DESK STUDY & BASEMENT IMPACT ASSESSMENT REPORT

15 Rudall Crescent
London NW3

Client: Bernard and Emma Shapero

Engineer: Richard Tant Associates

J17003

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GEA Geotechnical & Environmental Associates

Document Control

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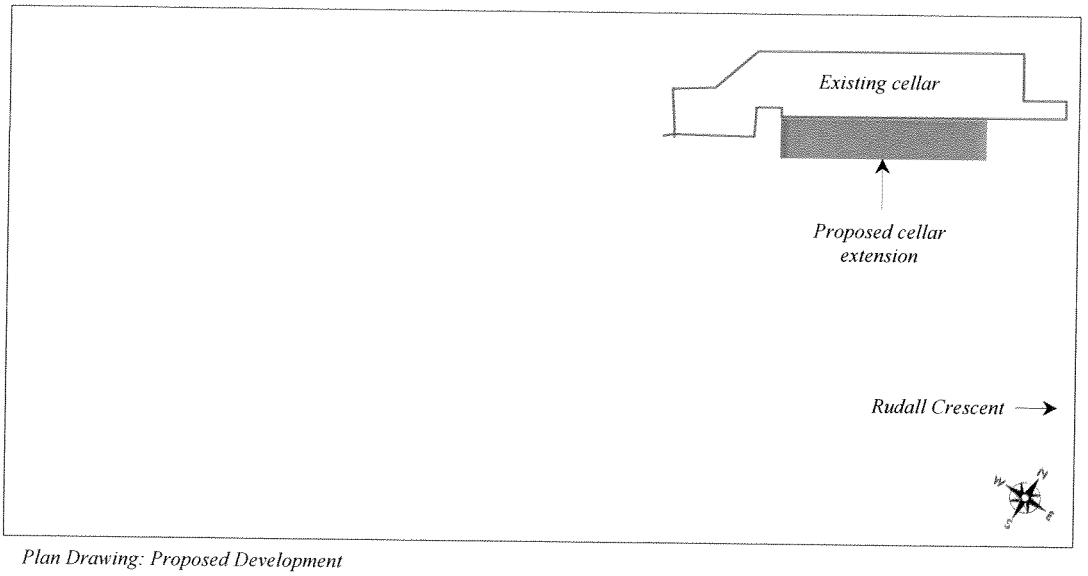
1.0 INTRODUCTION

Geotechnical and Environmental Associates Limited (GEA) has been commissioned by Richard Tant Associates, on behalf of Bernard and Emma Shapero, to carry out a desk study at 15 Rudall Crescent, London NW3 1RR. This report also forms part of a Basement Impact Assessment (BIA), which has been carried out in accordance with guidelines from the London Borough of Camden in support of a planning application.

1.1 Proposed Development

It is understood that it is proposed to extend the existing 2.2 m deep cellar by 0.4 m in depth and around 1.0 m in plan to form a single level basement as shown on the plan below.



Plan Drawing: Proposed Development

The following drawings have been referred to within this Basement Impact Assessment.

Drawing Reference	Response for 15 Rudall Crescent
A502-PL 104, dated 25 April 2016	Existing Basement Floor Plan
A502-PL 111, dated 12 December 2016	Proposed Basement Floor Plan
A502-PL 105, dated 25 April 2016	Existing Longitudinal Section
A502-PL 112, dated 12 December 2016	Proposed Longitudinal Section

This report is specific to the proposed development and the advice herein should be reviewed if the proposals are amended.

1.1.1 Basement Impact Assessment

The work carried out also includes a Hydrological and Hydrogeological Assessment and Land Stability Assessment (also referred to as Slope Stability Assessment), all of which form part of the BIA procedure specified in the London Borough of Camden (LBC) Planning Guidance CPG4[1] and their Guidance for Subterranean Development[2] prepared by Arup ('the Arup

1 London Borough of Camden Planning Guidance CPG4 *Basements and lightwells*

Report'). The aim of the work is to provide information on surface water, groundwater and land stability and in particular to assess whether the development will affect neighbouring properties or groundwater movements and whether any identified impacts can be appropriately mitigated by the design of the development.

1.1.2 Qualifications

The land stability element of the Basement Impact Assessment (BIA) has been carried out by Martin Cooper, a BEng in Civil Engineering, a chartered engineer (CEng), member of the Institution of Civil Engineers (MICE), and Fellow of the Geological Society (FGS) who has over 20 years' specialist experience in ground engineering. The subterranean (groundwater) flow assessment has been carried out by John Evans, MSc in Hydrogeology, Chartered Geologist (CGeol) and Fellow of the Geological Society of London (FGS). The surface water and flooding assessment has been carried out by Rupert Evans, a hydrologist with more than ten years consultancy experience in flood risk assessment, surface water drainage schemes and hydrology / hydraulic modelling. Rupert Evans is a Chartered Environmentalist, Chartered Water and Environmental Manager and a Member of CIWEM.

The assessments have been made in conjunction with Steve Branch, a BSc in Engineering Geology and Geotechnics, MSc in Geotechnical Engineering, a Chartered Geologist (CGeol) and Fellow of the Geological Society (FGS) with over 25 years' experience in geotechnical engineering and engineering geology.

All assessors meet the qualification requirements of the Council guidance.

1.2 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the investigation. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil, gas or groundwater samples tested; no liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no independent validation of such information has been made by GEA.

