



Practical, sustainable solutions to complex environmental problems

**Refined CSM
Phase 3 Options Appraisal (OA)
Remediation Strategy (RS)
and Verification Plan**

at

**Ashley Road Depot
Ashley Road
London
N17 9AZ**

(ref. TJ3952AR1v1.0)

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LIST OF COMMON ABBREVIATIONS

ACM	Asbestos Containing Material	PAH	Polyaromatic Hydrocarbon(s)
Al	Aluminium	PCB	Polychlorinated Biphenyl(s)
AONB	Area of Outstanding Natural Beauty	PCoC	Potential Contaminants of Concern
AoPC	Area(s) of Potential Concern	PE	Polyethylene
AST	Above Ground Storage Tank	PFS	Petrol Filling Station
BaA	Benzo(a)anthracene	PID	Photo Ionisation Detector
BaP	Benzo(a)pyrene	POS	Parks and Open Spaces
BbF	Benzo(b)fluoranthene	PPE	Personal Protective Equipment
BGS	British Geological Survey	PRA	Preliminary Risk Assessment
BH	Borehole	PVC	Polyvinyl Chloride
BTEX	Benzene, Toluene, Ethylbenzene & Xylene	RBMP	River Basin Management Plan
CAT	Cable Avoidance Tool	RMS	Risk Management Strategy
CD&E	Construction, Demolition & Excavation	RWFD	Revised Waste Framework Directive
Chy	Chrysene	RWL	Resting Water Level
CLEA	Contaminated Land Exposure Assessment	S	South
CSM	Conceptual Site Model	S4UL	Suitable 4 Use Levels
CWG	California Working Group	SAC	Special Area of Conservation
C4SL	Category 4 Screening Levels	SGV	Soil Guideline Value
DEFRA	Dept. for Environment, Food & Rural Affairs	SNRHW	Stable Non-Reactive Hazardous Waste
DahA	Dibenzo(ah)anthracene	SPA	Special Protection Area
DQRA	Detailed Quantitative Risk Assessment	SPL	Significant Pollutant Linkage
E	East	SPR	Source-Pathway-Receptor
EA	Environment Agency	SPZ	Source Protection Zone
EU	European Union (Council/Commission etc.)	SSAC	Site Specific Assessment Criteria
FRA	Flood Risk Assessment	SSSI	Site of Special Scientific Interest
GAC	Generic Assessment Criteria	SVOC	Semi Volatile Organic Compound(s)
GQA	General Quality Assessment	TGEN	Terragen Environmental Consultants Limited
GQRA	Generic Quantitative Risk Assessment	TOC	Total Organic Carbon
Ha	Hectare(s)	TP	Trial Pit
IcdP	Indeno(123-cd)pyrene	TPH	Total Petroleum Hydrocarbon(s)
LLTC	Low Level of Toxicological Concern	UCL ₉₅	95% Upper Confidence Limit
LNR	Local Nature Reserve	UK	United Kingdom
LoW	List of Wastes	UKAS	UK Accreditation Service
m	Metre(s)	UKEA	UK Environment Agencies
mAOD	Metres Above Ordnance Datum	UN	United Nations
mbgl	Metres Below Ground Level	USEPA	United States Environmental Protection Agency
MTBE	Methyl Tert-Butyl Ether	UST	Underground Storage Tank
MCERTS	EA Monitoring Certification Scheme	VOC	Volatile Organic Compound(s)
N	North	W	West
NGR	National Grid Reference	WAC	Waste Assessment Criteria
NNR	National Nature Reserve	WFD	Water Framework Directive
NP	National Park	WS	Window Sampler
NVZ	Nitrate Vulnerable Zone		



1.0 INTRODUCTION

TGEN was commissioned by Kalex Limited (the client), via a written instruction to proceed, to prepare an Options Appraisal, Remediation Strategy and Verification Plan to address land contamination conditions attached to the planning permission granted for the proposed development at the site.

2.0 SITE INFORMATION, FRAMEWORK AND APPROACH

Site Address	Ashley Road Depot, Ashley Road, London N7 9AZ.
NGR	TQ 34460 90120.
Site Location and Current Use	The irregular-shaped, circa 1.6ha site is a former council depot to the S and E of Park View Road, at the N end of Ashley Road, and to the N of Down Lane Park. There are no buildings that currently occupy the site, which is essentially clear. Immediately to the E of the site is the Harris Academy school and its associated outdoor sports facility. The local land use character is residential to the N and W, with the park and education facilities to the S and E of the site.
Proposed Development	The proposal comprises the redevelopment of the former council depot site to provide 272 new homes (Use Class C3) within a range of buildings from four to thirteen storeys in height, 174sqm of commercial space (Use Class E), new pedestrian and cycle routes through the site, vehicle access, car and cycle parking and new hard and soft landscaping. The development is split into three distinct blocks (A, B and C). Each block would have its own courtyard or podium amenity space area. They are each separated by new N-S routes through the site and are surrounded by new soft landscaped public realm areas onto Park View Road and Down Lane Park. There would be 42 car parking spaces and 512 high-quality cycle parking spaces provided. The new vehicle access from Ashley Road would provide a through-route to Park View Road for pedestrians and cyclists. We understand that a 5.5m deep basement is proposed below the building/block in the NE corner of the site.
Framework	The Land Contamination: Risk Management Guidance (EA, May 2020) outlines how to assess if there is unacceptable risk and to decide which options are the most suitable to manage the risk through the implementation of remediation (if necessary). The guidance is based upon The Model Procedures for the Management of Land Contamination, CLR 11 (EA, 2004), which were developed to provide a technical framework for applying a risk management process when dealing with land potentially affected by contamination. CLR11 has now been withdrawn, although the scope, framework and purpose remain the same. The process involves identifying, making decisions on, and taking appropriate action to deal with, land contamination in a way that is consistent with government policies and legislation within the UK. Environmental assessors use a SPR conceptual site model when determining the risk posed by a potentially contaminated site. For potential risk to arise each stage of the SPR linkage must be present, plausible, and significant. Our approach follows the framework provided in the new guidance, the stages, and tiers of which can be briefly summarised as follows: 📌 Stage 1 Risk Assessment (RA) - Tier 1: Preliminary Risk Assessment (PRA). - Tier 2: Site Investigation and Generic Quantitative Risk Assessment (GQRA). - Tier 3: Detailed Quantitative Risk Assessment (DQRA). 📌 Stage 2 Options Appraisal (OA) - Decide if sufficient up to date information is available. - Tier 1: Identify feasible remediation options. - Tier 2: Detailed evaluation of options. - Tier 3: Selection of final remediation option. 📌 Stage 3 Remediation Strategy (RS) - Tier 1: Develop a Remediation Strategy. - Tier 2: Remediation and Verification. - Tier 3: Long term monitoring and maintenance (if required).



3.0 STATUS AND REMIT

Planning Status	Planning permission (ref. HGY/2022/0752 dated 31/08/2022) was granted by the London Borough of Haringey (the local authority) for the erection of 272 homes including 50% socially rented homes extending 4-13 storeys, 174sqm of flexible Use Class E floorspace along with a new vehicular access to the site, car parking and two pedestrian north south routes. The proposal also includes both private and public hard and soft landscaping throughout the site. The planning permission is subject to conditions, including those related to the assessment and management of potential land contamination, which can be summarised as follows: Condition 22 Before development commences other than for investigative work: Using the information already provided in sections 7 (Advice and Recommendations) and 8 (Outstanding Risks & Issues) of the submitted Desk Study & Ground Investigation Report Revision 1 with reference J21294 prepared by GEA Ltd dated March 2022, the applicant shall undertake: a. A further site investigation which must be comprehensive enough to enable; a risk assessment to be undertaken, refinement of the Conceptual Model, and the development of: (a) Method Statement detailing the remediation requirements. (b) The risk assessment and refined Conceptual Model shall be submitted, along with the site investigation report, to the local authority which shall be submitted to, and approved in writing by, the Local Planning Authority prior to that remediation being carried out on site. (c) Where remediation of contamination on the site is required, completion of the remediation detailed in the method statement shall be carried out and a report that provides verification that the required works have been carried out, shall be submitted to, and approved in writing by the Local Planning Authority before the development is occupied.
Remit	As noted above, planning permission was granted in August 2022, within which Condition 22 was included requiring additional investigation and risk assessment to be undertaken to update the CSM and determine the need for and scope of remedial measures to be included within the development. Further to the report referred to in Condition 22, GEA Ltd undertook additional fieldwork and additional monitoring visits to the site, the findings of which are given in their Desk Study and Ground Investigation Report (ref. J21294 Rev 4 dated September 2022). Furthermore, following demolition of the site buildings, Kalex Limited undertook an additional phase of investigation and monitoring across parts of the site that were inaccessible during the GEA Ltd investigations. The remit of this OA and RS report is therefore through an assessment of the additional investigation reports to carry out additional risk assessment, update the CSM, prepare an OA and RS together with a verification plan to address Parts (a) and (b) of Condition 22 of the planning permission.



4.0 PREVIOUS INVESTIGATIONS

Desk Study and Ground Investigation Report

A Desk Study and Ground Investigation Report (ref. J21294 Rev 4 dated September 2022) was prepared by GEA Limited (GEA). The report should be read in full in conjunction with this OA and RS, the findings of which can be briefly summarised as follows:

Historical Mapping

Early mapping from 1864 shows the site to be farmland with a gravel pit located circa 50m to the E. By 1895 the gravel pit had been backfilled. By 1913, the site had been developed with a refuse destructor in the central S part of the site and a railway line to the E of the site. The surrounding environs had also been developed, comprising residential terraced houses with Down Lane Recreation Ground had directly to the S of the site. By 1956, the site had undergone significant changes with several additional buildings present on site, mostly in the centre of the site but also along the NW and N boundaries. A building in the W of the site was labelled as a refuse destructor. A tank was present in the centre of the site, along with a conveyor and two ramps. It is likely that at some point between 1970 and 1974 the refuse destructor was removed from site. From 1988 the site was labelled as a depot and mapping from 1991 shows a large building to have been established in the south of the site.

Existing Onsite Uses and Layout

The site is currently vacant and was most recently occupied by a municipal services depot, which provided storage, refuelling, cleaning and maintenance for bin lorries up until mid-November 2021. Various council offices were also located on site. All of the buildings had been demolished by the second phase of investigation undertaken by GEA in May 2022. A fuel-filling station was present on site, noted in the GEA report to have provided diesel for the bin lorries and other council vehicles. However, The London Fire Brigade held no records of any tanks located on the site. The site is almost entirely devoid of vegetation apart from eight mature London planes along the N and W boundaries of the site, plus a number of raised planters around the building in the S of the site. The site was level in keeping with the general topography of the area. Asbestos warning stickers were noted on buildings around the site as well as signs warning of oil tanks in some rooms, particularly in the N areas of the site. GEA noted that a refuse destructor was located on the site for a number of years, and reported anecdotal evidence that some of the waste was buried onsite. A vehicle washing facility was located in the far E of the site, which was used to clean the bin lorries and other council vehicles. The site originally extended an additional 70 m to the E, but this area was redeveloped in 2018 with the existing sports academy. A single licensed waste management facility was located onsite, but the license was surrendered in September 2017.

Offsite Potentially Contaminative Activities

An historic landfill was recorded, circa 190m to the E, which operated from 1955 until 1962 and received inert and industrial waste. Two other waste management facilities are located within 500m of the site but are noted to have expired. A total of 17 active contemporary trade directory entries were recorded within 250m of the site, including domestic cleaning services, food product manufacturers, a tungsten tool manufacturer and distributor and a printer.

Preliminary UXO Risk Assessment

The report indicates that, during World War II (WWII), the site was located in an area that sustained an overall high density of bombing. Despite this, no bombing incidents are recorded on or immediately surrounding the site on available London bomb census and local bomb plot mapping. The closest recorded strike was located N of the site boundary, opposite Park View Road and does not appear to have had a significant impact on the site. Additionally, no anecdotal or published information was located to suggest the site was bombed during WWII. No damage is recorded onsite or in the surrounding area. Furthermore, the site was subject to frequent access during the war due to the industrial usage and positioning in a built-up urban area of the site and it is believed to have been subject to post-raid checks. The report therefore concludes that the risk from UXO contamination is not considered to be significantly higher than the background risk for the area. The report concluded that whilst it is not possible to completely discount the risk from UXO, it is not recommended that any further action is taken for this site.

Published Geology

Below any near surface soil (made ground), the underlying geology is anticipated to comprise superficial drift of Enfield Silt over Kempton Park Gravel, over bedrock comprising a significant thickness of low permeability London Clay Formation.

Controlled Water

The Enfield Silt and London Clay Formation are classified as unproductive and the Kempton Park Gravel as a secondary (A) aquifer. The site is not located in an EA designated SPZ, but a Zone 2 (outer catchment) is located circa 10m to the SE. There are no abstractions within 500m of the site. The site is located in Flood Zone 2.

Preliminary Risk Assessment

Sources: fuel filling station, warehouses for servicing and repairing vehicles, vehicle washing facilities, salt stockpiles, underground storage tanks and vehicle storage. Offsite sources comprised a gravel pit circa 50m to the E of the site filled in the mid-19th century.



Contaminants of concern: heavy metals (e.g., lead), PAH, diesel, TEL, BTEX, MTBE and soil gas.
Receptors: human health (residential end users and construction workers), groundwater within the Kempton Park Gravel secondary aquifer and buried services.

Pathways: direct contact, ingestion and inhalation for end users in areas of soft landscaping and for site workers during construction. Building materials will also be exposed via direct contact. Groundwater flows are a pathway by which contamination could transfer on and offsite. The redevelopment of the site will not create any new pathways for contamination to reach shallow groundwater, nor will it create a pathway to adjacent sites.

Risk Appraisal: GEA considered there was a moderate risk of there being a significant pollutant linkage (SPL) at the site that could require remediation measures to be implemented.

To test the qualitative assessment of risk, GEA undertook a ground investigation, which can be briefly summarised as follows:

Ground Investigation

GEA undertook two phases of ground investigation comprising:

- Eight cable percussion (CP) boreholes to depths of up to 30m.
- Fourteen windowless sampler (WS) boreholes to depths of between 0.5m and 5.5m.
- Seven trial pits manually excavated to a maximum depth of 1.2m to expose existing foundations.
- Six slit trenches manually excavated to a maximum depth of 1.2m to expose tree roots.

As part of the investigation, seven of the boreholes were installed with combined gas and groundwater monitoring standpipes to depths of between 1.8m and 5.0m (6.73 m OD and 3.60 m OD) to facilitate a programme of environmental monitoring. Samples of soil and groundwater were recovered for contamination testing and during six return visits at circa three-week intervals gas monitoring was undertaken. Headspace testing using a Photoionisation Detector (PID) was carried out within Borehole Nos 14, 14A, 14B, 14C, 17 and 17A due to the close proximity to the fuel filling station.

Ground Conditions

The ground conditions comprised:

Hardstanding: concrete circa 0.23m thick.

Made ground: in general, 0.8-1.5m thick, comprising dark brown, orange/brown and yellow/brown slightly clayey gravelly sand with variable amounts of brick, concrete, flint gravel, plastic, metal, glass, carbonaceous material including suspected ash and clinker, ceramics, tile, suspected asbestos containing materials and roots and rootlets. A hydrocarbon odour was noted in Borehole No 17A, and staining was noted in Borehole No 12.

Enfield Silt: encountered in all locations apart from BH's 2, 5 and 11, to depths of between 1.3m and 3.0m comprising soft orange/brown, silty, slightly sandy gravelly clay. A slight hydrocarbon odour was noted in the Enfield Silt in Borehole No 17A.

Kempton Park Gravel: present to depths of between 4.5m and 6.0m comprising dense and very dense orange/brown, slightly clayey gravelly sand, and sandy gravel. There was no visual or olfactory evidence of contamination observed within this stratum.

London Clay: initially comprised firm becoming stiff dark brown fissured clay to depths of between 14m and 17m with rare fine selenite whereupon very stiff, dark grey slightly silty slightly sandy fissured clay with rare fine mica and occasional bioturbation was present to depths of between 23.1m and 25.8m. There was no visual or olfactory evidence of contamination observed within this stratum.

Lambeth Group: comprised very stiff dark grey and multicoloured silty sandy gravelly clay with rounded black pebbles and shells and dense light grey silty gravelly sand, also with rounded black pebbles, shells, fragments of siltstone and occasional fine chalk gravel. There was no visual or olfactory evidence of contamination observed within this stratum.

Groundwater: was encountered at depths of between 3.0m and 4.0m in the Kempton Park Gravel, and at depths of 22.5m and 24.5m in the Lambeth Group.

Monitoring

Combined gas and groundwater monitoring standpipes were installed in Borehole Nos 1, 2, 5, 6, 12, 13, and 17A to depths of between 1.8m and 6.0m. The standpipes were subsequently monitored on six occasions. Due to the ongoing demolition works, various boreholes were inaccessible at times during the programmed monitoring.

Laboratory Testing

A total of thirty-six samples of the shallow soil were submitted for contamination testing, including heavy metals, TPH, speciated PAH, total cyanide and monohydric phenols. Thirty-five soil samples were also screened for the presence of asbestos and four fragments of suspect ACM were submitted for bulk identification. Leachate testing was carried out on four samples, and contamination testing has been carried out on four groundwater samples.

Contamination

Soils: GEA compared the results of the soil testing to generic assessment criteria (GAC) based on a residential with homegrown produce end use criteria. Concentrations of arsenic, copper, lead, nickel and zinc, TPH and several PAH in the made ground were found to exceed their respective GAC for potential risks to human health. TPH was elevated in the Enfield Silt at BH17A (adjacent to fuel filling area). Leachate testing on four samples returned a single, elevated concentration of zinc.



	Asbestos: Four fragments of suspect ACM were confirmed to be chrysotile cement and of thirty-five samples screened for asbestos, fibres were detected in three samples. Groundwater: The groundwater samples returned elevated nickel and TPH concentrations. Soil Gas: GEA generated a gas screening value (GSV) of less than 0.07 l/hr, which indicated Characteristic Situation 1 (CS1). For a carbon dioxide concentration of above 5 %, consideration should usually be given to increasing to a Characteristic Situation 2 (CS2), but the worst-case carbon dioxide concentration encountered on the first visit, considered due to gas build up post installation, was not replicated on subsequent visits. It was therefore considered appropriate to retain CS1, although three additional visits were recommended to confirm this view. Recommendations GEA provided an outline remediation strategy, which included: ○ Removal of tanks and any grossly impacted soils surrounding the tanks. ○ Installation of a cover layer (topsoil/subsoil) in areas of soft landscaping. ○ Watching brief and discovery strategy for unexpected contamination. ○ Protection of water supply pipes. ○ Removal and management of asbestos. ○ Disposal of soils offsite as waste. GEA recommended that three further rounds of gas monitoring be undertaken in order to confirm the CS1 classification. GEA also noted that due to the presence of buildings, parts of the site had not been investigated and recommended further investigation post demolition.
Additional Site Investigation	An additional site investigation was undertaken to provide greater coverage of the site, particularly in areas that had previously been inaccessible areas (e.g., footprint of the former buildings) and three further rounds of ground gas monitoring as recommended in the conclusions of the GEA report. The findings of the additional site investigation and monitoring are provided in the Factual Report on Site Investigation (ref. LQ1139-R1 dated 19/05/2023) prepared by Kalex Limited (Kalex). The report should be read in full in conjunction with this OA and RS, the findings of which can be briefly summarised as follows: Site Investigation and Monitoring The investigation was undertaken on 4th and 5th May 2023 using a mechanical excavator and comprised the progression of twelve trial pits beneath the footprint of the recently demolished buildings. The trial pits extended to depths of between 1.1m and 2.2mbgl. In addition to the trial pits, two stockpiles of crushed construction and demolition materials were sampled for the presence or absence of asbestos. Ground Conditions The ground conditions encountered were consistent with those reported in the GEA investigations comprising a relatively thin layer of hardstanding, below which was a variable layer of made ground underlain by Enfield Silt. All of the trial pits terminated in the Enfield Silt. Environmental Observations With the exception of ash noted in the made ground at STP7, STP9, SPT11, SPT13 and STP14, there was no obvious olfactory or visual signs of gross contamination encountered in the trial pits. Groundwater Groundwater was not met during the Kalex investigation, and the trial pits were recorded as being dry on completion. Contamination Testing A total of 24 soil samples were taken from the trial pits and tested for a comprehensive testing suite including asbestos, metals, PAHs and TPH CWG. A further 8 soil samples were taken from the two stockpiles on site and tested for a soil asbestos screen only. One of the samples contained a visible fragment of suspect asbestos which was tested separately for identification. The results of the testing were comparable to that from the GEA investigation with the made ground returning elevated concentrations of heavy metals (arsenic, copper, lead and zinc) and the underlying natural ground (Enfield Silt) returning low concentrations of potential contaminants. Ground Gas/Vapour Monitoring Additional ground gas monitoring is due to be undertaken, at which point the report will be updated.



5.0 STAGE 1, TIER 2 GQRA

The GEA and Kalex investigations comprised the following:

- ✦ The progression of forty-seven exploratory holes (a density equivalent to 18m centres) across the site for the investigation of potential land contamination.
- ✦ Geo-environmental assessment of the strata encountered, including an assessment of visual and olfactory evidence of contamination.
- ✦ The installation of 50mm ID monitoring standpipes at seven of the exploratory locations.
- ✦ Testing of soil samples to include a general contamination suite (e.g., asbestos, soil reaction, heavy metals, cyanide, sulphate, PAH, TPH and BTEX).
- ✦ Six return visits to carry out gas monitoring and recover samples of groundwater for contamination testing.

Due to the ongoing demolition and site clearance activities, the investigations have been undertaken in phases as the site has become accessible. The exploratory holes were sited to provide an even spread across the site, whilst targeting potential sources of contamination and/or sensitive areas of the site (e.g., UST and fuel dispensing). The locations of the exploratory holes are shown on the plan presented in Figure 4.

The exploratory holes were logged by engineers from GEA and Kalex in accordance with BS 5930:2015+A1:2020 (2020), copies of which are included in the respective reports. As described in Section 4.0, the strata encountered across the site generally comprised a layer of hardstanding over a circa 0.8-1.5m thick layer of made ground, over a circa 1.3-3.0m thick layer of Enfield Silt, over Kempton Park Gravel to depths of 4.5m-6.0mbgl over a significant thickness of impermeable London Clay.

In addition to inclusions of brick, concrete, flint gravel, plastic, metal, glass, carbonaceous material including suspected ash and clinker and ceramics in the made ground, visual and olfactory evidence of contamination encountered during the investigations included:

- ✦ Fragments of cement-bonded tile (ACM) were noted at:
 - TP101 @ 0.4mbgl.
 - TP102 @ 0.4mbgl.
 - TP103 @ 0.3mbgl.
 - TP4 @ 0.5mbgl.
 - TP101A @ 0.23-1.2mbgl.
 - TP102A @ 0.23-1.2mbgl.
 - TP103A @ 0.23-1.2mbgl.
- ✦ Hydrocarbon odours and/or black staining were noted at:
 - BH3 @ 0.6-2.5mbgl (top of the Enfield Silt).
 - BH5 @ 0.4-1.7mbgl (made ground).
 - BH17A @ 0.4-0.9mbgl (made ground), 1.4mbgl and 2.0-2.6mbgl (Kempton Park Gravel).

BH17A is located in the centre of the site, just to the S of the former fuel filling station/diesel UST.

