soiltechnics

environmental and geotechnical consultants

Proposed residential redevelopment
106 King Henry's Road
Camden

Ground Investigation Report

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London
NW3 3SL

GROUND INVESTIGATION REPORT

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Aerial photograph of site

Report status and format

Report section	Principal coverage	Report status	
		Revision	Comments
1	Executive summary		
2	Introduction		
3	Desk study information and site observations		
4	Fieldwork		
5	Laboratory testing		
6	Ground conditions encountered		
7	Engineering assessment	01	Revised following engineer comment
8	Chemical contamination		
9	Gaseous contamination		
10	Effects of ground conditions on building materials		
11	Classification of waste soils under the Waste Acceptance Criteria		
12	Further investigations		

List of drawings

Drawing	Principal coverage	Status	
		Revision	Comments
01	Site location plan		
02	Plan showing existing site features, development proposals and location of exploratory points		
02A	Plan showing surface settlement contours as a results of basement excavations		
03	Plot summarising in situ SPT testing		
04	Plot summarising shear strength based on pocket penetrometer test results		
05	Section showing construction of standpipe installed in borehole DTS02		

List of appendices

Appendix	Content
A	Definitions of geotechnical terms used in this report
B	Definitions of geo-environmental terms used in this report
C	Investigation data sheets
D	Trial pit records
E	Borehole records (driven tube sampling techniques)
F	Copies of laboratory test result certificates – classification testing
G	Copies of laboratory test result certificates – concentrations of chemical contaminants
H	Conceptual model for chemical contamination
I	Landfill waste acceptance criteria – primary classification
J	Landfill waste acceptance criteria – secondary classification
K	Landfill waste acceptance criteria – basic categorisation schedules
L	Copies of statutory undertakers' replies
M	Copy of correspondence received from the Local Authority Building Control
N	Copy of desk study information produced by Envirocheck
O	Tensile strain calculation sheets

1 Executive summary

1.1 General

1.1.1 We recommend the following executive summary is not read in isolation to the main report which follows.

1.2 Site description, history and development proposals

1.2.1 The property is located in the London Borough of Camden within a predominantly residential area. The property comprises a two-storey terraced dwelling of traditional masonry construction with a flat roof. Small rear and front gardens are present, both area comprise of paving. Ground levels across the site and the local area are reasonably uniform.

1.2.2 Inspection of historical maps indicate the site comprised residential gardens until redevelopment of the surrounding area and construction of a suspected residential property circa 1896, the site and surrounding properties were subsequently redeveloped in the early 1970s concurrent to the present-day layout.

1.2.3 We understand the scheme will comprise the construction of a single storey basement beneath the existing footprint of the dwelling extending north to include the rear garden area. The scheme includes a redevelopment of the existing dwelling including the construction of a single-storey deep basement across the existing building footprint and rear paved courtyard area, the proposed scheme will adopt an open courtyard area to the rear in lieu of lightwells.

1.3 Ground conditions encountered

1.3.1 Exploratory excavations encountered Made Ground overlying the London Clay Formation.

1.3.2 No significant groundwater inflows were encountered.

1.4 Basement construction

1.4.1 In our opinion, it will be feasible to construct the basement using underpinning and cast in place bays. We estimate that long-term heave in the order to 20mm can be expected.

1.5 Chemical and gaseous contamination

1.5.1 Based on inspection of historical maps, desk study information and site reconnaissance, no likely sources of chemical or gaseous contamination have been identified on site or from adjacent sites and thus the risk to identified human and environmental receptors is considered to be low.

2 Introduction

2.1 Objectives

2.1.1 This report describes a ground investigation carried out for a proposed basement development at 106 King Henry's Road, Camden, London NW3 3SL.

2.1.2 The objective of the ground investigation was to establish ground conditions at the site, sufficient to identify possible foundation solutions for the development and provide parameters necessary for the design and construction of foundations.

2.1.3 The investigation included an evaluation of potential chemical and gaseous contamination of the site leading to the production of a risk assessment in relation to contamination.

2.1.4 The investigation included the establishment of ground conditions at the site, sufficient to establish the risks associated with basement construction and produce a basement settlement perimeter profile. A basement impact assessment has been prepared in a separate report (ref: STP4034B-BIA01).

2.1.5 The investigation has also been produced to support a planning application for the site by satisfying National Planning Policies Framework sections 120 and 121.

2.1.5 Our brief also included investigations and testing to allow classification of soils at the site to be disposed of to landfill.

2.2 Client instructions and confidentiality

2.2.1 The investigation was carried out in June 2017 and reported in August 2017 acting on instructions received from Solid Geometry on behalf of our client, Mr Gidon Katz.

2.2.2 This report has been prepared for the sole benefit of our above-named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.

2.2.3 Our original investigation proposals were outlined in our email to Solid Geometry on 24th April 2017. The investigation generally followed our original investigation proposals. The investigation process was also determined to maintain as far as possible the original investigation budget costs.

2.3 Site location and scheme proposals

2.3.1 The National Grid reference for the site is 527230, 184180. A plan showing the location of the site is presented on Drawing 01.

2.3.2 We understand the scheme will comprise the redevelopment of the existing dwelling including the construction of a single-storey deep basement across the existing building footprint and rear paved courtyard area, the proposed scheme will adopt an open courtyard area to the rear in lieu of lightwells.

2.3.3 We have received layout drawings of the proposed scheme with the layout presented on Drawing 02.

2.4 Report format and investigation standards

2.4.1 Sections 2 to 6 of this report describe the factual aspects of the investigation with Section 7 presenting an engineering assessment of the investigatory data. Section 8 provides a risk assessment of chemical contamination based on readily available historic records, inspection of the soils and laboratory testing. Section 9 provides a similar risk assessment in relation to gaseous contamination with Section 10, a risk assessment relating to construction materials likely to be in contact with the ground. Section 11 provides a classification of waste soils for off-site disposal under the waste acceptance criteria.

2.4.2 This investigation integrates both contamination and geotechnical aspects. The investigation was carried out generally, and where practical following the recommendations of BS EN 1997:2 2007 '*Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and Testing'*. Sections 2 to 6 form a Ground Investigation Report as set out in BS EN 1997:2 2007 '*Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and Testing'*

2.4.3 The investigation process also followed the principles of BS10175: 2011 *'Investigation of potentially Contaminated Sites – Code of Practice'*. In view of the client's requirement for rapid implementation of the investigation, the following elements, defined in BS10175, have been completed and incorporated in this report.

a) Phase I — Preliminary investigation (desk study and site reconnaissance)
b) Phase II — Exploratory and main (intrusive) investigations

2.4.4 The extent and result of the preliminary investigation (desk study) is reported in Section 3. Fieldwork combined the exploratory investigation and main investigation stages into one phase with the extent of these works described in Sections 4 and 6 of this report. Any supplementary investigations deemed necessary are identified in Section 12.

2.5 Status of this report

2.5.1 This report is final based on our current instructions.

2.5.2 This investigation has been carried out and reported based on our understanding of best practice. Improved practices, technology, new information and changes in legislation may necessitate an alteration to the report in whole or part after publication. Hence, should the development commence after expiry of one year from the publication date of this report then we would recommend the report be referred back to Soiltechnics for reassessment. Equally, if the nature of the development changes, Soiltechnics should be advised and a reassessment carried out if considered appropriate.

2.6 Report distribution

2.6.1 This report has been prepared to assist in the design and planning process of the development and normally will require distribution to the following parties, although this list may not be exhaustive:

Table summarising parties likely to require information contained in this report

Party	Reason
Client	For information / reference and cost planning
Developer / Contractor / project manager	To ensure procedures are implemented, programmed and costed
Planning department	Potentially to discharge planning conditions
Environment Agency	If ground controlled waters are affected and obtain approvals to any remediation strategies
Independent inspectors such as NHBC / Building Control	To ensure procedures are implemented and compliance with building regulations
Project design team	To progress the design
Principal Designer (PD)	To advise in construction risk identification and management under the Construction (design and management) regulations
Waste recycling operators (if appropriate)	For recycling or reducing hazardous properties (if and where appropriate)

Table 2.6

3 Desk study information and site observations

3.1 General

3.1.1 We have carried out a desk study which was limited to a review of readily available information including:

a) Review of published Ordnance Survey maps dating back to 1871 at various published scales

b) Inspection of geological maps produced by the British Geological Survey together with relevant geological memoirs

c) Consultation with Statutory Undertakers

d) Site reconnaissance

e) Other relevant published documents

3.1.2 We have obtained old Ordnance Survey maps using the Envirocheck database system. In addition to retrieval of historical and current Ordnance Survey data, Envirocheck provide information compiled from outside agencies including: -

- Ordnance Survey
- Environment Agency
- Scottish Environment Protection Agency
- The Coal Authority
- British Geological Survey
- Centre for Ecology and Hydrology
- Countryside Council for Wales
- Scottish Natural Heritage
- Natural England
- Health Protection Agency

3.1.3 The study did not extend to research of meteorological information or consultation with other interested parties such as English Heritage (ancient monuments), Ordnance Survey (survey control points), Planning Authorities or Archaeological Units.

3.1.4 A copy of records produced by Envirocheck is presented in Appendix N. Envirocheck produce a wealth of factual database information. Although we can provide a discussion on each of the database topics, this would produce a very lengthy document, but some of these discussions would not be relevant to the aims of this report. As a consequence, we have extracted some of the relevant topics and discussed them in this section of the report.

3.1.5 The data presented in the following report sections has primarily been extracted from the Envirocheck report.

3.2 Description of the site

3.2.1 The property is located in the London Borough of Camden within a predominantly residential area. Local topography falls in a southerly direction. The nearest watercourse is the Regents Canal, located some 830m to the south of the property. Neighbouring dwellings adjoin the site to the east and west and King Henrys Road borders the site to the south. A communal garden area to the surrounding properties lies to the north.

3.2.2 The property comprises a two-storey terraced dwelling, of apparent masonry construction with timber cladding and a flat roof. A small rear paved garden area is present to the north. Ground levels across the site and the local area are reasonably uniform. Drawing 02 records our site observations. The following photographs illustrate site conditions at the time of our investigation.

Photograph 1

View of the property looking north east.

Photograph 2

View across the rear patio area looking south-west

3.3 Injurious and invasive weeds and asbestos

3.3.1 Injurious and invasive weeds

3.3.1.1 The following weeds are controlled under the Weeds Act 1959:

- Common Ragwort
- Spear Thistle
- Creeping or Field Thistle
- Broad leaved Dock
- Curled Dock

3.3.1.2 Whilst it is not an offence to have the above weeds growing on your land, you must:

- Stop them spreading to agricultural land, particularly grazing areas or land used for forage, like silage and hay
- Choose the most appropriate control method for your site
- Not plant them in the wild

Should you allow the spread of these weeds to another parties land, Natural England could serve you with an Enforcement Notice. You can also be prosecuted if you allow animals to suffer by eating these weeds.

3.3.1.3 In addition to the above, you must not plant in the wild or cause certain invasive and non-native plants to grow in the wild as outlined in the Wildlife and Countryside act 1981. It is an offence under section 14(2) of the act to *'plant or otherwise cause to grow in the wild'* any plants listed in schedule 9, part II. This can include moving contaminated soil or plant cuttings. The offence carries a fine or custodial sentence of up to 2 years. The most commonly found invasive, non-native plants include:

- Japanese knotweed
- Giant hogweed
- Himalayan balsam
- Rhododendron ponticum
- New Zealand pigmyweed

You are not legally obliged to remove these plants or to control them. However, if you allow Japanese knotweed to spread to another parties land, you could be prosecuted for causing a private nuisance.

3.3.1.4 The presence of such weeds on site may have considerable effects on the cost / timescale in developing the site. Japanese knotweed can cause significant damage to buildings, roads and pavements following development, if untreated prior to development.

3.3.1.5 Our investigations exclude surveys to identify the presence of injurious and invasive weeds. We did not observe any obvious evidence the above species, however, we recommend specialists in the identification and procedures to deal with injurious and invasive weeds are appointed prior to commencement of any works on site.

3.3.2 Asbestos

3.3.2.1 Our investigations exclude surveys to identify the presence or indeed absence of asbestos on site. It should be noted however, that where intrusive investigations were undertaken we did not observe any obvious evidence of potential asbestos containing materials. This information does not constitute a site-specific risk assessment and we recommend specialists in the identification and control / disposal of asbestos are appointed prior to commencement of any works on site or, if appropriate, purchase of the site.

3.3.2.2 The presence of asbestos on site may have considerable effects on the cost / timescale in developing the site. There is good guidance in relation to Asbestos available on the Health and Safety Executive (HSE) web site.

3.4 History of the site

3.4.1 An attempt to trace the history of the site has been carried out by obtaining copies of old Ordnance Survey maps provided by Envirocheck. The recent history of the site based on published Ordnance Survey maps is summarised in the following table:

Summary description of site history from Ordnance Survey maps		
Date	**Onsite**	**Offsite**
1871-1874	Site is recorded as open land.	The site lies in a mixed residential and rural area. King Henry's Road borders the site in the south. Merton Road is recorded 20m to the east.
1896	Building recorded on site.	Significant residential encroachment to the east and west. Railway tracks recorded some 350m to the east, extend underground beneath Adelaide Road 100m to the north of the site. Air shaft is recorded 250m to the south-west of the site. Saw Mill recorded some 330m to the north of the site. Reservoir recorded some 500 to the south-east.
1915	No significant change	Residential encroachment to the east and west
1920-1951	No significant change	Saw Mill no longer recorded
1953	No significant change	Primrose Hill Tunnels are recorded 40m to the north running in an east-west direction. A Builders Yard is recorded 90m northeast.
1954-1968	No significant change	No significant change
1972 -1973	The site has undergone redevelopment with the current arrangement now recorded.	Builders Yard no longer recorded. Electricity substations present 50m north, 75m southeast and 115m northwest. Builders yard no longer present.
1973-2017	No significant change	No significant change
Table 3.4.1		

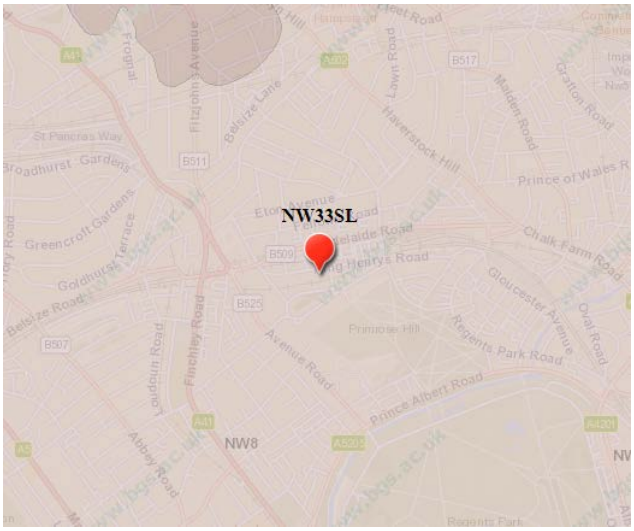
3.5 Geology and geohydrology of the area

3.5.1 Geology of the area

3.5.1.1 Envirocheck reproduce geological map extracts taken from the British Geological Survey (BGS) digital geological map of Great Britain at 1: 50,000 scale (ref Appendix N). A summary of the recorded geological information for the site is presented in the following table:

Summary of Geology and likely aquifer containing strata					
Strata	**Bedrock or drift**	**Approximate thickness**	**Typical soil type**	**Likely permeability**	**Likely aquifer designation**
London Clay Formation	Bedrock	85m	Clays	Low	Unproductive strata
Lambeth Group	Bedrock	15	Clays, occasionally sands	Low	Unproductive strata
Thanet Sands	Bedrock	10	Fine sands	Low/moderate	Secondary Aquifer
Chalk	Bedrock	200	Chalk	High	Principal Aquifer
Table 3.5.1.1					

3.5.1.2 An extract copy of the geological map is presented below, with brown shading representing the outcrop of the London Clay Formation. The shaded dark brown represents the Claygate beds (on higher ground to the north) with the property located on London Clays (light brown shading). The property position is shown by the red marker.



3.5.2 Geohydrology

3.5.2.1 Envirocheck report the London Clay Formation deposits (bedrock) at the site are designated Unproductive strata.

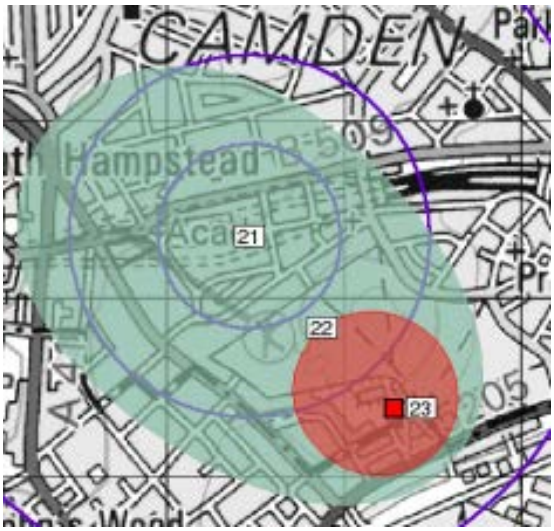
3.5.2.2 Unproductive strata are defined as deposits exhibiting low permeability with negligible significance for water supply or river base flow. Unproductive Strata are generally regarded as not containing groundwater in exploitable quantities.

3.5.3 Water abstractions

3.5.3.1 Seven active ground water and five active surface water abstraction points are located within 2000m of the site. The closest groundwater abstraction point lies 437m to the west of the site with water abstracted for spray irrigation. The closest surface water abstraction point lies 1260m to the east of the site with water abstracted for non - evaporative cooling. It should be noted that a public water supply borehole is located 618m to the southeast of the site.

3.5.4 Source protection zone

3.5.4.1 The site lies within a Source Protection Zone II. The zone is associated with a drinking water abstraction point located 618m to the southeast of the site. The edge of the inner protection zone lies 323m to the southeast. An SPZ II is defined by a 400-day travel time from a point below the water table. The zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction. An extract of the plan recording source protection zones is presented below, with green shading representing outer protection zones and red inner protection zones.



3.5.5 Coal mining and brine extraction

3.5.5.1 The site is not recorded to be within an area affected by past or present coal mining, or minerals worked in association with coal or brine extraction (within the Cheshire Brine Compensation District).

3.5.6 Shallow mining and natural subsidence hazards

3.5.6.1 The British Geological Survey present hazard ratings for shallow mining and natural subsidence hazards. The site has the following ratings:

Table summarising mining and subsidence hazards

Hazard	Rating
Mining hazard in non-coal mining areas	No hazard
Potential for collapsible ground stability hazard	Very low
Potential for compressible ground stability hazard	No hazard
Potential for ground dissolution stability hazard	No hazard
Potential for landslide ground stability hazard	Very low
Potential for running sand ground stability hazard	No hazard
Potential for shrinking or swelling clay ground stability hazard	Moderate

Table 3.5.6

3.5.6.2 The potential risk from shrinking or swelling clay is defined as moderate, which is likely associated with the London Clay Formation deposits recorded on site. The consequences for the proposed development are discussed in Section 7 of this report.

3.5.6.3 In addition to the above hazard ratings, a report completed by Ove Arup and Partners in December 1991, commissioned by the Department of the Environment (DoE) indicates where mining should be borne in mind when considered planning and development of land. The site is **not** recorded as lying in an area of conclusive rock mining as indicated by the report.

3.5.7 Borehole records

3.5.7.1 The British Geological Survey (BGS) retain records of boreholes formed from ground investigations carried out on a nationwide basis. The location of boreholes with records held by the BGS is recorded on the borehole map contained in Appendix N. We do not normally obtain copies of these records but can do on further instructions. There is normally a charge made by the BGS for retrieving and copying these records.

3.6 Landfill and infilled ground

3.6.1 There are no recorded or historical landfill sites within 1000m of the subject site.

3.6.2 There are no artificial deposits or areas of infilled ground recorded within 900m of the subject site.

3.7 Radon

3.7.1 With reference to the Building Research Establishment (BRE) publication "*Radon: guidance on protective measures for new buildings"* (2007), the site is located where **no protection** is considered necessary.

3.7.2 Envirocheck use the British Geological Survey database to review reported radon levels in the area in which the site is located to establish recommended radon protection levels for new dwellings. The database records the site as being located where no protection is recommended.

3.7.2 The Building Research Establishment publication applies to all new buildings, conversions and refurbishments whether they are for domestic or non-domestic use.

3.7.3 It is noteworthy that the BRE and BGS / HPA information is based on statistical analysis of measurements made in dwellings in combination with geological units, which are known to emit radon. Consequently, there is a risk for actual radon levels at the site to exceed the levels assessed by the BGS / HPA / BRE. Currently, the only true method of checking actual radon levels is by measurement within a building on the site over a period of several months. It should be noted that it is not currently a requirement of the Building Regulations to test new buildings for radon, however the BRE recommends testing on completion or occupation of all new buildings (domestic and non-domestic), extensions and conversions. Should you wish to undertake radon monitoring following completion of the development, we can provide proposals.

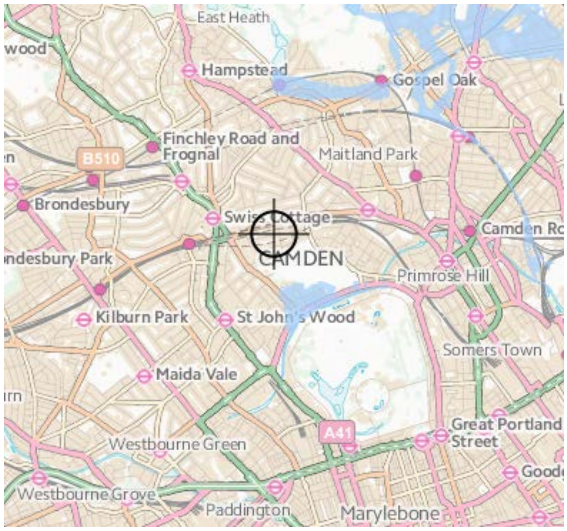
3.8 Flood risk

3.8.1 Fluvial/tidal flooding

3.8.1.1 The site is not located within a fluvial or tidal flood plain. An extract copy of the Envirocheck flood risk map is presented below which shows no blue shading representative of flooding.

