



Mineral Resource Assessment

Westergate, West Sussex

Cala Homes South Home Counties

The Dorking Business Park, Station Road, Dorking, RH4 1HJ

Prepared by:

SLR Consulting Limited

Unit 2, Newton Business Centre, Thornccliffe Park Estate,
Newton Chambers Road, Chapeltown, Sheffield, S35 2PH

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Making Sustainability Happen

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Basis of Report

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Acronyms and Abbreviations

BGS	British Geological Survey
JMLP	Joint Minerals Local Plan
MCA	Mineral Consultation Area
MSA	Mineral Safeguarding Area
SLR	SLR Consulting Limited
WSCC	West Sussex County Council



1.0 Introduction

1.1 Instruction

SLR Consulting Ltd (SLR) have been instructed by Cala Group (Holdings) Limited (the Client) to undertake a Mineral Resource Assessment for the proposed development on a circa 19.0ha parcel in Westergate, West Sussex. The site is centred on British National grid reference SU 94098 04799. The site location is shown on Drawing 01.

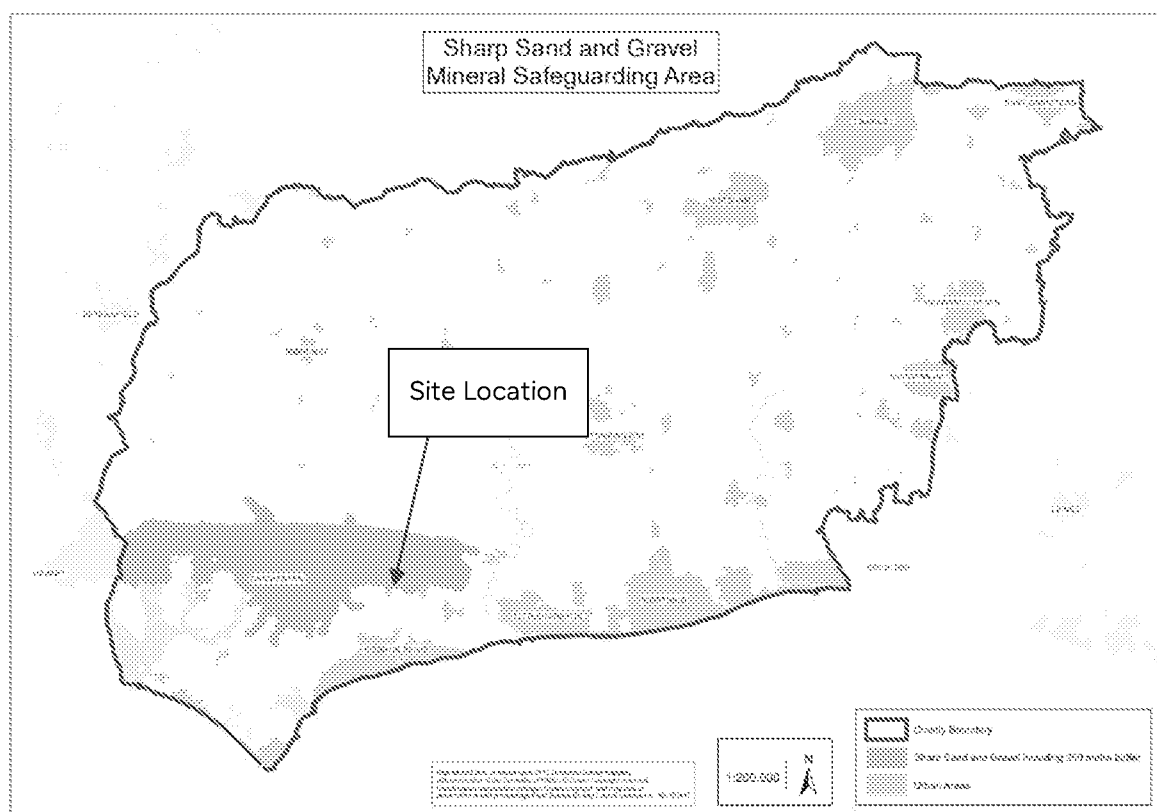
The land has been designated as within a Mineral Safeguarding Area (MSA) and Mineral Consultation Area (MCA) for Sharp Sand and Gravel as defined in the West Sussex County Council (WSCC) Joint Minerals Local Plan (JMLP), July 2018 (Partial Review March 2021). MSA's are defined to protect finite mineral resources from sterilisation by surface developments.

A Minerals Resource Assessment is required under the JMLP Policy M9 to determine the extent and nature of the safeguarded mineral deposit and, if present, to assess the viability and practicality of prior extraction of the mineral.

The MSA for Sharp Sand and Gravel is shown in Figure 1 below.

The site area is partially covered by the WSCC JMLP Sharp Sand and Gravel MSA and MCA (Drawing 01).

Figure 1: WSCC JMLP Sharp Sand and Gravel MSA (2021)



1.2 Methodology

Policy M9 within the West Sussex Joint Minerals Local Plan Minerals and Waste Safeguarding Guidance (March 2020) states that "safeguarded Areas will not be permitted unless;

- i. Mineral Sterilisation will not occur; or



- ii. *It is appropriate and practicable to extract the mineral prior to the development taking place, having regard to the other policies in this Plan; or*
- iii. *The overriding need for the development outweighs the safeguarding of the mineral and it has been demonstrated that prior extraction is not practicable or environmentally feasible."*

The aim of the Mineral Resource Assessment is to address the three conditions of Policy M9. This assessment has been produced in line with guidance provided in West Sussex County Council's Minerals and Waste Safeguarding (March 2021).

In the production of this assessment, a range of geological, environmental, and statutory mapping data sources have been reviewed using a Geographical Information System (GIS) to build a conceptual geological model of the safeguarded minerals. This information has been used to determine the presence or absence and extent of the potential deposit and any parts of the deposit already sterilised by existing development and environmental designations and restrictions.

Consideration of the practicality of prior extraction is given where a viable mineral resource may exist.

1.2.1 Data Sources

In the production of a Mineral Resource Assessment, it is necessary to consider all available relevant geological data for the site. Sources can include information on the mining and quarrying history, mineral assessments and market appraisals, boreholes, site investigations, geological memoirs, technical reports, mining plans, and the thickness of superficial deposits.

In the case of this assessment, the following data have been used to complete the appraisal of the site area as amended:

- Arun District Council Local Plan 2011-2031 (July 2018)
- Bingham Hall Associates, Geotechnical Ground Investigation Report, Land East of Westergate (2017)
- Bingham Hall Associates, Groundwater Monitoring Report, Land East of Westergate (2016)
- British Geological Survey (BGS) Borehole Dataset
- British Geological Survey Mineral Dataset
- British Geological Survey Mapping and memoirs
- DEFRA Magic Maps Dataset
- Environment Agency topographic and hydrology/hydrogeology data
- Natural England environmental designations
- Ordnance Survey mapping
- West Sussex County Council Joint Minerals Local Plan (2021)



2.0 Development Site

2.1 Site Description

The site area is located approximately 7.0km east of Chichester and 5.0km north of Bognor Regis. The site is centred on British National Grid Reference SU 940 047. The total area of the site is approximately 19.0ha.

The site area currently comprises a mixture of woodland, greenspace, and arable farmland. To the north, the site is bounded by residential properties. To the east the site is bounded by a north south running unnamed watercourse and beyond that lies fields in agricultural use. To the south, the site borders the West Coastway Line Railway. To the west, the site borders the settlements of Westergate and Woodgate, with residential properties and associated gardens backing onto the site.

The topography of the site area is dominated by the north south flowing unnamed watercourse along the eastern boundary of the site. The western side of the site sits approximately at 8-10mAOD and slopes downwards east towards the stream to circa 2-4mAOD on the site's eastern boundary.

2.2 Constraints

2.2.1 Environmental constraints

Within the site area, the land is not protected by any statutory designations. The closest statutory designation is the South Downs National Park that is located approximately 2.5km north of the site.

There are no Scheduled Monuments, World Heritage Sites, Historic Battlefields, Historic Parks, and Gardens in the site area. The nearest Listed Buildings are within the village of Westergate.

The site area is criss-crossed by Public Rights of Way, footpath numbers 317, 300, 298 and 296.

The site is located outside of the Air Quality Management Area. The nearest Air Quality Management Area is within Chichester, approximately 1.5km west of the site.

2.2.2 Services

A review of aerial photography indicates that an overhead electricity supply appears to be present crossing the site.

The following information on underground utilises has been provided by the client. Southern Water has three foul sewers crossing the site, with foul and surface water sewers in Westergate Street. Portsmouth Water has two potable water mains across the site.

It is also understood that BT Openreach has existing apparatus near the northern and western site boundaries and no capacity issues are anticipated in connecting to the site. There is also an existing low pressure gas main near the northern and western site boundaries and confirmation has been given that there is capacity to supply the site.

2.2.3 Hydrology and Hydrogeology

The hydrology of the site is dominated by the unnamed watercourse located along the sites eastern boundary that flows north to south and has a small tributary along the central belt of the site (Drawing 01). The watercourse eventually flows under the West Coastway Line on the site's southern boundary. The watercourse then flows into the Lidsey Rife waterbody to the south of the site.

The Environment Agency flood risk map shows that the site area along the unnamed stream and its tributary is within a flood zone 2 and flood zone 3 risk area. Indicating a flood risk posed along the site's eastern boundary and along its central belt. The Environment Agency flood risk data also highlights that Westergate Street (150m west of the site area) has recorded historic localised flooding.

Aquifer Designation



The Environment Agency (EA) designate aquifers in England in line with the Water Framework Directive (Europa, 2000). These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The aquifer designation data is based on the Environment Agency Aquifer Designation mapping (2015) and is split into superficial and bedrock aquifers.

The superficial deposits found within the site are designated secondary A aquifer status indicating a deposit capable of supporting water supplies on a local rather than strategic scale. The groundwater in these deposits will be perched upon the underlying London Clay Formation.

The underlying bedrock London Clay Formation is designated as unproductive indicating a deposit not capable of supporting water supplies.

Source Protection Zones

The EA have defined source protection zones (SPZ) for potable groundwater sources such as wells, boreholes, and springs for public drinking water supply. These zones are related to the time it takes, theoretically, for pollution to pass through the ground and reach a significant water abstraction point. An SPZ1 (inner protection zone) has the shortest travel time and an SPZ3 (total catchment) the longest.

The site area does not lie within an SPZ, whilst the nearest lies approximately 1km to the north of the site.

Depth and flow direction

Groundwater within the superficial deposits was shown to be between 0.40m and 2.00m below ground level from March 2016 to November 2016 (Groundwater Monitoring Report, Land East of Westergate, Bingham : Hall Associates, 2016). Further, groundwater monitoring data has not been provided at the time of writing this report.

2.3 Planning Constraints

A large area of the site encompassing an area approximately 700m south of the sites far northern boundary falls within the WSCC's JMPL sharp sand and gravel MSA and MCA (Drawing 01). The same area noted above also falls within the Arun District Council's Sharp Sand and Gravel MCA.

The site lies within the Arun District Council site specific strategic housing allocation SD5 BEW (Arun Local Plan 2011-2031 – Local Plan Policy Map 1).



3.0 Geology and Minerals

The local and regional geology is published in the BGS 1:50,000 scale map for Chichester and Bognor District (Sheet no. 317/332) and associated 'Sand and Gravel Resources of the Country around Chichester and North of Bognor Regis, Sussex BGS Mineral Assessment Report'.

3.1 Regional Geology

The site is situated within the regional geology of West Sussex. The region comprises gently dipping folds of Cretaceous sand Cenozoic strata, forming a series of east-west trending ridges across much of the region. The oldest rocks in the region are of the Early Cretaceous Wealden Group and outcrop in the High Weald area in the northeast of the county. This is overlain by the Lower Green Sand Group and Selborne Group. Above this lies the Upper Cretaceous Chalk Group. A regional unconformity separates the Upper Cretaceous strata from the overlying Tertiary (Palaeogene) sediments of shallow marine clays and carbonate rich sandstones (Lambeth, Thames, Bracklesham and Barton Groups). The Tertiary bedrock deposits are then overlain by quaternary superficial deposits.

The superficial deposits within West Sussex are variable, comprising quaternary clays (head deposits) and alluvial and fluvial deposits deposited along river and stream valleys. River Terrace Deposits dominate much of the southern areas of the county.

3.2 Site Specific Geology

3.2.1 Bedrock Geology

The published information indicates that the bedrock geology of the site and surrounding areas comprises strata of the London Clay Formation of Ypresian Age (56Ma-49Ma), as shown on Drawing 02. The London Clay Formation is more than 150m thick regionally across West Sussex. The formation on average is described as stiff brown to blue silty sandy clay with frequent selenite crystals.

The bedrock crops out at surface where superficial deposits are absent. The bedrock crops out along the line of the watercourse, which is roughly linear and controlled by the erosion and deposition of the nearby watercourse, as shown on Drawing 02.

Historically, the London Clay has been quarried for brick clay, although none of the bedrock deposits are considered as important minerals and are not safeguarded.

3.2.2 Superficial Geology

The published information indicates that superficial deposits are not mapped across the entirety of the site. Where present, the site is mapped as having a range of superficial geological units, mainly following the trend of the present and historic water courses. The deposit types are described in more detail below and shown on Drawing 03. The general stratigraphy of the area can be found in Table 1 below.

River Terrace Deposits are mapped mainly within the southern part of the site and a small outcrop in the far northern area of the site (Drawing 03). River Terrace Deposits typically are a term referring to superficial deposits formed by depositional processes related to fluvial mechanisms (rivers and their associated flood plains). River Terrace Deposits vary throughout the area but tend to deposit localised areas rich in sands, gravels, and clays.

There are several published BGS borehole records in the surrounding area which are mapped as within the River Terrace Deposits, these boreholes indicate that the overburden proven ranged from 0.4m to 3.4m in thickness overlying a very clayey or clayey sandy gravel or pebbly sand ranging in thickness from 1.5m to 3.8m. The locations of the BGS boreholes are shown Drawing 02 and Drawing 03.

Raised Beach Deposits are mapped along the western and central portion of the site following the watercourses. Raised Beach Deposits are a term referring to superficial deposits formed by processes of isostatic uplift along a shoreline. Raised beach deposits in the area deposit localised areas rich in sand and gravel.



Head Deposits are mapped covering a large part of the northern area of the site. Head Deposits are a term referring to superficial deposits formed by either aeolian or solifluction processes. Head deposits dominate much of West Sussex and reflect the bedrock from which they originate. They generally compose of clay, sand, and gravel. The deposits tend to be thin but laterally extensive. Head deposits have been quarried across the West Sussex coastal plain and around Chichester for aggregate materials.

Alluvial deposits are located along the central belt of the site and follow the watercourse. Alluvial deposits are a term referring to superficial deposits formed by processes within rivers and their associated flows. Alluvial deposits in the area deposit localised areas rich in clay, silt, sand, and gravel.

Table 1: General stratigraphy of the area

Age	Formation	Lithology
Quaternary (2.58Ma -Current day)	Alluvium	Sand, silt, clay and gravel
	Head	Sand, silt, clay and gravel
	Raised Beach Deposits 1	Sand and gravel
	River Terraced Deposits	Sand, silt, clay and gravel
Ypresian (56Ma - 49Ma)	London Clay	Clay. Silt and Sand

3.2.3 Site Specific Ground Investigation

A programme of geotechnical and geo-environmental ground investigation trial pits was undertaken by Bingham Hall Associates (Geotechnical Ground Investigation Report, Land East of Westergate, Bingham : Hall Associates, 2017). A total of 15 trial pits were excavated to approximately 3.50m below ground level. These trial pits were excavated to glean information for appropriate foundation design; however, the trial pit logs include geological description of the superficial deposits encountered. Approximate trial pit locations are shown on Drawing 02 and Drawing 03.

The descriptions of the trial pits indicate that the site consists of topsoil and head deposits underlain by the London Clay Formation. River Terrace deposits or Raised Beach deposits were not logged within the trial pits. A breakdown of the trial pit data can be found in Table 2 below. It should be noted that the base of the superficial deposits were not proven in several boreholes, therefore there may be superficial deposits at depth below the trial pit bases.

Topsoil is present across the site area and varied in the trial pits from 0.30m to 0.90m in thickness. The topsoil is described as orange to brown, stiff, slightly gravely, slightly sandy, clay. The topsoil is underlain by head deposits present across the site. The head deposits vary in thickness from 0.65m to 2.80m, however the base of the head deposits were not proven in several boreholes. The head deposits were logged as clay, clayey sand or clayey gravel, logs are provided as part of the ground investigation report in Appendix A.

The site is underlain by the London Clay Formation which has been proven in two boreholes across the site. Summary trial pit logs from the Bingham Hall Associates ground investigation data are provided below in Table 2.



