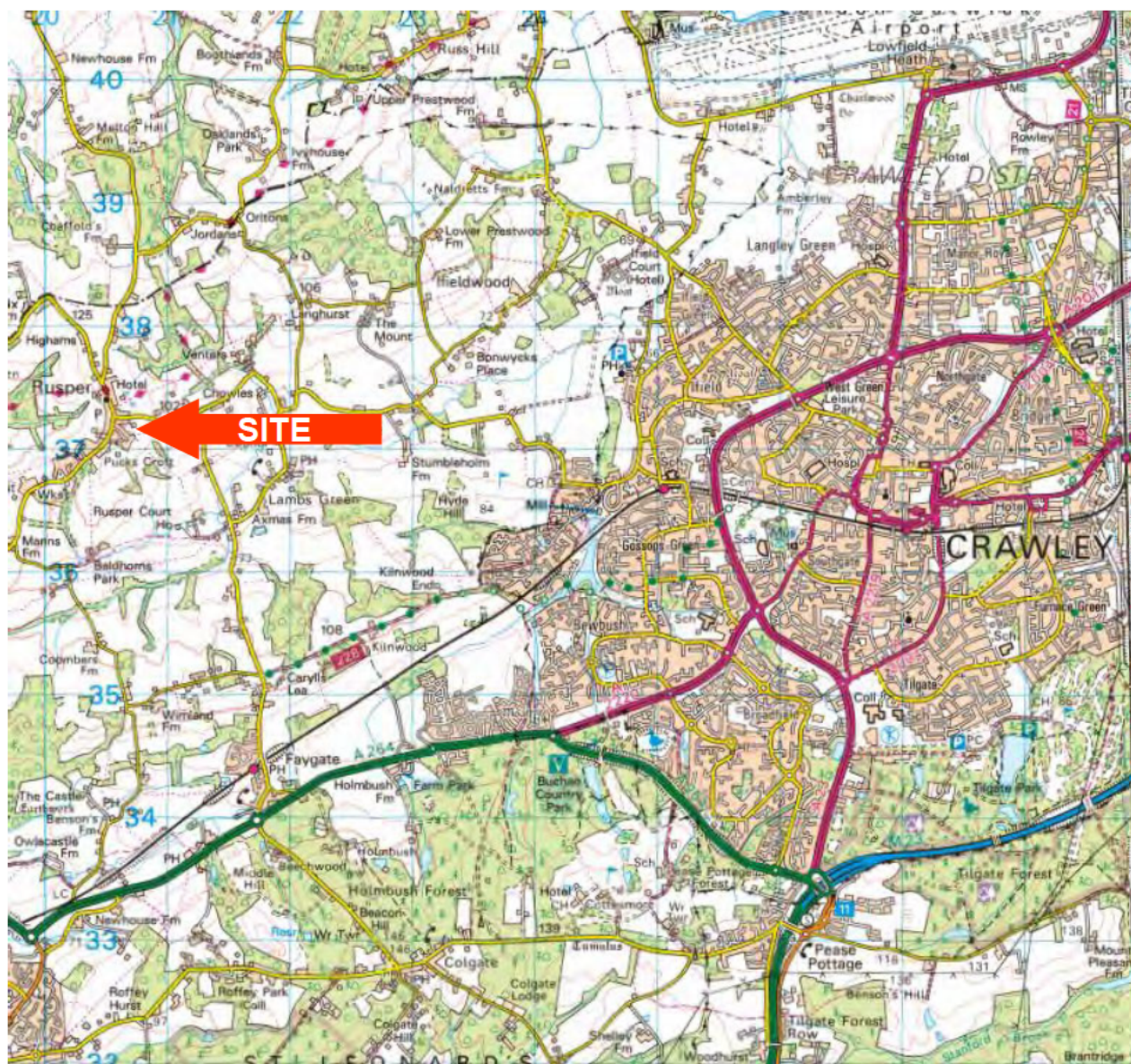
Characteristic Gas Situation

The characteristic situation for many sites is determined from evaluation of the Gas Screening Value derived against the criteria in the following table.

Characteristic situation	Hazard potential	Gas Screening Value (CH ₄ or CO ₂ l/hr)	Additional factors
CS1	Very low risk	<0.07	Typically Methane ≤1% and/or Carbon Dioxide ≤5%. Otherwise consider an increase to characteristic situation 2.
CS2	Low risk	0.07 to <0.7	Borehole air flow rate not to exceed 70 l/hr. Otherwise consider an increase to characteristic situation 3.
CS3	Moderate risk	0.7 to <3.5	-
CS4	Moderate to high risk	3.5 to <15	Quantitative risk assessment required to evaluate the scope of protection measures.
CS5	High risk	15 to <70	-
CS6	Very high risk	>70	-

APPENDIX 1

Site Location Plan



Not to scale.

Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP7-A
Date Issued: July 2025

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Site Walkover Photographs



Plate 1: Existing central farmyard buildings looking south.



Plate 2: Existing central farmyard buildings looking east.

Site Walkover Photographs



Plate 3: Existing large commercial style barn building at the southern end of the farmyard with southern manège in the foreground.



Plate 4: Inside the large barn building. Contrart to IDOM report, no evidence of a borehole having been drilled inside the building.

Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP6-A
Date Issued: July 2025

Site Walkover Photographs



Plate 5: Giant hogweed infestation.



Plate 6: Giant hogweed plan growing adjacent to the door of the large southern building.

Site Walkover Photographs



Plate 7: Area of raised ground artificially raised by imported soils



Plate 8: Surface materials in the central manège.

Site Walkover Photographs



Plate 9: Field in the northern area of the site.



Plate 10: Eastern fields proposed for public open space.



Accommodation Schedule

Open Market Provision [21 dwellings - 48.8%]
7no. 2-Bedroom Houses
3no. 3-Bedroom Houses
5no. 4-Bedroom Houses

Affordable Provision [22 dwellings - 51.2%]
Affordable Rent [10 dwellings - 68.2%]
3no. 1-Bedroom Houses
1no. 2-Bedroom Houses
3no. 3-Bedroom Houses
1no. 4-Bedroom Houses

Shared Ownership [5 dwellings - 31.8%]
2no. 2-Bedroom Houses
2no. 3-Bedroom Houses
1no. 4-Bedroom Houses

Affordable Dwellings - Tenure to be Agreed
[7 Dwellings - 16.3%]
1no. 1-Bedroom Houses
2no. 2-Bedroom Houses
1no. 4-Bedroom Houses

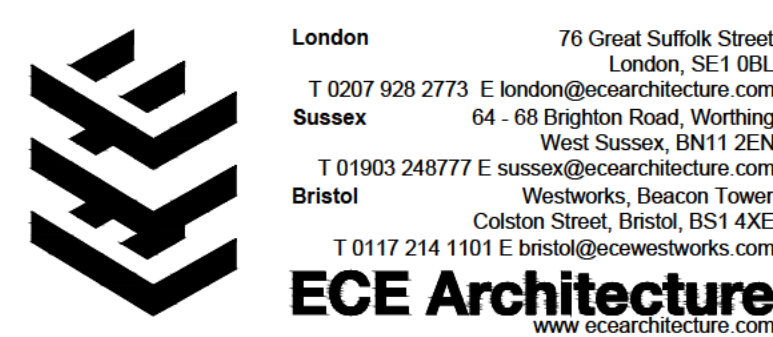
Total: 43 Dwellings

Car Parking
1.5 car spaces per 1 bed dwelling
2 car spaces per 2 & 3 bedroom dwellings
3 car spaces per 4 bed dwelling
13 visitor car spaces including 2no. disabled car parking spaces

Key

- Affordable Rent
- Shared Ownership
- Affordable Housing - Tenure to be Agreed
- Existing Building Footprints
- Existing Horse Training Ring
- Existing Trees and Hedges Retained

H	05.07.24	Trees added to parking court	EW	SLG
G	30.07.24	Revised layout	EW	SLG
F	24.08.24	Tenure allocation updated	SLG	AK
E	26.04.24	Amended client's name	FH	SLG
D	23.04.24	Layout amendments	KA	SLG
C	25.03.24	Layout amendments	KA	SLG
B	12.03.24	Layout amendments	KA	SLG
A	11.03.24	Coloured Layout	KA	SLG
Rev	Date	Revision Details	Dr	Ch



