



Land at Tollgate Road, Colney Heath

Minerals Assessment Desk Study

On behalf of **Vistry Group**

Vistry Group

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Registered Office: Buckingham Court Kingsmead Business Park, London Road, High Wycombe, Buckinghamshire, HP11 1JU
Office Address: 3rd Floor, 50-60 Station Road, Cambridge, CB1 2JH
T: +44 (0)1223 882000 E: cambridge.uk@stantec.com

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	Name	Position	Signature	Date
Prepared by:	Natasha Caton	Senior Engineer		02/12/22
Reviewed by:	Lawrence Truslove	Principal Engineer		05/12/22
Approved by:	Oliver Belson	Associate		09/12/22
For and on behalf of Stantec UK Limited				

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1 Introduction

1.1 Background

- 1.1.1 Stantec UK Limited (Stantec) has been commissioned by Vistry Group (the Client) to undertake a desk based study to identify potential mineral occurrence at the site known as 'Land at Tollgate Road, Colney Heath' in Hertfordshire. This report has been prepared to support a planning application for the proposed development.
- 1.1.2 This report presents an initial assessment of the mineral resource and potential for extraction based on a desk study review of:
- Geological data from the British Geological Survey, including publications and web hosted data.
 - Preliminary ground investigation data undertaken by Stantec (2022a).
 - Historical Ordnance survey maps at the site.
 - Local Minerals Plans prepared by Hertfordshire County Council.
- 1.1.3 The report will then assess the extent of the proposed development and identify any potential mineral at depth and if any resource present could feasibly be extracted prior to the built development.

1.2 Proposed Development

- 1.2.1 The site is proposed for residential development for up to 150 new homes, including 35% affordable housing and associated works.

1.3 Minerals Policy and Planning

National Planning Policy Framework

- 1.3.1 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021) paragraphs 209 to 214 describe how planning policies should facilitate the sustainable use of minerals.
- 1.3.2 Paragraph 210 states that '*Planning policies should:*
- c) Safeguard mineral resources by defining Mineral Safeguarding Areas and Mineral Consultation Areas; and adopt appropriate policies so that known locations of specific mineral resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resource defined will be worked); and*
 - d) set out policies to encourage the prior extraction of minerals, where practical and environmentally feasible, if it is necessary for non-mineral development to take place;...*
- 1.3.3 The NPPF also states in paragraph 213 that '*Minerals planning authorities should plan for a steady and adequate supply of aggregates by...*
- f) maintaining landbanks of at least 7 years for sand and gravel ... whilst ensuring that the capacity of operations to supply a wide range of materials is not compromised'.*

Hertfordshire Minerals Local Plan

- 1.3.4 The current Hertfordshire Minerals Local Plan (MLP) (HCC, 2007) was adopted in 2007. The MLP is currently under review and the emerging Minerals and Waste Local Plan with consultation on the plan ended on 31st October 2022.
- 1.3.5 The policies map within the current MLP and the emerging Minerals and Waste Local Plan (MWLP) (HCC, 2022) confirms that the site is located within a Minerals Safeguarding Area (MSA) for sand and gravel. The site does not cross a Mineral Consultation Area (MCA) or a Minerals Allocation Site (MAS). The nearest MAS is located approximately 720m to the southwest of the site and relates to Coursers Farm.

Hertfordshire County Council – Local Aggregate Assessment

- 1.3.6 The latest available Local Aggregate Assessment (LAA) was published in November 2021 (HCC, 2021) and reflects the position at the end of 2020 based on the current MLP. The LAA contains the following relevant information:
- **Mineral Extraction Facilities:** As of the end of 2020 there were seven permitted sand and gravel quarries in Hertfordshire, of those seven, three have remaining reserves of sand and gravel. The remaining four are no longer extracting sand and gravel. Two planning applications for sand and gravel extraction were also determined during 2020, one being refused, and one being permitted subject to the signing of the Section 106 legal agreement and therefore the reserves could not be added to the total reserves figure.
 - **Sand and Gravel Sales:** The 10-year annual average sales (2011 to 2020) figure was 1.19Mt and the 3-year sales average was 1.19Mt. However, an annual provision rate of 1.19Mt was considered too low, and the LAA deems a revised annual provision rate of 1.31Mt should be used to provide more flexibility.
 - **Sand and Gravel Landbank:** The current landbank is calculated using the 10-year sales average, which currently stands at 6.5years which is below the seven-year requirement set out in the NPPF.
- 1.3.7 The LAA concluded that the current stock of sand and gravel is insufficient to meet the future demands of the county, and as such there has been a review of the MLP and the emerging MWLP is being put into place to account for this. The emerging MWLP is being prepared with the 1.31Mt sales average in mind, however this means that Hertfordshire has a current landbank of 5.9 years. It is considered however that with the addition of the new extraction area mentioned above, approved but not yet added, this will significantly increase the reserves and increase the landbank. In addition, the measures and identified sites within the emerging MWLP will meet the county's future provisions for sand and gravel.

2 Site Setting

2.1 Site Location

2.1.1 The site is located on the southern edge of Colney Heath, Hertfordshire, approximately 5km southeast of St Albans. The site is approximately centred at National Grid Reference 520891, 205504 with the approximate postcode AL4 0NZ. A Site Location Plan is presented as **Figure 1**.

2.2 Site Description

2.2.1 The site comprises an irregularly shaped parcel of land occupied by a large horse paddock with stables on the western site boundary and a residential property (No.42 Tollgate Road) on the north-western corner of the site. The site is accessed via a gravel surfaced driveway located to the west of the residential property. A Site Layout Plan is presented in **Figure 2**.

2.2.2 The stable buildings were located just south of the access into the site and comprised a long single storey wooden structure with steel storage containers adjacent. The land immediately surrounding the stables was used for the storage of horse boxes.

2.2.3 a small outdoor arena, covered with shredded rubber surfacing was located in front of the stable building.

2.2.4 The field area closest to the stables had been sub-sectioned using electric fencing to provide smaller paddocks for the horses.

2.2.5 The north-eastern boundary of the site runs along the back of houses fronting onto Tollgate Road.

2.2.1 The following off site land uses have been identified:

- North - Residential properties fronting Tollgate Road.
- East and South-east - Fields with isolated residential properties beyond.
- West and South-west - River Colne with wooded area and isolated residential properties beyond.
- North-west - Field with isolated residential properties beyond

2.2.2 The site slopes downhill to the south-west towards the River Colne. The highest point occurs in the north-western corner of the site at around 76m AOD and the lowest point occurs in the south-western corner at around 70m AOD.

2.3 Historical Land Use

2.3.1 The OS map records and Google Earth imagery indicate that the site has been in agricultural usage since at least the late 19th century, the earliest record obtained to date. The residential properties adjacent to the northern side of the site date from the early through to the late twentieth century.

2.3.2 Other features of note are:

- Two blacksmiths were located between 200m and 460m to the north-west of the site on the 1896 map.

- A Gravel Pit was located 750m to the south-east of the site and an Old Chalk Pit approximately 1km to the west of the site on the 1896 map.
- An unspecified 'pit' was located 220m to the west of the site on the opposite bank of the River Colne to the site on 1930s mapping.

2.4 Ecology and Geodiversity

- 2.4.1 The site does not lie within 500m of any statutory designated ecological or geological site.
- 2.4.2 A Local Nature Reserve is located approximately 200m northwest of the site.

2.5 Water Environment

- 2.5.1 With reference to the Environment Agency mapping, the site falls into a Source Protection Zone (SPZ) II, with a SPZI located off site adjacent to the northeast boundary,.
- 2.5.2 The superficial Kesgrave Catchment Subgroup and the Alluvium are classified as a Secondary A Aquifers – these are permeable layers capable of supporting water supplies at a local, rather than strategic scale and may contribute baseflow to surface water features.
- 2.5.3 The Lowestoft Formation is classed as a Secondary Aquifer – Undifferentiated. 'Undifferentiated' is assigned where it is not possible to attribute either Secondary A category or B to a rock type. In general, these layers have previously been designated as both minor and non-aquifers in different locations due to the variable characteristics of the rock type.
- 2.5.4 The Chalk bedrock is designated a Principal Aquifer. Principal Aquifers are described as strata that provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands.
- 2.5.5 Shallow perched groundwater is expected within the Lowestoft Formation and Kesgrave Catchment Subgroup. Details of the groundwater encountered during the ground investigation is detailed in Section 3.3 below.
- 2.5.6 Groundwater within the Chalk bedrock principal aquifer is identified as flowing towards the southeast by reference to the hydrogeological map record. Shallow perched groundwater in the superficial deposits is considered likely to flow south or southwest towards the River Colne.
- 2.5.7 The River Colne runs parallel to the southern/south western site boundary which is classified by the Environment Agency as a Statutory Main River. A secondary drainage ditch is located just south-west of the River Colne and runs parallel to the river.

2.6 Utilities

- 2.6.1 Based on consultation undertaken during the project with BPA an oil pipeline has been identified running along the southwestern boundary of the site. The pipeline carries diesel, petrol, kerosene and Jet A1 fuel with a statutory easement of 6m surrounding the pipeline.

3 Geology

3.1 Published Geological Map Record

3.1.1 The 1:50,000 series geological map (BGS, 1978) and BGS GeoIndex (onshore) (BGS, 2021) indicate the following geological sequence underlying the Site:

- Deposits of the Lowestoft Formation Diamicton Till (formerly termed Boulder Clay) comprising a chalky till containing sands, gravels, silts and clays outcrop on the northern and north-eastern areas of the site.
- Deposits of the Kesgrave Catchment Subgroup, typically comprising sands and gravels outcrop over the central area of the site.
- The south-western edge of the site, closest to the River Colne, is mapped as being underlain by Alluvium.
- Beneath the superficial deposits the site is underlain by the Lewes Nodular Chalk Formation and Seaford Chalk Formation. These form part of the White Chalk Sub-Group which typically comprise chalk with flints, with discrete marl seams, nodular chalk and flint seams throughout.

3.2 Historical BGS Boreholes

3.2.1 The BGS borehole record viewer (BGS, 2022) includes two nearby borehole records. These are summarised in Table 2-1 below.

Table 3-1 BGS Borehole Records Summary

BGS Described Lithology	Depth from (m bgl)	Depth to (m bgl)
Borehole TL20NW14 200m west of the Site		
Made Ground	0.0	0.1
Topsoil	0.1	0.8
Boulder Clay	0.8	5.9
Glacial Gravel	5.9	11.0
Boulder Clay	11.0	13.0
Glacial Gravel	13.0	20.0
Upper Chalk	20.0	>21.0
Borehole TL20NW17 450m south-east of the Site		
Topsoil	0.0	0.2
Glacial Gravel	0.2	5.9
Lake Deposits	5.9	6.5
Boulder Clay	6.5	9.9
Upper Chalk	9.9	>10.2

3.3 Ground Investigation

3.3.1 A ground investigation was undertaken by Stantec in May 2022 and a Phase 2 Ground Investigation Report (Stantec, 2022b) prepared. The aim of the investigation was to provide preliminary ground conditions information across the site to support the submission of the planning application.