Table 2: 2016 Ground Investigation Summary

Trial Pit ID	Trial Pit Depth (m)	Overburden (Topsoil and Clay) Thickness (m)	Potential Mineral Thickness (m)	Mineral Deposit Type
SA01	2.00m	0.90m	1.10m+	Head
SA02	0.80m	0.80m	n/a	None (Topsoil underlain by London Clay Fm.)
SA03	2.00m	0.80m	1.20m+	Head
SA03A	1.35m	0.80m	0.55m+	Head
TP01	3.20m	1.60m	1.60m+	Head
TP02	3.50m	0.70m	2.80m+	Head
TP03	3.00m	1.00m	2.00m+	Head
TP04	1.20m	1.00m	0.20m+	Head
TP05	1.60m	0.40m	1.20m	Head
TP06	1.00m	0.35m	0.65m	Head
TP07	2.10m	2.10m	n/a	Head
TP08	2.60m	2.60m	n/a	Head
TP09	3.10m	1.20m	1.90m+	Head
TP11	2.10m	0.35m	0.35m	Head
TP12	3.20m	1.20m	2.00m+	Head
Average		1.05m	1.30m+	

Note: Where the base of deposit were not proven the thickness is recorded with a plus sign to indicate possible further deposit at depth.

3.2.4 Mineral Quality

Five samples were taken from the excavated materials during the ground investigation and underwent particle size distribution (PSD) testing. The original report (Geotechnical Ground Investigation Report, Land East of Westergate, Bingham : Hall Associates, 2017) has been included as Appendix A and details the results of these tests.

In summary, the PSD results indicate that three of the samples comprise 10% silt or clay, the material has been logged by the geotechnical engineer as head deposits. The remaining two samples have high percentage of fines (<0.063mm) which comprise silts and clays, recorded at 33% and 61% clay. The description of the deposits within the trial pit logs and testing results suggest a high level of clay contents within the deposits.

The gradings across the site are very variable and show samples from parts of the site contain very high clay content. The high clay content of the potential deposit would require washing to produce a suitable aggregate product. Typically, the clay content for in-situ materials should be less than 25% to be considered economically workable for construction aggregates.

Therefore, the quality of the mineral deposit has been inferred as generally low with a low-level certainty from the small number of trial pit logs and associated testing data. Whilst the potential sand and gravel deposits have been shown to vary in quantity and volume (a key consideration for aggregates), it has been possible to identify two key areas (named Area A and Area B) where trial pit data shows consistent volumes of material. Samples from these areas have been investigated for their physical properties to assess its potential use within aggregates.



A further indication of mineral quality would be the presence of any nearby current or historic sand and gravel workings. There are no current quarrying or mining areas within 5km of the site. There is one BGS record of historic nearby gravel workings is a reference to several gravel pits, (Northfields Farm Gravel Pit) 1.5km northeast of the site around Eastergate Lane. Generally, the mineral workings have been to the south of the site which comprise clay workings for brick products. This may indicate that the quality of the superficial deposits are such that it has not been considered as a viable mineral resource in the recent past. In contrast, there are extensive historic and active sand and gravel workings around Chichester to the west and in the extensive head deposits to the north of the site. This is in line with the documented records of workings and deposits are described in the JMLP.



4.0 Resource Assessment

4.1 Mineral Resource Areas

To define and quantify a mineral resource, consideration should be given to the potential environmental impacts and effects of the extraction of the mineral resource and the application of suitable buffer zones to maintain adequate distance between the operation and potential sensitive receptors.

Buffer zones are dependent upon the nature of the operation and the receptors, pathways for the impact and thus vary on a site-to-site basis. WSCC JMLP provides no guidance on specific buffer zones for mineral types. So, for this site, experience of existing operations and other policy areas has been implemented. The following buffer zones have been applied to this mineral assessment to reflect the environmental and economic viability of the mineral resource:

- Residential dwellings: 20m
- Public highways: 20m
- Watercourse: 20m
- Overhead and underground services: assumed to be removed and/or relocated.

Extraction inside the buffer zones has not been considered.

The MSA and MCA areas within the site mainly overlap with the mapped Alluvium and Head deposits, within the southern part of the site River Terrace Deposits may be present however the safeguarded areas do not cover this part of the site.

Two areas (Area A and Area B) of potential safeguarded mineral deposits have been identified within the site. The areas have been defined by mapped outcrops of superficial deposits, site specific data and environmental constraints.

Area A is situated in the centre of the site and covers approximately 6,700m², the average thickness of the mineral is estimated to be 1.20m based on available site data.

Area B is situated in the northern part of the site and covers approximately 54,200m², the average thickness of the mineral is estimated to be 1.50m. The constrained resource areas are shown on Drawing 04. The estimated quantity of sand and gravel within the site area is presented below in Table 3.

The area outside of the MSA south in the southern part of the site has may contain a potential mineral deposit based on the depths of material proved in the trial pits, as shown on Drawing 04. However, as this is outside the MSA, and is not subject to Policy M9 a volume or tonnage of potential mineral has not been calculated.

4.2 Quantity of the Mineral

Considering the factors described above, it is estimated there are approximately **109,000 tonnes** of clayey gravel and clayey sand within the site, based on the following assumptions:

- Total Area: 61,061m²
- Thickness: 1.2m to 1.5m
- Density conversion: 1.75t/m³
- Losses: 10% extraction and 20% processing losses (due to clay content)

Table 3 below provides a summary of the possible mineral resource areas (Area A and Area B).



Table 3: Potential Mineral Resource

Constrained Resource Area	Area (m ²)	Average Thickness (m)	Volume (m ³)	Tonnage (tonnes)
Area A	6,776	1.20	8000	14,000
Area B	54,285	1.50	81,000	142,000
Total pre-extraction	61,061	-	89,000	156,000
Total accounting for extraction and process loss	-	-	-	109,000

4.3 Method of Extraction and Route to Market

The method of extraction will vary for different mineral resources depending on the properties of the mineral resource and the environment in which the extraction takes place (for example groundwater levels). Soils, overburden or weathered rock that is considered unsaleable will require removal prior to mineral extraction. Following 'stripping', the overburden is usually stored in mounds or bunds around the perimeter of the extraction area, for later use in site restoration. These bunds often have dual purpose by design to provide visual or acoustic screening to the potential receptors away from the extraction area.

Existing ground water levels currently sit perched above bedrock and above the maximum extraction depth of any mineral. The high-water table and evidence of localised flooding along the watercourse within the site indicates a vast majority of any potential mineral the deposit would exist below the water table.

Therefore, extraction of any mineral would involve either dewatering of the void to extract the minerals 'dry' or extraction of the minerals 'wet' where the material is dug from a lagoon. Dewatering of the excavation would require planning permission and permits from the Environment Agency. The nature of dewatering requires the ability discharge displaced water into a local water course, and there may be potential impacts of lowering the groundwater table on the surrounding environment. It is considered given the location of the site and the minor size of the local water course which would unlikely cope with the amount of water that would need to be displaced, the material would need to be extracted wet.

Wet extraction reduces the material recovery achieved with an excavator as the base of the excavation is underwater and cannot be seen. Extracted material would require a set down area to be drained of water prior to processing. This would require a large area for a drying stockpile. Given the variable clay content of the deposit, the material will require washing and processing prior to sales or use.

The potential mineral deposit within the site is considered extremely small in terms of typical sand and gravel excavation. Therefore, it is unlikely to warrant cost of planning and installation of a processing plant and associated facilities, thus the material would be transported 'as-dug' to a nearby quarry for processing. This would require transport by lorries on the local road network. The nearest quarries that have the capability to process the material are within Chichester approximately 8km to the east.

The extraction of the mineral would require mineral planning permission and likely an Environmental Impact Assessment to determine the potential impacts of a mineral development in this area. It is considered an application to extract minerals is likely to attract local objections on the grounds of existing local residences and environmental impacts associated with a mineral development in close proximity.

Furthermore, a minerals development would require the temporary relocation the Public Rights of Way present within the site, and removal or relocation of the of the various different overhead and



underground services that are present on the boundaries and within the site itself (as discussed within Section 2.2.2).

If any number of the services or utilities present within the site were not relocated outside of the potential mineral resource areas, standoff margins (buffers) would need to be applied to protect the services from damage during mineral extraction. It is considered that as the potential mineral area is already limited, any margins to services would further reduce the potential resource and limit the economic viability of the site for mineral extraction.

4.4 Use within the Development

Whilst the detailed design of the development is not yet finalised, it is likely that there will be a requirement for areas of cut and fill to create developable sites. Use of minerals released through incidental extraction could be considered should the materials be of suitable quality. Such uses could be as a component in general fill, or in landscape features. It is not possible at this stage to ascertain areas where incidental extraction could occur, and furthermore the potential mineral deposit present on the site is likely to require specialist processing and cleaning prior to final use. As such it is unlikely that there will be a use of the materials directly within the proposed development as aggregate products.

4.5 Viability of Prior Extraction

Assuming that the services present on the site are relocated, the extraction of mineral in the site is technically feasible with respect to the points made above, but several other factors impact on the viability of prior extraction.

On completion of extraction stored overburden materials would be placed back into the void for restoration. It is estimated that the remaining void could be up to 3.0m in depth within areas A and B. With the expected high local water table, these voids would fill with water unless backfilled to original ground level.

For the proposed development to go ahead post excavation the void would require backfilling to the original development level with competent engineered material to the specification that would allow the construction of housing. The haulage and engineering costs to import and place this material would be substantial and further reduce the overall viability of the development.

Retaining the excavation voids within the development area would not be compatible with the current proposed development.

In addition, the export of the mineral and import of materials for backfilling the site would generate an estimated between 3,500 and 7,000 lorry movements (based on the anticipated volumes and depending on the ability to back-haul imported materials when exported as dug mineral). This potential impact on the local highways and residences would need to be assessed independently.

The mineral itself would likely be low value due to its anticipated low quality, and the haulage costs for transport to another quarry operation would further decrease the value of the mineral. Any operation receiving the material would need to have planning permission for the import of materials for processing and onward sale, as well as the capacity for disposal of the processing waste from washing the gravel.

Furthermore, the backfilled void would require geotechnical testing and likely more robust engineering measures to ensure the stability of the ground is suitable for the proposed housing development which could add to the cost of the development construction.

It is anticipated that several of the existing underground services present on the site will remain in-situ as part of the proposed housing development. In this scenario, prior extraction is not considered to be feasible. Area available for extraction would be limited and likely small narrow parcels of land, which would make extraction difficult and uneconomic.



5.0 Planning Context – Safeguarding of Minerals

Policy M9: Safeguarding Minerals of the WSCC JMLP provides three tests for considering the sterilisation of minerals.

“(a) Existing minerals extraction sites will be safeguarded against non-mineral development that prejudices their ability to supply minerals in the manner associated with the permitted activities.

(b) Soft sand (including potential silica sand), sharp sand and gravel, brick-making clay, building stone resources and chalk reserves³⁴ are safeguarded against sterilisation. Proposals for non-mineral development within the Minerals Safeguarded Areas will not be permitted unless:

- (i) Mineral sterilisation will not occur; or*
- (ii) It is appropriate and practicable to extract the mineral prior to the development taking place, having regard to the other policies in this Plan; or*
- (iii) The overriding need for the development outweighs the safeguarding of the mineral and it has been demonstrated that prior extraction is not practicable or environmentally feasible.”*

Within the context of the Site, these tests are addressed as follows:

5.1.1 Mineral Sterilisation will not occur:

The geological information indicates a potential resource of c. 109,000 tonnes within the site that could be sterilised by the proposed development. However, the definition of ‘mineral’ relies on the assumption that the geological materials thought to the present are of suitable quality and value to make their extraction economically viable. Whilst the quantity and quality of the material is inferred from direct sources (i.e., trial pit data from within the site boundary), the likely low quality and a low value of the ‘mineral’ is such that its extraction on its own merits is unlikely to be economically viable when compared to the costs of extraction, environmental mitigation, haulage, and restoration of the site.

5.1.2 It is appropriate and practicable to extract the mineral prior to the development taking place, having regard to the other policies in this Plan; or

Prior extraction of the mineral deposit, if the deposit were to be viable and a there was a market for the mineral, would result in a void filled with natural groundwater. To enable the proposed development to go ahead the void would require backfilling to original ground levels to avoid flooding.

The additional haulage required to import materials to backfill the void has the potential to have a significant impact on the local residences and highways, over and above the potential impacts of extraction. The costs of importing material, obtaining an environmental permit for the infilling of the land, are likely to outweigh the benefits of extracting the material in the first instance.

Furthermore, the backfilled void would require geotechnical testing and likely more robust engineering measures to ensure the stability of the ground is suitable for the proposed development which could add to the to the cost of the development construction.

5.1.3 The overriding need for the development outweighs the safeguarding of the mineral and it has been demonstrated that prior extraction is not practicable or environmentally feasible.

The site is currently allocated within the Arun District Council Local Plan as a strategic housing allocation site (no. SD5 BEW).

The overriding need for the development is a matter for discussion between the developer and the local authority. On the basis that prior extraction is not practicable (on economic grounds) or environmentally feasible, it is considered that sterilisation does not occur and the matter of overriding need does not apply.



6.0 Conclusions

A mineral safeguarding assessment has been carried out to quantify the tonnage of sand and gravel that would potentially be sterilised by the proposed development on the land east of Westergate, West Sussex.

Following desk-based GIS studies, review of historic intrusive ground investigation, and laboratory testing, an estimated **109,000 tonnes** of sand and gravel deposits has been identified that would be sterilised by the proposed development. A potential mineral deposit has been identified in two separate areas within the site area, when considering appropriate buffer zones from environmental features and designations, infrastructure, and residential developments.

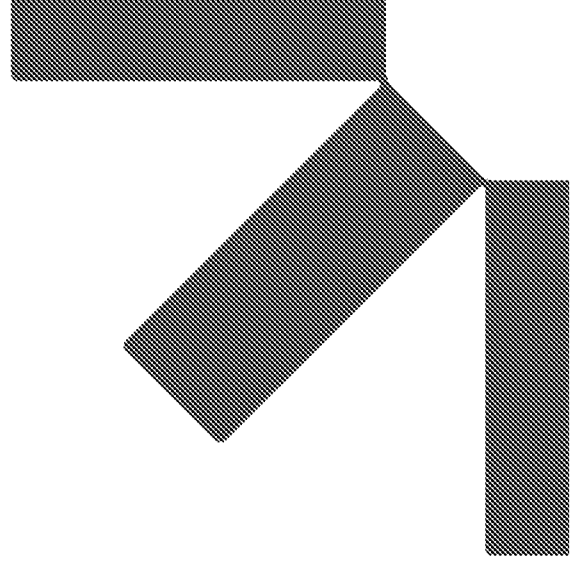
The laboratory testing has proven that the sand and/or gravel deposits, where it is free from significant amounts of clay have the potential to be suitable for aggregate products. However, the clay content of the sand and gravel vary across the site, with 40% of the samples tested being unviable for aggregate use.

While there is local market for aggregate products in West Sussex, market need is met by larger aggregate producers around Chichester and north of the site. Any mineral extracted from the site would most likely need to be transported to and processed at one of these larger producers' processing plants. The potential mineral deposit within the site is considered extremely small in terms of typical sand and gravel excavation. Therefore, it is unlikely to warrant cost of planning and installation of a processing plant and associated facilities, thus the material would be transported 'as-dug' to a nearby quarry for processing.

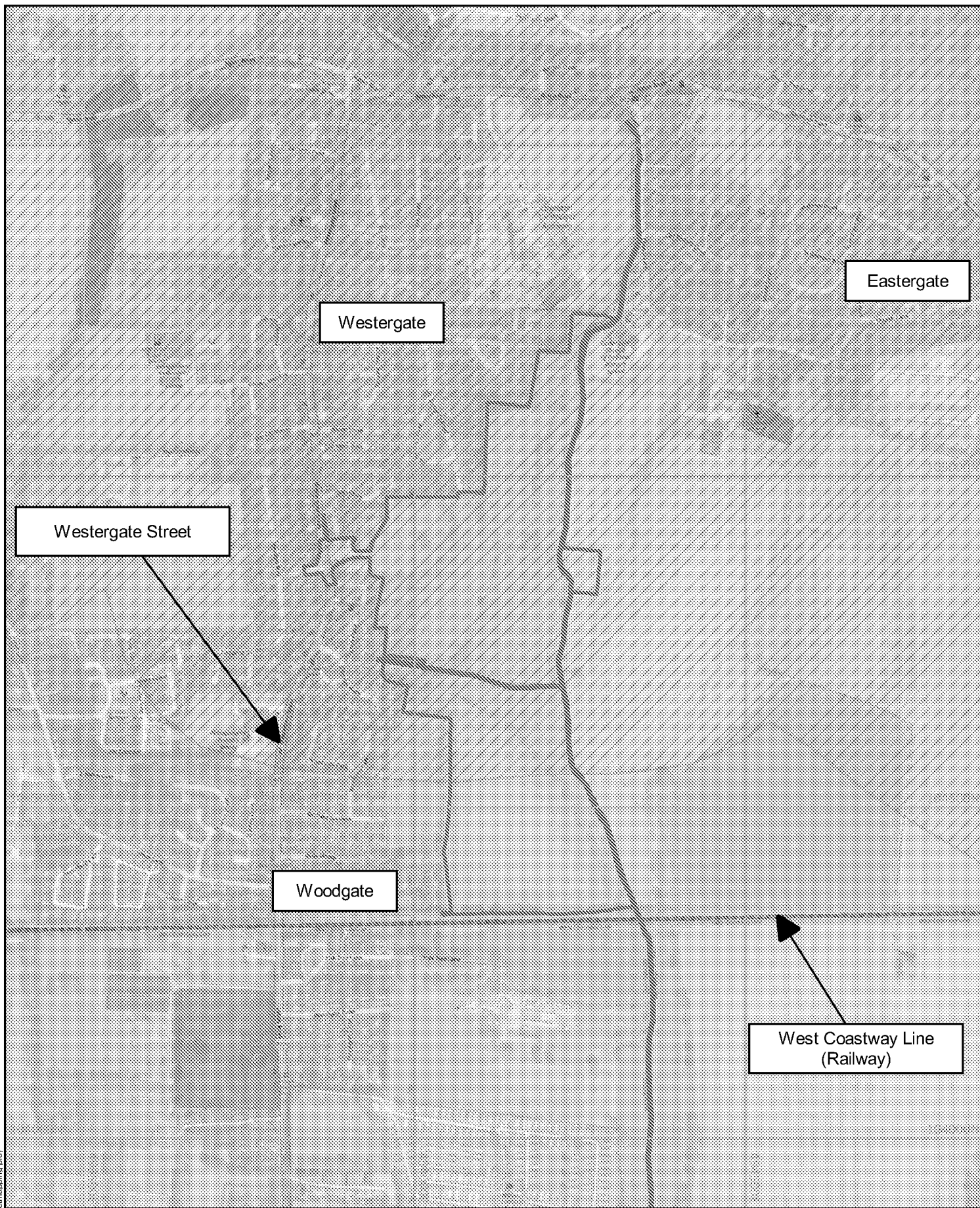
Furthermore, post extraction of the material within the site would create a landform that is not conducive to the current proposed development, resulting in an elevated flood risk or an engineered recovery scheme to return the ground levels to a suitable elevation.