Client's Name
Stonebond Properties (Guildford) Limited

Job Title
Land at Millfields Farm, Rusper, West Sussex

Drawing Title
Proposed Site Layout

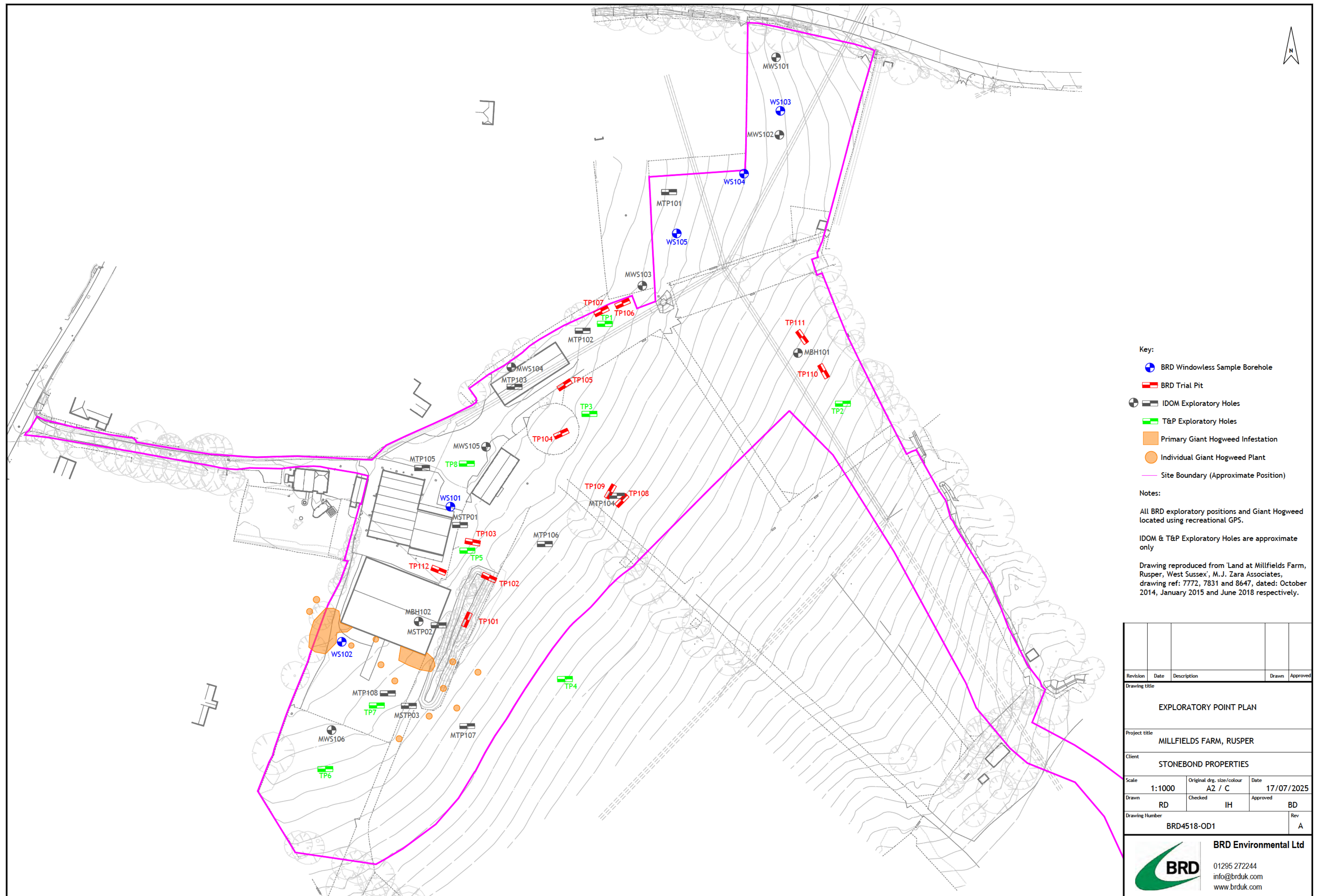
Scale
1:500 @ A0 / 1:1000 @ A2

metres 10 20 30 40 50

Drawn SLG Checked AK Date 09.02.24

Job No 7288 Drawing No PL-04 Rev H

Status
APPROVAL





- Reproduced from 'Proposed Site
Layout' Drawing ref. 7288-PL-04
Rev H, Dated 09.02.24

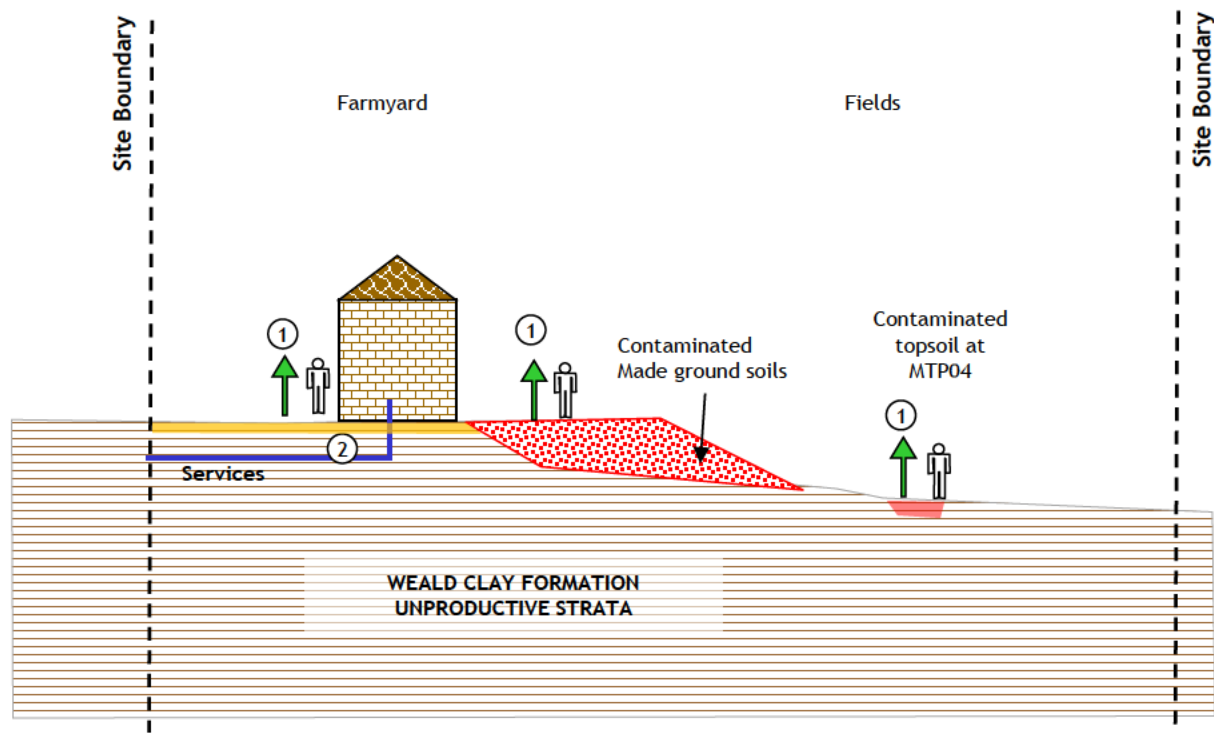
Not to scale.
All positions illustrative only.



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info@brduk.com

Revised Conceptual Model Plan

Proposed Development



Proposed Development



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP5-A
Date Issued: July 2025

APPENDIX 2

TRIAL PIT RECORD

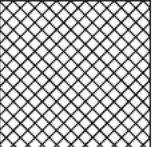
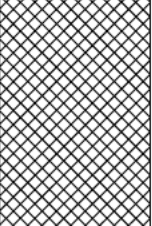
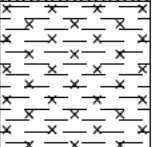
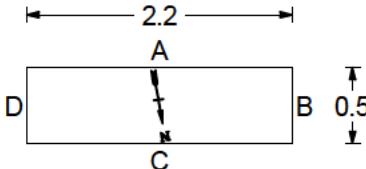
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				Sheet 1 of 1	

Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.20	J1		MADE GROUND TOPSOIL: Grass over brown gravelly silty clay. Gravel of fine to coarse and cobbles of subangular to angular brick, mudstone, tarmac, concrete and fragments of ceramic, metal and plastic.	0.30 0	MGTS	
0.60	PID J2	0.0 ppm	MADE GROUND: Firm to stiff light brown mottled grey clay with patches of dark brown silty clay.		MADE GROUND	
			0.90 m: Half of a brick.	1		
			1.10 m: Tile fragments.	1.20 0		
1.50	D1		Stiff light brown mottled grey silty CLAY.		WEALD CF	
1.70	SV	80/88/76 kPa		1.80 0		
				2		
				3		
				4		

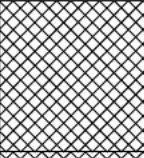
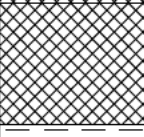
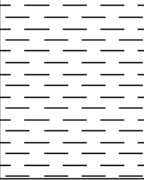
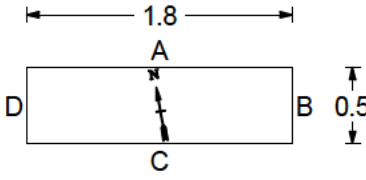
Pit Stability: Generally stable throughout Groundwater: Not encountered		Surface Elevation Level:
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Plan of Trial Pit: 	General Remarks: Trial pit terminated at 1.8m bgl in natural soils.	All dimensions in metres Log Scale 1:25 Telephone: 01295 272244 Email: info@brduk.com
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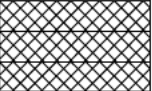
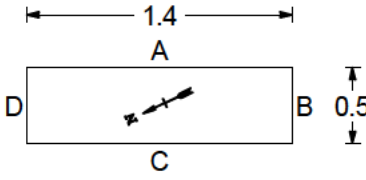
TRIAL PIT RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP102		
Sheet 1 of 1						
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.30	J1		MADE GROUND TOPSOIL: Vegetation over brown very gravelly sandy clay. Gravel of fine to coarse and cobbles of subangular to angular brick, concrete, clinker and fragments of metal, ceramic and plastic. 0.30 m: Metal pole and paving slab.	0.50 0	MGTS	
0.80	PID J2	0.0 ppm	MADE GROUND: Stiff to firm dark grey and black in places gravelly sandy silty clay with slight natural organic odour. Gravel of fine to coarse and cobbles of brick, concrete and some fragments of timber and half bricks.	1.30 0	MADE GROUND	
			Stiff light brown mottled grey silty CLAY.	1.80 0	WCF	
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 1.8m bgl in natural soils.			
All dimensions in metres Log Scale 1:25						
 Telephone: 01295 272244 Email: info@brduk.com						

TRIAL PIT RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP103		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.20	J1		MADE GROUND TOPSOIL: Vegetation over brown dry very gravelly sandy clay. Gravel of fine to coarse and cobbles of subangular to angular brick, concrete, tarmac, clinker and fragments of metal, ceramic and plastic.		MGTS	
0.70	PID J2	0.0 ppm	MADE GROUND: Loose slight brown slightly gravelly sand. Gravel of fine to coarse subangular to angular brick.	0.50 0 0.60 0	MG	
			MADE GROUND: Stiff to firm grey silty sandy slightly gravelly clay. Gravel of fine to coarse and cobbles of brick, concrete and occasional half to whole bricks. Slight natural organic odour.	1 1.00 0		
1.20	SV D1	54/50/54 kPa	Firm light brown mottled grey slightly fissured friable CLAY.		WEALD CF	
				1.70 0		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered				Surface Elevation Level:		
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 1.7m bgl in natural soils.		All dimensions in metres Log Scale 1:25	
					 Telephone: 01295 272244 Email: info@brduk.com	

