BASEMENT IMPACT ASSESSMENT

FOR

61 BAYHAM PLACE

LONDON NW1 OET

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Appendices:

1.0 Brief

As instructed by Modern City Estates Ellis and Moore Consulting Engineers Ltd have undertaken a Basement Impact Assessment (BIA) in accordance with the Guidelines prepared by Camden Council.

The wording in the Camden document is as follows:

Subterranean development of the site would trigger the need for a Basement Impact Assessment (BIA) prepared in accordance with Camden CPG4 (Basement and Lightwells). The policy DP27 sets out that applications should demonstrate (by Methodologies appropriate to the site) that schemes comply with the criteria (A) to (H). The BIA should address the impact of the proposals in terms of the stability and water environment, using the screening flow chart set out in the CPG. In particular, structural stability of the existing building on the site would be of concern and so the issue of slope stability will require attention.

This report follows the Camden Council requirements at the following Stages.

Stage 1	Screening
Stage 2	Scoping
Stage 3	Site Investigation and Study
Stage 4	Impact Assessment.

In preparing the report, the following Appendices have been relied on to provide information.

Appendix 1	Soils Investigation by Ground Engineering Ltd.
Appendix 2	Structural Scheme drawings prepared by Ellis and Moore for the basement
Appendix 3	Thames Water Sewer Records
Appendix 4	Camden Geological, Hydrogeological and Hydrological Maps.

2.0 Stage 1 - Screening

A Basement Impact Assessment has been requested for this development to determine if the proposed works will result in possible flooding in future either due to ground or surface water.

Currently there is a two storey terraced building on the site dating from Victorian times. The general profile of the land slopes down gently to the east

The flow charts Figure 1 in the Camden Planning Guidance document have been considered and it has been decided that a Basement Impact Assessment is necessary because of groundwater potential.

Stage 2 – Scoping

For this Stage, information has been sought from various sources including the Camden Geological, Hydrogeological and Hydrological maps together with the sewer records.

As the site is in Zone 1 it is proposed that a Flood Risk Assessment will not be undertaken as part of this exercise due to the limited size of the development. It is concluded that the site is not prone to flooding.

Referring to the map indicating water courses near the site it is to the west of the Fleet River which is culverted.

The geology of the area indicates that the site is underlain by made ground and London Clay of substantial thickness.

In Appendix 3, the Thames Water Sewer Records indicate that there is a combined sewer serving the property and a trunk storm sewer also close to the property.

As a result of the information obtaining the above information it was concluded that an intrusive soils investigation in addition to a Desk Study was required to be included in this report.

Stage 3 – Site Investigation and Study

A soils investigation has been undertaken by Ground Engineering Ltd. and is included in Appendix 1.

The survey can be summarised as follows. A single borehole and a single foundation inspection pit were undertaken. The borehole was drilled to 6.45 metres below existing ground level and the trial pit was used to expose the existing foundation to the building. Insitu testing was undertaken and a standpipe was installed to check the groundwater level. A subsequent visit was made to check the water level which was found to rise to 2.8 metres below existing ground level.

A desk study was undertaken as part of the soils investigation. The information is included in Stage 2 above as part of the Scoping. In this instance it is considered that sufficient soils investigation work was undertaken to conclude on the soil conditions as the development is limited in scope.

At this stage no further monitoring of the groundwater conditions is required due to the depth that was recorded in the soils investigation.

Stage 4 – Impact Assessment

From the information gathered in the previous Stages 1 to 3, it is considered that the most applicable structural solution would be to construct a series of L shaped retaining walls, underpinning the existing walls of the building. The details are indicated on the attached drawings 14946/Sch/01 and /03. Drawing /03 shows the depth of the made ground below existing ground level and the level of water that was found in the standpipe. The excavation will require adequate propping during the construction, which will involve the use of sacrificial steel sheets at the rear of the excavation to prevent damage to the adjacent properties. A detailed method statement will be prepared to accompany the working drawings.

It is likely that the ground slab and walls would be formed in waterproof concrete using one of the waterproofers either Caltite or Pudlo.

Due to the depth of the new basement it is likely that the foul water may have to be pumped up to the existing ground level and fed by gravity into one of the existing manholes. It will be necessary to undertake a CCTV survey of the existing drainage prior to the works commencing so that access can be achieved into the existing for the foul drainage.

It is concluded that the proposed drainage will adequately take care of any rainfall and runoff as it is likely to be similar to the existing.

During the site works, it is likely that localised pumping of excavations may be required as a result of rainfall

Conclusions

The following conclusions are drawn based on the investigative work undertaken to date:

- From the Soils Investigation it is concluded that this building will not impose any restrictions on the flow of ground water as the underside of the basement is approximately 400mm below the water level that was measured.

- As far as flooding is concerned, the existing drainage should be able to cope.

- Various flood maps have been consulted and they generally indicate that the site is in the area of low flood risk therefore no flood protection precautions are required for this development.

- As a result of the property being underpinned there is the possibility that as a result of the work there will be some minor cracking in the existing building as the underpinning settles in. This should be viewed as part of the works. Method statements will be required for both the underpinning and the proposed structural works to form the basement.

- It was concluded that when the basement is completed there should be no residual issues affecting the property or the land surrounding the building. It will be aim of the contractor to undertake the work using the safest possible techniques given the type of structure that has been selected.

- In summary it is concluded that this basement can be constructed successfully as long as the guidelines in this report are followed. It is likely that there will be no effect on the groundwater conditions below the site.

L.A.McDonald
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Ellis and Moore Consulting Engineers Ltd.

APPENDIX 1

SITE INVESTIGATION REPORT

BY GROUND ENGINEERING LTD.

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SITE INVESTIGATION REPORT

61 BAYHAM PLACE

LONDON NW1

Report Reference No. C13359

On behalf of:-

Modern City Estates Limited
Flat 7a, 18-22 Craven Hill
London
W2 3DS

September 2014

MODERN CITY ESTATES LIMITED

TERRY DACOMBE ARCHITECTS

ELLIS & MOORE

CONSULTING ENGINEERS

REPORT ON A SITE INVESTIGATION

AT

61 BAYHAM PLACE

LONDON NW1

Report Reference No. C13359 **September 2014**

INTRODUCTION

Modern City Estates, the client, intends to construct a single level basement below No.61 Bayham Place, London NW1.

At the time of the investigation the building was in residential use.

Ground Engineering Limited was instructed by the client to carry out a site investigation comprising a desk study and ground investigation under the direction of Consulting Engineers, Ellis & Moore. The ground investigation was to determine the nature and geotechnical properties of the underlying soils in relation to foundation/basement design and construction. In addition, a limited contamination assessment was to be included within the scope of this investigation.

LOCATION, TOPOGRAPHY, GEOLOGY AND HYDROGEOLOGY OF THE SITE

No.61 Bayham Place is situated on the southern side of the street, some 16m east of its junction with Bayham Street, and 25m west of the grounds of Richard Cobden Primary School, to the south-south-east of the centre of Camden Town, within the London Borough of Camden, London NW1. The approximately 5m wide and 10m deep rectangular site is bounded to the east and west by similar properties of Nos.59 and 63, respectively. The site is centred at National Grid Reference TQ 29289 83446.