On this basis, it is considered that an economic mineral deposit is not present, and therefore there would be no sterilisation by the proposed development.





Drawings



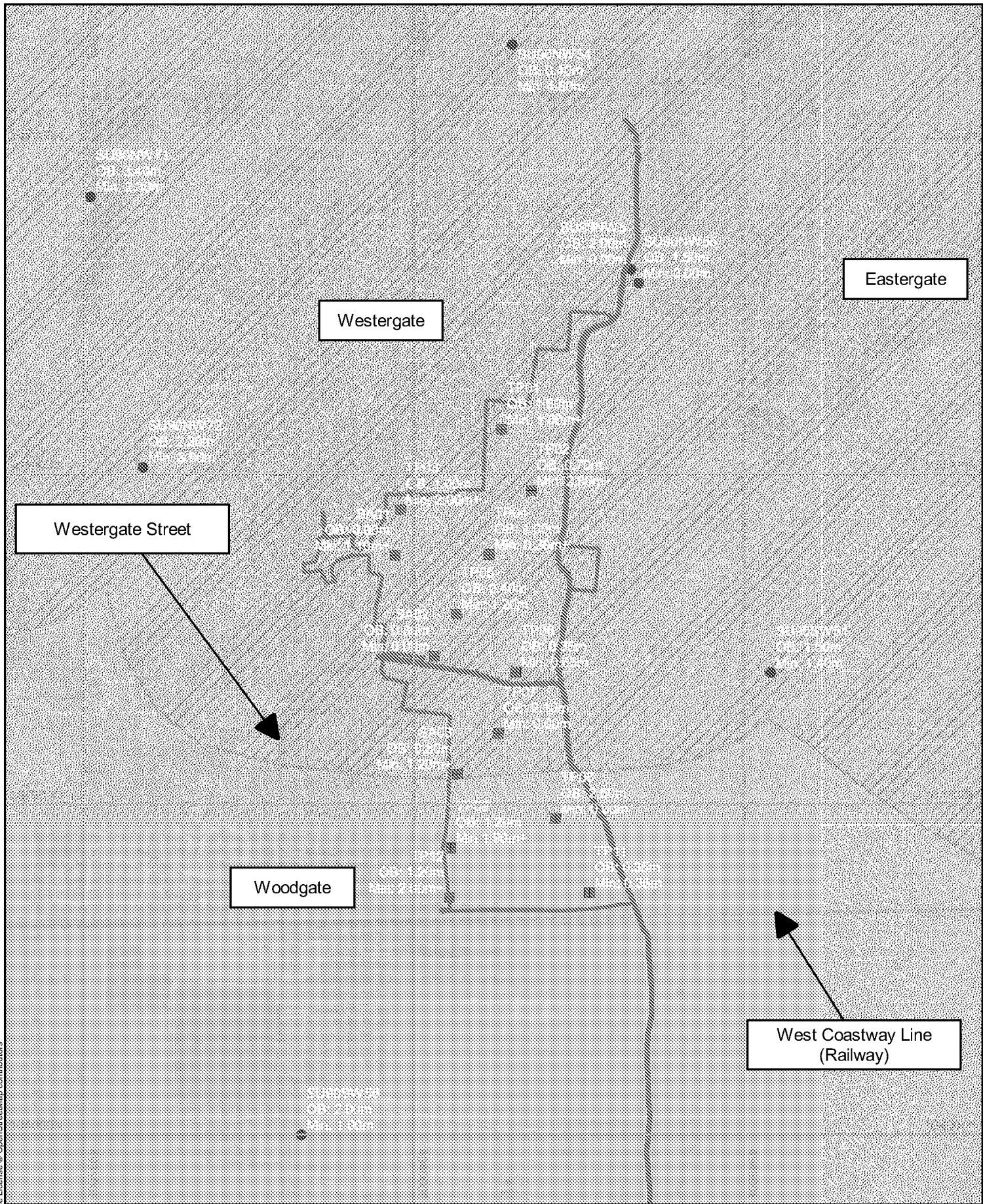
LEGEND

-  Site Boundary
-  Watercourses
-  Minerals and Waste Consultation Area



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Westgate, West Sussex Mineral Resource Assessment	
Site Location	
01	
SCALE 1:5000 (A4)	DATE 19/08/23





LEGEND

Site Boundary

Watercourses

Minerals and Waste Consultation Area

GI Trial Pit locations

BGS BH locations

Bedrock Geology

London Clay Fm.



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Westergate, West Sussex

Mineral Resource Assessment

Bedrock Geology

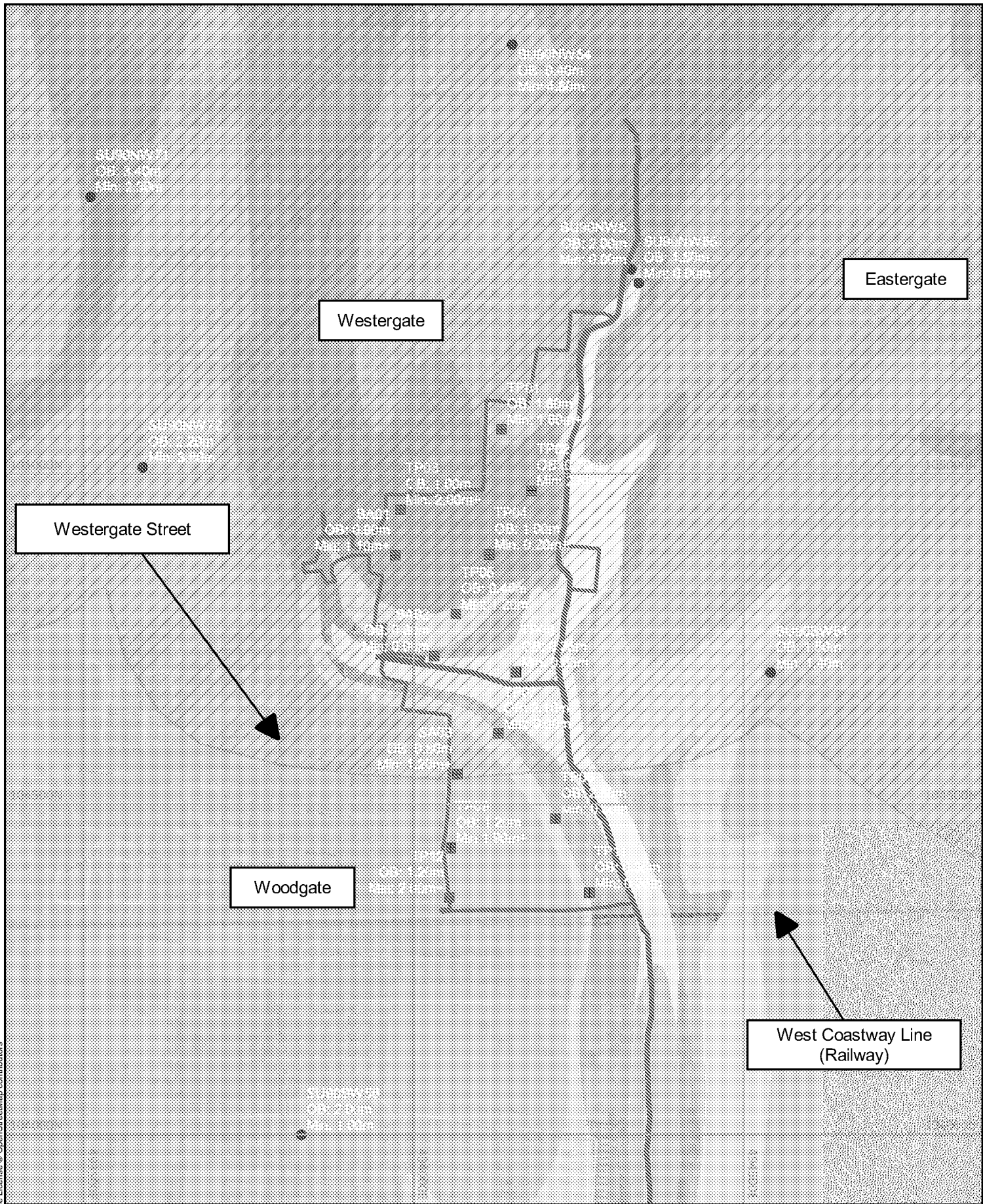
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LEGEND

- Site Boundary
- Watercourses
- Minerals and Waste Consultation Area
- GI Trial Pit locations
- BGS BH locations

Superficial Geology

- Alluvium
- Head
- Raised Marine Deposits
- Raised Beach Deposits
- River Terrace Deposits

OB: Overburden Thickness
Min: Mineral Thickness



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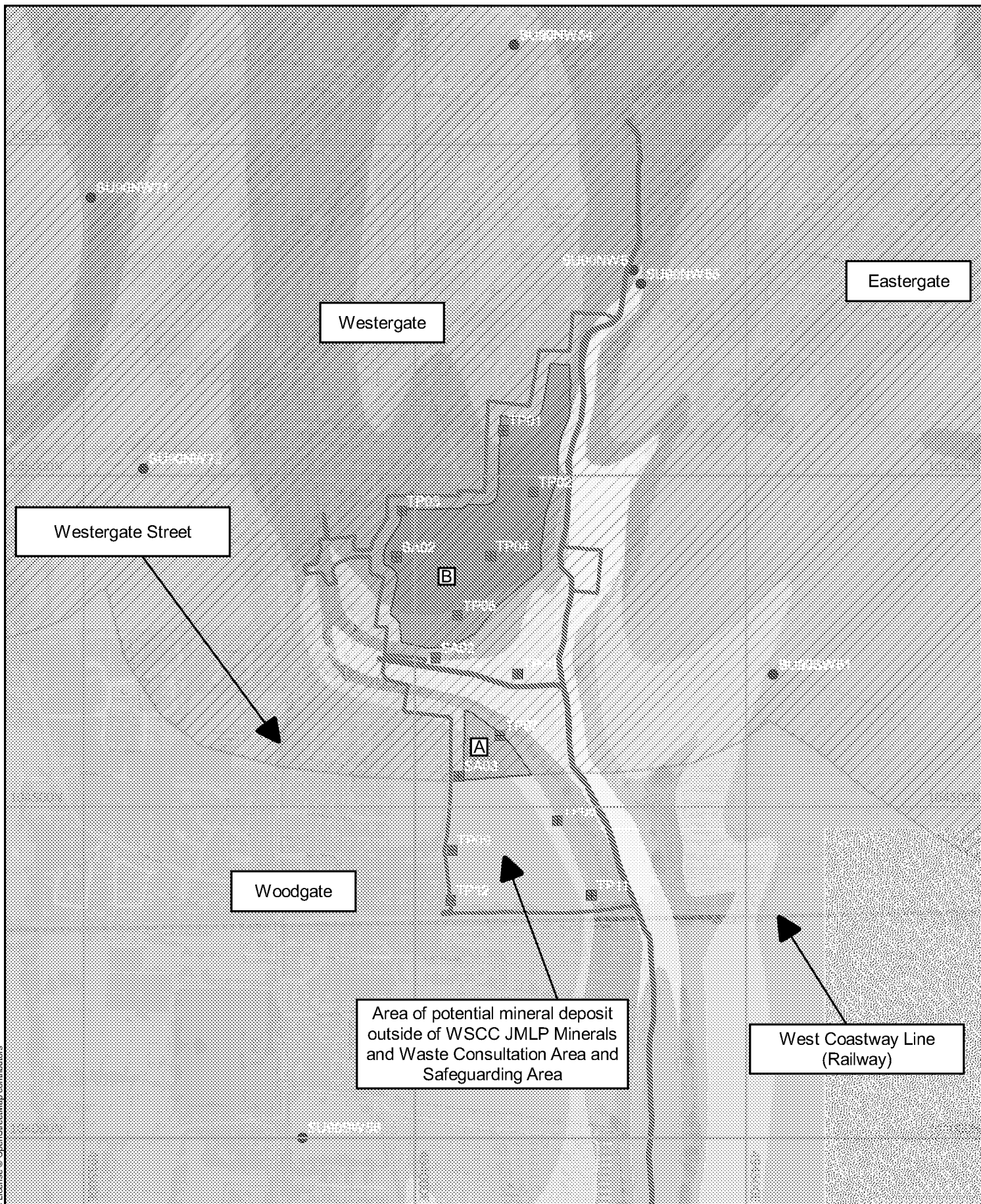
***SLR**

Westergate, West Sussex
Mineral Resource Assessment
Superficial Geology

03

SCALE 1:5000 (A4)

DATE 19/08/23



LEGEND

Site Boundary

Watercourses

Minerals and Waste Consultation Area

GI Trial Pit locations

BGS BH locations

Area A

Area B

Superficial Geology

Aluvium

Head

Raised Marine Deposits

Raised Beach Deposits

River Terrace Deposits



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Westergate, West Sussex

Mineral Resource Assessment

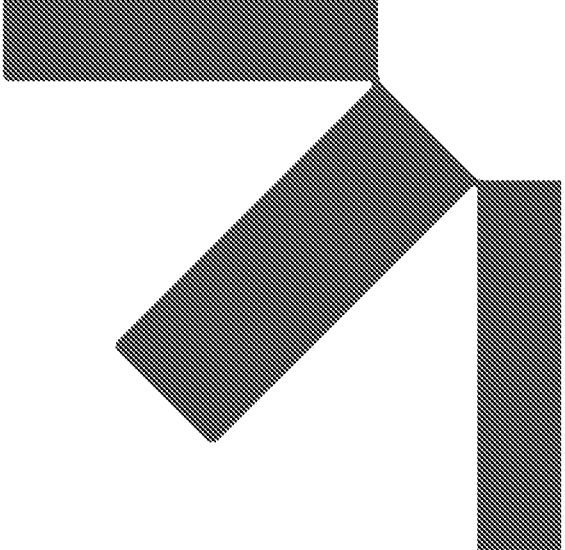
Potential Resource Areas

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Appendix A Bingham : Hall Associates Geotechnical Ground Investigation (2017)

Mineral Resource Assessment

Westergate, West Sussex

Cala Homes South Home Counties

SLR Project No.: 424.064829.00001

19 September 2023



Geotechnical Ground Investigation Report

Land East of Westergate



Cala Homes (South Home Counties) Ltd

February 2017 – Version 2

Oakleigh, Connaught Road, Attleborough, Norfolk NR17 2BW

www.binghamhall.com

BHA Consulting Ltd Registered no. 7225044 VAT no. 688 5450 83 Director: Andrew Bingham C.Eng

Document Control Sheet

Project Name: Proposed Residential Development, Land East of Westergate, West Sussex,
PO20 3QR

Project Reference: 3030

Report Title: Geotechnical Ground Investigation Report

Document Reference: Revised Red Line Boundary Plans Added

	Name	Position	Signature	Date
Prepared By:	Gillian Hoy	Geotechnical Engineer		2 February 2017
Approved By:	Andrew Bingham	Managing Director		2 February 2017
For and on behalf of Bingham Hall Associates				

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4 Laboratory Testing.....	9
5 Ground Conditions	10
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Appendices