3.8.2 Flooding from Reservoirs, Canals and other Artificial Sources

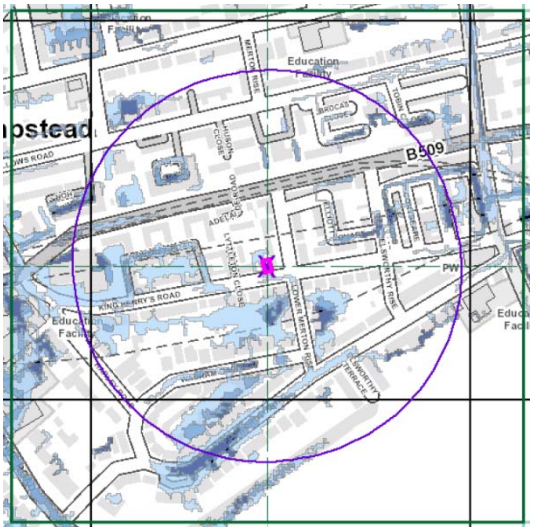
3.8.2.2 The Environment Agency website indicates the site is not located within an area considered at risk of flooding from breach of reservoir containment systems. An extract copy of the flood risk map is presented below which shows no blue shading representative of flooding as a result of failure of containment systems close to the site. The property is located within the crosshair.



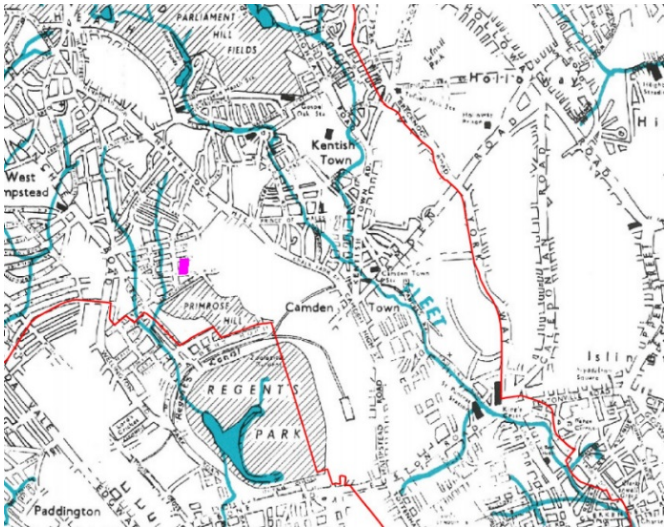
3.8.3 Flooding from Groundwater and surface waters

3.8.3.1 The site is underlain with a substantial thickness (85m) of relatively impermeable London Clay Formation. The site is not recorded as being within an area with the potential for groundwater flooding to occur.

3.8.3.2 The site is located within an area at low risk of surface water flooding. An extract of the Envirocheck surface water flooding map is presented below. The property is located within the red square and blue shading represents areas at risk of surface water flooding. The property is located in a low risk area, shown by the light blue shaded areas.

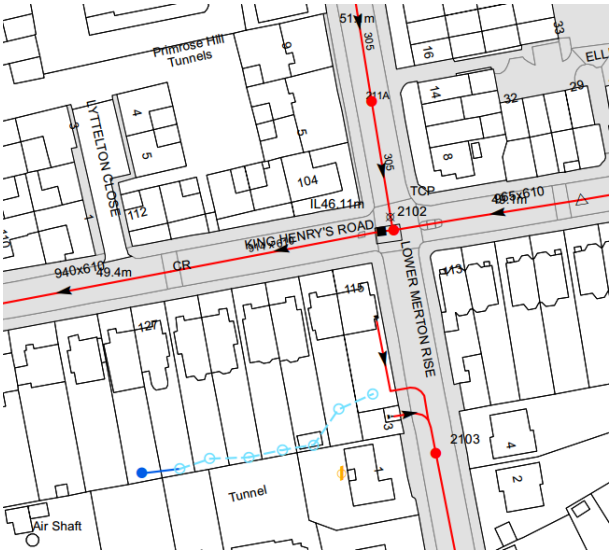


3.8.3.3 An extract of figure 11 from the Camden Geological, Hydrogeological and Hydrological Study (referenced in Section 1.4) is presented below. The blue lines show the locations of branches of formers in the area. The property is located within the red box and seems to be within close proximity to an upper branch of the River Tyburn.

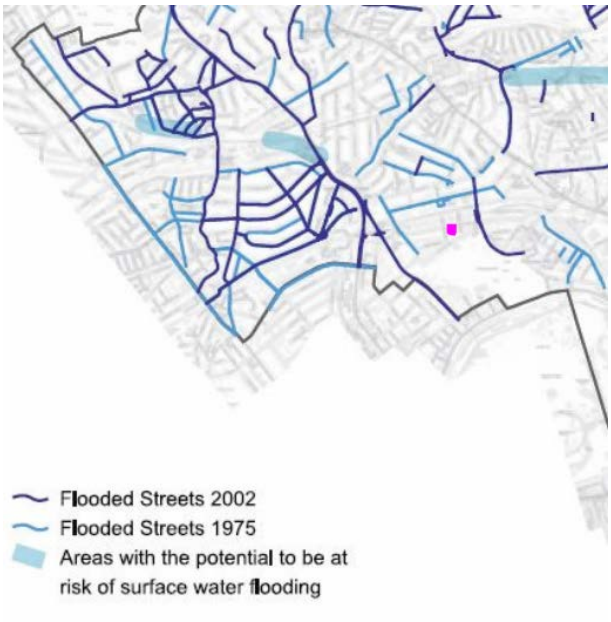


3.8.3.4 With reference to old mapping of the area described in section 3.1 above, the 1874 map (predevelopment) does not record any watercourses close to or within the immediate area of the property. Development of London has resulted in original watercourses being culverted, with culverts following, in the majority of cases, road infrastructure routes.

3.8.3.5 There is a 914 x 610 culvert in King Henry's Road recorded on Thames Water Asset register, an extract copy of which is presented below. The culvert follows a westerly route from the property.



3.8.3.6 An extract of figure 15 from the Camden Geological, Hydrogeological and Hydrological Study (referenced in Section 1.4) is presented below (property marked in a red box). The map records King Henry's Road has not historically been subject to flooding or is within an area with the potential to be at risk from surface water flooding.



3.8.3.7 There is a 4" below ground water supply pipe operated by Thames Water in King Henry's Road to the south of the property and to the east parallel to Lower Merton Rise.

3.9 Enquiries with statutory undertakers

3.9.1 We have contacted the following Statutory Undertakers (SUs) to obtain copies of their records in order to avoid damaging their apparatus during our fieldwork activities: -

a) BT Openreach Ltd
b) National Grid Gas plc
c) Anglian Water
d) Zayo Ground
e) UK Power Networks

Copies of responses received prior to publication of this report are presented in Appendix M. These records have been obtained solely for the purposes described above. Some of these records have been obtained from the Internet and from our database without contacting the statutory undertaker direct. Occasionally, SU information is recorded on drawings larger than A3, and thus cannot be easily presented in this report. In such cases we will copy the correspondence but not incorporate the drawing in this report, and maintain the records on our office file.

3.9.2 In addition, we have visited the Linesearch web site (www.linesearch.org) which provides a report on national grid networks (National Gas and Electricity Transmission Networks). Again a copy of their report is presented in Appendix M.

3.9.3 Normally Statutory Undertakers drawings record the approximate location of their services. We recommend further on site investigations be undertaken to confirm the position of the apparatus and thus establish the effect on the proposed development and the necessity or otherwise for the permanent or temporary diversion of the service to allow the construction of the development to safely and successfully proceed.

3.9.4 It should be noted that BT Power lines enter the property in the north. We are not aware that the supply to such services was capped offsite and as such they should be treated as live until further information indicates otherwise.

3.9.4/5 It should be noted that statutory undertakers' records normally exclude private services.

3.10 Enquiries with local authority building control and environmental health officers

3.10.1 We have contacted Local Authority Building Control and understand that they do not maintain comprehensive records of ground conditions in the Borough. A copy of the correspondence is presented in Appendix M.

3.10.2 We have also contacted the Environmental Health Officer but at the time of issue had not received a response. Should any relevant information be received following issue of this report, we will update this section accordingly.

3.11 Unexploded Ordnance (UXO) Risk

3.11.1 Prior to our fieldwork activities we obtained a desk study risk review report from MACC International. The risk review concluded that there was not a credible risk of encountering UXO during the ground investigation. **It should be noted that this preliminary risk review does not constitute a detailed risk assessment for the purposes of the construction phase.**

4 Fieldwork

4.1 General

4.1.1 Fieldwork comprised the excavation of two trial pits using hand tools and two boreholes using driven tube sampling techniques. Fieldwork was carried out on 28th June 2017.

4.1.2 A plan of the site showing observed/existing site features and position of exploratory points and development proposals is presented on Drawing 02. The position of exploratory points shown on these plans is approximate only and confirmation of these positions is subject to dimensional surveys, which is considered outside our brief.

4.1.3 The extent of fieldwork activities and position of exploratory points were determined by Soiltechnics.

4.1.4 Exploratory points were positioned to avoid known locations of underground services, to avoid possible location of proposed foundations but were also positioned to provide a reasonable coverage of the site. Prior to commencement of exploratory excavations an electronic cable locating tool was used to scan the area of the excavation. If we received a response to this equipment then the excavation would be relocated.

4.1.5 All soils exposed in excavations were described in accordance with BS EN ISO 14688 *'Identification and Classification of soil'* and BS EN ISO 14689 *'Identification and classification of rock'.*

4.2 Site restrictions

4.2.1 The rear garden area was surfaced with paving slabs that would have required breaking out prior to drilling, it is understood that a portion of the rear communal garden area falls under the land parcel of the property. Given the proximity of the rear communal area to the rear garden area our driven tube investigation was completed in the soft landscaped area to the rear of the property.

4.3 Exploratory trial pits

4.3.1 Trial pits TP01 and TP02 were excavated using hand tools to a maximum depth of 1.15m. An electrically powered breaker was used to loosen surface paving slabs prior to excavation.

4.3.2 Trial pits exposed foundation arrangements to existing buildings within the site. The trial pit excavations were backfilled with excavated material, which was compacted using hand held ramming tools. A Geotechnical Engineer supervised the excavations and carried out sampling and logging as trial pit excavations proceeded.

4.3.3 Trial pit records are presented in Appendix D.

4.4 Driven tube sampling

4.4.1 Boreholes DTS01 and DTS02 were formed using driven tube sampling equipment. Driven tube sampling comprises driving 1m long steel sample tubes which are screw coupled together or coupled to extension rods and fitted with a screw on cutting edge. The sample tubes are of various diameters, generally commencing with 100mm and reducing, with depth, to 50mm and include a disposable plastic liner which is changed between sampling locations in order to limit the risk of cross contamination. On completion of excavation the liner containing the sample is cut open and the soil sample logged by a geo-environmental engineer.

4.4.2 Samples for determination concentration of chemical contaminants are taken from samples obtained in the disposable tubes as sub-samples using stainless steel sampling equipment, which is cleaned with de-ionised water.

4.4.3 The driven tube sampler obtains samples under category A allowing laboratory test quality classes 3 to 5 as described in BS EN ISO 22475-1:2006.

4.4.4 Locally in DTS02, paving slabs were broken prior to excavation of the borehole. The surface was reinstated with concrete on completion.

4.4.5 A pocket penetrometer was used in the cohesive soils retrieved from the borehole. This tool is deemed to measure the apparent ultimate bearing capacity of the soil under test. The pocket penetrometer is calibrated in kg/cm^2. The reading can be approximately converted to an equivalent undrained shear strength by multiplying the results by a factor of 50. The results are reported on borehole records. The pocket penetrometer is not covered by British Standards.

4.4.6 A summary of pocket penetrometer results obtained from the cohesive soils retrieved from the boreholes are presented in graphical format on Drawing 03.

4.4.7 A groundwater monitoring standpipe was installed in borehole DTS02. The standpipe was installed following the recommendations of BS EN ISO 22475-1:2006 *'Geotechnical Investigation and Testing – Sampling methods and groundwater measurements – Part 1: Technical Principles for execution'.* Details of the standpipe installation are recorded on Drawing 05.

4.4.8 Records of boreholes formed using driven tube sampling techniques are presented in Appendix E.

4.5 Sampling strategies

4.5.1 Geotechnical

4.5.1.1 In general we adopted a judgemental sampling strategy in relation to geotechnical aspects of the investigation. The location and frequency of sampling was carried out in consideration of the following:

i) Topography
ii) Geology (including Made Ground)
iii) Nature of development proposals

4.5.2 Environmental

4.5.2.1 Details of sampling with respect to contamination issues are described in Section 8.

4.5.3 Sample retention

4.5.3.1 Samples are stored for a period of one month following issue of this report, unless otherwise requested.

5 Laboratory testing

5.1 Classification testing

5.1.1 Laboratory testing was carried out on samples retrieved from site. The method of testing is recorded on the laboratory test certificate. The following table summarises the classification testing scheduled:

Table summarising classification testing

Exploratory point	Depth (m)	Soil type	Testing scheduled
DTS01	0.9	London Clay	Liquid limit/plasticity limit and plasticity index/ moisture content
DTS01	1.5	London Clay	Liquid limit/plasticity limit and plasticity index/ moisture content
DTS01	3.7	London Clay	Liquid limit/plasticity limit and plasticity index/ moisture content

Table 5.1.1

5.1.2 Laboratory test certificates are presented in Appendix F.

5.2 Chemical testing

5.2.1 Chemical testing was carried out based on ground conditions and with reference to the contamination Initial Conceptual Model as presented in Section 8. The test methods are recorded on the chemical test certificates. The following table summarises the chemical testing scheduled:

Table summarising chemical testing

Exploratory point	Depth (m)	Medium/soil type	Testing scheduled (Refer to Appendix A for details).
DTS01	2.5	London Clay	Suite 8
TP01	0.2 – 0.7	Made Ground	Suite 1, Suite 8
TP02	0.4	Made Ground	Asbestos Screening + Free Fibres
WAC	0.0	Made Ground	Full 2 Stage (WAC)

Table 5.2.1

5.2.2 Laboratory testing was carried out by an independent specialist testing house which operates a quality assurance scheme. Copies of laboratory test result certificates are presented in Appendix G.

6 Ground conditions encountered

6.1 Soils

6.1.1 The exploratory excavations encountered a profile of soils considered to be Made Ground overlying the London Clay Formation.

6.1.2 Made Ground was encountered in all exploratory locations to depths in the range of 0.6 to 1.1m. Made Ground comprised of firm to stiff brown slightly sandy slightly gravelly to gravelly clay and slightly clayey to sandy gravel. Gravels consisted of brick, concrete, flint and localised bituminous bound material.

6.1.3 The London Clay Formation was encountered in all locations to depths in excess of 5m and generally comprised of firm to very stiff brown to orange brown slightly silty to silty slightly sandy clay.

Table summarising soil types

Strata	Depth to top (m)	Depth to bottom (m)	Thickness (m)	Summary description
Made Ground	0.0	0.6 - 1.1	-	Firm to stiff brown sandy gravelly clay with gravels of brick, concrete, flint and bituminous bound material
London Clay	0.6 - 1.1	5.0+	>5	Firm to very stiff brown to orange brown silty slightly sandy clay

Table 6.1.3

6.2 Groundwater

6.2.1 Groundwater was observed in one of the exploratory excavations. Our observations are summarised below:

Table summarising groundwater observations

Exploratory point	Date of observation	Depth (m) below ground levels	Observations
DTS01	28/06/2017	4.45m	Measured 25 minutes after borehole completion.

Table 6.2.1

6.2.2 No groundwater was encountered on our return monitoring visit.

6.2.3 It should be noted that water levels will vary depending generally on recent weather conditions and only long-term monitoring of levels in standpipes will provide a measure of seasonal variations in groundwater levels.

6.3 Evidence of contamination

6.3.1 During excavation of our exploratory points, no evidence of contamination was noted.

6.4 Obstructions and instability

6.4.1 The following table summarises obstructions encountered during our exploratory excavations;

Table summarising obstructions and instability observations

Exploratory point	Depth of obstruction	Description of obstruction and/or instability
TP01	700mm	150mm diameter pipe encountered at 700mm depth below surface.

Table 6.5.1

6.5 Existing foundation arrangements

6.5.1 Foundations were exposed in trial pits TP01 and TP02. Detailed logs of these excavations are presented in Appendix D but are summarised in the following table:

Table summarising foundation arrangement observations

Exploratory point	Depth of foundation	Projection from building line	Founding strata	Comments
TP01	1150	300	London Clay	150mm diameter pipe at approximately 700mm from surface. Solid concrete block footing to 210mm depth with unshuttered concrete footing to 500mm depth. Erratically placed concrete and brick from 500mm to 1150mm depth which includes a step in of approximately 200mm at 800mm depth.
TP02	600	140	London Clay	Concrete footing to 250mm depth with Erratically placed brick and concrete to 600mm depth.

Table 6.5.1

7 Engineering assessment

7.1 General description of the development

7.1.1 The following assessments are made on the investigatory data presented in the preceding sections of this report and are made with reference to specific nature of the development. Should scheme proposals change then it may be necessary to review the investigation and report.

7.1.2 The project will comprise the redevelopment of the existing dwelling including the construction of a single-storey deep basement across the existing building footprint and rear paved courtyard area, the proposed scheme will adopt an open courtyard area to the rear in lieu of lightwells. We understand the basement will be constructed by underpinning of existing foundations with retaining walls cast in stages where the basement extends beyond the existing building line. The overall depth of the basement excavation is unlikely to exceed 3.5m (including basement floor construction).

7.2 Building foundation, design and construction

7.2.1 Definitions of geotechnical terms used in the following paragraphs are provided in Appendix A.

7.2.2 Underpinning of existing foundations will transfer existing perimeter building loads to a lower level within the London Clay. Replacement of soil beneath existing foundations with concrete will result in a net increase in stress on soils at underpinned levels; however, this is unlikely to result in significant additional settlement. At this stage, we are not aware of proposed changes in building loads; if significant increases in loads are anticipated, we can provide estimates of settlement on further instruction.

7.2.3 Basement walls will be reinforced concrete underpinning, fully propped in the temporary condition then gaining lateral support from the basement raft in the permanent condition. We recommend that all underpinning bays are located on naturally deposited London Clay soils.

7.2.4 The following table provides soil parameters for foundation design purposes

Parameter	Value	Origin
Presumed bearing value for underpin L section (as proposed) assuming 1m wide base (temporary scenario)	100kN/m^2	Based on undrained shear strength measurements and section of underpinning
Characteristic constant volume angle of shearing resistance (made ground and London Clays)	22^o	Based on plasticity measurements and with reference to BS8002:2015
Earth pressure at rest (London Clay) K_0	1	CIRIA report C760 (over consolidated clays)
Active Earth Pressure K_a	0.5	Based on angle of shearing resistance
Earth pressure at rest (Made ground)	0.65	CIRIA report C760 (normally consolidated clays)
Characteristic weight density of soils above the groundwater table	18kN/m^3	Derived from BS8002:2015

7.2.4 Either K_0 or Ka can be used for design purposed however if K_a is adopted please be any associated movement will need to be accommodated.

7.2.5 Bearing capacity

7.2.5.1 Assuming the base of the underpins is about 1m wide and extend into the basement excavation by about 0.5m, (below basement floor excavations) calculations based on an undrained shear strength of 100kN/m^2 (based on the strength/depth relationship shown on Drawing 04), the ultimate bearing capacity would be about 540kN/m^2. Adopting a factor of safety of 3 against shear failure indicates the presumed bearing value would be about 225kN/m^2. Assuming a line load of say 60kN/m, and a 1m wide foundation the underpin will impose a stress of 60kN/m^2 at founding level. At this level of stress, immediate settlement is unlikely to exceed 7mm.

7.2.5.2 We understand from construction proposals that the basement will be formed at about 3.5m depth and we assume that the new basement floor will be connected to the underpinned/cast walls, thus producing a raft type foundation. The new basement excavation will be subject to some heave movements due to removal of say 3.5m x 18kN/m^3 = 63kN/m^2 of overburden stress. Our calculations indicate that total heave in the order of 20mm could be expected, of which approximately 10mm would be immediate and realised during construction.

7.2.6 Settlement around and inward yielding of basement excavations

7.2.6.1 The following analysis is based on observations of ground movements around basement excavations in clays as reported in Tomlinson 'Foundation design and construction' (seventh Edition) and CIRIA report C760 Guidance on embedded retaining wall Design.

7.2.6.2 It is recognised that some inward yielding of supported sides of strutted excavations and accompanying settlement of the retained ground surface adjacent to the excavation will occur even if structurally very stiff piles and props / strutting is employed. The amount of yielding for any given depth of excavation is a function of the characteristics of the supported soils and not the stiffness of the supports.

7.2.6.3 Following CIRIA C760, and assuming the conditions as set out in the notes therein, the basement excavation will be located in high support stiffness soils, assuming high propped walls and top-down construction the maximum yield / excavation depth (%) is 0.15. We understand the redevelopment will have an excavation depth of 3.5m. On this basis inward yield will be in the order of 3.5 x 0.15/100 x1000 = 5.25mm. Coincidental with the inward yield of the embedded wall, some settlement of the retained soils around the excavation will occur. Again, based on CIRIA C760, the ratio of surface settlement to excavation depth in high supported stiffness soils is 0.1%. Surface settlement in the order of 3.5 x 0.1/100 x 1000 = 3.5mm will occur. This settlement profile will extend for a distance of about 3.5 to 4 times the depth of excavation i.e. about 12.25m to 14m in a reasonably linear fashion. Where masonry panels are shorter than these distances the movement relative to the length of panel has been adopted.

7.2.6.4 Whilst it is acknowledged that settlement and inward yielding movement observations are generally for embedded piled or diaphragm retaining walls, we are not aware of any published observational data for underpinning walls and insitu concrete retaining walls, but consider a propped embedded piled wall would afford more onerous movements. The value of making a finite element analysis to determine the amount of inward yielding of excavation supports in all routine cases of basement excavations is questionable requiring estimates of soil moduli and other factors such as Poisson's ratio.

7.2.7 Engineering appraisal (Analysis of ground movements due to construction of basement and prediction of damage on adjacent (nearby) buildings)

7.2.7.1 Drawing 02A shows the radial influence of Stiff Clays, as such we have considered the effect of surface settlement (as differential settlement) on panels of masonry forming facades to adjacent properties (No104, No108 King Henry's Road and No5 Lower Merton Rise - referenced A, B and C on Drawing 02A), which are likely subject to the most significant potential movements. We have determined panel sizes from estimate measurements based on site reconnaissance. Assuming the panel of masonry is rectangular and ignoring the effects of openings, we have determined strains on the diagonal and horizontal and thus establish damage categories with reference to Burland's Table 6.4 in CIRIA report C760. Our calculations are presented in Appendix O.

Extract copy of Burland's classification of damage (extract from CIRIA report C760)

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain, ε_{lim} (%)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible	<0.1	0.0 to 0.05
1 Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection	<1	0.05 to 0.075
2 Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly.	<5	0.075 to 0.15
3 Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable lining. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5 to 15 or a number of cracks >3	0.15 to 0.3
4 Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Services pipes disrupted.	15 to 25, but also depends on number of cracks	>0.3
5 Very severe	This requires a major repair, involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	Usually >25, but depends on numbers of cracks	

Notes

1 In assessing the degree of damage, account must be taken of its location in the building or structure.

2 Crack width is only one aspect of damage and should not be used on its own as a direct measure of it.

7.2.8 Conclusion and risk reduction

7.2.8.1 Adjacent structures and buildings may potentially be affected by basement excavations, theoretically resulting in damage that just falls into Burland Category 1.