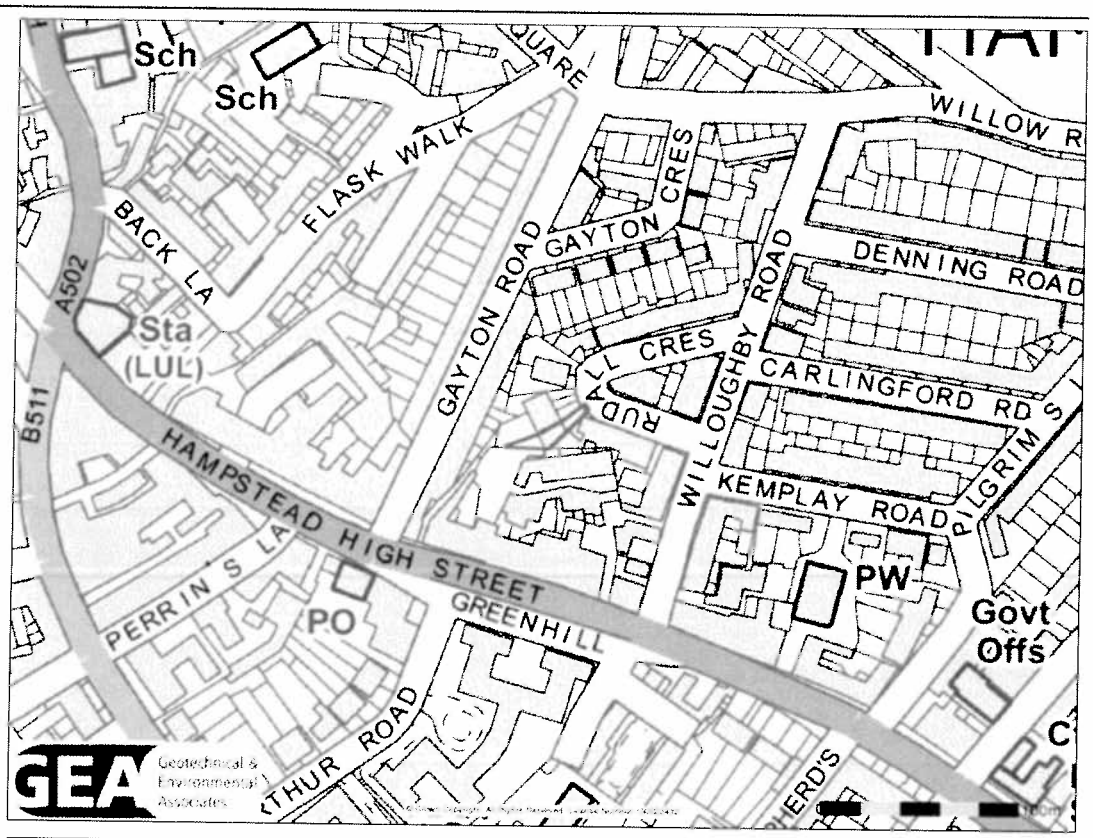
2.0 THE SITE

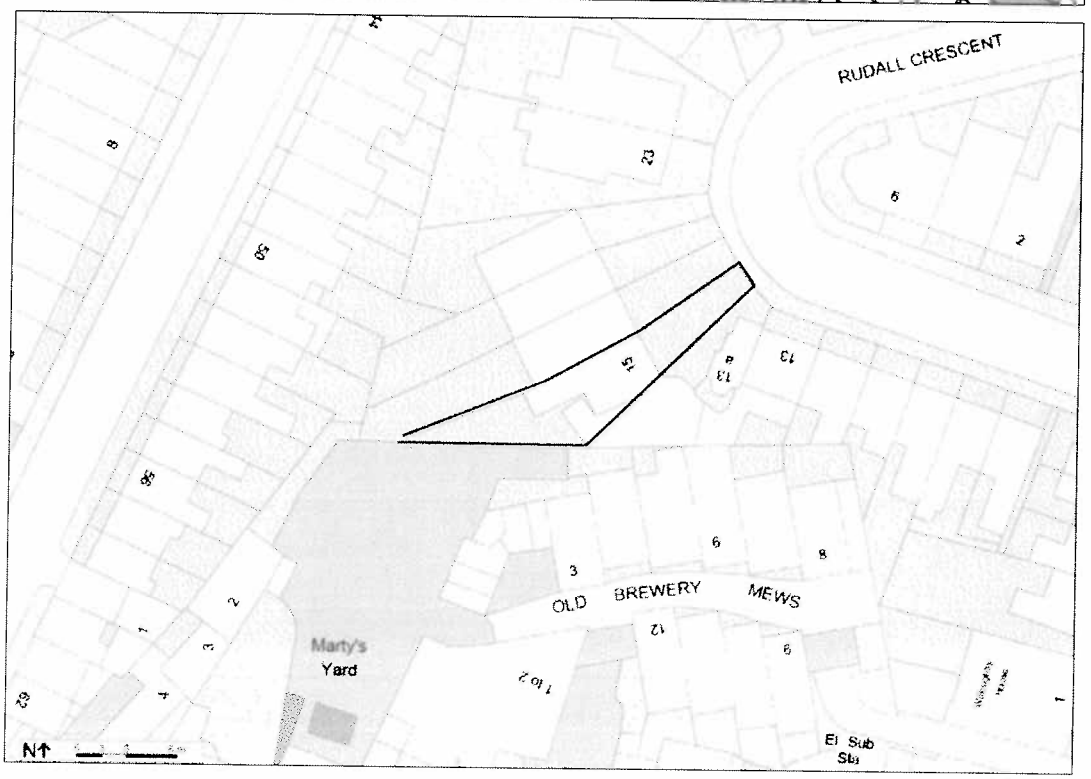
2.1 Site Description

The site is located in London Borough of Camden, roughly 230 m east of Hampstead London Underground station and 620 m northwest of Hampstead Heath London Underground Station. The site may additionally be located by National Grid Reference 526639, 185725 and is shown on the map extracts overleaf.

The site is roughly triangular in shape, measuring approximately 10 m north-south by 42 m east-west. It is accessed from Rudall Crescent in the northeast and is bounded by Nos 13 and 17 Rudall Close and the associated front and rear gardens to the southeast and north respectively, while the southwest of the site borders Marty's Yard.