At the time of the investigation the site was entirely occupied by the two-storey, terraced brick dwelling, a converted former workshop. The site was bounded to the north by the Bayham Place roadway and to the south by the rear garden of No.68 Crowndale Road. The site was devoid of vegetation but several trees and shrubs were present within the adjacent rear gardens to the south.

The site stands at an approximate elevation of 22mOD on gently eastward falling ground.

The 1935 geological map for the area at 1:10,560 scale is based on the 1920 Ordnance Survey London Sheet V NW and shows the site to be directly underlain by the solid geology of the London Clay. This map also shows that the site lies some 330m west-south-west of the south-eastward draining Hole Bourne or Turnmill Stream (now culverted), part of the River Fleet. The 2006 geological map for the area at 1:50,000 scale, Sheet 256, shows the site within the centre of a 280m by 100m rectangular area of worked ground, on the northern side of Crowndale Road, underlain by the London Clay Formation.

Well records on the 1935 geological map indicate that the Unproductive Stratum of the London Clay is about 27m thick beneath this part of London and that the underlying Principal Aquifer of the Chalk lies 45m below ground level (-23mOD). Based on the topography of the site area the direction of near surface groundwater and surface water flow would locally be from west to east.

HISTORY OF THE SITE

Historical maps dating between 1745 and the present day have been reviewed as part of this desk study together with internet research. Selected map sheets are reproduced in Appendix 1 with relevant descriptions given below.

John Roque's Plan of the Cities of London and Westminster and Borough of Southwark, and the Country Ten Miles Around, was published in 1745 (not reproduced) and shows the site within open fields on the northern side of the unnamed Crowndale Road and west-south-west of St. Pancras Workhouse. A similar map of 1786 (Cary) shows the site unchanged, whilst the 1807 (Ordnance Survey) map has the adjacent land along the northern side of Crowndale Road to have been developed at the south-eastern end of Camden Town, as the settlement was then depicted (not reproduced). Greenwood's Map of London of 1827 and 1830 (2nd Edition) have the site to the rear of dwellings lining the northern side of Gloucester Place (later Crowndale Road). Bayham Street had been set out to the west of the site but was as yet undeveloped, whilst the southern part of Camden Street, to the east, was fully lined with dwellings. The Gloucester Place dwellings had rear gardens extending northwards to a short lane (the future Bayham Place), and two of the houses had outbuildings at their northern ends. The land to the south of Gloucester Place, and north of the site, remained as open fields.

John Tallis' map of 1851 (not reproduced) shows the site area to have been wholly developed and the grid of streets within this southern part of Camden Town to be apparently fully lined with dwellings. Bayham Place is not detailed on this small scale map.

Stanford's 'Library Map of London and its Suburbs' was published in 1862 (Figure A) and also shows the site in little detail. Gloucester Street (now Bayham Place) was detailed running eastwards from Bayham Street and then turning northwards, beyond which it was called Bayham Place, before running to King Street. The southern side of Gloucester Street was lined by a row of three small square buildings, probably outbuildings, at the northern end of rear gardens to Gloucester Place.

The 1870, O.S. Town Plan (Figure B) at 1:1056 scale and 1875-76 First Edition O.S. maps for the area at 1:2500 scale (Figure C), London Sheets XVI & XXV, show the site on the southern side of the eastern section of Gloucester Street (now the southern section of Bayham Place), to the east of Bayham Street. The northern half of the site was occupied by a square outbuilding at the northern end of a rear garden to one of the Crowndale Road terrace, whilst the southern half of the site was the northern end of this garden. The surrounding area was as before apart from the development of the eastern side of Bayham Place, to the north-east of the site, with terraced housing and the St. Pancras Public Baths.

The O.S. Town Plan of 1894 (Figure D) at 1:1056 scale and 1896, Second Edition O.S. maps (Figure E) for the area at 1:2500 scale, London Sheets XXXVIII & XLIX, show the site redeveloped and wholly occupied by one of a row of five buildings along the southern side of the renamed Bayham Place. The row was bounded to the south by the truncated rear gardens to the dwellings on the northern side of Crowndale Road. Two small yards were present to the east and north-east of this row, with the northernmost called King's Yard associated with a piano factory. Further to the north-east, two schools had been constructed on former mushroom grounds to the east of the public baths.

The 1897 Goad Insurance map for the site area (not reproduced) indicates that the row of buildings along the southern side of Bayham Place are two-storey, flat-roofed, brick workshop buildings. No.61 was occupied by a plating factory, whilst No.63 adjacent to the west was a cap factory and No.59 to the immediate east was a cycle factory. Further east, No.57 was a mission hall and No.55 was occupied by a gas engineer. The northwards extending building at the junction of Bayham Street and Crowndale Road, to the south-west of the site, was a co-operative store.

The 1916, 3rd Edition O.S. maps (London Sheets V.1 and V.5) at 1:2500 scale (Figure F) have the site and adjacent housing unchanged. Further east the schools had expanded southwards, and a working men's college had been constructed at the junction of Camden Street and Crowndale Road. West of the site, a picture theatre had been built at the corner of Crowndale Road and Camden High Street.

The 1927 and 1930 Goad Insurance maps (not reproduced) indicate that No.61 was now occupied by a (smoking) pipe factory; No.63 was marked as a workshop; No.59 was denoted as a cabinet factory; No.57 was a wood turners; and Nos.53 and 55 was a music roll warehouse. In 1927 the rearward section of the co-operative store was an upholsterers but in 1930 this property was occupied by 'various factories'.

The London Bomb Damage Maps (1939-1945) for the area (not reproduced) show the site, and the adjacent workshops, to have survived unscathed. The closest bomb damage was minor and general blast damage to the terrace on the northern side of Crowndale Road and along the eastern side of Bayham Street, to the north.

The 1952, O.S. map at 1:2500 scale (TQ 2983) has the site unchanged (Figure G). The southernmost yard and associated workshops to the east had been cleared and were now included within the grounds of the adjacent school, to the east. Further school buildings had been removed to the north of the extant school.

The 1957 Goad Insurance map (not reproduced) indicates that No.61 was now a plastics factory; Nos.59 and 63, on either side, were occupied by engineers; Nos.53 and 55 were now a gown factory (ground level) and perfume factory (first floor); and No.2 Bayham Street (the former co-op store) was now a motor repairers.

The 1961-64, O.S. maps at 1:1250 scale (TQ 2983 SW & TQ 2983 NW) have the site unchanged (Figure H). The terraced streets of Bayham Street and Bayham Place, King's Yard and St. Pancras Public Baths, to the north of the site, had been cleared and partially replaced with multi-storey residential blocks (Westerham House, Rainham House, Brockham House and Faversham House). A playground was present to the east of the site, associated with the renamed Richard Cobden Primary School. The land to the north of this school remained vacant.