7.2.8.2 We understand from Solid Geometry the basement excavation will be undertaken in a controlled manner using traditional techniques with a full vertical and horizontal monitoring regime and specialist designed adjustable propping system. On this basis if the propping and subsequent compensatory works are appropriately monitored and adjusted this will negate the effects of worst case inward yield movements and therefore it is unlikely that damage will exceed Burland Category 0.

7.2.9 Basement excavation stability

7.2.9.1 We anticipate that excavations in the London Clay deposits will remain upright and stable in the short term, if slot trenches/bays are no more than 1m wide. It will be necessary, however, to shore any excavations to ensure the health and safety of workers. Should excavations be open during inclement weather, there is a risk of scour/surface erosion of exposed faces, which may lead to instability of excavation sides.

7.3 Influence of Trees and other major vegetation

7.3.1 Soil classification and new foundation design

7.3.1.1 The results of plastic and liquid limit determinations performed on samples of the London Clay Formation indicate the deposits are soils of high volume change potential when classified in accordance with National House Building Council (NHBC) Standards, Chapter 4.2. Foundations taken down onto a depth of 1.0m will penetrate the zone of shrinkage and swelling caused by seasonal wetting and drying. Trees and other major vegetation extend this zone and will require deeper foundations. A good guide to this subject is provided in NHBC Standards, Chapter 4.2.

7.3.2 New planting

7.3.2.1 Any planting schemes should also take into account the effect that new trees could have on foundations when they reach maturity. Again a good guide to this subject is provided in NHBC Standards, Chapter 4.2.

7.3.3 Tree species identification

7.3.3.1 There are a number of trees and other major vegetation at the site. We recommend a qualified arboriculturist (listed in the Arboricultural Association Directory of Consultants – www.trees.org.uk) be appointed to determine the location, height (and mature height) and water demand of all trees/major hedgerows at the site, information, which will be necessary to design foundations in accordance with NHBC Standards, Chapter 4.2.

7.4 Infiltration Potential

7.4.1 The London Clay Formation deposits are, in our opinion, effectively impermeable and would not be able to dispose of water using soakaway systems.

8 Chemical contamination

8.1 Contaminated land, regulation and liabilities

8.1.1 Statute

8.1.1.1 Part IIA of the Environment Protection Act 1990 became statute in April 2000. The principal feature of this legislation is that the hazards associated with contaminated land should be evaluated in the context of a site-specific risk based framework. More specifically contaminated land is defined as:

> *"any land which appears to the local authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under the land, that:*
>
> *a) Significant harm is being caused or there is a significant possibility of such harm being caused; or*
> *b) Pollution of controlled waters is being or is likely to be caused".*

8.1.1.2 Central to the investigation of contaminated land and the assessment of risks posed by this land is that:

i) There must be contaminants(s) at concentrations capable of causing health effects (*Sources).*
ii) There must be a human or environmental receptor present, or one which makes use of the site periodically *(Receptor)*; and
iii) There must be an exposure pathway by which the receptor comes into contact with the environmental contaminant *(Pathway).*

8.1.1.3 In most cases the Act is regulated by Borough or District Councils and their role is as follows:

i) Inspect their area to identify contaminated land
ii) Establish responsibilities for remediation of the land
iii) See that appropriate remediation takes place through agreement with those responsible, or if not possible:
- by serving a remediation notice, or

- in certain cases carrying out the works themselves, or
- in certain cases by other powers

iv) keep a public register detailing the regulatory action which they have taken

8.1.1.4 For "special" sites the Environment Agency will take over from the Council as regulator. Special sites typically include:-

- Contaminated land which affects controlled water and their quality
- Oil refineries
- Nuclear sites
- Waste management sites

8.1.2 Liabilities under the Act

8.1.2.1 Liability for remediation of contaminated land would be assigned to persons, organisations or businesses if they caused, or knowingly permitted contamination, or if they own or occupy contaminated land in a case where no polluter can be found.

8.1.3 Relevance to predevelopment conditions

8.1.3.1 For current use, Part IIA of the Environmental Protection Act 1990 provides the regulatory regime. The presence of harmful chemicals could provide a 'source' in a 'pollutant linkage' allowing the regulator (local authority or Environment Agency) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as 'contaminated' under the provision of the Act requiring the remediation process to be implemented.

8.1.4 Relevance to planned development

8.1.4.1 The developer is responsible for determining whether land is suitable for a particular development or can be made so by remedial action. In particular, the developer should carry out an adequate investigation to inform a risk assessment to determine:

a) Whether the land in question is already affected by contamination through source – pathway – receptor pollutant linkages and how those linkages are represented in a conceptual model
b) Whether the development proposed will create new linkages e.g. new pathways by which existing contaminants might reach existing or proposed receptors and whether it will introduce new vulnerable receptors, and
c) What action is needed to break those linkages and avoid new ones, deal with any unacceptable risks and enable safe development and future occupancy of the site and neighbouring land?

8.1.4.2 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, '*Site preparation and resistance to contaminants and moisture'* which seeks to protect the health,

safety and welfare of people in and around buildings, and includes requirements for protection against harm from chemical contaminants.

8.1.5 Pollution of controlled waters

8.1.5.1 Part IIA of the Environment Protection Act 1990, defines pollution of controlled waters as

> *'The entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter'*

8.1.5.2 Paragraphs A36 and A39 of statutory guidance (DETR 2000) further define the basis on which land may be determined to be contaminated land on the basis of pollution of controlled waters.

> *'Before determining that pollution of controlled waters is being, or likely to be, caused, the Local Authority should be satisfied that a substance is continuing to enter controlled waters, or is likely to enter controlled waters. For this purpose, the local authority should regard something as being likely when they judge it more likely than not to occur'*
>
> *'Land should not be designated as contaminated land where:*
>
> *a) A substance is already present in controlled waters:*
> *b) Entry into controlled waters of that substance from the land has ceased, and*
> *c) It is not likely that further entry will take place.*
>
> *Substances should be regarded as having entered controlled waters where:*
>
> *a) They are dissolved or suspended in those waters; or*
> *b) If they are immiscible with water, they have direct contact with those waters, or beneath the surface of the waters'*

8.1.5.3 Controlled waters are defined in statute to be:

> *'territorial waters which extend seawards for 3 miles, coastal waters, inland freshwaters, that is to say, the waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and groundwaters, that is to say, any waters contained in underground strata.'*

8.1.6 Further information

8.1.6.1 The above provides a brief outline as regards current statute and planning controls. Further information can be obtained from the Department for the Environment, Food and Rural Affairs (DEFRA) and their Web site www.defra.gov.uk.

8.2 Objectives and procedures

8.2.1 Objectives

8.2.1.1 This report section discusses investigations carried out with respect to chemical contamination issues relating to the site. The investigations were carried out to determine if there are any liabilities with respect to Part IIA of the Environment Protection Act. As stated in Section 2.4.2, the investigation process followed the principles of BS10175: 2011 *'Investigation of potentially contaminated sites – Code of Practice',* with the investigation combining a desk study (preliminary investigation) together with the exploratory and main investigations (refer BS10175: 2011 for an explanation).

8.2.1.2 This section of the report produces *'Conceptual models'* based on investigatory data obtained to date. The conceptual model is constructed by identification of *contaminants* and establishment of feasible *pathways* and *receptors.* The conceptual model allows a *risk assessment* to be derived. Depending upon the outcome of the risk assessment it may be necessary to carry out remediation and/or further investigations with a view to eliminating, reducing or refining the risk of harm being caused to identified receptors. If appropriate, our report will provide recommendations in this respect.

8.2.1.3 Clearly we must consider the current pre-development condition, establishing risks which may require action to render the site safe to all relevant (current) receptors meeting the requirements of current legislation (Part IIA of the Environmental Protection Act 1990).

8.2.1.4 Definition of terms used in the preceding paragraph and subsequent parts of this section of the report are presented in Appendix B.

8.2.2 Procedure to assess risks of chemical contamination

8.2.2.1 For the purposes of presenting this section of this report, we have adopted the following sequence in assessing risks associated with chemical contamination.

Table outlining sequence to assess risk associated with chemical contamination

Conceptual model element	Contributory information	Outcome
Receptor	Development categorisation	Identification of receptors at risk of being harmed Method of analysing test data Criteria for risk assessment modelling
Pathways	Geology and ground conditions Development proposals	Identification of critical pathways from source to receptor
Source	Previous site history Desk study information Site reconnaissance Fieldwork observations	Testing regime Identification of a chemical source Analysis of test data and other evidence

Table 8.2.2

8.2.2.2 We have adopted, in general, the procedures described in CIRIA C552 *'Contaminated land risk assessment - a guide to good practice'* in deriving a risk assessment. Initially we have carried out a 'phase 1 assessment' based on desk study information and site reconnaissance, to produce an initial conceptual model and thus a preliminary risk

assessment. This model / assessment is then used to target fieldwork activities and laboratory testing, with the results of this part of the investigation used to allow a phase 2 assessment to be produced by updating the conceptual model and refining the risk assessment.

8.3 Development characterisation and identified receptors

8.3.1 Site characterisation

8.3.1.1 The nature of the site has a significant influence the likely exposure pathways between potentially contaminated soils and potential receptors. The following table summarises elements which characterise the site based on site observations and desk study information.

Summary of site characteristics		
Element	**Source / criteria**	**Characteristic**
Current land use	Observations	Residential property with garden
Future land use	Advice	Site use to remain unchanged with the addition of a single level basement
Site history	Desk study	Formerly occupied by residential property from 1896 to 1965. Redeveloped to residential development concurrent with the present-day layout circa 1972
Geology	Site investigation	Shallow covering of Made Ground overlying London Clay, likely to extend to some 50m depth
Ground water	Aquifer potential	Unproductive strata within London Clay
	Abstractions	Nearest abstraction point 437m west. Public water supply located 618m southeast.
	Source protection zone	Site within source protection zone II.
Surface waters	Location	The Grand Union Canal (Regents Canal) located 841m southeast.
	Abstractions	None within 1000m of the site.

Table 8.3.1

8.3.2 Identified receptors

8.3.2.1 The principal receptors subject to harm caused by any contamination of the proposed development site are as follows.

Principle Receptor	Detail
Humans	Users of the current site
	End user of the developed site
	Construction operatives and other site investigators
Vegetation	Plants and trees, both before and after development
Controlled waters	Surface waters (Rivers, streams, ponds and above ground reservoirs)
	Ground waters (used for abstraction or feeding rivers / streams etc)
Building materials	Materials in contact with the ground

Table 8.3.2

This section of the report assesses those receptors listed above. Section 10 provides a risk assessment in relation to building materials.

8.3.3 Human receptors

8.3.3.1 The Contaminated Land Exposure Assessment (CLEA) model can be used to derive guideline values, against which land quality data can be compared to allow an assessment of the likely impacts of soil contamination on humans. The parameters used within the model can be chosen to allow guideline values to be derived for a variety of land uses and exposure pathways. For example, a construction worker is likely to be exposed in different ways and for different durations than an adult in a residential setting.

8.3.3.2 As the current site is residential, the critical site user (receptor) is considered to be a child under the age of 6 years. Following completion of the re development the critical site user (receptor) is again considered to be a child under the age of 6 years. This criterion has been used in the conceptual model for the current and future site use. Our assessment also considers construction operatives as adult receptors.

8.3.4 Vegetation receptors

8.3.4.1 Soil contaminants can have an adverse effect on plants if they are present at sufficient concentrations. The effects of phytotoxic contaminations include growth inhibition, interference with natural processes within the plant and nutrient deficiencies.

8.3.4.2 Vegetation is currently present on site and is likely to remain within the front garden areas of the site following the proposed redevelopment. On this basis, vegetation is considered to be a potentially sensitive receptor.

8.3.5 Water receptors

8.3.5.1 The site lies in an area designated unproductive strata, reflecting the effective impermeability of the underlying London Clay Formation. The site is located within a source protection zone 2, although given the thickness of the London Clay beneath the site (~50m), the Chalk aquifer at depth is not considered to be a potential sensitive receptor.

8.3.5.2 The nearest watercourse is Regents Canal located some 840m to the south of the site. Given the distance from the property, the canal is not considered to be a potential sensitive surface water receptor.

8.3.5 Summary of identified receptors

8.3.5.1 Based on the above assessments, the following table summarises identified and critical receptors.

Table summarising identified (viable) receptors				
Principle Receptor	**Detail**	**Viable and critical receptors**		
		Viability and justification		**Critical receptor**
Humans	Users of the current site	Yes	Residential property	Child
	End user of the developed site	Yes	Residential property	Child
	Construction operatives and other site investigators	Yes		Adult
Vegetation	Current site	Yes	Gardens on site	Vegetation
	Developed site	Yes	Gardens to remain	Vegetation
Controlled waters	Surface waters (Rivers, streams, ponds and above ground reservoirs)	No	Nearest watercourse some 840m from the site.	
	Ground waters (used for abstraction or feeding rivers / streams etc)	No	Unproductive strata beneath the site.	Groundwater
Building materials	Materials in contact with the ground	Yes	Assessed in report section 10	Building materials
Table 8.3.5				

8.4 Identification of pathways

8.4.1 Pathways to human receptors

8.4.1.1 Guidance published by the Environment Agency in Science Report SC050021/SR3 *'Updated technical background to the CLEA model'* provides a detailed assessment of pathways and assessment and human exposure rates to source contaminants. In summary, there are three principal pathway groups for a human receptor:

Table summarising likely pathways	
Principal pathways	**Detail**
Ingestion through the mouth	Ingestion of air-borne dusts
	Ingestion of soil
	Ingestion of soil attached to vegetables
	Ingestion of home grown vegetables
Inhalation through the nose and mouth.	Inhalation of air-borne dusts
	Inhalation of vapours
Absorption through the skin.	Dermal contact with dust
	Dermal contact with soil
Table 8.4	

8.4.1.2 The site is currently occupied by a residential property with a potentially productive front garden area and will remain so following completion of the proposed development. On this basis, all the above pathways are considered to be present under current and future site conditions.

8.4.1.3 Pathways associated with the consumption of vegetables are not considered relevant for construction operatives.

8.4.1.4 A summary of our pathway assessment is presented in Section 8.4.4.

8.4.2 Pathways to vegetation

8.4.2.1 Guidance published by the Environment Agency in Science Report SC050021/SR (Evaluation of models for predicting plant uptake of chemicals from soil) provides a detailed assessment of plant uptake pathways. In summary, plants are exposed to contaminants in soils by the following pathways:

- Passive and active uptake by roots.
- Gaseous and particulate deposition to above ground shoots.
- Direct contact between soils and plant tissue.

8.4.2.2 All of the above routes of exposure are considered to be present for vegetation.

8.4.3 Summary of identified likely pathways

8.4.3.1 Based on the above assessments, the following table summarises likely pathways of potential chemical contaminants at the site to identified receptors.

Table of likely pathways

Receptor group	Critical receptor	Pathway
Current and Proposed site users	Child	Ingestion air-borne dusts
		Ingestion of soil.
		Ingestion of soil attached to vegetables
		Ingestion of home grown vegetables
		Inhalation air-borne dusts
		Inhalation of vapours
		Dermal contact with dust
		Dermal contact with soil
Construction operatives	Adult	Ingestion of air-borne dusts
		Ingestion of soil
		Inhalation of air-borne dusts
		Inhalation of vapours
		Dermal contact with dust
		Dermal contact with soil
Vegetation		Root uptake, deposition to shoots and foliage contact.

Table 8.4.3

8.5 Assessment of sources of chemical contamination

8.5.1 Introduction

8.5.1.1 Initially, potential sources of contamination are assessed using the following elements of the investigation process.

- History of the site
- Desk study information
- Site reconnaissance
- Geology
- Fieldwork

These elements will dictate a relevant soil/water testing regime to quantify possible risks of any identified contaminative sources which may harm identified receptors.

8.5.2 Source assessment – History of the site

8.5.2.1 The history of the site and its immediate surroundings based on published Ordnance Survey maps is described in Section 3.

8.5.2.2 Based on published historical maps, there is no evidence to indicate the site, or its immediate surroundings have been subject to activities which could result in a source of chemical contamination.

8.5.2.4 A Builders Yard and Saw Mill were recorded 90m northeast and 330m north respectively. Due their distance from the site, these activities are unlikely to represent potential sources of contamination likely to affect the subject site.

8.5.3 Source assessment – Desk study information

8.5.3.1 Envirocheck presents a detailed database of environmental information in relation to the site including;

- Pollution incidents
- Landfill sites
- Trading activities

8.5.3.2 Based on the Envirocheck data (refer Appendix O) the site has no recorded history of any pollution events or trading activities likely to result in a source of contamination, or is located in close proximity to a landfill site.

8.5.4 Source assessment – Site reconnaissance

8.5.4.1 A full description of the site and observed adjacent land uses is provided in Section 3 of this report. A plan summarising observations made on site during our site reconnaissance visit is presented on Drawing 02.

8.5.4.2 We did not observe any obvious evidence of any current or recent activities on site or adjacent sites which could result in a source of chemical contamination.

8.5.5 Source assessment – Geology

8.5.5.1 The geological map of the area indicates the topography local to the site is formed in deposits of London Clay Formation. Typically, and in our experience, the London Clay Formation do not exhibit any abnormal concentrations of naturally occurring chemical contaminants.

8.5.6 Source assessment - Fieldwork observations

8.5.5.1 Made Ground was present within all borehole and trial pit locations and contained varying quantities of brick, concrete and bituminous bound material, suggesting the possible presence of a source of contamination. We therefore obtained samples of the potentially contaminated soils for subsequent laboratory testing.

8.5.7 Source assessment – summary

8.5.7.1 Based on the paragraphs above, we have not identified any potential significant sources of contamination at or in the immediate vicinity of the site.

8.6 Initial Conceptual Model

8.6.1 Based on our assessment of potential contaminative sources, identified receptors and viable pathways to receptors described in preceding paragraphs, we have produced an initial conceptual model in the form of a table which is presented in Appendix H. The risk of chemical contamination causing harm to identified receptors does not exceed the low category.

8.7 Risk assessment summary and recommendations

8.7.1 Based on our assessments described above, we can provide the following summaries and recommendations for each identified receptor:

8.7.2 Current and future site users

8.7.2.1 As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a low risk of causing harm to the health of current and future users of the site.

8.7.3 Construction operatives and other site investigators

8.7.3.1 The risk of damage to health of construction operatives and other site investigators is, in our opinion, low. As a precautionary approach, however, we recommend that adequate hygiene precautions are adopted on site. Such precautions include:

- Wearing protective clothing, particularly gloves, to minimise ingestion of soil from soil contaminated hands
- Avoiding dust by dampening soil during the works
- Wearing masks if processing produce dust

8.7.3.2 Guidance on safe working practices can be obtained from the following documents:

- The Health and Safety Executive Publication '*Protection of Workers and the General Public during the Development of Contaminated Land*' (HMSO)
- '*A Guide to Safer Working on Contaminated Sites*' (CIRIA Report 132)

8.7.3.3 In addition, reference should be made to the Health and Safety Executive. In all cases work shall be undertaken following the requirements of the Health and Safety at Work Act 1974 and regulations made under the Act, including the COSHH regulations.

8.7.4 Controlled waters

8.7.4.1 As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a low risk of causing harm to water receptors.

8.7.5 Vegetation

8.7.5.1 As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a low risk of causing harm to vegetation.

8.8 Statement with respect to National Planning Policy Framework

8.8.1 Based on investigations completed to date with respect to chemical contamination, we are of the opinion that the proposed development will be safe and suitable for use for the purpose for which it is intended (without the need for any remedial action), thus meeting the requirements of the National Planning Policy Framework section 121 and complying with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture*'.

8.9 On site monitoring

8.9.1 We have attempted to identify the potential for chemical contamination on the site; however, it is possible that areas which have not been investigated at this stage may exhibit contamination. If such areas are exposed at any time during construction, we will be pleased to re-attend site to assess what action is required to allow the development to safely proceed.

9 Gaseous contamination

9.1 Legislative framework

9.1.1 There is currently a complex mix of documentation relating to legislative and regulatory procedures on the issue of contamination and it is not considered a purpose of this report to discuss the detail of these regulations. Essentially, Government Policy is based on *'suitable for use approach',* which is relevant to both the current and proposed future use of land. For current use Part IIA of the Environmental Protection Act 1990 provides the regulatory regime (see Section 8.1 above). The presence of harmful soil gases could provide a 'source' in a 'pollutant linkage' allowing the regulator (Local Authority) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as 'contaminated' under the provision of the Act requiring the remediation process to be implemented with the Environment Agency responsible for enforcement.

9.1.2 The Town and Country Planning (General Development Procedure) Order 1995, requires the planning authority to consult with the Environment Agency before granting planning permission for development on land within 250 metres of land which is being used for deposit of waste, (or has been at any time in the last 30 years) or has been notified to the planning authority for the purposes of that provision.

9.1.3 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, '*Site preparation and resistance to contaminants and moisture'* which seeks to protect the health, safety and welfare of people in and around buildings and includes requirements for protection against harm from soil gas.

9.2 General

9.2.1 The following assessment relates to the potential for, and the effects of, gases generated by biodegradable matter. The potential for the development to be affected by radon gas is considered in Section 3 above. The principal ground gases are carbon dioxide (CO_2) and methane (CH_4). The following table provides a summary of the effects of these gases when mixed with air.

Significant gas concentrations in air		
Gas	**Concentration by volume**	**Consequence**
Methane	0.25%	Ventilation required in confined spaces
	5 - 15%	Potentially explosive when mixed with air
	30%	Asphyxiation
	75%	Death after 10 minutes
Carbon Dioxide	0.5%	8 hour long term exposure limit (LTEL) (HSE workplace limit)
	1.5%	15 min short term exposure limit (STEL) (HSE workplace limit)
	>3%	Breathing difficulties
	6 – 11%	Visual distortion, headaches, loss of consciousness, possible death
	>22%	Death likely to occur

Table 9.2.1

9.2.2 Following the current Building Regulations Approved Document C1, Section 2 '*Resistance to Contaminants*' (2004 incorporating 2010 and 2013 amendments) a risk assessment approach is required in relation to gaseous contamination based on the source-pathway-receptor conceptual model procedure. We have adopted procedures described in the following reference documents for investigation and assessments of risk of the development being affected by landfill type gases (permanent gases) and if appropriate the identification of mitigation measures.