2 Ove Arup & Partners (2010) *Camden geological, hydrogeological and hydrological study. Guidance for Subterranean Development.* For London Borough of Camden November 2010





A site walkover has not been carried out. A hard-surfaced driveway leads from Rudall Crescent in the northeast to the northern corner of the main house, and the front garden is laid to lawn with planted beds and borders. A four-storey house occupies the central third of the site, with the front and rear gardens in the east and west respectively. A 2 m wide and roughly 2.2 m deep cellar is present beneath the northern corner of the house and extends

beneath the front half of the main house. A two-storey extension is present at the rear of the house, and reduces to a single storey extension within the rear paved patio area, beyond which the rear garden is laid to lawn.

The site and nearby land slopes gently down towards the northeast, with the site at a level of roughly 97 m OD, while the wider area slopes down in a southeasterly direction. It is not known whether there are trees on the site, but there is a semi-mature tree at the northeastern boundary of the site and what appears to be a mature birch tree adjacent to the northeastern boundary in the pavement of Rudall Crescent.

2.2 Site History

The history of the site and surrounding area has been researched by reference to historical Ordnance Survey (OS) maps sourced from the Envirocheck database.

The first map studied, dated 1950, shows the site to have been undeveloped with part of the present-day road network in Hampstead shown, including the High Street and Flask Walk to the southwest and northwest respectively. Two unnamed roads leading from the High Street are shown to the southwest and southeast of the site. The next map, dated 1871, shows the area in general to have been notably developed, although the site itself remained undeveloped and apparently formed part of the Hampstead Heath to the northwest. The two roads to the southwest and southeast had been named White Heart Yard and Beehouse Yard respectively, the latter of which appears to have extended to the southeastern boundary of the site.

The site and area remained largely unchanged until the 1895 map, by which time the site had been developed with a house in the present-day layout of the main house, with Rudall Crescent to the northeast and neighbouring houses also in their respective present-day positions. Gayford Road had been constructed to the west and the brewery, named Hampstead Brewery, is shown to the south, along with a bank and public house that fronted onto the High Street, and a Presbyterian chapel and school to the southeast. The 1915 map shows that the buildings adjacent to the southwestern boundary of site, no longer annotated as a brewery, had been cleared and by 1936 a new larger building had been constructed in its place, and the house on the site had apparently been extended to the south. By 1954, the building to the south had been demolished and the buildings adjacent to the southeastern boundary of the site appear to have been redeveloped and the site is annotated as a garage. By 1973, the site to the south is no longer annotated as a garage, and the majority of the site had been redeveloped with what appear to be houses and by 1987 a new road named Old Brewery Mews is shown. The site has since remained largely unchanged.

2.3 Other Information

A search of public registers and databases has been made via the Envirocheck database and relevant extracts from the search are appended. Full results of the search can be provided if required.

The search has revealed that there are no landfills, waste management, transfer, treatment or disposal sites or areas of potentially infilled land within 300 m of the site. There have been no pollution incidents to controlled waters within 1 km of the site.

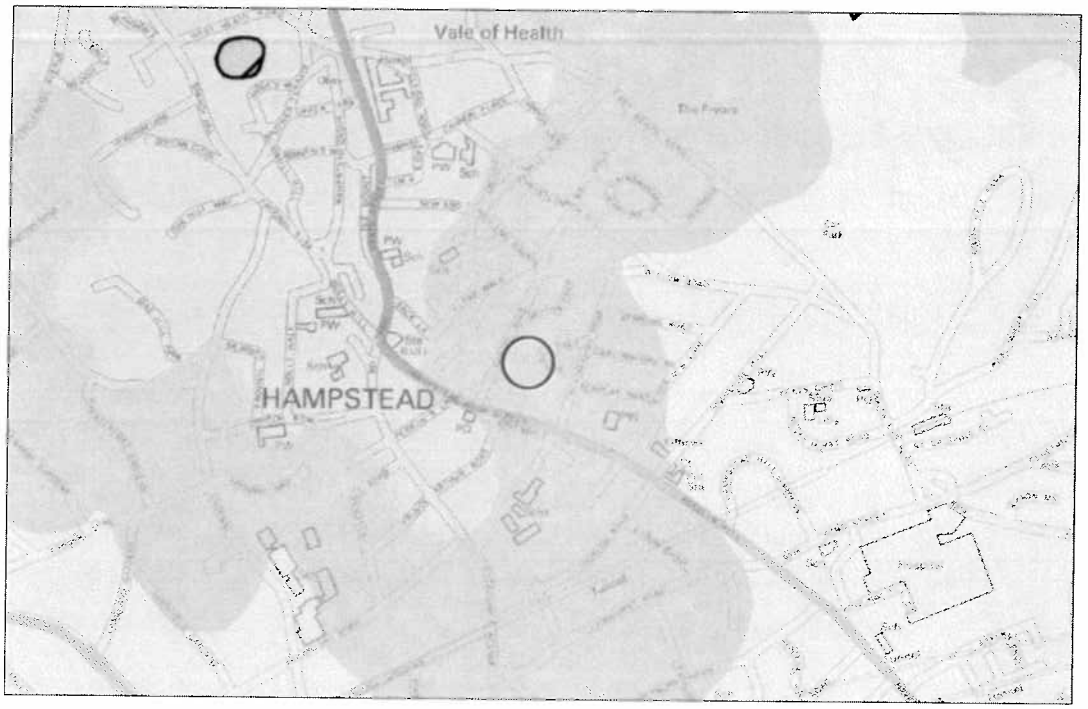
The search has indicated that the site is located in an area where less than 1% of homes are affected by radon emissions; which is the lowest classification given by the Health Protection Agency (HPA) and therefore no radon protective measures will be necessary.

The site is not located within a nitrate vulnerable zone or any other sensitive land use.