Appendix A: Illustrative Site Layout

Appendix B: Trial Pit Logs and Location Plan

Appendix C: Percolation Test Data

Appendix D: Geotechnical Laboratory Test Results

Executive Summary

Introduction	This Geotechnical Ground Investigation Report has been prepared in support of a hybrid planning application for a development of 350 dwellings on land east of Westergate, to be referred to hereafter as 'the Site'. The Site is currently greenfield land located to the east of the developed area of Westergate.
Geology	The British Geological Survey indicates the site lies on bedrock of the London Clay Formation. This is largely masked by superficial deposits of Head in the northern part of the site, and River Terrace Deposits in the southern part of the site, with the river valley comprising Alluvium and Raised Beach Deposits.
Site Sensitivity	The superficial deposits are designated as Secondary A Aquifers. Groundwater within these deposits will be perched upon the Unproductive London Clay Formation. The Site is located in an area of agricultural land that is bounded to the east by Lidsey Rife which flows from the north to the south and is culverted underneath the railway line. An unnamed tributary from the west joins the Lidsey Rife through the Site from Westergate, to assist in identification this watercourse is termed Westergate Stream in this Report.
Fieldwork	Ground investigation works were carried out on the 26 and 27 September 2016. The works comprised sixteen machine excavated trial pits, to aid foundation design and obtain samples for geotechnical laboratory testing purposes, and four BRE365 percolation tests, to aid soakaway drainage design.
Ground Conditions	All trial pits encountered natural strata from ground level, in line with the expected British Geological Society published geology. Some recorded groundwater between 1.40m and 2.4metres below existing ground level.
Preliminary Foundation Recommendations	Based on the trial pit records, it is recommended that new dwellings are supported on conventional concrete strip or trench fill foundations placed into the underlying natural firm/medium dense strata. The foundations should fully penetrate any Topsoil/Subsoil and extend a minimum of 150mm into the natural bearing strata. For foundations 0.45m-0.6m wide at depths of 0.80m below existing or final ground level, whichever is the greater, a theoretical net safe bearing capacity of 100kN/m ² may be reasonably adopted. Total and differential settlements should remain within acceptable limits on

	homogeneous strata, however consideration should be given to the provision of reinforcement where foundations are supported upon both granular and cohesive strata. The plasticity index tests indicate that the cohesive soils range from low to very high plasticity and are therefore likely to exhibit shrinkage and swelling characteristics. Therefore, the recommendations within the NHBC Standards, Chapter 4.2 Building Near Trees, should be adhered to with respect to deepening foundations to a depth where the likelihood of movement damage is low. The formation soils should be inspected by an experienced engineer to ensure the natural bearing strata is of adequate density. If loose/soft strata is encountered the foundations should be taken deeper to prove a suitable bearing layer or loose/soft pockets replaced with granular fill or lean mix concrete as soon as practical after excavation. Consideration should also be given to the provision of localised reinforcement of the foundations in such areas to effectively allow them to 'bridge' loose/soft spots.
Floor Slabs	Due to the plasticity index tests indicating that the cohesive soils range from low to very high plasticity it would be prudent to adopt fully suspended floor slabs with a minimum void space of 300mm.
Excavation and Temporary Works	Side slopes are unlikely to remain stable in the short term without support or battering back to a safe slope gradient. A detailed inspection of the side slopes should be made during excavation and a risk assessment carried out to fully assess the support measures required. It should be noted that clays deteriorate rapidly in the presence of water. Therefore, it is recommended that after inspection foundation trenches are rapidly blinded with concrete to prevent any deterioration due to exposure to the weather and moisture. Groundwater was encountered during ground investigation works. Therefore, the provision of groundwater control measures is recommended. Excavations for services and foundations should be well within the capability of conventional backhoe excavators.
Access Roads	Given the nature of the near surface materials it is suggested that a CBR value of 2% is used across the Site for pavement design.

Soakaway Drainage and Dissolution Features	Four BRE365 percolation tests were undertaken. The Soil Infiltration Rates suggest infiltration drainage methods are viable within the superficial Head Deposits, however should be limited to permeable pavings as deep infiltration structures are not considered viable due to the high groundwater table and variable depth to the impermeable London Clay which is not considered suitable for soakaway drainage.
Buried Concrete	The pH results obtained as part of the geotechnical testing indicate pH values are near neutral. The sulphate results correspond with design sulphate class DS-1 and a corresponding ACEC (Aggressive Chemical Environment for Concrete) class of AC-1d based on the site being greenfield with mobile groundwater conditions.
Ground Gases	The Desk Study indicated no reason to test for ground gases, therefore, no protective measures with respect to ground gases are required. The Site is in a lower probability radon area (1-3% of homes are above the action level), therefore no protective measures are required.
Further Work	It is recommended that the following additional intrusive investigations are carried out prior to development: • CBR testing at 25m spacings along proposed access roads.
This Executive Summary contains an overview of the key findings and conclusions in this report. No reliance should be placed on any part of the Executive Summary until the whole of this report has been read. Other sections of the report may contain information which puts into context the findings summarised in the Executive Summary.	

1 Introduction

- 1.1 Bingham Hall Associates (BHA) has been commissioned by CALA Homes (South Home Counties) Limited, to prepare a Geotechnical Ground Investigation Report in support of a hybrid planning application for a development of 350 dwellings on land east of Westergate, to be referred to hereafter as 'the Site'. The Site is currently greenfield land located to the east of the developed area of Westergate. The Illustrative Site Layout is provided in **Appendix A**.
- 1.2 The purpose of this report is to identify, as far as is reasonably possible, the physical ground conditions beneath the Site to enable recommendations for foundation design, floor slab design, and storm drainage design by infiltration.
- 1.3 The scope of works included:
 - Sixteen machine excavated trial pits
 - Four BRE365 percolation tests

Limitations

- 1.4 This document has been prepared for the titled project and should not be relied upon or used for any other project. Bingham Hall Associates accepts no responsibility or liability for the consequences of this document being used for a purpose other than that for which it was commissioned. The assessments and judgments contained herein should not be relied upon as legal opinion.
- 1.5 The findings and opinions are relevant to the dates of the Site visit and it should be noted that ground conditions will change over time due to natural variations and may be affected by human activities. The opinions included herein are based on the information obtained from the assessments undertaken at the Site and from our experience. If additional information becomes available which may alter our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion, if warranted.

2 Site Appraisal

Site setting

- 2.1 The Site is currently undeveloped arable land covering approximately 18.4ha as shown in Figures 2.1 and 2.2:

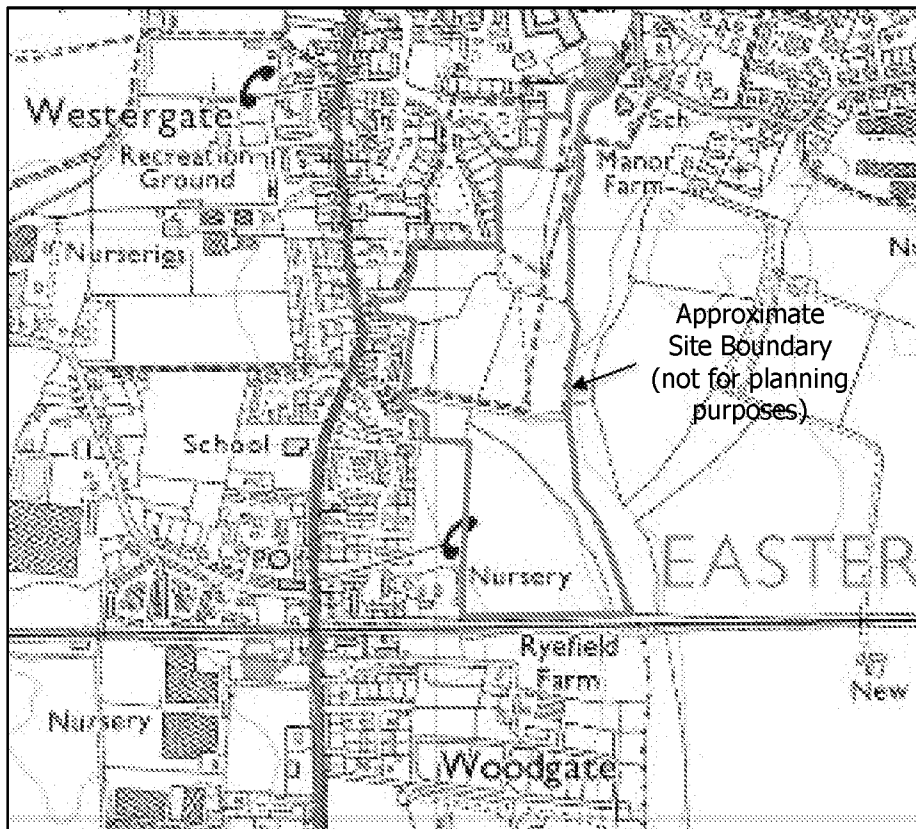


Figure 2.1: Site Location Plan

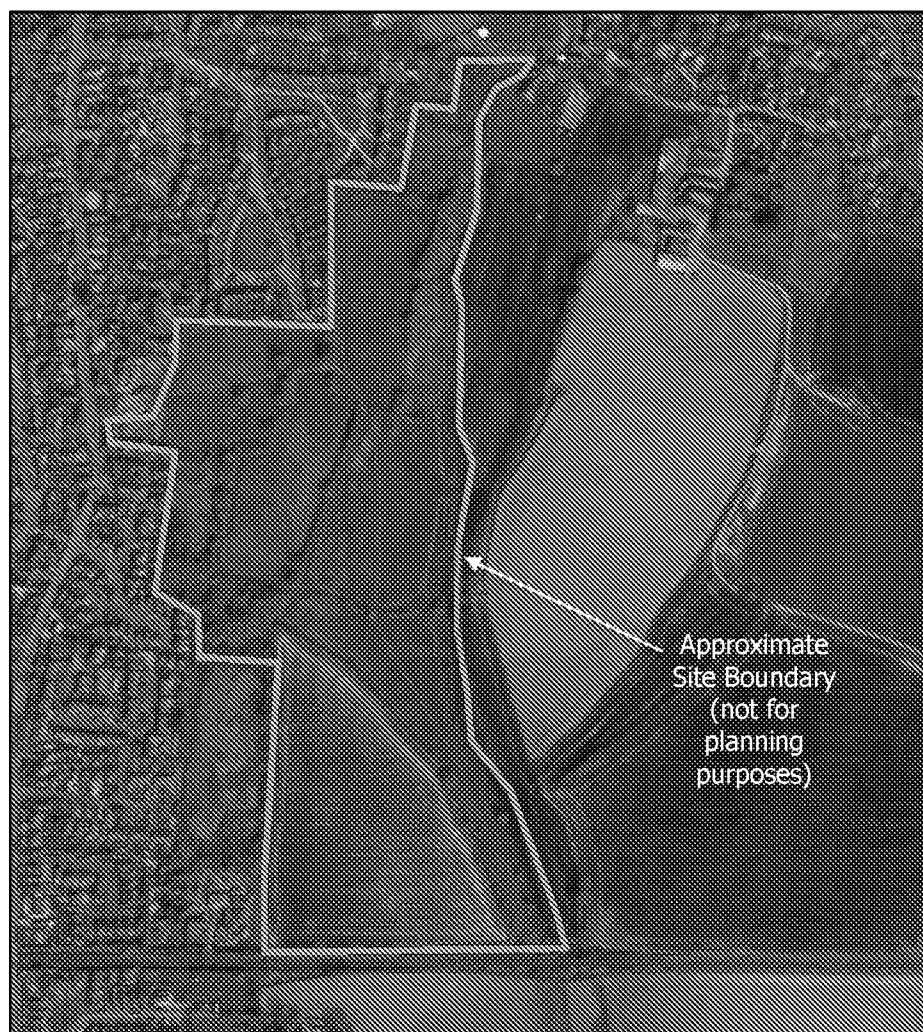


Figure 2.2: Site Location Plan: Aerial View

Geology

- 2.2 The British Geological Survey (BGS) 1:50,000 map for Chichester/Bognor (sheet 317/332) indicates the site lies on bedrock of the London Clay Formation. This is largely masked by superficial deposits of Head (Gravel, Sand Silt & Clay) in the northern part of the site and River Terrace Deposits (Sand, Silt & Clay) in the southern part of the site, with the river valley comprising Alluvium (Clay, Silt, Sand & Gravel) and Raised Beach Deposits (Sand and Gravel).

Hydrogeology

- 2.3 The superficial deposits are designated as Secondary A Aquifers (i.e. permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers). Groundwater within these deposits will be perched upon the Unproductive London Clay Formation (i.e. low permeability layers with negligible significance for water supply or river base flow) which is known to be in excess of 100m thick beneath the site.

Hydrology

- 2.4 The Site is located in an area of agricultural land that is bounded to the east by Lidsey Rife which flows from the north to the south and is culverted underneath the railway line. An unnamed tributary from the west joins the Lidsey Rife through the Site from Westergate, to assist in identification this watercourse is termed Westergate Stream in this Report.

Previous Reports

- 2.5 BHA is not aware of any previous Geotechnical Ground Investigation Reports that have been commissioned for this Site.
- 2.6 BHA were commissioned to carry out the Phase I Ground Contamination Report (Desk Study), in September 2016. The findings indicate the Site has remained greenfield land.
- 2.7 BHA were also commissioned to carry out long-term groundwater monitoring for this Site in accordance with the requirements set out by Arun District Council to assess groundwater conditions for new developments. At the time of writing, monitoring is on-going, however, the Groundwater Monitoring Report provides details of five monitoring wells and their data from March 2016 onwards.

3 Fieldwork

- 3.1 Ground investigation works were carried out on the 26 and 27 September 2016. The following works were carried out:
- Sixteen machine excavated trial pits (SA01-03, 03A and TP01-12) were excavated to depths of between 1.20mbgl and 4.00mbgl to aid foundation design and obtain samples for geotechnical laboratory testing purposes.
 - Four BRE365 percolation tests (SA01-03 and TP04)
- 3.2 The trial pits were logged on site to BS5930:1999+A2:2010 'Code of Practice for Site Investigations' by an engineer.
- 3.3 The Trial Pit Logs and Location Plan are provided in **Appendix B**. The Percolation Test Data is provided in **Appendix C**.

4 Laboratory Testing

Geotechnical

- 4.1 Geotechnical laboratory testing was carried out on selected samples taken from the trial pits, in accordance BS1377:1990 'Soils for Civil Engineering Purposes'. The following tests were scheduled:
- Five moisture contents
 - Five plasticity index (PI) tests
 - Five particle size distribution (PSD) tests
- 4.2 The laboratory test results have been incorporated into the trial pit logs, where applicable.
- 4.3 The laboratory test results are provided in **Appendix D**.

Chemical

- 4.4 Four samples were tested for soluble sulphate and pH values to aid concrete classification.
- 4.5 The laboratory test results are provided in **Appendix D**.

5 Ground Conditions

General

- 5.1 Full details of the strata encountered by this investigation can be seen on the Trial Pit Logs in **Appendix B**. All trial pits encountered natural strata from ground level, in line with the expected BGS published geology. The natural strata comprised layers of clay, sand and gravel lithologies.

Groundwater

- 5.2 The Trial Pit Logs indicate groundwater was encountered at depths of between 1.40m and 2.4mbgl at some locations.

Ground Gases

- 5.3 The desk study indicated no reason to test for ground gases, therefore, long term monitoring standpipes were not installed.
- 5.4 The Site is in a Radon Affected Area, as defined by the Health Protection Agency (HPA), as between 1% and 3% of properties are above the action level. However, no protective measures are required with respect to radon gas (Building Research Establishment, Publication BRE211.)

6 Comments & Recommendations

General

- 6.1 This ground investigation indicates that all trial pits encountered natural strata from ground level, in line with the expected BGS published geology. Some trial pits encountered groundwater between 1.40m and 2.4mbgl.

Preliminary Foundation Recommendations

- 6.2 Based on the trial pit records, it is recommended that new dwellings are supported on conventional concrete strip or trench fill foundations placed into the underlying natural firm/medium dense strata. The foundations should fully penetrate any Topsoil/Subsoil and extend a minimum of 150mm into the natural bearing strata.
- 6.3 For foundations 0.45m-0.6m wide at depths of 0.80m below existing or final ground level, whichever is the greater, a theoretical net safe bearing capacity of 100kN/m² may be reasonably adopted. Total and differential settlements should remain within acceptable limits on homogeneous strata, however consideration should be given to the provision of reinforcement where foundations are supported upon both granular and cohesive strata.
- 6.4 The plasticity index tests indicate that the cohesive soils range from low to very high plasticity and are therefore likely to exhibit shrinkage and swelling characteristics. Therefore, the recommendations within the NHBC Standards, Chapter 4.2 Building Near Trees, should be adhered to with respect to deepening foundations to a depth where the likelihood of movement damage is low.
- 6.5 The formation soils should be inspected by an experienced engineer to ensure the natural bearing strata is of adequate density. If loose/soft strata is encountered the foundations should be taken deeper to prove a suitable bearing layer or loose/soft pockets replaced with granular fill or lean mix concrete as soon as practical after excavation. Consideration should also be given to the provision of localised reinforcement of the foundations in such areas to effectively allow them to 'bridge' loose/soft spots.

Floor Slabs

- 6.6 Due to the plasticity index tests indicating that the cohesive soils range from low to very high plasticity it would be prudent to adopt fully suspended floor slabs with a minimum void space of 300mm.