- BS10175:2011 *'Investigation of potentially contaminated sites- Code of Practice'*
- BS8576:2013 '*Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'*
- BS8485:2015 '*Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'*
- CIRIA Report C665 '*Assessing risks posed by hazardous ground gases to buildings*' (2007)
- CL:AIRE Research Bulletin RB17 *'A pragmatic approach to ground gas risk assessment'* (November 2012)

Whilst we have followed the guidance and recommendations of BS8576, we have used BS8485:2015 to derive recommendations for protective works where considered necessary supplemented by NHBC report No 10627-R01(04).

9.2.3 An assessment of the risk of the site being affected by ground gases is based on the following aspects:

a) Source of the gas
b) Investigation information
c) Migration feasibility
d) Sensitivity of the development and its location relative to the source

9.3 Assessment of source of gases

9.3.1 General sources

9.3.1.1 The following table summarises the common sources of ground gases and parameters affecting the generation of ground gases:

Source and control of gases	
Type	**Parameters affecting the rate of gassing**
Landfills	Portion of biodegradable material, rate reduces with time
Mineworkings	Flooding reduces rate of gassing
Dock silt	Portion of organic matter
Carbonate deposits	Ground / rainwater (acidic) reacts with some carbonates to produce carbon dioxide.
Made Ground	Thickness of Made Ground and proportion of degradable organic matter
Naturally deposited soils/rocks	Portion of organic matter

Table 9.3.1

The rate of decomposition in gas production is also related to atmospheric conditions, pH, temperature, and water content / infiltration.

9.3.1.2 As the site is not within a dockland environment or an area affected by mineworkings, and near surface soils do not exhibit high carbonate content, then potential gas sources are limited to landfills and/or soils with a high proportion of organic matter.

9.3.2 Landfill and infilled ground sources

9.3.2.1 Waste Management Paper 27 (1991) produced by the Department of the Environment '*Control of Landfill Gases'* contains the recommendation to avoid building within 50m of a landfill site actively producing large quantities of landfill type gases and to carry out site investigations within a zone 250m beyond the boundary of a landfill site. No distinction is made between sites of differing ground conditions, but the paper does not advocate the site is safe beyond the 250m zone, dependant, of course, upon the type of landfill and potential for migration of landfill gases.

9.3.2.2 Envirocheck reports there are no recorded landfill sites, artificial deposits, BGS Recorded Mineral Sites or areas of infilled ground within 900m of the subject site. In addition, we have reviewed old Ordnance Survey maps and there is no obvious evidence of any quarrying in the area which may have been restored with materials which could generate landfill gases. On the above basis, there is no recorded evidence to suggest a source of landfill gases from such past activities.

9.3.3 Soil conditions

9.3.3.1 None of the soils observed in exploratory excavations, in our opinion, exhibit significant concentrations of organic matter which are likely to produce elevated quantities of carbon dioxide and / or methane gas.

9.3.4 Source assessment summary

9.3.4.1 The following table summarises the possibility of a source of landfill type gases.

Source assessment summary		
Potential source origin	**Viability of source**	**Evidence**
Landfills	Unlikely	Desk study information
Mineworkings	Unlikely	Desk Study information Geological conditions not amenable
Dock silt	Unlikely	Site remote from dockland environment
Carbonate deposits	Unlikely	Recorded and observed soil conditions do not indicate high concentrations of carbonates
Made Ground	Unlikely	Made Ground <3m thickness with low TOC content
Naturally deposited soils/rocks	Unlikely	Soils exposed in exploratory excavations do not exhibit high concentrations of organic matter

Table 9.3.4

9.4 Conclusion

9.4.1 Based on the above there is no evidence to demonstrate that there is a potential source rendering the site at a significant risk of being affected by ground gases (carbon dioxide / methane) sufficient to cause significant harm to human end users of the site, construction operatives or indeed buildings. On this basis, it is not considered necessary to consider possible pathways for migration of ground gases, and indeed implementation of further investigations to measure concentrations of ground gases. Again, on the basis of evidence provided above, mitigation measures against ingress of ground gases into the proposed development are not considered necessary.

9.5 Statement with respect to National Planning Policy Framework

9.5.1 Based on investigations completed to date with respect to gaseous contamination, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended (without the need for any remedial action) thus meeting the requirements of the National Planning Policy Framework section 121, and compliant with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture'.*

10 Effects of ground conditions on building materials

10.1 General

10.1.1 Building materials are often subjected to aggressive environments which cause them to undergo chemical or physical changes. These changes may result in loss of strength or other properties that may put at risk their structure integrity or ability to perform to design requirements. Aggressive conditions include:

- Severe climates
- Coastal conditions
- Polluted atmospheres
- Aggressive ground conditions

This report section only considers aggressive ground conditions, with other items considered outside our brief and scope of investigations.

10.1.2 In aggressive ground conditions, the potential for contaminant attack depends on the following:-

- The presence of water as a carrier of chemical contaminants, (except free phase organic contamination)
- The availability of the contaminant in terms of solubility, concentration and replenishment rate
- Contact between the contaminant and the building material
- The nature of the building materials and its capability of being attacked by contaminants

In general the thicker the building material the less likelihood there is for contaminant attack to cause damage to the integrity of the structure.

10.2 Reference documents

10.2.1 Following the Environment Agency publication *'Model Procedures for the Management of Land Contamination'* (Contaminated Land Report 11) the following documents have been referred to in production of the following report paragraphs.

- *'Performance of Building Materials in Contaminated Land'* report BR255 (Building Research Establishment 1994).
- *'Risks of Contaminated Land to Buildings, Building Materials and Services. A Literature Review'* - Technical Report P331 (Environment Agency 2000).
- *'Guidance on assessing and managing risks to buildings from land contamination'* - Technical Report P5 035/TR/01).
- Building Regulations Approved document C - site preparation and resistance to contaminants and moisture (Office of the Deputy Prime Minister, 2004).
- *'Concrete in aggressive ground'* Special Digest 1: 2005 (Building Research Establishment).

10.3 Hazard identification and assessment

10.3.1 The identification of hazards is based on the findings of this investigation primarily relating to former land uses (potential for chemical contamination, and likely type of contamination) and laboratory determination of concentration of chemical contaminants. Clearly, the scope of laboratory testing is determined with respect to former land uses, contaminants which may cause harm to human health and water resources.

10.3.2 Based on the above, the scope of our testing regime is described in Sections 8. We have utilised this test data in production of the following risk assessments in relation to building materials, in conjunction with test data targeting the effects of chemical attack on concrete in contact with the ground, as described in BRE Special Digest 1.

10.3.3 The identification of hazards from contamination and subsequent assessment of risks is based on the following:-

- The contaminants present on site.
- The nature of the contaminant (i.e. calcium sulphate is much less soluble than sodium or magnesium sulphate and is, therefore, less of a concern with regards sulphate attack).
- The concentration of contaminants - in general the higher the concentration the greater the hazard.
- The solubility of the contaminants - contaminants which are not soluble will not generally react with materials.
- The permeability of the soils - i.e. case by which fluids can transport contaminants to the building.

10.3.4 The process of risk assessment for building materials is concerned with identification of the hazard (contaminants at the site - a source) and subsequently how the contaminants can reach the building (pathway) and how they can react with the building (receptor). Thus the risk assessment is produced based on the source - pathway - receptor model.

10.4 Provision of test data to specifiers/manufacturer/installer

10.4.1 The following risk assessments are based on current published data. We strongly recommend, however, that information gained from this investigation are provided to specifiers/manufacturers/installers of building materials/service ducts/apparatus who may have more up to date research to confirm the ability of the product to resist the effects of chemical contaminants at the site for the desired lifespan of the product.

10.5 Risks assessments for individual building materials

10.5.1 The following/typical sections contain risk assessments for various building materials likely to be incorporated in developments. Other materials which we are not aware of may also be used in developments and in contact with the ground and, therefore, recommend the suppliers are consulted with respect to ground conditions at this site and their opinion sought as to the ability of the product to resist chemical conditions determined at the site.

10.6 Concrete - General mechanisms of attack

10.6.1 There are a number of mechanisms by which contaminants attack concrete including the following:-

- Hydrolysis of the hardened concrete.
- Degradation as a result of exchange reactions between calcium in calcium hydroxide (free lime hydrate) and ions in aggressive solutions.
- Expansive reactions as a result of chemical reaction or salt crystallisation.

10.7 Concrete - Sulphate attack

10.7.1 Hazard

10.7.1.1 Sulphate attack on concrete is characterised by expansion, leading to loss of strength, cracking, spalling and eventual disintegration. There are three principal forms of sulphate attack, as follows:-

- Formation of gypsum through reaction of calcium hydroxide and sulphate ions.
- Ettringite formation through reaction of tricalcium alluminate and sulphite irons.
- Thaumasite formation as a result of reactions between calcium silicate hydrates, carbonate ions (from aggregates) and sulphate ions.

10.7.2 Assessment

10.7.2.1 The hazard of sulphide attack is addressed by reference to procedures described in Building Research Establishment (BRE) Special Digest 1: 2005 '*Concrete in Aggressive Ground*' to establish a design sulphate class (DS) and the '*aggressive Chemical Environment for Concrete*' (ACEC). These procedures have been followed during our investigation and are described in the following paragraphs.

10.7.3 Desk Study Information

10.7.3.1 The first step in the procedure is to consider specific elements of the desk study. These are tabulated below.

Summary of desk study information

Element	Interrogation	Outcome	SD1: 2005 reference
Geology	Likelihood of soils containing pyrites	**Likely**	Box C6
Past industrial uses	Brownfield site?	**No**	C2.1.2

Table 10.7

10.7.3.2 A brownfield site is defined in SD1: 2005 as a site, or part of a site which has been subject to industrial development, storage of chemicals (including for agricultural use) or deposition of waste, and which may contain aggressive chemicals in residual surface materials, or in ground penetrated by leachates. Where the history of the site is not known, it should be treated as brownfield until there is evidence to classify it as natural.

10.7.3.3 Based on the above it is necessary to follow the procedures described in figure C5 (*'sites or locations where disturbance of pyrite bearing natural ground could result in additional sulphate'*).

10.7.4 Assessment of Design Sulphate Class

10.7.4.1 The sulphate concentration in a 2:1 water/soil extract was measured in one sample of Made Ground and one sample of the London Clay Formation. The test result for each soil type has been adopted as the characteristic value.

10.7.4.2 Forming foundations by, for instance, cutting a trench through naturally deposited soils or driving pre-cast concrete piles through naturally deposited soils does not, generally, create disturbed ground as defined in BRE SD 1:2005. However, any arisings resulting from replacement piling or spread footing excavations used for bulk filling on site would be classified as disturbed ground. We have therefore assessed the potentially pyritic strata underlying the site in disturbed and undisturbed states.

10.7.4.3 Following the recommendations of SD1: 2005, we have scheduled additional testing on the same soil samples to include:-

- Determination of total sulphate content (% SO_4)
- Determination of total sulphate present (% S)

Using this test data we have calculated the total potential sulphate content (TPS, % SO_4) and the amount of oxidisable sulfides (OS % SO_4), again following the procedures described in SD1: 2005. As the amount of oxidisable sulfides does not exceed 0.3% SO_4, pyrite is probably not present.

10.7.4.4 The characteristic total potential sulphate content has been based on the highest TPS value (rounded to 0.1% SO_4, refer to table 10.7.4). With reference to table C1 of SD1: 2005, the design sulphate class has been based on considering both the initial characteristic value, and characteristic total potential sulphate content, and adopting the more onerous of these two values.

10.7.4.5 The concentration of sulphate was measured at less than 3000mg/l and thus the concentration of magnesium was not measured.

10.7.5 Assessment of groundwater mobility

10.7.5.1 With reference to SD1: 2005, Section C3.1, we are of the opinion that soils at the site generally have a low permeability and thus 'static' groundwater conditions are considered characteristic of the site.

10.7.6 Assessment of pH

10.7.5.1 Following SD1: 2005, Section C5.1.1 (step 4) only a 'small number' of samples have been tested and thus the characteristic value for pH within Made Ground and London clay deposits equates to the measured values of 8.3 and 7.9 respectively.

10.7.7 Assessment of aggressive chemical environment for concrete (ACEC)

10.7.7.1 Based on the design sulphate class, characteristic value of pH and assessment of groundwater mobility, and with reference to table C1 of SDI: 2005, the ACEC class for each soil type is presented in Table 10.7.2 below.

Summary of concrete classification

Soil type	No. of samples	Characteristic pH	Groundwater mobility	Characteristic TPS	Characteristic sulphate (mg/l)	DS class	ACEC class
Made Ground	1	8.3	Static	N/A	100	DS-1	AC-1s
London Clay Formation	1	7.9	Static	N/A	680	DS-2	AC-1s
London Clay Formation (disturbed)				2.16		DS-2	AC-1s

Table reference 10.7.7

11 Classification of waste soils under the Waste Acceptance Criteria

11.1 The Landfill Directive

11.1.1 The Landfill Directive represents an important change in the way we dispose of waste. It encourages waste minimisation by promoting increased levels of recycling and recovery. The Landfill Directive became law in 1999 and transcribed into the Landfill (England and Wales) Regulations which came into force in 2002. These Regulations were amended in 2005 by introducing criteria to classify soils for disposal to landfill. It is the duty of the waste producer (the client) to classify the soils for this purpose.

11.2 Classification of soil types

11.2.1 Our investigations consider two soil types which may be generated as wastes as part of construction operations, potentially contaminated soil and uncontaminated soil. A full hazard assessment and subsequent testing for waste acceptance criteria is undertaken on soils which are not considered to be naturally deposited or are likely to be affected by artificial contamination. For soils that are unlikely to be affected by artificial contamination (such as natural soils), specific testing in relation to the classification process is not necessary.

11.3 Waste acceptance criteria (WAC)

11.3.1 The Environment Agency publication, *'Framework for the classification of contaminated soils as hazardous wastes'* (July 2004), provides an appropriate procedure for establishing if the soils are hazardous or non-hazardous and applies to soils that are identified as potentially contaminated. Uncontaminated, natural soils are considered separately (see Section 11.6).

11.3.2 Primary classification

11.3.2.1 The first stage is classifying a potentially 'contaminated' soil for disposal to landfill is to establish its chemical status by first identifying potential sources/types of chemical contamination (desk study) followed by intrusive site investigations to obtain samples for undefined testing of soil samples to measure concentrations of chemical contaminants. Such data provides information to partly complete the basic characteristic checklist.

11.3.2.2 Laboratory test data is then compared with the Environment Agency publication '*hazardous waste – Interpretation of the definition and classification of hazardous waste (second edition, version 2.1)'.* Where the waste is suspected to contain oil, we have referred to the Environment Agency draft consultation paper *'How to Find Out if Waste Oil and Wastes that Contain Oil are Hazardous'* (Draft Version 2.5 – October 2006). With reference to these documents a hazard assessment has been carried out to enable categorisation of the material as hazardous or non-hazardous and to subsequently establish the European Waste Catalogue (EWC) code (ref Section 11.3.4 below).

11.3.3 Secondary classification

11.3.3.1 If the soil is deemed hazardous then measurement of organic contaminants and leachable inorganic contaminants is necessary for comparison with values listed in the Environment Agency publication '*Guidance on sampling and testing of wastes to meet landfill waste acceptance procedures'* (April 2005) Table 5.1. Similarly should the soil be deemed as non-hazardous then such testing may also be undertaken to determine if it is potentially inert. This document also provides guidance on sampling materials and frequency as well as test procedures and quality assurance of testing.

11.3.3.2 The above procedures are described with respect to the subject site in the following sections Section 11.4 (primary) and 11.5 (secondary), leading to basic characterisation of soils for disposal. Subject to the results of the categorisation and anticipated development methodology, consideration should be given by the developer to reduce volumes of disposal or treatment to allow reclassification.

11.3.4 European waste catalogue (EWC) coding

11.3.4.1 The EWC 2002 is a catalogue of all wastes, grouped according to generic industry, process or waste type. It is divided into twenty main chapters, each with a two digit code between 01 and 20. Following the EWC, in our opinion, soils considered as part of this investigation would be categorised within 'Group 17' of the EWC catalogue, which comprises 'Construction and Demolition Wastes (including excavated soils from contaminated sites)'.

11.3.4.2 The Catalogue further categorises the waste, such that soils considered as part of this investigation would be classified as either 17 05 04 defined as *'soil and stones (other than those mentioned in 17 05 03)';* or 17 05 03* defined as soil or stones containing dangerous substances (where hazardous wastes are described by entries followed by an asterisk).

11.4 Primary classification

11.4.1 Soil types

11.4.1.1 Based on soils exposed in exploratory excavations, in combination with anticipated construction works, we assume soils requiring off-site disposal will comprise Made Ground and London Clay Formation generated from basement excavations and general site clearance.

11.4.2 Classification as hazardous or non-hazardous waste

11.4.2.1 The Environment Agency publication '*Framework for the classification of contaminated soils as hazardous wastes'* (July 2004) provides the following procedure for establishing if the soils are hazardous or non-hazardous. The first stage in classifying a potentially 'contaminated' soil for disposal is to establish its chemical status by first identifying potential sources/types of chemical contamination (desk study) followed by intrusive site investigations to obtain samples for laboratory testing of soil samples to measure concentrations of chemical contaminants.

11.4.2.2 An assessment of potential source of contamination is presented in Section 8 of this report. Laboratory testing has been set as deemed appropriate to our source assessment.

11.4.2.3 We have carried out an analysis of test data for each chemical contaminant considered in this investigation. Should the analysis indicate potentially hazardous properties then a process of zoning by further analysing the site history, geological conditions and analytical data may be undertaken.

11.4.2.4 Laboratory test data measures the concentration of anions, which are unlikely to exist in the pure metallic form in the soil, but probably exist as a compound. Following guidance provided in the Environment Agency Technical Guidance WM3 *'Guidance on the classification and assessment of waste'* (2015), we have reviewed a variety of compounds for each of the metallic and semi metallic elements we have tested.

11.4.2.5 To determine the hazardous waste properties for each element, we have reviewed chemical compounds listed in Table 3.2 of Annex VI of the European Regulation (1272/2008) for Classification, Labelling and Packaging (CLP) of chemicals which has now superseded the Approved Supply List (Published by the Health and Safety Executive) for the classification of hazardous chemicals in the UK. In order to provide a 'worst case' scenario, initially we adopt the most severe hazardous properties (risk phrases) associated with the various compounds for each element under review. If measured concentrations produce a hazardous outcome then the element or elements are reassessed on a site specific basis. For review of organic contamination, we have directly adopted the threshold concentrations for the appropriate organic compounds listed in Table 3.2.

11.4.2.6 The compound or compounds adopted for each element is used to convert the measured metallic concentration to the substance concentration using their respective molecular weights. This derived conversion factor is then used in the threshold concentration spreadsheet (refer paragraph 11.3.2.8 below).

11.4.2.7 Our assessment of each of the chemical substances is maintained on our files and is available for confidential review/audit by the Environment Agency.

11.4.2.8 A spreadsheet detailing the hazard assessment following the procedures described in *'framework for the classification of contaminated soils as hazardous wastes'* is presented in Appendix J.

11.4.2.9 The spreadsheet indicates the soils are **non-hazardous**.

11.5 Secondary assessment

11.5.1 Following '*Guidance on sampling and testing of wastes to meet landfill waste acceptance procedures'* produced by the Environment Agency (Version 1, April 2005) we have scheduled testing of **one** sample to measure the parameters listed in table 5.1 (landfill waste acceptance criteria) included in the above publication. A copy of the test result certificate is presented in Appendix G. The source of the composite sample(s) is detailed below:

Composition of soil samples for classification testing

Strata	Source		Soil Type
Made Ground	TP01	0.05 – 1.0m	Brown to grey slightly silty sandy gravel, clayey gravelly sand and sandy gravelly clay. Gravel consists of brick, concrete, sandstone, bituminous bound material and flint.
	TP02	0.4m	
	DTS01	0.2m	
	DTS01	0.5m	
	DTS02	0.5m	
	DTS01	0.8m	

Table 11.5.1

11.5.2 The sample was deemed representative of Made Ground soils as described in Section 5. The sample was formed by combining individual samples taken from exploratory excavations within the Made Ground. The combined sample was then quartered in the laboratory to produce a representative sample for subsequent testing.

11.5.3 Laboratory test data has been compared with the landfill waste acceptable criteria (table 5.1) to allow the secondary assessment to be completed. A copy of table 5.1 is presented in Appendix F with test result data added for ease of comparison.

11.5.4 Comparison of test data with landfill waste acceptance criteria indicates that Made Ground soils are suitable for disposal as **non-hazardous waste** but cannot be classified as inert due to elevated antimony.

11.6 Naturally deposited soils not affected by artificial contaminants

11.6.1 With reference to the European Waste Catalogue and table 5.1 of the Environment Agency publication *'a better place – guidance for waste destined for disposal in landfills – version 2 June 2006'*, naturally occurring soils not likely to be affected by contamination can be classified as inert waste, with a EWC code of 17 05 04. Should any of the naturally deposited soils be suspected to contain contamination (by virtue of visual of olfactory evidence) upon excavation, then such soils should be stockpiled appropriately and additional testing carried out as considered necessary. Based on evidence obtained during our investigations, we are of the opinion that the London Clay Formation deposits at the site are not likely to be affected by chemical contamination and thus can be classified as **inert waste.**

11.7 Basic categorisation

11.7.1 Based on the preceding assessment, we have produced **two** basic categorisation schedules relating to the Made Ground and London Clay deposits, which are presented in Appendix L. This schedule should be provided together with a copy of this report to an appropriately licensed landfill facility to demonstrate the material can be deposited at this facility.

11.7.2 We understand that some landfill sites have licences which have restrictions on concentrations of chemical contaminants and thus we recommend this report is provided to the selected landfill facility to confirm (or otherwise) it can accept the waste. Please be aware that landfill sites are obligated to undertake in house quality assurance tests and thus may require further WAC testing for any soils encountered as part of this investigation. There is no obligation on any landfill operator to accept waste if they choose not to and waste operators may require additional testing of untested waste soils prior to acceptance at landfill in accordance with the landfill regulations.

11.8 Treatment of waste

11.8.1 Treatment of wastes is now a requirement of the landfill directive applied by the Landfill (England and Wales) Regulations 2002. Landfill cannot accept untreated waste (be it hazardous or non-hazardous), thus waste producers have the choice of treating it themselves on site or treating it elsewhere prior to disposal to landfill. The regulations require:

> *'10 – (1) The operator of a landfill shall ensure that the landfill is only used for landfilling waste which is subject to prior treatment unless:*
>
> *a) It is inert waste for which treatment is not technically feasible; or*
>
> *b) It is waste other than inert waste and treatment would not reduce its quantity or the hazards which it poses to human health or the environment.'*

11.8.2 Regulation 2 defines treatment as: *'physical, thermal, chemical or biological processes (including sorting) that change the characteristics of waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery.'*

11.8.3 A treatment option must comply with the definition of treatment. This involves a 'three point test' against which treatment is assessed i.e.