The following sections comprise a generic assessment of the analytical results (for PCoC) and other data gathered during the GEA ground investigations and the Kalex additional site investigation, through comparison of the measured concentrations of contaminants against appropriate GAC in relation to the proposed development. For the purposes of the GQRA, the laboratory test results have been split into two datasets:

- ✦ Made Ground.
- ✦ Natural Ground (Enfield Silt and Kempton Park Gravel).
- ✦ Groundwater.

Summaries for each dataset are presented in Appendix D.



5.1 Human Health

The proposed development comprises the demolition of the existing buildings and clearance of the site, prior to the erection of 272 new homes within a range of buildings from four to thirteen storeys in height, 174sqm of commercial space (Use Class E), new pedestrian and cycle routes through the site, vehicle access, car and cycle parking and new hard and soft landscaping. The development is split into three distinct blocks (A, B and C). Each block would have its own courtyard or podium amenity space area. The development also includes areas of private amenity space. A circa a 5.5m deep basement is proposed below the building/block in the NE corner of the site. As such, the development will include:

- Areas of hardstanding:
 - Building footprint.
 - Access roads.
 - Parking and turning.
 - Basement.
- Soft landscaping:
 - Private amenity space.
 - Communal/public amenity space.

For the GQRA for human health, the generic residential (with homegrown produce) GAC based on the measured pH and/or total organic carbon converted to organic matter content would be applicable to areas of private amenity space, whereas across other parts of the site, a residential (without homegrown produce), or public open space - near residential (POS_{residential}) may be considered more realistic. In order to adopt a conservative approach, we have compared the results against the residential (with homegrown produce) GAC.

Where the maximum total concentration of a contaminant exceeded the respective GAC, a statistical assessment was undertaken in accordance with CL:AIRE (2020) Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration. The guidance emphasises the importance of a comprehensive understanding of the datasets in the context of the CSM to enhance decision making by all stakeholders and promote transparent, reasonable, and justified decisions in regard of land contamination. The guidance uses two-way confidence intervals and graphical summaries to evaluate the data and establish if the dataset is adequate to answer the question posed for the site. For planning scenarios, the aim of the assessment is to determine if we can confidently say that the mean concentration is below the critical concentration. Histograms for the made ground dataset are presented in Appendix E and the natural ground dataset are presented in Appendix F.

5.1.1 Made Ground Dataset.

The samples of made ground returned total concentrations of a number of potential contaminants across the dataset that exceeded their respective GAC for risks to human health in a residential (with homegrown produce) end use scenario, as detailed in the table below:

Made Ground Dataset	Unit	No.	Samples with Concentrations >GAC	Mean (mg/kg)	Max (mg/kg)	Human Health GAC
						Residential
Arsenic	mg/kg	44	26 (60%)	64	170	37
Beryllium	mg/kg	13	11 (85%)	5.3	13	1.7
Cadmium	mg/kg	44	1 (2%)	1.5	15	11
Copper	mg/kg	44	5 (11%)	824	4700	2400
Lead	mg/kg	44	42 (95%)	1323	4600	200
Nickel	mg/kg	44	7 (16%)	92	840	130
Zinc	mg/kg	44	2 (5%)	1323	4900	3700
Benzo(a)anthracene	mg/kg	44	1 (2%)	1.0	7.7	7.2
Benzo(b)fluoranthene	mg/kg	44	7 (16%)	1.1	5.6	2.6
Benzo(a)pyrene	mg/kg	44	6 (14%)	0.88	5.7	2.2
Dibenz(ah)anthracene	mg/kg	44	10 (23%)	0.17	1.1	0.24

The most elevated total concentrations of arsenic, beryllium, cadmium, copper, lead, nickel, zinc, benzo(a)anthracene (BaA), benzo(b)fluoranthene (BbF), benzo(a)pyrene (BaP) and



dibenz(ah)anthracene (DahA) exceeded the respective residential (with homegrown produce) GAC. Furthermore, the mean concentrations of arsenic beryllium and lead also exceeded the GAC.

As can be seen from the table above, the concentration of total lead in 95% of the made ground samples exceeded the GAC indicating that it is ubiquitous across the site.

In general, the datasets had either a lognormal distribution or no discernible distribution, except for beryllium, which had a normal distribution. Histograms for the made ground are presented in Appendix E and box plots have been created in accordance with the CL:AIRE (2020) guidance, copies of which are presented in Appendix G, the outputs from which are summarised in the table below:

Made Ground Dataset	Upper Quartile	Median	Lower Quartile	Critical Concentration	Mean	95% Confidence Interval		99% Confidence Interval	
				Residential		←-----→		←-----→	
Arsenic	4.47	3.86	3.29	3.61*	3.89	3.66	4.12	3.58	4.20
Beryllium	8.00	3.40	1.80	1.7	5.28	2.74	7.83	1.71	8.86
Cadmium	0.558	-1.609	-1.609	2.398*	-0.659	-1.07	-0.25	-1.21	-0.11
Copper	6.80	6.02	5.39	7.783*	6.04	5.67	6.42	5.55	6.54
Lead	7.56	7.00	6.32	5.298*	6.88	6.61	7.15	6.52	7.25
Nickel	4.58	4.02	3.46	4.868*	4.11	3.86	4.36	3.78	4.44
Zinc	7.55	6.99	6.19	8.216*	6.78	6.48	7.09	6.37	7.19
BaA	-0.07	-1.18	-2.48	1.974*	-1.04	-1.51	-0.58	-1.66	-0.42
BbF	-0.03	-0.93	-3.00	0.956*	-0.98	-1.46	-0.50	-1.63	-0.34
BaP	-0.09	-1.27	-3.00	0.788*	-1.15	-1.61	-0.69	-1.76	-0.54
DahA	-3.00	-3.00	-3.00	-1.427	-2.46	-2.77	-2.15	-2.88	-2.05

* Natural Log Value of the GAC

The statistical assessment is undertaken to determine where the true mean concentration of the dataset lies and in so doing whether we can be confident whether the true mean is above or below the critical concentration (GAC).

As can be seen from the table above, whilst there are concentrations of cadmium, copper, nickel, zinc, BaA, BbF, BaP and DahA in the made ground dataset that are above the GAC, overall, we can be confident that the true mean is below the GAC. However, there is a 95% chance that upper limit of the interval within which the true mean of arsenic, beryllium and lead lies is above the residential with homegrown produce GAC.

We would therefore conclude that the concentrations of arsenic, beryllium and lead within the made ground across the site are a potential risk to human health in the context of the proposed use where exposure pathways exist warranting remedial measures to be implemented to mitigate the risk.



5.1.2 Natural Ground Dataset

In general, the samples of natural ground returned total concentrations of potential contaminants across the dataset that were below their respective most conservative Tier 2 GAC for risks to human health in a residential (with homegrown produce) end use scenario. The only exception was the concentration of total lead, as summarised in the table below:

Natural Ground Dataset	Unit	No.	Samples with Concentrations >GAC	Mean (mg/kg)	Max (mg/kg)	Human Health GAC
						Residential
Lead	mg/kg	16	3 (19%)	156	890	200

The lead in the natural ground dataset had no discernible distribution. Histograms for the natural ground are presented in Appendix F and a box plot has been created in accordance with the CL:AIRE (2020) guidance, a copy of which is presented in Appendix H, the output from which is summarised in the table below:

Natural Ground Dataset	Upper Quartile	Median	Lower Quartile	Critical Concentration	Mean	95% Confidence Interval		99% Confidence Interval	
				Residential		←-----→		←-----→	
Lead	4.44	3.91	3.37	5.298*	4.22	3.58	4.86	3.34	5.10

* Natural Log Value of the GAC

As can be seen from the table above, whilst there were a small number of samples of natural ground returning concentrations of total lead above the GAC, overall, we can be confident that the true mean is below the GAC. As such, potential risks to human health from the natural ground would be deemed low, not warranting remedial measures to be included in the development.

5.1.3 Asbestos Containing Material (ACM)

Visible fragments of asbestos containing material (ACM) were observed in the made ground at TP101 @ 0.4mbgl, TP102 @ 0.4mbgl, TP103 @ 0.3mbgl, TP4 @ 0.5mbgl, TP101A @ 0.23-1.2mbgl, TP102A @ 0.23-1.2mbgl and TP103A @ 0.23-1.2mbgl. No suspect ACM was observed in the natural ground.

Forty-one samples of made ground and two samples of natural ground were screened for asbestos fibres. No fibres were detected in either sample of natural ground. Asbestos was detected in three samples of made ground (circa 7%). In each case, the ACM comprised chrysotile fibres and the samples were submitted for quantification. Two of the made ground samples submitted for quantification returned concentrations below the laboratory limit of detection (i.e., <0.001%).

As such, whilst there does not appear to be gross ACM contamination of the made ground, its presence will need to be mitigated during the development. In the parts of the development that will remain under permanent hardstanding (e.g., building footprint, access road) etc. the development itself will break the exposure pathway to longer term risks. However, measures to mitigate short-term risks to groundworkers during the development and to mitigate long-term risks to end users post development in areas where exposure pathways will exist (e.g., areas of soft landscaping) will need to be implemented.

5.1.4 TPH and BTEX

Hydrocarbon odours and/or staining were noted in three locations, BH3 @ 0.6-2.5mbgl (top of the Enfield Silt), BH5 @ 0.4-1.7mbgl (made ground) and BH17A @ 0.4-0.9mbgl (made ground), 1.4mbgl and 2.0-2.6mbgl (Kempton Park Gravel).

Sixty samples (forty-four made ground and sixteen natural ground) were submitted for TPH testing, a proportion of which included aliphatic and aromatic splits (CWG Method) and BTEX.

All the samples of made ground returned concentrations that were below the respective GAC for residential (with homegrown produce) indicating that the concentration of TPH in the made ground would not be considered a potential risk to human health in the context of the proposed development.



One sample of natural ground from BH17A @ 2.4mbgl returned an elevated concentration of TPH that exceeded the human health GAC for residential with homegrown produce GAC. This location was to the S of the former fuel filling station and would indicate that there is a degree of hydrocarbon contamination in the soils at this location that will require remedial measures as part of the development.

5.2 Landscape Planting

5.2.1 Made Ground Dataset.

In general, the samples of made ground returned total concentrations of potential contaminants across the dataset that were above their respective GAC for risks to landscape planting as detailed in the table below:

Made Ground Dataset	Unit	No.	Samples with Concentrations >GAC	Mean (mg/kg)	Max (mg/kg)	Landscape Planting GAC
Copper	mg/kg	44	33 (75%)	824	4700	200
Nickel	mg/kg	44	8 (18%)	92	840	110
Zinc	mg/kg	44	37 (84%)	1323	4900	300

The most elevated total concentrations of copper, nickel and zinc exceeded the respective landscape planting GAC. In addition, the mean concentration of copper and zinc also exceeded the GAC with 75% and 84% of samples of made ground above the GAC.

None of the datasets had a normal distribution. Histograms for the made ground dataset are presented in Appendix E and boxplots are presented in Appendix I, the outputs from which are summarised in the table below:

Made Ground Dataset	Upper Quartile	Median	Lower Quartile	Critical Concentration	Mean	95% Confidence Interval		99% Confidence Interval	
				Landscape Planting		←-----→		←-----→	
Copper	6.80	6.02	5.39	5.298*	6.04	5.67	6.42	5.55	6.54
Nickel	4.58	4.02	3.46	4.700*	4.11	3.86	4.36	3.78	4.44
Zinc	7.55	6.99	6.19	5.704*	6.78	6.48	7.09	6.37	7.19

* Natural Log Value of the GAC

As can be seen from the table above, whilst there are concentrations of nickel in the made ground dataset that are above the GAC, overall, we can be confident that the true mean is below the GAC. However, there is a 95% chance that upper limit of the interval within which the true mean of copper and zinc lies is above the landscape planting GAC.

We would therefore conclude that the concentrations of copper and zinc within the made ground across the site are a potential risk to landscape planting in the context of the proposed use where exposure pathways exist warranting remedial measures to be implemented to mitigate the risk.

5.2.2 Natural Ground Dataset.

In general, the samples of natural ground returned total concentrations of potential contaminants across the dataset that were below their respective GAC for risks to landscape planting. The only exception was an isolated, slightly elevated concentration of copper as detailed in the table below:

Natural Ground Dataset	Unit	No.	Samples with Concentrations >GAC	Mean (mg/kg)	Max (mg/kg)	Landscape Planting GAC
Copper	mg/kg	16	1 (6%)	45	210	200



The copper dataset had no discernible distribution., whereas the nickel and zinc dataset had a normal distribution. Histograms for the natural ground dataset are presented in Appendix F and a boxplot is presented in Appendix J, the output from which is summarised in the table below:

Natural Ground Dataset	Upper Quartile	Median	Lower Quartile	Critical Concentration	Mean	95% Confidence Interval		99% Confidence Interval	
				Landscape Planting		←-----→		←-----→	
Copper	3.70	3.31	3.15	5.298*	3.52	3.15	3.89	3.01	4.04

* Natural Log Value of the GAC

As can be seen from the table above, whilst there is a single isolated concentration of copper in the natural ground dataset that are above the GAC, overall, we can be confident that the true mean is below the GAC. As such, potential risks to landscape planting from the natural ground would be deemed low, not warranting remedial measures to be included in the development.

5.3 Controlled Water

Within the preliminary CSM presented in the desk study report, controlled waters (groundwater and surface water) were considered of low sensitivity. We have based our Tier 2 GQRA on the following information that is presented in the PRA:

- ✎ The superficial drift (Enfield Silt) and underlying bedrock (London Clay Formation) are both classified as unproductive. The intervening layer of Kempton Park Gravel is designated as a secondary (A) aquifer.
- ✎ The site is not located in an EA designated SPZ, but a Zone 2 (outer catchment) is located circa 10m to the SE.
- ✎ There are no abstractions within 500m of the site.
- ✎ The site is located in Flood Zone 2.
- ✎ The nearest surface water feature is located circa 280m to the NE.

5.3.1 Leachate Testing

As part of the GEA investigation, leachate testing was undertaken on four samples of made ground, which all returned slightly elevated concentrations of lead and one returned an elevated concentration of zinc above the respective controlled water GAC. As part of the Kalex investigation, leachate testing was undertaken on samples of made ground returning elevated total concentrations. The results are currently pending, but from the GEA investigation it would appear that the elevated concentrations of total lead and zinc in the made ground are potentially mobile and therefore a potential risk to controlled water.

As noted in Section 5.3 above, the made ground and groundwater in the Kempton Park Gravel secondary aquifer are separated by a 1.3m to 3.0m thick of unproductive Enfield Silt. As such, it is not considered that the potentially mobile contaminants in the made ground would have a significant impact on the quality of water in the Kempton Park Gravel aquifer.

5.3.2 Groundwater Quality

Groundwater was encountered at depths of between 3.0m and 4.0m in the Kempton Park Gravel, and at 22.5m and 24.5m in the Lambeth Group. Groundwater has subsequently been monitored at depths of between 0.74m and 2.85m.

Four groundwater samples were taken as part of the GEA investigation, which generally returned concentrations of potential contaminants below the respective controlled water GAC. The only exceptions were slightly elevated concentrations of nickel at BH13 and BH17A and an elevated concentration of TPH (C₁₆-C₂₁ and C₂₁-C₃₅) at BH17A. BH13 was located in the centre of the site and BH17A was located just to the S of the former fuel filling station.

As such, there does not appear to be any gross groundwater contamination at the site, rather localised contamination at BH17A, just to the S of the former fuel filling station and UST, likely associated with spillages/leakages of diesel. Considering the low sensitivity of the groundwater below the site, the



distance to an identifiable surface water or groundwater receptor, we do not consider that a detailed groundwater risk assessment (DQRA) is required to assess risks to controlled water, but remedial measures should be implemented during the development to ensure betterment of the groundwater quality in the vicinity of BH17A.

5.3.3 Groundwater Vapours

The groundwater quality testing has included TPH and PAH. The concentrations returned by the samples were generally below the laboratory limits of detection and below the respective GAC for risks to controlled water.

In addition, where possible we have compared the results against the GAC for assessing vapour risks to human health from VOC in groundwater (SoBRA 2017). In each case, the concentrations were below their respective GAC_{gw vap} including the concentration of TPH C16-C21 (270ug/l) at BH17A, which was below the respective GAC_{gw vap}.

As such, whilst we do not consider the groundwater onsite to represent a significant source of organic contamination or to represent a SPL to human health in terms of indoor air quality and do not consider that further assessment is required, as noted in Section 5.3.2, measures should be implemented at BH17A to ensure betterment of groundwater quality in the vicinity of the former fuel filling station.

5.4 Buildings and Construction Materials

5.4.1 Concrete Cast In-Situ

According to the GEA report (see Appendix B), the made ground returned reasonably high concentrations of soluble sulphate and near neutral pH, in accordance with Class DS-4 conditions of Table C2 of BRE Special Digest 1:SD Third Edition (2005). The measured pH values of the samples show that an ACEC class of AC-4 would be appropriate which assumes a mobile water condition at the site.

Chemical analyses of the natural soils have revealed much lower concentrations of soluble sulphate and near neutral pH, in accordance with Class DS-2 conditions of Table C2 of BRE Special Digest 1:SD Third Edition (2005). The measured pH values of the samples show that an ACEC class of AC-2 would be appropriate. These values assume a mobile water condition at the site. The guidelines contained in the digest should be followed in the design of foundation concrete.

We would recommend that the advice and guidance provided in the GEA report be followed in respect of concrete structures in the ground.

5.4.2 Potable Water Supply Pipes

In accordance with UKWIR (2010), as partially superseded by Water UK (2014), several of the samples of made ground and natural ground at BH3 and BH17A returned elevated concentrations of TPH (C₁₁-C₂₀) and TPH (C₂₁-C₄₀) that would preclude the use of standard PE pipe materials.

As such, should it be necessary to install water supply pipes as part of the development, then remedial measures would be required, which may include the removal of made ground materials from along the route of a suitably constructed water supply pipe trench to allow the use of standard PE pipes, or consideration should be given to the use of (PE-Al-PE) barrier pipes (e.g., Protectaline or similar). This should be confirmed by the local water supply company.

5.4.3 Ground Gas and Vapours

As previously noted, additional gas monitoring visits are currently being undertaken by Kalex and therefore the following assessment is based on the findings from the GEA investigation, during which six rounds of gas monitoring were undertaken.

The results from the first GEA visit indicated that BH2 and BH17A were at near normal oxygen levels of 17.6 % and 17.7 % respectively, BH13 had slightly reduced oxygen levels of 13.7 % and BH5 and BH13 had significantly reduced oxygen levels of 7.7 % and 7.2 % respectively. Oxygen concentrations in all boreholes that could be accessed during the remaining visits had recovered to near normal. Reduced oxygen concentrations were recorded in BH12 during the fourth visit, but this was the first time this borehole was accessible, and the gas tap was noted to have been closed, which could have allowed for



a build-up in concentrations. Negligible carbon dioxide concentrations were recorded in BH12 in subsequent visits.

Slight carbon dioxide levels were recorded in all boreholes of between 0.2 % in BH13 and 2.2 % in BH1 during the first visit. Carbon dioxide concentrations were all at 0.1 % during the second visit and between 0.1 % and 0.9 % during the remaining visits, apart from BH12 discussed above. No methane, carbon monoxide, or hydrogen sulphide was identified.

During the GEA investigation, all boreholes were also tested for VOC using a PID. A maximum concentration of 4.3 ppm was recorded in BH17A during the second visit, but concentrations of 0.0 ppm and 0.054 ppm were recorded in this borehole during the first and third visits respectively. A moderate to significant flow was recorded in BH's 1, 5 and 13 of 4.0 l/h, 19.9 l/hr and 20.2 l/hr respectively during the first visit, but no flow was recorded during the remaining five visits. Relative downhole pressure was measured at between 3 mb and 245 mb also during the first visit but was measured to be 0 mb during the remaining five visits. Breezy conditions were observed on the day of the first monitoring visit, which is likely to have affected the flow readings. This appears to have been confirmed with the further five monitoring visits, and as such the average flow rate should be considered to be <0.1 l/hr.

Thresholds and Screening Values

CIRIA (2007) states that primary hazardous ground gases comprise CH₄, CO₂, hydrocarbon vapours and radon. Other gases also exist that can potentially pose a risk, such as CO and H₂S. CIRIA (2007) and NHBC (2007) provide assessments for CO₂ and CH₄ based upon GSV utilising flow rates and concentrations (suitable for 50mm diameter gas monitoring standpipes only). The site based GSVs for CH₄ and CO₂ are based upon the following equation:

$$\text{GSV} = \frac{\text{Gas Concentration (v/v)}}{100} \times \text{flow rate (l/hr)}$$

The GSVs within CIRIA (2007) are based upon all buildings other than standard residential houses. The NHBC (2007) GSV are based upon standard residential houses with precast concrete floors (block and beam). As such, based upon the end use of the site the GSV within the CIRIA guidance should be adopted.

The GSV for both are summarised in the table below:

CIRIA		NHBC		
Classification	GSV (CH ₄ and CO ₂)	Classification	GSV (CH ₄)	GSV (CO ₂)
CS1	<0.07	Green	<0.13	<0.78
CS2	<0.70	Amber 1	<0.63	<1.60
CS3	<3.5	Amber 2	<1.60	<3.10
CS4	<15	Red	>1.60	>3.10
CS5	<70			
CS6	>70			

There are currently no GSV for CO or H₂S. Thresholds are only available for occupational exposure limits (OEL). For CO, the short term OEL (OELST) is 200ppm and the long term OEL (OELLT) is 30ppm. For H₂S, the OELST is 10ppm and OELLT is 5ppm. It should be noted that the OELLT is based upon an 8-hour exposure limit converted to an annual mean and the OELST is based upon 15-minute exposures converted to an annual mean. The OEL may therefore be inappropriate for residential end uses.

For CO it is reasonable to assume the European Standard EN50291, which supersedes BS7860, for the lower alarm limit of 30ppm for domestic carbon monoxide detectors in residential properties as a GSV for this site. This GSV also correlates with the OELLT.

Site Specific Assessment

The results of the gas monitoring are summarised in the table below, which utilises the highest steady state concentrations and the highest flow rates returned during the monitoring programme to adopt worst-case scenarios for the risk assessments.



Ashley Road Depot					
Steady State CH ₄ (%)	Steady State CO ₂ (%)	Flow (l/h)	CH ₄ GSV (l/hr)	CO ₂ GSV (l/hr)	Characteristic Situation
<0.1	6.1	<0.10	<0.0001	0.0061	CS1

According to CIRIA (2007), the worst-case monitoring results for would be classified as CS1.

As stated in the GEA report, where a carbon dioxide concentration is above 5%, consideration should usually be given to increasing to a Characteristic Situation 2 (CS2). However, the worst-case carbon dioxide concentration has not been replicated since the first visit.

In addition, according to the ternary plot of zones indicting the potential gas source given in Figure 3.2 of NHBC (2023) Hazardous Ground Gas – An Essential Guide for Housebuilders, the data is predominantly in a zone that indicates the carbon dioxide is caused by biological respiration or oxidation of organic material in the ground (e.g., made ground) indicating low rates of gas generation.

A ternary plot is useful for deciding whether to increase a site's classification from CS1 to CS2 where there are elevated concentrations but low flow rates. For example, if there are concentrations from a single well or only occur occasionally that are in the purple, light blue, squared hatched and vertical hatched areas may indicate that there is no need to increase the classification.

In our experience, it is common for boreholes to return elevated pressure, flow and gas concentrations during the first visit after installation and considering the ternary plot above, we would concur with the assessment undertaken by GEA that the site would be CS1. We would however also agree with GEA that the monitoring programme be extended with an additional three visits to confirm this view.