The 1963 Goad Insurance map (not reproduced) denotes the site (No.61) as a shoe repairers and the adjacent No.63 as a printers, and the other workshops as they were in 1957. The

1966 Goad Insurance map has the use of No.61 changed yet again, this time to a printers; Nos.53, 55 and 57 were also printers; No.59 remained as an engineer; and No.63 was now occupied by a lubricating oil store. The motor repair garage remained at No.2 Bayham Street.

The 1968, O.S. map at 1:2500 scale (TQ 2983) shows the site (Figure I) as before. A number of sites within the surrounding area had been redeveloped with residential blocks, and within part of the former baths plot a row of residents' garages had been built.

The 1969 Goad Insurance map (not reproduced) marks No.61 Bayham Place as being vacant in March 1969. The other workshop occupiers remained unchanged from 1966.

The 1968-72, 1:1250 scale maps TQ 2883 SE & NE (not reproduced) have the site and immediate surrounding area unchanged from the 1968 map.

The 1984-86 revisions of the 1:1250 scale maps TQ 2883 SE & NE (not reproduced), have the site and surrounding area as before, as do the 1987-92 editions of these maps (not reproduced).

The 2002 Raster Map at 1:10,000 scale (not reproduced), shows the site and surrounding area unchanged from the 1990s. Similarly, the 2010 and 2014 National Grid maps at 1:10,000 scale (not reproduced), have the site as before and as it was at the time of this investigation in August 2014. The 2013 aerial photograph presented on page 1 of Appendix 2 shows the site with trees and shrubs within the neighbouring rear gardens to the south.

Summary

In summary, the site was within open fields until the beginning of the Nineteenth Century after which the land was progressively covered by predominantly residential development with small workshops and yards. The site was occupied by a square outbuilding, probably a small stable, and the northern end of a rear garden to one of the Crowndale Road terraced houses, and remained unchanged through to the 1880s when the extant workshop building, and the adjoining workshops, were built.

The site use changed periodically and ranged between a plating factory, (smoking) pipe factory, a plastics factory, a shoe repairers, and a printers. The current site use is residential. The adjacent workshops have had a variety of uses, including: printers, engineers, gown and perfume factories, wood turners, a lubricating oil store, a mission hall, a cycle factory, a cabinet factory, a cap factory, and a music roll warehouse. The surrounding area was developed throughout the Nineteenth Century, and parts were progressively redeveloped from the 1950s as clearance and bomb damaged plots were redeveloped with residential blocks.

ENVIRONMENTAL DATABASE INFORMATION

Appendix 2 contains information from Environmental Databases for a radius of up to 2km from the site. The information covers various datasets and contributors include the Environment Agency, Local Authorities, British Geological Survey, Ordnance Survey and the Coal Authority. The results obtained are presented together with a detailed search on selected areas of enquiry, and have been described below for a radius of 250m from the site.

Environmental Permits, Incidents & Registers

The following is a summary of the main points for environmental authorisations:

Statutory Authorisations

IPC & IPPC Regulations: There are no (0) recorded sites authorised by the Environment Agency under Part I of the Environmental Protection Act 1990, to carry out processes subject to Integrated Pollution Control (IPC) or Integrated Pollution Prevention and Control (IPPC) on, or within 250m of the site. There are no (0) recorded IPC Registered Waste Sites on, or within 250m of the site.

Water Industry Act Referrals: There are no (0) recorded referrals under the Water Industry Act on or within 250m of the site.

Local Authority Pollution Prevention and Control Enforcements: There are no (0) recorded enforcements under Part I of the Environmental Protection Act 1990 on, or within 250m of the site.

Keeping of Dangerous Substances: There are no (0) Environment Agency List 1 or 2 Dangerous Substance Inventory Sites listed on or within 250m of the site.

Enforcement Notices and Authorised Processes: There are no (0) Part A(2) and Part B activities and enforcements recorded by the Environment Agency under Part I of the Environmental Protection Act 1990 on site and four (4) Part B activities listed within 250m of the site. The latter all refer to two dry cleaners on Camden High Street and Crowndale Street, the nearest of which lies 147m west of the site.

Keeping of Radioactive Substances: There are no (0) recorded sites registered by the Environment Agency under the Radioactive Substances Act 1993, on or within 250m of the site.

Discharge Consents

Discharges to Water: There no (0) consents issued, by the Environment Agency, to discharge to watercourses in accordance with the Water Resources Act 1991 positioned within 250m of the site.

Storage of Hazardous Substances

Storage of Hazardous Substances: There are no (0) recorded sites subject to hazardous substances consents granted by the relevant local authority under the Planning (Hazardous Substances) Act 1990 on, or within 250m of the site.

Control of Major Accidents: There are no (0) recorded sites regulated by the Health and Safety Executive under the Control of Major Accident Hazards (COMAH) regulations 1999, on, or within 250m of the site.

Notification of Installations Handling Hazardous Substances: There are no (0) sites within 250m of the site regulated by the HSE under the Notification of Installations Handling Hazardous Substances (NIHHS) regulations.

Pollution Incidents

Pollution Incidents and Prosecutions: There are no (0) pollution incidents recorded within 250m of the site.

Contaminated Land Register Entries & Notices: There are no (0) recorded entries or notices on the Contaminated Land Register listed on, or within 250m of the site.

Landfill & Waste Sites

The following is a summary of the main points for the Waste section:

Landfill Sites: There are no (0) recorded landfill sites licensed by the Environment Agency under Part II of the Environmental Protection Act 1990, within 250m of the site.

Registered Landfill or Local Authority Recorded Landfill Sites: There are no (0) recorded operational or non-operational landfills located on or within 250m of the site.

Registered Waste Transfer Site: There are no recorded waste transfer sites on or within 250m of the site.

Waste Treatment, Transfer and Disposal: There are no (0) records of waste treatment, transfer or disposal licences issued by the Environment Agency under Part II of the Environmental Protection Act 1990 recorded within 250m of the site.

Potentially Contaminative Uses

Current Industrial Sites: There are no (0) recorded potentially contaminative uses recorded for the site, and nineteen (19) within 250m of the site. The closest of these, at No.2 Bayham Street, refers to a vehicle hirer, 9m to the south-west; whilst the remainder are for two electricity sub-stations, publishers, unspecified works, electronic component suppliers, haulage and storage depots, photographers, cosmetics suppliers, stoneworkers, vehicle repairers/cleaners and an underground railway station (Mornington Crescent).

Fuel Station Entries: There is one (1) recorded obsolete fuel station entry within 250m of the site. This relates to the former Parkway Filling Station some 114m to the south-west of the site.

High Pressure Oil & Gas Pipelines: There are no (0) recorded underground high pressure oil and gas pipelines within 250m of the site.

Geology & Hydrogeology – Pathways & Receptors

The following is a summary of the main points for the sensitivity section:

Artificial & Made Ground: The site, including a 50m buffer, is recorded as being covered by worked ground.