1. It must be a physical, thermal, chemical or biological process including sorting
2. It must change the characteristics of the waste: and
3. It must do so in order to:
    a) Reduce its volume: or
    b) Reduce its hazardous nature: or
    c) Facilitate its handling: or
    d) Enhance its recovery.

11.8.4 Treatment of inert wastes

11.8.4.1 Inert waste does not need to be treated if it is not technically feasible however treatment should reduce the amount of waste which goes to landfill and enhance its recovery (by re-use or recycling). Inert wastes are often suitable for recycling, for example as an aggregate or an engineering fill material. A fact sheet on treatment of inert wastes is available on the following website www.environment-agency.gov.uk

11.8.4.2 Clearly, excavations in the London Clay Formation will generate inert wastes which could be reused on site or off site for bulk filling, subject of course to maintenance of an acceptable water content and provided that it is fit for its intended purpose.

11.8.5 Treatment of non-hazardous waste

11.8.5.1 Guidance and indeed examples of treatment is provided in the Environment Agency publication '*Treatment of non-hazardous wastes for landfill - your waste – your responsibility,'* again available on the EA website.

11.8.6 Landfill operators

11.8.6.1 It is a requirement of the landfill operator to check if the waste soils taken to the facility have been treated.

11.9 Reuse of Soils - Materials Management Plans

11.9.1 Where soils are to be moved and reused onsite, or are to be imported to the site, a Waste Exemption or an Environmental Permit is required.

11.9.2 An alternative is the use of a Materials Management Plan (MMP) to determine where soils are and are not considered to be a waste. By following *'The Definition of Waste: Development Industry Code of Practice'* published by CL:AIRE (produced in 2008 and revised in March 2011), soils that are suitable for reuse without the need for remediation (either chemical or geotechnical) and have a certainty of use, are not considered to be waste and therefore do not fall under waste regulations. In addition, following this guidance may present an opportunity to transfer suitable material between sites, without the need for Waste Exemptions or Environmental Permits.

11.9.3 MMPs offering numerous benefits, including maximising the use of soils onsite, minimising soils going to landfill and reducing costs and time involved in liaising with waste regulators.

11.9.4 We can provide further advice on this and provide fees for producing a Materials Management Plan on further instructions.

12 Further investigations

12.1 At this stage we do not consider further investigations to be necessary.

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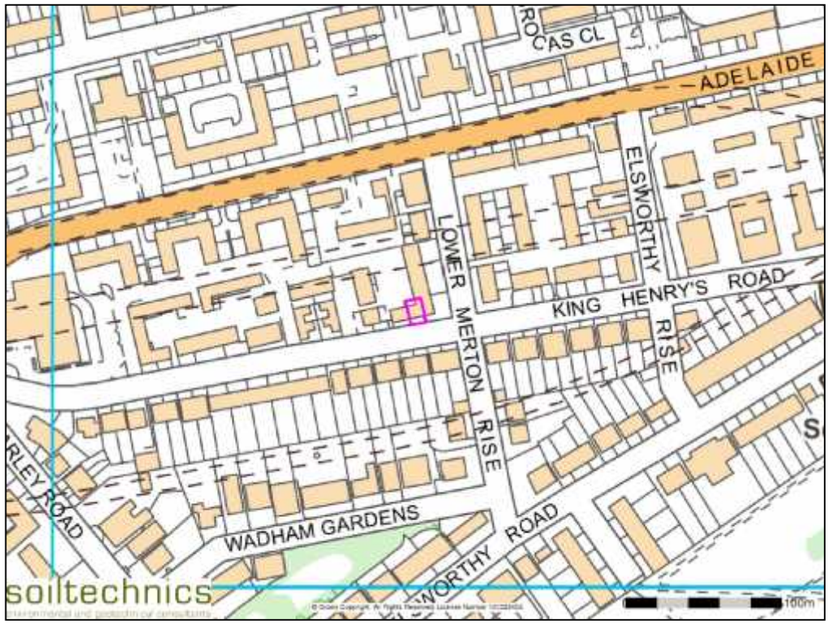
Neighbourhood extract from Ordnance Survey map

Town extract from Ordnance Survey map



Detail extract from Ordnance Survey map

Title	Scale	Drawing number
Site location plan	Not to scale	01

Proposed residential redevelopment
106 King Henrys Road, London

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Approximate location of network rail asset

3 Three storey

Communal garden

Grass

Shrubs and tree up to 4m heigh

5 Three storey

Approximate extent of proposed basement

DTS01

Residential

Courtyard
(paving slabs)

TP02

104 Two storey

106 Two storey

Residential

110 Two storey

108 Two storey

Cobbles

TP01

Shed

Paving slabs

DTS02

Approximate site boundary

Lower Merton Rise

King Henrys Road

Residential

Key

DTS — Approximate location of borehole formed by Driven Tube Sampling techniques

TP — Approximate location of trial pit excavation

Title	Scale	Drawing number
Plan showing existing site features and location of exploratory points	1:200 at A3	02

Proposed residential redevelopment
106 King Henrys Road, London

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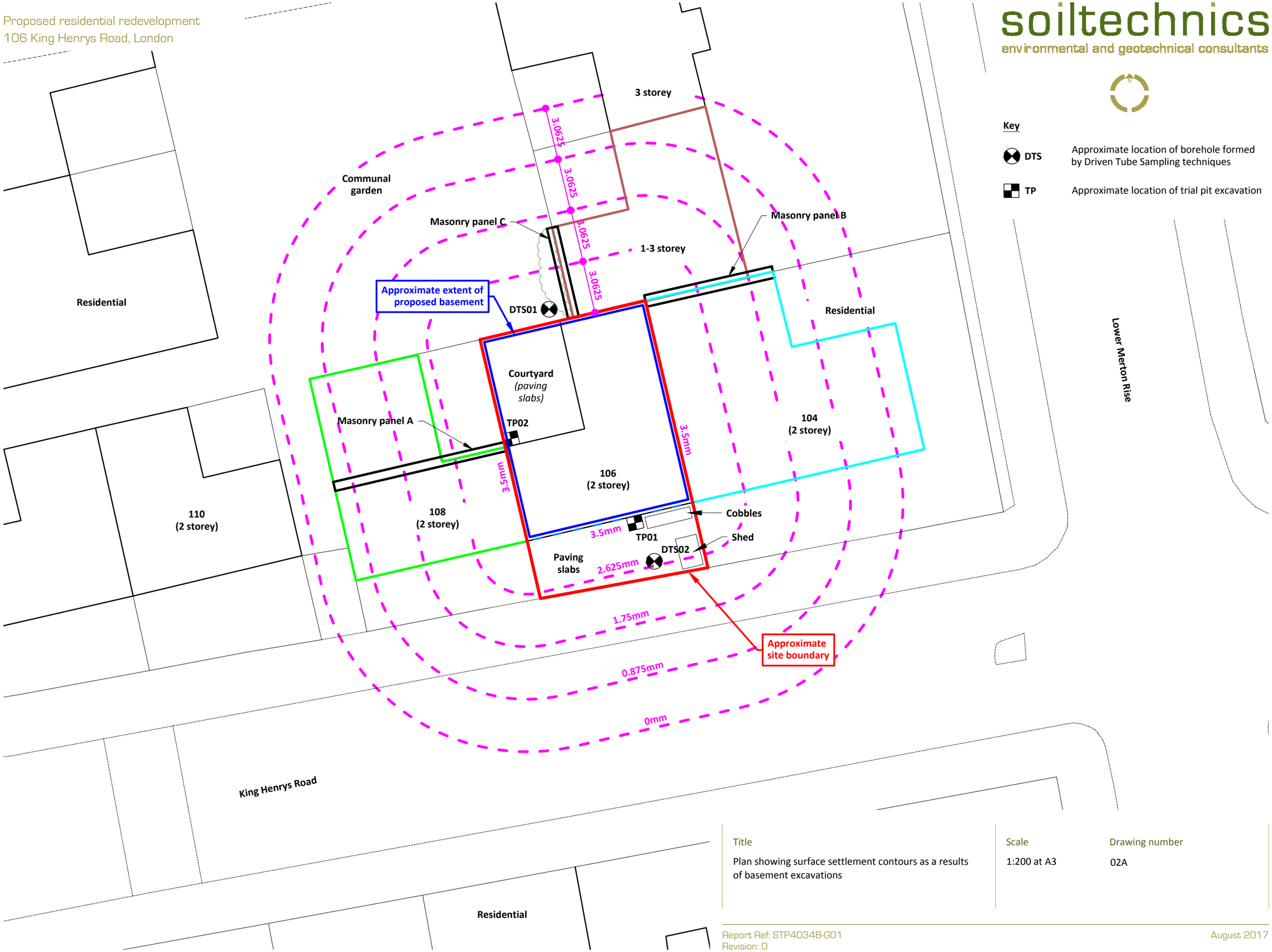


Key

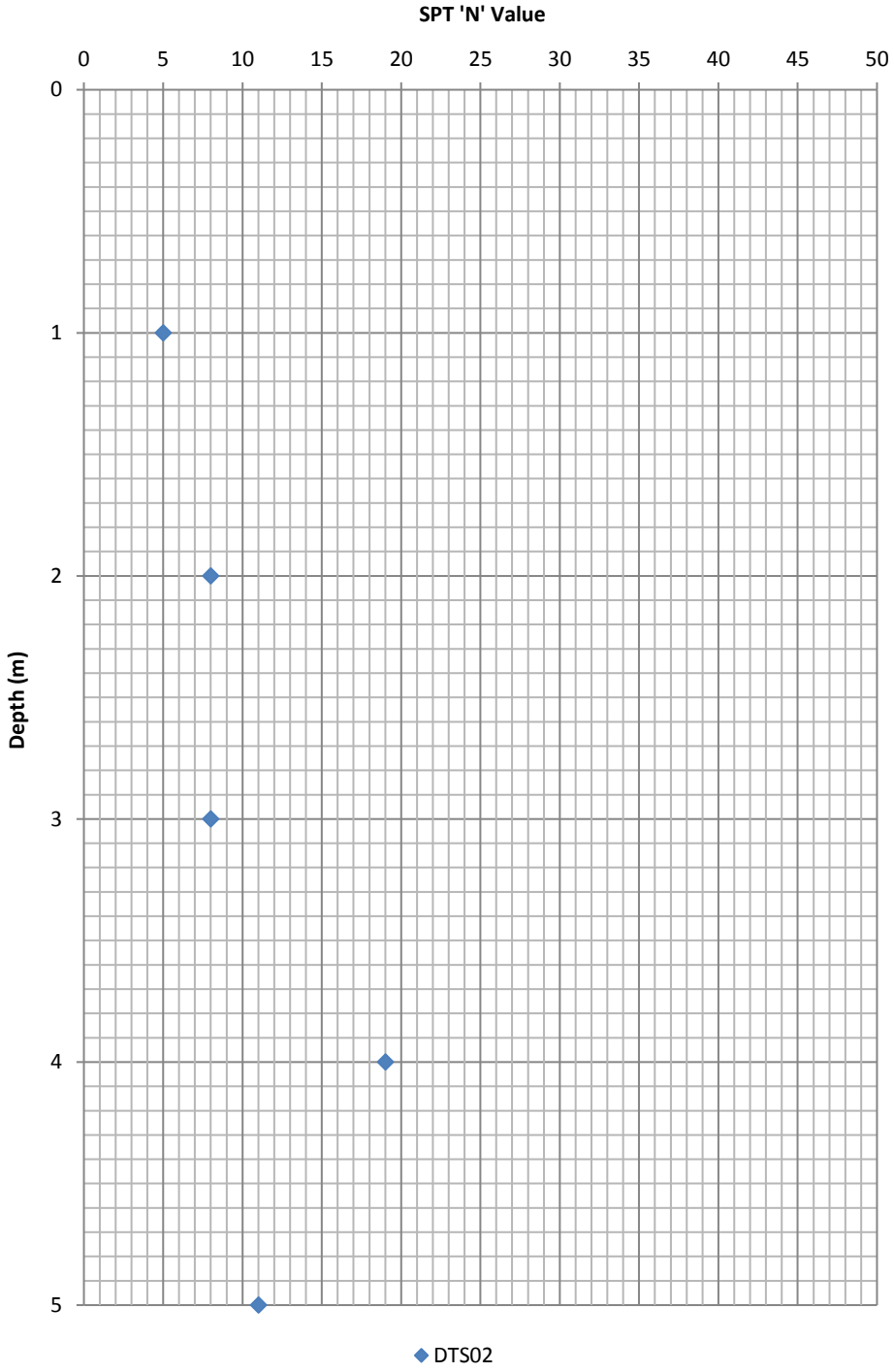
DTS — Approximate location of borehole formed by Driven Tube Sampling techniques

TP — Approximate location of trial pit excavation

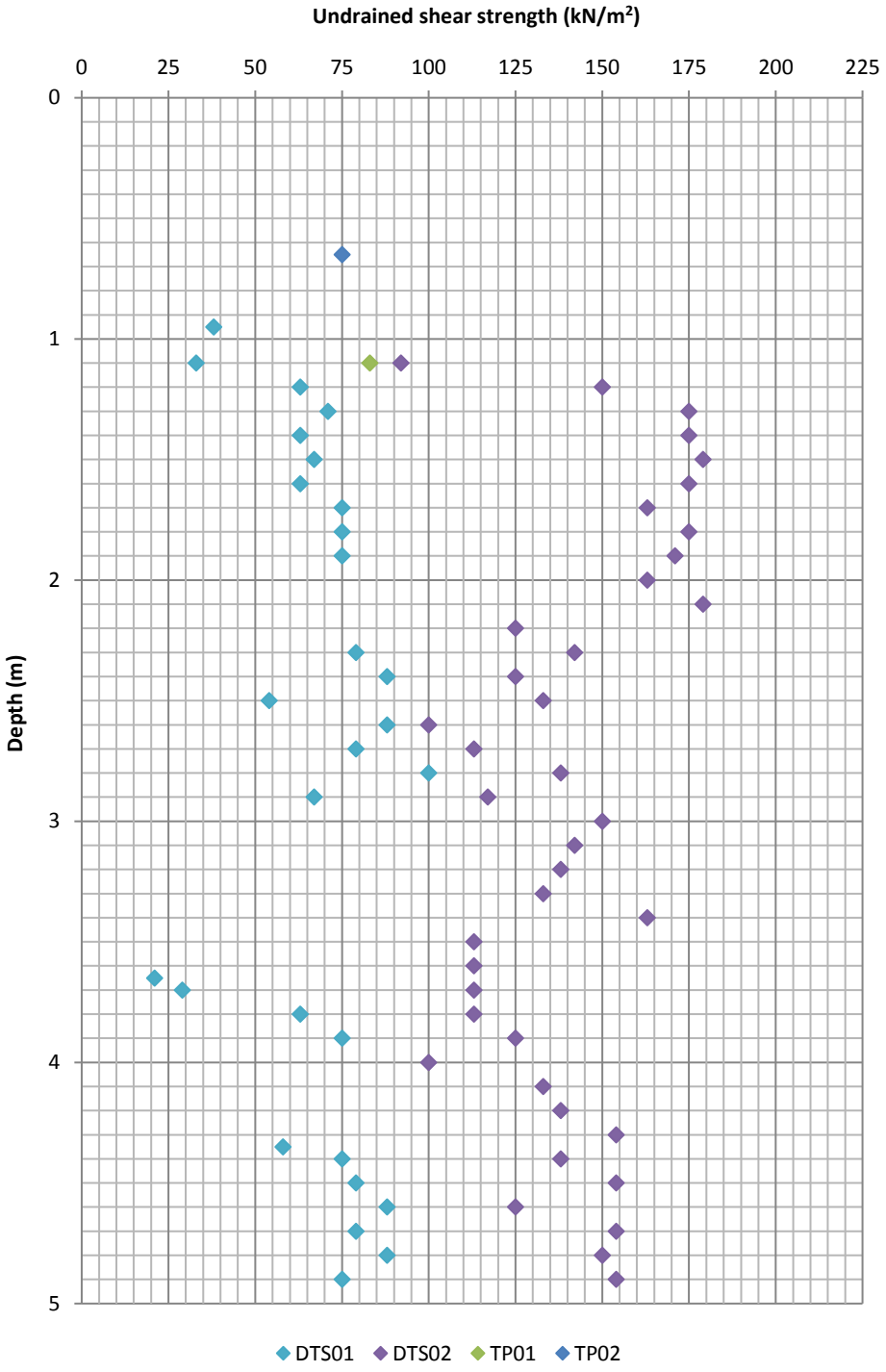
Title	Scale	Drawing number
Plan showing surface settlement contours as a results of basement excavations	1:200 at A3	02A

Report Ref: STP4034B-G01
Revision: 0

August 2017



Title	Scale	Drawing number
Plot summarising results of standard penetration test results by location	As shown	03



Notes

1) Equivalent undrained shear strength derived by multiplying Pocket Penetrometer (PP) results by 50

Title	Scale	Drawing number
Plot summarising results of pocket penetrometer determinations by location	As shown	04

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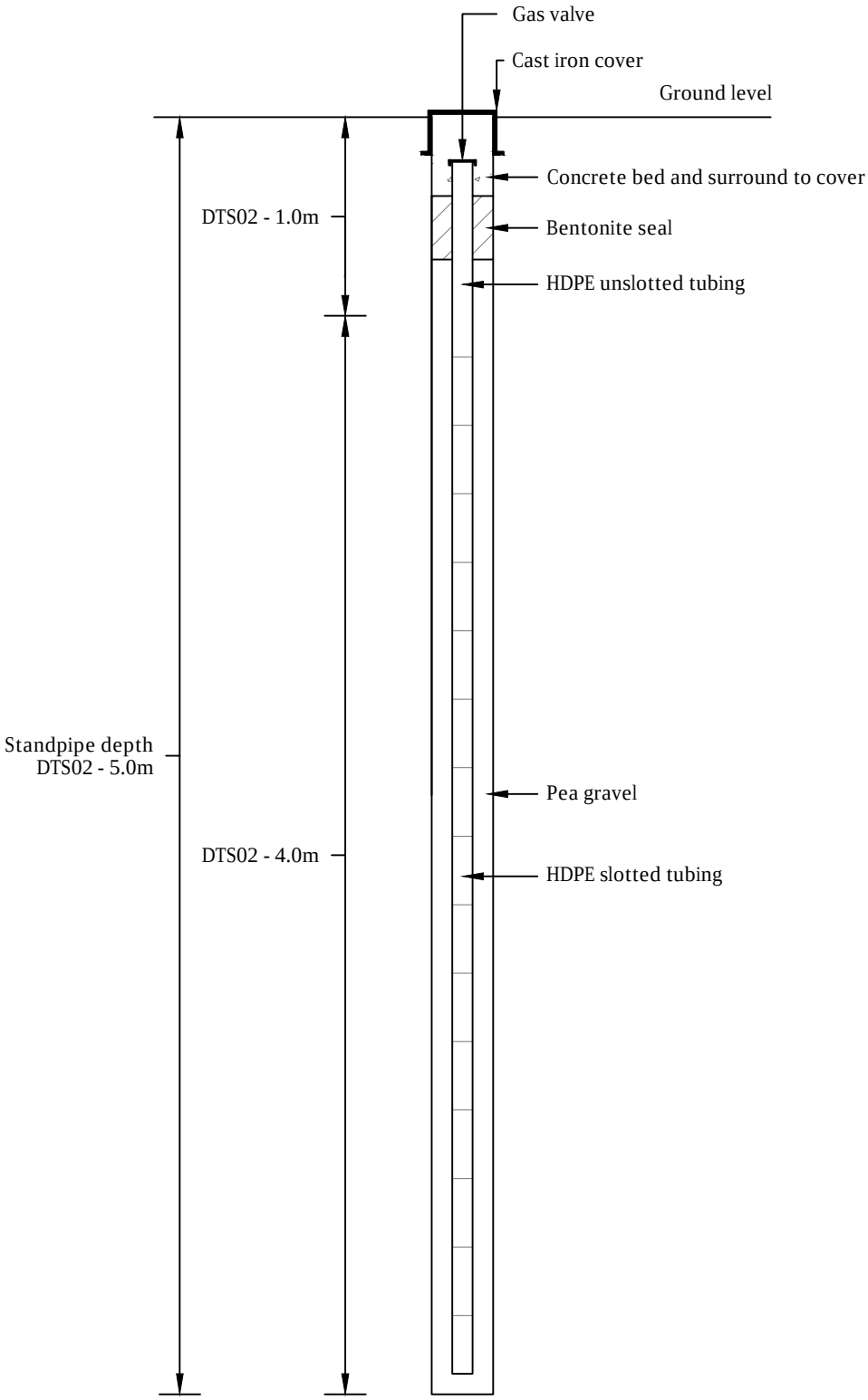

Title	Scale	Drawing number
Section showing construction of monitoring standpipe installed in borehole DTS02	Not to scale	06

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Definition of geotechnical terms used in this report - foundations

Strip foundations.
A foundation providing a continuous longitudinal ground bearing.

Trench fill concrete foundation.
A trench filled with mass concrete providing continuous longitudinal ground bearing.

Pad foundation.
An isolated foundation to spread a concentrated load.

Raft foundation.
A foundation continuous in two directions, usually covering an area equal to or greater than the base area of the structure.

Substructure.
That part of any structure (including building, road, runway or earthwork) which is below natural or artificial ground level. In a bridge this includes piers and abutments (and wing walls), whether below ground level or not, which support the superstructure.

Piled foundations and end bearing piles. A pile driven or formed in the ground for transmitting the weight of a structure to the soil by the resistance developed at the pile point or base and the friction along its surface. If the pile supports the load mainly by the resistance developed at its point or base, it is referred to as an end-bearing pile; if mainly by friction along its surface, as a friction pile.

Bored cast in place pile.
A pile formed with or without a casing by excavating or boring a hole in the ground and subsequently filling it with plain or reinforced concrete.

Driven pile.
A pile driven into the ground by the blows of a hammer or a vibrator.

Precast pile.
A reinforced or prestressed concrete pile cast before driving.

Driven cast in place pile.
A pile installed by driving a permanent or temporary casing, and filling the hole so formed with plan or reinforced concrete.

Displacement piles.
Piled formed by displacement of the soil or ground through which they are driven.

Skin friction.
The frictional resistance of the surrounding soil on the surface of cofferdam or caisson walls, and pile shafts.

Downdrag or negative skin friction. A downwards frictional force applied to the shaft of a pile caused by the consolidation of compressible strata, e.g. under recently placed fill. Downdrag has the effect of adding load to the pile and reducing the factor of safety.