The additional monitoring is currently being undertaken by Kalex. This section will be updated upon completion of the additional rounds of gas monitoring.

In addition, the VOC monitoring of the borehole headspace returned low concentrations, indicating a low risk from vapours. As such, the inhalation of vapours (indoors and outdoors) SPL is considered inactive.



6.0 REFINED CSM

The table below presents a revised Tier 2 CSM for the site based upon the SPL identified within the Tier 2 site investigation and GQRA and summarises the relevant sources, pathways and receptors at the site based on the proposed development.

Source(s)	Potential Contaminant(s)	Potential Migration Pathway(s)	Potential Receptor(s)	Consequence	Probability	Risk Matrix Classification*	Active/Inactive
Made Ground.	ACM	Ingestion of contaminated soils. Inhalation of dust (indoors and outdoors). Direct dermal contact with soils.	Human health (Future site users, groundworkers and neighbours).	Medium.	Likely.	MODERATE	The severity of consequence of exposure to ACM in the made ground across the site is deemed of medium risk to human health. The probability of a linkage is deemed likely. As such, in the context of the proposed development the overall risk is deemed moderate. (SPL1) .
	Asbestos Fibres Heavy Metals (As, Be and Pb)	Ingestion of contaminated soils. Inhalation of dust (indoors and outdoors). Direct dermal contact with soils.	Human health (Future site users, groundworkers and neighbours).	Medium.	Likely.	MODERATE	The severity of consequence of exposure to elevated concentrations of asbestos, heavy metals, and PAH compounds in the made ground across the site is deemed of medium risk to human health. The probability of a linkage is deemed likely. As such, in the context of the proposed development the overall risk is deemed moderate. (SPL2) .
	Copper Zinc	Root uptake.	Landscape planting	Mild	Likely	LOW/MODERATE	The severity of consequence of exposure to elevated concentrations of copper and zinc in the made ground across the site is deemed of mild risk to landscape planting. The probability of a linkage is deemed likely. As such, in the context of the proposed development the overall risk is deemed low/moderate. (SPL3) .
	TPH compounds.	Impairment of potable water through permeation, structural or physical deterioration or contamination.	Water supply pipes.	Mild.	Likely.	LOW/MODERATE	Several samples of made ground and natura ground returned concentrations of TPH that exceeded the respective threshold for PE pipes. As such, should it be necessary to install new water supply pipes as part of the development some, barrier pipes should be selected. The local water supply company should confirm this. (SPL4) .
Made Ground and Shallow Ground Water	Potential for TPH contaminants to be present within the subsurface soils and shallow ground water associated with former onsite fuel filling station near BH17A	Migration of vapours to the surface followed by inhalation (indoors and outdoors).	End users and indoor air quality.	Mild.	Likely.	LOW/MODERATE	Potentially contaminative former onsite activities (fuel filling station etc.) considered to be potential sources of dissolved phase organic contamination. The probability is classified as medium on the basis that elevated There was visual/olfactory evidence of hydrocarbon contamination at BH17A, which returned elevated concentrations of TPH in both the underlying natural soils and the shallow groundwater. Therefore, the migration pathway to the secondary aquifer is considered active (SPL5) .



7.0 STAGE 2 OPTIONS APPRAISAL (OA)

The objective of the OA is to establish an appropriate remediation option or combination of options to implement during the development as a means of reducing or controlling the risks associated with a relevant pollutant linkage (RPL) to an acceptable level.

In the first instance it is necessary to decide if there is sufficient up to date information upon which to base the OA. Once the validity of the supporting information has been ascertained there are 3 tiers to follow in an OA:

- 📌 Stage 2, Tier 1: Identify feasible remediation options.
- 📌 Stage 2, Tier 2: Undertake a detailed evaluation of options.
- 📌 Stage 2, Tier 3: Select your final remediation options.

To effectively evaluate and identify remediation options it may be necessary to collect more site investigation data and to update the CSM. It may also be necessary to obtain general information relating to:

- 📌 Regulatory controls (e.g., what permits may be required).
- 📌 Noise restrictions (e.g., some remediation techniques may need to be controlled)
- 📌 Baseline ambient air quality.
- 📌 Weather conditions during remediation (e.g., it may be necessary to consider seasonal variations in water levels and potential for flooding).

The proposed development comprises the demolition of the existing buildings and the clearance of the site prior to the erection of a mixed-use development comprising 272 new homes (Use Class C3) within a range of buildings from four to thirteen storeys in height, 174sqm of commercial space (Use Class E), new pedestrian and cycle routes through the site, vehicle access, car and cycle parking and new hard and soft landscaping. The development is split into three distinct blocks (A, B and C). Each block would have its own courtyard or podium amenity space area. They are each separated by new N-S routes through the site and are surrounded by new soft landscaped public realm areas onto Park View Road and Down Lane Park. There would be 42 car parking spaces and 512 high-quality cycle parking spaces provided. The new vehicle access from Ashley Road would provide a through-route to Park View Road for pedestrians and cyclists. We understand that a 5.5m deep basement is proposed below the building/block in the NE corner of the site. A proportion of the proposed development will be under permanent hardstanding (e.g., building/basement footprints, parking, roads and pathways) and parts will be soft landscaped.

The Stage 1, Tier 2 GQRA and refined CSM presented in Section 6.0 concluded that most of the SPL are either inactive and/or will be broken by the development and rendered a very low to low risk. The only SPL considered to remain are as follows:

- 📌 **SPL1:** Presence of ACM in the building fabric and visible fragments in the made ground deemed a potential short-term risk to construction workers and neighbours during the development and a long-term risk to end-users.
- 📌 **SPL2:** Elevated concentrations of asbestos (fibres) and heavy metals (arsenic, beryllium and lead) in the made ground considered a potential risk to human health (long-term exposure post completion and short-term exposure during the development) in areas of the proposed development where exposure pathways exist.
- 📌 **SPL3:** Elevated concentrations of copper and zinc in the made ground considered a potential risk to landscape planting where it coincides with area of soft landscaping.
- 📌 **SPL4:** Elevated concentrations of TPH in the made ground considered a potential risk to water supply pipes where it coincides with the route of the water supply pipe(s).
- 📌 **SPL5:** Fuel storage and dispensing infrastructure (e.g., UST) associated with the former fuel filling station and residual TPH contamination of the underlying soils and groundwater at BH17A.



The OA can be summarised as follows:

Supporting Information	The options appraisal is based on Stage 1, Tier 1 reports compiled in September 2022 (GEA) and May 2023 (Kalex), including site investigation, laboratory testing and environmental monitoring. The site investigation comprised the progression of forty-seven exploratory holes (boreholes, trial pits and windowless sampler boreholes) across the circa 16000m² site, a density equivalent to a circa 18m sampling grid. Representative samples of near surface soil/made ground and underlying natural ground (Enfield Silt and Kempton Park Gravel) were submitted for contamination testing. The testing undertaken included a broad range of potential contaminants associated with a wide range of potentially contaminative activities together with targeted contaminants of concern associated with the potential sources of contamination identified in the PRA (i.e., TPH, BTEX etc.). The scope of testing is considered appropriate in respect of the uses (current and past) of the site and immediate surrounds. The reports have been compiled by experienced/competent geo-environmental engineers in line with current good practice guidance. Therefore, the PRA, site investigation and RA reports are considered sufficient upon which to base the Stage 2 OA.
Stage 2 Tier 1 Feasible Options	<u>Breaking the Exposure Pathway(s)</u> In terms of protecting sensitive receptors such as human health (e.g., end users, ground workers and neighbours), landscape planting etc., one potential option would be to break the respective pathways of potential exposure. This may involve a cover layer placed above any remaining near surface soil in sensitive end use areas. This type of option would break the relevant exposure pathways to the receptor without removing the actual source of contamination. The suitability of the installation of a cover layer in areas of sensitive end use is partly dependent upon whether it is possible to raise the completed levels of the development in these areas. If this were not the case, then it may be necessary to remove, or at least partly remove, the made ground layer to accommodate the required depth of cover. <u>Source Removal</u> Sensitive receptors such as human health, controlled water, landscape planting, etc., could also be protected by removing of the source(s) of contamination (i.e., contaminated made ground) coinciding with areas of sensitive end use (e.g., area of soft landscaping) thus breaking the long-term SPL by removal of source of contamination.
Stage 2 Tier 2 Detailed Evaluation	Considering the straight-forward nature of the options appraisal, a detailed evaluation is not considered necessary.
Stage 2 Tier 3 Final Remediation Option	The development includes the cessation of the former commercial use of the site, removal and demolition of the existing buildings and UST etc. followed by the erection of a mixed-use residential development with associated access, parking, and both private and communal areas of amenity space. As such, across a proportion of the site where the proposal includes the installation of permanent hardstanding (e.g., building/basement footprint, access road etc.), the development itself will create a permanent barrier across the site, where some of the SPL will be broken, and no long-term remedial measures will be required. In other areas, e.g., where soft landscaping is proposed as part of the development where there will be no barrier and includes areas of private garden and a small area of amenity/screen planting along the W perimeter. The final remedial option recommended includes a combination of source removal and barriers to break the pathways of exposure associated with the active SPL as follows: 1) Removal of ACM from the fabric of the former buildings and any visible ACM in the near surface soil/made ground (SPL1). 2) Removal of made ground from areas of proposed private/communal gardens and open space and replacement with suitable topsoil and subsoil. Implementation of mitigation to minimise the potential of fibre release during the development, particularly where there is the potential for dusty conditions. (SPL2 and SPL3). 3) Excavation of suitable trenches and/or installation of suitable PE-AL-PE barrier pipes e.g., Protectaline or similar (SPL4). 4) Removal of UST, fuel delivery and dispensing infrastructure and any residual hydrocarbon contaminated soils and shallow groundwater in the vicinity of the former fuel-filling station and BH17A to mitigate residual risks of migration of hydrocarbon/vapours into indoor spaces (SPL5). The remediation scheme proposed in Section 8.0 includes measures to remove the source(s) of contamination and break exposure pathways as detailed above. In addition, other measures, not necessarily part of the remediation strategy to ensure the proposed development is undertaken in accordance with good environmental practice are dealt with in the Site Management Procedures detailed in Section 9.0.



8.0 STAGE 3 REMEDIATION STRATEGY (RS)

There are three tiers for a Stage 3 RS, which can be summarised as follows:

- 📌 Stage 3, Tier 1: Develop a remediation strategy (RS).
- 📌 Stage 3, Tier 2: Remediation and verification.
- 📌 Stage 3, Tier 3: Long term monitoring and maintenance (if required).

8.1 Removal of Visible ACM (SPL1)

Any parts of the fabric of the existing buildings confirmed to contain ACM (e.g., roof sheeting etc.) should be removed by an appropriately licenced contractor (notified to the HSE if required) and disposed to an appropriately permitted waste management facility. In addition, any visible fragments of asbestos encountered in the site soils should also be removed by appropriately trained personnel.

8.1.1 Validation Procedure

The following records should be provided by the contractor for inclusion in the verification report (Condition 22 Part c) to demonstrate the implementation of the remedial measures to mitigate SPL1:

- 📌 Risk assessment and method statement (RAMS) for the works involving the removal of ACM.
- 📌 Training records for operatives (e.g., asbestos awareness training).
- 📌 Consignment notes for ACM removed from the site.
- 📌 Waste carriers' licences (WCL) for hauliers used to remove ACM from the site.
- 📌 Environmental permit(s) of disposal facility(ies).

8.2 Human Health (SPL2) and Landscape Planting (SPL3)

Asbestos fibres and elevated concentrations of heavy metals (arsenic, beryllium and lead) considered a potential risk to human health (end users) and elevated concentrations of copper and zinc considered a potential risk to landscape planting have been identified in the made ground across the site. Whilst the SPL will be broken in areas of permanent hardstanding (e.g., building footprint, parking etc.) the SPL will remain active in any areas of proposed soft landscaping/amenity space where any made ground remains in-situ. In accordance with BRE (2004), where made ground remains in-situ in areas of landscaping, we would recommend that:

- 📌 **Private Amenity Space/Gardens:** A minimum 600mm* of soil (topsoil and subsoil*) validated as being free from significant contamination should be placed above the in-situ site soils (should they be retained in-situ) to break the exposure pathway to end users and landscape planting.
- 📌 **Communal Amenity Space/Gardens:** A minimum 600mm* of soil (topsoil and subsoil*) validated as being free from significant contamination should be placed above the in-situ site soils (should they be retained in-situ) to break the exposure pathway to end users and landscape planting.
- 📌 **Public Open Space/Screen Planting:** A minimum 450mm* of soil (topsoil and subsoil*) validated as being free from significant contamination should be placed above the in-situ site soils (should they be retained in-situ) to break the exposure pathway to end users and landscape planting.

* The thickness of the capping/cover layers as detailed above should comprise at least 50% topsoil.

The initial site strip may result in the removal of much of the made ground, but where this is not the case, additional made ground should be removed to accommodate the required thickness of cover in areas of soft landscaping. As such, in areas of private/communal amenity space/garden a minimum of 600mm of made ground should be removed to accommodate the cover soils. In areas of public open space/screen planting a minimum of 450mm of made ground should be removed. In some areas it is possible that the top of the natural ground will be encountered at a shallower depth and in any such cases the top of the natural ground can be used as a marker for the depth of remedial excavation. If natural ground is encountered, then the thickness of clean cover can be reduced accordingly. Where the cover soils are placed over in-situ made ground, a geotextile marker layer should be installed between the made ground and imported soils.

Once the made ground has been removed from areas of soft landscaping, the formation level should be validated in accordance with the procedure detailed in Section 8.2.1. Soils imported onto site for placement in areas of landscaping should be validated in accordance with the procedures detailed in Section 8.2.2.



Records confirming the removal of the made ground from areas of landscaping (e.g., photographic record, waste transfer notes, waste carriers' licences, environmental permits, formation inspection records etc.) should be retained for inclusion in the verification report.

8.2.1 Validation Procedure

Upon completion of remedial excavations in areas of proposed landscaping, a validation exercise should be undertaken by a geo-environmental engineer to confirm that the required depth (e.g., up to 0.6m thick in areas where made ground remains in-situ, or to the top of the natural ground) of made ground has been removed and to inspect the soils at formation level (visual and olfactory observations backed by PID monitoring and laboratory testing where necessary) for evidence of unexpected contamination. Each inspection will consist of physical descriptions/records of the soils at formation level, backed by a photographic and validation sampling (if necessary) for inclusion in the verification report. Should any unexpected contamination be encountered at the formation level then the discovery strategy should be implemented.

Where any existing in-situ made ground remains in-situ, then the capping/cover layer should be installed over a 'deter to dig' membrane, which should be adopted in all areas of soft landscaping at ground level. The 'deter to dig' membrane should be conspicuous, easily identifiable, suitably permeable and of appropriate longevity. This would not be required in areas of soft landscaping where the inspections reveal that the topsoil/made ground has been removed in its entirety.

The location, size, and extent of the remedial excavation(s) in areas of soft landscaping should be recorded (e.g., on a sketch plan and/or photographic records etc.) for inclusion in the verification report. Upon confirmation that the required depth has been achieved and the absence of unexpected contamination, then the remedial excavation should be backfilled with suitable soils (e.g., topsoil and subsoil).

The results of all validation monitoring and testing, including a photographic record, will be maintained, and presented in a verification report. Upon completion of the works, the contractor will supply all duty of care documentation (e.g., waste transfer notes etc.) confirming that all contaminated soils have been removed and managed appropriately.

8.2.2 Imported Materials

Upon installation of the capping/cover layer a geo-environmental engineer should inspect the site soils to confirm that the required thickness has been achieved in each area of soft landscaping. The results of inspections, including a photographic record, should be maintained, and presented in a verification report.

Prior to the importation of any soils (topsoil and/or subsoil) the client will obtain a detailed declaration, including laboratory testing results, from the chosen supplier(s) for approval. Laboratory certificates provided by the supplier(s) will be assessed for compliance with an appropriate specification for the works, industry good practice, validation criteria outlined in Section 8.3.1 and landscape planting GAC (i.e., BS3882:2015 Specification for Topsoil). Once the supplier(s) has been selected, then a sampling regime based on the requirements of the local authority will be implemented as follows:

- One sample of imported soil (topsoil and subsoil) per source will be sampled and tested for independent source validation from the first load(s) delivered to the site.
- In addition, for each source, after placement, one sample per 50m³ or one sample per landscaped area (including any soils placed in paved landscaped areas) will be sampled and tested for routine monitoring purposes of the source(s).

The testing regime and imported soil criteria set out a minimum requirement to be achieved. Depending on the nature of the source(s) selected it may be necessary to increase the rate of sampling and/or the scope of testing required. If deemed necessary, this will be set out in the validation report. The imported soil testing results will be compared against the Validation Criteria given in Section 8.2.3. Should it be necessary to import other materials (e.g., crushed concrete etc.) that will be permanently reused onsite then a performance certificate/specification (e.g., grading certificate) should be provided by the supplier to confirm the suitability of the material. Such material should also be subjected to a suitable programme



of testing (e.g., asbestos) to confirm suitability for reuse onsite. Such materials should be tested at a rate of at least one sample per 250m³ before placement. The contractor should provide documentation (e.g., delivery notes) indicating the volume and/or number of loads delivered of each material imported to the site and should record the location and depth of placement achieved (e.g., photographic record with scale demonstrating the depth of placement).

8.2.3 Validation Criteria (Imported Soil)

Validation criteria for imported soil based on end use area is presented in the table below:

Determinand	Unit	GAC (Private Gardens)	GAC (Communal Gardens)	GAC (Public Space)	Source
pH	Units	5.5-8.5	5.5-8.5	5.5-8.5	BS3882:2015
Antimony	mg/kg	550	550	550	CL:AIRE (2009)
Arsenic	mg/kg	37	40	79	S4UL
Barium	mg/kg	1300	1300	1300	CL:AIRE (2009)
Beryllium	mg/kg	1.7	1.7	2.2	S4UL
Cadmium	mg/kg	11	85	120	S4UL
Chromium	mg/kg	910	910	1500	S4UL
Chromium	mg/kg	6	6	7.7	S4UL
Copper	mg/kg	200	200	200	BS3882:2015
Lead	mg/kg	200	310	630	C4SL
Mercury	mg/kg	40	56	120	S4UL
Molybdenum	mg/kg	670	670	670	CL:AIRE (2009)
Nickel	mg/kg	110	110	110	BS3882:2015
Selenium	mg/kg	250	430	1100	S4UL
Vanadium	mg/kg	410	1200	2000	S4UL
Zinc	mg/kg	300	300	300	BS3882:2015
Aliphatic C ₅ -C ₆	mg/kg	42	42	570000	S4UL
Aliphatic C ₆ -C ₈	mg/kg	100	100	600000	S4UL
Aliphatic C ₈ -C ₁₀	mg/kg	27	27	13000	S4UL
Aliphatic C ₁₀ -C ₁₂	mg/kg	130	130	13000	S4UL
Aliphatic C ₁₂ -C ₁₆	mg/kg	1100	1100	13000	S4UL
Aliphatic C ₁₆ -C ₃₅ ^f	mg/kg	65000	65000	250000	S4UL
Aliphatic C ₃₅ -C ₄₄	mg/kg	65000	65000	250000	S4UL
Aromatic C ₅ -C ₇	mg/kg	70	370	56000	S4UL
Aromatic C ₇ -C ₈	mg/kg	130	860	56000	S4UL
Aromatic C ₈ -C ₁₀	mg/kg	34	47	5000	S4UL
Aromatic C ₁₀ -C ₁₂	mg/kg	74	250	5000	S4UL
Aromatic C ₁₂ -C ₁₆	mg/kg	140	1800	5100	S4UL
Aromatic C ₁₆ -C ₂₁	mg/kg	260	1900	3800	S4UL
Aromatic C ₂₁ -C ₃₅	mg/kg	1100	1900	3800	S4UL
Total TPH	mg/kg	500*	500*	1000*	Site Specific GAC
Acenaphthene	mg/kg	210	3000	15000	S4UL
Acenaphthylene	mg/kg	170	2900	15000	S4UL
Anthracene	mg/kg	2400	31000	74000	S4UL
Benzo(a)anthracene	mg/kg	7.2	11	29	S4UL
Benzo(a)pyrene	mg/kg	2.2	3.2	5.7	S4UL
Benzo(b)fluoranthene	mg/kg	2.6	3.9	7.1	S4UL
Benzo(g,h,i)perylene	mg/kg	320	360	640	S4UL
Benzo(k)fluoranthene	mg/kg	77	110	190	S4UL
Chrysene	mg/kg	15	30	57	S4UL
Dibenzo(a,h)anthracene	mg/kg	0.24	0.31	0.57	S4UL
Fluoranthene	mg/kg	280	1500	3100	S4UL
Fluorene	mg/kg	170	2800	9900	S4UL
Indeno(1,2,3-cd)pyrene	mg/kg	27	45	82	S4UL
Naphthalene	mg/kg	2.3	2.3	4900	S4UL
Phenanthrene	mg/kg	95	1300	3100	S4UL
Pyrene	mg/kg	620	3700	7400	S4UL
Total PAH	mg/kg	20*	20*	100*	Site Specific GAC
Phenol	mg/kg	120	440	440	S4UL
Asbestos	%	Not Detected	Not Detected	<0.001%	-

* It is necessary to complete testing of all compounds listed in the table above. The inclusion of total TPH and total PAH does not preclude the requirement to undertake the testing of speciated fractions/compounds. The speciated TPH fractions and PAH compounds will be capped by the total TPH and total PAH thresholds.



8.2.4 Reuse of Site Won Material

In the unlikely event that any site won materials be reused (e.g., existing site soils etc.), then prior to reuse, such materials should be tested at a rate of at least one sample per 50m³ before placement. More testing will be required if material displays visual or olfactory evidence of contamination and/ or variability. If the sample results fail to meet the validation criteria, the materials should be either further tested to demonstrate suitability for reuse or disposed offsite.

8.2.5 Asbestos Fibres

During the laboratory testing, asbestos fibres were detected in the made ground in a small number of samples. In two cases the concentrations were below the laboratory detection limit. During the groundwork phase of the development, the contractor should implement the following to minimise risks from fibre release to ground workers and neighbours during the development:

- ✦ During excavations, the near surface soil should be damped down to prevent fibre release. A power washer (or similar) should be used to create a mist over any excavations in made ground to suppress airborne particles. In dry conditions, all areas should be damped down as a matter of course to keep dust suppressed.
- ✦ Should any visible fragments of suspected ACM be observed the surface of the site or in the made ground, these should be hand-picked and placed in a dedicated covered/sealed receptacle pending offsite disposal to a suitably permitted facility. Suitably trained operatives (e.g., with asbestos awareness training) should wear face fitted masks, disposable overalls, overshoes, and gloves whilst hand picking ACM fragments.
- ✦ Any areas of previously identified or suspected asbestos contamination should be carefully excavated under supervision.
- ✦ The excavation within near surface soil and any temporary stockpiles of potentially asbestos containing soils should be dampened down to prevent the release of asbestos fibres.
- ✦ Soils containing suspected ACM should be placed in a dedicated temporary stockpile or directly into covered wagons pending offsite disposal at an appropriately permitted facility.
- ✦ Should ACM impacted soils be encountered then representative samples should be submitted to an accredited laboratory for asbestos fibre screen analysis.

Soils containing low-level asbestos fibres would be properly classified as non-hazardous (LoW Code 17 05 04) for disposal offsite as waste. Soils with asbestos of >0.1% would be considered as hazardous waste (LoW Code 17 05 03*) for disposal offsite as waste.