A search has been carried out of the London Borough of Camden Planning Portal for planning applications relating to the properties surrounding the site to determine if they have basements. The presence of basements specifically beneath Nos 17 and 19 Rudall Crescent and the cluster of buildings that make up Nos 13 and 13A Rudall Crescent is inconclusive. A view of the house from Google Streetview indicates that houses along Rudall Crescent are unlikely to have basements, as lightwells or vents are not present at the front of the properties. It is likely, however, that cellars exist beneath the northern and northwestern corners of the houses, as is the case at No 15 Rudall Crescent.

2.4 Geology

The British Geological Survey (BGS) map of the area (Sheet 256) indicates the site to be underlain by the Claygate Formation over the London Clay Formation. A digital map sourced from FIND maps is shown below, indicating the location of the site with respect to the geological boundaries.



The Claygate Member is described in the geological memoir as typically comprising interbedded fine grained sand, silt and clay, whilst the underlying London Clay Formation is homogenous, slightly calcareous silty clay to very silty clay, with some beds of clayey silt grading to silty fine grained sand.

The geology in this area is generally horizontally bedded such that the boundary between the geological formations roughly follows the ground surface contour lines. The boundary between the Claygate Member and the upper unit of the London Clay is typically found to be at a level of approximately 80 m OD.
According to the BGS Sheet 256, dated 2006, the area to the east of the site is shown as having a "Head Propensity". Head propensity is shown on the BGS map as areas denoted as most likely to be covered by Quaternary Head Deposits as interpreted from digital slope analysis and confirmed by borehole data. These deposits are not mapped and have not been verified by fieldwork. These deposits are noted as having properties similar to that of the London Clay and are shown to occur close to the boundary with the overlying Claygate Member.

A previous investigation was carried out by GEA on a nearby site roughly 150 m to the northeast of the site. The investigation encountered concrete or topsoil over made ground to depths of between 2.4 m to 3.2 m, below which Superficial Deposits were encountered overlying the London Clay Formation.

Below the made ground, firm greenish grey to orange-brown silty clay with gravel and carbonaceous material was encountered in a number of locations to depths of between 3.5 m and 3.75 m, which was interpreted as Superficial (Head) Deposits. This, in turn, is underlain by the London Clay, which was found to comprise an upper layer of firm pale orange-brown to brownish grey silty clay and extended to depths of between 4.0 m and 5.0 m, whereupon it was underlain by firm dark brownish grey silty clay to the full depth of the investigation of 10.0 m. Rare selenite crystals and occasional partings of silt and sand were observed to be present within the London Clay, along with claystones in one location at a depth of approximately 6.5 m. This formation was found to comprise an upper weathered layer of firm pale orange-brown or brown becoming brownish grey silty clay, which extended to the full depth of Borehole Nos 1 to 3 and was proved in Borehole No 4 to a depth of 5.0 m (80.4 m OD). This upper layer may comprise the lowest part of the Claygate Member, although the appearance and consistency of the samples recovered from the boreholes was more akin to typical soils of the upper London Clay.

A review of publicly available information from the BGS database has found records of a deep borehole located approximately 125 m to the northeast of the site, which indicated that the London Clay is likely to extend to a depth of around 105 m (approximately -9.0 m OD) beneath the site, below which the Lambeth Group, Thanet Sand and Upper Chalk were found to be present.

2.5 Hydrology and Hydrogeology

The Claygate Member is classified as a Secondary 'A' Aquifer, which refers to strata that contain permeable layers capable of supporting water supply at a local level and in some cases may form an important source of base flow for local rivers, as defined by the Environment Agency (EA). The underlying London Clay is classified as a Non-Aquifer and Unproductive Stratum, which refers to a soil or rock with low permeability that has a negligible effect on local water supply or river base flow.

There are no EA designated Source Protection Zones (SPZs) on the site. The Envirocheck report indicates that the nearest surface water feature is located 566 m east of the site and appears to be Hampstead Pond No 1.

The site is within an area with a limited potential for groundwater flooding to occur, and the map showing risk of flooding from surface water indicates the site to not be at risk. The site is not within an area at risk of flooding from rivers or the sea.

Perched water is likely to be present within the Claygate Member, or other superficial deposits, where present, and other investigations carried out around the area of Hampstead Heath indicate that spring lines, reflecting the presence of perched groundwater, are present at the interface of the Bagshot Beds and the Claygate Member, and at a lower level at the boundary between the Claygate Member and the underlying essentially impermeable London Clay. These springs have been the source of a number of London's "lost" rivers, notably the Fleet, Westbourne and Tyburn, which all rose on Hampstead Heath, to the north of the current site, at the base of the Bagshot Beds.

Groundwater is likely to flow in the direction of the local topography, which in this area slopes down towards the Hampstead Ponds to the east, from a site level of roughly 97 m OD.

Figure 11 of the Arup report does not show the site to be located within 250 m of any previous springs or watercourses. However, historical records[3] indicate that a tributary of the River Fleet rose on the edge of Hampstead Heath to the northwest of the site and flowed in a southeasterly direction in the area between Christchurch Hill and East Heath Road, before joining with the main branch of the river, just to the south of Hampstead Ponds. This tributary, like many of London's lost rivers, was culverted or covered and incorporated into the existing sewer network in the late 19th Century.

The course of this former tributary is also coincident with the spring line shown on the late 19th Century maps, approximately 150 m to the north of the site on Well Walk, which subsequently become known as Chalybeate Spring or Well. As mentioned previously, anecdotal evidence indicates that water has never flown freely from the well, due to development of the area and redirection of groundwater flows into the sewer network.

The Claygate Member is predominantly cohesive in nature and therefore groundwater flow is likely to be relatively slow, although horizons of sandier soils are sometimes present, resulting in the permeability ranging from "very low" to "high". Any groundwater flow in the area will be restricted to these sandier horizons and will generally follow the local topography with a flow direction to the northeast, towards the former tributary of the River Fleet.

Published data for the permeability of the London Clay indicates the horizontal permeability to generally range between 1×10^{-10} m/s and 1×10^{-8} m/s, with an even lower vertical permeability.