Definition of geotechnical terms used in this report – bearing values

Ultimate bearing capacity.
The value of the gross loading intensity for a particular foundation at which the resistance of the soil to displacement of the foundation is fully mobilised.

Presumed bearing value.
The net loading intensity considered appropriate to the particular type of ground for preliminary design purposes. The particular value is based on calculation from shear strength tests or other field tests incorporating a factor of safety against shear failure.

Allowable bearing pressure.
The maximum allowable net loading intensity at the base of the foundation, taking into account the ultimate bearing capacity, the amount and kind of settlement expected and our estimate of ability of the structure to accommodate this settlement.

Factor of safety.
The ratio of the ultimate bearing capacity to the intensity of the applied bearing pressure or the ratio of the ultimate load to the applied load.

Definition of geotechnical terms used in this report – road pavements

The following definitions are based on Transport and Road Research Laboratory (TRRL) Report LR1132.

Equilibrium CBR values.
A prediction of the CBR value, which will be attained under the completed pavement.

***Thin pavement*.**
A thin pavement (which includes both bound and unbound pavement construction materials 1 in 300mm thick and a thick pavement is 1200mm thick (typical of motorway construction).

Definition of geo-environmental terms used in this report

Conceptual model
Textual and/or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information obtained from the investigatory process.

Contamination
Presence of a substance which is in, on or under land, and which has the potential to cause harm or to cause pollution of controlled water.

Controlled water
Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three mile limit of territorial waters.

Harm
Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of humans, including property.

Pathway
Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.

Receptor
Persons, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by the contaminant(s).

Risk
Probability of the occurrence of, and magnitude of the consequences of, an unwanted adverse effect on a receptor.

Risk Assessment
Process of establishing, to the extent possible, the existence, nature and significance of risk.

Definition of environmental risk/hazard terms used in this report.

Based on CIRIA report C552 '*Contaminated land risk assessment – A guide to good practice*'.

Potential hazard severity definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures.
Mild	Pollution of non sensitive waters, minor damage to buildings or structures.
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non sensitive ecosystems or species.

Probability of risk definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable.

Level of risk for potential hazard definition

Probability of risk	Potential severity			
	Severe	Medium	Mild	Minor
High Likelihood	Very high	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low Likelihood	Moderate	Low/Moderate	Low	Very low
Unlikely	Low/Moderate	Low	Very low	Very low

Refer sheet 2 for definitions of 'very high' to 'low'

Definition of environmental risk/hazard terms used in this report.

Based on CIRIA report C552 '*Contaminated land risk assessment – A guide to good practice'.*

Risk classifications and likely action required:

Very high risk
High probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.

High risk
Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

Moderate risk
It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

Low risk
It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

Very low risk
It is a low possibility that harm could arise to a designated receptor. On the event of such harm being realised it is not likely to be severe.

List of documents used in assessment of chemical contamination

No.	Title	Publication reference / publisher
1	Human health toxicological assessment of contaminants in soil	EA Science Report – SC050021/SR2
2	Updated technical background to the CLEA model	EA Science Report – SC050021/SR3
3	CLEA Software (Version 1.03 beta) Handbook	EA Science Report - SC050021/SR4
4	Guidance on comparing Soil Contamination Data with a Critical Concentration	CIEH
5	The LQM/CIEH S4ULs for Human Health Risk Assessment (2015)	LQM/CIEH
6	Assessment of Risks to Human Health from Land Contamination: An overview of the development of soil guideline values and related research	R&D Publication, Contaminated Land Report CLR 7
7	Contaminants of Soil: Collation of Toxicological Data and Intake Values for Humans	R&D Publication, Contaminated Land Report CLR 9
8	The Contaminated Land Exposure Assessment Model (CLEA): Technical Basis and Algorithms	R&D Publication, Contaminated Land Report CLR 10
9	Model Procedures for the Management of Land Contamination	R&D Publication, Contaminated Land Report CLR 11
10	Contaminants in Soil: Collection of Toxicological Data and Intake Values for Human Values	R&D Publications, Tox. 6
11	Soil Guideline Values for Contamination (2002)	R&D Publications, SGV 10
12	Soil Guideline Values (2009)	EA Science Reports – SC050021
13	Atkins ATRISK^{SOIL} (2011)	http://www.atrisksoil.co.uk
14	Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (September 2014)	CL:AIRE

CIEH	Chartered institute of Environmental Health
LQM	Land Quality Management
EA	Environment Agency
CL:AIRE	Contaminated Land: Applications in Real Environments

Testing suite summary

Table summarising testing suites		
Suite	**Parameters**	**Medium**
Suite 1	Arsenic, beryllium, boron, cadmium, chromium (total and VI), copper, lead, mercury, nickel, selenium, vanadium zinc, cyanide (free, total and complex), organic matter content, PAH (16 speciated), pH, phenol (total), TOC	Soil
Suite 2	Arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, PAH (16 speciated), pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Leachate
Suite 3	Arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, PAH (16 speciated), pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Water
Suite 4	TPH Texas Banding Aliphatic/Aromatic Split, PAH (16 speciated), TOC	Soil
Suite 5	TPH Texas Banding Aliphatic/Aromatic Split, PAH (16 speciated)	Leachate
Suite 6	TPH Texas Banding Aliphatic/Aromatic Split, PAH (16 speciated)	Water
Suite 7	TPH Texas Banding Aliphatic/Aromatic Split, TOC, organic matter	Soil
Suite 8	Sulphur (total), sulphate (water and acid soluble), pH	Soil
Suite 9	Sulphate, ammoniacal nitrogen, dissolved magnesium, pH	Water
Suite 10	VOC, SVOC, TOC, organic matter	Soil
Suite 11	VOC, SVOC	Leachate
Suite 12	VOC, SVOC	Water
Suite 13	Organotins dibutyltin/ tributyl-tin/tetrabutyltin/triphenyl-tin, Tetraethyl-lead/tetramethyl-lead	Soil
Suite 14	Organotin	Leachate
Suite 15	Organotin	Water
Suite 16	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, VOC, SVOC	Soil, water, leachate
Suite 17	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, SVOC, VOC, arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Soil, water, leachate
Concrete BRE suite	pH, sulphate (water and acid soluble), magnesium (water soluble), ammonia (water soluble), chloride, nitrate	Soil

Pocket Penetrometer Results

Location	Depth (m)	Results				Undrained Shear Strength (kN/m^2)	Strength Term	Strata
		1	2	3	Av.			
DTS01	0.95	0.75	0.75	0.75	*0.8*	*38*	Low	LONDON CLAY FORMATION
	1.1	0.5	0.5	1	*0.7*	*33*	Low	LONDON CLAY FORMATION
	1.2	1.25			*1.3*	*63*	Medium	LONDON CLAY FORMATION
	1.3	1.5	1.5	1.25	*1.4*	*71*	Medium	LONDON CLAY FORMATION
	1.4	1.25			*1.3*	*63*	Medium	LONDON CLAY FORMATION
	1.5	1.25	1.25	1.5	*1.3*	*67*	Medium	LONDON CLAY FORMATION
	1.6	1.25			*1.3*	*63*	Medium	LONDON CLAY FORMATION
	1.7	1.5	1.5	1.5	*1.5*	*75*	High	LONDON CLAY FORMATION
	1.8	1.5			*1.5*	*75*	High	LONDON CLAY FORMATION
	1.9	1.5	1.5	1.5	*1.5*	*75*	High	LONDON CLAY FORMATION
	2.3	1.5	1.5	1.75	*1.6*	*79*	High	LONDON CLAY FORMATION
	2.4	1.5	1.5	2.25	*1.8*	*88*	High	LONDON CLAY FORMATION
	2.5	1.5	1.5	0.25	*1.1*	*54*	Medium	LONDON CLAY FORMATION
	2.6	1.75			*1.8*	*88*	High	LONDON CLAY FORMATION
	2.7	1.25	1.5	2	*1.6*	*79*	High	LONDON CLAY FORMATION
	2.8	2			*2.0*	*100*	High	LONDON CLAY FORMATION
	2.9	1.5	1.5	1	*1.3*	*67*	Medium	LONDON CLAY FORMATION
	3.65	0.25	0.5	0.5	*0.4*	*21*	Low	LONDON CLAY FORMATION
	3.7	0.5	0.5	0.75	*0.6*	*29*	Low	LONDON CLAY FORMATION
	3.8	1.25	1.25	1.25	*1.3*	*63*	Medium	LONDON CLAY FORMATION
	3.9	1.5	1.5	1.5	*1.5*	*75*	High	LONDON CLAY FORMATION
	4.35	1	1.25	1.25	*1.2*	*58*	Medium	LONDON CLAY FORMATION
	4.4	1.5			*1.5*	*75*	High	LONDON CLAY FORMATION
	4.5	1.5	1.5	1.75	*1.6*	*79*	High	LONDON CLAY FORMATION
	4.6	1.75			*1.8*	*88*	High	LONDON CLAY FORMATION
	4.7	1.5	1.5	1.75	*1.6*	*79*	High	LONDON CLAY FORMATION
	4.8	1.75			*1.8*	*88*	High	LONDON CLAY FORMATION
	4.9	1.5	1.5	1.5	*1.5*	*75*	High	LONDON CLAY FORMATION
DTS02	1.1	2.25	1.25	2	*1.8*	*92*	High	LONDON CLAY FORMATION

Notes

1. Pocket penetrometer determinations converted to undrained shear strength using a factor of 50.

2. Undrained shear strength is based on average pocket penetrometer determination.

3. Strength terms in accordance with BS EN IS0 14688-2 2004.

Title	Appendix
Table summarising results of pocket penetrometer determinations	C

Pocket Penetrometer Results

Location	Depth (m)	Results				Undrained Shear Strength (kN/m^2)	Strength Term	Strata
		1	2	3	Av.			
DTS02	1.2	3			*3.0*	*150*	Very high	LONDON CLAY FORMATION
	1.3	3.5	3.5	3.5	*3.5*	*175*	Very high	LONDON CLAY FORMATION
	1.4	3.5			*3.5*	*175*	Very high	LONDON CLAY FORMATION
	1.5	3.5	3.5	3.75	*3.6*	*179*	Very high	LONDON CLAY FORMATION
	1.6	3.5			*3.5*	*175*	Very high	LONDON CLAY FORMATION
	1.7	3.25			*3.3*	*163*	Very high	LONDON CLAY FORMATION
	1.8	3.5			*3.5*	*175*	Very high	LONDON CLAY FORMATION
	1.9	3.25	3.5	3.5	*3.4*	*171*	Very high	LONDON CLAY FORMATION
	2	3.25			*3.3*	*163*	Very high	LONDON CLAY FORMATION
	2.1	3.75	3.5	3.5	*3.6*	*179*	Very high	LONDON CLAY FORMATION
	2.2	2.5			*2.5*	*125*	High	LONDON CLAY FORMATION
	2.3	2.5	3	3	*2.8*	*142*	High	LONDON CLAY FORMATION
	2.4	2.5			*2.5*	*125*	High	LONDON CLAY FORMATION
	2.5	2.75	2.25	3	*2.7*	*133*	High	LONDON CLAY FORMATION
	2.6	2			*2.0*	*100*	High	LONDON CLAY FORMATION
	2.7	2.25			*2.3*	*113*	High	LONDON CLAY FORMATION
	2.8	2.75			*2.8*	*138*	High	LONDON CLAY FORMATION
	2.9	2.25	2.5	2.25	*2.3*	*117*	High	LONDON CLAY FORMATION
	3	3			*3.0*	*150*	Very high	LONDON CLAY FORMATION
	3.1	2.75	3	2.75	*2.8*	*142*	High	LONDON CLAY FORMATION
	3.2	2.75			*2.8*	*138*	High	LONDON CLAY FORMATION
	3.3	2.75	2.75	2.5	*2.7*	*133*	High	LONDON CLAY FORMATION
	3.4	3.25			*3.3*	*163*	Very high	LONDON CLAY FORMATION
	3.5	2.25	2.25	2.25	*2.3*	*113*	High	LONDON CLAY FORMATION
	3.6	2.25			*2.3*	*113*	High	LONDON CLAY FORMATION
	3.7	2.5	2	2.25	*2.3*	*113*	High	LONDON CLAY FORMATION
	3.8	2.25			*2.3*	*113*	High	LONDON CLAY FORMATION
	3.9	2.5			*2.5*	*125*	High	LONDON CLAY FORMATION
	4	2			*2.0*	*100*	High	LONDON CLAY FORMATION

Notes

1. Pocket penetrometer determinations converted to undrained shear strength using a factor of 50.

2. Undrained shear strength is based on average pocket penetrometer determination.

3. Strength terms in accordance with BS EN ISO 14688-2 2004.

Title	Appendix
Table summarising results of pocket penetrometer determinations	C

Pocket Penetrometer Results

Location	Depth (m)	Results				Undrained Shear Strength (kN/m^2)	Strength Term	Strata
		1	2	3	Av.			
DTS02	4.1	3	2.5	2.5	*2.7*	*133*	High	LONDON CLAY FORMATION
	4.2	2.75			*2.8*	*138*	High	LONDON CLAY FORMATION
	4.3	3.5	2.75	3	*3.1*	*154*	Very high	LONDON CLAY FORMATION
	4.4	2.75			*2.8*	*138*	High	LONDON CLAY FORMATION
	4.5	3	3	3.25	*3.1*	*154*	Very high	LONDON CLAY FORMATION
	4.6	2.5			*2.5*	*125*	High	LONDON CLAY FORMATION
	4.7	3	3.25	3	*3.1*	*154*	Very high	LONDON CLAY FORMATION
	4.8	3			*3.0*	*150*	Very high	LONDON CLAY FORMATION
	4.9	3.25	3	3	*3.1*	*154*	Very high	LONDON CLAY FORMATION
TP01	1.1	1.75	1.75	1.5	*1.7*	*83*	High	LONDON CLAY FORMATION
TP02	0.65	1.5	1.5	1.5	*1.5*	*75*	High	LONDON CLAY FORMATION

Notes

1. Pocket penetrometer determinations converted to undrained shear strength using a factor of 50.

2. Undrained shear strength is based on average pocket penetrometer determination.

3. Strength terms in accordance with BS EN ISO 14688-2 2004.

Title	Appendix
Table summarising results of pocket penetrometer determinations	C

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Standard Penetration Test Results

Location	Depth to top of SPT (m)	Results						Penetration (mm)					
		Seating 1	Seating 2	Main 1	Main 2	Main 3	Main 4	Total Seating	Total Main	Total Seating	Total Main	Relative Density	Strata
DTS02	1	0	1	2	1	1	1	1	5	150	300		MADE GROUND
	2	1	1	1	2	2	3	2	8	150	300		LONDON CLAY FORMATION
	3	2	1	2	2	2	2	3	8	150	300		LONDON CLAY FORMATION
	4	4	3	9	3	3	4	7	19	150	300		LONDON CLAY FORMATION
	5	2	2	3	3	2	3	4	11	150	300		LONDON CLAY FORMATION

Notes

1) Relative Density in accordance with BS 5930 2015 - Table 10 for granular soils only.

Title

Table summarising results of standard penetration testing

Appendix

C

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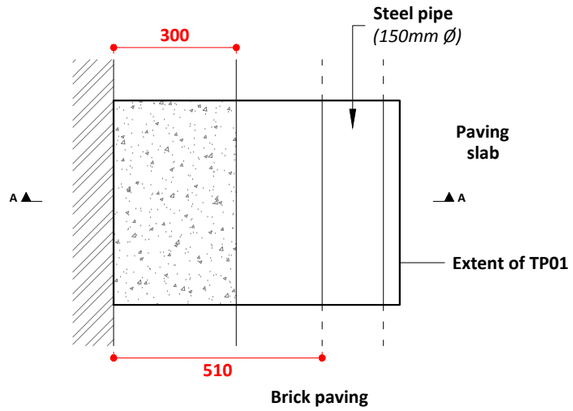
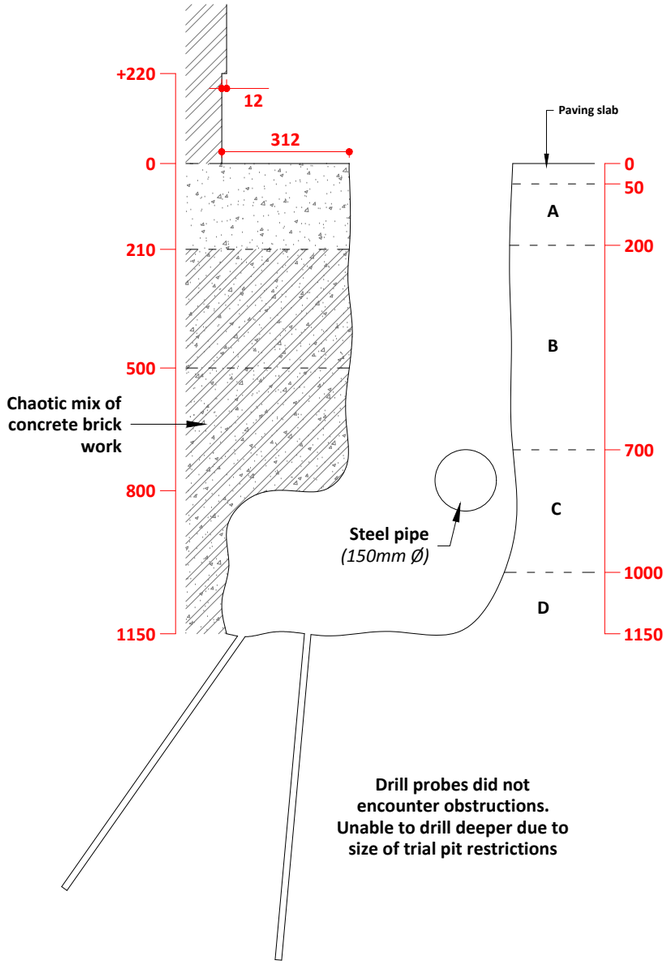
Plan



Section A-A



Photographic record

Key

A. Loose dark brown slightly clayey slightly gravelly SAND. Gravel consists of fine flint.
(MADE GROUND)

B. Soft to firm grey brown gravelly very sandy CLAY. Gravel consists of fine to coarse sub-angular flint, brick and occasional concrete.
(MADE GROUND)

C. Firm to stiff brown gravelly very sandy CLAY. Gravel consists of fine to coarse angular brick and flint.
(MADE GROUND)

D. Firm orange brown slightly silty slightly sandy CLAY.
(LONDON CLAY FORMATION)

Observed features
Assumed features

Denotes brickwork
Denotes concrete

Notes

1. All dimensions shown in millimetres.
2. Disturbed samples taken from 0.05-1.0m, 0.05-0.2m, 1.0-1.15m depths.
3. Environmental samples taken from 0.2-0.7m and 0.7-1.0m depths.
3. Pocket penetrometer testing:
   - PP 1.1m - 83 kN/m^2

Method of excavation	Hand tools
Dimensions	As shown
Groundwater observations	No groundwater encountered.
Title	Trial pit record
Date of works	28.06.2017
Scale	1:15 at A3
Location reference	TP01
Location plan on drawing number	02
Appendix	D

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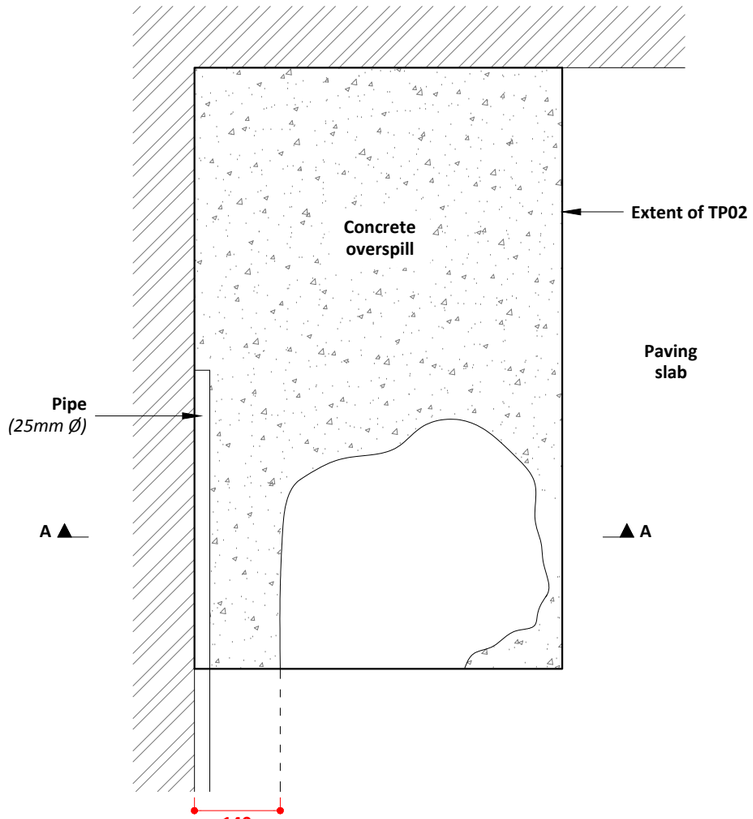
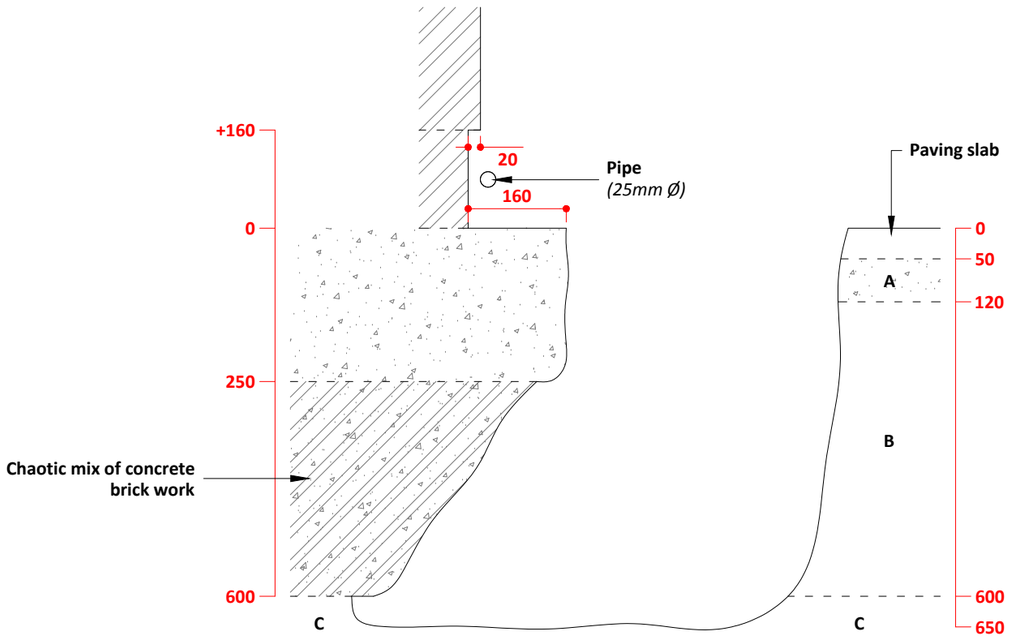
Plan



Section A-A



Photographic record

Key

A. Grey unreinforced CONCRETE.
(MADE GROUND)

B. Firm brown sandy gravelly CLAY. Gravel consists of fine to coarse brick, flint and concrete.
(MADE GROUND)

C. Firm orange brown slightly silty slightly sandy CLAY.
(LONDON CLAY FORMATION)

Observed features
Assumed features

Denotes brickwork
Denotes concrete

Notes

1. All dimensions shown in millimetres.
2. Disturbed sample taken from 0.4m depth.
3. Pocket penetrometer testing:
   - PP 0.65m - 75 kN/m^2

Method of excavation	Hand tools
Dimensions	As shown
Groundwater observations	No groundwater encountered.