TRIAL PIT RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP104		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.05	J1		MADE GROUND: Loose light brown gravelly sand. Gravel of fine to coarse subangular to subrounded flint with fragments of plastic and rubber tyre.	0.10	MG	
0.15	J2		MADE GROUND: Medium dense dark brown sandy gravel of medium to coarse subrounded to subangular flint and granite.	0.20		
			MADE GROUND: Firm grey silty clay with slight organic odour. Stiff light brown mottled grey silty CLAY.	0.30		
				0.60		
				1		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 0.6m bgl in natural soils.		All dimensions in metres Log Scale 1:25  Telephone: 01295 272244 Email: info@brduk.com	

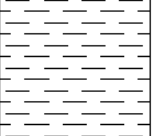
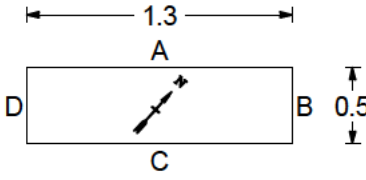
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Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP105		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.50	SV D1	80/88/90 kPa	MADE GROUND: Vegetation over white sandy gravel of medium to coarse subangular to angular chalk, limestone and rare brick.	0.20 0	MG	
			Stiff light brown with grey silty CLAY.	0.60 0	WCF	
				1		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 0.6m bgl in natural soils.			
			All dimensions in metres Log Scale 1:25 Telephone: 01295 272244 Email: info@brduk.com			

TRIAL PIT RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP106		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.10	J1	0.0 ppm	MADE GROUND TOPSOIL: Loose brown silty sandy gravel in a topsoil matrix. Gravel of fine to coarse subangular to angular flint, brick, concrete, tarmac, limestone with some half to whole bricks, glass and abundant rootlets.	0.25 0	MGTS	
0.35	PID J2		Hard light brown with grey dry CLAY with some rootlets.	0.60 0		
			Stiff light brown with grey fissured friable silty CLAY.	1.20 0		
				1	WEALD CLAY FORMATION	
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered				Surface Elevation Level:		
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 1.2m bgl in natural soils.		All dimensions in metres Log Scale 1:25	
					Telephone: 01295 272244 Email: info@brduk.com	

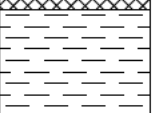
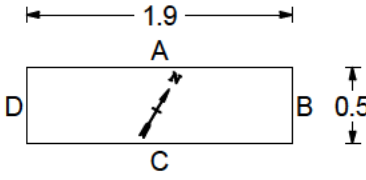
TRIAL PIT RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP107		
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Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.10	J1		MADE GROUND TOPSOIL: Loose brown silty sandy gravel in a topsoil matrix. Gravel of fine to coarse subangular to angular flint, brick, concrete, tarmac, limestone with some half to whole bricks, glass and abundant rootlets.	0.20 0	MGTS	
			Hard light brown and grey dry silty CLAY with some rootlets.	0.70 0	WCF	
				1		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 0.7m bgl in natural soils.			
			All dimensions in metres Log Scale 1:25  Telephone: 01295 272244 Email: info@brduk.com			

TRIAL PIT RECORD

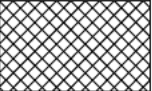
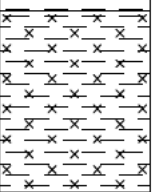
Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP108		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.10	J1	0.0 ppm	TOPSOIL: Grass over brown dry sandy silty slightly gravelly clay. Gravel of fine tabular mudstone.	0.25 0	TS	
0.40	PID J2		Very stiff / hard light brown and grey dry blocky silty CLAY.			
					0.60 0	WCF
				1		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 0.6m bgl in natural soils.			
			All dimensions in metres Log Scale 1:25 Telephone: 01295 272244 Email: info@brduk.com			

TRIAL PIT RECORD

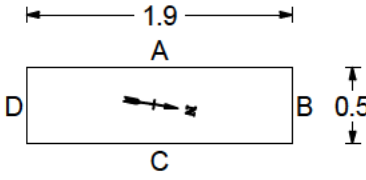
Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP109		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.20	J1		MADE GROUND: Grass over brown dry sandy silty slightly gravelly clay. Gravel of fine to medium subangular to tabular mudstone and rare brick fragments.	0.25 0	MG	
			Very stiff / hard light brown and grey dry blocky CLAY.	0.60 0	WCF	
				1		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 0.6m bgl in natural soils.			
			All dimensions in metres Log Scale 1:25  Telephone: 01295 272244 Email: info@brduk.com			

TRIAL PIT RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP110	
				Sheet 1 of 1	

Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.10	J1		MADE GROUND TOPSOIL: Grass over brown dry sandy silty slightly gravelly clay. Gravel of fine to medium subangular to subrounded mudstone with rare brick and charcoal.	0.30 0	MGTS	
0.60	SV	104/98/100 kPa	Very stiff / hard light brown and grey dry blocky CLAY.	0.70 0		
1.00	SV	80/80/86 kPa	Stiff light brown with light grey silty CLAY with rare subrounded calcareous aggregations.	1 1.30 0		
				2 3 4	WEALD CLAY FORMATION	

Pit Stability: Generally stable throughout Groundwater: Not encountered		Surface Elevation Level:
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Plan of Trial Pit: 	General Remarks: Trial pit terminated at 1.3m bgl in natural soils.	All dimensions in metres Log Scale 1:25  Telephone: 01295 272244 Email: info@brduk.com
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TRIAL PIT RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP111	
				Sheet 1 of 1	

Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.20	J1		MADE GROUND TOPSOIL: Grass over brown dry sandy silty slightly gravelly clay. Gravel of fine to medium subangular to subrounded mudstone with rare brick and charcoal.	0.30 0	MGTS	
0.60	SV	122/110/100 kPa	Very stiff / hard light brown and grey dry blocky CLAY. 0.60 m: Roots.	0.80 0	WEALD CLAY FM	
1.00	SV	80/90/90 kPa	Stiff light brown with light grey silty CLAY with rare subrounded calcareous aggregations.	1 1.10 0		
				2		
				3		
				4		

Pit Stability: Generally stable throughout Groundwater: Not encountered		Surface Elevation Level:
Plan of Trial Pit: 	General Remarks: Trial pit terminated at 1.1m bgl in natural soils.	
		All dimensions in metres Log Scale 1:25 Telephone: 01295 272244 Email: info@brduk.com

TRIAL PIT RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Completed: 24/06/2025 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP112		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.40	PID J1	0.0 ppm	CONCRETE with 5mm reinforcing bar.	0.10 0	MADE GROUND	
			MADE GROUND: Very soft dark brown silty sandy very gravelly clay / very clayey gravel. Gravel of fine to coarse and cobbles of subangular to angular brick, concrete, limestone and occasional metal and clinker.	0.60 0		
0.70	PID J2	0.0 ppm	MADE GROUND: Soft to firm dark grey silty slightly gravelly clay with natural organic odour. Gravel of fine to coarse and occasional cobbles of brick.	1.10 0		
			Stiff light brown and light grey silty CLAY.	1.50 0		
				2	WCF	
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered				Surface Elevation Level:		
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 1.5m bgl in natural soils.			
			All dimensions in metres Log Scale 1:25 Telephone: 01295 272244 Email: info@brduk.com			

Trial Pit Photographs

TP101



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



01295 272244
info@brduk.com

Trial Pit Photographs

TP102



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



01295 272244
info@brduk.com

Trial Pit Photographs

TP103



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



01295 272244
info@brduk.com

Trial Pit Photographs

TP104



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



01295 272244
info@brduk.com

Trial Pit Photographs

TP105



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



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info@brduk.com

Trial Pit Photographs

TP106



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



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info@brduk.com

Trial Pit Photographs

TP107



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



01295 272244
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Trial Pit Photographs

TP108



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



01295 272244
info@brduk.com

Trial Pit Photographs

TP109



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



01295 272244
info@brduk.com

Trial Pit Photographs

TP110



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025



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info@brduk.com

Trial Pit Photographs

TP111



Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025

Trial Pit Photographs

TP112

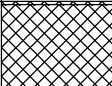
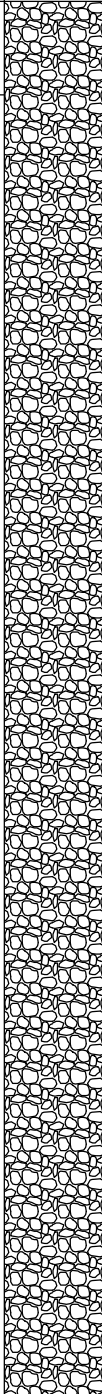
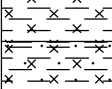
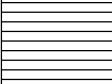
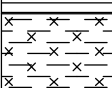


Project Title: Millfields Farm, Rusper
Client: Stonebond Properties
BRD Reference: BRD4518-OP3-A
Date Issued: June 2025