As the Claygate Member and underlying London Clay are likely to comprise predominantly clay soils, they cannot support groundwater flow over any significant distance, nor can they be considered to support a "water table" such as would be found within a porous and permeable saturated stratum.

During the aforementioned GEA investigation, groundwater was encountered during drilling at depths of between 3.0 m (82.55 m OD) and 3.3 m (82.10 m OD) and was subsequently monitored at depths of between 2.55 m (83.0 m OD) and 3.04 m (82.46 m OD).

The site is not located in an area at risk of flooding from rivers or sea, as defined by the EA and is not listed within a London Borough of Camden report[4] as having suffered from surface water flooding in the 1975 or 2002 flooding event. It is also not shown on Figure 15 of the Arup report[5], or the EA surface water flood maps, as being in an area with the potential to be at high risk from surface water flooding.

The central third of the site is almost entirely covered by the existing building and areas of external block paving. Infiltration of rainwater in this area is therefore generally restricted to surface water drains, such that the majority of surface runoff is likely to drain into combined sewers in the road.

3 Nicholas Barton & Stephen Myers (2016) The *Lost Rivers of London.* Historical Publications Ltd
4 London Borough of Camden (2003) *Floods in Camden, Report of the Floods Scrutiny Panel*
5 Ove Arup & Partners (2010) *Camden geological, hydrogeological and hydrological study. Guidance for Subterranean Development.* For London Borough of Camden November 2010

2.6 Preliminary Contaminated Land Risk Assessment

Part IIA of the Environmental Protection Act 1990, which was inserted into that Act by Section 57 of the Environment Act 1995, provides the main regulatory regime for the identification and remediation of contaminated land. The determination of contaminated sites is based on a "suitable for use" approach, which involves managing the risks posed by contaminated land by making risk-based decisions. This risk assessment is carried out on the basis of a source-pathway-receptor approach.

2.6.1 Source

The desk study research has indicated that the site has only been occupied by the existing house for its entire developed history, with a former garage having been located to the south of the site. The garage was apparently removed prior to the redevelopment of the land with housing and it is assumed that any contamination within the shallow soils and groundwater as a result of the previous site use, was remediated as part of the redevelopment. The site is therefore not considered to have a contaminative history.

2.6.2 Receptor

The future end users of the commercial building will represent high sensitivity receptors. The site is underlain by a Secondary 'A' Aquifer and therefore groundwater is considered to be a relatively sensitive receptor. Similarly, perched water may also exist in the made ground or in the vicinity of existing foundations. Buried services are likely to come into contact with any contaminants present within the soils through which they pass and site workers are likely to come into contact with any contaminants present during demolition and construction works.

2.6.3 Pathway

The expansion of the existing cellar will not change the amount of hardstanding on the site, such that no new linkages will exist between any contamination present within the shallow soils and a potential receptor.

Buried services will be exposed to any contaminants present within the soil through direct contact and site workers will come into contact with the soils during construction works. There is thus considered to be very low potential for a contaminant pathway to be present between any potential contaminant source and a target for the particular contaminant.

2.6.4 Preliminary Risk Appraisal

On the basis of the above it is considered that there is a low risk of there being a significant contaminant linkage that could result in any requirement for remediation work. Furthermore, as there is no evidence of filled ground within the vicinity, there is not considered to be a significant potential for hazardous soil gas to be present on or migrating towards the site; such that there should thus be no need to consider soil gas exclusion systems.

3.0 SCREENING

The LBC guidance suggests that any development proposal that includes a subterranean basement should be screened to determine whether or not a full BIA is required.

3.1 Screening Assessment

A number of screening tools are included in the Arup document and for the purposes of this report reference has been made to Appendices E1, E2 and E3 which include a series of questions within screening flowcharts for surface flow and flooding, subterranean (groundwater) flow and land stability. The flowchart questions and responses to these questions are tabulated below.

3.1.1 Subterranean (groundwater) Screening Assessment

Question	Response for 15 Rudall Crescent
1a. Is the site located directly above an aquifer?	*Yes. The site is located above a Secondary 'A' Aquifer as designated by the EA.*
1b. Will the proposed basement extend beneath the water table surface?	*Possibly. The Claygate Member may be present beneath the existing cellar and groundwater is anticipated to be present within the Claygate Member. The deepest excavations are understood to extend below the site by deepening the existing cellar by 0.4 m, to a depth of 2.6 m, although the basement will not extend to the full width or length of the existing house and thus it is unlikely that the Claygate Member will be fully excavated as part of the proposed basement construction and therefore that the proposed basement would not cause a barrier to groundwater flow.*
2. Is the site within 100 m of a watercourse, well (used/ disused) or potential spring line?	No. The site is located 566 m to the west of the Hampstead Ponds and around 200 m east of the boundary within the Bagshot Formation.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No. The site is located roughly 560 m west of the Hampstead Chain Catchment.
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No, the basement development will occur entirely beneath the footprint of the existing house.
5. As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No. Site drainage will continue to be directed to public sewer, as per the existing situation.
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than, the mean water level in any local pond or spring line?	No. There are no local ponds or spring lines within 200m of the proposed excavation.

The above assessment has identified the following potential issues that need to be assessed:

Q1a The site is located directly above an aquifer.
Q1b The proposed basement could extend beneath the water table.