- 3.3.2 The ground conditions beneath the site, as revealed by the current ground investigation comprise locally either Topsoil, or Made Ground overlying the Kesgrave Catchment Subgroup, with the Lowestoft Formation (Boulder Clay) located at depth. The Lewes Nodular Chalk Formation and Seaford Chalk Formation and the Alluvium were not encountered during the ground investigation. This is because the chalk is present at depth beneath the 10m deep boreholes that were sunk and investigation was not possible on the south-western side of the site where the Alluvium was expected due to the presence of the oil pipeline.
- 3.3.3 The ground conditions encountered are summarised in the following table and copies of the exploratory hole logs from the investigation are presented in **Appendix A**:

Table 3-2 Summary of Encountered Ground Conditions

Stratum	Base of Stratum (m bgl)	Thickness range (m)	Typical Description
Topsoil	0.15 to 0.40 (from surface in all location except WS1 & WS2)	0.15 to 0.40	Grey slightly gravelly clayey fine to medium SAND
Made Ground	0.50 to 0.70 (present in WS1, WS2 and SA02 only)	0.30 to 0.70	Encountered in SA02 as re-worked topsoil with plastic inclusions. Encountered in WS1 & WS2 as grey sandy GRAVEL surfacing material.
Kesgrave Catchment Subgroup	1.50 to 4.70 ^[a]	1.25 to 3.10	Cohesive: Variable firm orangish brown or greyish brown slightly to very gravelly slightly sandy to very sandy CLAY
	0.85 to 9.30 ^[a]	0.50 to 8.95	Granular: Medium dense orangish brown slightly clayey gravelly SAND or slightly clayey sandy GRAVEL
Lowestoft Formation	2.10 to 7.80 ^[a]	0.30 to 2.90	Cohesive: Firm grey clay with sand sized chalk fragments
	4.60 to 10.00 ^[a]	>0.6 to >4.3	Granular: Medium dense to dense grey fine SAND
Chalk	-	-	Not Encountered.
Notes: [a] Stratum not fully penetrated in all exploratory holes			

- 3.3.4 Two Particle Size Distribution (PSD) tests were undertaken in the near surface cohesive Kesgrave Catchment Subgroup, the tests indicate the fines fraction is variable with the clay fraction between 14% - 32% and the silt fraction between 16% - 25%. The sand fraction was indicated to be between 26% - 39% and the gravel fraction between 17% - 31%.
- 3.3.5 Six PSD tests were undertaken in the granular Kesgrave Catchment Subgroup, the tests indicate the fines fraction (clay and silt) to be between 6% - 21%, the sand fraction between 23% - 34% and the gravel fraction between 50% - 66%. A copy of the laboratory testing is presented in **Appendix B**.
- 3.3.6 Groundwater monitoring results from the post ground investigation monitoring indicated the groundwater was generally relatively high, with groundwater present at approximately 3.0 to 4.0m bgl in the north and east of the site, and at around 0.6 to 2.0 bgl in the south and west of the site. These results show that groundwater is typically shallower within proximity to the River Colne that forms the southwestern site boundary.
- 3.3.7 It should be noted that the groundwater monitoring was undertaken in early summer only, when groundwater levels would have likely been at their lowest. Groundwater levels are generally at their highest in late winter/ early spring.

3.4 Minerals Assessment Report

- 3.4.1 A regional sand and gravel Minerals Assessment Report (MAR) carried out by the Institute of Geological Sciences (IGS) considers the mineral resource around Hatfield and Cheshunt (IGS, 1981). The MAR is a series of reports that describe the mineral resource across areas of the United Kingdom. The reports were produced using data gathered from borehole surveys and contain qualitative and quantitative data on lithology, composition, particle size analysis and other information of commercial value. The survey was concerned with the estimation of resources, which included deposits that were at that time not being exploited but which had a foreseeable potential for future working.
- 3.4.2 MAR 67 (IGS, 1981) subdivides the area covered into resource blocks, with the site falling into resource block A, where the site is located within an area marked as 'continuous or almost continuous spread of mineral beneath overburden'.
- 3.4.3 As part of the study a number of boreholes were sunk across the region to establish the thickness and quality of the mineral. None of the boreholes were situated within the site boundary, however two boreholes were sunk located in proximity to the site. These are the two boreholes summarised in **Section 3.2** above.

4 Mineral Assessment

4.1 Baseline Conditions

- 4.1.1 The historical boreholes and the findings of the ground investigation undertaken across the site have proven the anticipated geology with the Kesgrave Catchment Subgroup identified as being present beneath the site which is the material likely to be safeguarded.
- 4.1.2 The Kesgrave Catchment Subgroup was found to be highly variable both vertically and laterally across the site with intermixed cohesive and granular material identified as shown on the cross sections presented as **Figure 3**.
- 4.1.3 Laboratory testing indicated a fines (i.e. clay and silt) content of the granular strata to be up to 21%. The gravel fraction was found to be fine to medium rounded flint.

4.2 Constraints to Mineral Extraction

- 4.2.1 As outlined in the Hertfordshire MWLP there is a requirement to determine whether prior extraction of the mineral is practical and environmentally acceptable and must take account of the potential impacts on the immediate surroundings.
- 4.2.2 Several constraints and easements/stand-offs would thus be applied to this area with respect to any potential future working of the identified mineral resource as listed below, and as a consequence may affect the overall viability of the prior extraction of the material. These buffers are presented on **Figure 4** and further explanation is given below.

Groundwater

- 4.2.3 Groundwater was recorded at a relatively shallow depth, typically between 0.6m and 4m bgl within the superficial deposits, designated a Secondary A Aquifer. The site also falls within a SPZII with a SPZI located immediately adjacent to the northeast of the site which is likely to be associated with a groundwater abstraction within the underlying chalk, designated a Principal Aquifer. The cohesive Lowestoft Formation superficial deposits, locate beneath the Kesgrave Subgroup will likely act as an aquitard between the Secondary A aquifer and the Principal Aquifer.
- 4.2.4 The River Colne runs parallel to the southern/southwestern site boundary, which is classified as a Statutory Main River by the Environment Agency. The southwestern part of the site is also located within a Flood Zone 2 and 3.
- 4.2.5 Any sand and gravel extraction would be completed using surface quarrying techniques and would therefore be likely to encounter groundwater at a shallow depth. Groundwater lowering by pumping would likely be required to facilitate the extraction of the sand and gravel from the site.
- 4.2.6 Large scale groundwater lowering, would likely have an impact on the hydrogeological regime within the area. Groundwater dewatering is unlikely to have an impact on the SPZs, as they are associated with the deeper chalk aquifer, however it is likely to impact on the Secondary A aquifer below the site as well as the River Colne and the flood plain. Therefore, it is highly unlikely that large scale dewatering would be permitted by the Environment Agency without a detailed assessment demonstrating that there will be no negative impact from dewatering operations on the aquifer and river. Any dewatering would require the necessary permits for both abstraction and disposal, which may negatively affect the local hydrogeological and hydrological setting of the Site and the immediate environment. A buffer zone is likely to be placed around the river to protect it from any potential negative effects of the extraction. The HCC MLP (2007) currently does not give any indication of a suitable standoff, however a buffer

of 100m is considered appropriate based on experience and professional judgement, as shown on **Figure 4**.

- 4.2.7 Once extraction has been completed, the resultant void from mineral extraction would require infilling to reinstate site levels, likely using inert waste. The backfilling of such voids would need to be undertaken in accordance with an Environmental Permit and necessary engineering measures put in place such that the waste does not present an adverse impact on groundwater resources.
- 4.2.8 The placement of inert waste would act as an artificially enhanced geological barrier and is likely to result in changes to the hydrogeological setting and regime and possibly result in groundwater mounding upstream and a groundwater 'shadow' downstream of the landfill body. This could therefore present a negative impact locally in relation to groundwater levels.
- 4.2.9 The infilling of the resultant void is also likely to have an impact on the floodplain of the River Colne. The current MLP (HCC, 2007) states that '*mineral workings must be planned so they do not exacerbate flooding issues*' and that mineral development '*shall not be permitted if the development would increase the risk of flooding or have a material negative impact on the storage or flow capacity of the floodplain*' therefore it is likely that mineral extraction and then infilling will not be allowed within the floodplains of the river and a buffer zone placed around it, as shown on **Figure 4**.

Utilities

- 4.2.10 An oil pipeline has been identified running along the southern boundary of the site which requires a 6m easement surrounding it. Further stability assessment would be required and consultation with BPA to obtain their agreement to have such works in close proximity to their infrastructure. The standoff required is likely to be larger than the 6m already stated due to the nature of the development. It is expected that a minimum standoff of 50m to the extraction edge with a 6m plant exclusion zone is likely to be imposed on the pipeline which further reduces the extractable amount of the resource from the site. The impact of this exclusion zone is shown on **Figure 4**.

Existing Residential Properties

- 4.2.11 Residential properties are situated immediately to the northeast of the site. It is expected that a buffer zone will be required to minimise the potential impacts such as generation of noise and dust as a result of mineral extraction activities on sensitive receptors, such as human receptors in residential properties.
- 4.2.12 The Hertfordshire Minerals Local Plan states that appropriate buffer zones to safeguard sensitive land-use, which includes dwellings, needs to be incorporated into the development. The current MLP (HCC, 2007) and the emerging MLP (HCC, 2022) do not state a specific buffer zone, however the MLP from Essex County Council (2014) states a buffer of 100m from residential properties is required for minerals development which has been utilised on **Figure 4**. The buffer will also mean that the amount of extractable material is reduced further.

Transport Network

- 4.2.13 Any proposals for land won sharp sand and gravel extraction, would only normally be permitted in accordance with minerals policy 16 of the MLP which is related to transport of minerals to and from the development site.
- 4.2.14 As a consequence of development, consideration would need to be given to the potential impact of significant lorry movements associated with both the prior extraction of mineral reserves and also the importation of inert materials to facilitate restoration to appropriate levels.

Practical Considerations

- 4.2.15 In addition to those mentioned above, in respect of the potential practicability of prior extraction:
- 4.2.16 The variable interbedded nature of the deposits is likely to result in extra work to strip and stockpile overburden such as topsoil and clay strata.
- 4.2.17 The variable interbedded nature of the deposits is likely to result in increased processing and a high percentage of 'waste' material arising due to the cohesive nature of a portion of the in situ geology, which would make reduce the commercial viability of the site for mineral extraction and processing. This material would therefore require either offsite disposal or backfilling to the resultant voids with the need to potentially create a series of stockpiles and settlement and silt lagoons. These ground conditions could give rise to potential development constraints that will need to be accommodated during the planning and design process, and include;
- The presence of weak and compressible made ground backfill to the resultant void post mineral extraction that is likely to require piled foundations or ground improvement to support structural loads. Settlement of the ground needs to be carefully considered.
 - Buried pit edges forming the transition between different types of worked/ filled ground and natural unworked ground need to be considered in terms of possible differential settlement effects on the design of roads and underground services, drainage pipes, buildings etc.
 - Silt lagoons are notoriously dangerous as the materials are extremely weak (unless, for example, covered by a significant thickness of stronger material) and often remain weak for decades until the excess pore water pressures dissipate. The latter is highly dependent on the thickness of the silt layer and the nature of the adjacent materials above and below the silt – e.g. if highly permeable layers occur above and below the silt, the water pressures will dissipate relatively quickly, if not, then relatively slowly.
- 4.2.18 Any resultant void from minerals extraction would require infilling to reinstate site levels. Whilst the mantle of Topsoil overlying the mineral would need to be removed to allow extraction, it would likely be retained for future restoration. Overburden and waste resulting from mineral processing would be used to fill the resultant void however import of additional materials would be required. These would require temporary stockpiling and as such additional requirements in relation to assessment of landscape and visual effects would need to be considered in addition to temporary surface water management during the operational phases.
- 4.2.19 Minerals Planning Consent would be required for prior extraction and restoration. An Environmental Permit would also likely be required from the Environment Agency for the import and placement of suitable inert waste to reinstate site levels.
- 4.2.20 The timeline over which prior extraction and subsequent backfilling/ reinstatement would take place will be dependent on both the perceived economic viability of the Site to individual aggregate companies but also availability of material to import to Site to facilitate restoration.
- 4.2.21 Post extraction development would incur additional ground-related abnormalities which could impact on both the land value and potential overall viability of some schemes. In this respect, it is noted the current National House Building Council Technical Standards would likely require special foundation schemes to be employed. Consideration would need to be given also to the potential differential settlement of infilled materials and the impact that they may have on roads and infrastructure, which could result in increased mitigation measures needing to be employed.

5 Conclusions

- 5.1.1 The site falls into a minerals safeguarded area as part of the current MLP (HCC, 2007) and the emerging MWLP (HCC, 2022) for sand and gravel.
- 5.1.2 The latest LAA identified that the current landbank of material in Hertfordshire is 6.5 years which is below the 7 year landbank required under the NPPF. However, the report concluded that with the addition of the new extraction area (Land adjoining Coopers Green) having planning permission granted, this will significantly increase the reserves and increase the landbank. In addition, the measures and identified sites within the emerging MWLP will meet the county's future need for sand and gravel.
- 5.1.3 An intrusive ground investigation was undertaken at the site to provide information on the ground conditions. The ground conditions were found to contain potentially extractable strata of the Kesgrave Catchment Subgroup. However this geological strata was found to be variable laterally and vertically across the site comprising intermixed layers of cohesive and granular material, with only the latter being suitable for extraction and processing. Cross sections across the site show that the granular material is not laterally extensive and a substantial quantity of material would be generated as an overburden waste if the material was extracted.
- 5.1.4 A number of constraints have been identified to extraction operations. In principle the constraints comprise;
- the proximity of the oil pipeline,
 - the presence of existing residential properties immediately to the northeast of the Site.
 - the requirement for dewatering on the Aquifers and adjacent River Colne.
- 5.1.5 Buffers have been applied around the constraints and the likely available area available for minerals extraction is shown on **Figure 4**.
- 5.1.6 It is concluded that sand and gravel mineral extraction ahead of development would not be practical nor is it likely to be commercially viable and therefore is unlikely to be required prior to development.