Excavations & Temporary Works

- 6.7 Side slopes are unlikely to remain stable in the short term without support or battering back to a safe slope gradient. A detailed inspection of the side slopes should be made during excavation and a risk assessment carried out to fully assess the support measures required.
- 6.8 It should be noted that clay soils deteriorate rapidly in the presence of water. Therefore, it is recommended that after inspection foundation trenches are rapidly blinded with concrete to prevent any deterioration due to exposure to the weather and moisture.
- 6.9 Groundwater was encountered during site investigation works. Therefore, the provision of groundwater control measures is recommended.
- 6.10 Excavations for services and foundations should be well within the capability of conventional backhoe excavators.

Access Roads

- 6.11 In-situ California Bearing Ratio (CBR) tests did not form part of the scope of this investigation, however, given the nature of the near surface materials it is suggested that a CBR value of 2% is used across the Site for pavement design. All potential subgrade materials should be taken as frost susceptible and a minimum construction thickness of 450mm should be adopted. Any localised made ground (if encountered) should be replaced with imported granular fill or re-used soils excavated on-site (following removal of any unsuitable material) compacted to an engineering specification.

Soakaway Drainage

- 6.12 BRE365 percolation tests undertaken in SA01, SA02, SA03A and TP04. The results are shown in the following table:

Trial Pit Number	Test Zone Strata	Soil Infiltration Rate (m/s)
SA01	Head	1.27×10^{-4}
SA02	London Clay	Test Failed
SA03	Head	1.07×10^{-5}
TP04	Head	2.08×10^{-4}

Table 6.1: Summary Infiltration Test Results

- 6.13 The Soil Infiltration Rates suggest infiltration drainage methods are viable within the superficial Head Deposits. However, should be limited to permeable pavings as deep infiltration structures are not considered viable due to the high groundwater table and variable depth to the impermeable London Clay which is not considered suitable for soakaway drainage.

Buried Concrete

- 6.14 The pH results obtained as part of the geotechnical testing indicate pH values are near neutral. The sulphate results correspond with design sulphate class **DS-1** and a corresponding ACEC (Aggressive Chemical Environment for Concrete) class of **AC-1d** based on the site being greenfield with mobile groundwater conditions.

Ground Gases

- 6.15 The Desk Study indicated no reason to test for ground gases, therefore, no protective measures with respect to ground gases are required.
- 6.16 The Site is in a Radon Affected Area, as defined by the Health Protection Agency (HPA), as between 1% and 3% of properties are above the action level. However, no protective measures are required with respect to radon gas (Building Research Establishment, Publication BR211.)

Further Work

- 6.17 It is recommended that the following additional intrusive investigations are carried out prior to development:
- CBR testing at 25m spacings along proposed access roads.

Appendix A: Illustrative Site Layout

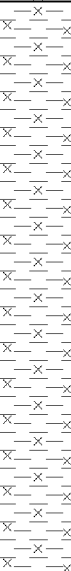


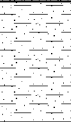
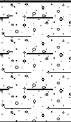
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E 07-11-16		Disabled and motorcycle parking bays added. Safeguarded route indicated and other footpaths added, hard landscaping updated as per Landscape Architects proposals. (BH)						SCALE:		1:1000 (A0 ORIGINAL)		DRAWING:		Proposed Site Layout Roof Level					
F 21-11-16		Site boundary red line updated. (BH)						DRAWN:		BH		16046		P101		H			
G 30-01-17		Phase 1 Site boundary red line updated. (AL)						DATE:		Aug '16									
H 02-02-17		Site boundary red line updated. (AL)																O'KEEFE SCANLON LIMITED	
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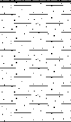
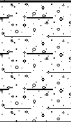
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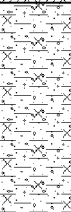
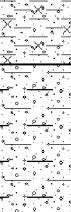
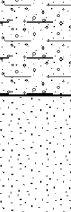
Appendix B: Trial Pit Logs and Location Plan

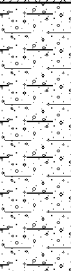
		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR 			Trial Pit Log		Trial Pit No. SA01	
Project Name: Land at Westergate,		Project No.: 15808		Method:		Sheet 1 of 1		
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD				Plant:		Hole Type TP		
Client: BHA Consulting Ltd		Trial Pit Length: m		Trial Pit Width: m		Scale 1:25		
Dates: 26/09/2016		Level:		Co-ords:		Logged By CF		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	D					Turf over stiff dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL	
	0.60	D						
	0.90	D		0.70			Stiff dark orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. HEAD	
	1.50	D		0.90				
	2.00	D		1.80			Dark brown sandy clayey fine to coarse, sub angular to sub rounded flint GRAVEL. Sand is fine to coarse. HEAD	
			2.00					
							Orangish brown fine to coarse SAND. HEAD	
						End of Pit at 2.00m		
							1	
							2	
							3	
							4	
							5	
General Remarks: Roots encountered to 1.0m bgl.							Sample Type D: Disturbed B: Bulk J: Jar W: Water	
Groundwater Remarks: Running sand at 2.0m bgl								

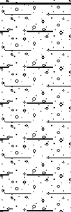
		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR			Trial Pit Log		Trial Pit No. SA02 Sheet 1 of 1			
Project Name: Land at Westergate,				Project No.: 15808		Method:		Hole Type TP		
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD				Plant:		Support:				
Client: BHA Consulting Ltd				Trial Pit Length: m		Trial Pit Width: m		Scale 1:25		
Dates: 26/09/2016			Level:		Co-ords:		Logged By CF			
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
	0.30	D		0.80			Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint, with frequent rootlets. TOPSOIL			
	0.60	D								
	0.90	D								
	1.50	D		2.10			Stiff dark brown silty CLAY, with occasional orange fine to coarse sand pockets and occasional selenite crystals. LONDON CLAY FORMATION			
	2.00	D								
	2.50	D								
	3.00	D		4.00			Stiff heavily fissured bluish brown silty CLAY with frequent rootlets and selenite crystals. LONDON CLAY FORMATION			
	3.50	D								
	4.00	D								
							End of Pit at 4.00m			
General Remarks: Roots encountered to 4.0m bgl.								Sample Type D: Disturbed B: Bulk J: Jar W: Water		
Groundwater Remarks:										

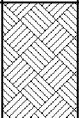
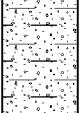
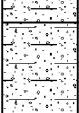
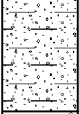
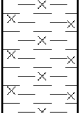
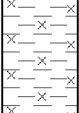
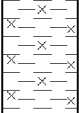
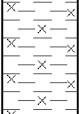
		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR		Trial Pit Log		Trial Pit No. SA03 Sheet 1 of 1	
Project Name: Land at Westergate,			Project No.: 15808		Method:		Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD			Plant:		Support:		
Client: BHA Consulting Ltd			Trial Pit Length: m		Trial Pit Width: m		Scale 1:25 Logged By CF
Dates: 26/09/2016		Level:		Co-ords:			
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	D		0.40			Dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. TOPSOIL
	0.60	D		0.80			Orangish brown sandy CLAY. Sand is fine to coarse. HEAD
	0.90	D		1.20			Dark orangish brown sandy clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub angular to sub rounded made up of flint. HEAD
	1.50	D					Orangish brown fine to coarse SAND. HEAD
	2.00	D		2.00			End of Pit at 2.00m
General Remarks: Roots encountered to 0.5m bgl.			Sample Type D: Disturbed B: Bulk J: Jar W: Water				
Groundwater Remarks:							

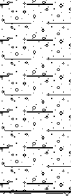
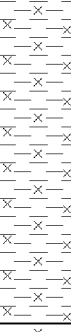
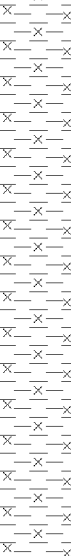
		Soils Limited Newton House, Grass Road, Tedworth, K/T20 5GP			Trial Pit Log		Trial Pit No. SA03A Sheet 1 of 1	
Project Name: Land at Westergate,				Project No.: 15808		Method:		Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD				Plant:		Support:		
Client: BHA Consulting Ltd				Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 26/09/2016			Level:		Co-ords:			Logged By CF
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	D		0.40			Dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. TOPSOIL	
	0.60	D		0.80			Orangish brown sandy CLAY. Sand is fine to coarse. HEAD	
	0.90	D		1.20			Dark orangish brown sandy clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub angular to sub rounded made up of flint. HEAD	
				1.35			Orangish brown fine to coarse SAND. HEAD	
						End of Pit at 1.35m		
General Remarks: Roots encountered to 0.5m bgl.								
Groundwater Remarks:								
Sample Type D: Disturbed B: Bulk J: Jar W: Water								

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR T [REDACTED]			Trial Pit Log		Trial Pit No. TP01 Sheet 1 of 1	
Project Name: Land at Westergate,				Project No.: 15808		Method:		Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD				Plant:		Support:		
Client: BHA Consulting Ltd				Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 27/09/2016			Level:		Co-ords:			Logged By CF
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	D		0.70			Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL	1
	0.60	D						
	0.90	D		1.60			Stiff dark orangish brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded flint. HEAD	2
	1.50	D						
	2.00	D		2.40			Dark brown sandy clayey fine to coarse, sub angular to sub rounded flint GRAVEL. Sand is fine to coarse. HEAD	3
	2.50	D						
3.00	D		3.20			Orangish brown fine to coarse SAND. HEAD	4	
						End of Pit at 3.20m		5
General Remarks: Pit collapsing at 3.2m bgl, backfilled. Roots encountered to 1.0m bgl.								Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks: Groundwater encountered at 2.30m bgl.								

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SP			Trial Pit Log		Trial Pit No. TP02 Sheet 1 of 1	
Project Name: Land at Westergate,				Project No.: 15808		Method:		Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD				Plant:		Support:		
Client: BHA Consulting Ltd				Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 27/09/2016			Level:		Co-ords:		Logged By CF	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	D		0.70			Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL.	
	0.60	D						
	0.90	D						
	1.50	D		1.60			Dark brown sandy clayey fine to coarse, sub angular to sub rounded flint GRAVEL. Sand is fine to coarse.	
	2.00	D						
	2.50	D						
	3.00	D		3.50			Orangish brown fine to coarse SAND.	
							End of Pit at 3.50m	
General Remarks: Pit collapsing at 3.50m bgl, backfilled. Roots encountered to 1.0m bgl.								
Groundwater Remarks:							Sample Type D: Disturbed B: Bulk J: Jar W: Water	

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR 			Trial Pit Log		Trial Pit No. TP03	
Project Name: Land at Westergate,		Project No.: 15808		Method:		Sheet 1 of 1		
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD				Plant:		Hole Type TP		
Client: BHA Consulting Ltd		Trial Pit Length: m		Trial Pit Width: m		Scale 1:25		
Dates: 26/09/2016		Level:		Co-ords:		Logged By CF		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	D		0.70			Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL	
	0.60	D						
	0.90	D						
	1.50	D		1.70			Stiff dark orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. HEAD	
							Dark brown sandy clayey fine to coarse, sub angular to sub rounded flint GRAVEL. Sand is fine to coarse. HEAD	
	2.00	D						
2.50	D		3.00			Orangish brown fine to coarse SAND. HEAD		
3.00	D							
End of Pit at 3.00m							3	
							4	
							5	
General Remarks: Pit collapsed. Roots encountered to 1.0m bgl.							Sample Type D: Disturbed B: Bulk J: Jar W: Water	
Groundwater Remarks: Running sand at 2.4m bgl.								

 Soils Limited Newton House, Cross Road, Tadworth KT20 5SR T: [REDACTED]		Trial Pit Log		Trial Pit No. TP05 Sheet 1 of 1			
Project Name: Land at Westergate,			Project No.: 15808		Method:		
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD			Plant:		Hole Type TP		
Client: BHA Consulting Ltd			Trial Pit Length: m		Trial Pit Width: m		
Dates: 27/09/2016			Level:		Co-ords:		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	D		0.40			Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse, gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL
	0.60	D					Light orangish brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. HEAD
	0.90	D		0.90			Orangish brown gravelly slightly clayey fine to coarse SAND. Gravel is fine to coarse, sub angular to sub rounded made up of flint. HEAD
	1.50	D		1.60			Firm dark brownish blue slightly fissured silty CLAY with occasional selenite crystals. LONDON CLAY FORMATION
	2.00	D					
	2.50	D					
	3.00	D					
	3.50	D		3.50			
End of Pit at 3.50m							
General Remarks: Roots encountered to 1.0m bgl.							Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks: Running sand at 2.40m bgl.							

 Soils Limited Newton House, Cross Road, Tadworth KT20 5SP [Redacted Address Line]		Trial Pit Log		Trial Pit No. TP06 Sheet 1 of 1			
Project Name: Land at Westergate,		Project No.: 15808		Method:			
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:		Support:			
Client: BHA Consulting Ltd		Trial Pit Length: m		Trial Pit Width: m			
Dates: 26/09/2016		Level:		Co-ords:			
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	D		0.35			Turf over stiff dark brown slightly gravelly sandy silty CLAY. Sand is fine to coarse, gravel is fine to medium, sub angular to sub rounded, made up of flint, with frequent rootlets. TOPSOIL
	0.60	D					Dark orangish brown sandy clayey GRAVEL. Sand is fine to medium and gravel is fine to coarse sub angular to sub rounded flint. HEAD
	0.90	D		1.00			Stiff dark brown silty CLAY occasional rootlets. LONDON CLAY FORMATION
	1.50	D					
	2.00	D		2.10			Stiff fissured bluish brown silty CLAY, with frequent rootlets and frequent selenite crystals. LONDON CLAY FORMATION
	2.50	D					
	3.00	D					
	3.50	D					
	4.00	D		4.00			End of Pit at 4.00m
General Remarks: Roots encountered to 4.0m bgl.							
Groundwater Remarks:							
Sample Type D: Disturbed B: Bulk J: Jar W: Water							



Trial Pit No.

TP07

Sheet 1 of 1

Project Name: Land at Westergate.

Project No.: 15808

Method:	
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Hole Type	Location	Depth (ft)	Flow Rate (gpm)	Pressure (psi)	Notes
1	...	...	...	...	...
2	...	...	...	...	...
3	...	...	...	...	...
4	...	...	...	...	...
5	...	...	...	...	...
6	...	...	...	...	...
7	...	...	...	...	...
8	...	...	...	...	...
9	...	...	...	...	...
10	...	...	...	...	...
11	...	...	...	...	...
12	...	...	...	...	...
13	...	...	...	...	...
14	...	...	...	...	...
15	...	...	...	...	...
16	...	...	...	...	...
17	...	...	...	...	...
18	...	...	...	...	...
19	...	...	...	...	...
20	...	...	...	...	...
21	...	...	...	...	...
22	...	...	...	...	...
23	...	...	...	...	...
24	...	...	...	...	...
25	...	...	...	...	...
26	...	...	...	...	...
27	...	...	...	...	...
28	...	...	...	...	...
29	...	...	...	...	...
30	...	...	...	...	...
31	...	...	...	...	...
32	...	...	...	...	...
33	...	...	...	...	...
34	...	...	...	...	...
35	...	...	...	...	...
36	...	...	...	...	...
37	...	...	...	...	...
38	...	...	...	...	...
39	...	...	...	...	...
40	...	...	...	...	...
41	...	...	...	...	...
42	...	...	...	...	...
43	...	...	...	...	...
44	...	...	...	...	...
45	...	...	...	...	...
46	...	...	...	...	...
47	...	...	...	...	...
48	...	...	...	...	...
49	...	...	...	...	...
50	...	...	...	...	...
51	...	...	...	...	...
52	...	...	...	...	...
53	...	...	...	...	...
54	...	...	...	...	...
55	...	...	...	...	...
56	...	...	...	...	...
57	...	...	...	...	...
58	...	...	...	...	...
59	...	...	...	...	...
60	...	...	...	...	...
61	...	...	...	...	...
62	...	...	...	...	...
63	...	...	...	...	...
64	...	...	...	...	...
65	...	...	...	...	...
66	...	...	...	...	...
67	...	...	...	...	...
68	...	...	...	...	...
69	...	...	...	...	...
70	...	...	...	...	...
71	...	...	...	...	...
72	...	...	...	...	...
73	...	...	...	...	...
74	...	...	...	...	...
75	...	...	...	...	...
76	...	...	...	...	...
77	...	...	...	...	...
78	...	...	...	...	...
79	...	...	...	...	...
80	...	...	...	...	...
81	...	...	...	...	...
82	...	...	...	...	...
83	...	...	...	...	...
84	...	...	...	...	...
85	...	...	...	...	...
86	...	...	...	...	...
87	...	...	...	...	...
88	...	...	...	...	...
89	...	...	...	...	...
90	...	...	...</		

Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD

Plant:

TP

Support:

Scale

Client: BHA Consulting Ltd

Trial Pit Length: m

Trial Pit Width: m

1:25

Dates: 26/09/2016

Level:

Co-ords:

Logged By
CF

1
2
3
4
5

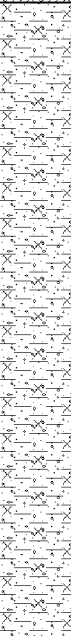
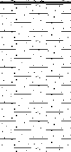
General Remarks:

Roots encountered to 3.2m bgl.