Title	Trial pit record
Date of works	28.06.2017
Scale	1:10 at A3
Location reference	TP02
Location plan on drawing number	02
Appendix	D

Proposed residential redevelopment
106 King Henrys Road, London

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass onto brown slightly gravelly very silty SAND. Gravel consists of bituminous bound material, brick, flint and concrete. (MADE GROUND)											0.20		D
	Dark brown and grey slightly silty sandy GRAVEL. Gravel consists of brick, concrete, sandstone, bituminous bound material and flint. (MADE GROUND)	0.35										0.50		D
	Firm dark grey slightly gravelly sandy CLAY. Gravel consists of fine to medium brick, slate and flint. (MADE GROUND)	0.70										0.80		D
	Firm medium to high strength brown slightly sandy silty CLAY. (LONDON CLAY FORMATION)	0.90								PP 0.95	PP=38	0.90		D
										PP 1.10	PP=33			
										PP 1.20	PP=63			
										PP 1.30	PP=71			
										PP 1.40	PP=63			
										PP 1.50	PP=67	1.50		D
										PP 1.60	PP=63			
										PP 1.70	PP=75			
										PP 1.80	PP=75			
										PP 1.90	PP=75			
										PP 2.30	PP=79			
										PP 2.40	PP=88			
										PP 2.50	PP=54	2.50		D
										PP 2.60	PP=88			
										PP 2.70	PP=79			
										PP 2.80	PP=100			
	CONTINUED ON NEXT SHEET									PP 2.90	PP=67			

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Groundwater observations

Minor seepage encountered from 0.6 to 0.7m depth. Water measured at 4.45m, 25 minutes after completion of drilling.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	100
2.00 - 3.00	80
3.00 - 4.00	80
4.00 - 5.00	75

Method
Driven tube sampler

Logged by
DN

Date(s)
28/06/2017

Level (m OD)

Compiled by
TH

Sheet number
Sheet 1 of 2

Co-ordinates
527230mE, 184185mN

Checked by

DTS01

Report ref: STP4034B-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
										PP 3.65	PP=21			
										PP 3.70	PP=29	3.70		D
										PP 3.80	PP=63			
										PP 3.90	PP=75			
										PP 4.35	PP=58			
										PP 4.40	PP=75			
										PP 4.50	PP=79	4.50		D
										PP 4.60	PP=88			
	...between 4.65m and 4.7m depth, pocket of angular gravels of flint.									PP 4.70	PP=79			
										PP 4.80	PP=88			
										PP 4.90	PP=75			
	BOREHOLE TERMINATED AT 5.00m	5.00												

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Groundwater observations

Minor seepage encountered from 0.6 to 0.7m depth. Water measured at 4.45m, 25 minutes after completion of drilling.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	100
2.00 - 3.00	80
3.00 - 4.00	80
4.00 - 5.00	75

Method
Driven tube sampler

Logged by
DN

Date(s)
28/06/2017

Level (m OD)

Compiled by
TH

Sheet number
Sheet 2 of 2

Co-ordinates
527230mE, 184185mN

Checked by

DTS01

Report ref: STP4034B-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Brick onto creamy SAND. (MADE GROUND)													
	Dark brown and black gravelly SAND. Gravel consists of fine to medium sub-angular bituminous bound material. (MADE GROUND)	0.20										0.20		ES
	Stiff to very stiff brown slightly sandy slightly gravelly CLAY. Gravel consists of fine to medium sub-angular brick. (MADE GROUND)	0.30										0.50		D
	Stiff brown gravelly CLAY. Gravel consists of brick, bituminous bound material and brick. (MADE GROUND)	0.80												
	Stiff to very stiff brown slightly sandy slightly gravelly CLAY. Gravel consists of bituminous bound material and brick. (MADE GROUND)	0.95				C 1.00-1.45	(1) 5		DRY					
	Stiff to very stiff high to very high strength orange brown slightly silty slightly sandy CLAY. (LONDON CLAY FORMATION)	1.10								PP 1.10	PP=92			
										PP 1.20	PP=150			
										PP 1.30	PP=175			
										PP 1.40	PP=175			
										PP 1.50	PP=179	1.50		D
										PP 1.60	PP=175			
										PP 1.70	PP=163			
										PP 1.80	PP=175			
										PP 1.90	PP=171			
	...from 2m depth, becoming brown.					C 2.00-2.45	(2) 8		DRY	PP 2.00	PP=163			
										PP 2.10	PP=179			
										PP 2.20	PP=125			
										PP 2.30	PP=142			
										PP 2.40	PP=125			
										PP 2.50	PP=133	2.50		D
										PP 2.60	PP=100			
										PP 2.70	PP=113			
										PP 2.80	PP=138			
										PP 2.90	PP=117			

CONTINUED ON NEXT SHEET

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 5.00	100

Method Driven tube sampler	**Logged by** DN	**Date(s)** 28/06/2017
Level (m OD)	**Compiled by** TH	**Sheet number** Sheet 1 of 2
Co-ordinates 527236mE, 184170mN	**Checked by**	**DTS02**

Report ref: STP4034B-G01 **Revision:** 0

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environmental and geotechnical consultants

WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
						C 3.00-3.45	(3) 8		DRY	PP 3.00	PP=150	3.01		D
	...between 3.1m and 3.15m depth, gravel-sized pocket of slightly gravelly clayey SAND.									PP 3.10	PP=142			
										PP 3.20	PP=138			
										PP 3.30	PP=133			
										PP 3.40	PP=163			
										PP 3.50	PP=113	3.50		D
										PP 3.60	PP=113			
										PP 3.70	PP=113			
										PP 3.80	PP=113			
										PP 3.90	PP=125			
						C 4.00-4.45	(7) 19		DRY	PP 4.00	PP=100	4.00		D
										PP 4.10	PP=133			
										PP 4.20	PP=138			
										PP 4.30	PP=154			
										PP 4.40	PP=138			
										PP 4.50	PP=154	4.50		D
										PP 4.60	PP=125			
										PP 4.70	PP=154			
										PP 4.80	PP=150			
										PP 4.90	PP=154			
	BOREHOLE TERMINATED AT 5.00m	5.00				C 5.00-5.45	(4) 11		DRY					

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 5.00	100

Method
Driven tube sampler

Logged by
DN

Date(s)
28/06/2017

Level (m OD)

Compiled by
TH

Sheet number
Sheet 2 of 2

Co-ordinates
527236mE, 184170mN

Checked by

DTS02

Report ref: STP4034B-G01

Revision: 0

ESG
2 Newton Close
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0001

TEST REPORT

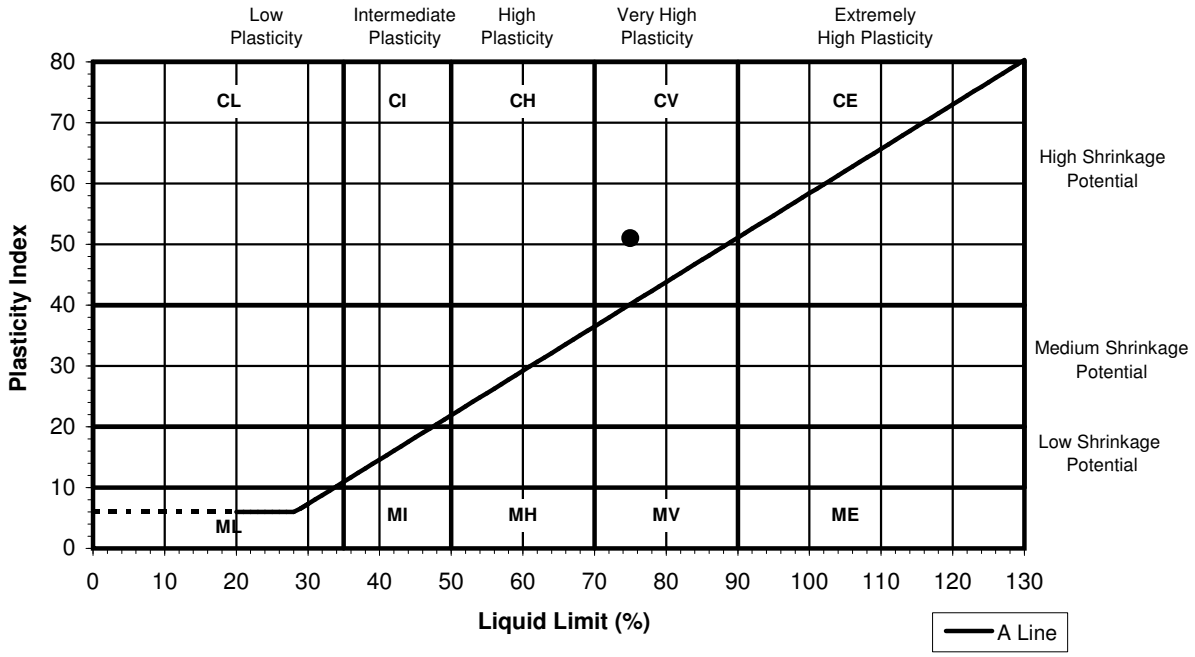
Determination of Moisture Content and Atterberg Limits

Client:	Soiltechnics Limited	Report No:	51034688/17/01
Client Address:	Cedar Barn,	Batch Number:	DAM0068661
	White Lodge		
	Walgrave	Client Reference:	STP4034B
Postcode:	NN6 9PY	Sampled by:	Client
Contact:	Andy Keeler	Date Sampled:	28.06.17
		Date Received:	05.07.17
Site:	106 King Henrys Road, Camden	Tested From:	10.07.17-11.07.17
		Sample Type:	Disturbed

Test Results:

Description: Brown sandy CLAY

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	% Passing 425µm
45322568	DTS01	0.90	21	75	24	51	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Page: 1 of 1
Date: 14.07.17

Signed _____

[✓] J. Pullar - Materials Section Manager
[ ] S. Bourton - Laboratory Manager

For and on behalf of Environmental Scientifics Group

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Drayton Fields Industrial Estate
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0001

TEST REPORT

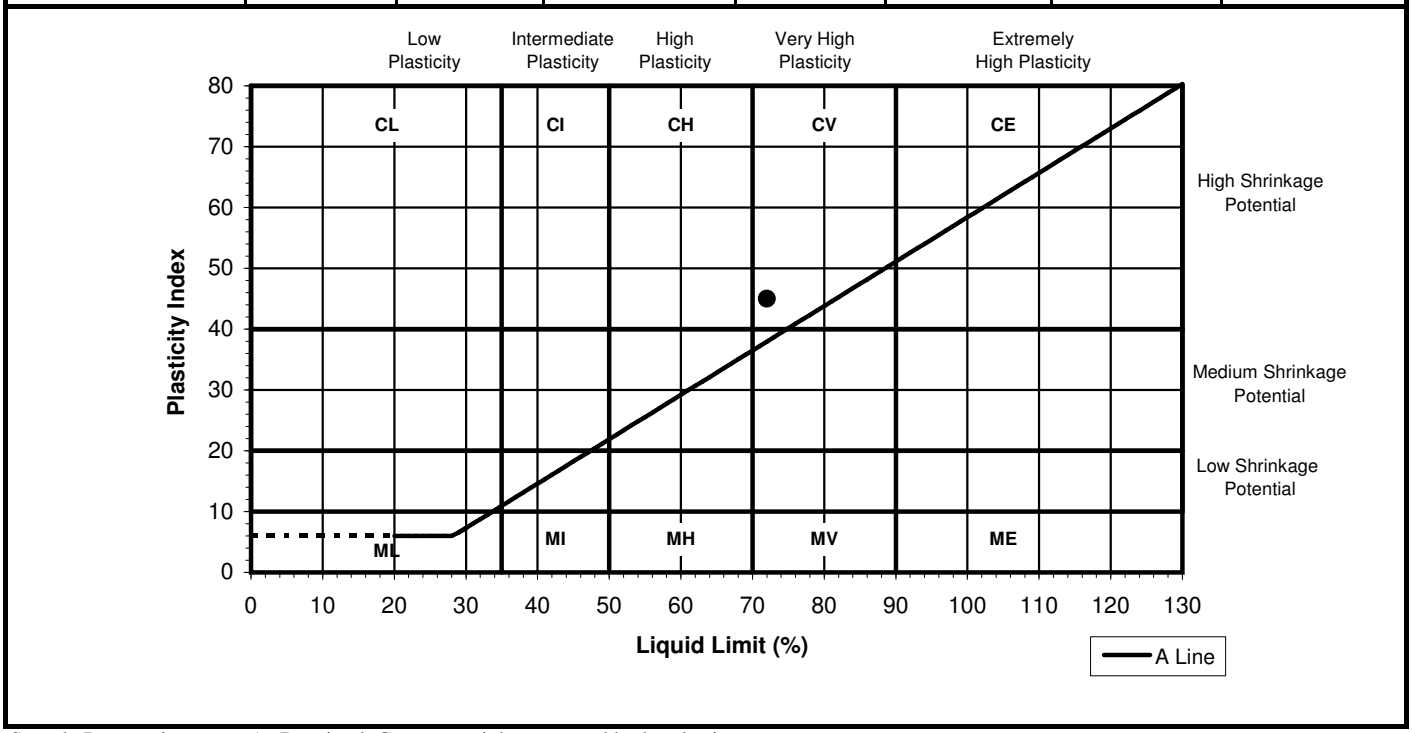
Determination of Moisture Content and Atterberg Limits

Client:	Soiltechnics Limited	Report No:	51034688/17/02
Client Address:	Cedar Barn,	Batch Number:	DAM0068661
	White Lodge		
	Walgrave	Client Reference:	STP4034B
Postcode:	NN6 9PY	Sampled by:	Client
Contact:	Andy Keeler	Date Sampled:	28.06.17
		Date Received:	05.07.17
Site:	106 King Henrys Road, Camden	Tested From:	10.07.17-11.07.17
		Sample Type:	Disturbed

Test Results:

Description: Brown sandy CLAY

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	% Passing 425µm
45322569	DTS01	1.50	36	72	27	45	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Page: 1 of 1
Date: 14.07.17

Signed JPullar

[✓] J. Pullar - Materials Section Manager
[ ] S. Bourton - Laboratory Manager

For and on behalf of Environmental Scientifics Group

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Drayton Fields Industrial Estate
Daventry
Northants NN11 8RR
Telephone: +44 (0) 1327 703828
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0001

TEST REPORT

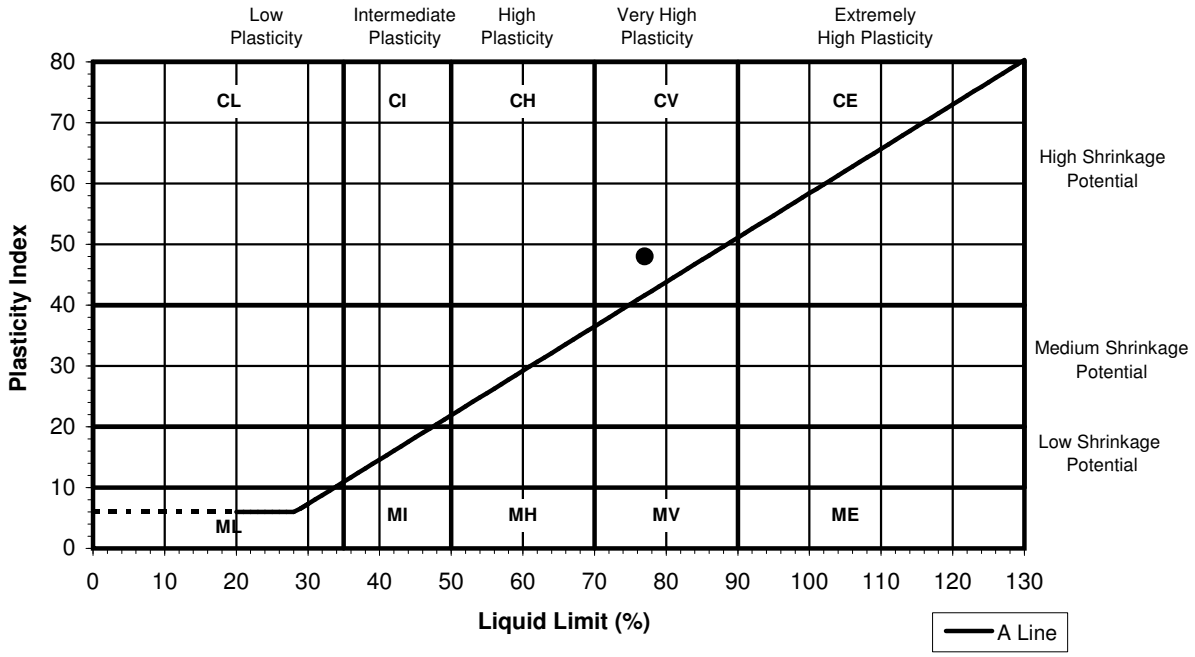
Determination of Moisture Content and Atterberg Limits

Client:	Soiltechnics Limited	Report No:	51034688/17/03
Client Address:	Cedar Barn,	Batch Number:	DAM0068661
	White Lodge		
	Walgrave	Client Reference:	STP4034B
Postcode:	NN6 9PY	Sampled by:	Client
Contact:	Andy Keeler	Date Sampled:	28.06.17
		Date Received:	05.07.17
Site:	106 King Henrys Road, Camden	Tested From:	10.07.17-11.07.17
		Sample Type:	Disturbed

Test Results:

Description: Brown sandy CLAY

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	% Passing 425µm
45322570	DTS01	3.70	40	77	29	48	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Page: 1 of 1
Date: 14.07.17

Signed JPullar

[✓] J. Pullar - Materials Section Manager
[ ] S. Bourton - Laboratory Manager

For and on behalf of Environmental Scientifics Group

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

Final Report

Report No.:	17-17404-1
Initial Date of Issue:	13-Jul-2017
Client	Soiltechnics Limited
Client Address:	Cedar Barn White Lodge Walgrave Northampton Northamptonshire NN6 9PY
Contact(s):	Rachel Brown
Project	STP4034B 106 King Henry's Road, Camden

Quotation No.:		**Date Received:**	06-Jul-2017
Order No.:	POR000678	**Date Instructed:**	06-Jul-2017
No. of Samples:	3		
Turnaround (Wkdays):	5	**Results Due:**	12-Jul-2017
Date Approved:	13-Jul-2017		

Approved By:

Details: Martin Dyer, Laboratory Manager

Chemtest
The right chemistry to deliver results

Results - Soil

Project: STP4034B 106 King Henry's Road, Camden

Client: Soiltechnics Limited		**Chemtest Job No.:**			17-17404	17-17404	17-17404
Quotation No.:		**Chemtest Sample ID.:**			480330	480331	480332
Order No.: POR000678		Client Sample Ref.:			DTS01	TP01	TP02
		Client Sample ID.:			DTS012.501-008	TP010.201-002	TP020.401-022
		Sample Type:			SOIL	SOIL	SOIL
		Top Depth (m):			2.50	0.20	0.40
		Bottom Depth (m):				0.70	
		Date Sampled:			28-Jun-2017	28-Jun-2017	28-Jun-2017
		Asbestos Lab:					COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A			-
Asbestos Identification	U	2192	%	0.001			No Asbestos Detected
Moisture	N	2030	%	0.020	25	15	
Soil Colour	N	2040		N/A	Brown	Brown	
Other Material	N	2040		N/A	NONE	Stones	
Soil Texture	N	2040		N/A	Clay	Sand	
pH	M	2010		N/A	7.9	8.3	
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40		0.81	
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.68	0.10	
Total Sulphur	M	2175	%	0.010	0.72	0.048	
Cyanide (Complex)	M	2300	mg/kg	0.50		0.70	
Cyanide (Free)	M	2300	mg/kg	0.50		< 0.50	
Cyanide (Total)	M	2300	mg/kg	0.50		0.70	
Sulphate (Acid Soluble)	M	2430	%	0.010	2.5	0.12	
Arsenic	M	2450	mg/kg	1.0		11	
Beryllium	U	2450	mg/kg	1.0		1.1	
Cadmium	M	2450	mg/kg	0.10		0.30	
Chromium	M	2450	mg/kg	1.0		23	
Copper	M	2450	mg/kg	0.50		31	
Mercury	M	2450	mg/kg	0.10		0.43	
Nickel	M	2450	mg/kg	0.50		20	
Lead	M	2450	mg/kg	0.50		150	
Selenium	M	2450	mg/kg	0.20		0.36	
Vanadium	U	2450	mg/kg	5.0		27	
Zinc	M	2450	mg/kg	0.50		90	
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	
Organic Matter	M	2625	%	0.40		1.1	
Naphthalene	M	2800	mg/kg	0.10		0.11	
Acenaphthylene	N	2800	mg/kg	0.10		< 0.10	
Acenaphthene	M	2800	mg/kg	0.10		< 0.10	
Fluorene	M	2800	mg/kg	0.10		< 0.10	
Phenanthrene	M	2800	mg/kg	0.10		0.28	
Anthracene	M	2800	mg/kg	0.10		< 0.10	
Fluoranthene	M	2800	mg/kg	0.10		0.39	
Pyrene	M	2800	mg/kg	0.10		0.21	

Chemtest
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Results - Soil

Project: STP4034B 106 King Henry's Road, Camden

Client: Soiltechnics Limited			**Chemtest Job No.:**		17-17404	17-17404	17-17404
Quotation No.:			**Chemtest Sample ID.:**		480330	480331	480332
Order No.: POR000678			Client Sample Ref.:		DTS01	TP01	TP02
			Client Sample ID.:		DTS012.501-008	TP010.201-002	TP020.401-022
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		2.50	0.20	0.40
			Bottom Depth (m):			0.70	
			Date Sampled:		28-Jun-2017	28-Jun-2017	28-Jun-2017
			Asbestos Lab:				COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Benzo[a]anthracene	M	2800	mg/kg	0.10		< 0.10	
Chrysene	M	2800	mg/kg	0.10		< 0.10	
Benzo[b]fluoranthene	M	2800	mg/kg	0.10		< 0.10	
Benzo[k]fluoranthene	M	2800	mg/kg	0.10		< 0.10	
Benzo[a]pyrene	M	2800	mg/kg	0.10		< 0.10	
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10		< 0.10	
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10		< 0.10	
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10		< 0.10	
Total Of 16 PAH's	N	2800	mg/kg	2.0		< 2.0	
Total Phenols	M	2920	mg/kg	0.30		< 0.30	