3.1.2 Stability Screening Assessment

Question	Response for 15 Rudall Crescent
1. Does the existing site include slopes, natural or manmade, greater than 7°?	No. Figure 16 of the Arup Report indicates the site does not have a slope of greater than 7°.
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7°?	No. Ref Proposed Longitudinal Section A502-PL 112, dated 12 December 2016
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	No. Figure 16 of the Arup Report indicates the neighbouring land does not have a slope of greater than 7°.
4. Is the site within a wider hillside setting in which the general slope is greater than 7°?	No. Figure 16 of the Arup Report indicates the site is not within a wider hillside setting in which the general slope is greater than 7°.
5. Is the London Clay the shallowest stratum at the site?	*Possibly, the site is indicated as being underlain by the Claygate Member of the London Clay, although the site is also close to the boundary of an area of Head propensity and the shallowest natural stratum may be Head Deposits*
6. Will any trees be felled as part of the proposed development and / or are any works proposed within any tree protection zones where trees are to be retained?	No.
7. Is there a history of seasonal shrink-swell subsidence in the local area and / or evidence of such effects at the site?	*Yes – this area is prone to these effects due to the presence of shrinkable clayey Head Deposits, London Clay and abundant mature trees.*
8. Is the site within 100 m of a watercourse or potential spring line?	No. The nearest surface water feature is 566 m to the east of the site.
9. Is the site within an area of previously worked ground?	No.
10. Is the site within an aquifer?	*Yes, a Secondary 'A' Aquifer.*
11. Is the site within 50 m of Hampstead Heath ponds?	No.
12. Is the site within 5 m of a highway or pedestrian right of way?	*Yes the northeastern corner of the site is adjacent to Rudall Crescent, however the house and proposed basement development will be roughly 12 m from Rudall Crescent.*
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	*Possibly, the dimensions of the foundations of the adjoining house at No 17 Rudall Crescent to the northwest are not known, although the basement deepening will be limited to 0.4 m.*
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No. The exclusion zone for the Northern Line of the London Underground is located roughly 55 m to the southwest of the site.

The above assessment has identified the following potential issues that need to be assessed:

Q5 The Claygate Member of the London Clay may be the shallowest stratum at the site.
Q7 There is a history in the area is of shrink-swell subsidence due to the presence of shrinkable clays.
Q10 The site is located within the Secondary 'A' Aquifer of the Claygate Member.
Q12 Rudall Crescent is located to the northeast of the site.
Q13 The proposed basement extension may increase the differential depth of foundations relative to the neighbouring properties

3.1.3 Surface Flow and Flooding Screening Assessment

Question	Response for 15 Rudall Crescent
1. Is the site within the catchment of the pond chains on Hampstead Heath?	No. Figure 14 of the Camden geological, hydrogeological and hydrological study – Guidance for subterranean development dated 2010, confirms that the site is not located within this catchment area.
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No. There will not be an increase in impermeable area across the ground surface above the basement, so the surface water flow regime will be unchanged. The basement will be beneath the footprint of the existing building, therefore the 1m distance between the roof of the basement and ground surface as recommended by the Arup report and para 2.16 of the CPG4 does not apply.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No. There will not be an increase in impermeable area across the ground surface above the basement.
4. Will the proposed basement development result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses?	No. There will not be an increase in impermeable area across the ground surface above the basement, so the surface water flow regime will be unchanged. The basement will be beneath the footprint of the existing building, therefore the 1m distance between the roof of the basement and ground surface as recommended by the Arup report and para 2.16 of the CPG4 does not apply across these areas.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No. The proposed basement is very unlikely to result in any changes to the quality of surface water being received by adjacent properties or downstream watercourses as the surface water drainage regime will be unchanged and the land uses will remain the same.
6. Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk of flooding, for example because the proposed basement is below the static water level of nearby surface water feature?	No. The findings of this BIA together with the Camden Flood Risk Management Strategy dated 2013 and Figures 3iv, 4e, 5a and 5b of the SFRA dated 2014, in addition to the Environment Agency online flood maps show that the site has a very low flooding risk from surface water, sewers, reservoirs (and other artificial sources), groundwater and fluvial/tidal watercourses. It is possible that the basement will be constructed within a perched water table and the recommendations outlined in the BIA with regards to water-proofing and tanking of the basement will reduce the risk to acceptable levels. In accordance with paragraph 5.11 of the CPG a positive pumped device will be installed in the basement in order to further protect the site from sewer flooding. The site is located within the Critical Drainage Area Group3_10, but not in a Local Flood Risk Zone as identified in the Camden SWMP and Updated SFRA Figure 6/Rev 2.

The above assessment has not identified potential issues that need to be assessed.

4.0 SCOPING AND SITE INVESTIGATION

The purpose of scoping is to assess in more detail the factors to be investigated in the impact assessment. Potential impacts are assessed for each of the identified potential impact factors.

4.1 Potential Impacts

The following potential impacts have been identified by the screening process

Potential Impact	Consequence
The site is located directly above an aquifer The Claygate Member of the London Clay may be the shallowest stratum at the site.	The site is underlain by the Claygate Member, which is classified as a Secondary 'A' Aquifer. This has the potential of being able to support local water supplies as well as forming an important source of base flow for local rivers. There is the potential for the hydrogeological setting to be affected by a basement development.
The proposed basement extends beneath the water table surface. It is possible that the basement will be constructed within a perched groundwater table.	As stated above, groundwater would be expected to be encountered within the Claygate Member and therefore it is possible that the basement excavation will extend below the water table. Water-proofing and tanking of the basement extension is likely to reduce the risk to acceptable levels.
The Claygate Member of the London Clay may be the shallowest stratum at the site There is a history in the area is of shrink-swell subsidence due to the presence of shrinkable clays.	If a new basement is not excavated to below the depth likely to be affected by tree roots this could lead to damaging differential movement between the subject site and adjoining properties.
Is the site located within 5 m of a public highway or pedestrian right of way?	The northeastern corner of the site is adjacent to Rudall Crescent, however the house and proposed basement development will be roughly 12 m from Rudall Crescent.
The proposed basement extension may increase the differential depth of foundations relative to the neighbouring properties	If not designed and constructed appropriately, the excavation of a basement may result in structural damage to neighbouring buildings and structures.

These potential impacts have been investigated through the site investigation, as detailed below.

4.2 Exploratory Work

Two shallow trial pits were excavated by others to expose the existing foundations and confirm the underlying shallow soils. The trial pits were sketched by contractors on site and a copy of the findings was provided to GEA for review.