Records (e.g., photographic, training records, waste transfer notes, waste carriers' licences, environmental permits etc.) should be retained for inclusion in the verification report.

Upon completion of any excavations at the site, records demonstrating that measures to mitigate fibre release (e.g., photographic record) were implemented should be provided for inclusion in the verification report.

8.3 Water Supply Pipes (SPL4)

Should it be necessary to install water supply pipes as part of the development, then risks from residual organic contamination (e.g., TPH etc.) in the made ground along the route of the water supply pipe should be mitigated through:

- 1) The removal of made ground from along the route of the supply pipe, which should be installed in a suitably constructed trench. In accordance with good practice a trench to accommodate the water pipe should be excavated to a depth of between 0.75m and 1.35m. The pipes should then be protected from stones etc. by backfill and bedding with suitable material; followed by
- 2) The installation of PE-Al-PE barrier pipes (e.g., Protectaline or similar).

8.3.1 Validation Procedure

The local water supply company should be consulted, and the proposed mitigation measures agreed. The removal of made ground from along the route of the trench, the trench construction details, and the installation of the barrier pipes should be recorded and documented (e.g., photographic record, product data sheet etc.) and subsequently examined and approved (e.g., by the building control inspector or similar) for inclusion in the verification report.



8.4 UST, Fuel Filling Infrastructure and Residual Impacted Soil and Groundwater (SPL5)

Any underground storage tanks (UST) and associated infrastructure associated with the former fuel filling station should be subject to controlled decommissioning, decontamination, and removal in accordance with relevant guidance detailed within EA (2016) Prevent Groundwater Pollution from Underground Fuel Storage Tanks.

If UST, interceptors, or other fuel dispensing infrastructure are encountered, the contents shall be investigated and tested by suitably qualified specialist subcontractors. Demolition activities will take care to prevent the spills and leaks of oils, chemicals etc. that arise or may be stored in current buildings and present in substations. These will need to be removed in a controlled manner, prior to demolition. All uncharted tanks shall be reported and protected. The contents of any tanks will be disposed of offsite by a specialist contractor to a suitably licenced waste facility. Removal activities will take care to prevent the spills and leaks of oils, chemicals etc. that are stored in current buildings.

A watching brief shall be maintained by suitably qualified personnel and if impacted material is present during excavation, such as that encountered at BH17A, then these materials will be stockpiled separately (i.e., quarantined) for testing prior to disposal offsite. The excavation of buried tanks shall be witnessed by a suitably qualified geo-environmental engineer and after removal the base of excavations will be surveyed. A summary of the guidance that will be followed is:

Procedure for Decommissioning Fuel Storage and Dispensing Infrastructure

1	Task specific risk assessments and method statements should be in place, and risks and required mitigation measures communicated to all relevant personnel prior to the works commencing. Appropriate PPE and, if required, RPE should be provided and utilised.
2	Once the location of the identified structure(s) is confirmed it should be made safe and removed from the site in accordance with the recommendations in Chapter 5 of the Defra Groundwater Protection Code <i>'Petrol stations and other fuel dispensing facilities involving underground storage tanks'</i> . The structure(s) and any associated pipework should be removed for offsite disposal. All works should be undertaken under specialist supervision.
3	If the structure(s) has not been previously decommissioned it should be assessed, opened to vent any gases contained within and any contents removed by vacuum tanker prior to removing it and any associated pipework for offsite disposal.
4	During the removal of the structure(s) and the excavation of the associated soils, a qualified geo-environmental engineer should maintain a watching brief and undertake a visual inspection of the ground material. Clean overburden should be stockpiled separately for reuse and damped down or covered to prevent dust generation as appropriate.
5	On the assumption that any significant hydrocarbon contamination is likely to be in localised hotspots, it is considered that the site has a low potential to generate levels of odour that are likely to cause a nuisance issue at or beyond the site boundary. However, should a potentially significant odour issue be identified, the groundwork in that area should be suspended until a suitable odour suppression or mitigation system is put in place.

If an interceptor and/or AST or UST is found to contain liquids, then these will be emptied and cleaned/degassed by an appropriately licensed contractor. All certification for this process will be retained. The local petroleum officer will also be informed of this activity and in the case of petroleum filled tanks may wish to be in attendance to verify the process. Allowance will be made for over excavation to remove any hydrocarbon contaminated soils from around the base and sides of the interceptor and any AST or UST.

Elevated concentrations of petroleum hydrocarbons above the GAC have been detected in the natural ground at BH17A to the S of the former fuel filling station at a depth of 2.4mbgl, as summarised in the table below:

Known Hydrocarbon Hotspots

Ref	Coordinates		Level (mAOD)	Profile (mbgl)			Contaminants
BH17A	534 478.0	190 094.0	8.66	HS 0.00-0.23	MG 0.23-0.90	KPG 0.90-4.50	Hydrocarbon odours in the made ground and staining in the sand and gravel at 1.4-2.6mbgl.

HS – Hardstanding, MG – Made Ground, ES – Enfield Silt, KPG – Kempton Park Gravel.

There is also the potential to encounter additional petroleum hydrocarbon hotspots, fuel storage and dispensing infrastructure and impacted soils post demolition and site clearance.



Visual and Olfactory Criteria for the Identification of Hydrocarbon Hotspots

Contaminant/Indicator	Criteria
Mineral Oils (Total Petroleum Hydrocarbons)	Visual: Liquid oil, oil saturated solids in veins or zones over 0.1m thickness. Heavily stained or coated surfaces.
Tanks/Tank Infrastructure & Obstructions	Visual: Evidence of tanks/tank infrastructure or obstructions.
Other Contaminates or abnormality	Visual evidence.

8.4.1 Removal of Hydrocarbon Contaminated Soils

Hydrocarbon impacted soils at BH17A, surrounding any UST or encountered elsewhere onsite will be removed. At each location where hydrocarbon contaminated soils have been identified/encountered, the layer or layers of contaminated soil will be carefully excavated out until no visual or olfactory (supplemented with VOC monitoring where appropriate) evidence of contamination remains. Contaminated soils will be transported to a quarantine area, which shall be bunded and have an impermeable base, for further assessment, pending disposal offsite as waste. Impacted materials will be stockpiled separately and will not be mixed.

8.4.2 Validation Procedure

Upon completion of any remedial excavations of known (e.g., BH17A) or unexpected hotspots and/or the segregation of unsuitable materials, a validation exercise will be undertaken by a suitably qualified geo-environmental engineer, comprising in-situ monitoring (VOC using PID) and soil testing around the base and sides of the hotspot.

For all hotspot remedial excavations, one validation sample will be recovered from each of the sides at a rate of at least one per 5m (linear) and one from the base per 25m². In addition, samples will be recovered from the excavated materials placed into stockpiles in the quarantine area and tested at a rate of at least one per 250m³.

8.4.3 Removal of Hydrocarbon Impacted Groundwater

At BH17A and/or where contaminated soils and groundwater are encountered associated with the removal of UST and/or fuel filling infrastructure, then impacted soils will be excavated out to create a sump. Any free-phase hydrocarbons shall be removed through the use of skimming pumps, absorbent pads etc. with liquids recovered into secure above ground containers (e.g., IBC) for disposal offsite.

If necessary, larger volumes of water pumped from excavations may require treatment (via an oil-water separator, granulated activated carbon treatments system etc.) prior to disposal to sewer (subject to an appropriate discharge permit from the local water company) or pumped direct to a tanker for disposal offsite. Any water discharged to sewer shall be tested in accordance with the conditions of the discharge permit issued by the local water company.

8.5 Post Remediation Monitoring

The RS presented in Sections 8.1 to 8.4 in conjunction with the proposed development and site management procedures detailed in Section 9 have been developed to achieve the remediation objectives in a relatively short timeframe. As such, it is not intended that the site will be subjected to an onward long-term monitoring programme.



9.0 SITE MANAGEMENT PROCEDURES

In conjunction with the RS detailed in Section 8.0, we would recommend that a robust programme of site management procedures be implemented and documented to demonstrate the appropriate management of other environmental risks addressed as part of the development for inclusion in a verification report.

9.1 Personnel and Briefings

The standard risks to onsite construction workers during the works should be mitigated through suitable measures. It would be considered prudent to provide maintenance contractors and any future contractors (who may come into contact with soil or undertake intrusive works) this report, in order that appropriate health and safety measures can be adopted. The main contractor (and any sub-contractors) should prepare their own risk assessments in accordance with Health and Safety legislation to protect operatives at the site.

The potential for direct contact, vapour, and dust inhalation during the enabling works earthworks and any subsequent below groundwork can be mitigated by a combination of the measures set out below:

- Ensuring awareness of the potential for contamination amongst the construction workforce engaged in any below ground works by the provision of briefing and site induction which should include a clear description of the potential for and the nature of potential contaminants and setting out the provisions implemented on site.
- Providing an appropriate level of personal protective equipment (PPE) and ensuring that this is worn at all times.
- Ensuring that supplementary PPE that may become necessary (e.g., vapour masks) are immediately available to be used if required.
- Ensuring a good standard of hygiene with the consumption of food and drink permitted only in designated areas. Smoking should not be permitted on site.
- Provision should be made for vapour monitoring if vapours are identified as a significant hazard (by visual or olfactory evidence for hydrocarbon vapours) or by further chemical analysis/ monitoring (e.g., for vapours).
- In the unlikely event of a requirement for entry into below ground confined spaces, precautions should be adopted to accord with HSE guidance and Regulations.

The contractor(s) should provide a written statement confirming that all operatives were informed of the nature of contamination at the site and the requirements of the RS including the discovery strategy. This should take the form of an induction or toolbox talk from the site manager and the contractor(s) should provide documentation confirming that all operatives have attended such an induction for inclusion in the verification report.

9.2 Discovery Strategy for Unexpected Contamination

A discovery strategy for dealing with the potential for unexpected contamination. The investigations to date have provided a robust assessment of potential contamination across the site. There is however a risk of further contamination being present in small discrete areas (hotspots) that have not been previously identified and there can be no certainty that all such areas have been or will be located and/or sampled. The discovery strategy sets out the actions that must be taken if unexpected contamination (e.g., soil of an unusual appearance and/or odour) is encountered during the development and will be in force during the duration of groundwork at the site (e.g., piling, enabling works etc.).



Examples of the types of observations that would be considered significant and trigger the implementation of the discovery strategy are set out in the table below:

Evidence	Description
Visual	- Fuel or oil like substances mixed with or smeared on the soil or floating/perched groundwater or surface waters. - Organic rich soils/sludges (e.g., sewage contamination) with strong organic/sulphide odours. - Waste materials (refuse, barrels, industrial wastes, ash, tar, etc.) buried at a specific location or across the site. - Marked variation in colour. For example, red, orange, yellow, green, light, or dark blue, etc. may indicate contamination from a variety of contaminants. - Soils including large amounts of ash and clinker where such contamination of soils was not expected. - Soils containing large proportions of deleterious materials (e.g., wood, paper, plant remains, plastic etc.).
Odours	- Fuel, oil, and chemical type odours. - Unusual odours such as sweet odours, ammonia, creosote, sulphide, mothballs, or fishy odours.
Wellbeing	- Light headedness and/or nausea when in excavations, at the working face of an excavation, when visual or olfactory evidence of contamination exists, etc. - Burning of nasal passages, throat, lungs, or skin - Blistering or reddening of skin due to contact with soil

Note: The examples provided in this table are not exhaustive.

The site manager will maintain a photographic record of the progress of the works. If during the works, contamination is encountered which was not previously identified (e.g., soils of an unusual appearance and/or odour etc.), either by visual or olfactory methods, the contractor(s) will implement the following procedures:

- Works will be halted, and the site manager will be contacted to inspect the area of concern.
- The contaminated land officer (CLO) will be informed.
- Photographs of the area will be taken.
- A geo-environmental engineer will attend site to inspect and sample the area of unexpected contamination or materials deemed to represent a potential source of ground gas at formation level.
- A risk assessment will be undertaken to determine if the Stage 2 OA and Stage 3 RS need to be updated. The RA will be submitted to the CLO for approval.
- If necessary, following approval of the risk assessment, the OA and RS will be revised and submitted to the CLO for approval prior to implementation.
- Following approval any additional remediation works will be implemented and validated in accordance with the approved RS with records retained for inclusion in the validation report.

The following table sets out the actions that must be taken if significant or suspected land, water or air contamination is observed by site staff, contractors, or visitors.

Person observing contamination	To be reported to:	Action to be taken by person observing contamination
Site visitor	Must report observations to the site manager.	None.
Contractor	Must report observations to the site manager.	Stop work and where possible and safe make area safe and secure area before reporting to site manager.
Onsite manager	Must report observations to the local authority contaminated land officer and geo-environmental engineer.	Stop work and where possible and safe make area safe and secure area before reporting to others.
Geo-environmental engineer	Must report observations to the local authority contaminated land officer and site manager.	Advise that work stops and where possible that the area is made safe before reporting to others. A revised RS should be prepared and submitted to the local authority for approval.



The following table identifies other organisations that may need to be contacted in an emergency or where pollution of controlled waters or nuisance is occurring.

Occurrence	Description	Contact
Risk to the public	If at any point, residents, the public or others may be at risk as a result of contamination found during investigation, remediation, or development works.	- Contact the emergency services if there is a risk to life. - Contaminated land officer/planning authority. - Health & Safety Executive.
Nuisance to residents/the public	If a nuisance has been or is likely to be caused to nearby residents, the public and others – for example odours, dust, noise, vibration, etc.	Pollution Control Team at the local authority.
Pollution of controlled waters	If any surface, culverted or groundwater has been polluted (e.g., chemical spillage, slurry, contaminated soil/water entering a river or canal).	- EA. - Local planning authority contaminated land officer.
Pollution of adjoining land	If land outside the boundary of the development site is polluted from site activities (e.g., chemical spillage, slurry, contaminated soil/water etc.).	- The owner of the land. - Local authority contaminated land officer.

9.2.1 Hotspots and Areas of Contamination

If, during the development and the implementation of the discovery strategy/watching brief, hotspots of contamination are encountered/identified, then the location, size, and extent of any hotspot(s) of unexpected contamination should be recorded (e.g., on a sketch plan and/or photographic records etc.) for inclusion in the verification report. Upon completion of any remedial excavations associated with the removal hotspots of unexpected contamination, a validation exercise should be undertaken by a geo-environmental engineer, comprising in-situ monitoring (VOC using PID), and testing of the soils from the base and sides of the remedial excavation.

For any hotspot remedial excavations, as a minimum, one validation sample will be recovered from each of the sides at a rate of one sample per 5m and one sample from the base of the remedial excavations. The samples will be appropriately targeted to reflect the nature of the hotspot and any visual/ olfactory evidence of contamination.

Should the first round of validation sampling return results that fail the respective validation criteria (i.e., residential without homegrown produce GAC) then additional material will be removed and the validation process repeated until the targets are achieved. Upon confirmation that the remedial targets have been achieved the remedial excavation will be backfilled with uncontaminated materials.

If any hotspots of unexpected contamination are identified and removed, the results of all validation monitoring and testing, including a photographic record, will be maintained, and presented in a verification report. Upon completion of the works, the contractor will supply all duty of care documentation (e.g., waste transfer notes etc.) confirming that all contaminated soils have been removed and managed appropriately.

9.2.2 Discovery Strategy for ACM

If gross ACM is encountered in the site soils during the groundwork phase of the development, then the soils at any such locations should be carefully excavated and any visible fragments of ACM assessed by a suitably qualified operative (e.g., asbestos awareness trained etc.). To decide if exemption from the requirements in regulations 9, 18(1)(a) and 22 applies, that is to decide if the work is non-licenced work, the employer will need to assess the work to be done and decide if it meets both of the first two conditions below and one of the categories from Condition 3 (taken from regulation 3(2)):

- Condition 1** - the exposure to asbestos of employees is sporadic and of low intensity (SALI); and
- Condition 2** - it is clear from the risk assessment that the exposure to asbestos of any employee will not exceed the control limit; and



- ✦ **Condition 3** - the work falls into one of the following categories:
 - Short duration, non-continuous maintenance activities in which only non-friable materials are handled.
 - Removal without deterioration of non-degraded materials in which the asbestos fibres are firmly linked in a matrix.
 - Encapsulation or sealing of ACMs in good condition.
 - Air monitoring and control and collecting and analysing samples to establish whether a specific material contains asbestos.

To adopt a conservative approach, the contractor should implement the following, particularly during dry and dusty conditions to minimise risks from dust and the potential for fibre release to ground workers and neighbours during the development:

- ✦ During excavations, the near surface soil should be damped down to prevent dust/fibre release. A power washer (or similar) should be used to create a mist over any excavations in made ground to suppress airborne particles. In dry conditions, all areas should be damped down as a matter of course to keep dust suppressed.
- ✦ Should any visible fragments of suspected ACM be observed at the surface of the site or in the made ground the procedure above should be followed. Pending assessment, it may be possible for lower risk ACM (e.g., fragments of non-friable cement) to be hand-picked and placed in a dedicated covered/sealed receptacle pending offsite disposal to a suitably permitted facility. Suitably trained operatives (e.g., with asbestos awareness training) should wear face fitted masks, disposable overalls, overshoes, and gloves whilst hand picking ACM fragments.
- ✦ The excavation within near surface soil and any temporary stockpiles of potentially asbestos containing soils should be dampened down to prevent the release of asbestos fibres.
- ✦ Soils containing suspected ACM should be placed in a dedicated temporary stockpile or directly into covered wagons pending offsite disposal at an appropriately permitted facility.
- ✦ Should ACM impacted soils be encountered then representative samples should be submitted to an accredited laboratory for asbestos fibre screen analysis.

Should gross ACM and/or gross ACM impacted soils be found, then it may be necessary for the contractor to prepare and implement a method statement for the works to be undertaken in accordance with the Control of Asbestos Regulations (HSE 2012) and Asbestos in soil and made ground: a guide to understanding and managing risks (CIRIA 2014).

9.3 Noise, Vibration and Dust Emissions

Potential risks to human health of offsite neighbours during the development, particularly during the demolition and groundwork phase, will be mitigated through the implementation of good practice. The standard risks to onsite construction workers during the works should be mitigated through suitable measures. It would be considered prudent to provide maintenance contractors and any future contractors (who may come into contact with soil or undertake intrusive works) this report, in order that appropriate health and safety measures can be adopted. The main contractor (and any sub-contractors) should prepare their own risk assessments in accordance with Health and Safety legislation to protect operatives at the site.

9.4 Watching Brief

A watching brief should be maintained throughout the works. The watching brief should be undertaken by experienced staff and should be defined onsite, communicated to staff involved in the ground works (toolbox talks etc), appropriately documented, reported on during progress meetings and the results compiled in a verification report. The watching brief should include appraisal (visual and olfactory) of material testing and excavation works, and the testing of any material in accordance with the remediation implementation and verification strategy.

9.5 Regulatory Permit Requirements

Permits may be required as part of the remediation works as follows:

- ✦ If dewatering is required, a trade effluent discharge consent to foul sewer will be required.

Any permits should be presented in the verification report.



9.6 Waste Disposal Records

The proposed development is likely to result in the generation of materials that are deemed excess to requirements, thus needing disposal offsite as waste. This will include materials generated as part of the demolition and enabling works (e.g., building fabric, foundations, service trenches, basement excavations etc.). A full waste classification is beyond the scope of this report, but a brief summary of the likely classification of the waste materials is provided in the following sections.

9.6.1 Removal of ACM from the Building Fabric

Any parts of the fabric of the existing buildings confirmed to contain ACM (e.g., roof sheets etc.) should be removed by an appropriately licenced contractor (notified to the HSE if required) and disposed to an appropriately permitted waste management facility.

Any waste ACM would be properly described as:

- Construction material containing asbestos (LoW 17 06 05*), or
- Insulation materials containing asbestos (LoW Code 17 06 01*).

Records (e.g., consignment notes, waste carriers' licences, environmental permits etc.) should be retained for inclusion in the verification report.

9.6.2 Hardstanding and Structures

Any demolition arisings, surface hardstanding and/or any buried structures/obstructions would most likely be classified as concrete (e.g., LoW Code 17 01 01) or mixtures of concrete, bricks, ceramics, cobbles etc. (e.g., LoW Code 17 01 07). Any such material encountered should be removed and segregated for disposal to an appropriately permitted recycling facility.

Records (e.g., waste transfer notes, consignment notes, waste carriers' licences, environmental permits etc.) should be retained for inclusion in the verification report.

9.6.3 Made Ground

In accordance with the LoW (as amended), made ground (soil and stones from construction sites) is a mirror entry and the correct description of the arisings based on their physical appearance would be either:

- (i) soil and stones containing dangerous substances (LoW Code 170503*); or
- (ii) soil and stones not containing dangerous substances (LoW Code 170504).

Forty-four samples of made ground were submitted for laboratory testing, which included an asbestos screen and a suite of general contaminants.

Circa 22 samples of made ground (50%) returned elevated concentrations of heavy metals (copper, lead and zinc), that would be considered hazardous for disposal offsite as waste (LoW Code 17 05 03*).

Visible fragments of asbestos were noted at seven locations and asbestos fibres were detected in three out of forty-one samples of made ground. Asbestos is a naturally occurring silicate mineral and exists in a number of chemical types – for example chrysotile ('white'), amosite ('brown') and crocidolite ('blue') – either in a bonded or fibrous form. The fibres are very fine, less than 3 microns in diameter and respirable into the lung passageways where they can lodge indefinitely and penetrate tissue. All forms of asbestos are classified the same way in the Mandatory Classification List (MCL) under the GB CLP Regulation:

- Carc. Cat 1A; H350, and
- STOT RE1; H372**

The assessment of asbestos containing waste considers both the presence of asbestos as:

- Fibres that are free and dispersed, and
- Identifiable pieces of asbestos containing material



If the waste contains fibres that are free and dispersed, then the waste will be hazardous if the waste as a whole contains 0.1% or more asbestos.

If the waste contains any identifiable pieces of suspected asbestos containing material, they must be assessed as set out below. This would also apply to any dispersed fibres produced by deliberately breaking up such identifiable pieces.

Where the waste contains identifiable pieces of asbestos containing material (i.e., any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye), then these pieces must be assessed separately. The waste is hazardous if the concentration of asbestos in the piece of asbestos containing material is 0.1% or more. The waste is regarded as a mixed waste and classified accordingly. The following codes should be assigned to the asbestos waste as appropriate:

- 17 06 05* Construction material containing asbestos MH
- 17 06 01* Insulation material containing asbestos MH

NB. 17 06 05* would normally be used in preference to 17 06 01* for the asbestos in asbestos contaminated soil and stones.

Visible fragments of asbestos containing material (ACM) were observed in the made ground at TP101 @ 0.4mbgl, TP102 @ 0.4mbgl, TP103 @ 0.3mbgl, TP4 @ 0.5mbgl, TP101A @ 0.23-1.2mbgl, TP102A @ 0.23-1.2mbgl and TP103A @ 0.23-1.2mbgl. At these locations, the asbestos should be segregated from the soil and stones matrix by appropriately trained personnel and disposed offsite as construction material containing asbestos (LoW Code 17 06 05*). If it is not possible to segregate the asbestos and the soil and stones, then it would be deemed a mixed waste and would be classified as hazardous waste.

Forty-one samples of made ground and two samples of natural ground were screened for asbestos fibres. No fibres were detected in either sample of natural ground. Asbestos was detected in three samples of made ground (circa 7%). In each case, the ACM comprised chrysotile fibres and the samples were submitted for quantification. Two of the made ground samples submitted for quantification returned concentrations below the laboratory limit of detection (i.e., <0.001%). As such, where fibres were detected, the concentrations were below the hazardous limit of 0.1%.