Drift Deposits & Solid Geology: The site, including a 50m buffer, is recorded as being directly underlain by the solid geology of the London Clay Formation (clay, silt and sand).

Groundwater Vulnerability: The site is designated by the EA as being underlain by the Unproductive stratum of the London Clay.

Water Abstractions: There are no (0) recorded water abstraction licences listed on, or within 2000m of the site.

Source Protection Zones: The site does not lie within a Source Protection Zone.

River Quality: There is no (0) Environment Agency information relating to river quality within 250m of the site.

River Network & Surface Water Features: There are no (0) detailed river network or surface water feature entries within 250m of the site apart from a culvert some 237m to the north-east of the site.

Flood Risk: The site is not within 250m of a Zone 2 or Zone 3 flood plain. The site is not within a zone benefiting from flood defences and is not used for flood storage.

The site is designated as within an area that is 'Not Prone to groundwater flooding.

Environmentally Sensitive Receptors

Environmentally Sensitive Areas: There are no (0) environmentally sensitive areas within 250m of the site.

Protected Countryside Areas: There are no (0) National Parks or other protected areas or parks recorded as being either on or within 250m of the site.

Nitrate Vulnerable Zones: The site and surroundings are not indicated to be within a nitrate vulnerable zone.

Natural & Mining Hazards

Natural Subsidence Risk: According to the British Geological Survey there is a 'Moderate' hazard potential for Shrinking or Swelling Clay; a 'Very Low' hazard potential for Landslides and Collapsible Rocks; and a 'Null-Negligible' hazard potential for Soluble Rocks, Running Sand, Compressible Ground and Shallow Mining.

Coal Mining: The site is not within 75m of any areas affected by coal mining.

Brine Affected Areas: The site is not within 75m of any areas affected by brine extraction.

Radon Affected Area: The site lies within an area where less than 1% of properties are above the action level for radon.

Radon Protection Measures: The site lies within an area where no radon protection measures are necessary for new dwellings or extensions in accordance with Building Research Establishment report BR211 (1999).

PRELIMINARY RISK ASSESSMENT

In order to assess the risks associated with the presence of ground contamination the linkages between the sources and potential receptors to contamination need to be established and evaluated. This is in accordance with the Environmental Protection Act 1990, which provides a statutory definition of Contaminated Land. To fall within this definition it is necessary that, as a result of the condition of the land, substances may be present on or under the land such that

- *Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- *Pollution of controlled waters is being, or is likely to be, caused*

There are three principal factors that are assessed whilst undertaking a qualitative risk assessment for any site. These are the presence of a contamination source, the existence of migration pathways and the presence of a sensitive target(s). It should be noted that it is necessary for each element of source, pathway and target to be present in order for exposure of a human or environmental receptor to occur.

UK Government guidance on the assessment of contaminated land, requires risk to human health and the environment to be reviewed using source – pathway – target relationships. If each of these elements is present, the linkage provides a potential risk to the identified targets. ***Contaminants or potential pollutants*** identified as ***sources*** in relation to the identified previous uses are listed below in Table 1.

Table 1: Identified Potential Contaminant Sources

Contaminant Source	*Comments*
Drainage/Building	Effluent from leaking drains would provide a contaminant source. The existing building may have or have had asbestos containing materials (ACMs) within it.
Soil Beneath Site	Contamination may be present within any made ground materials beneath the site.
Soil Gas	Potential soil gas generated from made ground or natural organic soils.
Ground Contamination Outside Site Boundary	Ground contamination migrating from adjoining sites.

A ***Pathway*** is defined as one or more routes through which a receptor is being, or could be, exposed to, or affected by, a given contaminant.

Potential ***Target or Receptors*** fall within the categories of Human Health, Water Environment, Flora and Fauna, and Building Materials.

There are a number of possible pathways for the contaminants identified on the site to impact human and/or environmental receptors and these are summarised in Tables 2 and 3.

Table 2: Human Receptors and Pathways

Human Receptor-Mechanism	***Typical Exposure Pathway***
Human Inhalation	Breathing Dust and Fumes Breathing Gas emissions
Human Ingestion	Eating -contaminated soil, for example by small children -plants grown on contaminated soil Ingesting dust or soil on fruit or vegetables Drinking contaminated water
Human Contact	Direct skin contact with contamination Direct skin contact with contaminated liquids

Table 3: Water Receptors and Pathways

Receptor-Water Environment	***Typical Exposure Pathway***
Groundwater The site is directly underlain by made ground and the Unproductive strata of the London Clay Formation.	Surface infiltration of atmospheric waters into the soils beneath the site could wash or dissolve potential contaminants and migrate to underlying groundwater. Contamination leads to restriction/prevention of use as a resource, for example, drinking water, and can have secondary impacts on other resources, which depend on it.
Surface Water There are no water courses or surface water features recorded within 250m of the site. The culverted River Fleet is depicted on the 1935 geology map some 330m to the east-north-east of the site.	Surface infiltration of atmospheric waters into the soils beneath the site could wash or dissolve potential contaminants and laterally migrate. Contamination leads to a restriction/prevention of use: -as drinking water resource -for amenity use Effects on aquatic life

Preliminary Conceptual Model

Assessment of the potential linkage between ground contamination sources, human and environmental receptors have been assessed based on the desk study research documented in the preceding sections of this report.

A generalised preliminary conceptual model relative to the construction phase and completed development is presented below in Table 4.

Table 4: Preliminary Conceptual Model Relative to Construction/Future Use of Site

Receptors	Pathway	Estimated Potential for Linkage with Contaminant Sources			
		Drainage/ Buildings	Soil Beneath Site	Soil Gas	Ground Contamination Outside Site Boundary
Human Health – ground workers	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	Likely	Likely	Likely	Low likelihood
Human Health – users of completed development	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	Unlikely	Low likelihood	Low likelihood	Low likelihood
Water Environment	Migration through ground into surface water or groundwater	Low likelihood	Low likelihood	Unlikely	Low likelihood
Flora	Vegetation on site growing on contaminated soil.	Low likelihood	Low likelihood	Unlikely	Low likelihood
Building Materials	Contact with contaminated soil	Low likelihood	Low likelihood	Unlikely	Low likelihood

Key to Table 4

Estimated Potential for Linkage with Contaminant Source	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.
N/A	Not Applicable

SITE WORK

A single borehole and a single foundation inspection pit were undertaken at the positions depicted on the site plan at the rear of this report, as requested by the Engineer and agreed with the Architect. Services information was obtained and referenced in relation to the exploratory hole positions prior to boring.

The investigation was undertaken following the protocols detailed in British Standards (BS) 'Code of Practice for Site Investigations' (BS5930:1999) and 'Methods of test for soils for engineering purposes' (BS1377:1990). The site work was supervised by a Geoenvironmental Engineer.

Borehole

On 8th August 2014, portable window sampling equipment was brought to site, taken into the dwelling, and the position (WS 1) was selected within the ground floor after a cable avoidance tool (CAT) scan was undertaken. The floor slab was cored using diamond drilling equipment and a starter pit was excavated using hand tools to 1.20m depth.