6 Essential Guidance for Report Readers

- 6.1.1 This report has been prepared within an agreed timeframe and to an agreed budget that will necessarily apply some constraints on its content and usage. The remarks below are presented to assist the reader in understanding the context of this report and any general limitations or constraints. If there are any specific limitations and constraints, they are described in the report text.
- 6.1.2 The opinions and recommendations expressed in this report are based on statute, guidance, and best practice current at the time of its publication. Stantec UK does not accept any liability whatsoever for the consequences of any future legislative changes or the release of subsequent guidance documentation, etc. Such changes may render some of the opinions and advice in this report inappropriate or incorrect and the report should be returned to us and reassessed if required for re-use after one year from date of publication. Following delivery of the report, Stantec has no obligation to advise the Client or any other party of such changes or their repercussions.
- 6.1.3 Some of the conclusions in this report may be based on third party data. No guarantee can be given for the accuracy or completeness of any of the third-party data used. Historical maps and aerial photographs provide a “snapshot” in time about conditions or activities at the site and cannot be relied upon as indicators of any events or activities that may have taken place at other times.
- 6.1.4 The conclusions and recommendations made in this report and the opinions expressed are based on the information reviewed and/or the ground conditions encountered in exploratory holes and the results of any field or laboratory testing undertaken. There may be ground conditions at the site that have not been disclosed by the information reviewed or by the investigative work undertaken. Such undisclosed conditions cannot be taken into account in any analysis and reporting.
- 6.1.5 It should be noted that this report is a land condition assessment and does not purport to be an ecological, flood risk or archaeological survey and additional specific surveys may be required.
- 6.1.6 This report has been written for the sole use of the Client stated at the front of the report in relation to a specific development or scheme. The conclusions and recommendations presented herein are only relevant to the scheme or the phase of project under consideration. This report shall not be relied upon or transferred to any other party without the expressed written authorisation of Stantec. Any such party relies upon the report at its own risk.
- 6.1.7 The interpretation carried out in this report is based on scientific and engineering appraisal carried out by suitably experienced and qualified technical consultants based on the scope of our engagement. We have not taken into account the perceptions of, for example, banks, insurers, other funders, lay people, etc., unless the report has been prepared specifically for that purpose. Advice from other specialists may be required such as the legal, planning and architecture professions, whether specifically recommended in our report or not.
- 6.1.8 Public or legal consultations or enquiries, or consultation with any Regulatory Bodies (such as the Environmental Agency or Local Planning Authorities) have taken place only as part of this work where specifically stated.

7 References

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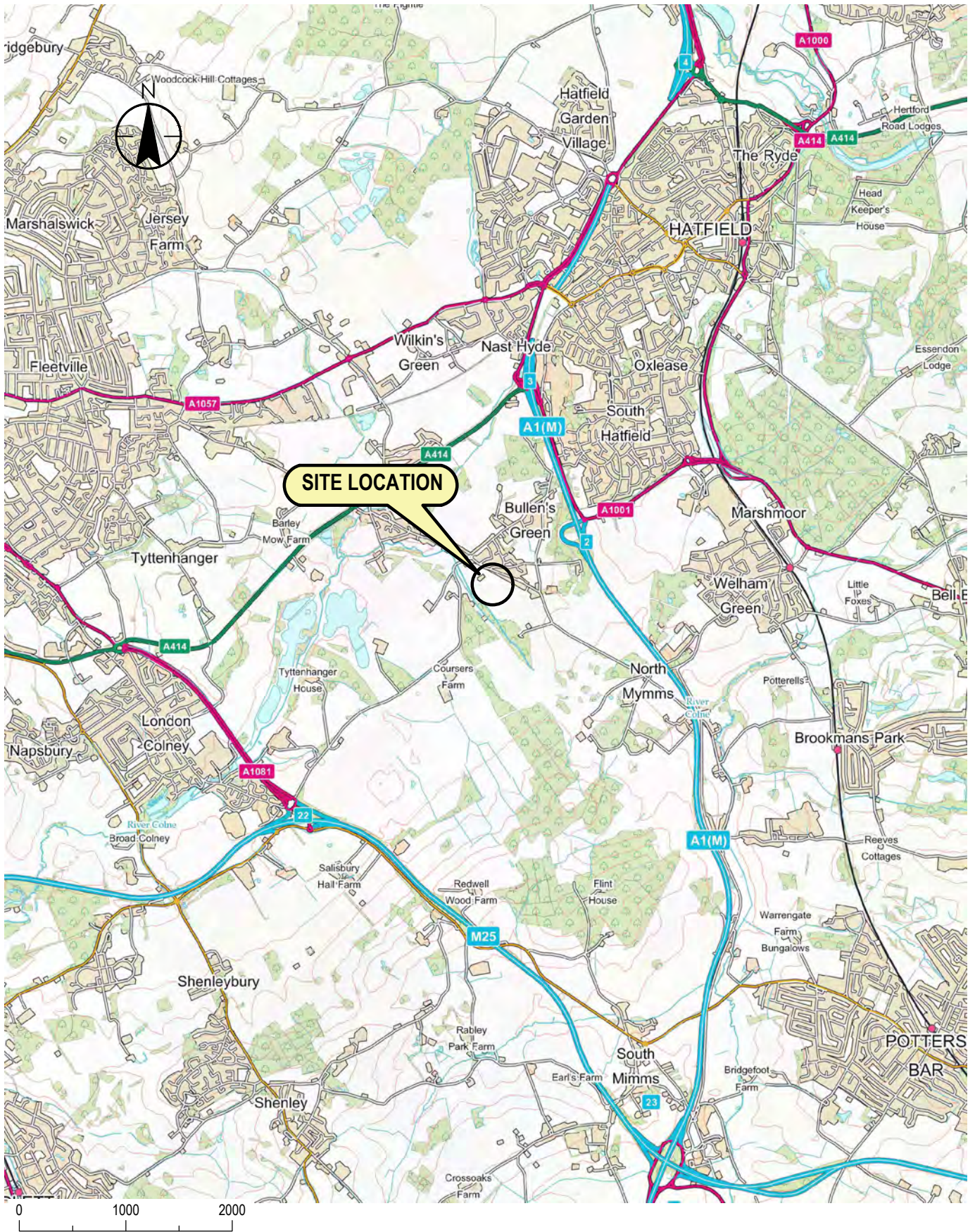
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Stantec, 2022b, Phase 2 Ground Investigation Report. Land at Tollgate Road, Colney Heath. Reference: 332510999/3501/R02. Stantec UK Limited.

Figures



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Site Grid Reference: TL 20910 05489



Stantec UK Limited
 READING
 Caversham Bridge House, Waterman Place, Reading,
 Berkshire RG1 8DN
 Tel: +44 1189 500 761
 www.stantec.com/uk

Client/Project:
 Vistry Group

Land at Tollgate Road,
 Colney Heath

Prepared: davco Checked: NC Date: 2022.12.02

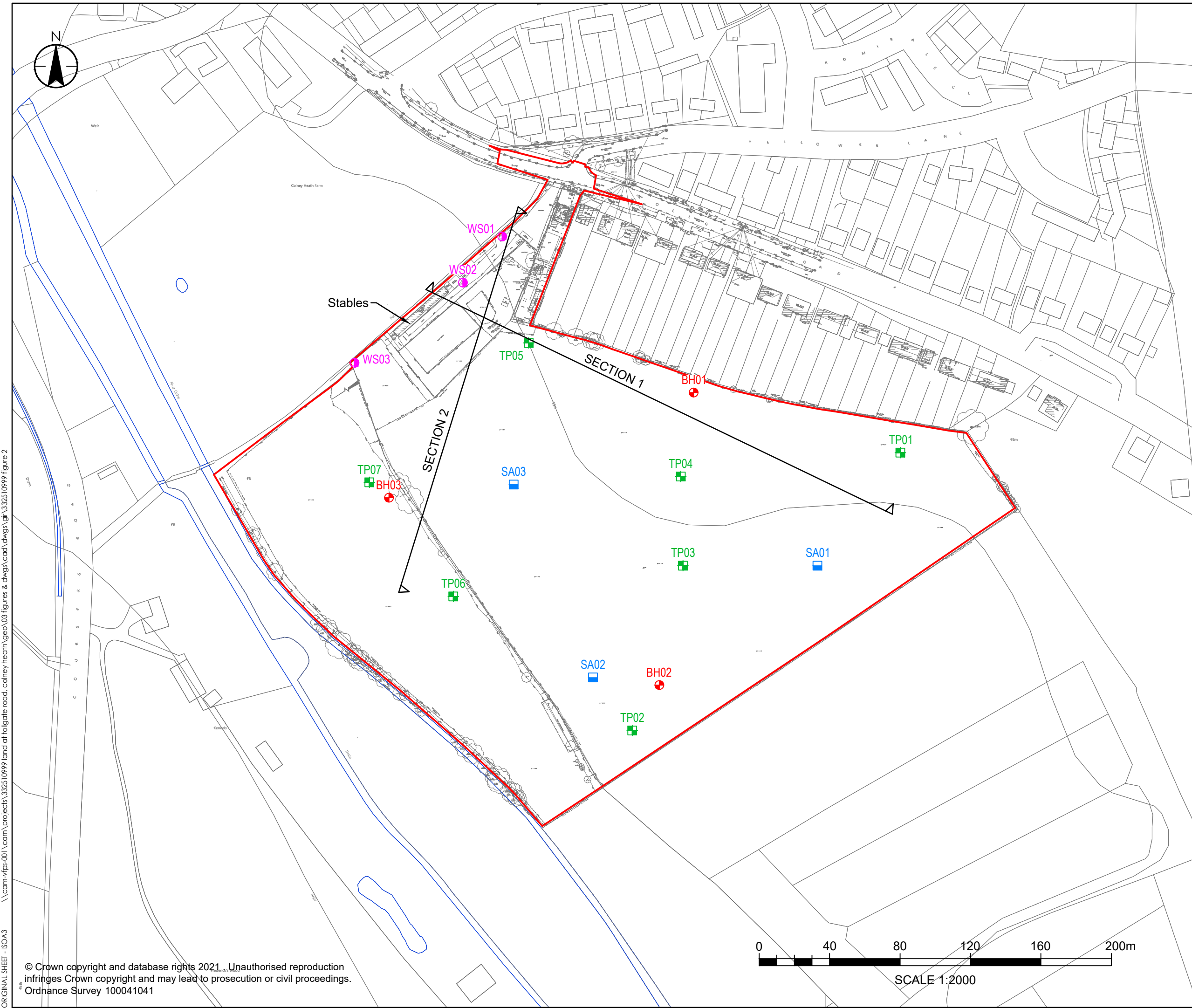
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Revision: 0 Figure



Key

- Approximate Site Boundary
- ⊕ Borehole
- ⊕ Trial Pit
- Window Sample
- ⊕ Soakaway
- △ Cross Sections (Refer to Figure 3)



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Client/Project:
Vistry Group