No suspect ACM or asbestos fibres were observed or detected in the natural ground.

Records (e.g., waste transfer notes and/or consignment notes, waste carriers' licences, environmental permits etc.) should be retained for inclusion in the verification report.

9.6.4 Natural Ground

In general, the natural ground (Enfield Silt and/or Kempton Park Gravel) clay was free from visual and olfactory evidence of contamination, returning low concentrations of potential contaminants and based on its physical appearance it would be properly described as soil and stones, not containing dangerous substances (LoW Code 17 05 04) and in our opinion would be suitable for disposal to an inert permitted site/facility, without the need for any further testing.

The only exception to this was the hydrocarbon impacted Kempton Park Gravel at BH17A, which returned an elevated concentration of TPH above 0.1% (moisture correct to 0.43%) that would be considered potentially hazardous (HP7 and HP11).

In accordance with WM3, where the identity of the contaminating oil is unknown, then the oil contaminating the waste can be classified as non-carcinogenic/mutagenic due to the presence of oil if all three of the following criteria are met:

- The waste contains benzo[a]pyrene (BaP) at a concentration of less than 0.01% (1/10,000th) of the TPH concentration (This is the carcinogenic limit specified in MCL under the GB CLP for BaP)
- This has been determined by an appropriate and representative sampling approach in accordance with the principles set out in Appendix D of WM3
- The analysis clearly demonstrates, for example by carbon bands or chromatograph, and the laboratory has reasonably concluded that the hydrocarbons present have not arisen from petrol or diesel.

Where any of these three criteria is not met the oil should be classified as H350 (carcinogenic) and H340 (mutagenic).



In this case, the BaP marker was below 0.01% and therefore below the limit given in WM3, which would tend to suggest that the hydrocarbon impacted soil at BH17A is non-hazardous. However, additional testing/assessment may be required to assess the final criteria to demonstrate that the hydrocarbons have not arisen from petrol or diesel, which considering the proximity to a fuel-filling station/UST may not be the case.

9.6.5 Segregation of Arisings

The classifications provided should be confirmed with the proposed receiving site(s) prior to removal of the materials offsite. The contractor will be required to retain copies of the permits for each of the receiving sites, waste carriers' licences for the haulage contractor(s), waste transfer note(s) and/or consignment note(s) for inclusion in the verification report. During the groundwork, the arisings should be appropriately managed and segregated for disposal to the appropriate receiving facility.

10.0 VERIFICATION PLAN

10.1 Verification Report

Following completion of the remediation works outlined in Section 8 and the site management procedures detailed in Section 9, a verification/closure report should be compiled to address the matters reserved by Condition 22 Part (c) demonstrating that the works have been carried out satisfactorily and validation criteria have been achieved. A verification plan detailing the information to be gathered during the works is presented in Section 10.2.

10.2 Verification Plan

The verification plan below lists the information that will be gathered and presented in the verification report:

- ✦ Documentation confirming that all operatives attended a toolbox talk on potential contamination at the site and were informed of the requirements of the RS and discovery strategy.
- ✦ A summary of the records (e.g., site and soil descriptions, site works, photographic record etc.) collected during the watching brief.
- ✦ If any hotspots are identified as part of the discovery strategy, site plans showing their location together with details (including laboratory test reports etc.) of validation testing undertaken from the sides and base of any remedial excavations (base and sides) to demonstrate that soils remaining in-situ level meet the site validation criteria.
- ✦ Details (including laboratory test reports) of any additional reassurance testing for waste disposal monitoring (including additional WAC testing where required) to demonstrate that the arisings were managed/segregated appropriately.
- ✦ Duty of care records (e.g., waste carriers' licences, consignment notes, waste transfer notes, environmental permits etc.) demonstrating that materials were transported and disposed of at appropriate waste management facilities. These records together with site survey data should demonstrate the volume of soil removed from the site as part of the development.
- ✦ Supplier declarations/reports for any soil (topsoil and subsoil) or materials imported onto site.
- ✦ Delivery notes for any soil (topsoil and subsoil) or materials imported onto site together with calculations to confirm the volume of soil placed at the site including below areas of hard landscaping.
- ✦ If, during development and the implementation of the discovery strategy, contamination not previously identified is found to be present, or material is encountered at formation level deemed to have the propensity to generate ground gas then work will cease at that location, the local authority will be informed immediately, a risk assessment undertaken and submitted to the local authority and if necessary a revision to the RS will be issued for approval indicating the nature of the contamination and how it is to be dealt with.
- ✦ If unexpected contamination is not encountered, a statement to this effect by a suitably qualified and experienced individual will be provided.
- ✦ Evidence (e.g., photographic record, site diary entries etc.) from contractors that measures to mitigate noise, vibration, dust, and odour (where necessary) were implemented during the development.
- ✦ Verification including approval from the local water supply company that water supply pipes were installed in appropriately constructed trenches. Information (e.g., product data sheets, photographic record etc.) will be included in the validation report, which will show where the pipes enter the basement and how this service entry point was sealed.



11.0 REGULATORY APPROVAL

We assume that the previous Desk Study and Ground Investigation Report (GEA) and Factual Report on Site Investigation (Kalex) will be submitted to the local authority in respect of the matters reserved by Condition 22 Part (a).

Formal approval should be sought from the local authority regarding the matters reserved by Condition 22 Part (b) relating to this refined CSM, options appraisal, remediation strategy and verification plan.

The verification plan culminating in the production of a verification/closure report demonstrating the successful implementation of the remediation strategies during future phases of the development should address the remaining matters reserved by Condition 22 Part (c). If, as a result of the implementation of the discovery strategy, unexpected contamination is encountered at any point in the future during the development, then it will be necessary to revise the remediation strategy accordingly. As noted in Section 8.5, the remediation strategy and site management procedures have been developed to achieve the remediation objectives in a short timeframe. As such, it is not intended that the site will be subjected to an onward long-term monitoring programme.



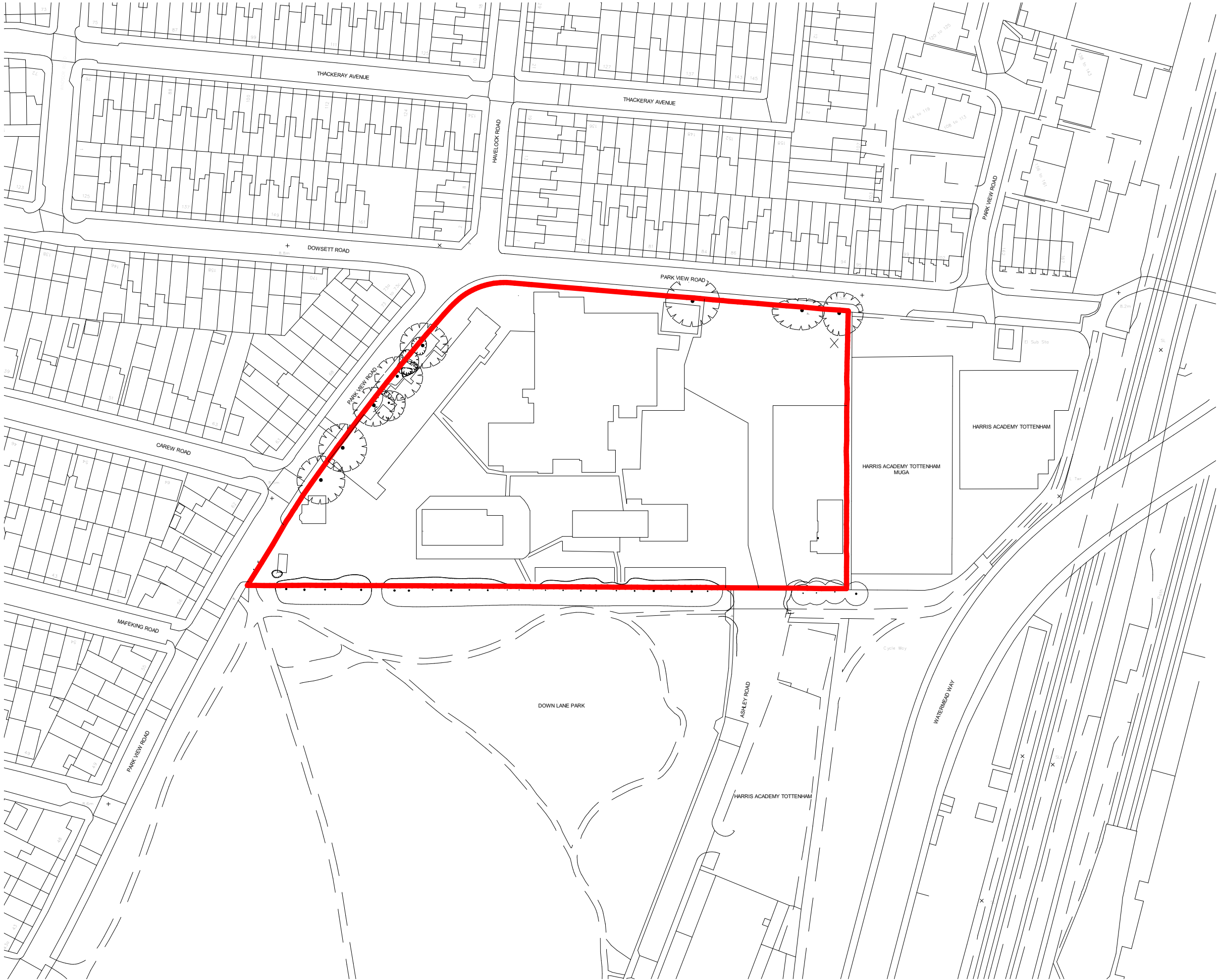
12.0 LIMITATIONS AND USE OF THIS REPORT

IMPORTANT: This section should be read before reliance is placed on any of the opinions, advice, recommendations, or conclusions set out in this report.

- a) This report has been prepared for the purpose of providing advice to the client pursuant to its appointment of TGEN to act as a consultant.
- b) Save for the client no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations, or conclusions herein set out.
- c) All work carried out in preparing this report has used, and is based upon, our professional knowledge and understanding of the current relevant English and European Community standards, approved codes of practice, technology, and legislation.
- d) Changes in the above may cause the opinion, advice, recommendations, or conclusions set out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations, and conclusions, TGEN has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, we will have no obligation to advise the client of any such changes, or of their repercussions.
- e) TGEN acknowledges that it is being retained, in part, because of its knowledge and experience with respect to environmental matters. TGEN will consider and analyse all information provided to it in the context of our knowledge and experience and all other relevant information known to us. To the extent that the information provided to us is not inconsistent or incompatible therewith, TGEN shall be entitled to rely upon and assume, without independent verification, the accuracy and completeness of such information.
- f) The content of this report represents the professional opinion of experienced environmental consultants. TGEN does not provide specialist legal advice and the advice of lawyers may be required.
- g) In the summary and recommendations sections of this report, TGEN has set out our key findings and provided a summary and overview of our advice, opinions, and recommendations. However, other parts of this report will often indicate the limitations of the information obtained by TGEN and therefore any advice, opinions or recommendations set out in the executive summary, summary and recommendations sections ought not to be relied upon unless they are considered in the context of the whole report.
- h) The assessments made in this report are based on the ground conditions as revealed by walkover survey and/or intrusive investigations, together with the results of any field or laboratory testing or chemical analysis undertaken and other relevant data which may have been obtained including previous site investigations. In any event, ground contamination often exists as small discrete areas of contamination (hot spots) and there can be no certainty that any or all such areas have been located and/or sampled.
- i) There may be special conditions appertaining to the site which have not been taken into account in the report. The assessment may be subject to amendment in light of additional information becoming available.
- j) Where any data supplied by the client or from other sources, including that from previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by TGEN for inaccuracies within the data supplied by other parties.
- k) Whilst the report may express an opinion on possible ground conditions between or beyond trial pit or borehole locations, or on the possible presence of features based on either visual, verbal, or published evidence this is for guidance only and no liability can be accepted for the accuracy thereof.
- l) Comments on groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. Groundwater conditions may vary due to seasonal or other effects.
- m) This report is prepared and written in the context of the agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a reinterpretation of the report in whole or part after its original submission.
- n) The copyright in the written materials shall remain the property of the TGEN but with a royalty-free perpetual license to the client deemed to be granted on payment in full to TGEN by the client of the outstanding amounts.
- o) These terms apply in addition to the TGEN standard terms of engagement (or in addition to another written contract which may be in place instead thereof) unless specifically agreed in writing (In the event of a conflict between these terms and the said standard terms of engagement the said standard terms of engagement shall prevail). In the absence of such a written contract the standard terms of engagement will apply.
- p) TGEN maintains adequate insurance cover for public liability and professional indemnity. However, we are unable to accept liability for asbestos related matters. Our work must not be taken as sufficient to identify the presence or absence of asbestos in or on the ground. In placing a contract with us the client accepts the restriction on asbestos. If we find or strongly suspect asbestos is or may be present in or on the ground, we will inform the client and advise specialist investigation. The client agrees that they shall not bring any claim personally against any director / employee or consultant to us in respect of loss or damage suffered by the client arising out of this contract.



Figure 1 Site Location Plan(s).



Notes

1. Do not scale this drawing.
2. All dimensions must be checked on site and any discrepancies verified with the architect.
3. Unless shown otherwise, all dimensions are to structural surfaces.
4. Drawing to be read with all other issued information. Any discrepancies to be brought to the attention of the architect.
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Site Boundary

P1 15/03/22 PLANNING ISSUE

Rev	Date	Description	Drawn / Checked
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Project name

Ashley Road Depot

Tottenham Hale

Drawing number	Rev
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3742A - LB - XX - XX - DP - A - 100010	P1
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Drawing

Site Location Plan (Predemolition)

Purpose of issue

PLANNING

Scale	Date
-------	------

1 : 1250 @ A3	15/03/22
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Client

London Borough of Haringey

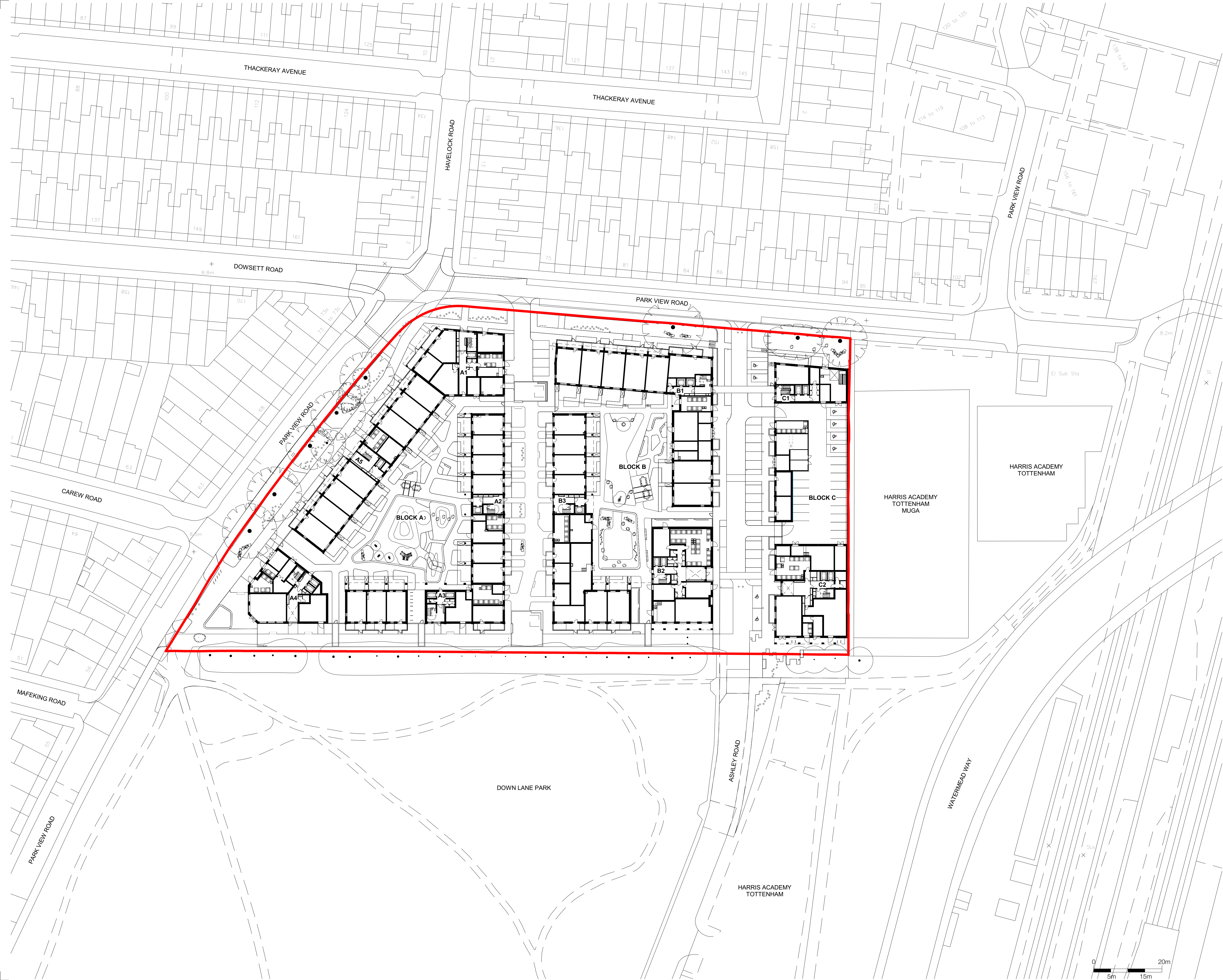
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Figure 2 Proposed Development Plan(s).



Notes

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2. All dimensions must be checked on site and any discrepancies verified with the architect.

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To be read in conjunction with landscape plans & landscape key. Please see drawings 3742A-LBA-00-00-DP-L-200000 to 3742A-LBA-00-00-DP-L-200006

P3	30/06/22	PLANNING RESUBMISSION	CL
P2	11/04/22	PLANNING ISSUE	CL
P1	15/03/22	PLANNING ISSUE	CL
Rev	Date	Description	Drawn / Checked

Project name

Ashley Road Depot
Tottenham Hale

Drawing number

3742A - LB - XX - 00 - DP - A - 120000

Drawing

Ground Floor Site Plan

Purpose of issue
PLANNING

Scale
1:500 @ A1

Date
15/03/22

Client
London Borough of Haringey

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Appendix A Planning Permission.

Planning Service

Rob Krzyszowski Assistant Director Planning, Building Standards & Sustainability

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Da Vinci House
44 Saffron Hill
london
EC1N 8FH

On behalf of
London Borough of Haringey
C/o Agent

Planning Application Reference No. **HGY/2022/0752**

TOWN AND COUNTRY PLANNING ACT 1990
TOWN AND COUNTRY PLANNING (DEVELOPMENT MANAGEMENT PROCEDURE) (ENGLAND)
ORDER 2015

NOTICE OF PLANNING PERMISSION

Location: **Council Depot, Ashley Road, N17**

Proposal: Full planning application for the erection of 272 homes including 50% socially rented homes extending 4-13 storeys, 174sqm of flexible Use Class E floorspace along with a new vehicular access to the site, car parking and two pedestrian north south routes. The proposal also includes both private and public hard and soft landscaping throughout the site.

In pursuance of their powers under the above Act, the London Borough of Haringey as Local Planning Authority hereby **PERMIT** the above development in accordance with the application dated 16/03/2022 and drawing numbers: 3742A-LB-XX-00-DP-A-120000-P3, 3742A-LB-ZZ-00-DP-A-120200-P3, 3742A-LB-ZZ-01-DP-A-120201-P3, 3742A-LB-ZZ-02-DP-A-120202-P3, 3742A-LB-ZZ-03-DP-A-120203-P3, 3742A-LB-ZZ-04-DP-A-120204-P3, 3742A-LB-ZZ-13-DP-A-120214-P3, 3742A-LB-B-XX-DEA-130201-P4, 3742A-LB-B-XX-DE-A-130202-P3, 3742A-LB-B-XX-DE-A-130203-P4, 3742ALB-C-XX-DE-A-130301-P4, 3742A-LB-C-XX-DE-A-130302-P4, 3742A-LB-BA-00-DP-A-120100-P3, 3742A-LB-BA-01-DP-A-120101-P3, 3742A-LB-BA-02-DP-A-120102-P3, 3742ALB-BA-03-DP-A-120103-P3, 3742A-LB-BA-04-DP-A-120104-P3, 3742A-LB-BA-05-DP-A-120105-P3, 3742A-LB-A-XX-DE-A-130101-P4, 3742A-LB-A-XX-DE-A-130102-P4, 3742ALB-A-XX-DE-A-130103-P4, 3742A-LBA-00-00-DP-L-20001, 3742A-LBA-00-00-DP-L-20000, 3742A-LBA-00-00-DP-L-20002, 3742A-LBA-00-00-DP-L-20003, 3742A-LBA-00-00-DP-L-20004, 3742A-LBA-00-04-DP-L-20005, 3742A-LBA-00-04-DP-L-20006, 3742A-LB-A-XX-DEA-140000-GA, 3742A-LB-A-XX-DE-A-140001-GA, 3742A-LB-BA-06-DP-A-120106, 3742ALB-BA-07-DP-A-120107, 3742A-LB-XX-XX-DP-A-100010, 3742A-LB-XX-XX-DP-A-100020, 3742A-LB-ZZ-05-DP-A-120205, 3742A-LB-ZZ-06-DP-A-120206, 3742A-LB-ZZ-07-DP-A-120207, 3742A-LB-ZZ-08-DP-A-120208, 3742A-LB-ZZ-09-DP-A-120209, 3742A-LB-ZZ-10-DP-A-120210, 3742A-LB-ZZ-11-DP-A-120211, 3742A-LB-ZZ-12-DP-A-120212, 3742A-LB-ZZ-13-DP-A-120213, 3742A-LB-ZZ-B1-DP-A-120199, 3742A-LB-ZZ-ZZ-DE-A-100030, 3742A-LB-ZZ-ZZ-DE-A-100031, 3742A-LB-ZZ-ZZ-DE-A-100040, 3742A-LB-ZZ-ZZ-DE-A-100041; 3230-1100-T-031-B, 3230-1100-T-032-B, 3230-1100-T-033-B.

SEE SCHEDULE OF CONDITIONS ATTACHED



Robbie McNaughton
Head of Development Management and Planning Enforcement
Planning Service

31/08/2022

Planning Service
6th Floor, River Park House,
225 High Road, Wood Green,
London, N22 8HQ
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Planning Service

Rob Krzyszowski Assistant Director Planning, Building Standards & Sustainability

NOTE:

1. You can find advice in regard to your rights of appeal at:
www.planningportal.gov.uk/planning/appeals/guidance/guidancecontent
2. This notice relates solely to a planning decision and does not purport to convey any approval or consent which may be required under the Building Regulations or any other statutory purpose.
If you intend to submit an appeal that you would like examined by inquiry then you must notify the Local Planning Authority and Planning Inspectorate (inquiryappeals@planninginspectorate.gov.uk) at least 10 days before submitting the appeal.
For more information about making a Building Regulations application, please contact Haringey Council Building Control Team by email building.control@haringey.gov.uk, telephone 020 8489 5504, or see our website at www.haringey.gov.uk/buildingcontrol.

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HGY/2022/0752

The following conditions have been applied to this consent and these conditions must be complied with:

1) The development hereby authorised must be begun not later than the expiration of three years from the date of this permission, failing which the permission shall be of no effect.