The borehole was then advanced using window sampling equipment that consisted of 1.00m long drive-in samplers of specially constructed and strengthened 87mm to 57mm diameter steel sample tubes with a plastic core-liner. The samplers were driven into the ground from the base of the borehole by an automatic trip hammer weighing 63.50kg falling freely through 750mm. Upon extraction a continuous profile of the soil was obtained in the plastic liners (U) inserted in the samplers. The borehole was completed at 6.45m depth.

Small disturbed samples (D) of soil were recovered at regular intervals within the WS 1 starter pit and borehole.

Standard penetration tests were undertaken in WS 1 at 1.00m intervals in order to give an indication of the in-situ relative density/shear strength of the material. The test was made by driving a 50mm diameter open shoe and split spoon sampler (S) of 50mm diameter into the soil at the base of the borehole by means of an automatic trip hammer weighing 63.50kg falling freely through 750mm. The penetration resistance was determined as the number of blows required to drive the tool the final 300mm of a total penetration of 450mm into the soil ahead of the borehole.

On completion of boring, a 38mm diameter standpipe was installed to 5.00m depth. The annulus around the standpipe was backfilled with pea gravel with a bentonite seal placed around the top of the installation within 1.00m of ground level. A gas tap was installed in the top of the standpipe. A protective steel stopcock cover was concreted into the ground flush with the surface over the installation. Below the installation the borehole was infilled with clean arisings.

The borehole record gives the descriptions and depths of the various strata encountered, results of the in-situ tests, details of all samples taken and the groundwater conditions observed during boring, on completion and subsequently in the WS 1 standpipe.

Trial Pit

A single trial pit (TP A) was undertaken on the same day as the borehole. The surface layer of concrete was stitch-cored using diamond drilling equipment and then the pit was extended using hand tools. The exposed strata and foundations were logged and the soils sampled by the supervising Geoenvironmental Engineer. The trial pit was completed at 1.20m below ground floor level.

An immediate assessment of the apparent soil cohesion was made using a Pilcon hand shear vane (V) in clay soils. The average of three readings was recorded at each position.

Disturbed samples of soil were taken at regular intervals throughout the pit and placed in polycarbonate pots (D samples).

The trial pit record gives descriptions and depths of the various strata encountered, the details of all samples, the results of the in-situ tests and the groundwater conditions observed during excavation. A sketch section and photographs of the exposed footing are presented on the pages following the record for the relevant excavation. On completion of the excavation, the spoil was returned to the pit and placed in layers, which were recompacted. The surface layer of concrete was reinstated.

Gas and Groundwater Monitoring

A single return visit was made on 3rd September 2014 in order to monitor methane, carbon dioxide and oxygen gas levels in the WS 1 standpipe. Ambient pressures and flow rates were recorded together with the depth to groundwater. The water level has been added to the borehole record and the gas/groundwater results are presented following the exploratory hole records.

LABORATORY TESTING

The samples were inspected in the laboratory and assessments of the soil characteristics have been taken into account during preparation of the exploratory hole records. The soil sample descriptions are in accordance with BS5930:1999.

The chemical testing schedule was devised by Ground Engineering Limited for a broad suite of potential contaminants, outlined by the Environment Agency (EA) and National House Building Council (NHBC) document R&D 66; 2008 'Guidance for the Safe Development of Housing on Land Affected by Contamination'.

The geotechnical tests were conducted to BS1377:1990 and other industry standards, and the results are presented following the exploratory hole records, whilst the results of the chemical tests are presented in Appendix 3.

Geotechnical Testing

The index properties of selected soil samples were determined as a guide to soil classification and behaviour. The liquid limit was determined by the cone penetrometer method.

In the laboratory, an immediate assessment of the apparent soil cohesion was made using a Pilcon hand shear vane (V) in the clay soils recovered within the plastic liners. The average of three readings was recorded at each position.

Selected samples of soil were analysed to determine the concentration of soluble sulphates. The pH values were also determined using an electrometric method.

Chemical Testing

Two soil samples recovered from the exploratory holes were tested for total concentrations of arsenic, cadmium, chromium, lead, mercury, selenium, nickel and benzo[a]pyrene, together with speciated polyaromatic hydrocarbons (PAH), boron, copper and zinc, phenols, total and free cyanide, hexavalent chromium, sulphate, sulphide and pH. The soil samples were also tested for organic content.

A sample of made ground from TP A at 0.70m depth was scheduled for a full Waste Acceptance Criteria (WAC) CEN Leachate Suite at 2l/kg and 10l/kg.

GROUND CONDITIONS

The ground conditions encountered were as expected from the geological records with London Clay encountered beneath a cover of made ground.

Made Ground

The surface layer at the borehole position was 0.10m thick, but it thickened towards its edge in TP A, where it was 0.30m thick. In the borehole the slab was laid upon a dark brown, silty sand and gravel with a gravel fraction of brick, ash, glass, flint, concrete and coal. This coarse grained fill was proved to 0.70m below floor level, a thickness of 0.60m, but was absent in TP A, only 2.5m distant.

Beneath the thickened floor slab in TP A, and below 0.70m depth in WS 1, a firm or soft, dark brown, brown and orange brown mottled, slightly sandy, slightly gravelly to gravelly clay was met, with a similar gravel fraction to the coarse grained fill but also including fragments of plastic and slate. With increasing depth the artefacts within the made ground were predominantly of brick, ash and flint.

The made ground was found to at least 1.20m depth where TP A was completed, and proved to 1.40m below floor slab level in WS 1.

London Clay

The solid geology of the London Clay was met at 1.40m depth and was initially weathered to a firm, brown, orange brown and grey mottled silty clay with occasional silt partings. At 3.00m depth the London Clay was a stiff, closely fissured, brown and orange brown mottled clay with blue grey stained fissure planes, occasional selenite crystals, and patches of silt. This typical London Clay was found to at least 6.45m depth where the hole was completed.

Groundwater

The trial pit and borehole were dry during excavation/boring and on completion.

The standpipe water level recorded on 3rd September 2014 was at 2.82m depth.

Roots

No live roots were recorded in the exploratory holes.

Evidence of Contamination

The made ground contained pieces of brick, concrete, coal, ash, plastic and glass. There was no olfactory or visual evidence of hydrocarbon contamination. No visual evidence of asbestos containing material was detected within the exploratory holes.

Existing Foundations

Trial pit TP A, on the western elevation of the dwelling, found a 0.77m deep brick footing, with a 0.07m thick single brick course projecting 0.39m from the wall at 0.60m depth.

This projection may be a remnant of the floor to the former outbuilding/stable that occupied the northern half of the site until the 1880s, which may have been incorporated into the foundation to the existing structure.