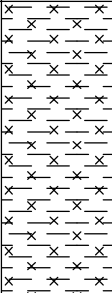


01295 272244
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PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig					Borehole No. WS101 Sheet 1 of 2				
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill	
Depth	Type & No	Value							
0.10	J1	4.5/4.5/4.5 kg/cm ²		MADE GROUND: Tarmac and granite gravel. MADE GROUND: Medium dense red sandy gravel of fine to medium subangular granite, concrete and brick.	0.01 0.30		MG		
0.50	J2			Stiff grey mottled light brown silty CLAY.					
0.60	PEN D1								
1.20	SPT D2	42 N		1.00 m: Becoming very sandy, slightly fissured and friable. 1.20 m: SPT: 2,5/7,20,9,6	1.0 1.30				
1.60	PEN J3	4.5/4.5/4.5 kg/cm ²		Recovered as dark brown and grey silty GRAVEL of subangular to tabular claystone.	1.50				
1.80	D3								
2.00	SPT	24 N		2.00 m: SPT: 2,3/4,5,7,8	2.0 2.10				
2.50	D4			Very stiff / hard light brown with light grey and some red heavily fissured laminated sandy silty CLAY with occasional fine to coarse tabular siltstone and mudstone.					
2.80	J4								
3.00	SPT			23 N		3.00 m: SPT: 3,3/3,5,7,8	3.0		
3.60	J5			Extremely weak thinly laminated light brown with grey and orange brown silty sandy MUDSTONE. Recovered as medium to coarse tabular gravel. 3.60 m: Unable to perform hand penetrometer test due to fracturing.	3.50				
3.80	D5								
4.00	SPT			33 N	Very stiff / hard dark grey with some brown silty CLAY. 4.00 m: SPT: 9,7/7,6,9,11				4.0 4.00
					4.50				
General Remarks: Borehole terminated at 5.45m bgl.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com		
					All dimensions in metres Log Scale 1:25				

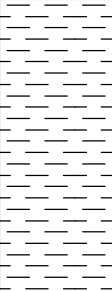
PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS101		
						Sheet 2 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
4.50	PEN >5.0 / >5.0 / >5.0			Continued from 4.00m: Very stiff / hard dark grey with some brown silty CLAY. 5.00 m: SPT: 4,4/4,7,7,8			WEALD CLAY FORMATION	
4.70	D6 J6	kg/cm²						
5.00	SPT	26 N						
					5.0			
					5.45			
					6.0			
					7.0			
					8.0			
					9.0			
General Remarks: Borehole terminated at 5.45m bgl.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS102		
						Sheet 1 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
0.60	D1			MADE GROUND: Light brown slightly gravelly fine sand. Gravel of fine to medium subangular to angular brick and concrete with abundant fragments of plastic and rubber.	0.10		MG	
0.70	J1			MADE GROUND: White sandy gravel of fine to coarse subangular to angular chalk.	0.30			
				MADE GROUND: Firm dark brown slightly gravelly clay. Gravel of fine to medium subangular brick.	0.40			
1.00	SPT	15 N		Stiff light brown mottled grey sandy CLAY with occasional tabular coarse claystone gravel.	1.00		WEALD CLAY FORMATION	
				1.00 m: SPT: 3,2/3,3,4,5	1.50			
1.70	D2			Stiff / hard light brown and grey laminated heavily fissured friable silty CLAY with occasional subangular to tabular mudstone.	2.00			
1.80	PEN	>5.0/>5.0/>5.0 kg/cm²		2.00 m: SPT: 4,5/6,6,7,7	2.50			
2.00	SPT	26 N			3.00			
2.60	D3			Extremely weak thinly laminated light brown with grey and orange brown silty sandy MUDSTONE. Recovered as medium to coarse tabular gravel.	3.10			
3.00	SPT	16 N		3.00 m: SPT: 3,3/3,4,4,5	4.00			
3.50	PEN D4	4.0/4.0/4.0 kg/cm²		Stiff grey with some orange silty CLAY. Fissured in places with silty partings.	4.50			
4.00	SPT	23 N		Very stiff grey fissured CLAY with occasional relict rootlets.				
				4.00 m: SPT: 2,3/5,5,6,7				
General Remarks: Borehole terminated at 5.45m bgl. Drilling rig and equipment cleaned before leaving Giant Hogweed area.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig							Borehole No. WS102 Sheet 2 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill	
Depth	Type & No	Value							
4.60	D5	43 N		Continued from 4.00m: Very stiff grey fissured CLAY with occasional relict rootlets.	5.0		WEALD CLAY FORMATION		
5.00	SPT			5.00 m: SPT: 3,10/11,10,11,11					5.45
					6.0				
					7.0				
					8.0				
					9.0				

General Remarks:

Borehole terminated at 5.45m bgl. Drilling rig and equipment cleaned before leaving Giant Hogweed area.

Surface Elevation Level:

All dimensions in metres

Log Scale 1:25



Telephone: 01295 272244

Email: info@brduk.com

PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS103		
						Sheet 1 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
0.10	J1			MADE GROUND TOPSOIL: Grass over light brown desiccated slightly gravelly silty clay. Gravel of fine to medium subangular brick.	0.25		MGTS	
0.50	D1			Hard dry brown with grey slightly gravelly CLAY. Gravel of fine to medium subangular claystone. Clay is fissile to 0.4m.	0.70			
1.10	PEN D2	3.5/3.5/3.5 kg/cm²		Firm to stiff light brown with some grey sandy CLAY.	1.0			
1.20	SPT	8 N		0.90 m: Pocket of orange brown clayey sand.	1.40			
1.70	PEN D3	4.5/4.5/4.5 kg/cm²		1.20 m: SPT: 1,2/2,2,2,2				
2.00	SPT	16 N		Stiff dark brown and light grey slightly fissured slightly gravelly silty CLAY. Gravel of medium to coarse to tabular mudstone and siltstone. Some dark orange staining on gravel surfaces.	2.0			
2.50	PEN D4	4.5/4.5/4.5 kg/cm²		2.00 m: SPT: 2,2/3,4,4,5				
3.00	SPT	21 N		2.00 - 2.40 m: Becoming slightly sandy and very gravelly.	3.0			
3.70	PEN D5	4.5/4.5/4.5 kg/cm²		Firm to stiff light grey with some dark grey silty very sandy CLAY.	3.30			
4.00	SPT	43 N		3.00 m: SPT: 2,4/5,7,9,10	3.50			
				Extremely weak grey and dark brown thinly laminated clayey MUDSTONE.			WEALD CLAY FORMATION	
				3.40 m: Slight groundwater seepage.				
				Stiff to very stiff dark brown heavily fissured silty CLAY.	4.0			
				Very stiff dark grey brown with some orange staining fissured very silty CLAY.	4.50			
General Remarks: Borehole terminated at 5.45m bgl.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

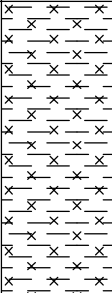
PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS103		
						Sheet 2 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
4.50	PEN D6	5.0/5.0/5.0 kg/cm²		Continued from 4.00m: Very stiff dark grey brown with some orange staining fissured very silty CLAY.			WEALD CLAY FORMATION	
5.00	SPT	26 N		5.00 m: SPT: 3,4/5,5,7,9	5.0			
					5.45			
					6.0			
					7.0			
					8.0			
					9.0			
General Remarks: Borehole terminated at 5.45m bgl.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS104		
						Sheet 1 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
0.10	J1			MADE GROUND TOPSOIL: Grass over light brown desiccated slightly gravelly silty clay. Gravel of fine to medium subangular brick.	0.20		MGTS	
0.40	PEN J2	5.0/5.0/5.0 kg/cm²		Stiff dry light brown with grey slightly silty CLAY.	0.50			
0.60	PEN D1	4.5/4.5/4.5 kg/cm²		Stiff brown with grey slightly silty CLAY.				
1.00	SPT	7 N		1.00 m: Becoming firm to stiff. 1.00 m: SPT: 1,1/2,1,2,2	1.0			
1.50	D2			Very stiff dark brown grey heavily fissured silty CLAY.	1.20			
1.80	PEN	5.0/5.0/5.0 kg/cm²		Extremely weak MUDSTONE and SILTSTONE. Some dark orange staining on surfaces.	1.80			
2.00	SPT	16 N		Hard light brown with some dark grey heavily fissured sandy CLAY with occasional black specks. 2.00 m: SPT: 3,3/3,4,4,5	2.0 2.00			
2.50	PEN	5.0/5.0/5.0 kg/cm²						
2.60	D3							
3.00	SPT	27 N		3.00 m: SPT: 12,7/6,6,7,8 3.00 - 3.20 m: Some grey claystone fragments.	3.0			
3.70	PEN D4	5.0/5.0/5.0 kg/cm²					WEALD CLAY FORMATION	
4.00	SPT	30 N		Hard grey brown very silty CLAY. 4.00 m: SPT: 9,7/7,6,8,9	4.0 4.00			
				Hard brown with some grey fissured silty CLAY with some tabular mudstone lenses. Some orange staining at surfaces.	4.30			
					4.50			
General Remarks: Borehole terminated at 5.45m bgl.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS104		
						Sheet 2 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
4.70	PEN D5	5.0/5.0/5.0 kg/cm ²		Continued from 4.30m: Hard brown with some grey fissured silty CLAY with some tabular mudstone lenses. Some orange staining at surfaces.			WEALD CLAY FORMATION	
5.00	SPT	27 N		5.00 m: SPT: 3,4/6,6,7,8	5.0			
					5.45			
					6.0			
					7.0			
					8.0			
					9.0			
General Remarks: Borehole terminated at 5.45m bgl.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS105		
						Sheet 1 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
0.10	J1			MADE GROUND TOPSOIL: Grass over light brown dry slightly gravelly silty clay. Gravel of fine to medium subangular brick.	0.20		MG	
				Stiff to very stiff dry light brown with some light grey slightly silty very sandy CLAY.				
0.50	D1							
0.65	J2			Firm to stiff light brown and light grey very silty very sandy CLAY.	0.60			
1.00	D2				1.0			
1.20	SPT	12 N		Stiff light brown slightly sandy silty CLAY. 1.20 m: SPT: 1,2/2,3,3,4	1.10			
1.70	PEN D3	4.5/4.5/4.5 kg/cm²		1.50 m: Becoming fissured with occasional tabular mudstone gravel and orange sandy lenses.				
2.00	SPT	16 N			2.0 2.00			
				Stiff to very stiff grey brown silty slightly fissured CLAY with occasional black specks. 2.00 m: SPT: 3,3/3,4,4,5				
2.60	PEN	5.0/5.0/5.0 kg/cm²			2.70			
				Extremely weak thinly laminated MUDSTONE with some dark brown staining on surfaces.				
3.00	SPT	25 N			3.0 3.00			
				Very stiff grey with some brown fissured sandy CLAY with some silty partings. Occasional selenite. 3.00 m: SPT: 5,5/6,6,6,7				
3.80	PEN D4	5.0/5.0/5.0 kg/cm²			4.0			
4.00	SPT	50 N		4.00 m: SPT: 4,6/9,14,13,14 for 65mm 4.00 - 5.45 m: Some tabular mudstone bands.				
					4.50			
General Remarks: Borehole terminated at 5.45m bgl.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