Reason: This condition is imposed by virtue of Section 91 of the Town and Country Planning Act 1990 and to prevent the accumulation of unimplemented planning permissions.

2) The development hereby permitted shall be carried out in material compliance with the following approved plans and specifications:

3742A-LB-XX-00-DP-A-120000-P3, 3742A-LB-ZZ-00-DP-A-120200-P3, 3742A-LB-ZZ-01- DP-A-120201-P3, 3742A-LB-ZZ-02-DP-A-120202-P3, 3742A-LB-ZZ-03-DP-A-120203-P3, 3742A-LB-ZZ-04-DP-A-120204-P3, 3742A-LB-ZZ-13-DP-A-120214-P3, 3742A-LB-B-XX-DEA-130201-P4, 3742A-LB-B-XX-DE-A-130202-P3, 3742A-LB-B-XX-DE-A-130203-P4, 3742ALB-C-XX-DE-A-130301-P4, 3742A-LB-C-XX-DE-A-130302-P4, 3742A-LB-BA-00-DP-A120100-P3, 3742A-LB-BA-01-DP-A-120101-P3, 3742A-LB-BA-02-DP-A-120102-P3, 3742ALB-BA-03-DP-A-120103-P3, 3742A-LB-BA-04-DP-A-120104-P3, 3742A-LB-BA-05-DP-A120105-P3, 3742A-LB-A-XX-DE-A-130101-P4, 3742A-LB-A-XX-DE-A-130102-P4, 3742ALB-A-XX-DE-A-130103-P4, 3742A-LBA-00-00-DP-L-20001, 3742A-LBA-00-00-DP-L-20000, 3742A-LBA-00-00-DP-L-20002, 3742A-LBA-00-00-DP-L-20003, 3742A-LBA-00-00-DP-L20004, 3742A-LBA-00-04-DP-L-20005, 3742A-LBA-00-04-DP-L-20006, 3742A-LB-A-XX-DEA-140000-GA, 3742A-LB-A-XX-DE-A-140001-GA, 3742A-LB-BA-06-DP-A-120106, 3742ALB-BA-07-DP-A-120107, 3742A-LB-XX-XX-DP-A-100010, 3742A-LB-XX-XX-DP-A-100020, 3742A-LB-ZZ-05-DP-A-120205, 3742A-LB-ZZ-06-DP-A-120206, 3742A-LB-ZZ-07-DP-A120207, 3742A-LB-ZZ-08-DP-A-120208, 3742A-LB-ZZ-09-DP-A-120209, 3742A-LB-ZZ-10- DP-A-120210, 3742A-LB-ZZ-11-DP-A-120211, 3742A-LB-ZZ-12-DP-A-120212, 3742A-LBZZ-13-DP-A-120213, 3742A-LB-ZZ-B1-DP-A-120199, 3742A-LB-ZZ-ZZ-DE-A-100030, 3742A-LB-ZZ-ZZ-DE-A-100031, 3742A-LB-ZZ-ZZ-DE-A-100040, 3742A-LB-ZZ-ZZ-DE-A100041; 3230-1100-T-031-B, 3230-1100-T-032-B, 3230-1100-T-033-B.

Supporting documents also approved:

Energy and Sustainability Report Rev. H, Drainage calculations dated 12th April 2022, Air Quality Neutral Assessment dated March 2022, Sustainability requirements for small non-residential spaces document dated June 2022, Circular Economy Statement Rev. C, Ecological Impact Assessment, Tree Survey, Arboricultural Impact Assessment, Preliminary Arboricultural Method Statement & Tree Protection Plan, Biodiversity Net Gain calculations, Urban Greening Factor calculations, Design and Access Statement, London Plan Fire Statement, Fire Statement Form, Flood Risk Assessment and Drainage Strategy, Heritage Townscape & Visual Impact Assessment, Transport Assessment, Planning Utilities Assessment, Outline Site Waste Management Plan, Operational Waste Management Strategy.

Reason: In order to avoid doubt and in the interests of good planning.

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3) Notwithstanding the provisions of the Town & Country Planning (Use Classes) Order 1987, or any provision equivalent to that Class in any statutory instrument revoking and re-enacting that Order, the ground floor non-residential units hereby approved shall be used for activities within Use Class E only and shall not be used for any other purpose unless approval first is obtained to a variation of this condition through the submission of a planning application.

Reason: In order to restrict the use of the premises to those compatible with the surrounding area.

4) Notwithstanding the provisions of the Town & Country Planning General Permitted Development Order 2015 or any Order revoking or re-enacting that Order, no roof extensions, rear extensions, means of enclosure (walls/fences), shall be carried out without the grant of planning permission having first been obtained from the Local Planning Authority.

Reason: To safeguard the visual amenities of the area and to prevent overdevelopment of the site by controlling proposed extensions and alterations consistent with Policy D6 of the London Plan 2021 and Policy DM1 of the Development Management DPD 2017.

5) Prior to the commencement of above ground works detailed drawings (including sections) to a scale of 1:20 to confirm the detailed design and materials of the:

- a) Detailed elevational treatment;
- b) Detailing of roof and parapet treatment;
- c) Windows and doors (including plan, elevation and section drawings indicating jamb, head, cill, reveal and surrounds of all external windows and doors at a scale of 1:10), which shall include a recess of at least 115mm;
- d) Details of entrances and porches which shall include a recess of at least 115mm;
- e) Details and locations of down pipes, rainwater pipes or foul pipes and all external vents;
- f) Details of balustrading;
- g) Facing brickwork: sample panels of proposed brickwork to be used showing the colour, texture, pointing, bond, mortar, and brickwork detailing shall be provided;
- h) Details of cycle, refuse enclosures and plant room; and
- i) Any other external materials to be used;

together with a full schedule of the exact product references for all materials shall be submitted to and approved in writing by the Local Planning Authority. The development shall thereafter be carried out solely in accordance with the approved details.

Reason: To safeguard and enhance the visual amenities of the locality in compliance with Policies DM1, DM8 and DM9 of the Development Management Development Plan Document 2017.

6) All residential units on site shall be built to Part M4(2) 'accessible and adaptable dwellings' of the Building Regulations 2013 (as amended), and at least 10% (eight dwellings) shall be wheelchair accessible or easily adaptable for wheelchair use in accordance with Part M4(3) of the same Regulations, unless otherwise agreed in writing in advance with the Local Planning Authority.

Reason: To ensure that the proposed development meets the Council's standards for the provision of wheelchair accessible dwellings in accordance with Local Plan 2017 Policy SP2 and London Plan Policy D7.

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7) The placement of a satellite dish or television antenna on any external surface of the development is precluded, with an exception provided only for a communal solution(s). Details of any communal dish/antenna must be submitted to the Local Planning Authority for its written approval prior to the first occupation of any residential unit within the development hereby approved. The communal dish/antenna solutions provided shall thereafter be retained as installed.

Reason: To protect the visual amenity of the locality in accordance with Policy DM1 of the Development Management Development Plan Document 2017.

8) Prior to the first occupation of each building or part of a building or use, a 'Secured by Design' accreditation shall be obtained for such building or part of such building or use and thereafter all features are to be permanently retained. Accreditation must be achieved according to current and relevant Secured by Design guidelines at the time of above grade works of each building or phase of said development. Confirmation of the certification shall be submitted to and approved in writing by the Local Planning Authority.

Reason: In the interest of creating safer, sustainable communities.

9) The commercial aspects of the development must achieve the relevant Secured by Design certification at the final fitting stage, prior to the commencement of business and details shall be submitted to and approved, in writing, by the Local Planning Authority.

Reason: In the interest of creating safer, sustainable communities.

10) Prior to first occupation of the development hereby approved details of all external lighting to approved building facades, street furniture, communal and public realm areas shall be submitted to and approved in writing by the Local Planning Authority, in consultation with the Council's Senior Lighting Engineer and Nature Conservation Officer. Such details shall include location, height, type and direction of sources and intensity of illumination, demonstrated through a lux plan. Due regard shall be had to the recommendations of the approved Ecological Impact Assessment. The agreed lighting scheme shall be installed as approved and retained/maintained as such thereafter.

Reason: To ensure the design, ecological and environmental quality of the development is protected and enhanced and also to safeguard residential amenity in accordance with Policies DM1, DM19 and DM23 of the Development Management Development Plan Document 2017.

11) Prior to the first occupation of the development hereby approved full details of both hard and soft landscape works shall be submitted to and approved in writing by the Local Planning Authority, and these works shall thereafter be carried out as approved.

Details shall include information regarding, as appropriate:

- a) Proposed finished levels or contours;
- b) Means of enclosure;
- c) Hard surfacing materials including details of tonal contrasts between pedestrian, cycle and vehicle priority areas;
- d) Minor artefacts and structures (e.g. Furniture, play equipment, refuse or other storage units, wayfinding measures, signs, lighting etc.); and

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Soft landscape works shall be supported by:

- e) Planting plans including a CAVAT assessment of existing and proposed trees;
- f) Written specifications (including details of cultivation and other operations associated with plant and/or grass establishment);
- g) Schedules of plants, noting species, plant sizes and proposed numbers/densities where appropriate; and
- h) Implementation and long-term management programmes (including a five-year irrigation plan for all new trees).

The soft landscaping scheme shall include detailed drawings of:

- i) Existing trees to be retained;
- j) Existing trees which will require thinning, pruning, pollarding or lopping as a result of this consent; and
- k) Any new trees and shrubs, including street trees, to be planted together with a schedule of species;
- l) Annotated plans and details on what measures will be delivered to the external amenity areas that will help adapt the development and its occupants to the impacts of climate change through more frequent and extreme weather events and more prolonged droughts;
- m) detailed final urban greening factor plan showing that a factor of greater than 0.4 has been achieved.

The approved scheme of planting, seeding or turfing comprised in the approved details of landscaping shall be carried out and implemented in strict accordance with the approved details in the first planting and seeding season following the occupation of the building or the completion of development (whichever is sooner). Any trees or plants, either existing or proposed, which, within a period of five years from the completion of the development die, are removed, become damaged or diseased shall be replaced in the next planting season with a similar size and species. The landscaping scheme, once implemented, is to be retained thereafter.

Reason: In order for the Local Planning Authority to assess the acceptability of any landscaping scheme, thereby ensuring a satisfactory setting for the proposed development in the interests of the visual amenity of the area consistent with Policy DM1 of the Development Management DPD 2017 and Policy SP11 of the Local Plan 2017.

12) Noise arising from the use of any plant and associated equipment shall not increase the existing background noise level (LA90 15mins) when measured (LAeq 15mins) 1 metre external from the nearest residential or noise sensitive premises. The applicant shall also ensure that vibration/structure borne noise derived from the use of any plant or equipment does not cause nuisance within any residential unit or noise sensitive premises.

Reason: To protect residential amenity in accordance with Policy DM1 of the Development Management DPD 2017.

13) Prior to the commencement of above ground works for the development hereby approved scaled drawings with details of the location and dimensions of secure and covered cycle parking facilities have been submitted to and approved in writing by the Local Planning Authority. The cycle parking spaces shall be provided in accordance with the London Cycling Design Standards. Such spaces shall be retained thereafter for this use only.

Reason: To promote travel by sustainable modes of transport and to comply with the London Plan 2021 minimum cycle parking standards and the London Cycling Design Standards.

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14) The approved development shall not be occupied until a Delivery and Servicing Plan (DSP) has been submitted to and approved in writing by the Local Planning Authority. The DSP shall be updated in writing and re-submitted to the Local Planning Authority within the first six months of occupation or at 75% occupancy, whichever comes first. The development shall thereafter be implemented in accordance with the approved details and retained as such thereafter.

Reason: To enable safe, clean and efficient deliveries and servicing. In accordance with Policy DM21 of the Development Management DPD 2017.

15) (a) Prior to the commencement of above ground works for the development hereby approved, the following documents shall be submitted for the written approval of the Local Planning Authority, in accordance with the Ecological Impact Assessment hereby approved:

- i. Construction Environmental Management Plan
- ii. Sensitive Lighting Strategy
- iii. Landscape and Ecology Management Plan

(b) Prior to the first occupation of development, photographic evidence and a post-development ecological field survey and impact assessment shall be submitted to and approved by the Local Planning Authority to demonstrate the delivery of the ecological enhancement and protection measures is in accordance with the approved measures.

Development shall accord with the details as approved and measures shall be retained for the lifetime of the development.

Reason: To ensure that the development provides the maximum provision and protection of habitats for biodiversity and the mitigation and adaptation of climate change. In accordance with Policies G1, G5, G6, SI1 and SI2 of the London Plan (2021) and Policies SP4, SP5, SP11 and SP13 of the Haringey Local Plan (2017).

16) Notwithstanding any provisions to the contrary, the 136 of the residential units within the development hereby approved shall be provided for rent at Council social-rent levels within the C3 use class, and for no other tenure or use unless otherwise agreed in writing in advance by the Local Planning Authority.

Reason: To define the scope of this permission in relation to the provision of affordable housing.

17) The development hereby approved shall not be occupied until the associated highway works, as set out in the approved plans and details, have been completed.

Reason: To ensure that the development includes accessible parking and does not prejudice the free flow of vehicular and pedestrian traffic or the conditions of highway safety generally.

18) The approved development shall not be occupied unless and until verified estimates of the 'Be Seen' energy performance indicators have been submitted to the GLA via their online portal and evidence of this, plus a metering strategy, has been submitted to the Local Planning Authority for its written approval.

Reason: To contribute towards sustainable development, energy reduction measures and climate change mitigation.

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19) All parking spaces shall be provided with electric vehicle charging infrastructure. Details of the charging infrastructure shall be submitted to the Local Planning Authority for its written approval prior to installation. 20% of the spaces shall have 'active' charging points. The infrastructure shall be installed in accordance with the approved documentation and retained as such thereafter.

Reason: In order to ensure low carbon and low air quality impact of the development.

20) The applicant must ensure that the project architect (Levitt Bernstein Associates of 2-4 Thane Studios, Thane Villas, Islington, London, N7 7PA) continues to be employed as the project architect through the whole of the construction phase for the development except where the architect has ceased trading. The applicant shall not submit any drawings relating to details of the exterior design of the development that are required to be submitted pursuant to conditions of the planning permission unless such drawings have been prepared or overseen and agreed by the project architect.

Reason: In order to retain the design quality of the development in the interest of the visual amenity of the area and consistent with Policy SP11 of the Local Plan 2017.

21) In the event that the land within the red line (as per drawing no. 3742A-LB-XX-XX-DP-A-100020 Rev. P1) is sold and the parties with a legal interest in the land within the red line change, the new owners of the land shall enter into an agreement pursuant to Section 106 of the Town and Country Planning Act 1990 (as amended) prior to the commencement of above ground works, for planning obligations which shall otherwise be committed (as the Council is sole landowner) through a letter between the Assistant Director of Planning, Building Standards and Sustainability and the Director of Housing, Regeneration and Planning (attached to this application).

Reason: In the interests of proper planning and to ensure the adequate enforcement of planning obligations which are required to make the development acceptable in planning terms.

22) Before development commences other than for investigative work: Using the information already provided in sections 7 (Advice and Recommendations) and 8 (Outstanding Risks & Issues) of the submitted Desk Study & Ground Investigation Report Revision 1 with reference J21294 prepared by GEA Ltd dated March 2020, the applicant shall undertake: a. A further site investigation which must be comprehensive enough to enable; a risk assessment to be undertaken, refinement of the Conceptual Model, and the development of a Method Statement detailing the remediation requirements. b. The risk assessment and refined Conceptual Model shall be submitted, along with the site investigation report, to the Local Planning Authority which shall be submitted to, and approved in writing by, the Local Planning Authority prior to that remediation being carried out on site. c. Where remediation of contamination on the site is required, completion of the remediation detailed in the method statement shall be carried out and a report that provides verification that the required works have been carried out, shall be submitted to, and approved in writing by the Local Planning Authority before the development is occupied.

Reason: To ensure the development can be implemented and occupied with adequate regard for environmental and public safety.

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23) If, during development, contamination not previously identified is found to be present at the site then no further development (unless otherwise agreed in writing with the Local Planning Authority) shall be carried out until a remediation strategy detailing how this contamination will be dealt with has been submitted to and approved in writing by the Local Planning Authority. The remediation strategy shall be implemented as approved.

Reasons: To ensure that the development is not put at unacceptable risk from, or adversely affected by, unacceptable levels water pollution from previously unidentified contamination sources at the development site in line with paragraph 174 of the National Planning Policy Framework.

24) The site or Contractor Company shall be registered with the Considerate Constructors Scheme. Proof of registration must be sent to the Local Planning Authority prior to any works being carried out above ground level.

Reason: To safeguard residential amenity, reduce congestion and mitigate obstruction to the flow of traffic, protect air quality and the amenity of the locality.

25) Above ground works for the development hereby approved shall not commence until a Construction Environmental Management Plan (CEMP) has been submitted to and approved in writing by the Local Planning Authority. The CEMP shall include a Construction Logistics Plan (CLP) and Air Quality and Dust Management Plan (AQDMP).

i. A construction method statement which identifies the stages and details how works will be undertaken; ii. Details of working hours, which unless otherwise agreed with the Local Planning Authority shall be limited to 08.00 to 18.00 Monday to Friday and 08.00 to 13.00 on Saturdays; iii. Details of plant and machinery to be used during demolition/construction works; iv. Details of an Unexploded Ordnance Survey; v. Details of the waste management strategy; vi. Details of community engagement arrangements; vii. Details of any acoustic hoarding; viii. A temporary drainage strategy and performance specification to control surface water runoff and Pollution Prevention Plan (in accordance with Environment Agency guidance); ix. Details of external lighting; and, x. Details of any other standard environmental management and control measures to be implemented.

c) The CLP will be in accordance with Transport for London's Construction Logistics Plan Guidance (July 2017) and shall provide details on: i. Dust Monitoring and joint working arrangements during the demolition and construction work; ii. Site access and car parking arrangements; iii. Delivery booking systems; iv. Agreed routes to/from the Plot; v. Timing of deliveries to and removals from the Plot (to avoid peak times, as agreed with Highways Authority, 07.00 to 9.00 and 16.00 to 18.00, where possible); and vi. Travel plans for staff/personnel involved in demolition/construction works to detail the measures to encourage sustainable travel to the Plot during the demolition/construction phase; and vii. Joint arrangements with neighbouring developers for staff parking, Lorry Parking and consolidation of facilities such as concrete batching.

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d) The AQDMP will be in accordance with the Greater London Authority SPG Dust and Emissions Control (2014) and shall include: i. Mitigation measures to manage and minimise demolition/construction dust emissions during works; ii. Details confirming the Plot has been registered at <http://nrmm.london>; iii. Evidence of Non-Road Mobile Machinery (NRMM) and plant registration shall be available on site in the event of Local Authority Inspection; iv. An inventory of NRMM currently on site (machinery should be regularly serviced, and service logs kept on site, which includes proof of emission limits for equipment for inspection); v. A Dust Risk Assessment for the works; and vi. Lorry Parking, in joint arrangement where appropriate.

The development shall be carried out in accordance with the approved details as well as in accordance with the approved Air Quality Assessment and/or Air Quality Neutral reports, as appropriate.

Reason: To safeguard residential amenity, reduce congestion and mitigate obstruction to the flow of traffic, protect air quality and the amenity of the locality.

26) No development shall take place until a stage 1 written scheme of investigation (WSI) has been submitted to and approved by the local planning authority in writing. For land that is included within the WSI, no demolition or development shall take place other than in accordance with the agreed WSI, and the programme and methodology of site evaluation and the nomination of a competent person(s) or organisation to undertake the agreed works. If heritage assets of archaeological interest are identified by stage 1 then for those parts of the site which have archaeological interest a stage 2 WSI shall be submitted to and approved by the local planning authority in writing. For land that is included within the stage 2 WSI, no demolition/development shall take place other than in accordance with the agreed stage 2 WSI which shall include:

(A) The statement of significance and research objectives, the programme and methodology of site investigation and recording and the nomination of a competent person(s) or organisation to undertake the agreed works;

(B) Where appropriate, details of a programme for delivering related positive public benefits;

(C) The programme for post-investigation assessment and subsequent analysis, publication & dissemination and deposition of resulting material. This part of the condition shall not be discharged until these elements have been fulfilled in accordance with the programme set out in the stage 2 WSI.

Reason: To comply with the requirements of paragraph 194 of the NPPF 2021 and Policy DM9 of the Development Management DPD 2017.

27) No development above ground level shall take place until a detailed Surface Water Drainage scheme for site has been submitted and approved in writing by the Local Planning Authority. The detailed drainage scheme should also accompany a detailed drainage plan appropriately cross-referenced to supporting calculations for the development and they should clearly indicate the location of all proposed drainage elements demonstrating that the surface water generated by this development (For all the rainfall durations starting from 15 min to 10080 min and intensities up to and including the climate change adjusted critical 100 yr storm) can be accommodated and disposed of without discharging onto the highway and without increasing flood risk on or off-site.

Reason: To ensure that the principles of Sustainable Drainage are incorporated into this proposal and maintained thereafter.

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28) Prior to first occupation of the development hereby approved, a detailed drainage management and maintenance plan for the lifetime of the development, which shall include arrangements for adoption by an appropriate public body or statutory undertaker, management by residents' management company or other arrangements to secure the operation of the drainage scheme throughout the lifetime of the development. The development shall be constructed in accordance with the approved details and thereafter retained.

Reason: To prevent increased risk of flooding to improve water quality and amenity to ensure future maintenance of the surface water drainage system

29) Prior to commencement of above ground works for the development hereby approved, a construction phase fire strategy, to include: details of access for firefighting personnel and equipment; that there is sufficient firefighting water supply; and details of the evacuation strategy and assembly points in the event of a fire, should be provided to and approved by the Local Planning Authority. Once approved the development shall be completed in accordance with the approved details.

Reason: In line with Policy D12 of the London Plan 2021.

30) Prior to the first occupation of the development hereby approved, an updated Fire Strategy Statement (FSS) to include the following additional details: where fire and rescue service pumping appliances are to be sited; the location of fire evacuation assembly points and mitigation measures to ensure they are kept clear of obstructions; evacuation strategy including provisions for the evacuation of mobility impaired residents and details of how the strategy would be communicated to residents; adequate firefighting water supply; how the FSS would be managed, updated and monitored as required; how residents will be notified of the strategy, should be submitted to and approved by the Council. Once approved the development shall be completed in accordance with the approved details and retained as such thereafter.

Reason: In line with Policy D12 of the London Plan.

31) An updated Air Quality Assessment, including an Air Quality Neutral report, shall be submitted to the Local Planning Authority for its written approval prior to the commencement of above ground works for the development hereby approved. Once approved the development shall be completed in accordance with the approved details.

Reason: To Comply with the GLA Sustainable Design and Construction SPG.

32) Prior to the commencement of above ground works for the development hereby approved a Stage 2 Road Safety Audit based on the scope of the Stage 1 Road Safety Audit shall be submitted to the Local Planning Authority for its written approval. The recommendations of the Stage 2 RSA shall be taken up and followed in the design of the development as appropriate, and retained as such thereafter.

Reason: In order to protect amenity and the safety of the public highway.

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33) Prior to the first residential or commercial occupation of the development (whichever occurs first) hereby approved a Car Parking Management Strategy (CPMS) shall be submitted in writing to and for approval by the Local Planning Authority. The CPMS shall confirm availability and management of all approved parking before occupation. The CPMS shall be implemented as approved and maintained thereafter.

Reason: In order to protect amenity, the safety of the public highway and to promote sustainable travel.