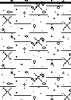
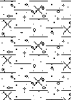
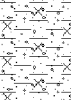
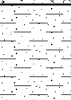
Sample Type

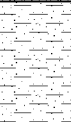
D: Disturbed
B: Bulk
J: Jar
W: Water

Groundwater Remarks:

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR 			Trial Pit Log		Trial Pit No. TP08	
Project Name: Land at Westergate,		Project No.: 15808		Method:		Sheet 1 of 1		
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:		Support:		Hole Type TP		
Client: BHA Consulting Ltd		Trial Pit Length: m		Trial Pit Width: m		Scale 1:25		
Dates: 29/09/2016		Level:		Co-ords:		Logged By CF		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	D		0.50			Turf over stiff dark brown slightly gravelly sandy silty CLAY. Sand is fine to coarse, gravel is fine to medium, sub angular to sub rounded, made up of flint, with frequent rootlets. TOPSOIL	
	0.60	D						
	0.90	D						
	1.50	D		2.60			Stiff dark orangish brown slightly gravelly silty sandy CLAY / very clayey SAND. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. HEAD	
	2.00	D						
	2.50	D						
	3.00	D		3.10			Dark orangish brown sandy CLAY / clayey SAND, with occasional weakly cemented mudstone bands between 2.6-3.0m. Sand is fine to medium. LONDON CLAY FORMATION	
End of Pit at 3.10m								
General Remarks: Roots encountered to 2.6m bgl.								
Groundwater Remarks: 2.60m bgl slow seepage.								
							Sample Type D: Disturbed B: Bulk J: Jar W: Water	

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR 			Trial Pit Log		Trial Pit No. TP10	
Project Name: Land at Westergate,		Project No.: 15808		Method:		Sheet 1 of 1		
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:		Support:		Hole Type TP		
Client: BHA Consulting Ltd		Trial Pit Length: m		Trial Pit Width: m		Scale 1:25		
Dates:		Level:		Co-ords:		Logged By CF		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.00			Not undertaken, due to uncertainty of underground service location. 1 2 3 4 5	
General Remarks:							Sample Type D: Disturbed B: Bulk J: Jar W: Water	
Groundwater Remarks:								

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR [REDACTED] k			Trial Pit Log		Trial Pit No. TP11 Sheet 1 of 1	
Project Name: Land at Westergate,				Project No.: 15808		Method:		Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD				Plant:		Support:		
Client: BHA Consulting Ltd				Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 26/09/2016			Level:		Co-ords:			Logged By CF
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	D		0.35			Turf over stiff dark brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint, with frequent rootlets. TOPSOIL	
	0.60	D		0.70			Dark orangish brown sandy clayey GRAVEL. Sand is fine to coarse and gravel is fine to coarse, sub angular to sub rounded flint. HEAD	
	0.90	D					Stiff dark orangish brown sandy silty slightly gravelly CLAY / slightly gravelly very clayey SAND. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. HEAD	
	1.50	D					Dark orangish brown sandy CLAY / clayey SAND, with occasional weakly cemented mudstone bands between 2.6-3.0m. LONDON CLAY FORMATION	
	2.00	D		2.10			Dark orangish brown sandy CLAY / clayey SAND, with occasional weakly cemented mudstone bands between 2.6-3.0m. LONDON CLAY FORMATION	
	2.50	D					Dark orangish brown sandy CLAY / clayey SAND, with occasional weakly cemented mudstone bands between 2.6-3.0m. LONDON CLAY FORMATION	
	3.00	D		3.00			Dark orangish brown sandy CLAY / clayey SAND, with occasional weakly cemented mudstone bands between 2.6-3.0m. LONDON CLAY FORMATION	
End of Pit at 3.00m							3	
							4	
							5	
General Remarks: Roots encountered to 2.1m bgl.								Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks:								

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR 			Trial Pit Log		Trial Pit No. TP12	
Project Name: Land at Westergate,		Project No.: 15808		Method:		Sheet 1 of 1		
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:		Support:		Hole Type TP		
Client: BHA Consulting Ltd		Trial Pit Length: m		Trial Pit Width: m		Scale 1:25		
Dates: 26/09/2016		Level:		Co-ords:		Logged By CF		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	D		0.40			Dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. TOPSOIL	
	0.60	D					Stiff orangish brown sandy CLAY. Sand is fine to coarse. HEAD	
	0.90	D					... becoming soft from 0.8m	
				1.20			Orangish brown fine to coarse SAND. HEAD	
	1.50	D		3.20				
	2.00	D						
	2.50	D						
	3.00	D						
							End of Pit at 3.20m	
General Remarks: Pit collapsed back to 1.2m, backfilled.								
Groundwater Remarks: No seepage, but sand very wet.							Sample Type D: Disturbed B: Bulk J: Jar W: Water	



GENERAL NOTES

1. This drawing and the works depicted thereon are the copyright of BHA Consulting Ltd. Unauthorised reproduction infringes copyright.
2. All dimensions are in millimetres unless stated otherwise.
3. Do not scale from this drawing.
4. This drawing should be read in conjunction with Bingham Hall Associates engineering related drawings and all relevant drawings by the Architect and other specialists.

P1	First Issue	06/10/16	RB	AB
Rev	Description	Date	By	App

P - Preliminary
C - For Construction

Bingham : Hall Associates

Oakleigh Connaught Rd
Attleborough
Norfolk NR17 2BW

Tel 01953 456806
email: office@binghamhall.com
website: www.binghamhall.com

Client



Project Title
Land East of Westergate

Drawing Title
Trial Pit Location Plan

Drawn by RB	Checked by GH	Approved By AB
Size A3	Scale N.T.S	Date Oct 2016

Drawing No. 3030.103	Rev P1
-------------------------	-----------

Appendix C: Percolation Test Data



Infiltration Testing Data

Job No: 15808
Job Name: Westergate

Trial Hole	TP04	Test 1		Test 2	
Width Top (m)	0.50	Time (Min)	Depth (m)	Time (Min)	Depth (m)
Width Bottom (m)	0.50	0	0.420	0	0.250
Length Top (m)	2.10	1	0.460	1	0.350
Length Bottom (m)	1.20	2	0.540	3	0.400
Depth (m)	1.10	3	0.620	4	0.460
		5	0.700	5	0.500
		10	0.790	6	0.540
		15	0.840	7	0.563
		End of test hole collapsed		8	0.595
				9	0.608
				10	0.620
				11	0.641
				12	0.656
				13	0.678
				18	0.730
				23	0.774
				28	0.788
				33	0.806
				38	0.813
				43	0.830
				End of test	



Trial Hole **SA01**
Width Top (m) 0.50
Width Bottom (m) 0.50
Length Top (m) 2.40
Length Bottom (m) 2.20
Depth (m) 1.80

Test 1	
Time (Min)	Depth (m)
0	1.500
4	1.580
6	1.600
End of test hole collapsed	

Test 2	
Time (Min)	Depth (m)
Trial hole cleared out to 1.60m bgl.	
0	1.420
1	1.460
2	1.500
3	1.510
4	1.520
5	1.530
7	1.540
10	1.540
16	1.550
26	1.560
35	1.570
50	1.580
End of test	

Test 3	
Time (Min)	Depth (m)
0	1.400
1	1.420
2	1.440
4	1.450
8	1.470
10	1.470
22	1.480
32	1.490
50	1.510
End of test	



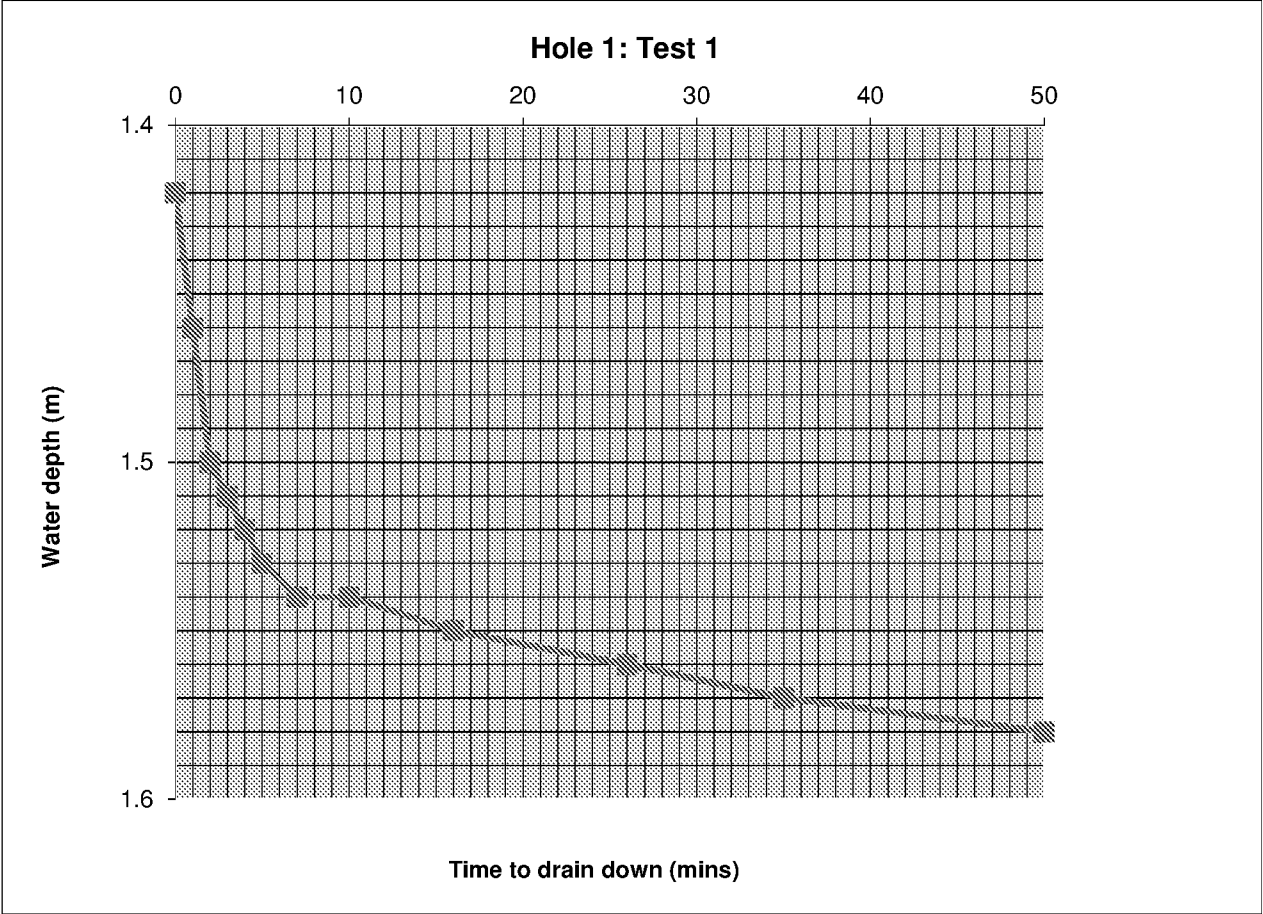
Trial Hole **SA02**
Width Top (m) 0.50
Width Bottom (m) 0.50
Length Top (m) 2.40
Length Bottom (m) 2.20
Depth (m) 4.00

Test 1	
Time (Mir Depth (m)	
0	2.720
1	2.720
2	2.730
5	2.730
20	2.730
48	2.730
End of test	

Trial Hole **SA03**
Width Top (m) 0.50
Width Bottom (m) 0.50
Length Top (m) 2.40
Length Bottom (m) 2.20
Depth (m) 1.35

Test 1	
Time (Mir Depth (m)	
0	0.468
1	0.470
2	0.478
3	0.479
4	0.482
5	0.483
6	0.485
7	0.488
8	0.491
9	0.493
10	0.494
15	0.500
20	0.509
25	0.516
30	0.525
35	0.529
45	0.542
75	0.570
105	0.593
135	0.605
205	0.621
235	0.635
265	0.645
End of test	

Job No: 3030	Date: 26/09/2016	Client: CALA Homes Ltd	Bingham:Hall Associates  web: www.binghamhall.com
Prepared By: GH	Checked By: AB	Project: Land East of Westergate	
Sheet No: 2 of 2	Revision 0		



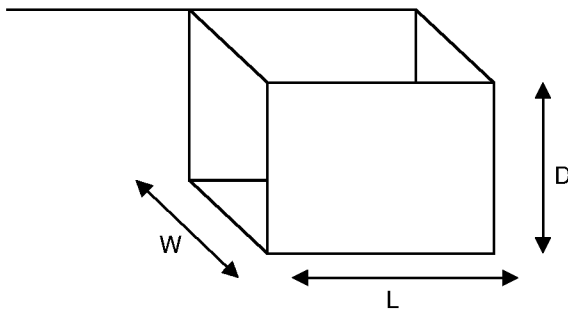
V (75-25)	0.088 cu m
T (75-25)	7.500 mins
Wetted Area (50%)	1.532 sq m
Infiltration rate m/hr	0.45953 m/hr
Infiltration rate m	1.276E-04 m/s

Bingham:Hall Associates

Test Hole Number:

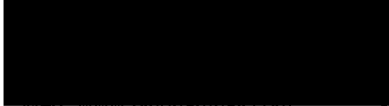
Ground level

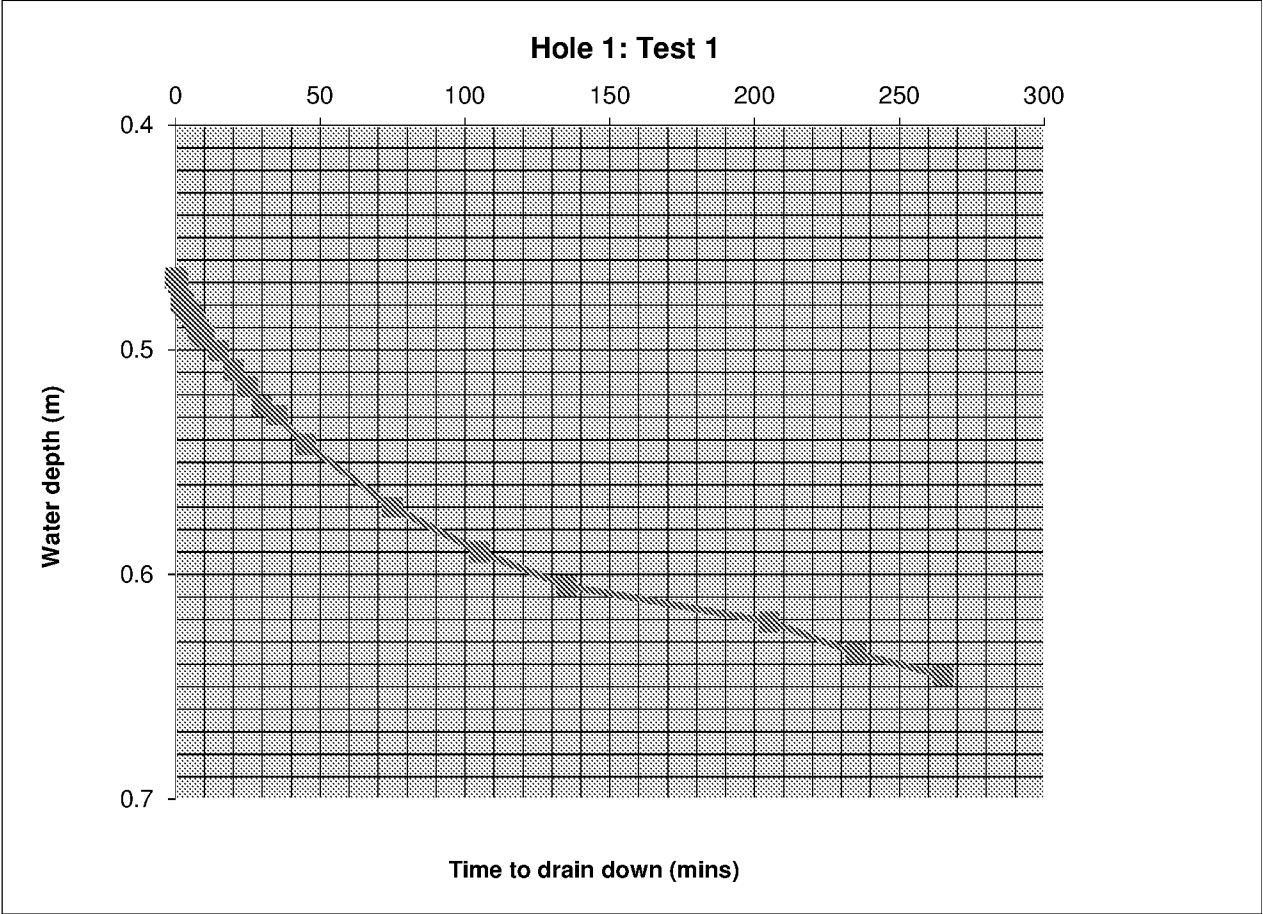
0.5 m wide (W)
2.2 m long (L)
1.4 m deep (D)
100 % void