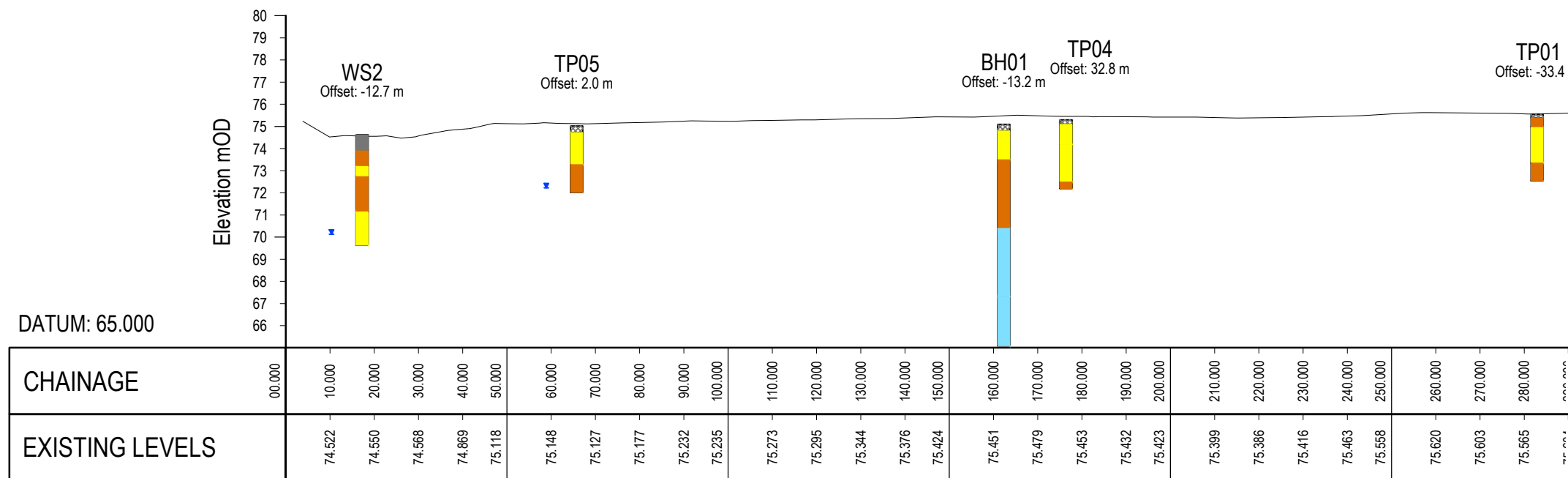
Land at Tollgate Road,
Colney Heath

Prepared: davco	Checked: NC	Date: 2022.12.02
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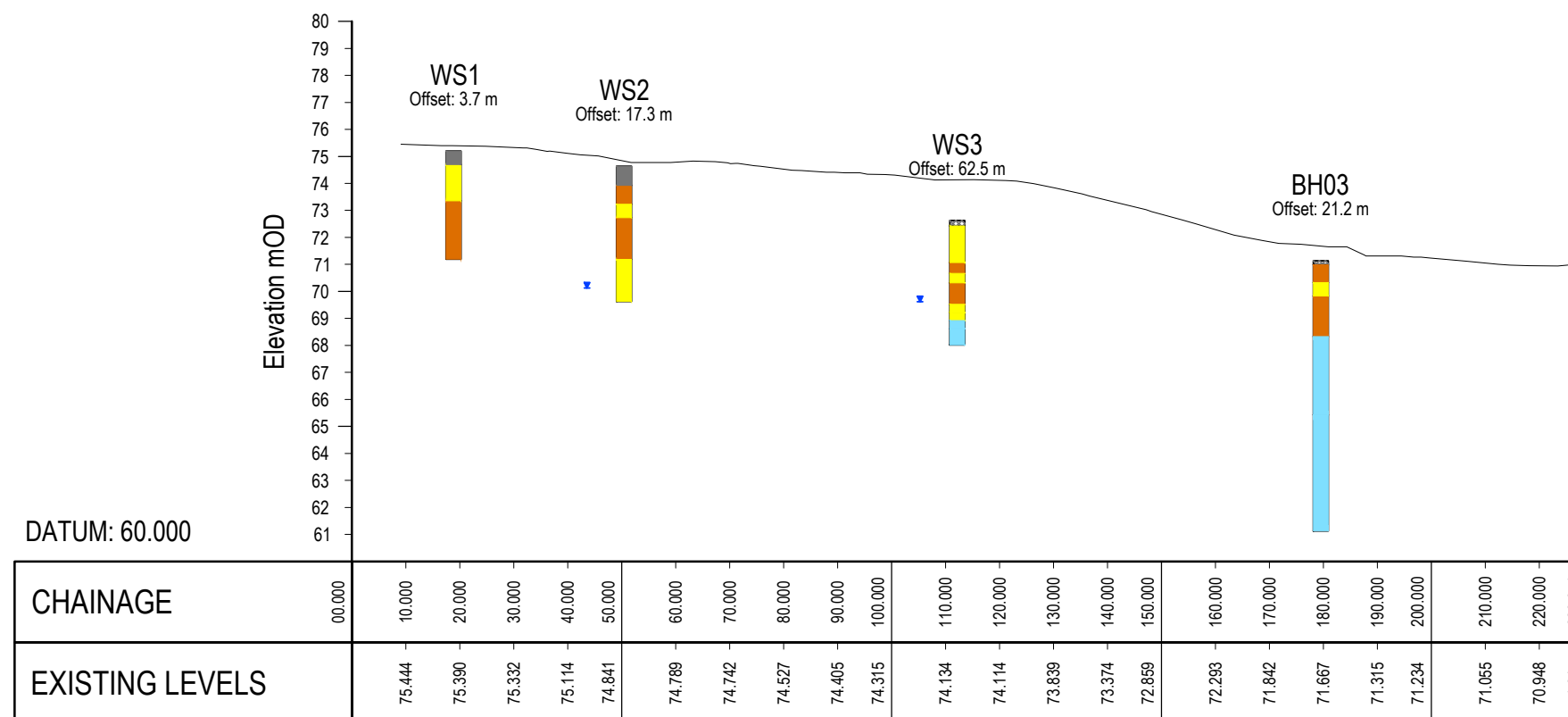
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SECTION 1
SCALE: H 1:1250, V 1:250.



- Legend
- Made Ground
 - Topsoil
 - Kesgrave - Cohesive
 - Kesgrave - Granular
 - Lowestoft

SECTION 2
SCALE: H 1:1250, V 1:250.



Refer to Figure 2 for Cross Section Alignments

Client/Project:
Vistry Group
Land at Tollgate Road,
Colney Heath








Prepared: davco Checked: NC Date: 2022.12.02

Title
Geological Cross Sections

Revision: 0 Figure 3



Key

-  Approximate Site Boundary
-  Oil Pipeline
-  Floodline Extent
-  Residential Buffer Zone 100m
-  River Colne Buffer Zone 100m
-  Oil Pipeline Buffer Zone 50m
-  Potential Available Extraction Area



SCALE 1:2000

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ORIGINAL SHEET - ISCA3
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Client/Project:
Vistry Group

Land at Tollgate Road,
Colney Heath







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davco	NC	2022.12.12

Title
Site Constraints

Revision:	Figure
0	4

Appendix A Ground Investigation Logs


Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			TRIAL PIT SA01
Client Vistry Group		Start Date End Date 04/05/2022 04/05/2022			
Contractor A F Howlands		Ground Level 75.23m OD		Logged By: MRG	Sheet 1 of 1
Method/Plant JCB 3CX		Coordinates 520995 E 205463 N		Checked By: LT	Scale 1:25

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrum entation /Backfill
	Depth	Type	Results						
0.10		ES ES1				(0.30)		TOPSOIL: Grey slightly gravelly clayey fine to medium SAND. Gravels are fine to medium rounded flints.	
						0.30	74.93	<u>Very gravelly below 0.2m</u> Orangish brown slightly clayey very gravelly fine to coarse SAND. Gravels are fine to medium round flints [Kesgrave Catchment Subgroup]	
1						(1.20)			
						1.50	73.73	Firm grey sandy CLAY with localised orangish brown mottling. Sand is fine to medium. [Kesgrave Catchment Subgroup]	
2						(1.50)			
3						3.00	72.23	End of Trial Pit at 3.00m	
4									
5									


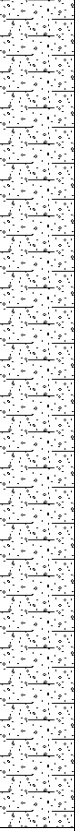
General Remarks 1. CAT Scanned Prior to excavation	Water	Stability:
	Strike	Pit Dimensions
	Standing	<div style="border: 1px solid black; width: 100px; height: 20px;"></div>
	Flow	

Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			TRIAL PIT
Client Vistry Group		Start Date 04/05/2022	End Date 04/05/2022		SA02
Contractor A F Howlands		Ground Level 72.40m OD			
Method/Plant JCB 3CX		Coordinates 520868 E 205400 N		Logged By: MRG	Sheet 1 of 1
				Checked By: LT	Scale 1:25

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
0.10	ES ES1					(0.30)	72.10	TOPSOIL: Grey slightly gravelly clayey fine to medium SAND. Gravels are fine to medium rounded flints.	
0.50	ES2					(0.30)	71.80	MADE GROUND: Grey slightly gravelly clayey fine to medium SAND with occasional pieces of plastic. Gravels are fine to medium rounded flints. (reworked topsoil)	
						(0.60)	71.30	Grey slightly gravelly slightly silty fine to medium SAND . Gravels are fine to medium rounded flints. [Kesgrave Catchment Subgroup]	
						(0.50)	71.30	Firm brown sandy CLAY. [Kesgrave Catchment Subgroup] <i>Clay filled land drain</i>	
						(1.10)	70.60	Firm grey slightly sandy silty CLAY [Kesgrave Catchment Subgroup]	
						(1.80)		<i>band of dark brown fibrous peat with strong organic odour</i>	
						(1.40)			
						(3.20)	69.20	End of Trial Pit at 3.20m	




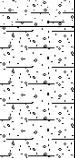



General Remarks 1. CAT Scanned Prior to excavation	Water Strike Standing Flow	Stability: Pit Dimensions
		


Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			TRIAL PIT SA03
Client Vistry Group		Start Date End Date 04/05/2022 04/05/2022			
Contractor A F Howlands		Ground Level 74.11m OD		Logged By: MRG	Sheet 1 of 1
Method/Plant JCB 3CX		Coordinates 520823 E 205509 N		Checked By: LT	Scale 1:25

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
0.20		ES ES1				(0.25)	73.86	TOPSOIL: Grey slightly gravelly clayey fine to medium SAND. Gravels are fine to medium rounded flints.	
						0.25		Orangish brown slightly clayey very gravelly fine to coarse SAND. Gravels are fine to medium round flints [Kesgrave Catchment Subgroup]	
1						(2.75)		<i>Side walls unstable below 1.5m</i>	
2									
3						3.00	71.11	End of Trial Pit at 3.00m	
4									
5									




























General Remarks 1. CAT Scanned Prior to excavation	Water Strike Standing Flow	Stability: Pit Dimensions <div style="border: 1px solid black; width: 100px; height: 20px; margin: 5px auto;"></div>

Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			TRIAL PIT
Client Vistry Group		Start Date 05/05/2022	End Date 05/05/2022		TP01
Contractor A F Howlands		Ground Level 75.54m OD			
Method/Plant JCB 3CX		Coordinates 521042 E 205528 N		Logged By: MRG	Sheet 1 of 1
				Checked By: LT	Scale 1:25




(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
	0.10	ES ES1				(0.15) 0.15	75.39	TOPSOIL: Grey slightly gravelly clayey fine to medium SAND. Gravels are fine to medium rounded flints.	
	0.30	ES2				(0.40)		Firm greyish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium rounded flint. [Kesgrave Catchment Subgroup]	
						0.55	74.99	Orangish brown clayey gravelly fine to coarse SAND. Gravel is fine to medium rounded flint [Kesgrave Catchment Subgroup]	
1	1.00	B3				(1.65)			
						2.20	73.34	Firm brown CLAY [Kesgrave Catchment Subgroup]	
						(0.80)			
3						3.00	72.54	End of Trial Pit at 3.00m	
4									
5									

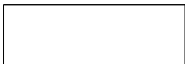
General Remarks 1. CAT Scanned Prior to excavation	Water Strike Standing Flow	Stability: Pit Dimensions
		

Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			TRIAL PIT
Client Vistry Group		Start Date 05/05/2022	End Date 05/05/2022		TP02
Contractor A F Howlands		Ground Level 73.50m OD			
Method/Plant JCB 3CX		Coordinates 520890 E 205370 N		Logged By: MRG	Sheet 1 of 1
				Checked By: LT	Scale 1:25











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	Depth	Type	Results						
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	0.40	ES ES2				0.20		Firm orangish brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium rounded flint [Kesgrave Catchment Subgroup]	
	0.80	D3				(1.30)			
1									
									
									
									
									
2	2.00	D4				1.50	72.00	Firm grey CLAY with frequent sand sized chalk fragments present [Lowestoft Formation Boulder Clay]	
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									

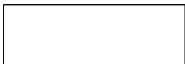
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Client Vistry Group		Start Date End Date 05/05/2022 05/05/2022			
Contractor A F Howlands		Ground Level 75.16m OD		Logged By: MRG Checked By: LT	
Method/Plant JCB 3CX		Coordinates 520919 E 205463 N		Sheet 1 of 1 Scale 1:25	

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation /Backfill
	Depth	Type	Results						
0.10	ES ES1					(0.15) 0.15	75.01	TOPSOIL: Grey slightly gravelly clayey fine to medium SAND. Gravels are fine to medium rounded flints. Orangish brown gravelly to very gravelly fine to coarse SAND. Gravels are fine to medium rounded flints [Kesgrave Catchment Subgroup]	
0.50	ES2					(2.65)			
1.50	B3					2.80 (0.20) 3.00	72.36 72.16	Firm grey sandy CLAY. Sand is fine to medium [Kesgrave Catchment Subgroup]	
								End of Trial Pit at 3.00m	