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

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I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

UKAS TESTING
2183

Final Report

Report No.:	17-17407-1
Initial Date of Issue:	14-Jul-2017
Client	Soiltechnics Limited
Client Address:	Cedar Barn White Lodge Walgrave Northampton Northamptonshire NN6 9PY
Contact(s):	Rachel Brown
Project	STP4034B 106 King Henry's Road, Camden

Quotation No.:		**Date Received:**	06-Jul-2017
Order No.:	POR000677	**Date Instructed:**	06-Jul-2017
No. of Samples:	1		
Turnaround (Wkdays):	7	**Results Due:**	14-Jul-2017
Date Approved:	14-Jul-2017		

Approved By:

Details: Martin Dyer, Laboratory Manager

Results - 2 Stage WAC

Project: STP4034B 106 King Henry's Road, Camden

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	17-17407								
Chemtest Sample ID:	480344								
Sample Ref:	WAC								
Sample ID:	WAC0.001-023						**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Top Depth(m):	0.00								
Bottom Depth(m):	0.00								
Sampling Date:	28-Jun-2017								
Determinand	**SOP**	**Accred.**	**Units**						
Total Organic Carbon	2625	U	%			0.91	3	5	6
Loss On Ignition	2610	U	%			3.6	--	--	10
Total BTEX	2760	U	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	U				8.4	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.041	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
Arsenic	1450	U	0.0028	0.0038	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.042	0.022	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0073	0.0040	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0087	0.0058	< 0.050	< 0.050	2	50	100
Mercury	1450	U	0.00051	< 0.00050	0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.031	0.011	0.061	0.14	0.5	10	30
Nickel	1450	U	0.0015	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	0.0033	< 0.010	0.029	0.5	10	50
Antimony	1450	U	0.017	0.013	0.033	0.14	0.06	0.7	5
Selenium	1450	U	0.0028	0.0017	< 0.010	0.018	0.1	0.5	7
Zinc	1450	U	0.0075	0.0059	< 0.50	< 0.50	4	50	200
Chloride	1220	U	14	5.1	28	62	800	15000	25000
Fluoride	1220	U	0.84	0.58	1.7	6.1	10	150	500
Sulphate	1220	U	110	11	210	240	1000	20000	50000
Total Dissolved Solids	1020	N	310	100	610	1300	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	15	13	< 50	130	500	800	1000

Soild Information	
Dry mass of test portion/kg	0.175
Moisture (%)	16

Leachate Test Information	
Leachant volume 1st extract/l	0.316
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.227

Waste Acceptance Criteria

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

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Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS

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customerservices@chemtest.co.uk

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Initial Conceptual Model

Current site use Residential
Proposed site use Residential

Source	Pathway									Receptor		Risk assessment to CIRIA C552	
	Humans						Vegetation	Water				Consequence of risk occurring via most likely pathway	Risk
	Ingestion of airborne dust	Ingestion of soil	Ingestion of vegetables and soil attached to vegetables	Inhalation of airborne dust	Inhalation of vapours	Dermal contact with soil and dust	Root uptake, deposition to shoots and foliage contact	Percolation of water through contaminated soil	Saturation of contaminated soil by flood water				
Soils													
No sources	Likely	Likely	Likely	Likely	Likely	Likely	-	-	-	Current and proposed site users	Child	Minor	Low
identified	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	Construction operatives	Adult	Minor	Low
	-	-	-	-	-	-	Likely	-	-	Vegetation (current)	-	Minor	Low
	-	-	-	-	-	-	Likely	-	-	Vegetation (proposed)	-	Minor	Low
	-	-	-	-	-	-	-	Likely	Likely	Water (current and proposed)	-	Minor	Low

Title	Table number
Initial Conceptual Site Model	1

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Table comparing cumulative compound concentrations with hazardous waste threshold values

Category of danger		Irritant	Harmful	Toxic		Carcinogenic		Corrosive		Toxic for reproduction		Mutagenic		Ecotoxic		
														∑N : R50-53/0.25	∑N : 50-53	∑N : 50-53
														+∑N : R51-53/2.5	+∑N : R50	+∑N : 51-53
						Carc Cat 1				Repr Cat 1 or				+∑N : R52-53/25		+∑N : 52-53
Risk Phrase		Xi	Xn	T+	T	or 2	Carc Cat 3	C R34	C R35	2	Repr Cat 3	Muta Cat 2	Muta Cat 3			+∑N : R53
Contaminant	Highest concentration	H4 (%)	H5 (%)	H6 (%)	H6 (%)	H7 (%)	H7 (%)	H8 (%)	H8 (%)	H10 (%)	H10 (%)	H11 (%)	H11 (%)	H14	H14	H14
Metals																
Arsenic	11.00			0.0015	0.0017	0.0017								0.1732	0.0017	0.0017
Beryllium	1.10	0.0003		0.0003	0.0003	0.0003										0.0003
Copper	31.00	0.0078	0.0078												0.0078	0.0078
Cadmium	0.30		0.0000		0.0000	0.0000										
Chromium	23.00					0.0037									0.0037	0.0037
Lead	150.00		0.0162							0.0162	0.0162				0.0162	0.0162
Mercury	0.43			0.0000											0.0000	0.0000
Nickel	20.00		0.0025				0.0025				0.0025				0.0025	0.0025
Selenium	0.36				0.0000										0.0000	0.0000
Zinc	90.00														0.0112	0.0000
Vanadium	27.00	0.0040			0.0040						0.0040		0.0040			0.0040
PAH																
Naphthalene	0.11		0.0000												0.0000	0.0000
Benzo(a)anthracene	0.00				0.0000	0.0000									0.0000	0.0000
Chrysene	0.00				0.0000	0.0000							0.0000		0.0000	0.0000
Benzo(b)fluoranthene	0.00				0.0000	0.0000									0.0000	0.0000
Benzo(k)fluoranthene	0.00				0.0000	0.0000									0.0000	0.0000
Benzo(a)pyrene	0.00					0.0000				0.0000		0.0000			0.0000	0.0000
Dibenzo(a,h)anthracene	0.00				0.0000	0.0000									0.0000	0.0000
TPH																
Benzene	1.00				0.0001	0.0001										
Hydrocarbon (C6 to C35)	0.00		0.0000			0.0000					0.0000	0.0000				0.0000
Total (or greatest)		0.0120	0.0265	0.0018	0.0061	(0.0000)	(0.0025)	0.0000	0.0000	(0.0000)	(0.0162)	(0.0000)	(0.0000)	0.1732	0.0431	0.0362
Threshold		1%	1%	0.10%	3%	0.10%	1%	5%	1%	0.50%	3%	0.10%	1%	1	25%	25%
Exceeded Y/N		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Title	Table number
Hazard assessment spreadsheet - Made Ground within existing mound Area A	1 of 1

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Landfill Waste Acceptance Criteria				Laboratory test data
Parameter	**Inert waste landfill**	**Stable non-reactive hazardous waste in non-hazardous landfill**	**Hazardous waste landfill**	**WAC**
Parameters determined on the waste				
Total organic carbon (w/w %)	3%	5%	6%*	0.91
Loss on ignition			10%*	3.6
BTEX (mg kg^{-1})	6			<0.01
PCBs (7 congeners) (mg kg^{-1})	1			<0.1
Mineral oil C_{10} - C_{40} (mg kg^{-1})	500			<10
PAH (17 congeners)	100			<2
pH		>6		8.4
Acid neutralisation capacity pH 6 (mol kg^{-1})		To be evaluated	To be evaluated	0.041
Acid neutralisation capacity pH 4 (mol kg^{-1})		To be evaluated	To be evaluated	
Limit values (mg kg^{-1}) for compliance test using BN 12457-3 at L/S 10 l kg^{-1}				
As (arsenic)	0.5	2	25	< 0.050
Ba (barium)	20	100	300	< 0.50
Cd (cadmium)	0.04	1	5	< 0.010
Cr (chromium (total))	0.5	10	70	< 0.050
Cu (Copper)	2	50	100	< 0.050
Hg (mercury)	0.01	0.2	2	< 0.0050
Mo (molybdenum)	0.5	10	30	0.14
Ni (nickel)	0.4	10	40	< 0.050
Pb (lead)	0.5	10	50	0.029
Sb (antimony)	0.06	0.7	5	0.14
Se (selenium)	0.1	0.5	7	0.018
Zn (zinc)	4	50	200	< 0.50
Cl (chloride)	800	15,000	25,000	62
F (fluoride)	10	150	500	6.1
SO_4 (sulphate)	1000#	20,000	50,000	240
Total Dissolved Solids (TDS)+	4,000	60,000	100,000	1300
Phenol index	1			< 0.50
Dissolved organic carbon at own pH or pH 7.5-8.0@	500	800	1000	130

Notes

* Either TOC or LOI must be used for hazardous waste
\# If an inert waste does not meet the SO4 L/S10 limit, alternative limit values of 1500 mg l-1 SO4 at Co (initial eluate from the percolation test (prCEN/TS 14405:2003)) AND 6000 mg kg-1 SO4 at L/S10 (either from the percolation test or batch test BS EN 12457-3), can be used to demonstrate compliance with the acceptable criteria for inert wastes.
\+ The value for TDS can be used instead of the values for Cl and SO4
@ DOC at pH 7.5-8.0 abd L/S10 can be determined or eluate derived from a modified version of the pH dependence Test, prEN 14429, if the limit value at own pH (BS EN 12457 eluate) is not met.

PRIMARY CLASSIFICATION	NON-HAZARDOUS
SECONDARY CLASSIFICATION	NON-HAZARDOUS

Title

Comparison of test data to landfill waste acceptance criteria (table 5.1) (Secondary classification)

Table

1 of 1

Basic categorisation schedule for Made Ground soils

Produced following the requirements of The Landfill (England and Wales) (Amendment) Regulations 2004 Part 2 (5)

(a) Source and origin of waste

Proposed redevelopment and basement excavation at property off King Henrys Road, Camden, London.

(b) Process producing the waste

Basement excavations, foundation and service trench excavations, general site clearance, earthworks

(c) Statement on waste treatment

Refer to pre-treatment confirmation form

(d) Composition of the waste

Brown to dark brown grey slightly silty sandy gravel and firm brown to grey gravelly sandy clay slightly clayey gravelly sand. Gravels consists of fine to coarse brick, concrete, bituminous bound material, flint and sandstone.

(e) Appearance of the waste

As above

(f) European waste catalogue code

17-05-04 *(for non-hazardous waste)*

(g) Hazardous waste properties

None

(h) Is the waste prohibited under regulation 9?

No

(i) Landfill class

Non-hazardous based on laboratory testing

(j) Additional precautions required at landfill

None

(k) Can waste be recycled or recovered?

Yes

(l) Name and address of waste producer

Solid Geometry, Unit 212 Block A, Biscuit Factory, 100 Clements Road, London, SE16 4DG

(m) Name and address of consultant

Soiltechnics Limited, Cedar Barn, White Lodge, Walgrave, Northampton. NN6 9PY.
Tel: (01604) 781877 **E-mail: mail@soiltechnics.net**
Fax: (01604) 781007 **Website: www.soiltechnics.net**

Schedule Date:

August 2017

Soiltechnics reference:

STP3916A-G01

signed

Darryl Neylon BSc (Hons)
Geo-environmental Engineer for Soiltechnics Limited

Basic categorisation schedule for London Clay Formation deposits

Produced following the requirements of The Landfill (England and Wales) (Amendment) Regulations 2004 Part 2 (5)

(a) *Source and origin of waste*

Proposed redevelopment and basement excavation at property off King Henrys Road, Camden, London.

(b) *Process producing the waste*

Basement excavations, foundation and service trench excavations, general site clearance, earthworks

(c) *Statement on waste treatment*

Refer to pre-treatment confirmation form

(d) *Composition of the waste*

Firm to stiff brown to orange brown slightly sandy silty CLAY.

(e) *Appearance of the waste*

As above

(f) *European waste catalogue code*

17-05-04 (*for non-hazardous waste*)

(g) *Hazardous waste properties*

None

(h) *Is the waste prohibited under regulation 9?*

No

(i) *Landfill class*

Inert based on soils being of natural origin and unlikely to be affected by artificial contamination

(j) *Additional precautions required at landfill*

None

(k) *Can waste be recycled or recovered?*

Yes

(l) *Name and address of waste producer*

Solid Geometry, Unit 212 Block A, Biscuit Factory, 100 Clements Road, London, SE16 4DG

(m) *Name and address of consultant*

Soiltechnics Limited, Cedar Barn, White Lodge, Walgrave, Northampton. NN6 9PY.
Tel: (01604) 781877 **E-mail: mail@soiltechnics.net**
Fax: (01604) 781007 **Website: www.soiltechnics.net**

Schedule Date:

August 2017

Soiltechnics reference:

STP4034B-G01

signed

Darryl Neylon BSc (Hons)
Geo-environmental Engineer for Soiltechnics Limited

Ross Carrington

From: Building Control <building.control@camden.gov.uk>
Sent: 13 July 2017 13:12
To: Leanne Carr
Subject: RE: Enquiry from the public - (ref: 21011685)

Importance: High

Dear Sir or Madam

The London Building Acts and the Building Regulations

Thank you for your request for information. In answer to your query:

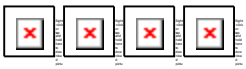
We regret to inform you that the Council does not maintain comprehensive records of ground conditions in the borough (nor foundations in a general manner). It is therefore not possible to answer your enquiry.

Should your client wish to pursue this matter further, he or she may wish to arrange for a survey of the site to be carried out.

Yours faithfully

Support Services Team
Building Control
Place Management
Supporting Communities
London Borough of Camden

Telephone: 020 7974 4444 (option 6)
Fax: 020 7974 5603
Web: camden.gov.uk
2nd Floor
5 Pancras Square
5 Pancras Square
London N1C 4AG



General enquiry form - Ref. 21011685

Customer

First Name	Leanne
Name	Carr

My enquiry is	Good afternoon, We are currently undertaking a ground investigation at 106 King Henry's Road, Camden. We have obtained information about the history of the site and are looking to investigate the ground parameters. Do you have any knowledge of any foundation failure issues in the area? Do you know if soakaways are used effectively in the area? Lastly, do you have any knowledge of any chemical/gaseous contamination in the area? Many thanks, Leanne Carr
I would like to be contacted by	eMail
Email	leanne.carr@soiltechnics.net
Phone	01604781877
Address	NW3 3SL 106 King Henry's Road London NW3 3SL

Please upload supporting documents

No files attached

About this form

Issued by	Council and Democracy Camden Town Hall Judd Street London WC1H 9JE
Received on	13/07/2017
Form reference	21011685
Contact method	Self service

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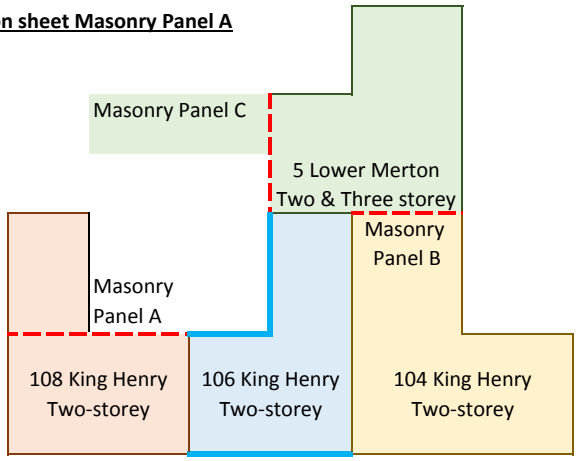
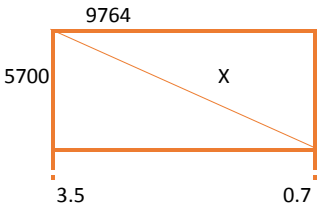
Calculation sheet Masonry Panel A



Dig depth (m)	3.5
Inward yield (mm)	5.25
Surface settlement (mm)	3.5

Vertical		horizontal	
Radius (m)	Settlement (mm)	Radius (m)	Settlement (mm)
0	3.5	0	5.25
3.0625	2.625	3.5	3.9375
6.125	1.75	7	2.625
9.1875	0.875	10.5	1.3125
12.25	0	14	0

Masonry Panel A
Consider elevation of 108 King Henry Road - all measurements in mm

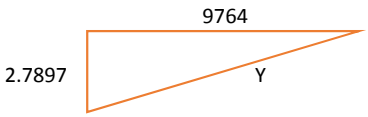


X = 11306
net settlement = 2.789714286

Tensile strain in vertical

$\frac{2.7897}{11306} * 100 = 0.0246746\ \%$ Burland Category 0

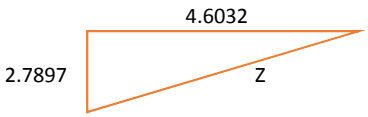
Tensile strain in horizontal



Y = 9764.000399

$\frac{0.040}{9764} * 100 = 0.0004082\ \%$ Burland Category 0

Tensile strain in diagonal



Z= 5.382527

$\frac{5.38}{11306} * 100 = 0.0476077\ \%$ Burland Category 0

Tensile strain on adjusted horizontal diagonal

$\frac{5.38}{9764} * 100 = 0.0551262\ \%$ Burland Category 1

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Walgrave
Northamptonshire
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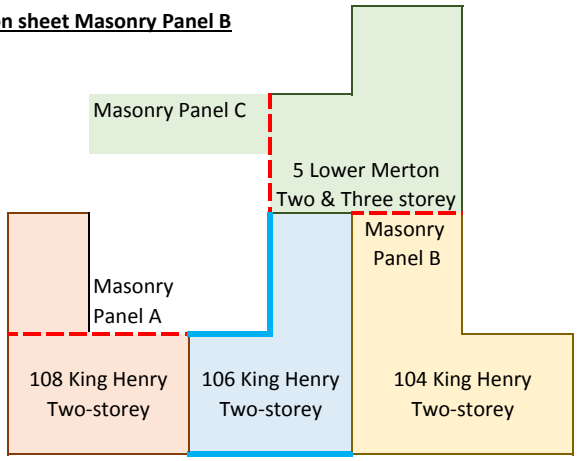
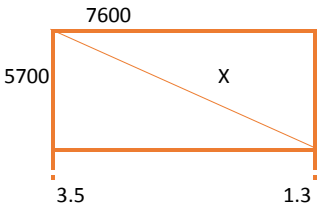
Calculation sheet Masonry Panel B



Dig depth (m)	3.5
Inward yield (mm)	5.25
Surface settlement (mm)	3.5

Vertical		horizontal	
Radius (m)	Settlement (mm)	Radius (m)	Settlement (mm)
0	3.5	0	5.25
3.0625	2.625	3.5	3.9375
6.125	1.75	7	2.625
9.1875	0.875	10.5	1.3125
12.25	0	14	0

Masonry Panel B
Consider elevation of 104 King Henry Road - all measurements in mm

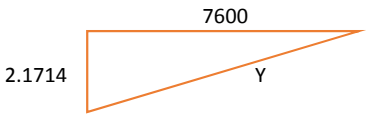


X = 9500
net settlement = 2.171428571

Tensile strain in vertical

$\frac{2.1714}{9500} * 100 = 0.0228571\ \%$ Burland Category 0

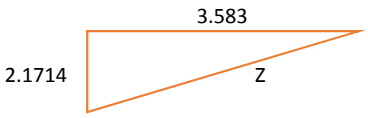
Tensile strain in horizontal



Y = 7600.000310

$\frac{0.031}{7600} * 100 = 0.0004082\ \%$ Burland Category 0

Tensile strain in diagonal



Z= 4.189595

$\frac{4.19}{9500} * 100 = 0.044101\ \%$ Burland Category 0

Tensile strain on adjusted horizontal diagonal

$\frac{4.19}{7600} * 100 = 0.0551262\ \%$ Burland Category 1

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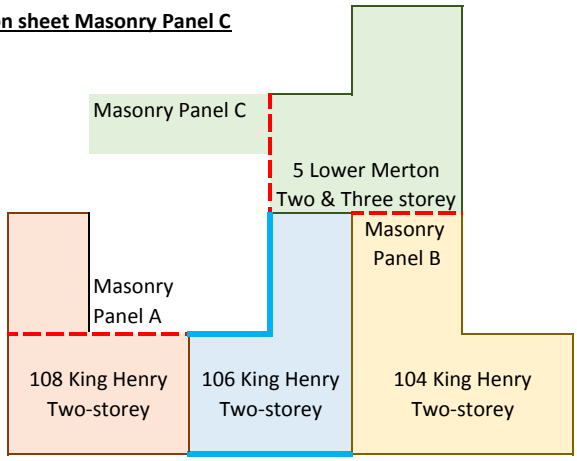
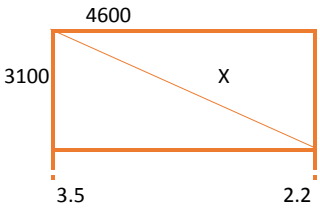
Calculation sheet Masonry Panel C



Dig depth (m)	3.5
Inward yield (mm)	5.25
Surface settlement (mm)	3.5

Vertical		horizontal	
Radius (m)	Settlement (mm)	Radius (m)	Settlement (mm)
0	3.5	0	5.25
3.0625	2.625	3.5	3.9375
6.125	1.75	7	2.625
9.1875	0.875	10.5	1.3125
12.25	0	14	0

Masonry Panel c
Consider elevation of 5 Lower Merton Street - all measurements in mm

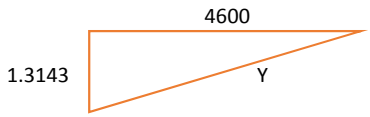


X = 5547
net settlement = 1.314285714

Tensile strain in vertical

$\frac{1.3143}{5547}$ *100 = 0.0236933 % Burland Category 0

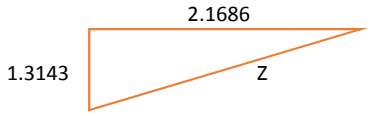
Tensile strain in horizontal



Y = 4600.000188

$\frac{0.019}{4600}$ *100 = 0.0004082 % Burland Category 0

Tensile strain in diagonal



Z= 2.535807

$\frac{2.54}{5547}$ *100 = 0.0457143 % Burland Category 0

Tensile strain on adjusted horizontal diagonal

$\frac{2.54}{4600}$ *100 = 0.0551262 % Burland Category 1

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