Test Hole Fill: None

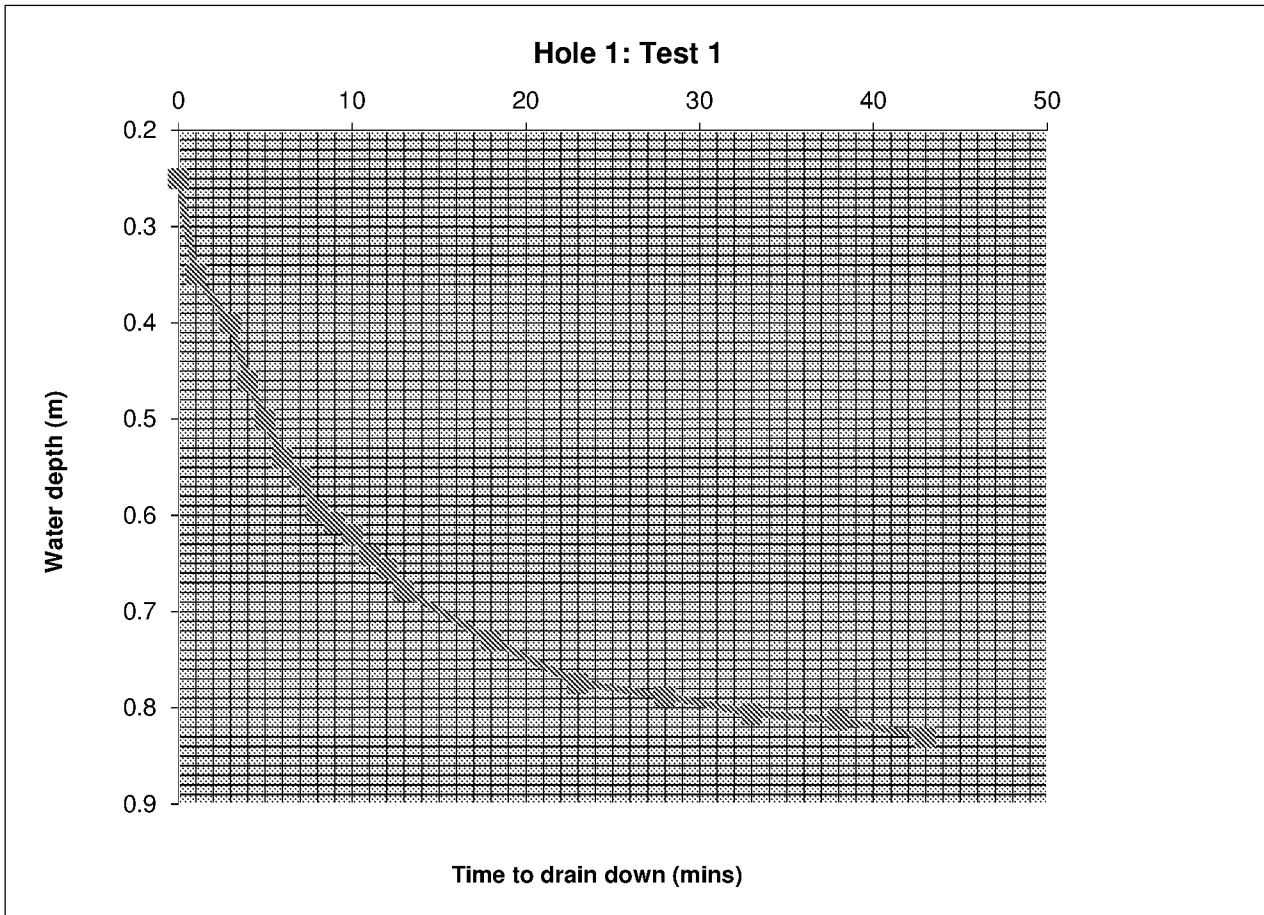
0.00 mins = effective 75% full

Job No: 3030	Date: 26/09/2016	Client: CALA Homes Ltd	Bingham:Hall Associates  web: www.binghamhall.com
Prepared By: GH	Checked By: AB	Project: Land East of Westergate	
Sheet No: 2 of 2	Revision 0		



V (75-25)	0.099 cu m
T (75-25)	97.000 mins
Wetted Area (50%)	1.586 sq m
Infiltration rate m/hr	0.03861 m/hr
Infiltration rate m	1.073E-05 m/s

Job No: 3030	Date: 26/09/2016	Client: CALA Homes Ltd	Bingham:Hall Associates  Web: www.binghamhall.com
Prepared By: GH	Checked By: AB	Project: Land East of Westergate	
Sheet No: 2 of 2	Revision 0		



V (75-25) 0.305 cu m

T (75-25) 9.500 mins

Wetted Area (50%) 2.558 sq m

Infiltration rate m/hr 0.75182 m/hr

Infiltration rate m 2.088E-04 m/s

Appendix D: Geotechnical Laboratory Test Results



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 32654

Client's Reference: **15808**

Report Date: **17-10-2016**

Client **Soils Limited**
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

Contract Title: **Westergate**
For the attention of: **Luke Wilkinson**

Date Received: **05-10-2016**

Date Commenced: **05-10-2016**

Date Completed: **17-10-2016**

Test Description	Qty
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS	5
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	5
PSD Wet Sieve method 1377 : 1990 Part 2 : 9.2 - * UKAS	5
Disposal of Samples on Project	1

Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager)
Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director)

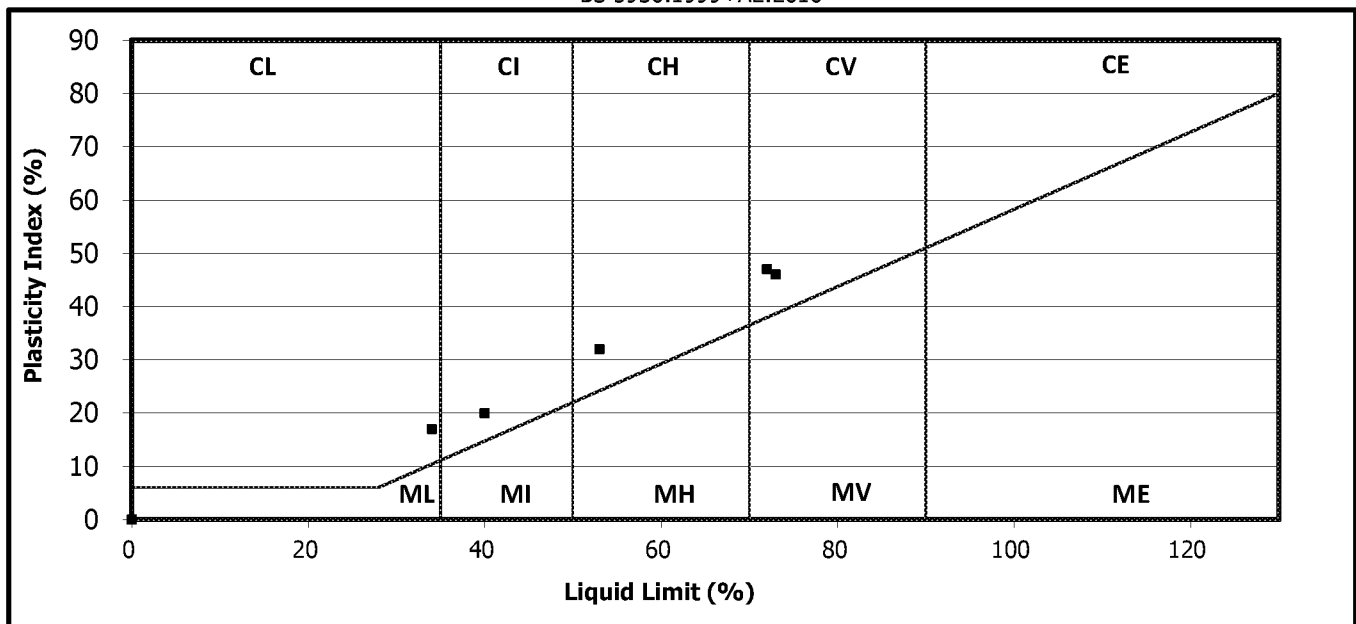
GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

**Test Report: Method of the Determination of the plastic limit and plasticity index
BS 1377 : Part 2 : 1990 Method 5**

Client ref: 15808
Location: Westergate
Contract Number: 32654

Hole/ Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
TP1	S/B	0.90	18	34	17	17	95	CL Low Plasticity
TP5	S/B	2.00	35	72	25	47	100	CV Very High Plasticity
TP6	S/B	3.00	32	73	27	46	100	CV Very High Plasticity
TP8	S/B	1.50	23	53	21	32	100	CH High Plasticity
TP11	S/B	2.50	21	40	20	20	100	CI Intermediate Plasticity

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.
BS 5930:1999+A2:2010



GSTL
GEO SITE & TESTING SERVICES LTD

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)
Date: 17.10.16



Client ref: ###
Location: Westergate
Contract Number: 32654

[illegible]

Note: Results on this table are in summary format and may not meet the requirements of the relevant standards, additional information is held by the laboratory



For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)

Date: 17.10.16



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

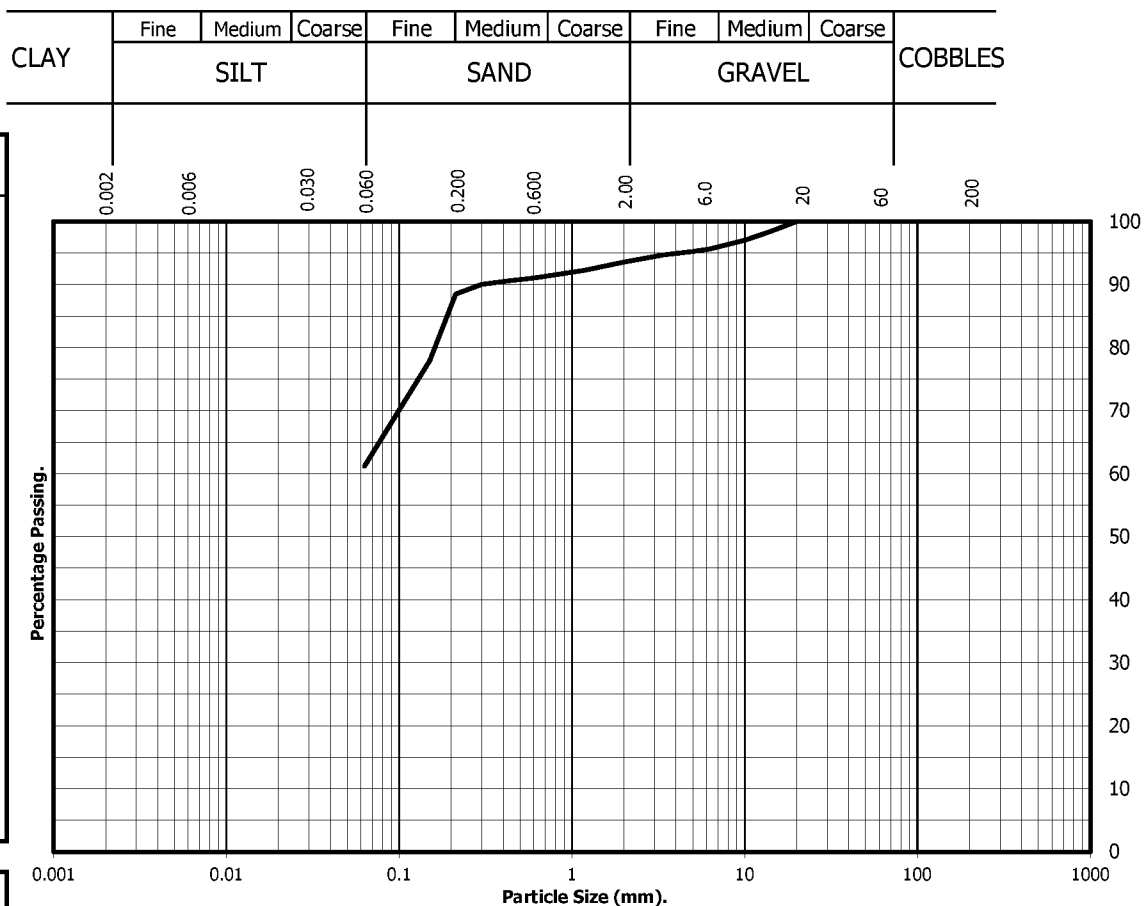
Wet Sieve, Clause 9.2

Client ref: **15808**
 Contract Number: **23654**
 Hole Number: **TP2**

Sample Number:
 Depth from (m): **1.50**
 Depth to (m): **0.00**
 Sample Type: **S/B**

Location: **Westergate**
 Description: **Brown slightly gravelly sandy SILT**

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	98
10	97
6.3	96
5.0	95
3.35	95
2.00	94
1.18	92
0.60	91
0.425	91
0.300	90
0.212	88
0.150	78
0.063	61



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	61	33	6	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Ben Sharp (Contracts Manager)

Date: **17.10.16**

Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

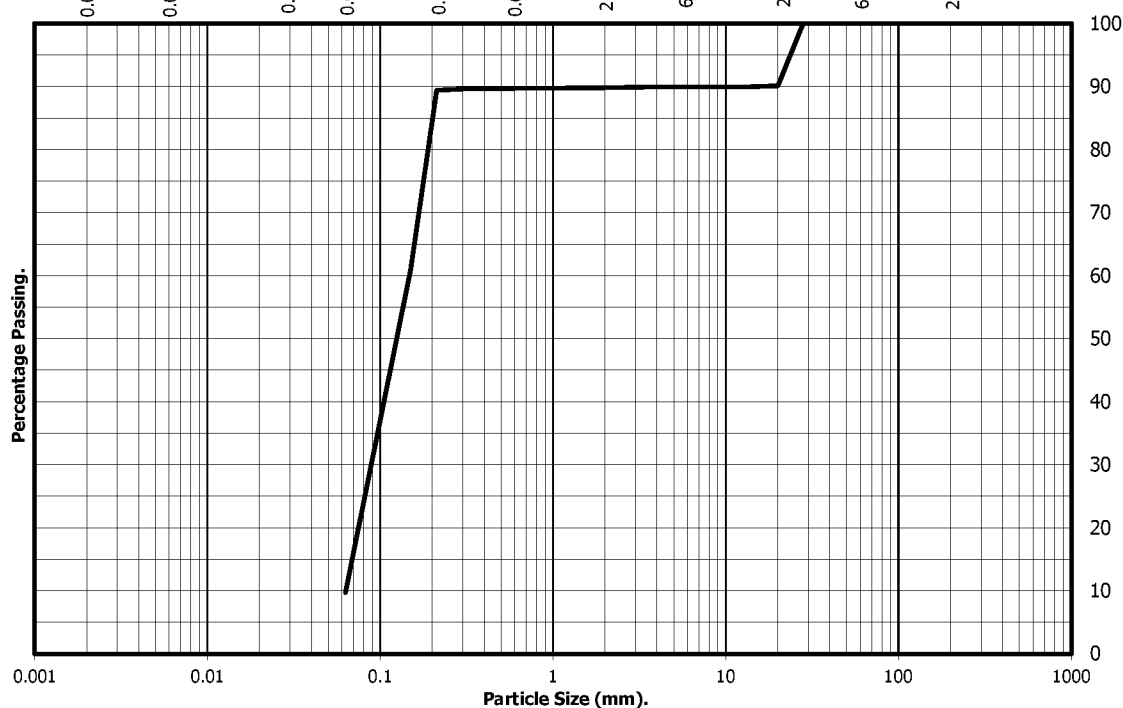
Client ref: **15808**
Contract Number: **23654**
Hole Number: **TP3**

Sample Number:
Depth from (m): **2.00**
Depth to (m): **0.00**
Sample Type: **S/B**

Location: **Westergate**
Description: **Brown slightly gravelly slightly silty SAND**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	90
14	90
10	90
6.3	90
5.0	90
3.35	90
2.00	90
1.18	90
0.60	90
0.425	90
0.300	90
0.212	89
0.150	61
0.063	10



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	10	80	10	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Ben Sharp (Contracts Manager)