PROBEHOLE RECORD

Client: Stonebond Properties Project Title: Millfields Farm, Rusper Project No: BRD4518 Logged By: I Hibberd Date Commenced: 23/06/2025 Date Completed: 23/06/2025 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS105		
						Sheet 2 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
4.50	PEN D5	5.0/5.0/5.0 kg/cm²		Continued from 3.00m: Very stiff grey with some brown fissured sandy CLAY with some silty partings. Occasional selenite.			WEALD CLAY FORMATION	
5.00	SPT	42 N		5.00 m: SPT: 9,7/9,10,11,12	5.0			
					5.45			
					6.0			
					7.0			
					8.0			
					9.0			
General Remarks: Borehole terminated at 5.45m bgl.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

APPENDIX 3

BRD Environmental Ltd
Hawthorne Villa
1 Old Parr Road
Banbury
Oxfordshire
OX16 5HT

Normec DETS Limited
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 25-06069

Site Reference: Millfields Farm, Ruser
Project / Job Ref: BRD4518
Order No: None Supplied
Sample Receipt Date: 27/06/2025
Sample Scheduled Date: 27/06/2025
Report Issue Number: 1
Reporting Date: 07/07/2025

Authorised by:

Steve Knight
Customer Support Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. 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 certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Soil Analysis Certificate						
DETS Report No: 25-06069	~Date Sampled	23/06/25	23/06/25	24/06/25	24/06/25	24/06/25
BRD Environmental Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Millfields Farm, Rusper	~TP / BH No	SS01	WS103	TP101	TP102	TP102
~Project / Job Ref: BRD4518	~Additional Refs	J1	J1	J1	J1	J1
~Order No: None Supplied	~Depth (m)	0.05	0.10	0.20	0.30	0.80
Reporting Date: 07/07/2025	DETS Sample No	780965	780966	780967	780968	780969

Determinand	Unit	RL	Accreditation	(n)		(n)	
Asbestos Screen ^(S)	N/a	N/a	ISO17025				
Sample Matrix ^(S)	Material Type	N/a	NONE				
Asbestos Type ^(S)	PLM Result	N/a	ISO17025				
Asbestos Quantification ^(S)	%	< 0.001	ISO17025	< 0.001	< 0.001	< 0.001	< 0.001
pH	pH Units	N/a	MCERTS	7.6	6.7	7.6	7.5
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS				
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10	47	1630	1570
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01	0.05	1.63	1.57
Total Sulphur	%	< 0.02	NONE				
Organic Matter (SOM)	%	< 0.1	MCERTS	2.4	3.6	2.3	3.6
Arsenic (As)	mg/kg	< 2	MCERTS	4	18	12	14
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.4	0.4	0.3	0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	4	35	40	20
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	708	31	45	93
Lead (Pb)	mg/kg	< 3	MCERTS	96	49	83	134
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	< 3	15	24	15
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2
Zinc (Zn)	mg/kg	< 3	MCERTS	125	66	113	157

Soil Analysis Certificate						
DETS Report No: 25-06069	~ Date Sampled	24/06/25	24/06/25	24/06/25	24/06/25	24/06/25
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	TP103	TP104	TP106	TP106	TP107
~ Project / Job Ref: BRD4518	~ Additional Refs	J2	J1	J1	J2	J1
~ Order No: None Supplied	~ Depth (m)	0.20	0.05	0.10	0.35	0.10
Reporting Date: 07/07/2025	DETS Sample No	780970	780971	780972	780973	780974

Determinand	Unit	RL	Accreditation	(n)		(n)	
Asbestos Screen ^(S)	N/a	N/a	ISO17025				
Sample Matrix ^(S)	Material Type	N/a	NONE				
Asbestos Type ^(S)	PLM Result	N/a	ISO17025				
Asbestos Quantification ^(S)	%	< 0.001	ISO17025	< 0.001		< 0.001	< 0.001
pH	pH Units	N/a	MCERTS	7.7	7.3	7.8	5.3
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS				
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	1260	31	344	138
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	1.26	0.03	0.34	0.14
Total Sulphur	%	< 0.02	NONE				
Organic Matter (SOM)	%	< 0.1	MCERTS	4.6	10.3	14.1	1.3
Arsenic (As)	mg/kg	< 2	MCERTS	13	4	11	18
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.4	7.4	1.4	0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	20	8	29	34
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	92	3360	111	43
Lead (Pb)	mg/kg	< 3	MCERTS	90	636	105	20
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	14	7	12	19
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2
Zinc (Zn)	mg/kg	< 3	MCERTS	107	775	169	67

Soil Analysis Certificate						
DETS Report No: 25-06069	~ Date Sampled	24/06/25	24/06/25	24/06/25	24/06/25	23/06/25
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	TP108	TP108	TP109	TP112	WS101
~ Project / Job Ref: BRD4518	~ Additional Refs	J1	J2	J1	J1	D2
~ Order No: None Supplied	~ Depth (m)	0.10	0.40	0.20	0.40	1.20
Reporting Date: 07/07/2025	DETS Sample No	780975	780976	780977	780978	780979

Determinand	Unit	RL	Accreditation				Detected	
Asbestos Screen ^(S)	N/a	N/a	ISO17025				Amosite and Chrysotile present as fibre bundles	
Sample Matrix ^(S)	Material Type	N/a	NONE				Amosite Chrysotile	
Asbestos Type ^(S)	PLM Result	N/a	ISO17025				0.004	
Asbestos Quantification ^(S)	%	< 0.001	ISO17025					
pH	pH Units	N/a	MCERTS	7.0	7.6	7.3		7.7
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS					< 200
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	21	57	20		40
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	0.06	0.02		0.04
Total Sulphur	%	< 0.02	NONE					< 0.02
Organic Matter (SOM)	%	< 0.1	MCERTS	5	0.7	4.6		
Arsenic (As)	mg/kg	< 2	MCERTS	13	11	11		
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.2	< 0.2	0.3		
Chromium (Cr)	mg/kg	< 2	MCERTS	27	30	23		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2		
Copper (Cu)	mg/kg	< 4	MCERTS	25	29	22		
Lead (Pb)	mg/kg	< 3	MCERTS	38	15	31		
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	13	13	11		
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Zinc (Zn)	mg/kg	< 3	MCERTS	65	41	52		

Soil Analysis Certificate						
DETS Report No: 25-06069	~ Date Sampled	23/06/25	23/06/25	23/06/25	23/06/25	23/06/25
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	WS104	WS102	WS103	WS105	WS103
~ Project / Job Ref: BRD4518	~ Additional Refs	D2	D2	D3	D3	D4
~ Order No: None Supplied	~ Depth (m)	1.50	1.70	1.70	1.70	2.50
Reporting Date: 07/07/2025	DETS Sample No	780980	780981	780982	780983	780984

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025					
Sample Matrix ^(S)	Material Type	N/a	NONE					
Asbestos Type ^(S)	PLM Result	N/a	ISO17025					
Asbestos Quantification ^(S)	%	< 0.001	ISO17025					
pH	pH Units	N/a	MCERTS	8.1	6.8	8.1	6.2	7.9
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	< 200	< 200	< 200	< 200	257
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	34	19	< 10	16	57
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.03	0.02	< 0.01	0.02	0.06
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	0.03
Organic Matter (SOM)	%	< 0.1	MCERTS					
Arsenic (As)	mg/kg	< 2	MCERTS					
Cadmium (Cd)	mg/kg	< 0.2	MCERTS					
Chromium (Cr)	mg/kg	< 2	MCERTS					
Chromium (hexavalent)	mg/kg	< 2	NONE					
Copper (Cu)	mg/kg	< 4	MCERTS					
Lead (Pb)	mg/kg	< 3	MCERTS					
Mercury (Hg)	mg/kg	< 1	MCERTS					
Nickel (Ni)	mg/kg	< 3	MCERTS					
Selenium (Se)	mg/kg	< 2	MCERTS					
Zinc (Zn)	mg/kg	< 3	MCERTS					

Soil Analysis Certificate						
DETS Report No: 25-06069	~Date Sampled	23/06/25	23/06/25	23/06/25	23/06/25	
BRD Environmental Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
~Site Reference: Millfields Farm, Rusper	~TP / BH No	WS101	WS102	WS104	WS105	
~Project / Job Ref: BRD4518	~Additional Refs	D4	D4	D5	D4	
~Order No: None Supplied	~Depth (m)	2.50	3.50	3.70	3.80	
Reporting Date: 07/07/2025	DETS Sample No	780985	780986	780987	780988	

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025					
Sample Matrix ^(S)	Material Type	N/a	NONE					
Asbestos Type ^(S)	PLM Result	N/a	ISO17025					
Asbestos Quantification ^(S)	%	< 0.001	ISO17025					
pH	pH Units	N/a	MCERTS	7.8	8.3	8.2	8.2	
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	< 200	< 200	< 200	638	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	19	< 10	< 10	173	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	< 0.01	< 0.01	0.17	
Total Sulphur	%	< 0.02	NONE	< 0.02	0.05	< 0.02	0.04	
Organic Matter (SOM)	%	< 0.1	MCERTS					
Arsenic (As)	mg/kg	< 2	MCERTS					
Cadmium (Cd)	mg/kg	< 0.2	MCERTS					
Chromium (Cr)	mg/kg	< 2	MCERTS					
Chromium (hexavalent)	mg/kg	< 2	NONE					
Copper (Cu)	mg/kg	< 4	MCERTS					
Lead (Pb)	mg/kg	< 3	MCERTS					
Mercury (Hg)	mg/kg	< 1	MCERTS					
Nickel (Ni)	mg/kg	< 3	MCERTS					
Selenium (Se)	mg/kg	< 2	MCERTS					
Zinc (Zn)	mg/kg	< 3	MCERTS					

Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 25-06069	~ Date Sampled	23/06/25	23/06/25	24/06/25	24/06/25	24/06/25
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	SS01	WS103	TP101	TP102	TP102
~ Project / Job Ref: BRD4518	~ Additional Refs	J1	J1	J1	J1	J1
~ Order No: None Supplied	~ Depth (m)	0.05	0.10	0.20	0.30	0.80
Reporting Date: 07/07/2025	DETS Sample No	780965	780966	780967	780968	780969

Determinand	Unit	RL	Accreditation	(n)			(n)	
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.18	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.22	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	4.15	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	3.12	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.12	32.70	1.26
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	9.90	0.35
Fluoranthene	mg/kg	< 0.1	MCERTS	0.13	0.22	0.36	45.40	3.24
Pyrene	mg/kg	< 0.1	MCERTS	0.14	0.21	0.35	38.20	2.54
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.12	0.22	18.40	1.49
Chrysene	mg/kg	< 0.1	MCERTS	0.12	0.13	0.25	15.40	1.33
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.19	0.16	0.28	15.40	1.50
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.15	6.59	0.53
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.23	0.15	0.29	14.20	1.55
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.21	6.85	0.91
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	1.54	0.18
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.20	5.87	0.82
**Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	2.4	218	15.7

Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 25-06069	~ Date Sampled	24/06/25	24/06/25	24/06/25	24/06/25	24/06/25
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	TP103	TP104	TP106	TP106	TP107
~ Project / Job Ref: BRD4518	~ Additional Refs	J2	J1	J1	J2	J1
~ Order No: None Supplied	~ Depth (m)	0.20	0.05	0.10	0.35	0.10
Reporting Date: 07/07/2025	DETS Sample No	780970	780971	780972	780973	780974

Determinand	Unit	RL	Accreditation	(n)		(n)	
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.25	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.25
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.24
Phenanthrene	mg/kg	< 0.1	MCERTS	0.57	0.61	1.06	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	0.13	0.14	0.54	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	1.23	2.27	7.04	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	1.16	2.24	7.91	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.67	1.72	6.64	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	0.70	2.21	6.26	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.95	< 0.1	13.10	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.39	< 0.1	4.39	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	1.20	< 0.1	11.80	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.62	0.20	6.84	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.12	0.17	1.35	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.53	0.86	5.63	< 0.1
**Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	8.3	10.4	72.9	< 1.6

Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 25-06069	~ Date Sampled	24/06/25	24/06/25	24/06/25		
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied	None Supplied		
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	TP108	TP108	TP109		
~ Project / Job Ref: BRD4518	~ Additional Refs	J1	J2	J1		
~ Order No: None Supplied	~ Depth (m)	0.10	0.40	0.20		
Reporting Date: 07/07/2025	DETS Sample No	780975	780976	780977		

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	
Phenanthrene	mg/kg	< 0.1	MCERTS	0.72	< 0.1	< 0.1	
Anthracene	mg/kg	< 0.1	MCERTS	0.25	< 0.1	< 0.1	
Fluoranthene	mg/kg	< 0.1	MCERTS	3.43	< 0.1	< 0.1	
Pyrene	mg/kg	< 0.1	MCERTS	3.02	< 0.1	< 0.1	
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	1.72	< 0.1	< 0.1	
Chrysene	mg/kg	< 0.1	MCERTS	1.43	< 0.1	< 0.1	
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	1.46	< 0.1	< 0.1	
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.48	< 0.1	< 0.1	
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	1.56	< 0.1	< 0.1	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.83	< 0.1	< 0.1	
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.18	< 0.1	< 0.1	
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.73	< 0.1	< 0.1	
**Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	15.8	< 1.6	< 1.6	

Soil Analysis Certificate - TPH LQM Banded

DETS Report No: 25-06069	~ Date Sampled	24/06/25	24/06/25	24/06/25	24/06/25	24/06/25
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	TP102	TP106	TP106	TP107	TP108
~ Project / Job Ref: BRD4518	~ Additional Refs	J1	J1	J2	J1	J1
~ Order No: None Supplied	~ Depth (m)	0.80	0.10	0.35	0.10	0.10
Reporting Date: 07/07/2025	DETS Sample No	780969	780972	780973	780974	780975

Determinand	Unit	RL	Accreditation	(n)				
Aliphatic >C5 - C6 : HS 1D MS AL	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8 : HS 1D MS AL	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10 : EH CU 1D AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12 : EH CU 1D AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16 : EH CU 1D AL	mg/kg	< 3	MCERTS	< 3	5	< 3	< 3	< 3
Aliphatic >C16 - C35 : EH CU 1D AL	mg/kg	< 10	MCERTS	< 10	187	< 10	69	< 10
Aliphatic >C35 - C44 : EH CU 1D AL	mg/kg	< 10	NONE	< 10	69	< 10	< 10	< 10
Aliphatic (C5 - C44) : HS 1D_MS+EH_CU_1D_AL	mg/kg	< 30	NONE	< 30	260	< 30	69	< 30
Aromatic >C5 - C7 : HS 1D MS AR	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8 : HS 1D MS AR	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21 : EH CU 1D AR	mg/kg	< 3	MCERTS	11	29	< 3	27	8
Aromatic >C21 - C35 : EH CU 1D AR	mg/kg	< 10	MCERTS	23	299	< 10	49	< 10
Aromatic >C35 - C44 : EH CU 1D AR	mg/kg	< 10	NONE	< 10	74	< 10	< 10	< 10
Aromatic (>C5 - C44) : HS 1D_MS+EH_CU_1D_AR	mg/kg	< 30	NONE	34	402	< 30	77	< 30
Total >C5 - C44 : HS 1D_MS+EH_CU_1D_Tot al	mg/kg	< 60	NONE	< 60	662	< 60	145	< 60

Soil Analysis Certificate - TPH LQM Banded

DETS Report No: 25-06069	~ Date Sampled	24/06/25	24/06/25			
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied			
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	TP108	TP109			
~ Project / Job Ref: BRD4518	~ Additional Refs	J2	J1			
~ Order No: None Supplied	~ Depth (m)	0.40	0.20			
Reporting Date: 07/07/2025	DETS Sample No	780976	780977			

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6 : HS 1D MS AL	mg/kg	< 0.01	NONE	< 0.01	< 0.01			
Aliphatic >C6 - C8 : HS 1D MS AL	mg/kg	< 0.05	NONE	< 0.05	< 0.05			
Aliphatic >C8 - C10 : EH CU 1D AL	mg/kg	< 2	MCERTS	< 2	< 2			
Aliphatic >C10 - C12 : EH CU 1D AL	mg/kg	< 2	MCERTS	< 2	< 2			
Aliphatic >C12 - C16 : EH CU 1D AL	mg/kg	< 3	MCERTS	< 3	< 3			
Aliphatic >C16 - C35 : EH CU 1D AL	mg/kg	< 10	MCERTS	< 10	< 10			
Aliphatic >C35 - C44 : EH CU 1D AL	mg/kg	< 10	NONE	< 10	< 10			
Aliphatic (C5 - C44) : HS 1D_MS+EH_CU_1D_AL	mg/kg	< 30	NONE	< 30	< 30			
Aromatic >C5 - C7 : HS 1D MS AR	mg/kg	< 0.01	NONE	< 0.01	< 0.01			
Aromatic >C7 - C8 : HS 1D MS AR	mg/kg	< 0.05	NONE	< 0.05	< 0.05			
Aromatic >C8 - C10 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C10 - C12 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C12 - C16 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C16 - C21 : EH CU 1D AR	mg/kg	< 3	MCERTS	< 3	< 3			
Aromatic >C21 - C35 : EH CU 1D AR	mg/kg	< 10	MCERTS	< 10	< 10			
Aromatic >C35 - C44 : EH CU 1D AR	mg/kg	< 10	NONE	< 10	< 10			
Aromatic (>C5 - C44) : HS 1D_MS+EH_CU_1D_AR	mg/kg	< 30	NONE	< 30	< 30			
Total >C5 - C44 : HS 1D_MS+EH_CU_1D_Tot al	mg/kg	< 60	NONE	< 60	< 60			

Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 25-06069	~ Date Sampled	24/06/25	24/06/25	24/06/25	24/06/25	24/06/25
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	TP102	TP106	TP106	TP107	TP108
~ Project / Job Ref: BRD4518	~ Additional Refs	J1	J1	J2	J1	J1
~ Order No: None Supplied	~ Depth (m)	0.80	0.10	0.35	0.10	0.10
Reporting Date: 07/07/2025	DETS Sample No	780969	780972	780973	780974	780975

Determinand	Unit	RL	Accreditation	(n)		
Benzene : HS_1D_MS	µg/kg	< 2	MCERTS	< 2	< 2	< 2
Toluene : HS_1D_MS	µg/kg	< 5	MCERTS	< 5	< 5	< 5
Ethylbenzene : HS_1D_MS	µg/kg	< 2	MCERTS	3	< 2	< 2
p & m-xylene : HS_1D_MS	µg/kg	< 2	MCERTS	6	< 2	< 2
o-xylene : HS_1D_MS	µg/kg	< 2	MCERTS	4	< 2	< 2
MTBE : HS_1D_MS	µg/kg	< 5	MCERTS	< 5	< 5	< 5

Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 25-06069	~ Date Sampled	24/06/25	24/06/25			
BRD Environmental Ltd	~ Time Sampled	None Supplied	None Supplied			
~ Site Reference: Millfields Farm, Rusper	~ TP / BH No	TP108	TP109			
~ Project / Job Ref: BRD4518	~ Additional Refs	J2	J1			
~ Order No: None Supplied	~ Depth (m)	0.40	0.20			
Reporting Date: 07/07/2025	DETS Sample No	780976	780977			

Determinand	Unit	RL	Accreditation				
Benzene : HS_1D_MS	µg/kg	< 2	MCERTS	< 2	< 2		
Toluene : HS_1D_MS	µg/kg	< 5	MCERTS	< 5	< 5		
Ethylbenzene : HS_1D_MS	µg/kg	< 2	MCERTS	< 2	< 2		
p & m-xylene : HS_1D_MS	µg/kg	< 2	MCERTS	< 2	< 2		
o-xylene : HS_1D_MS	µg/kg	< 2	MCERTS	< 2	< 2		
MTBE : HS_1D_MS	µg/kg	< 5	MCERTS	< 5	< 5		

Soil Analysis Certificate - Sample Descriptions

DETS Report No: 25-06069	
BRD Environmental Ltd	
~Site Reference: Millfields Farm, Rusper	
~Project / Job Ref: BRD4518	
~Order No: None Supplied	
Reporting Date: 07/07/2025	

DETS Sample No	~ TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
780965	SS01	J1	0.05	1.2	Brown sandy gravel with stones and vegetation
780966	WS103	J1	0.10	14.4	Brown sandy clay with vegetation
780967	TP101	J1	0.20	10.8	Brown sandy clay with vegetation
780968	TP102	J1	0.30	8.6	Brown sandy gravel with stones
780969	TP102	J1	0.80	20.6	Brown sandy clay with stones and vegetation
780970	TP103	J2	0.20	7.4	Brown sandy clay with stones and vegetation
780971	TP104	J1	0.05	0.7	Black sandy gravel with stones and concrete
780972	TP106	J1	0.10	3.3	Brown sandy gravel with stones and concrete
780973	TP106	J2	0.35	17.6	Light brown clay
780974	TP107	J1	0.10	5.2	Brown sandy clay with stones
780975	TP108	J1	0.10	16.6	Light brown sandy clay with vegetation
780976	TP108	J2	0.40	16.6	Light brown clay
780977	TP109	J1	0.20	17.2	Brown sandy clay with vegetation
780979	WS101	D2	1.20	17.4	Light grey clay
780980	WS104	D2	1.50	15.5	Light brown sandy clay
780981	WS102	D2	1.70	12.9	Light brown clay
780982	WS103	D3	1.70	16.7	Light brown clay
780983	WS105	D3	1.70	16.9	Light brown clay
780984	WS103	D4	2.50	17.8	Light brown clay
780985	WS101	D4	2.50	12.8	Light brown clay
780986	WS102	D4	3.50	18.8	Grey clay
780987	WS104	D5	3.70	13.6	Light brown clay
780988	WS105	D4	3.80	16	Brown clay

Moisture content is part of procedure E003 & is not an accredited test

Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 25-06069

BRD Environmental Ltd

~Site Reference: Millfields Farm, Rusper

~Project / Job Ref: BRD4518

~Order No: None Supplied

Reporting Date: 07/07/2025

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of FOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

List of HWOL Acronyms and Operators

DETS Report No: 25-06069

BRD Environmental Ltd

~Site Reference: Millfields Farm, Rusper

~Project / Job Ref: BRD4518

~Order No: None Supplied

Reporting Date: 07/07/2025

Acronym	Description
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH 2D Total but with humics mathematically subtracted
#2	EH 2D Total but with fatty acids mathematically subtracted
	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS Total or EH CU+HS Total
~	Sample details provided by customer and can affect the validity of results

Benzene - HS 1D MS

Ethylbenzene - HS 1D MS

MTBE - HS 1D MS

TPH CWG - Aromatic >C16 - C21 - EH CU 1D AR

TPH LQM - Aliphatic >C10 - C12 - EH CU 1D AL

TPH LQM - Aliphatic >C12 - C16 - EH CU 1D AL

TPH LQM - Aliphatic >C16 - C35 - EH CU 1D AL

TPH LQM - Aliphatic >C35 - C44 - EH CU 1D AL

TPH LQM - Aliphatic >C5 - C44 - HS 1D MS+EH CU 1D AL

TPH LQM - Aliphatic >C5 - C6 - HS 1D MS AL

TPH LQM - Aliphatic >C6 - C8 - HS 1D MS AL

TPH LQM - Aliphatic >C8 - C10 - EH CU 1D AL

TPH LQM - Aromatic >C10 - C12 - EH CU 1D AR

TPH LQM - Aromatic >C12 - C16 - EH CU 1D AR

TPH LQM - Aromatic >C21 - C35 - EH CU 1D AR

TPH LQM - Aromatic >C35 - C44 - EH CU 1D AR

TPH LQM - Aromatic >C5 - C44 - HS 1D MS+EH CU 1D AR

TPH LQM - Aromatic >C5 - C7 - HS 1D MS AR

TPH LQM - Aromatic >C7 - C8 - HS 1D MS AR

TPH LQM - Aromatic >C8 - C10 - EH CU 1D AR

TPH LQM - Total >C5 - C44 - HS 1D MS+EH CU 1D Total

Toluene - HS 1D MS

m & p-xylene - HS 1D MS

o-Xylene - HS 1D MS

Normec DETS Limited
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Certificate Key

Symbol	Description
F	Filtered sample
UF	Unfiltered sample
D	Dried sample
AR	As received sample
RL	Reporting limit
~	Sample details provided by customer and can affect the validity of results
M/S	Missing Sample
*	The Dutch 10 PAH compounds consist of Naphthalene, Anthracene, Phenanthrene, Fluoranthene, Benz(a)anthracene, Chrysene, Benzo(k)fluoranthene, Benzo(a)pyrene, Benzo(g,h,i)perylene, and Indeno(1,2,3-cd)pyrene
**	Total EPA-16 PAHs consist of the following polycyclic aromatic hydrocarbons: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, and Benzo(ghi)perylene.
***	Total WAC-17 PAHs consist of the following polycyclic aromatic hydrocarbons: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene and Coronene.
n	Please note that we are MCERTS soil accredited (UK soils only) for sand, loam, and clay, and UKAS accredited for groundwater, tap water, surface water, and generated leachates. Other matrices are outside our scope of accreditation.
S	Subcontracted analysis
M	MCERTS accredited test
U	UKAS accredited test



TEST REPORT
ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 11/07/2025



Contract	Millfields Farm, Rusper		
Serial No.	47949_1		
Client: BRD Environmental Ltd BRD Environmental Ltd Hawthorne Villa 1 Old Parr Road Banbury Oxfordshire OX16 5HT		Soil Property Testing Ltd 15, 16, 18 Halcyon Court, St Margaret's Way, Stukeley Meadows, Huntingdon, Cambridgeshire, PE29 6DG Tel: [REDACTED] Email: [REDACTED] Website: www.soilpropertytesting.com	
Samples Submitted By: BRD Environmental Ltd Samples Labelled: Millfields Farm, Rusper		Approved Signatories: ☒ J.C. Garner B.Eng (Hons) FGS Technical Director & Quality Manager ☐ W. Johnstone Materials Lab Manager [REDACTED]	
Date Received: 02/07/2025		Samples Tested Between: 02/07/2025 and 11/07/2025	
Remarks: For the attention of [REDACTED] Your Reference No: BRD4518			
Notes: 1 All remaining samples or remnants from this contract will be disposed of after 21 days from today, unless we are notified to the contrary. 2 Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. 3 Tests marked "NOT UKAS ACCREDITED" in this test report are not included in the UKAS Accreditation Schedule for this testing laboratory. 4 This test report may not be reproduced other than in full except with the prior written approval of the issuing laboratory. 5 The results within this report only relate to the items tested or sampled.			



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 11/07/2025



Contract		Millfields Farm, Rusper																						
Serial No.		47949_1										Target Date		16/07/2025										
Scheduled By		BRD Environmental Ltd																						
Schedule Remarks																								
Bore Hole No.	Type	Sample Ref.	Top Depth	Water Content (BSN) Liquid/Plastic Limits																				Sample Remarks
TP101	D	1	1.50	1	1																			
TP105	D	1	0.60	1	1																			
WS101	D	1	0.60	1	1																			
WS103	D	1	1.10	1	1																			
WS104	D	1	0.60	1	1																			
WS105	D	2	1.00	1	1																			
Totals				6	6																	End of Schedule		



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 11/07/2025



Contract	Millfields Farm, Rusper
Serial No.	47949_1

SUMMARY OF WATER CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole /Pit No.	Depth (m)	Type	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index	Sample Preparation				Description	Class
									Method	Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	Curing Time (hrs)		
TP101	1.50	D	1	28.1	61	23	38	0.13	From Natural	0 (A)		24	Firm mottled bluish grey and orangish brown CLAY with rare recently active and decayed roots	CH
TP105	0.60	D	1	32.2	74	27	47	0.11	From Natural	0 (A)		24	Firm mottled bluish grey and orangish brown CLAY with occasional recently active and decayed roots	CV
WS101	0.60	D	1	30.7	65	25	40	0.14	From Natural	0 (A)		24	Firm mottled bluish grey and orangish brown CLAY with rare recently active roots	CH
WS103	1.10	D	1	32.4	77	25	52	0.14	From Natural	0 (A)		24	Firm mottled light bluish grey and olive yellow CLAY with rare calcareous aggregations and recently active roots	CV
WS104	0.60	D	1	27.6	69	30	39	-0.06	From Natural	0 (A)		25	Very stiff fissured mottled bluish grey and olive yellow CLAY with rare calcareous aggregations and recently active roots	CH
WS105	1.00	D	2	24.5	58	25	33	-0.01	From Natural	0 (A)		24	Stiff mottled bluish grey and olive yellow CLAY with occasional orange staining and rare recently active roots	CH