34) No piling shall take place until a Piling Method Statement (detailing the depth and type of piling to be undertaken and the methodology by which such piling will be carried out, including measures to prevent and minimise the potential for damage to subsurface sewerage infrastructure, and the programme for the works) has been submitted to and approved in writing by the Local Planning Authority in consultation with Thames Water. Any piling must thereafter be undertaken in accordance with the terms of the approved piling method statement.

Reason: The proposed works will be in close proximity to underground sewerage and water utility infrastructure.

35) Prior to the first occupation of the development hereby approved details of Vehicular Access Control Arrangements describing the detailed management of the access controls (e.g. raising bollards) and appropriate safeguards in case of damage or lack of functionality shall be submitted to the Local Planning Authority for its written approval. Details shall include information on bollard design, layout, spacing to enable larger cycles to pass through, management, maintenance, and rapid repairs and replacement in case of damage. One approved works shall be implemented in accordance with the approved details and retained as such thereafter.

Reason: To ensure suitable access controls for vehicles are provided and to ensure the safety of the public highway.

36) Prior to the first occupation of the development hereby approved details of the proposed junction of the park edge route with the new raised crossing on Ashley Road entrance, including details of the legibility of the pedestrian and cyclist environment, desire lines, accompanying signage, lining, tonal contrast and material choices, shall be submitted to the Local Planning Authority for its written approval. Once approved works shall be implemented in accordance with the approved details and retained as such thereafter.

Reason: To ensure the safety of the public highway.

37) Prior to the first occupation of the development hereby approved exact details of the play space to be installed within the development, around it and in other open spaces nearby shall be submitted to the Local Planning Authority for its written approval. Once approved works shall be implemented in accordance with the approved details and retained as such thereafter.

Reason: To meet the play space requirements of Policy S4 of the London Plan 2021.

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38) Prior to the commencement of above ground works for the development hereby approved details of evacuation lifts for each block shall be submitted to the Local Planning Authority for its written approval. Once approved works shall be implemented in accordance with the approved details and retained as such thereafter.

Reason: In accordance with the requirements of Policy D5 of the London Plan 2021.

39) The development hereby approved shall be constructed in accordance with the Energy and Sustainability Statement and Appendices prepared by Etude (dated June 2022, Rev H) delivering a minimum 84% improvement on carbon emissions over 2013 Building Regulations Part L, with SAP10 emission factors, Passivhaus-level fabric efficiencies, connection to the Decentralised Energy Network with a centralised air source heat pump (ASHP) system as a backup solution, and a minimum 350 kWp solar photovoltaic (PV) array.

(a) Prior to above ground construction, an updated Energy Strategy shall be submitted to and approved by the Local Planning Authority. This must include:

- Confirmation of how this development will meet the zero-carbon policy requirement in line with the Energy Hierarchy;
- Confirmation of the necessary fabric efficiencies to achieve a minimum 30% reduction, including details to reduce thermal bridging;
- Location, specification and efficiency of the proposed Plan B ASHP system (Coefficient of Performance, Seasonal Coefficient of Performance, and the Seasonal Performance Factor), with plans showing the ASHP pipework and noise and visual mitigation measures;
- Specification and efficiency of the proposed Mechanical Ventilation and Heat Recovery (MVHR) with and without cooling coils, with plans showing the rigid MVHR ducting and location of the unit;
- Details of the PV, demonstrating the roof area has been maximised, with the following details: a roof plan; the number, angle, orientation, type, and efficiency level of the PVs; how overheating of the panels will be minimised; their peak output (kWp);
- A metering strategy.

The development shall be carried out strictly in accordance with the details so approved prior to first operation and shall be maintained and retained for the lifetime of the development. The solar PV array shall be installed with monitoring equipment prior to completion and shall be maintained at least annually thereafter.

(b) Within six months of first occupation, evidence that the solar PV installation has been installed correctly shall be submitted to and approved by the Local Planning Authority, including photographs of the solar array, a six-month energy generation statement, and a Microgeneration Certification Scheme certificate.

(c) Within six months of first occupation, evidence shall be submitted to the Local Planning Authority that the development has been registered on the GLA's Be Seen energy monitoring platform.

(d) Within one year of first occupation, evidence shall be submitted to and approved by the Local Planning Authority to demonstrate how the development has performed against the approved Energy Strategy and to demonstrate how occupants have been taken through training on how to use their homes and the technology correctly and in the most energy efficient way and that issues have been dealt with. This should include energy use data for the first year and a brief statement of occupant involvement to evidence this training and engagement.

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Reason: To ensure the development reduces its impact on climate change by reducing carbon emissions on site in compliance with the Energy Hierarchy, and in line with London Plan (2021) Policy SI2, and Local Plan (2017) Policies SP4 and DM22.

40) Prior to the above ground commencement of construction work, details relating to the future connection to the DEN must be submitted to and approved by the local planning authority. This shall include:

- Further detail of how the developer will ensure the performance of the DEN system will be safeguarded through later stages of design (e.g. value engineering proposals by installers), construction and commissioning including provision of key information on system performance required by CoP1 (e.g. joint weld and HIU commissioning certificates, CoP1 checklists, etc.);
- Peak heat load calculations in accordance with CIBSE CP1 Heat Networks: Code of Practice for the UK (2020) taking account of diversification.
- Detail of the pipe design, pipe sizes and lengths (taking account of flow and return temperatures and diversification), insulation and calculated heat loss from the pipes in Watts, demonstrating heat losses have been minimised together with analysis of stress/expansion;
- A before and after floor plan showing how the plant room can accommodate a heat substation for future DEN connection. The heat substation shall be sized to meet the peak heat load of the site. The drawings should cover details of the phasing including any plant that needs to be removed or relocated and access routes for installation of the heat substation;
- Details of the route for the primary pipework from the energy centre to a point of connection at the site boundary including evidence that the point of connection is accessible by the area wide DEN, detailed proposals for installation for the route that shall be coordinated with existing and services, and plans and sections showing the route for three 100mm diameter communications ducts;
- Details of the space allowance for the DEN main passing through the site from Park View Road to Ashley Road;
- Details of the location for building entry including dimensions, isolation points, coordination with existing services and detail of flushing/seals;
- Details of the location for the set down of a temporary plant to provide heat to the development in case of an interruption to the DEN supply including confirmation that the structural load bearing of the temporary boiler location is adequate for the temporary plant and identify the area/route available for a flue;
- Details of a future pipework route from the temporary boiler location to the plant room.

Reason: To ensure the development reduces its impact on climate change by reducing carbon emissions on site in compliance with the Energy Hierarchy, and in line with London Plan (2021) Policy SI2 and SI3, and Local Plan (2017) Policies SP4 and DM22.

41) At least six months prior to the occupation of each non-residential unit, an Overheating Report must be submitted to and approved by the Local Planning Authority if that space is to be occupied for an extended period of time or will accommodate any vulnerable users, such as office/workspace, community, healthcare, or educational uses.

The report shall be based on the current and future weather files for 2020s, 2050s and 2080s for the CIBSE TM49 central London dataset. It shall set out:

- The proposed occupancy profiles and heat gains in line with CIBSE TM52
- The modelled mitigation measures which will be delivered to ensure the development complies with DSY1 for the 2020s weather file.
- A retrofit plan that demonstrates which mitigation measures would be required to pass future weather files, with confirmation that the retrofit measures can be integrated within the design.

Planning Service

Rob Krzyszowski Assistant Director Planning, Building Standards & Sustainability

The mitigation measures hereby approved shall be implemented prior to occupation and retained thereafter for the lifetime of the development.

Reason: In the interest of reducing the impacts of climate change, to enable the Local Planning Authority to assess overheating risk and to ensure that any necessary mitigation measures are implemented prior to construction, and maintained, in accordance with London Plan (2021) Policy SI4 and Local Plan (2017) Policies SP4 and DM21.

42) (a) Prior to above ground works, an updated Overheating Report modelling future weather files shall be submitted to and approved by the Local Planning Authority. This assessment shall be based on the TM59 modelling undertaken by Etude (Energy and Sustainability Statement dated June 2022). This revised strategy shall include:

- Modelling of dwellings based on CIBSE TM59, using the CIBSE TM49 London Weather Centre files DSY1 for the 2020s, high emissions, 50% percentile;
- Modelling of mitigation measures required to pass the mandatory weather files, clearly setting out which measures will be delivered before occupation in line with the Cooling Hierarchy;
- Updated as-designed heat loss calculations from heat interface units and pipework.

(b) Prior to occupation, the development must be built in accordance with the approved overheating measures and retained thereafter for the lifetime of the development:

- Natural ventilation, with openable areas including fixed louvred side panel for accessible bedrooms and secure night latch for other accessible habitable rooms;
- Glazing g-value of 0.50 or lower;
- External shading to south-facing windows on top floors (min. 1m depth);
- Brise soleil for other windows without balcony shading on south façades (1m full height, 0.8m for punched windows)
- External shutters for west-facing bedrooms (perforated/slatted shutters for airflow)
- Internal blinds on all façades (light-coloured, solar transmittance of 0.11);
- MVHR with summer bypass (min. 0.55ach);
- Minimal heat losses from heat interface units (HIU) and pipework;
- Active cooling with 1.5 kW cooling coil only for 19 dwellings with habitable rooms facing south-east;
- Any further mitigation measures identified as required in part (a).

Reason: In the interest of reducing the impacts of climate change, to enable the Local Planning Authority to assess overheating risk and to ensure that any necessary mitigation measures are implemented prior to construction, and maintained, in accordance with London Plan (2021) Policy SI4 and Local Plan (2017) Policies SP4 and DM21.

43) Prior to occupation of the residential dwellings, a Building User Guide for new residential occupants shall be submitted in writing to and for approval by the Local Planning Authority. The Building User Guide will advise residents how to operate their property during a heatwave, setting out a cooling hierarchy in accordance with London Plan (2021) Policy SI4 with passive measures being considered ahead of cooling systems. The Building User Guide will be issued to residential occupants upon first occupation.

Reason: In the interest of reducing the impacts of climate change and mitigation of overheating risk, in accordance with London Plan (2021) Policy SI4, and Local Plan (2017) Policies SP4 and DM21.

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44) Prior to the commencement of above ground construction works to Buildings A1-5, B2-3 and C2 only, a Design Stage Passivhaus Strategy shall be submitted to and approved by the Local Planning Authority. This should show that a Passivhaus level space heating demand target of 15 kWh/m²/year is achieved, accompanied by Passive House Planning Package (PHPP) calculations.

Within one month of completion of Buildings A1-5, B2-3 and C2, a Passivhaus Certificate will be submitted for approval demonstrating that Buildings A1-5, B2-3 and C2 meet the Passivhaus Standards, awarded by a suitably qualified independent Passivhaus Certifier.

Reasons: In the interest of addressing climate change and securing sustainable development in accordance with London Plan (2021) Policies SI2, SI3 and SI4, and Local Plan (2017) Policies SP4 and DM21.

45) Prior to the commencement of above ground construction works to Buildings B1 and C1, a Design Stage Passivhaus Strategy shall be submitted to and approved by the Local Planning Authority. Passive House Planning Package (PHPP) calculations should show that the design follows the Passivhaus methodology and achieve the highest level of energy efficiency that is technically feasible on this site, achieving a space heating demand target of 20 kWh/m²/year.

Within one month of completion of Buildings B1 and C1, air tightness certificates should be submitted to demonstrate that the development achieves the level of air tightness targeted in the PHPP model at pre-commencement stage. The dwellings are to achieve a maximum 20 kWh/m²/year space heating demand target, evidenced with a PHPP spreadsheet.

Reasons: In the interest of addressing climate change and securing sustainable development in accordance with London Plan (2021) Policies SI2, SI3 and SI4, and Local Plan (2017) Policies SP4 and DM21.

46) Prior to the occupation of any building or development, a Post-Completion Report setting out the predicted and actual performance against all numerical targets in the relevant Circular Economy Statement shall be submitted to the GLA at: circulareconomystatements@london.gov.uk, along with any supporting evidence as per the GLA's Circular Economy Statement Guidance. The Post-Completion Report shall provide updated versions of Tables 1 and 2 of the Circular Economy Statement, the Recycling and Waste Reporting form and Bill of Materials. Confirmation of submission to the GLA shall be submitted to, and approved in writing by, the local planning authority, prior to occupation.

Reason: In the interests of sustainable waste management and in order to maximise the re-use of materials in accordance with London Plan (2021) Policies D3, SI2 and SI7, and Local Plan (2017) Policies SP4, SP6, and DM21.

47) Prior to the occupation of each building the post-construction tab of the GLA's whole life carbon assessment template should be completed accurately and in its entirety in line with the GLA's Whole Life Carbon Assessment Guidance. The post-construction assessment should provide an update of the information submitted at planning submission stage, including the whole life carbon emission figures for all life-cycle modules based on the actual materials, products and systems used. This should be submitted to the GLA at: ZeroCarbonPlanning@london.gov.uk, along with any supporting evidence as per the guidance. Confirmation of submission to the GLA shall be submitted to, and approved in writing by, the local planning authority, prior to occupation of the relevant building.

Reason: In the interests of sustainable development and to maximise on-site carbon dioxide savings in accordance with London Plan (2021) Policy SI2, and Local Plan (2017) Policies SP4 and DM21.

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48) (a) At least two months prior to the occupation of the commercial units, the employer requirements setting the sustainability requirements for the non-domestic units should be submitted to and approved by the planning authority. This should achieve the highest possible standard through measurable outputs to demonstrate how environmental sustainability has been integrated into the development, seeking to deliver as a minimum the credits as outlined in the BREEAM Pre-Assessment. These measures shall be maintained thereafter for the lifetime of the development.

(b) Within six months after occupation, evidence of implementing the sustainability measures on site shall be submitted to the Local Planning Authority.

Reasons: In the interest of addressing climate change and securing sustainable development in accordance with London Plan (2021) Policies SI2, SI3 and SI4, and Local Plan (2017) Policies SP4 and DM21.

49) (a) Prior to the commencement of above ground works, details of the living and blue roofs must be submitted to and approved in writing by the Local Planning Authority. Living roofs must be planted with flowering species that provide amenity and biodiversity value at different times of year. Plants must be grown and sourced from the UK and all soils and compost used must be peat-free, to reduce the impact on climate change. The submission shall include:

- i) A roof plan identifying where the living and blue roofs will be located;
- ii) A section demonstrating settled substrate levels of no less than 120mm for extensive living roofs (varying depths of 120-180mm), and no less than 250mm for intensive living roofs (including planters on amenity roof terraces);
- iii) Roof plans annotating details of the substrate: showing at least two substrate types across the roof, annotating contours of the varying depths of substrate
- iv) Details of the proposed type of invertebrate habitat structures with a minimum of one feature per 30m² of living roof: substrate mounds and 0.5m high sandy piles in areas with the greatest structural support to provide a variation in habitat; semi-buried log piles / flat stones for invertebrates with a minimum footprint of 1m², rope coils, pebble mounds of water trays;
- v) Details on the range and seed spread of native species of (wild)flowers and herbs (minimum 10g/m²) and density of plug plants planted (minimum 20/m² with roof ball of plugs 25m³) to benefit native wildlife, suitable for the amount of direct sunshine/shading of the different living roof spaces. The living roof will not rely on one species of plant life such as Sedum (which are not native);
- vi) Roof plans and sections showing the relationship between the living roof areas and photovoltaic array; and
- vii) Management and maintenance plan, including frequency of watering arrangements.
- viii) A section showing the build up of the blue roofs and confirmation of the water attenuation properties, and feasibility of collecting the rainwater and using this on site;

(b) Prior to the occupation of 90% of the dwellings, evidence must be submitted to and approved by the Local Planning Authority that the living and blue roofs have been delivered in line with the details set out in point (a). This evidence shall include photographs demonstrating the measured depth of substrate, planting and biodiversity measures. If the Local Planning Authority finds that the living roof has not been delivered to the approved standards, the applicant shall rectify this to ensure it complies with the condition. The living and blue roofs shall be retained thereafter for the lifetime of the development in accordance with the approved management arrangements.

Reason: To ensure that the development provides the maximum provision towards the creation of habitats for biodiversity and supports the water retention on site during rainfall. In accordance with London Plan (2021) Policies G1, G5, G6, SI1 and SI2 and Local Plan (2017) Policies SP4, SP5, SP11 and SP13.

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Rob Krzyszowski Assistant Director Planning, Building Standards & Sustainability

50) (a) At least 12 months prior to occupation of development, details of ecological enhancement measures and ecological protection measures shall be submitted to and approved in writing by the Council. This shall detail the biodiversity net gain, plans showing the proposed location of ecological enhancement measures, a sensitive lighting scheme, justification for the location and type of enhancement measures by a qualified ecologist, and how the development will support and protect local wildlife and natural habitats.

(b) Prior to the occupation of development, photographic evidence and a post-development ecological field survey and impact assessment shall be submitted to and approved by the Local Planning Authority to demonstrate the delivery of the ecological enhancement and protection measures is in accordance with the approved measures and in accordance with CIEEM standards.

Development shall accord with the details as approved and retained for the lifetime of the development.

Reason: To ensure that the development provides the maximum provision towards the creation of habitats for biodiversity and the mitigation and adaptation of climate change. In accordance with London Plan (2021) Policies G1, G5, G6, SI1 and SI2 and Local Plan (2017) Policies SP4, SP5, SP11 and SP13.

51) The detailed design of the balconies, including screening features as appropriate, for the development hereby approved shall be submitted to and approved in writing by the Local Planning Authority prior to the commencement of above ground works. Once approved the details shall be implemented and retained as such thereafter.

Reason: To ensure the high-quality design and amenity of the development in accordance with Policy DM1 of the Development Management DPD 2017.

52) Prior to the first occupation of the development hereby approved a scheme of digital connectivity infrastructure shall be submitted to the Local Planning Authority for its written approval that shows how full fibre connectivity shall be facilitated to all residential and non-residential units. Once approved the details shall be implemented and retained as such thereafter.

Reason: In accordance with Policy SI6 of the London Plan 2021.

53) Prior to the commencement of above ground works on site an Arboricultural Method Statement, in accordance with the tree protection measures shown in the approved Tree Survey, Arboricultural Impact Assessment Preliminary Arboricultural Method Statement & Tree Protection Plan shall be submitted to the Local Planning Authority for its written approval. Once approved the details shall be followed thereafter.

Reason: To protect trees in accordance with Policy DM1 of the Development Management DPD 2017.

54) Prior to the commencement of above ground works for the development hereby approved an existing condition survey will need to be carried out in collaboration with the Council with respect to the public highway along the site with particular reference to the carriageway, footway and crossovers. Prior to the first occupation of the development (and again on completion of the development if this occurs after first occupation) a similar final condition survey shall be undertaken. The applicant shall ensure that any damages caused by the construction works and highlighted by the before-and-after surveys are addressed and the condition of the public highway reinstated to the satisfaction of the Council. All costs to undertake the surveys and carry out any highway works should be paid in full by the applicant.

Reason: To ensure the construction works do not result in the deterioration of the condition of the public highway along the site.

Planning Service

Rob Krzyszowski Assistant Director Planning, Building Standards & Sustainability

Informatives

1. In dealing with this application the Council has implemented the requirement in the National Planning Policy Framework to work with the applicant in a positive and proactive way. We have made available detailed advice in the form of our development plan comprising the London Plan 2021, the Haringey Local Plan 2017 along with relevant SPD/SPG documents, in order to ensure that the applicant has been given every opportunity to submit an application which is likely to be considered favourably. In addition, where appropriate, further guidance was offered to the applicant during the consideration of the application.
2. Based on the information given on the plans, with a CIL liable residential floor area of 13,904.10sqm and a CIL liable commercial floor area of 174sqm would be £289,761.44 for Haringey CIL (based on a CIL rate of £20.84 per sqm for residential floor space) and £868,135.48 for Mayoral CIL (based on a CIL rate of £60.36 per sqm for residential floor space and £166 per sqm for commercial floor space).
3. The applicant is reminded that this planning permission does not infer consent for any signage that may be attached to the development hereby approved and separate advertisement consent may need to be sought.
4. The new development will require numbering. The applicant should contact Haringey Local Land Charges at least six weeks before the development is occupied (tel. 020 8489 3797 / email: street.naming@haringey.gov.uk) to arrange for the allocation of a suitable address.
5. Prior to demolition of existing buildings, an asbestos survey should be carried out to identify the location and type of asbestos containing materials. Any asbestos containing materials must be removed and disposed of in accordance with the correct procedure prior to any demolition or construction works carried out.
6. Thames Water will aim to provide customers with a minimum pressure of 10m head (approx 1 bar) and a flow rate of 9 litres/minute at the point where it leaves Thames Waters pipes. The developer should take account of this minimum pressure in the design of the proposed development.
7. The applicant must seek the advice of the Metropolitan Police Service Designing Out Crime Officers (DOCOs) to achieve accreditation. The services of MPS DOCOs are available free of charge and can be contacted via docomailbox.ne@met.police.uk or 0208 217 3813.
8. Written schemes of investigation will need to be prepared and implemented by a suitably qualified professionally accredited archaeological practice in accordance with Historic England's Guidelines for Archaeological Projects in Greater London. This condition is exempt from deemed discharge under schedule 6 of The Town and Country Planning (Development Management Procedure) (England) Order 2015.

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Rob Krzyszowski Assistant Director Planning, Building Standards & Sustainability

9. The design and siting of installations should take into account possible effects of noise, vibration and generation of airborne dust in regard to the operational railway. Contractors are expected to use the 'best practical means' for controlling pollution and environmental nuisance complying all current standards and regulations. The design and construction methodologies should consider mitigation measures to minimise the generation of airborne dust, noise and vibration in regard to the operational railway. Demolition work shall be carried out behind hoardings and dust suppression systems are to be employed to risk to the operational line.

10. Glint and Sunlight glare assessment should be carried out to demonstrate the proposed development does not import risk of glare to the train drivers which can obstruct in the visibility of the signals.

11. Operation of mobile cranes should comply with CPA Good Practice Guide 'Requirements for Mobile Cranes Alongside Railways Controlled by Network Rail'. Operation of Tower Crane should also comply with CPA Good Practice Guide 'Requirements for Tower Cranes Alongside Railways Controlled by Network Rail'. Operation of Piling Rig should comply with Network Rail standard 'NR/L3/INI/CP0063 ? Piling adjacent to the running line'. Collapse radius of the cranes should not fall within 4m from the railway boundary unless possession and isolation on NR lines have been arranged or agreed with Network Rail.

12. Any Soakaways / attenuation ponds / septic tanks etc, required for the proposed scheme as a means of storm/surface water disposal should not be constructed within 10 metres of Network Rail's boundary or at any point which could adversely affect the stability of Network Rail's property/infrastructure. Storm/surface water must not be discharged onto Network Rail's property or into Network Rail's culverts or drains. Network Rail's drainage system(s) are not to be added to nor compromised by any proposed work(s). Suitable drainage or other works must be provided and maintained by the Developer to prevent surface water flows or run-off onto Network Rail's property / infrastructure. Proper provision must be made to accept and continue drainage discharging from Network Rail's property. (The Land Drainage Act) is to be complied with. Suitable foul drainage must be provided separate from Network Rail's existing drainage. Once water enters a pipe it becomes a controlled source and as such no water should be discharged in the direction of the railway.

13. Any Outside Party projects that will be within 20m and/or any transmitter within 100m of the operational railway will be required to undertake an Electromagnetic Compatibility assessment to be carried out in accordance with Network Rail standards 'NR/L1/RSE/30040 & 'NR/L1/RSE/30041' and 'NR/L2/TEL/30066'.