COMMENTS ON THE GROUND CONDITIONS IN RELATION TO FOUNDATION DESIGN AND CONSTRUCTION

The investigation found a thin cover of made ground associated with the construction of No.61. Foundations for the basement will penetrate this made ground and be based within the underlying London Clay, which should have adequate bearing properties. The net reduction in pressure at basement floor level during construction could give negligible base heave. The groundwater level was recorded at about 2.80m below ground level, and this may well impact construction.

Foundation Depths

The borehole encountered natural ground at 1.40m below ground floor level.

The underlying London Clay had a modified plasticity index of 39%, so is of medium volume change potential. In open natural ground, well away from trees, a minimum foundation depth of 0.90m below finished or existing ground level would be required.

The presence of trees and shrubs within the adjacent rear garden to the south, means that the depth affected by seasonal changes in moisture content of clay soils may have locally been increased. However, foundations for the new basement, based perhaps 3m below ground floor level should be deeper than any root-induced desiccation effects due to this vegetation, even when mature.

Foundations within the range of influence of retained and removed trees will have to be separated from the soil by a suitable void former. The required gap dimensions for footings in medium volume change potential clay soils are detailed in the previously cited NHBC document.

Bearing Capacity

The construction of a 3m deep basement on this site will remove the surface layers and the foundations will be within the solid geology of the London Clay.

The results of the laboratory triaxial compression strength tests indicate that a net safe bearing capacity of 200kN/m^2 could be applied on a 1.00m wide strip foundation cast at or just below basement level on the stiff London Clay. This value incorporates a factor of safety of 3.0 against general shear failure and should be more than sufficient to support the likely foundation pressures applied by the structure.

Such a value could be used for the design of underpinned walls to the existing structure, which currently have only shallow footings.

Basement

The construction of the basement will remove the surface layer of made ground and the top of the underlying weathered London Clay. Foundations for the basement walls at or just below the basement floor level would be within the stiff London Clay and could be designed using the previously detailed bearing capacity of 200kN/m^2 for 1.00m wide strip foundations.

Alternatively a basement raft foundation could be considered for this structure. A net safe bearing capacity of 150kN/m^2, which incorporates a factor of safety of 3.0, could be used for the design of a raft foundation on the London Clay at 3m below existing ground floor level.

It is estimated that theoretical base heave at the centre of a 10m long and 5m wide, 3m deep unconfined basement excavation would be in the order of 10mm to 15mm following the removal of 60kN/m^2 of overburden pressure. Any heave within the basement would begin to take place soon after excavation but would be confined by the basement floor loading once it had been constructed.

A likely basement raft loading is unknown but if it were equal to a pressure of 30kN/m^2, and hence a net pressure of -30kN/m^2 once the overburden is removed, it could result in net theoretical heave in the order of 5mm to 10mm. This net heave would need to be taken into account in the design of the basement floor slab. Alternatively, if the raft loading were greater than the $60kN/m^2$ of overburden removed, then net settlement would take place. For example, for a raft loading of $75kN/m^2$ consolidation settlement would be in the order of 25mm, and so net settlement would be in the order of 15mm to 20mm once the theoretical heave was taken into account.

Excavations/Groundwater

The excavation of the basement to 3m below ground floor level will require the construction of close support to its sides, the control of groundwater, and the need to avoid undermining adjacent structures.

The use of mass concrete walls, constructed in alternate panels around the perimeter of the basement could provide support to the excavation.

The excavation of a basement could then be undertaken within the walls, although it should be noted that wall lined excavations may not be water tight.

In order to construct the basement beneath this site it will be necessary to provide permanent support to the adjacent structures, which are likely to be based at relatively shallow depths similar to No.61. This support can either be provided by underpinning these structures to the same depth as the proposed basement prior to basement construction or by constructing walls to the excavation. These will need to be adequately propped during construction using temporary support and permanently by the basement and ground floors, to prevent movement at the top of the retaining walls. Or by a combination of the two.

Such lateral movement would otherwise be accompanied by settlement of the ground behind the basement walls. Provided that a very stiff bracing system is used to prevent deflection of the proposed basement walls, resultant changes to the state of soil stress and structural movement of neighbouring structures should be negligible.

The advice of specialist groundworks contractors with experience of constructing such basements should be sought, particularly in respect of other potential methods of providing support to the sides of the basement excavation.

The basement excavation should be inspected on completion to ensure that the condition of the soil complies with that assumed in design. Should pockets of inferior material be present, they should be removed and replaced with well graded hardcore or lean mix concrete. The excavated surface should be protected from deterioration and a blinding layer of concrete used where foundations are not completed without delay.

Water was recorded within the standpipe within the London Clay at 2.82m, which will be just above the base of the proposed basement excavation, and may either reflect the groundwater level beneath the site or the slow filling of the standpipe installation by 'perched' water emanating from the base of the overlying made ground. This could be determined by further monitoring. In either case potential flotation due to groundwater on this site should not be a problem.

With a groundwater level recorded above the floor of the proposed basement, it will be considered necessary to waterproof the basement in order to prevent the ingress of water, including downward percolating surface water, into the completed structure.

Piled Foundations

Piled foundations will not be necessary for the proposed small-scale basement.

Retaining Walls

The walls of the proposed basement will act as retaining walls and will need to be designed accordingly. For a permanent retaining wall analysis effective stress parameters would be appropriate, however, in the absence of effective stress testing on samples from this site, published parameters, previous experience and in-situ test results could be used as a conservative approach.

The design of retaining walls around the basement area may be based on the following stress parameters:

Soil Type	Bulk Density (Mg/m^3) γ_B	Effective Shear Strength (kPa) c'	Angle of Shearing Resistance (degrees) ϕ'
Made Ground	1.80	0	28
London Clay	1.95	0-2	25-27

Slope Stability

The ground within which the plot is located very gently slopes down to the east and falls from 22.65mOD within Bayham Place on the opposite side of Bayham Street, to 21.81mOD to the north-east in Bayham Place. This is a slope angle of less than 1 degree, and so is not highlighted on Figure 16 of the London Borough of Camden 'Guidance for subterranean development', which indicates slopes of greater than 7 degrees.

Slopes of 8 degrees or greater are reported in this document to be potentially unstable if the land topography is adversely disturbed. On this small site it is considered highly unlikely that the proposed basement extension will induce slope instability.

Buried Concrete

Sulphate analysis of the soil samples tested gave results in Design Sulphate Classes DS-1 to DS-4 of the BRE Special Digest 1, Table C2 (2005) presented in Appendix 4. The DS-3 and DS-4 results were recorded within the made ground and selenite-bearing London Clay. The pH results were between 7.1 and 8.1 and so alkaline.

The London Clay Formation is listed in this publication as being a stratum that may contain sulphides, such as pyrite, hence oxidation due to disturbance during the excavation of foundations and basements may increase the total potential sulphate content. Visual evidence of pyrite beneath this site was not recorded. The basement excavation will be within London Clay Formation clay, which should not be left exposed to the elements for any length of time, otherwise there would be a potential for oxidation of any pyrite within the London Clay and, in the long term, possible thaumasite formation.