Method Of Preparation: BS EN ISO: 17892-1: 2014+A1:2022 & BS 1377: Part 2:1990:4.2
Method of Test: BS EN ISO: 17892-1: 2014+A1:2022 & BS 1377: Part 2:1990:3.2, 4.4, 5.3, 5.4
Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
Comments:

Table Notation: Ret'd 0.425mm: (A) = Assumed, (M) = Measured



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 11/07/2025

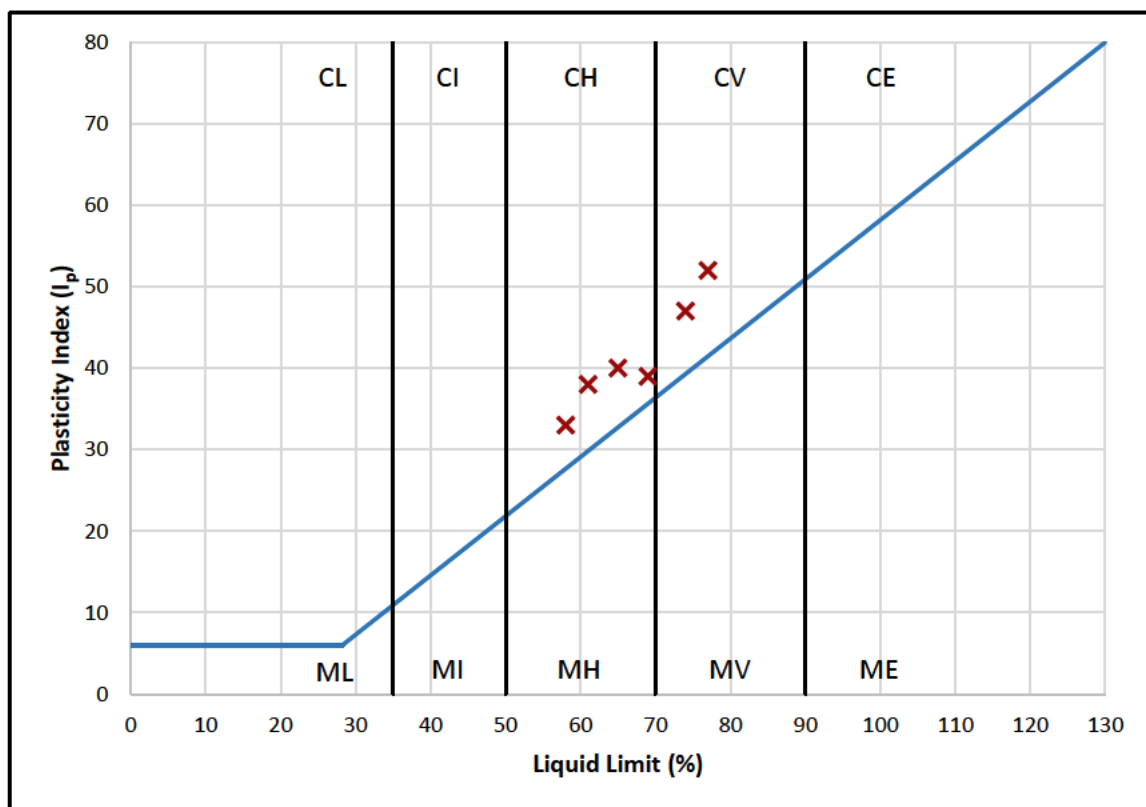


Contract **Millfields Farm, Rusper**

Serial No. **47949_1**

PLOT OF PLASTICITY INDEX AGAINST LIQUID LIMIT USING CASAGRANDE CLASSIFICATION CHART

Plasticity				
Low	Medium	High	Very High	Extremely High



Plasticity Chart BS5930: 2015: Figure 8

NHBC Volume Change Potential	
High	Medium
Low	

Method of Preparation: BS 1377: Part 2: 1990: 4.2

Method of Test: BS1377: Part 2: 3.2, 4.4, 5.3, 5.4

Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

Comments: Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index



TEST REPORT

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Contract	Millfields Farm, Rusper						
Serial No.	47949_1						
DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX							
Borehole / Pit No.	Depth m	Sample Type Reference		Water Content (W) %	Description	Remarks	
TP101	1.50	D	1	28.1	Firm mottled bluish grey and orangish brown CLAY with rare recently active and decayed roots		
PREPARATION					Liquid Limit	61 %	
Method of preparation					From natural	Plastic Limit	23 %
Sample retained 0.425mm sieve (Assumed)					0 %	Plasticity Index	38 %
Corrected water content for material passing 0.425mm						Liquidity Index	0.13
Sample retained 2mm sieve (Assumed)					0 %	NHBC Modified (I'p)	n/a
Curing time		24 hrs		Clay Content	Not analysed	Derived Activity	Not analysed
C=CLAY M=SILT Plasticity Index % (Ip) High Medium Low NHBC Volume Change Potential Liquid Limit %							

Plasticity Chart BS5930: 2015: Figure 8



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 11/07/2025



Contract	Millfields Farm, Rusper						
Serial No.	47949_1						
DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX							
Borehole / Pit No.	Depth m	Sample Type Reference		Water Content (W) %	Description	Remarks	
TP105	0.60	D	1	32.2	Firm mottled bluish grey and orangish brown CLAY with occasional recently active and decayed roots		
PREPARATION					Liquid Limit	74 %	
Method of preparation					From natural	Plastic Limit	27 %
Sample retained 0.425mm sieve (Assumed)					0 %	Plasticity Index	47 %
Corrected water content for material passing 0.425mm						Liquidity Index	0.11
Sample retained 2mm sieve (Assumed)					0 %	NHBC Modified (I'p)	n/a
Curing time		24 hrs		Clay Content	Not analysed	Derived Activity	Not analysed
C=CLAY M=SILT Plasticity Index % (Ip) High Medium Low NHBC Volume Change Potential Liquid Limit %							

Plasticity Chart BS5930: 2015: Figure 8



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 11/07/2025



Contract	Millfields Farm, Rusper						
Serial No.	47949_1						
DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX							
Borehole / Pit No.	Depth m	Sample Type Reference		Water Content (W) %	Description	Remarks	
WS101	0.60	D	1	30.7	Firm mottled bluish grey and orangish brown CLAY with rare recently active roots		
PREPARATION					Liquid Limit	65 %	
Method of preparation					From natural	Plastic Limit	25 %
Sample retained 0.425mm sieve (Assumed)					0 %	Plasticity Index	40 %
Corrected water content for material passing 0.425mm						Liquidity Index	0.14
Sample retained 2mm sieve (Assumed)					0 %	NHBC Modified (I'p)	n/a
Curing time		24 hrs		Clay Content	Not analysed	Derived Activity	Not analysed
C=CLAY M=SILT Plasticity Index % (Ip) High Medium Low NHBC Volume Change Potential Liquid Limit %							

Plasticity Chart BS5930: 2015: Figure 8



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 11/07/2025



Contract	Millfields Farm, Rusper						
Serial No.	47949_1						
DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX							
Borehole / Pit No.	Depth m	Sample Type Reference		Water Content (W) %	Description	Remarks	
WS103	1.10	D	1	32.4	Firm mottled light bluish grey and olive yellow CLAY with rare calcareous aggregations and recently active roots		
PREPARATION					Liquid Limit	77 %	
Method of preparation					From natural	Plastic Limit	25 %
Sample retained 0.425mm sieve (Assumed)					0 %	Plasticity Index	52 %
Corrected water content for material passing 0.425mm						Liquidity Index	0.14
Sample retained 2mm sieve (Assumed)					0 %	NHBC Modified (I'p)	n/a
Curing time		24 hrs		Clay Content	Not analysed	Derived Activity	Not analysed
C=CLAY M=SILT Plasticity Index % (Ip) High Medium Low NHBC Volume Change Potential Liquid Limit %							

Plasticity Chart BS5930: 2015: Figure 8



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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX							
Borehole / Pit No.	Depth m	Sample Type Reference		Water Content (W) %	Description	Remarks	
WS104	0.60	D	1	27.6	Very stiff fissured mottled bluish grey and olive yellow CLAY with rare calcareous aggregations and recently active roots		
PREPARATION					Liquid Limit	69 %	
Method of preparation					From natural	Plastic Limit	30 %
Sample retained 0.425mm sieve (Assumed)					0 %	Plasticity Index	39 %
Corrected water content for material passing 0.425mm						Liquidity Index	-0.06
Sample retained 2mm sieve (Assumed)					0 %	NHBC Modified (I'p)	n/a
Curing time		25 hrs		Clay Content	Not analysed	Derived Activity	Not analysed
C=CLAY M=SILT Plasticity Index % (Ip) High Medium Low NHBC Volume Change Potential Liquid Limit %							

Plasticity Chart BS5930: 2015: Figure 8



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Contract	Millfields Farm, Rusper						
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX							
Borehole / Pit No.	Depth m	Sample Type Reference		Water Content (W) %	Description	Remarks	
WS105	1.00	D	2	24.5	Stiff mottled bluish grey and olive yellow CLAY with occasional orange staining and rare recently active roots		
PREPARATION					Liquid Limit	58 %	
Method of preparation					From natural	Plastic Limit	25 %
Sample retained 0.425mm sieve (Assumed)					0 %	Plasticity Index	33 %
Corrected water content for material passing 0.425mm						Liquidity Index	-0.01
Sample retained 2mm sieve (Assumed)					0 %	NHBC Modified (I'p)	n/a
Curing time		24 hrs		Clay Content	Not analysed	Derived Activity	Not analysed
C=CLAY M=SILT Plasticity Index % (Ip) High Medium Low NHBC Volume Change Potential Liquid Limit %							

Plasticity Chart BS5930: 2015: Figure 8