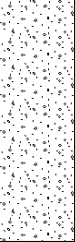
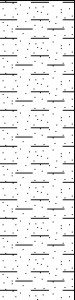

General Remarks 1. CAT Scanned Prior to excavation	Water Strike Standing Flow	Stability: Pit Dimensions
		

Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			TRIAL PIT
Client Vistry Group		Start Date 05/05/2022	End Date 05/05/2022		TP04
Contractor A F Howlands		Ground Level 75.29m OD			
Method/Plant JCB 3CX		Coordinates 520918 E 205514 N		Logged By: MRG	Sheet 1 of 1
				Checked By: LT	Scale 1:25

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
	0.10	ES ES1				(0.20)	75.09	TOPSOIL: Grey slightly gravelly clayey fine to medium SAND. Gravels are fine to medium rounded flints.	
	0.30	ES ES2				0.20		Orangish brown slightly clayey very gravelly fine to coarse SAND. Gravels are fine to medium round flints [Kesgrave Catchment Subgroup]	
1						(0.90)			
	1.50	B3				1.10	74.19	Orangish brown slightly gravelly clayey fine to coarse SAND. Gravels are fine to medium rounded flints [Kesgrave Catchment Subgroup]	
2						(1.70)			
						2.80	72.49	Firm grey sandy CLAY. Sand is fine to medium [Kesgrave Catchment Subgroup]	
3						(0.30)			
						3.10	72.19	End of Trial Pit at 3.10m	
4									
5									




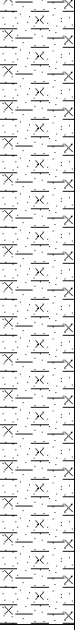










General Remarks 1. CAT Scanned Prior to excavation	Water Strike Standing Flow	Stability: Pit Dimensions
		

Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			TRIAL PIT
Client Vistry Group		Start Date 05/05/2022	End Date 05/05/2022		TP05
Contractor A F Howlands		Ground Level 75.02m OD			
Method/Plant JCB 3CX		Coordinates 520831 E 205590 N		Logged By: MRG	Sheet 1 of 1
				Checked By: LT	Scale 1:25


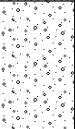

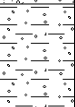
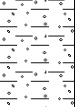
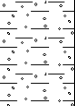
(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
	0.20	ES ES1				(0.30)		TOPSOIL: Grey slightly gravelly clayey fine to medium SAND. Gravels are fine to medium rounded flints.	
	0.60	ES ES2				0.30	74.72	Orangish brown gravelly to very gravelly fine to coarse SAND. Gravels are fine to medium rounded flints [Kesgrave Catchment Subgroup]	
1	1.00	B3				(1.45)			
2	2.00	D4				1.75	73.27	Firm greyish brown slightly sandy to sandy CLAY [Kesgrave Catchment Subgroup]	
						(1.25)			
3				▼		3.00	72.02	End of Trial Pit at 3.00m	
4									
5									

General Remarks 1. CAT Scanned Prior to excavation	Water Strike 2.80 m Standing 2.80 m Flow	Stability: Pit Dimensions <div style="border: 1px solid black; width: 100px; height: 20px; margin: 5px auto;"></div>
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Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			TRIAL PIT
Client Vistry Group		Start Date 05/05/2022	End Date 05/05/2022		TP06
Contractor A F Howlands		Ground Level 71.09m OD			
Method/Plant JCB 3CX		Coordinates 520788 E 205446 N		Logged By: MRG	Sheet 1 of 1
				Checked By: LT	Scale 1:25



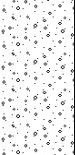
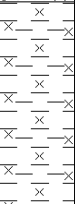
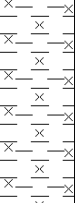

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
	0.10	ES ES1				(0.25)		TOPSOIL: Grey slightly gravelly clayey fine to medium SAND. Gravels are fine to medium rounded flints.	
	0.40	ES2				(0.60)	70.84	Grey slightly clayey sandy fine to medium rounded flint GRAVEL. [Kesgrave Catchment Subgroup]	
	0.50	B3							
1	1.00	D4				(2.10)	70.24	Firm grey mottled brown slightly sandy silty CLAY [Kesgrave Catchment Subgroup]	
									
									
									
									
									
									
									
									
									
									

Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			TRIAL PIT
Client Vistry Group		Start Date 05/05/2022	End Date 05/05/2022		TP7
Contractor A F Howlands		Ground Level 71.10m OD			
Method/Plant JCB 3CX		Coordinates 520741 E 205511 N		Logged By: MRG	Sheet 1 of 1
				Checked By: LT	Scale 1:25

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
	0.10	ES ES1				(0.40)		TOPSOIL: Grey slightly gravelly clayey fine to medium SAND. Gravels are fine to medium rounded flints.	
	0.50	ES ES2				0.40	70.70	Grey sandy fine to medium rounded flint GRAVEL [Kesgrave Catchment Subgroup] <i>damp</i>	
1	1.00	B3		▼		(0.75)			
	1.50	D4				1.15	69.95	Firm slightly gravelly CLAY. Gravels are fine to medium rounded flints. [Kesgrave Catchment Subgroup] <i>sandy with orangish brown mottling</i>	
2						(1.80)			
3						2.95	68.15	End of Trial Pit at 2.95m	
4									
5									

General Remarks 1. CAT Scanned Prior to excavation	Water Strike 1.15 m Standing Flow	Stability: Pit Dimensions <div style="border: 1px solid black; width: 100px; height: 20px; margin: 5px auto;"></div>
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Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			DYNAMIC SAMPLE WS1
Client Vistry Group		Start Date 03/05/2022	End Date 03/05/2022		
Contractor A F Howlands		Ground Level 75.20m OD		Logged By: LHT	Sheet 1 of 1
Method/Plant Dando Terrier		Energy Ratio 70 %	Coordinates 520816 E 205650 N		Checked By: LT Scale 1:40

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation /Backfill
	Depth	Type	Results						
	0.30	ES ES1				(0.50)		MADE GROUND: Grass over brown and grey sandy gravel with rootlets.	
						0.50	74.70	Dense brown becoming light brown and brown sandy fine to medium subangular to rounded flint GRAVEL. [Kesgrave Catchment Subgroup]	
1	1.20	S	50 (7,12/50 for 170mm)			(1.35)			
2	2.00	S	N=8			1.85	73.35	Firm brown silty becoming very silty CLAY. [Kesgrave Catchment Subgroup]	
3	3.00	S	N=13			(2.15)			
4	4.00	S	N=13			4.00	71.20	End of Window Sample at 4.00m	
5									
6									
7									
8									

General Remarks 1. CAT Scanned prior to excavation. 2. Hand dug starter pit to 1.2m bgl	Water Strike			Window Sample Run			
	Strike	Time (mins)	Rose to	Start	End	Dia. (mm)	Rec. %

Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			DYNAMIC SAMPLE WS2	
Client Vistry Group		Start Date 04/05/2022	End Date 04/05/2022			
Contractor A F Howlands		Ground Level 74.63m OD				
Method/Plant Dando Terrier		Energy Ratio 70 %	Coordinates 520794 E 205624 N		Logged By: LHT Checked By: LT	Sheet 1 of 1 Scale 1:40

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
	0.20	ES ES1				(0.70)		MADE GROUND: Grass and weeds over brown and grey sandy gravel with rootlets.	
1	0.80	ES2				0.70	73.93	Firm brown slightly sandy gravelly CLAY. Gravel is subangular to rounded flint. [Kesgrave Catchment Subgroup]	
	1.20	S	N=19			1.40	73.23	Medium dense light brown sandy fine to medium subangular to rounded flint GRAVEL. [Kesgrave Catchment Subgroup]	
2	2.00	S	N=13			1.90	72.73	Firm brown slightly sandy gravelly CLAY. Gravel is subangular to rounded flint. [Kesgrave Catchment Subgroup]	
	3.00	S	N=23			(1.55)			
3						3.45	71.18	Medium dense brown silty fine to medium SAND. [Kesgrave Catchment Subgroup]	
4						(1.55)			
5						5.00	69.63	End of Window Sample at 5.00m	
6									
7									
8									

General Remarks 1. CAT Scanned prior to excavation. 2. Hand dug starter pit to 1.2m bgl	Water Strike			Window Sample Run			
	Strike	Time (mins)	Rose to	Start	End	Dia. (mm)	Rec. %
	4.50	20	-				

Project Name Land of Tollgate Road, Colney Heath		Project No: 332510999			DYNAMIC SAMPLE WS3
Client Vistry Group		Start Date 05/05/2022	End Date 05/05/2022		
Contractor A F Howlands		Ground Level 72.62m OD			
Method/Plant Dando Terrier	Energy Ratio 70 %	Coordinates 520732 E 205578 N		Logged By: LHT	Sheet 1 of 1
				Checked By: LT	Scale 1:40

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation /Backfill
	Depth	Type	Results						
						(0.20) 0.20	72.42	Grass and weeds over dark brown very clayey sand TOPSOIL. Brown slightly silty sandy rounded fine to medium occasionally coarse flint GRAVEL/ gravelly SAND. [Kesgrave Catchment Subgroup]	
1	1.20	S	N=17			(1.35)			
						1.55 (0.40)	71.07	Stiff light grey and brown CLAY. [Kesgrave Catchment Subgroup]	
2	2.00	S	N=5			1.95 (0.35)	70.67	Loose brown sandy flint GRAVEL. [Kesgrave Catchment Subgroup]	
						2.30 (0.80)	70.32	Firm grey slightly gravelly to gravelly CLAY. Gravel is fine to medium chalk. [Kesgrave Catchment Subgroup]	
3	3.00	S	N=3			3.10 (0.30)	69.52	Loose (wet) brown very clayey slightly gravelly SAND. [Kesgrave Catchment Subgroup]	
						3.40 (0.30)	69.22	Firm brown sandy CLAY. [Kesgrave Catchment Subgroup]	
4	4.00	S	N=17			3.70 (0.30)	68.92	Stiff light grey gravelly CLAY. Gravel is fine to medium chalk. [Lowestoft Formation Boulder Clay]	
						4.00 (0.60)	68.62	Medium dense grey very clayey fine to medum SAND. [Lowestoft Formation Boulder Clay]	
						4.60	68.02	End of Window Sample at 4.60m	

General Remarks 1. CAT Scanned prior to excavation. 2. Hand dug starter pit to 1.2m bgl	Water Strike			Window Sample Run			
	Strike	Time (mins)	Rose to	Start	End	Dia. (mm)	Rec. %
	3.00	20	-				

Appendix B Laboratory Analysis

SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Location	Depth (m)	Sample Ref	Type	Description	WC %	LL %	PL %	PI %	<425 µm %	Bulk Mg/m³	Dry Mg/m³	Condition	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 g/L	
BH01	5.10	U1	U	Very stiff dark grey gravelly CLAY. Gravel is chalk.	14.6					2.23	1.95	Undisturbed	100	444	222			
BH01	5.60	D4	D	Grey CLAY with rare fine to medium gravel sized chalk.	14.4	39	18	21	87									
BH02	1.30-1.80	B2	B	Brown clayey silty very sandy GRAVEL.														Particle Size Distribution
BH02	9.50	D2	D	Grey CLAY with rare sand and gravel.	15.1	37	15	22	98									
BH03	5.00	UT1	U	Stiff grey gravelly CLAY. Gravel is fine to medium chalk.	14.1					2.28	2.00	Undisturbed	100	207	103			
SA01	1.50-3.00	B1	B	Yellowish brown mottled dark brown slightly gravelly slightly sandy silty CLAY.	20.2	55	22	33	79									Particle Size Distribution
SA02	1.10-1.80	D3	D	Brown clayey silty very sandy GRAVEL.														Particle Size Distribution
SA03	0.30-3.00	B1	B	Orangish brown silty clayey very sandy GRAVEL.														Particle Size Distribution
TP01	1.00	B1	B	Orangish brown very sandy GRAVEL.														Particle Size Distribution
TP02	0.80	D1	D	Yellowish brown gravelly sandy CLAY. Gravel is fine to medium.	15.0	40	18	22	58									


Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by S Burke - Senior Technician 06/06/2022	Project Number: <p style="text-align: center;">GEO / 35461</p> Project Name: <p style="text-align: center;">TOLGATE ROAD, COLNEY HEATH KPB/22.045/00/01</p>	
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SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments	
Location	Depth (m)	Sample Ref	Type	Description	WC %	LL %	PL %	PI %	<425 µm %	Bulk Mg/m³	Dry Mg/m³	Condition	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 g/L		W/S Mg mg/L
TP03	1.50	B2	B	Orangish brown silty clayey very sandy GRAVEL.															Particle Size Distribution
TP04	1.50	B2	B	Orangish brown gravelly very sandy silty CLAY.															Particle Size Distribution
TP05	2.00	D2	D	Yellowish brown silty CLAY with rare fine to medium gravel.	19.2	36	18	18	99										
TP06	0.50	B1	B	Brown silty clayey very sandy GRAVEL.															Particle Size Distribution
TP07	1.50	B2	B	Brown mottled grey sandy CLAY with rare fine to medium gravel. Sand is fine.	15.6	26	13	13	98										

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by <div style="background-color: black; width: 100px; height: 40px; margin: 5px 0;"></div> S Burke - Senior Technician 06/06/2022	Project Number: GEO / 35461 Project Name: TOLGATE ROAD, COLNEY HEATH KPB/22.045/00/01	
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PARTICLE SIZE DISTRIBUTION

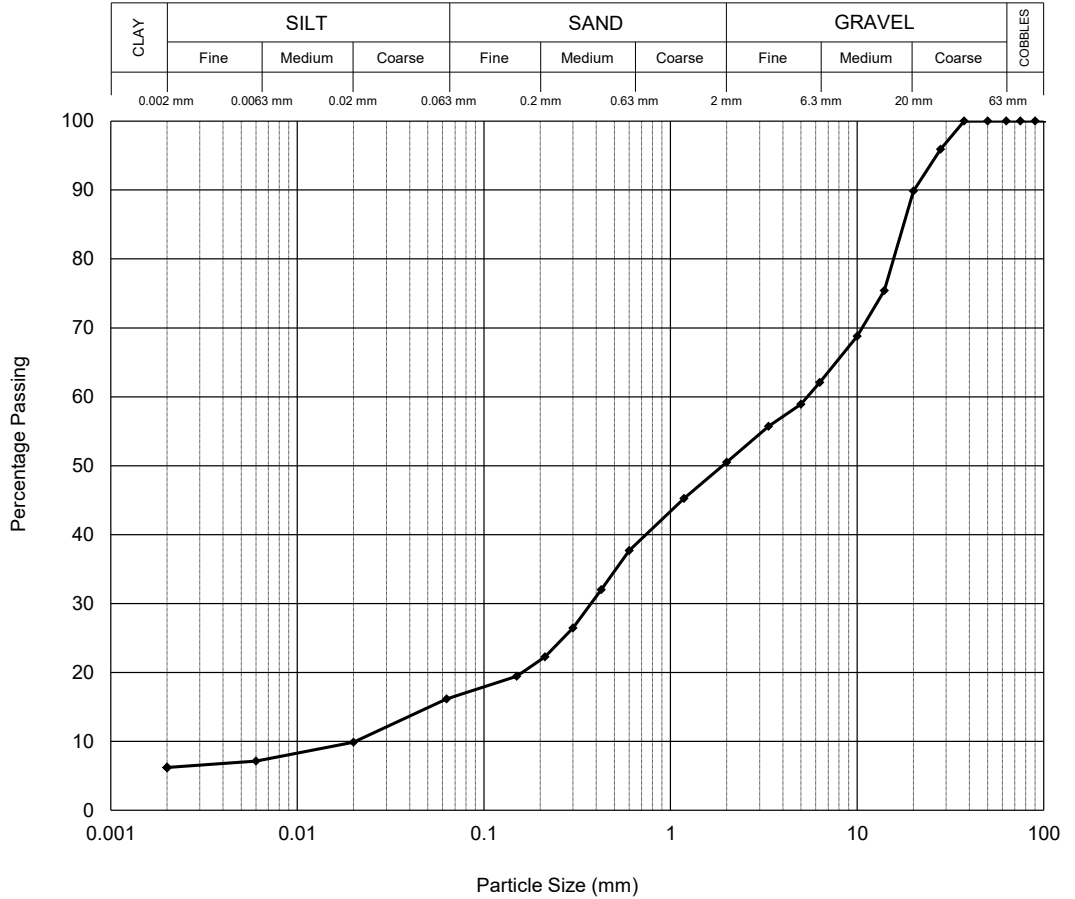
1262 - PSD BH02 01.30 B2 B - 35461-440315.XLSM

Location	BH02
Sample Ref	B2
Depth (m)	1.30-1.80
Sample Type	B

Description
Brown clayey silty very sandy GRAVEL.


BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	96
20.0 mm	90
14.0 mm	75
10.0 mm	69
6.30 mm	62
5.00 mm	59
3.35 mm	56
2.00 mm	50
1.18 mm	45
600 µm	38
425 µm	32
300 µm	26
212 µm	22
150 µm	19
63 µm	16



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	10
6 µm	7
2 µm	6
Particle Density 2.70(A) Mg/m ³	

Particle Proportions	
Cobbles	0.0
Gravel	49.5
Sand	34.3
Silt	9.9
Clay	6.3

Tested by AW
Checked and Approved by

S Burke - Senior Technician
06/06/2022

Project Number: **GEO / 35461**
Project Name: **TOLGATE ROAD, COLNEY HEATH**
KPB/22.045/00/01



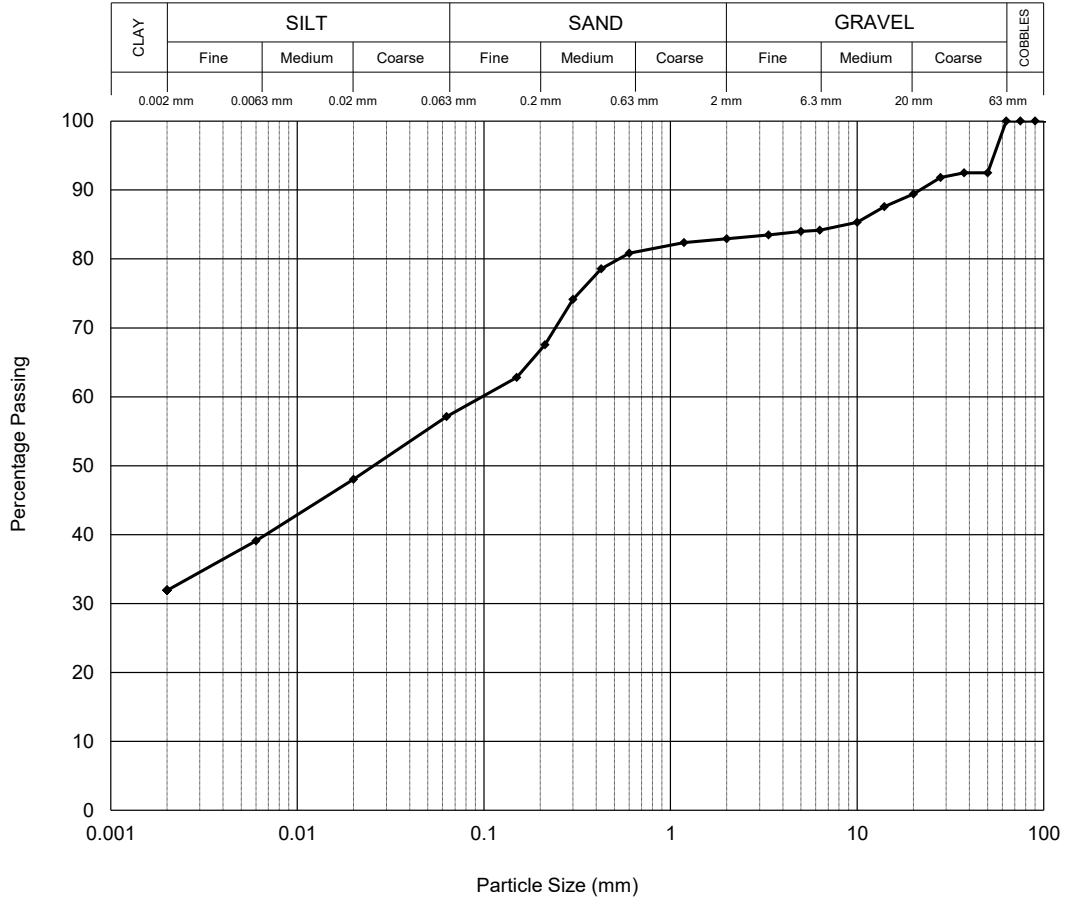
PARTICLE SIZE DISTRIBUTION

Location SA01
 Sample Ref B1
 Depth (m) 1.50-3.00
 Sample Type B

Description
 Yellowish brown mottled dark brown slightly gravelly slightly sandy silty CLAY.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
 BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	92
37.5 mm	92
28.0 mm	92
20.0 mm	89
14.0 mm	88
10.0 mm	85
6.30 mm	84
5.00 mm	84
3.35 mm	83
2.00 mm	83
1.18 mm	82
600 µm	81
425 µm	79
300 µm	74
212 µm	68
150 µm	63
63 µm	57



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	48
6 µm	39
2 µm	32

Particle Density 2.70(A) Mg/m³

Particle Proportions	
Cobbles	0.0
Gravel	17.1
Sand	25.8
Silt	25.2
Clay	31.9

Tested by AW
 Checked and Approved by

 S Burke - Senior Technician
 06/06/2022

Project Number: **GEO / 35461**
 Project Name: **TOLGATE ROAD, COLNEY HEATH**
KPB/22.045/00/01



Version 113.2.11223

PARTICLE SIZE DISTRIBUTION

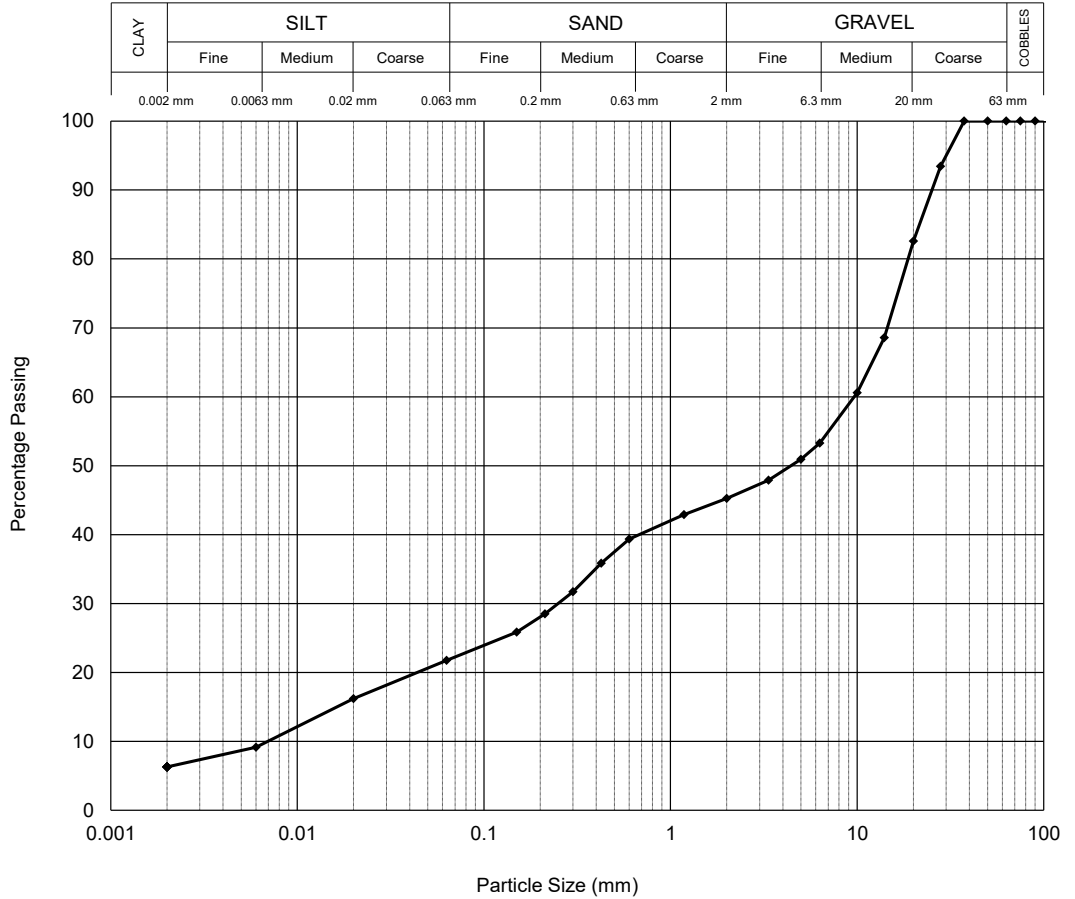
1262 - PSD SA02 01_10 D3 D - 35461-440303.XLSM

Location	SA02
Sample Ref	D3
Depth (m)	1.10-1.80
Sample Type	D

Description
Brown clayey silty very sandy GRAVEL.


BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	93
20.0 mm	83
14.0 mm	69
10.0 mm	61
6.30 mm	53
5.00 mm	51
3.35 mm	48
2.00 mm	45
1.18 mm	43
600 µm	39
425 µm	36
300 µm	32
212 µm	29
150 µm	26
63 µm	22



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	16
6 µm	9
2 µm	6
Particle Density 2.70(A) Mg/m ³	

Particle Proportions	
Cobbles	0.0
Gravel	54.8
Sand	23.5
Silt	15.4
Clay	6.3

Tested by AW
Checked and Approved by

S Burke - Senior Technician
06/06/2022

Project Number: **GEO / 35461**
Project Name: **TOLGATE ROAD, COLNEY HEATH
KPB/22.045/00/01**



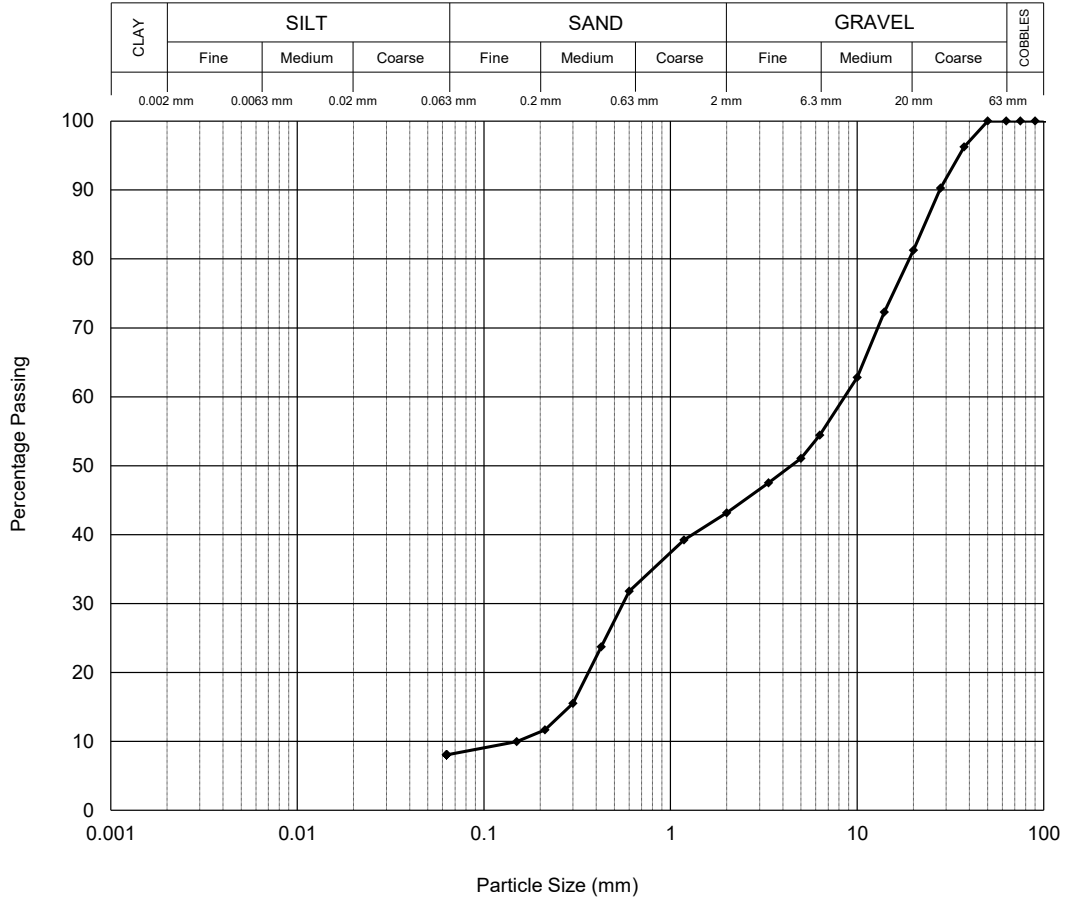
PARTICLE SIZE DISTRIBUTION

Location SA03
 Sample Ref B1
 Depth (m) 0.30-3.00
 Sample Type B

Description
 Orangish brown silty clayey very sandy GRAVEL.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve


Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	96
28.0 mm	90
20.0 mm	81
14.0 mm	72
10.0 mm	63
6.30 mm	54
5.00 mm	51
3.35 mm	47
2.00 mm	43
1.18 mm	39
600 µm	32
425 µm	24
300 µm	16
212 µm	12
150 µm	10
63 µm	8



Particle Proportions	
Cobbles	0.0
Gravel	56.9
Sand	35.1
Silt & Clay	8.0

1262 - PSD SA03 00.30 B1 B - 35461-440312.XLSM

Version 113.2.11223

Tested by AW
 Checked and Approved by

 S Burke - Senior Technician
 06/06/2022

Project Number:

GEO / 35461

Project Name:

**TOLGATE ROAD, COLNEY HEATH
 KPB/22.045/00/01**



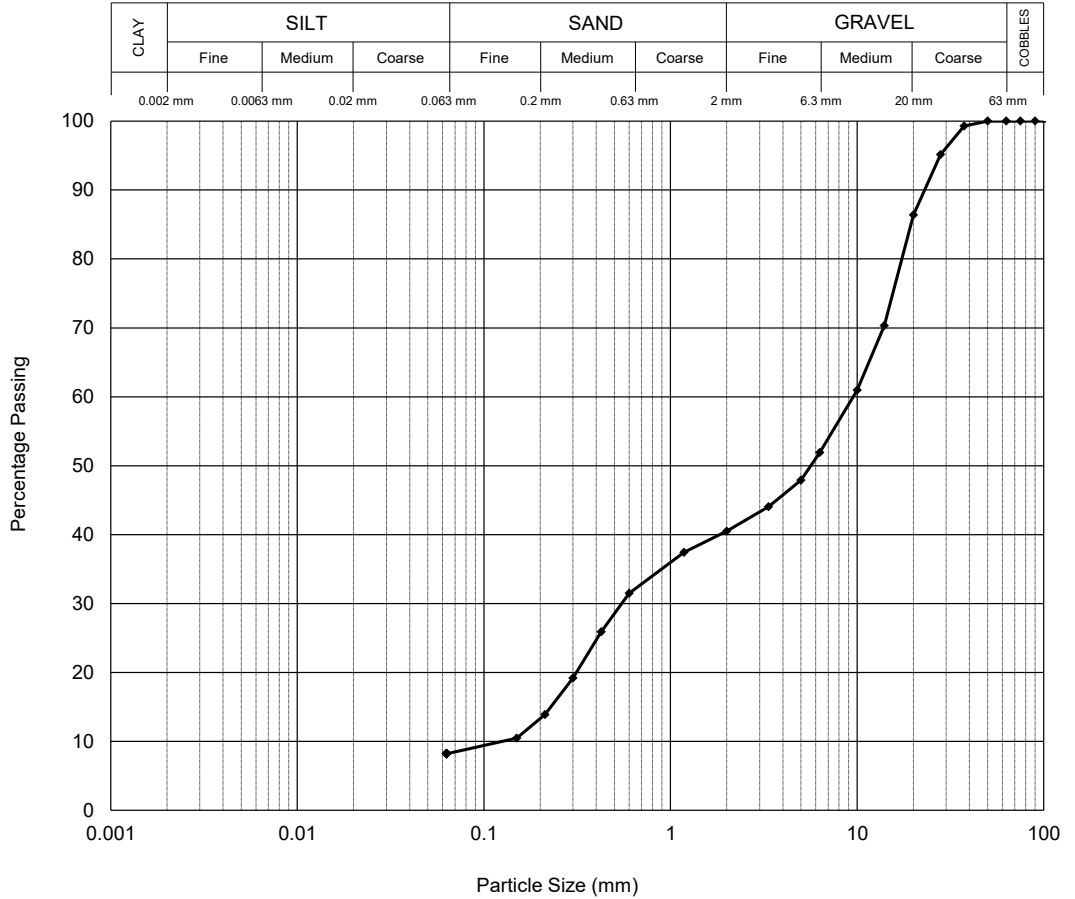
PARTICLE SIZE DISTRIBUTION

Location TP01
 Sample Ref B1
 Depth (m) 1.00
 Sample Type B

Description
 Orangish brown very sandy GRAVEL.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve


Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	99
28.0 mm	95
20.0 mm	86
14.0 mm	70
10.0 mm	61
6.30 mm	52
5.00 mm	48
3.35 mm	44
2.00 mm	40
1.18 mm	37
600 µm	31
425 µm	26
300 µm	19
212 µm	14
150 µm	10
63 µm	8



Particle Proportions	
Cobbles	0.0
Gravel	59.5
Sand	32.3
Silt & Clay	8.2

1262 - PSD TP01 01.00 B1 B - 35461-440316.XLSM

Version 113.2.11223

Tested by AW
 Checked and Approved by

 S Burke - Senior Technician
 06/06/2022

Project Number:

GEO / 35461

Project Name:

**TOLGATE ROAD, COLNEY HEATH
 KPB/22.045/00/01**

Test Report By GEOLABS Limited

Bucknalls Lane, Garston, Watford, Hertfordshire, WD25 9XX

Client : A F Howland Associates, The Old Exchange, Newmarket Road, Cringleford, Norfolk, NR4 6UF



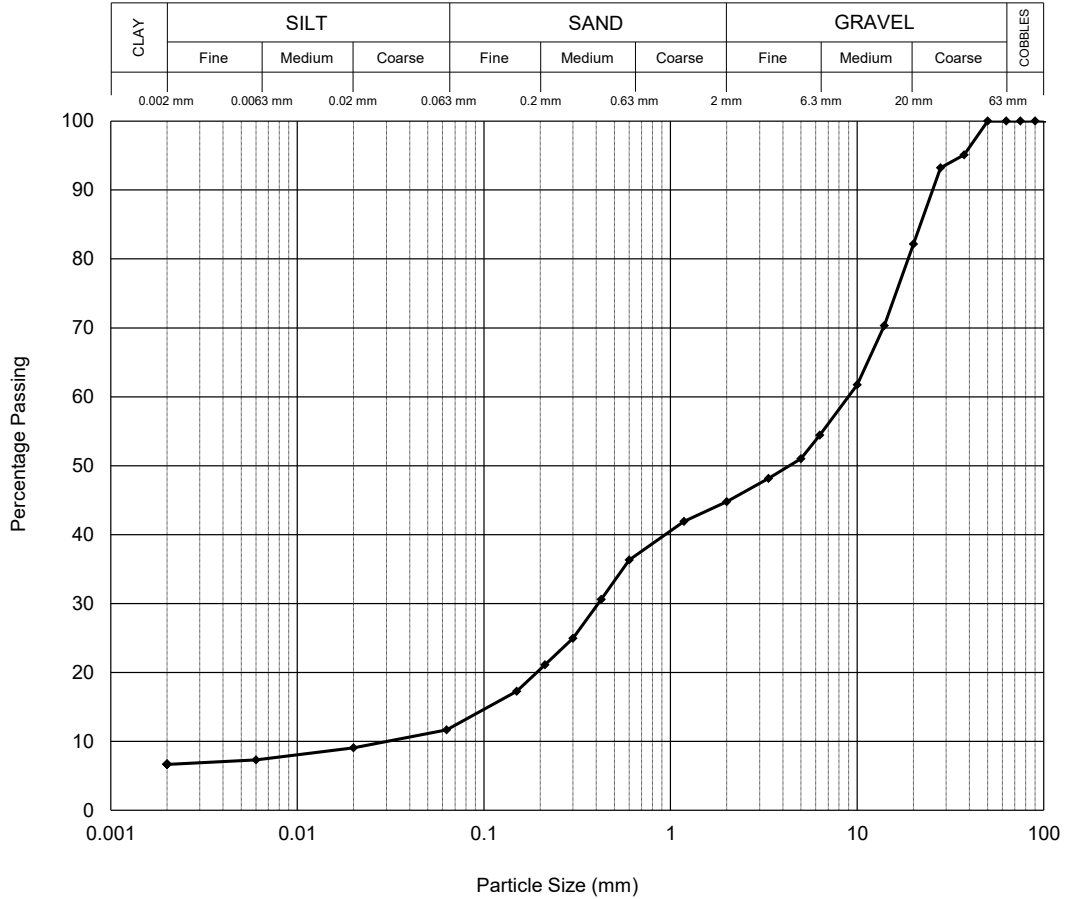
PARTICLE SIZE DISTRIBUTION

Location TP03
 Sample Ref B2
 Depth (m) 1.50
 Sample Type B

Description
 Orangish brown silty clayey very sandy GRAVEL.


BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
 BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	95
28.0 mm	93
20.0 mm	82
14.0 mm	70
10.0 mm	62
6.30 mm	54
5.00 mm	51
3.35 mm	48
2.00 mm	45
1.18 mm	42
600 µm	36
425 µm	31
300 µm	25
212 µm	21
150 µm	17
63 µm	12



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	9
6 µm	7
2 µm	7
Particle Density 2.70(A) Mg/m ³	

Particle Proportions	
Cobbles	0.0
Gravel	55.2
Sand	33.1
Silt	5.0
Clay	6.7

Tested by AW
 Checked and Approved by

 S Burke - Senior Technician
 06/06/2022

Project Number: **GEO / 35461**
 Project Name: **TOLGATE ROAD, COLNEY HEATH**
KPB/22.045/00/01



Version 113.2.11223

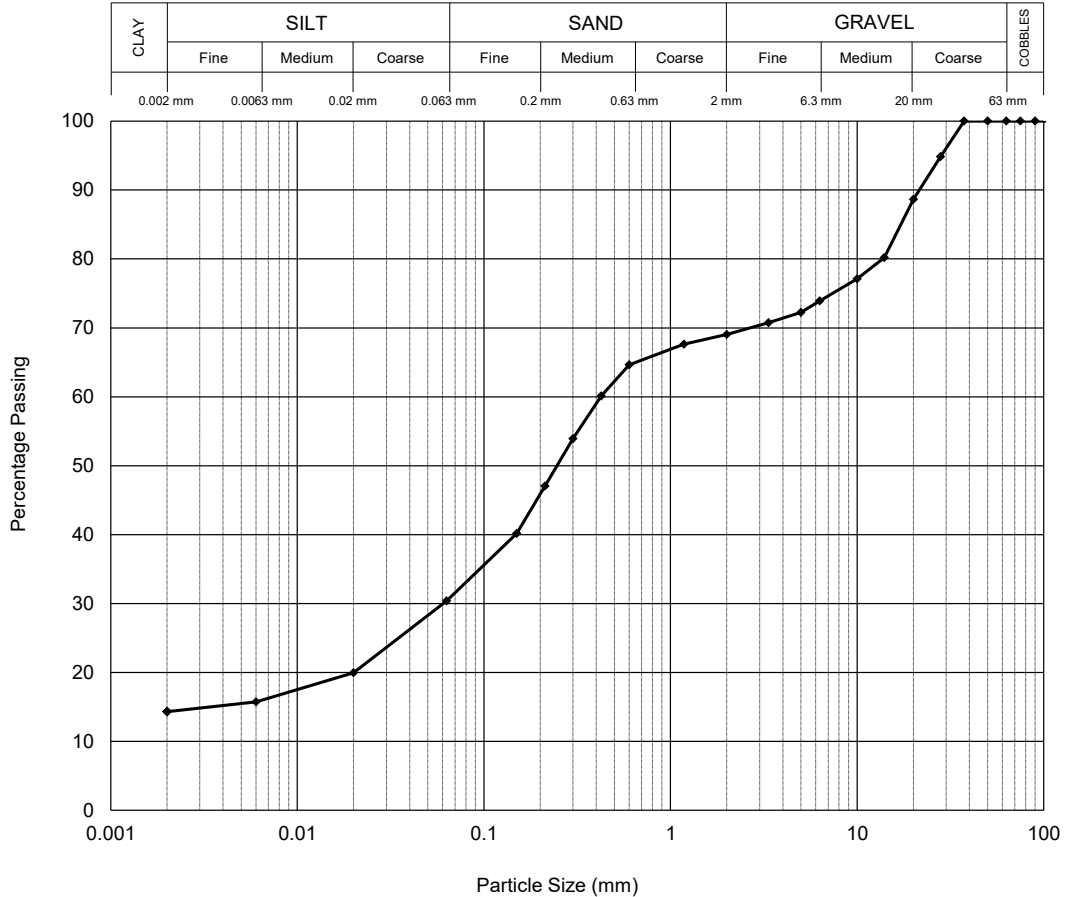
PARTICLE SIZE DISTRIBUTION

Location TP04
 Sample Ref B2
 Depth (m) 1.50
 Sample Type B

Description
 Orangish brown gravelly very sandy silty CLAY.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve
 BS EN ISO 17892-4 : 2016 : Clause 5.4 - Sedimentation by Pipette

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	95
20.0 mm	89
14.0 mm	80
10.0 mm	77
6.30 mm	74
5.00 mm	72
3.35 mm	71
2.00 mm	69
1.18 mm	68
600 µm	65
425 µm	60
300 µm	54
212 µm	47
150 µm	40
63 µm	30



Sedimentation	
No Pre-treatment used	
Temp (°C)	25.0
Size	% Pass
20 µm	20
6 µm	16
2 µm	14

Particle Density 2.70(A) Mg/m³

Particle Proportions	
Cobbles	0.0
Gravel	30.9
Sand	38.7
Silt	16.1
Clay	14.3

Tested by AW
 Checked and Approved by

 S Burke - Senior Technician
 06/06/2022

Project Number: **GEO / 35461**
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KPB/22.045/00/01



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PARTICLE SIZE DISTRIBUTION

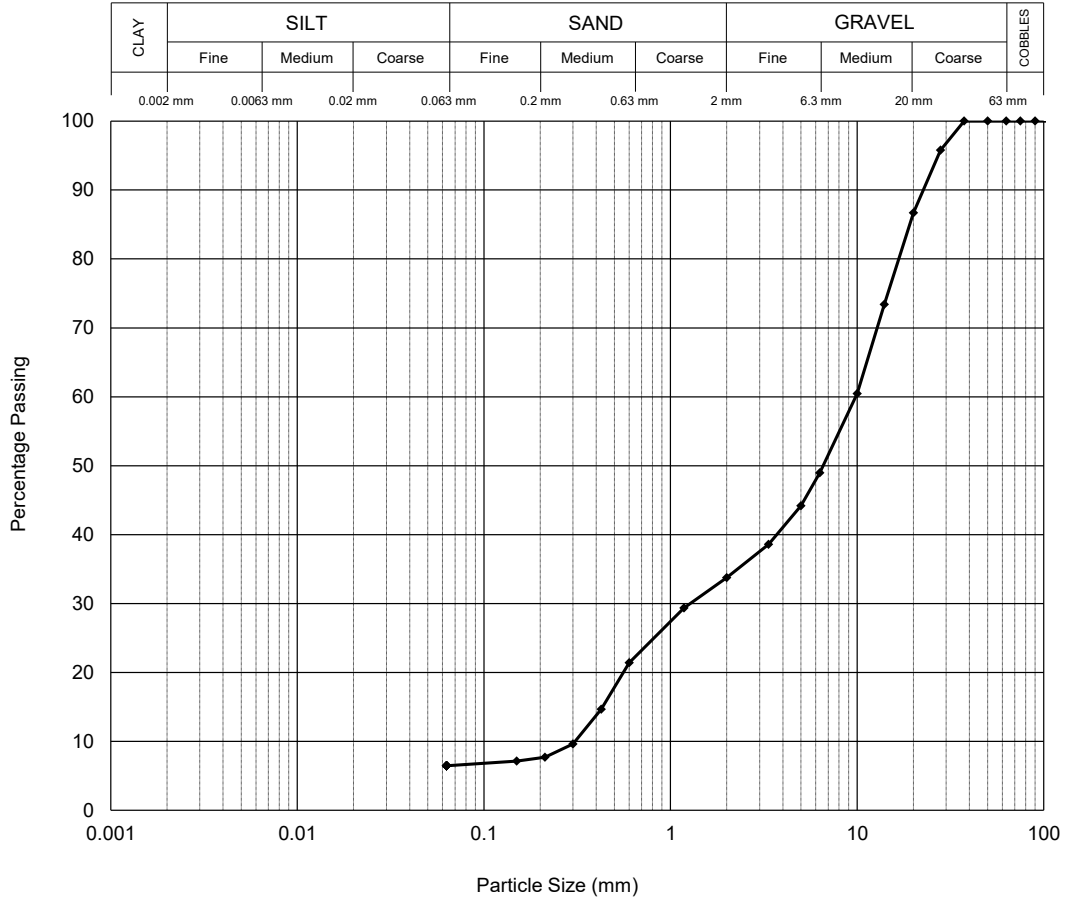
1262 - PSD TP06 00.50 B1 B - 35461-440309.XLSM

Location	TP06
Sample Ref	B1
Depth (m)	0.50
Sample Type	B


Description
Brown silty clayey very sandy GRAVEL.

BS EN ISO 17892-4 : 2016 : Clause 5.2 - Wet Sieve

Sieve	
Size	% Pass
200.0 mm	100
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	96
20.0 mm	87
14.0 mm	73
10.0 mm	60
6.30 mm	49
5.00 mm	44
3.35 mm	39
2.00 mm	34
1.18 mm	29
600 µm	21
425 µm	15
300 µm	10
212 µm	8
150 µm	7
63 µm	6



Particle Proportions	
Cobbles	0.0
Gravel	66.3
Sand	27.3
Silt & Clay	6.4

Tested by AW
Checked and Approved by

S Burke - Senior Technician
06/06/2022

Project Number:
GEO / 35461

Project Name:
**TOLGATE ROAD, COLNEY HEATH
KPB/22.045/00/01**



Version 113.2.11223

1731 - UUTXL BH01 05.10 U1 U Test 01 - 35461-440301.XLSM

UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION

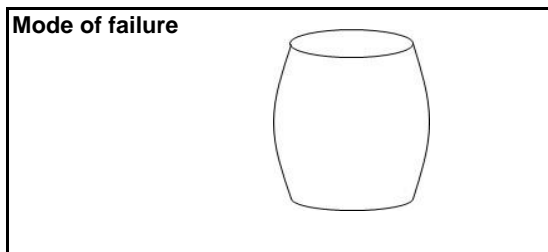
Location	BH01
Sample Ref	U1
Depth (m)	5.10
Sample Type	U

Description:
Very stiff dark grey gravelly CLAY. Gravel is chalk.

Specimen Details


Specimen conditions		Undisturbed
Length	(mm)	200.3
Diameter	(mm)	102.0
Moisture content	(%)	14.6
Bulk density	(Mg/m ³)	2.23
Dry density	(Mg/m ³)	1.95
Test Details		
Latex membrane thickness	(mm)	0.3
Specimen height prior to shearing	(mm)	200.3
Membrane correction	(kPa)	1.1
Mean rate of shear	(%/min)	2.0
Cell pressure	(kPa)	100
Strain at failure	(%)	18.5
Maximum deviator stress	(kPa)	444
Shear Stress Cu	(kPa)	222

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	70

Version 95.220215

Tested by SB
Checked and Approved by

S Burke - Senior Technician
06/06/2022

Project Number:	GEO / 35461
Project Name:	TOLGATE ROAD, COLNEY HEATH
	KPB/22.045/00/01



UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION

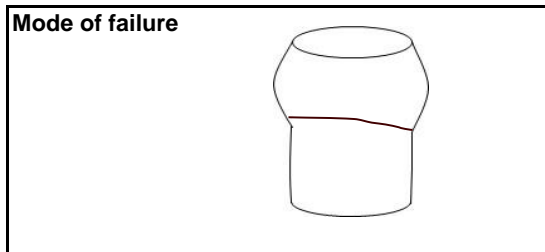
Location	BH03
Sample Ref	UT1
Depth (m)	5.00
Sample Type	U

Description:
Stiff grey gravelly CLAY. Gravel is fine to medium chalk.

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	200.0
Diameter	(mm)	101.8
Moisture content	(%)	14.1
Bulk density	(Mg/m ³)	2.28
Dry density	(Mg/m ³)	2.00
Test Details		
Latex membrane thickness	(mm)	0.3
Specimen height prior to shearing	(mm)	200.0
Membrane correction	(kPa)	1.1
Mean rate of shear	(%/min)	2.0
Cell pressure	(kPa)	100
Strain at failure	(%)	20.0
Maximum deviator stress	(kPa)	207
Shear Stress Cu	(kPa)	103

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	60

Tested by SB Checked and Approved by
S Burke - Senior Technician 06/06/2022

Project Number:	GEO / 35461
Project Name:	TOLGATE ROAD, COLNEY HEATH KPB/22.045/00/01