Using the sulphate results an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-4 would be considered appropriate for buried concrete beneath this site as detailed in the above cited BRE document.

Other Issues

The basement development beneath this site would only be considered likely to affect the drainage system of the site itself. However, drainage and sewerage records for the surrounding buildings will need to be referenced, if available, or perhaps surveyed to confirm that the site does not share a communal drainage system that runs beneath the site.

The flow of surface water within the surrounding area, to the east, should not be significantly changed by the proposed redevelopment of this small site.

As previously described, groundwater beneath this site was recorded at 2.82m below ground floor level. The proposed basement depth therefore just extends below this water level so there should be minimal displacement of groundwater by its exclusion from beneath the area of the basement after it has been constructed. Consequently there should be little, if any, rise in the level at which groundwater currently stands beneath the area around the site.

The orientation of the proposed basement, north to south, would be across the likely direction of near surface groundwater flow on this very gently eastward sloping ground, but as the proposed 3m deep deepened structure only just extends below the recorded groundwater level, the drainage path should not be significantly increased and would not be expected to impact the adjoining properties downslope to the east. In the event that the adjacent west to east aligned former workshops also have basements, the construction of a basement at No.61 would therefore not be expected to have a combined effect in this regard.

COMMENTS ON THE CHEMICAL TEST RESULTS

The results of the laboratory chemical testing on samples of made ground have been compared to CLEA Soil Screening Values (SSVs) and Category 4 Screening Levels (C4SLs), which have been used as screening tools for use in the assessment of land affected by contamination.

Atkins Limited has derived ATRISKsoil SSVs based on the default assumptions provided in SR3, which have been used in the development of the Soil Guideline Values (SGVs) published by the Environment Agency in 2009. Atkins SSVs have been derived in line with the Environment Agency 2009 guidance (SR2, SR3, SR4, SR7) using the CLEA v1.04 and CLEA v1.06 software. These are provided under licence to Ground Engineering Limited, and respective toxicology reports and technical details on the derivation of the SSVs can be provided on request.

Following revised statutory guidance to support Part 2A of the Environment Protection Act (April 2012), Final Category 4 Screening Levels have recently been published (for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead) by the Department for Environment Food and Rural Affairs in their document SP1010: March 2014. With the exception of lead the C4SLs are higher than the SSVs.

The following standard land uses form the basis of the assessment in relation to soils:

- Residential use with home grown produce
- Residential use without home grown produce
- Commercial and industrial usage

The intended purpose of the SSVs are as "intervention values" in the regulatory framework for assessment of human health risks in relation to land use. These values are not binding standards, but are intended to inform judgements about the need for action to ensure that a new use of land does not pose any unacceptable risks to the health of the intended users.

Table 5 compares the test results for the made ground with the SSVs, and C4SLs for lead, in relation to the specified uses. The numbers of test results, which exceed these values, are also provided.

Table 5: Comparison of Chemical Test Results with Soil Screening Criteria (SSC)

Determinand	Number of Samples	Min Value (mg/kg)	Max Value (mg/kg)	Number of Samples Exceeding SSC for:			Soil Screening Criteria SSC (1% SOM)			
				Residential with home grown produce	Residential without home grown produce	Commercial/ Industrial	Assessment Method	Residential with home grown produce (mg/kg)	Residential without home grown produce (mg/kg)	Commercial/ Industrial (mg/kg)
Organic matter	2	<0.40%	0.48%	-	-	-	-	-	-	-
Arsenic	2	22	40	1	1	0	SSV	32	35	640
Cadmium	2	0.22	0.90	0	0	0	SSV	10	83	230
Trivalent* Chromium	2	22	28	0	0	0	SSV	12,800	15,500	21,300
Hexavalent Chromium	2	<0.50	<0.50	0	0	0	SSV	14	38	330
Lead	2	450	2900	2	2	1	C4SL	200#	310#	2330#
Mercury	2	0.94	4.0	0	0	0	SSV	6	7	66
Selenium	2	<0.20	<0.20	0	0	0	SSV	350	595	13,000
Nickel	2	21	27	0	0	0	SSV	130	130	1800
Phenols	2	<0.30	<0.30	0	0	0	SSV	162	262	686
Benzo[a]pyrene	2	<0.10	0.90	1	0	0	SSV	0.8	0.9	14
Copper	2	59	120	0	0	0	SSV	3970	8370	109,000
Zinc	2	87	470	0	0	0	SSV	16,900	46,800	917,000
Free Cyanide	2	<0.50	<0.50	0	0	0	SSV	34	34	34

Notes
*The concentration of Trivalent Chromium is assumed to be equivalent to the Total Chromium concentration.
This is because most naturally occurring chromium is in the trivalent (chromic) state.
Category 4 Screening Levels for lead are based on 6% SOM.

Discussion of Results and Statistics

The results of the laboratory analysis indicate the made ground contains elevated concentrations of arsenic, lead and benzo[a]pyrene, which exceeded the residential soil screening criteria. The recorded arsenic and benzo[a]pyrene concentrations did not exceed the screening values for a commercial/industrial end use, but the highest lead result did. None of the other contaminants tested for exceeded their respective screening values for a residential or commercial/industrial land uses.

Statistical analysis would not be meaningful on such a small dataset, and has not been undertaken.

The results indicate that the made ground beneath the site would be unsuitable for retention or re-use at the surface in a residential setting due to the presence of arsenic, lead and benzo[a]pyrene within the made ground, and unsuitable at the surface in a commercial/industrial setting due to the presence of elevated lead.

No asbestos containing material (ACM) was found during sample preparation prior to chemical analysis and visual evidence of ACM was not recorded during this investigation.

Visual and olfactory evidence of hydrocarbon impacted soils was not detected within the soils beneath this site during the investigation. The single soil TPH result determined during the WAC testing was <10mg/kg, which confirms the absence of hydrocarbon contamination in the soils beneath this site.

SOIL GAS MONITORING RESULTS

The single return visit to this site on 3rd September 2014 recorded the concentrations of landfill type gases (methane, carbon dioxide and oxygen) in the WS 1 standpipe. The results are presented to the rear of the exploratory hole records. The recorded concentrations of methane were less than 0.1%, whilst the carbon dioxide level recorded was a maximum of 0.1%. The recorded oxygen concentrations within the standpipes were comparable to atmospheric conditions. The in-situ measurement confirmed a negligible gas emission rate with a recorded flow rate of <0.1l/hr in all instances.

Assuming a positive flow rate of 0.1l/hr, the results give a Gas Screening Value (GSV) of 0.0001l/hr. This GSV falls within the modified Wilson and Card Characteristic Situation 1 or 'Green' classification of the NHBC traffic light system (for low rise housing), as defined by the Construction Industry Research and Information Association, CIRIA Report C665, 'Assessing risks posed by hazardous ground gasses to buildings'.

UPDATED CONCEPTUAL MODEL

Assessment of the potential linkage between ground contamination sources, human and environmental receptors have been assessed based on the desk study research and the intrusive ground investigation documented in the preceding sections of this report.