No geotechnical or contamination samples were taken during the fieldwork. The trial pits were not inspected by GEA.

The trial pit records are appended for reference.

5.0 GROUND CONDITIONS

Below an initial brick surface to a depth of 80 mm, soft clay was encountered to the full depth of the trial pits, of at least 0.5 m. It is not clear if the soft clay represented made ground or natural soils.

Groundwater was noted within Trial Pit TH1, although the depth to water is not known.

5.1 Existing Foundations

Two trial pits were excavated by others on behalf of the consulting engineers to investigate the existing foundations. The results are summarised in the table below and the trial pit records and associated site plan can be found in the appendix.

Trial Pit No.	Foundation detail	Bearing Stratum
TH1	A single brick corbel over a concrete footing Top ≈ 40 mm below basement level Base ≈ 240 mm below basement level Lateral projection minimum of 150 mm	'Soft CLAY'
TH2	No apparent footing	'Soft CLAY'

Part 2: DESIGN BASIS REPORT

This section of the report provides an interpretation of the findings detailed in Part 1, in the form of a ground model, and then provides advice and recommendations with respect to foundation options and contamination issues.

6.0 INTRODUCTION

It is understood that it is proposed to extend the existing 2.2 m deep cellar by 0.4 m in depth and around 1.0 m in plan to form a single level basement.

7.0 BASEMENT IMPACT ASSESSMENT

The screening identified a number of potential impacts. The desk study and trial pitting information has been used below to review the potential impacts, to assess the likelihood of them occurring and the scope for reasonable engineering mitigation.

The table below summarises the previously identified potential impacts and the additional information that is now available from the site investigation in consideration of each impact.

Potential Impact	Site Investigation Conclusions
The site is located directly above an aquifer. The Claygate Member of the London Clay may be the shallowest stratum at the site.	Groundwater was encountered within one of the trial pits, such that some form of dewatering may be required. However, as the soils encountered are predominantly a clay, which is unlikely to support groundwater flow or a water table, the potential for impacting on the local groundwater regime is likely to be negligible.
The proposed basement may extend beneath the water table surface. It is possible that the basement will be constructed within a perched groundwater table.	A continuous groundwater table is unlikely to be present below the site, although perched groundwater is present within the shallow soils. Continuous groundwater is likely to be of limited extent if the site is underlain by the Claygate Member. Therefore, such inflows are unlikely to be sustained and the basement structure will not pose a risk to the hydrogeological or hydrological setting, particularly as adequate space will remain around the basement structure.
The Claygate Member of the London Clay may be the shallowest stratum at the site There is a history in the area is of shrink-swell subsidence due to the presence of shrinkable clays.	The Claygate Member of the London Clay can be prone to seasonal shrink-swell and can cause structural damage. The foundations for the proposed basement would be expected to bypass any desiccated soils present.
The site within 5 m of a public highway and pedestrian right of way.	The investigation has not indicated any specific problems, such as weak or unstable ground or voids, although groundwater was noted within one of the trial pits. In any case, although Rudall Crescent is adjacent to the site boundary, the proposed development is around 12 m from the road.
The development will increase the differential founding depth	The investigation has indicated that the existing foundations and boundary walls are currently founded on conventional strip foundations bearing in the made ground or natural soils. It is assumed that the chosen construction methodology will prevent differential founding depths and maintain structural stability.

The results of the site investigation have been used below to review the remaining potential impacts, to assess the likelihood of them occurring and the scope for reasonable engineering mitigation.

The site is underlain by a Secondary 'A' Aquifer / The proposed basement may extend beneath the water table surface

It is not clear if the Claygate Member was encountered during the trial pitting works and the underlying soils were described by the contractor as "soft clay", although it is possible that these soils represent made ground. In any case, the presence of clay soils beneath the site is considered to have the hydraulic characteristics of Non Productive strata. Therefore, a continuous groundwater table is very unlikely to be present within the clay soils beneath the site, although perched groundwater was encountered within one of the trial pits.

Given these factors and the fact that there will be space around and beneath the proposed basement construction, it is not considered that it will have any significant influence on the local hydrogeology and will not therefore have any potential impact on any adjoining sites.

Seasonal Shrink-Swell

The proposed basement will extend to a depth such that new foundations will be expected to bypass any desiccated soils.

Subject to inspection of foundation excavations in the normal way to ensure that there is not significant unexpectedly deep root growth, it is not considered that the occurrence of shrink-swell issues in the local area has any bearing on the proposed development.

Location of public highway

The basement excavation will not extend to within 5.0 m of the pathway and highway to the northeast and therefore the basement excavation is unlikely to impact on the highway.

The proposed basement will increase the differential depth of foundations relative to neighbouring properties

It is unlikely that the proposed basement will extend to a significant depth relative to the existing foundations of neighbouring properties due to the proposed basement deepening being limited to only 400 mm. In any case, the basement deepening will need to consider the stability of nearby structures in close proximity to the site.

7.1 Non-Technical Summary of Evidence

This section provides a short summary of the evidence acquired and used to form the conclusions made within the BIA.

7.1.1 Screening

The following table provides the evidence used to answer the subterranean (groundwater flow) screening questions.

Question	Evidence
1a. Is the site located directly above an aquifer?	Aquifer designation maps acquired from the Environment Agency as part of the desk study and Figures 3, 4 and 8 of the Arup report.
1b. Will the proposed basement extend beneath the water table surface?	Previous nearby GEA investigations and BGS archive borehole records.

Question	Evidence
2. Is the site within 100 m of a watercourse, well (used/ disused) or potential spring line?	Topographical maps acquired as part of the desk study and Figures 11 and 12 of the Arup report.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	Topographical maps acquired as part of the desk study and Figures 12, 13 and 14 of the Arup report
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Development plans confirm that the proposed basement does not extend beneath any areas of existing landscaping.
5. As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	The details of the proposed development do not indicate the use of soakaway drainage.
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than, the mean water level in any local pond or spring line?	Topographical maps acquired as part of the desk study and Figures 11 to 14 of the Arup report.