Date: **17.10.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

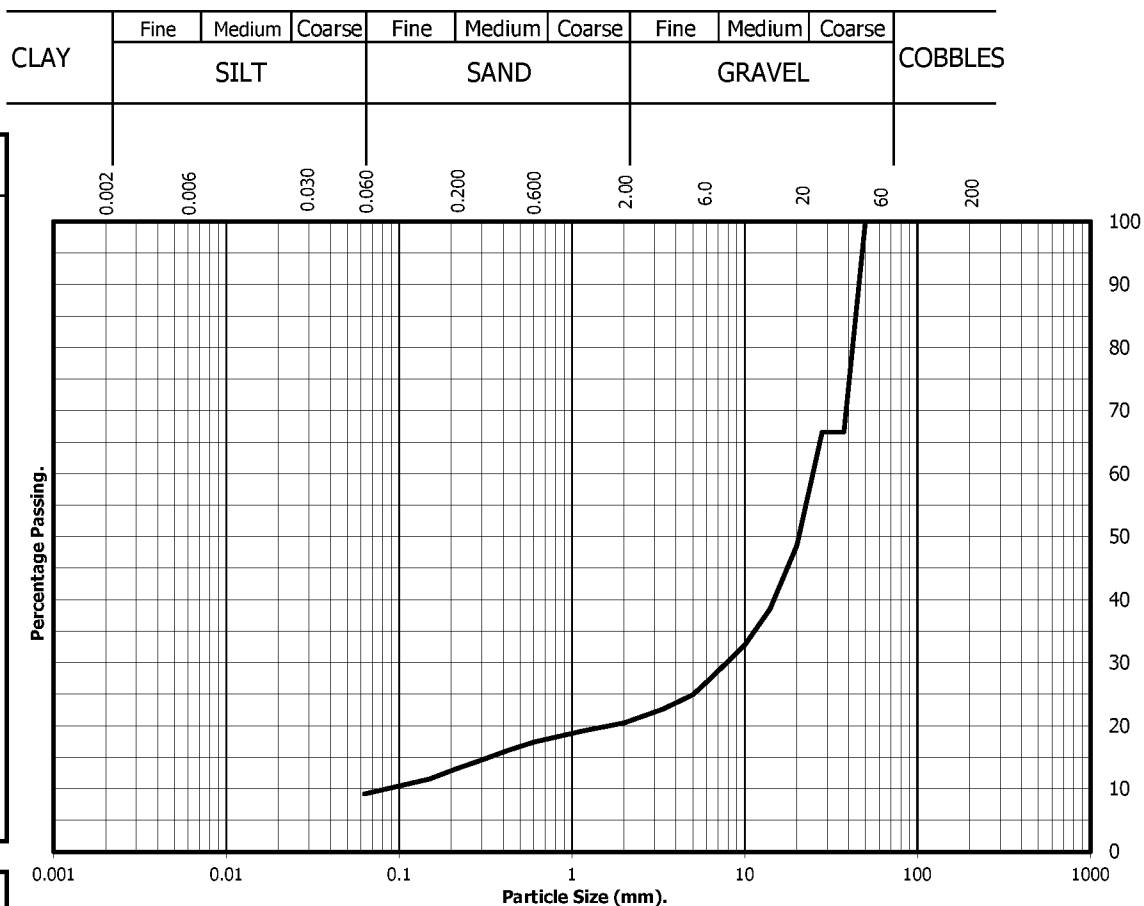
Wet Sieve, Clause 9.2

Client ref: **15808**
 Contract Number: **23654**
 Hole Number: **TP6**

Sample Number:
 Depth from (m): **0.90**
 Depth to (m): **0.00**
 Sample Type: **S/B**

Location: **Westergate**
 Description: **Brown slightly silty slightly sandy GRAVEL**

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	67
28	67
20	49
14	38
10	33
6.3	27
5.0	25
3.35	23
2.00	20
1.18	19
0.60	17
0.425	16
0.300	15
0.212	13
0.150	12
0.063	9



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	9	11	80	0	Total Percentage

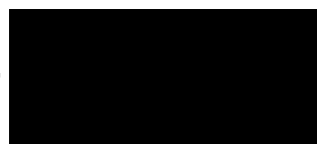
Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Ben Sharp (Contracts Manager)

Date: **17.10.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Client ref: 15808

Contract Number: 23654

Hole Number: TP9

Sample Number:

Depth from (m): 2.50

Depth to (m): 0.00

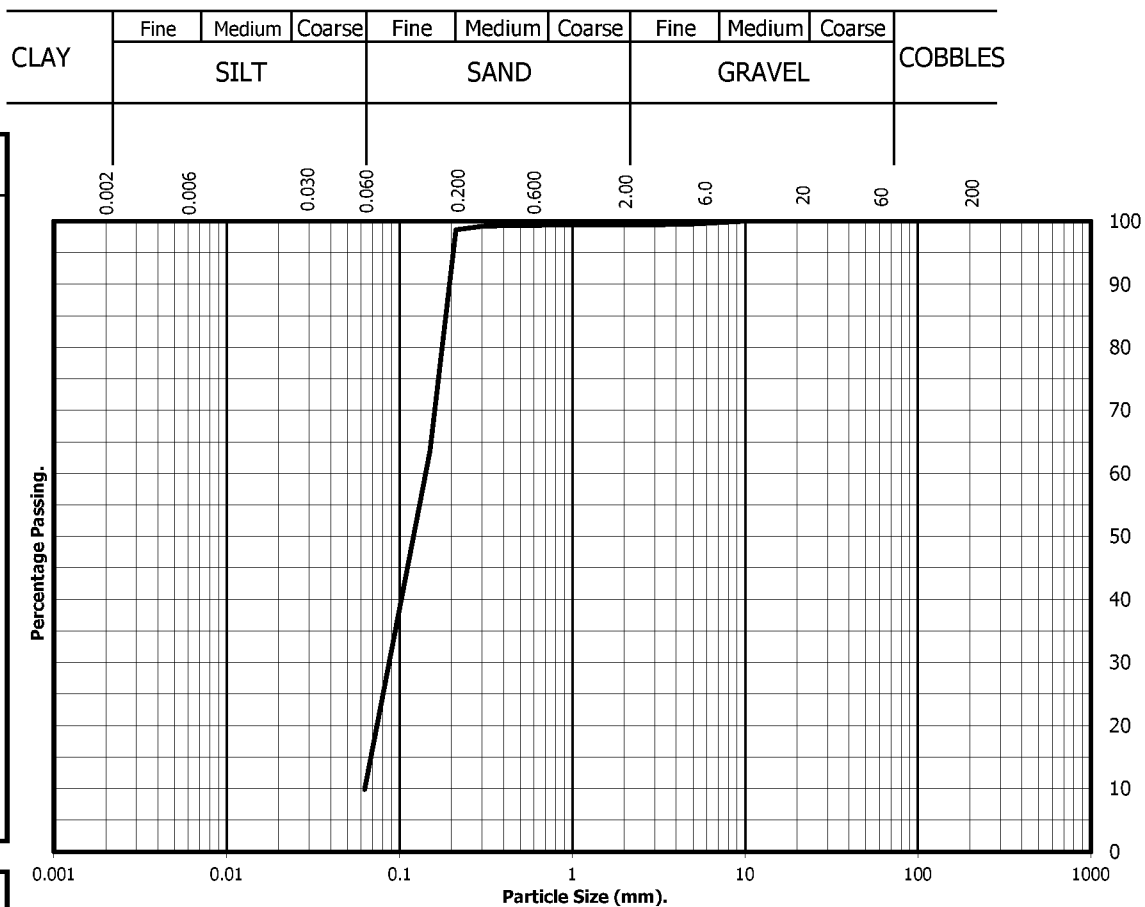
Sample Type: S/B

Location: Westergate

Description: Brown silty SAND

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	99
2.00	99
1.18	99
0.60	99
0.425	99
0.300	99
0.212	99
0.150	64
0.063	10

Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#



	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	10	89	1	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

 Authorised By:
 Ben Sharp (Contracts Manager)

Date: 17.10.16



Test Report:

Particle Size Distribution Test **BS 1377 Part 2:1990.**

Wet Sieve, Clause 9.2

 Client ref: **15808**

 Contract Number: **23654**

 Hole Number: **TP12**

Sample Number:

 Depth from (m): **1.50**

 Depth to (m): **0.00**

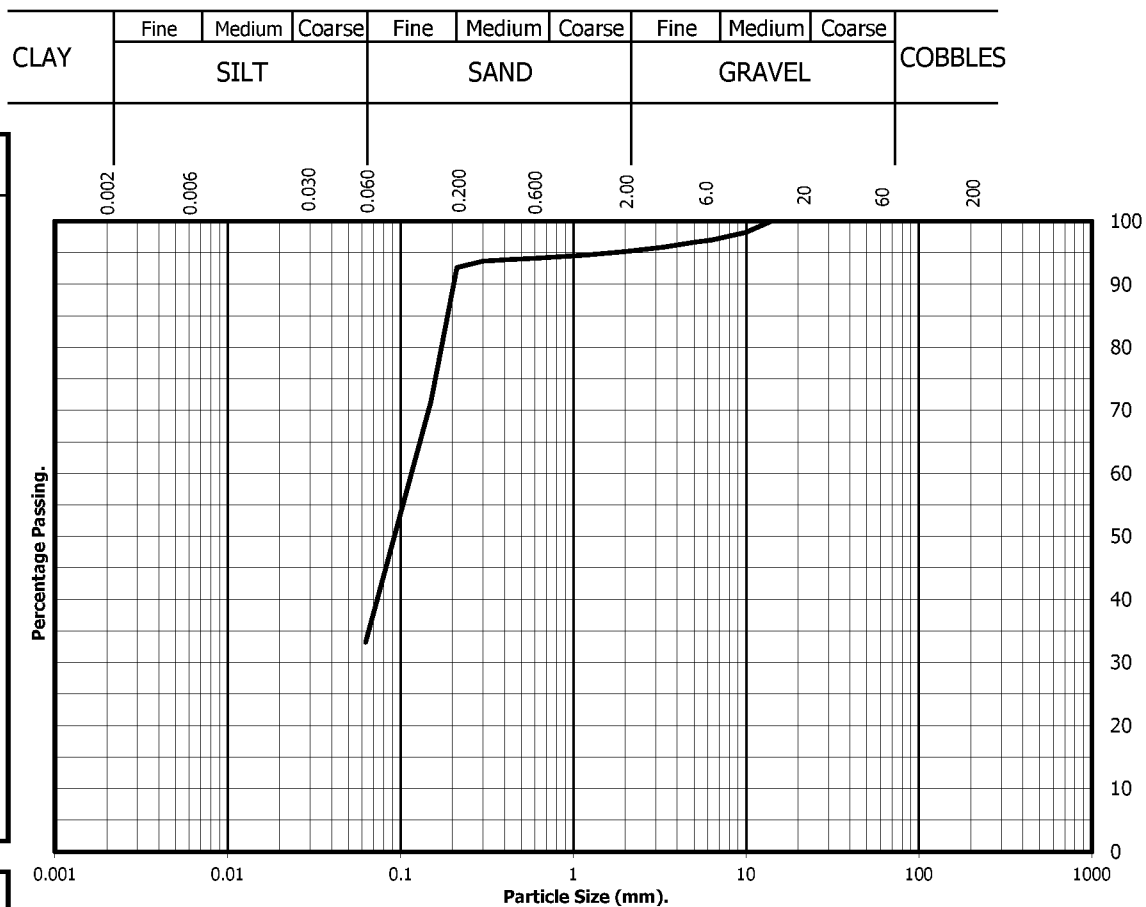
 Sample Type: **S/B**

 Location: **Westergate**

 Description: **Brown slightly gravelly silty SAND**

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	98
6.3	97
5.0	97
3.35	96
2.00	95
1.18	95
0.60	94
0.425	94
0.300	94
0.212	93
0.150	71
0.063	33

Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#



	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	33	62	5	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

 Authorised By:
 Ben Sharp (Contracts Manager)

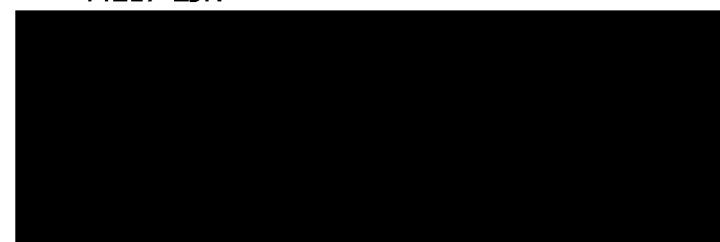
 Date: **17.10.16**




Luke Wilkinson
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR



QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN



QTS Environmental Report No: 16-49918

Site Reference: Westergate

Project / Job Ref: 15808

Order No: None Supplied

Sample Receipt Date: 04/10/2016

Sample Scheduled Date: 04/10/2016

Report Issue Number: 1

Reporting Date: 10/10/2016

Authorised by:



Kevin Old
Associate Director of Laboratory

Authorised by:

Russell Jarvis
Associate Director of Client Services



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate						
QTS Environmental Report No: 16-49918	Date Sampled	27/09/16	27/09/16	27/09/16	27/09/16	
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Westergate	TP / BH No	TP1	TP4	TP7	TP12	
Project / Job Ref: 15808	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.50	1.10	2.50	2.00	
Reporting Date: 10/10/2016	QTSE Sample No	230573	230574	230575	230576	

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.3	7.9	7.6	7.4	
Total Sulphate as SO ₄	mg/kg	< 200	NONE	331	< 200	< 200	< 200	
Total Sulphate as SO ₄	%	< 0.02	NONE	0.03	< 0.02	< 0.02	< 0.02	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	26	< 10	16	< 10	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.03	< 0.01	0.02	< 0.01	
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	
Ammonium as NH ₄	mg/kg	< 0.5	NONE	5.6	7	8.8	6.3	
Ammonium as NH ₄	mg/l	< 0.05	NONE	0.56	0.70	0.88	0.63	
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	46	12	29	7	
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	22.9	5.9	14.7	3.7	
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	< 3	5	5	8	
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	< 1.5	2.4	2.6	4.1	
W/S Magnesium	mg/l	< 0.1	NONE	1.2	0.2	2.1	0.2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis ^(S)



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 16-49918	
Soils Ltd	
Site Reference: Westergate	
Project / Job Ref: 15808	
Order No: None Supplied	
Reporting Date: 10/10/2016	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
230573	TP1	None Supplied	1.50	14.1	Light brown clay with stones
230574	TP4	None Supplied	1.10	17.9	Brown clay
230575	TP7	None Supplied	2.50	19.7	Brown clay
230576	TP12	None Supplied	2.00	19.3	Brown clay

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

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}



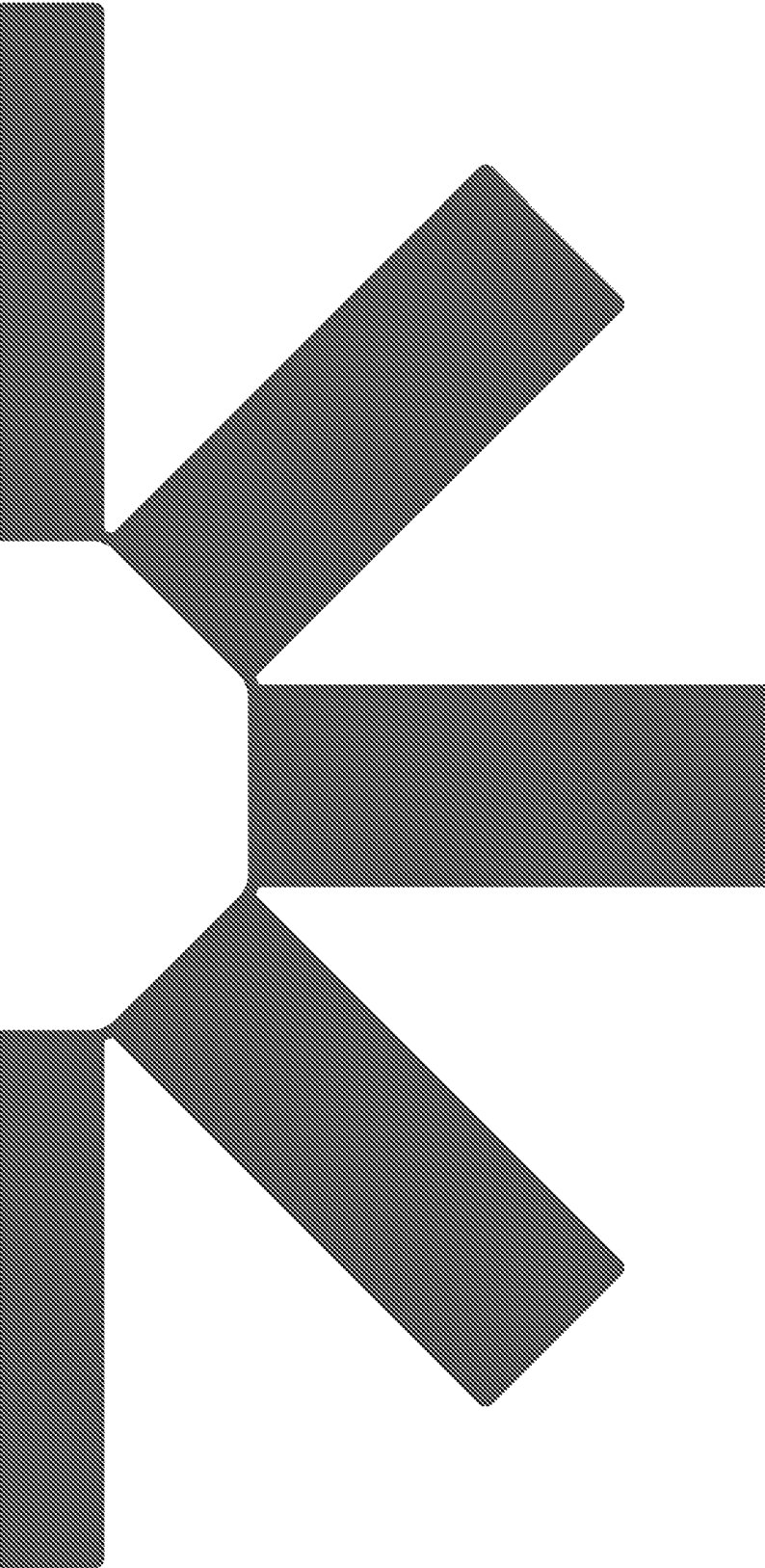
QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Methodology & Miscellaneous	
QTS Environmental Report No: 16-49918	
Soils Ltd	
Site Reference: Westergate	
Project / Job Ref: 15808	
Order No: None Supplied	
Reporting Date: 10/10/2016	

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	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

D Dried
AR As Received



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