A generalised conceptual model, updated following the intrusive works, monitoring and testing, and targeted to provide coverage across the site, relative to the construction phase and completed development, is presented below in Table 6.

Table 6: Updated Conceptual Model Relative to Construction and Future Development

Receptors	Pathway	Estimated Potential for Linkage with Contaminant Sources			
		Drainage/ Building	Soil Beneath Site	Soil Gas	Ground Contamination Outside Site Boundary
Human Health – ground workers	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	Moderate	Moderate	Very Low	Very Low
Human Health – users of completed development	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	N/A	Low (landscaping) to Moderate (private gardens)	Very Low	Very Low
Water Environment	Migration through ground into surface water or groundwater	N/A	Very Low	Very Low	Low
Flora	Vegetation on site growing on contaminated soil.	N/A	Very Low	Very Low	Very Low
Building Materials	Contact with contaminated soil	N/A	Very Low	Very Low	Very Low

Key to Table 6

RISK	Definition
Very High	There is a 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. The risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) and remedial works may be necessary in the short term and likely over the long term.
Moderate	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 more likely that the harm would be relatively mild.
Low	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	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.
N/A	Not Applicable because the proposed development will remove the source.

COMMENTS ON GROUND CONTAMINATION IN RELATION TO PROPOSED DEVELOPMENT

The proposed development is a single level basement. Anticipated exposure scenarios relating to the site and future redevelopment works including remedial options as applicable are discussed as follows.

This investigation may not have revealed the full extent of contamination on the site and appropriate professional advice should be sought if subsequent site works reveal materials that may appear to be contaminated.

Contaminated Soil

The exploratory holes found up to 1.40m of made ground beneath the rear garden of the site. The made ground beneath the site contained elevated concentrations of arsenic, lead and benzo[a]pyrene, which exceeded soil screening values for a residential and, in the case of lead, commercial/industrial end use. None of the other contaminants tested for exceeded their respective screening values for a residential or commercial/industrial land uses.

Existing Drainage and Building

Redundant foul or surface water drain runs, should be removed from beneath the site and precautions should ensure that any remaining effluent is directly disposed off-site. The integrity of existing drainage should be checked, and where they are to be retained, any damaged sections should be replaced prior to development. The latter measures should remove any future likelihood of risk to human health and to the water environment.

The existing building may have asbestos containing materials within it. Suitable precautions, in line with current best practice, should be put in place to protect workers from the effects of asbestos material, during the demolition/construction phase.

Human Health - Construction Workers

The presence of arsenic, lead and benzo[a]pyrene contamination within the made ground soils beneath the site indicates that there is locally a moderate risk that a pathway could develop affecting groundworkers during the construction phase of development.

However, no special precautions would be required during the development of the site by workers who may come into contact with the soil during groundworks, providing standard precautions are adopted which should generally include the procedures given by the Health and Safety Executive (The Blue Book) HS(G)66.

For the protection of workers during groundworks the following is recommended:

a) Limit repeated or prolonged skin contact with soils by wearing gloves with sleeves rolled down.

b) Washing facilities should be made available to groundworkers, so as to minimise the potential for inadvertent ingestion of soil.

c) If any soils are revealed which are different to those encountered by this ground investigation, the advice of a specialist should be sought in view of classifying the material and ascertaining its risk to groundworkers.

d) Dust suppression measures such as 'damping down', could also be adopted to prevent the spread of soil contaminants.

Human Health - Users of Completed Development

The risk of the encountered ground contamination affecting the site users when present beneath buildings and permanent areas of hardstanding would be considered to be very low. This is because it would be highly unlikely that the general site users would normally be able to penetrate the basement walls and floors, which would be necessary for them to uncover any contaminated soils beneath the site. However, it is considered that there would be a low to moderate risk of the ground contamination affecting site end users if the near surface fill were retained within new private gardens or exposed at the surface within new soft landscaped garden areas.

The presence of statistically elevated arsenic, lead and benzo[a]pyrene within the made ground means that such soils should not be retained at the surface within gardens or soft landscaping in the proposed redevelopment, which is highly unlikely.

Effects on Services

Consideration should be given to upgrading service materials, particularly for water supply pipes, where they will be in contact with made ground containing elevated concentrations of arsenic, lead and benzo[a]pyrene, or ensure that the made ground is not used as a backfill around such water supply pipes. Further guidance on the selection of materials for use as water supply pipes should be sought from the local water supplier.

Soil Gas

According to database information, there are no active landfills within influencing distance of the site and although 1.40m of made ground was encountered it was not found to include organic and putrescible material.

The gas monitoring has determined that a Wilson and Card Characteristic Situation 1 would apply and that no special precautions are required to protect the proposed development from ingress of soil gases.

The site lies within an area where radon protection measures are not required for new dwellings in accordance with BR211.

Water Environment

Although some soil contamination was identified by the investigative works; the groundwater table was found to lie at about 2.80m below ground level within the practically impervious London Clay, which is about 27m thick hereabouts; and the site and immediate surrounding area are devoid of watercourses, surface water features and source protection zones. It is consequently considered unlikely that the proposed redevelopment would impact the quality of the water environment, indeed the removal of made ground during basement excavation would be considered to improve the situation on this site.

Off-Site Disposal of Soil Arisings

The results of chemical analysis are provided in Appendix 3 and can be used for the basic characterisation of the soil destined for landfill. The Environment Agency publication Hazardous Waste, Technical Guidance WM2 outlines the methodology for classifying wastes and should be referenced for guidance. The test results (total metals, hydrocarbons and cyanide) should be compared to the relevant thresholds to determine whether they fall into the primary categories of non-hazardous waste or hazardous waste and will help indicate the likely European Waste Catalogue (EWC) code, which is determined by the waste type. The results of Waste Acceptance Criteria (WAC) leachate testing should be used to check whether if categorised as non-hazardous waste it could be disposed of at an inert waste landfill; or if categorised as hazardous waste whether it could qualify as stable non-reactive hazardous waste for disposal in non-hazardous landfill.

Excavated material and excess spoil should always be classified prior to removal from site as required by 'Duty of Care' (Environmental Protection Act, 1990) legislation. This means that material has to be given a proper description and waste classification prior to removal. Basic characterisation is the responsibility of the waste producer and compliance checking and on-site verification are generally the responsibility of the landfill operator. The landfill operator will need to liaise with the waste producer as the approach relies on the information from basic characterisation.

The clean arisings from the underlying natural soils across this site would fall under the EWC code 17 05 04 under the inert category.

CONCLUSIONS

The proposed residential development will be a single level basement. The existing site is detailed on the site plan at the rear of this report. The proposed site layout will need to be provided by the Engineer in due course. This plan will need to clearly identify areas of gardens and soft landscaping, in the highly unlikely event that any are envisaged.

Remediation

Remediation of the soils beneath the site, in respect of the redevelopment, is not considered necessary as the building floors and walls will prevent contact between any contaminated ground and the site end users.

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