The table below provides the evidence used to answer the stability screening questions.

Question	Evidence
1. Does the existing site include slopes, natural or manmade, greater than 7°?	Topographical maps and Figures 16 and 17 of the Arup report.
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7°?	The details of the proposed development provided do not include the re-profiling of the site to create new slopes
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	Topographical maps and Figures 16 and 17 of the Arup report.
4. Is the site within a wider hillside setting in which the general slope is greater than 7°?	
5. Is the London Clay the shallowest strata at the site?	Geological maps and Figures 3, 4 and 8 of the Arup report.
6. Will any trees be felled as part of the proposed development and / or are any works proposed within any tree protection zones where trees are to be retained?	The development proposals do not include the removal of any existing trees.
7. Is there a history of seasonal shrink-swell subsidence in the local area and / or evidence of such effects at the site?	Knowledge on the ground conditions of the area were used to make an assessment of this
8. Is the site within 100 m of a watercourse or potential spring line?	Topographical maps acquired as part of the desk study and Figures 11 and 12 of the Arup report.
9. Is the site within an area of previously worked ground?	Geological maps and Figures 3, 4 and 8 of the Arup report
10. Is the site within an aquifer?	Aquifer designation maps acquired from the Environment Agency as part of the desk study and Figures 3, 4 and 8 of the Arup report.
11. Is the site within 50 m of Hampstead Heath ponds?	Topographical maps acquired as part of the desk study and Figures 12, 13 and 14 of the Arup report.
12. Is the site within 5 m of a highway or pedestrian right of way?	Aerial photography and site plans.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Information provided by the consulting engineers and an aerial photograph confirmed the position of the proposed basement relative the neighbouring properties.
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	Online infrastructure map.

The following table provides the evidence used to answer the surface water flow and flooding screening questions.

Question	Evidence
1. Is the site within the catchment of the pond chains on Hampstead Heath?	Topographical maps acquired as part of the desk study and Figures 12, 13 and 14 of the Arup report.
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	The details provided on the proposed development indicate that this situation will remain once the development is complete.
4. Will the proposed basement development result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses?	
5. Will the proposed basement result in changes to the quantity of surface water being received by adjacent properties or downstream watercourses?	
6. Is the site in an area known to be at risk from surface water flooding such as South Hampstead, West Hampstead, Gospel Oak and Kings Cross, or is it at risk of flooding because the proposed basement is below the static water level of a nearby surface water feature?	Flood risk maps acquired from the Environment Agency as part of the desk study, Figure 15 of the Arup report, the Camden Flood Risk Management Strategy dated 2013 and the SFRA dated 2014.

7.1.2 Scoping and Site Investigation

The questions in the screening stage that required further assessment, were taken forward to a scoping stage and the potential impacts discussed in Section 4.0 of this report, with reference to the possible impacts outlined in the Arup report.

Two trial pits have allowed an assessment of the potential impacts of the basement development on the various receptors identified from the screening and scoping stages. Principally the investigation aimed to establish the ground conditions, including the groundwater level, the engineering properties of the underlying soils to enable suitable design of the basement development and the configuration of existing party wall foundations. The findings of the investigation are discussed in Section 5.0 of this report and summarised in both Section 7.0 and the Executive Summary.

7.2 BIA Conclusion

A Basement Impact Assessment has been carried out following the information and guidance published by the London Borough of Camden.

It is concluded that the proposed development is unlikely to result in any specific land or slope stability issues and it is considered that there is not a requirement for any additional investigation as part of the planning submission.

APPENDIX

Envirocheck Report Summary

Historical Maps

Existing / Proposed Drawings

GEA Geotechnical & Environmental Associates

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
110753442_1_1

Customer Reference:
J17003

National Grid Reference:
526620, 185720

Slice:
A

Site Area (Ha):
0.03

Search Buffer (m):
1000

Site Details:

15 Rudall Crescent
LONDON
NW3 1RR

Client Details:

Mr S Branch
GEA Ltd
Widbury Barn
Widbury Hill
Ware
Herts
SG12 7QE

GEA Geotechnical & Environmental Associates

Contents

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.

In the attached datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes			n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 1				1
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 1		1		7
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 2				Yes
Pollution Incidents to Controlled Waters					
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances	pg 2				37
River Quality					
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register	pg 9				1
Water Abstractions	pg 9				(*4)
Water Industry Act Referrals					
Groundwater Vulnerability	pg 10	Yes	n/a	n/a	n/a
Drift Deposits			n/a	n/a	n/a
Bedrock Aquifer Designations	pg 10	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
Detailed River Network Lines					n/a
Detailed River Network Offline Drainage					n/a

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites					
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Landfill Coverage	pg 11	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)	pg 11			1	6
Potentially Infilled Land (Water)	pg 11			1	2
Registered Landfill Sites					
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					

GEA Geotechnical & Environmental Associates

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 12	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry					
BGS Recorded Mineral Sites					
BGS Urban Soil Chemistry	pg 12		Yes	Yes	Yes
BGS Urban Soil Chemistry Averages	pg 14	Yes			
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas			n/a	n/a	n/a
Mining Instability			n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain				n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 14	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards				n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 15	Yes		n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 15	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 15	Yes		n/a	n/a
Radon Potential - Radon Affected Areas			n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 16		29	9	91
Fuel Station Entries	pg 26				1
Points of Interest - Commercial Services	pg 26		1		19
Points of Interest - Education and Health	pg 28				9
Points of Interest - Manufacturing and Production	pg 29				4
Points of Interest - Public Infrastructure	pg 29			4	11
Points of Interest - Recreational and Environmental	pg 30				2
Gas Pipelines					
Underground Electrical Cables	pg 31		6	2	4

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland	pg 33				1
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves	pg 33				1
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones					
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					