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14. Network Rail strongly recommends the developer contacts the Asset Protection Team AssetProtectionAnglia@networkrail.co.uk prior to any works commencing on site, and also to agree an Asset Protection Agreement with us to enable approval of detailed works. More information can also be obtained from our website <https://www.networkrail.co.uk/running-the-railway/looking-after-the-railway/assetprotection-and-optimisation/>

Robbie McNaugher

Robbie McNaugher
Head of Development Management and Planning Enforcement
Planning Service

31/08/2022



Appendix B Desk Study and Ground Investigation Report.



**Ashley Road Depot
Ashley Road
London N17 9AZ**

Desk Study and Ground
Investigation Report

Haringey Council

September 2022

J21294
Rev 4



Report prepared by



Jordan Wood BSc MSc FGS
Geotechnical Engineer

**Report checked and
approved for issue by**



Steve Branch BSc MSc CGeol FGS FRGS
Managing Director

Rev No	Status	Revision Details	Date	Approved for Issue
0			21 February 2022	
1	Final	Agreed amendments	8 March 2022	
2	Final	Agreed amendments	29 March 2022	
3	Final	Additional fieldwork regarding slit trenches plus basement sections	31 May 2022	
4	Final	Addition of final monitoring visits	9 September 2022	

This report has been issued by the GEA office indicated below. Any enquiries regarding the report should be directed to the office indicated or to Steve Branch in our Herts office.

✓ Hertfordshire	tel 01727 824666
Nottinghamshire	tel 01509 674888
Manchester	tel 0161 209 3032

Geotechnical & Environmental Associates Limited (GEA) disclaims any responsibility to the Client and others in respect of any matters outside the scope of this work. This report has been prepared with reasonable skill, care and diligence within the terms of the contract with the Client and taking account of the manpower, resources, investigation and testing devoted to it in agreement with the Client. This report is confidential to the Client and GEA accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known, unless formally agreed beforehand. Any such party relies upon the report at their own risk. This report may provide advice based on an interpretation of legislation, guidance notes and codes of practice. GEA does not however provide legal advice and if specific legal advice is required a lawyer should be consulted.

This report is intended as a Ground Investigation Report (GIR) as defined in BS EN1997-2, unless specifically noted otherwise. The report is not a Geotechnical Design Report (GDR) as defined in EN1997-2 and recommendations made within this report are for guidance only.

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EXECUTIVE SUMMARY

This executive summary contains an overview of the key findings and conclusions. No reliance should be placed on any part of the executive summary until the whole of the report has been read. Other sections of the report may contain information that puts into context the findings that are summarised in the executive summary.

BRIEF

This report describes the findings of a desk study and ground investigation carried out by Geotechnical and Environmental Associates Limited (GEA) on the instructions of Haringey Council. The work has been carried out in two phases to date, with respect to the proposed redevelopment of the site through the demolition of the existing buildings and subsequent construction of a new residential development providing a total of 272 homes, comprising a number of apartment blocks of between four-storeys and 12-storeys in addition to two-storey houses, with associated areas of public realm, 174 square metres of flexible use Class E floorspace, private and communal soft landscaping and new roads and pavements. The purpose of the investigation has been to research the history of the site, to determine the ground conditions, to provide an indication of the presence of contamination and to provide information to assist with the design of suitable foundations.

DESK STUDY FINDINGS

The earliest map studied, dated 1864, shows the site to have comprised farmland. A gravel pit was located approximately 50 m to the east and had apparently been backfilled by the time of the 1895 map. The 1913 map shows a refuse destructor in the central southern portion of the site and also shows a small building in the far west of the site, likely to be the existing cottage, and shows that the railway line to the east had been expanded. Terraced housing had been constructed in the surrounding area along with associated road networks and Down Lane Recreation Ground had been established directly to the south of the site. The site had undergone significant changes by 1956 with several additional buildings present on site, mostly in the centre of the site but also along the northwestern and northern boundaries. A much smaller building in the west of the site was labelled as a refuse destructor, but this could be due to differences in mapping. A tank was present in the centre of the site, along with a conveyor and two ramps. It is likely that at some point between 1970 and 1974 the refuse destructor was removed from site. From 1988, the site is labelled as 'depot'. The map dated 1991 shows a large building to have been established in the south of the site.

GROUND CONDITIONS

Beneath a variable but generally moderate thickness of made ground, Enfield Silt was encountered over Kempton Park Gravel, underlain by London Clay. Below this, the Lambeth Group was encountered to the maximum depth investigated, of 30.00 m. The made ground extended to depths of between 0.50 m and 3.80 m, but generally to between 0.80 m and 1.50 m and comprised dark brown, orange-brown and yellowish brown slightly clayey gravelly sand with variable amounts of brick, concrete, gravel, plastic, metal, glass, suspected ash and clinker, ceramics, tile, suspected asbestos-containing materials and roots and rootlets. A hydrocarbon odour was noted in Borehole No 17A, and staining was noted in Borehole No 12. The Enfield Silt extended to depths of between 1.30 m and 3.00 m, below which Kempton Park Gravel was present to depths of between 4.50 m and 6.00 m. The London Clay initially comprised firm becoming stiff dark brown fissured clay to depths of between 14.00 m and 16.00 m over very stiff dark grey slightly silty slightly sandy fissured clay to depths of between 23.40 m and 26.00 m. The Lambeth Group comprised very stiff dark grey and multicoloured silty sandy gravelly clay and dense light grey silty gravelly sand, with rounded black pebbles and shells. Groundwater was encountered at depths of between 3.00 m and 4.00 m in the Kempton Park Gravel, and at 22.50 m and 24.50 m in the Lambeth Group. Groundwater has subsequently been monitored at depths of between 0.74 m and 2.85 m.

Contamination testing has indicated elevated concentrations of lead, arsenic, nickel, zinc, copper, sulphide, PAH and TPH above the generic risk-based screening value for a residential end use with plant uptake. Asbestos has also been identified.

RECOMMENDATIONS

Moderately sized pad or strip foundations bearing in the dense Kempton Park Gravel may be designed to apply a net allowable bearing pressure of 225 kN/m² at a minimum depth of 0.90 m. Alternatively, piled foundations could be adopted and a 450 mm pile extending to a depth of 20 m would provide a safe working load of approximately 550 kN. Given the high sensitivity of end users, it is likely that remediation will be required.

Following an appropriate programme of remediation, the proposed development of the site will not present a risk to end users or the wider environment. Remediation details should be set out in a Remediation Method Statement, and verification should be detailed in a verification report to be carried out towards the end of the construction phase. Site workers should be made aware of the potential presence of contamination.

Part 1: INVESTIGATION REPORT

This section of the report details the objectives of the investigation, the work that has been carried out to meet these objectives and the results of the investigation. Interpretation of the findings is presented in Part 2.

1.0 INTRODUCTION

Geotechnical and Environmental Associates Limited (GEA) has been commissioned by Haringey Council, to carry out a desk study and ground investigation at Ashley Road Depot, Ashley Road, Tottenham N17 9AZ. Civic Engineers are the structural engineers for the project.

1.1 Proposed Development

It is understood that it is proposed to demolish the existing buildings and subsequently construct a new residential development providing a total of 272 homes, comprising a number of apartment blocks of between four-storeys and 12-storeys in addition to two-storey houses, with associated areas of public realm, private and communal soft landscaping and new roads and pavements.

It is understood that a building in the northeastern corner of the site is proposed to have a 5.5 m deep basement.

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

1.2 Purpose of Work

The principal technical objectives of the work carried out were as follows:

-  to check the history of the site with respect to previous contaminative uses;
-  to provide an assessment of the risk of Unexploded Ordnance (UXO);
-  to determine the ground conditions and hydrogeology and their engineering properties;
-  to provide advice and information with respect to the design of suitable foundations;
-  to provide an indication of the degree of soil contamination present; and
-  to assess the risk that any such contamination may pose to the proposed development, its users or the wider environment.

1.3 Scope of Work

In order to meet the above objectives, a desk study was carried out, followed by a ground investigation. The desk study comprised:

-  a review of historical Ordnance Survey (OS) maps and environmental searches sourced from the Envirocheck database;

-  a review of readily available geology maps;
-  a walkover survey of the site carried out prior to fieldwork;
-  commissioning of a tank search with the London Fire Brigade (ref: 31/013623, dated October 2021); and
-  commissioning of a preliminary UXO risk assessment (ref: PA14366-00, dated October 2021).

In the light of this desk study, two phases of intrusive ground investigation were carried out which comprised, in summary, the following activities:

-  eight boreholes advanced to a depth of 30.00 m (-21.35 m OD) using a standard cable percussion rig;
-  a total of 14 boreholes advanced to depths of between 0.50 m and 5.50 m (8.54 m OD and 4.20 m OD) using an opendrive sampler (Terrier) rig;
-  seven trial pits manually excavated to a maximum depth of 1.20 m, in order to expose existing foundations;
-  six slit trenches manually excavated to a maximum depth of 1.20 m (8.52 m OD), in order to expose tree roots;
-  standard penetration tests (SPTs), carried out at regular intervals in the boreholes to provide quantitative data on the strength of the soils;
-  the installation of seven combined gas and groundwater monitoring standpipes to depths of between 1.80 m and 5.00 m (6.73 m OD and 3.60 m OD) to monitor ground gas and groundwater and for the retrieval of groundwater samples for contamination testing;
-  six return monitoring visits carried out at approximately three-weekly intervals after the fieldwork;
-  six in situ California Bearing Ratio (CBR) tests, carried out at depths of 0.40 m (9.19 m OD) and 0.60 m (8.99 m OD) in areas of proposed new access roads;
-  soakage tests carried out within Trial Pits IT1, IT2 and IT3;
-  testing of selected soil and groundwater samples for contamination and geotechnical purposes;
-  testing of groundwater samples for contamination purposes; and
-  provision of a report presenting and interpreting the above data, together with our advice and recommendations with respect to the proposed development.

This report includes a contaminated land assessment which has been undertaken by a suitably qualified and competent professional in accordance with the methodology presented by the

Environment Agency in their Land contamination risk assessment (LCRM)¹ published 8 October 2020. This involves identifying, making decisions on, and taking appropriate action to deal with, land contamination in a way that is consistent with government policies and legislation within the United Kingdom. Risk management is divided into three stages; Risk Assessment, Options Appraisal and Remediation, and each stage comprises three tiers. The Risk Assessment stage includes preliminary risk assessment (PRA), generic quantitative risk assessment (GQRA) and detailed quantitative risk assessment (DQRA) and this report includes the PRA and GQRA.

The exploratory methods adopted in this investigation have been selected on the basis of the constraints of the site including but not limited to access and space limitations, together with any budgetary or timing constraints. Where it has not been possible to reasonably use an EC7 compliant investigation technique a practical alternative has been adopted to obtain indicative soil parameters and any interpretation is based upon engineering experience, local precedent where applicable and relevant published information.

1.4 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 ground water samples tested. No liability can be accepted for conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from third parties are given in good faith on the assumption that the information is accurate; no independent validation of third-party information has been made by GEA.

2.0 THE SITE

2.1 Site Description

The site is located within London Borough of Haringey, approximately 540 m north of Tottenham Hale station and 1 km to the south of Northumberland Park station. The site fronts onto Ashley Road to the south and is bounded by Park View Road to the north and west, by sports pitches associated with the Harris Academy Tottenham to the east and by Down Lane Park to the south. The areas to the north and west are largely residential, whilst industrial estates are present to the east and northeast. It may additionally be located by National Grid Reference 534460, 190120 and is shown on the map extract overleaf.

The site is irregular in shape, with an area of 1.6270 hectares. It is occupied by a former municipal services depot, which provided storage, refuelling, cleaning and maintenance for bin lorries up until mid-November 2021. Various council offices were also located on site. The site is now largely vacant, and all buildings had been demolished by the time of the second phase of work in May 2022.

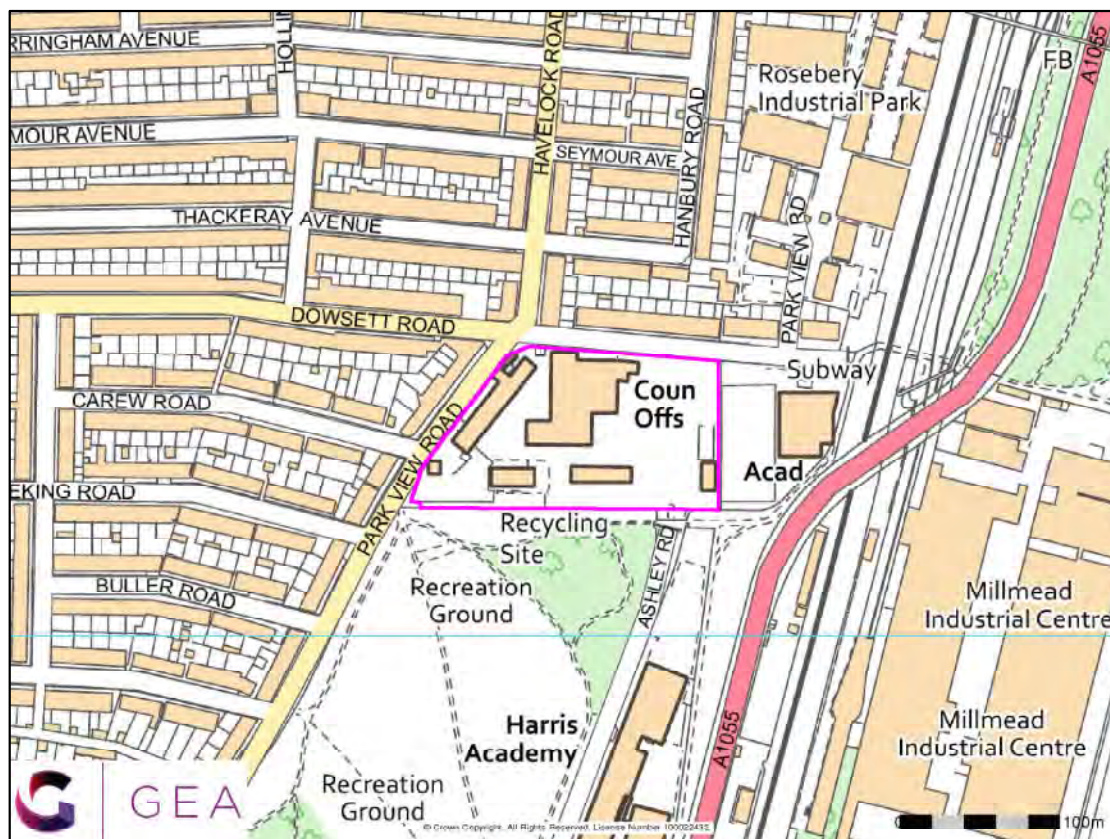
A fuel filling station is present on site, apparently providing diesel for the bin lorries and other council vehicles. The London Fire Brigade holds no records of any tanks located on the site. The site is almost entirely devoid of vegetation apart from eight mature London planes along the northern and western boundaries of the site, ranging in height from 14 m to 21 m, as well

¹ <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

as limited planters around the building in the south of the site. The site is sensibly level in keeping with the general topography of the area.

Asbestos warning stickers were present on buildings around the site as well as signs warning of oil tanks in some rooms, particularly in the northern areas of the site. It is understood a refuse destructor was located on the site for a number of years, and anecdotal evidence provided by a council worker on site suggested some of the waste was buried on site.

A vehicle washing facility is located in the far east of the site, which is used to clean the bin lorries and other council vehicles. The site originally extended an additional 70 m to the east, but this area was redeveloped in 2018 with the existing sports academy.



2.2 Site History

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

The earliest map studied, dated 1864, shows the site to comprise farmland associated with Hale Farm. Down Lane surrounded the northern and western extents of the site, and a small track was present running north to south bisecting the eastern portion of the site. A gravel pit was located approximately 50 m to the east with the Cambridge branch of the Great Eastern Railway a further 50 m to the east. The gravel pit had apparently been backfilled by the time of the 1895 map.

The site remained vacant until some time prior to the map dated 1913, which shows a refuse destructor located in the central southern portion of the site, labelled as being owned by 'Tottenham U.D. Council'. This map also shows that a small building was located in the far west of the site, likely to be the existing cottage, and that the railway line to the east had been

expanded. Terraced housing had been constructed in the surrounding area, along with associated road networks and Down Lane Recreation Ground had been established directly to the south of the site. Further terraced housing had been constructed in the surrounding area by the time of the next map, dated 1936, along with an athletic ground in the southern portion of the Down Lane Recreation Ground. A radio factory was present approximately 40 m to the northeast of the site. Few changes are noted on site, although what appears to be two train lines connecting to the nearby railway are present on the site, probably to aid bringing refuse into the site for the destructor.

The site had undergone significant changes by 1956 with several additional buildings present on site, mostly in the centre but also along the northwestern and northern boundaries. A much smaller building in the west of the site was labelled as the refuse destructor, but this could be due to differences in mapping. A tank was present in the centre of the site, along with a conveyor and two ramps. The aforementioned radio factory had changed uses to both a clothing factory and an atlas works. A zinc works was also present approximately 100 m to the northeast along with a cabinet factory and an engineering works was present across the railway, approximately 110 m to the east.

It is likely that at some point between 1970 and 1974 the refuse destructor was removed from site. From 1988 onwards, the site is labelled as 'depot'. The map dated 1991 shows a large building to have been established in the south of the site. Aerial imagery dated September 1999, source from Google Earth, appears to show a large pile of spreading salt stockpiled in the east of the site. Further imagery dated June 2018 shows the buildings to the east of the site had been removed and the site cleared. It appears as if the spreading salt stockpile had been removed, and in part replaced with the vehicle washing facility located on site today. By June 2019, four sports pitches had been established in this area along with a sports centre.

By the time of the additional phase of work in May 2022, all buildings on site had been demolished and several piles of debris were present on site.

2.3 Other Information

A search of public registers and databases has been made via the Envirocheck database and full results from the search are appended.

The search has revealed that there are no current landfill sites within 1 km of the site, however a historic landfill is recorded, located 192 m to the east. This operated from 1955 until 1962 and the specified waste is listed as inert and industrial waste. A single licensed waste management facility is located on site, but the license was surrendered in September 2017. Two other waste management facilities are located within 500 m of the site, but both have expired licenses.

Envirocheck holds records of three waste transfer sites located on site, all owned by London Borough of Haringey. The most recent licence is dated January 1995 and is still listed as 'operational as far as is known', although this may have been surrendered now that the site is vacant. One other waste transfer facility is located within 500 m of the site, located 380 m to the south, but its licence is suspended.

No other waste transfer, management, treatment or disposal sites are located within 500 m of the site.

The Envirocheck report suggests that no areas of infilled land are located within 200 m of the site, the closest is located 220 m to the southwest of the site and is associated with unknown

filled ground involving a pond or river etc. However, the historical maps indicate the presence of a gravel pit approximately 50 m to the east of site in the mid to late 19th Century.

Envirocheck holds records of a single pollution incident to controlled waters within 250 m of the site, located 236 m to the northeast listed as a category 3 – minor incident involving an unknown sewage pollutant occurring in April 1997.

A local authority pollution prevention and control is recorded on site, described as general waste incineration processes under 1 tonne an hour, dated December 1994. The authorisation for this has been revoked, however no details are provided as to when this happened.

Reference to records compiled by the Health Protection Agency (formerly the National Radiological Protection Board) indicates that the site falls within an area where less than 1% of homes are affected by radon emissions and therefore radon protective measures will not be necessary.

A total of 17 active contemporary trade directory entries are recorded within 250 m of the site, including a waste disposal services on site, a domestic cleaning services 23 m to the west, five food product manufacturers located 148 m, 235 m and 247 m to the southeast and 169 m and 210 m to the east, a tungsten tool manufacturers and distributors 184 m to the northeast and a printers 199 m to the northeast.

Five inactive contemporary trade directory entries are recorded within 100 m of the site, including a tungsten tool manufactures and distributors formerly located on site, a domestic cleaning services located 23 m to the west, and two entries classified as ‘gearboxes’ located 98 m to the northeast.

No active fuel filling station is located within 1 km of the site. There are, however, records of three obsolete fuel filling stations located within 1 km of the site, the closest of which was located 471 m to the south. No dates of operation are provided.

The site is not located within any area of sensitive land use, however two areas of adopted green belt are located within 500 m of the site, located 171 m and 469 m to the east. A nitrate vulnerable zone is located 79 m to the east as well as a Ramsar site, Site of Special Scientific Interest and Special Protection, all relating to the Lee Valley and Walthamstow Reservoirs, located 471 m to the east.

A tank search was commissioned with the London Fire Brigade for the site, and the authority holds no record of petroleum storage tanks on the site. It is, therefore, likely that the fuel filling station comprises diesel tanks only.

2.4 Preliminary UXO Risk Assessment

A Preliminary UXO Risk Assessment has been completed by 1st Line Defence (report ref PA14366-00, dated October 2021), and the report is included in the appendix. The risk assessment has been carried out in accordance with the guidelines provided by CIRIA², which state that the likelihood of encountering and detonating UXO below a site should be assessed along with establishing the consequences that may arise. The first phase comprises a preliminary risk assessment, which should be undertaken at an early stage of the development planning. If such an assessment identifies a high level of risk, then a detailed risk assessment

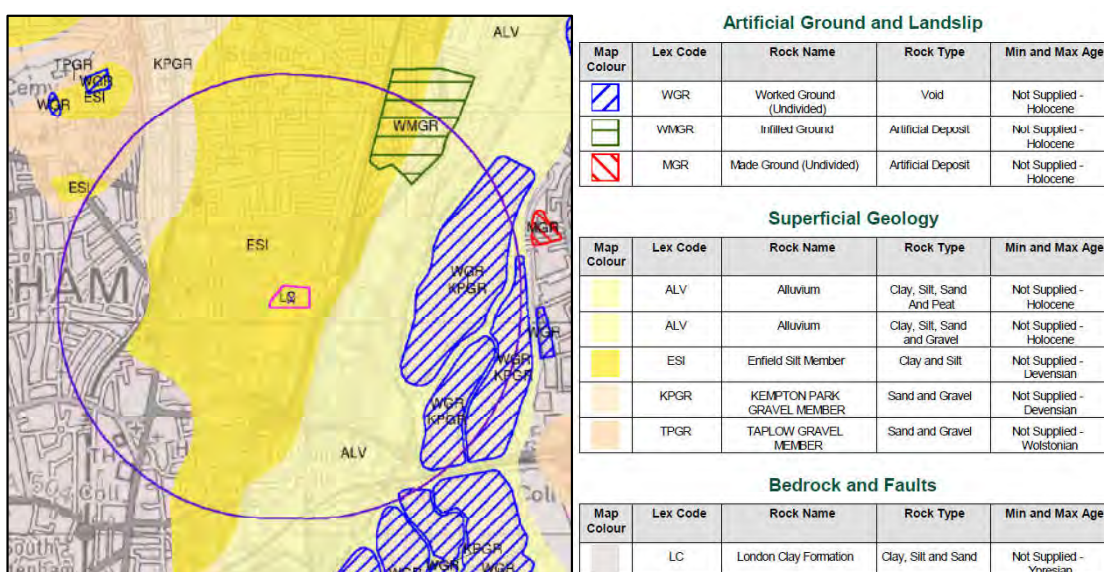
² CIRIA C681 (2009) *Unexploded ordnance (UXO) A guide for the construction industry*

should be carried out by a UXO specialist, which will identify an appropriate course of action with regard to risk mitigation.

The report indicates that, during World War II (WWII), the site was located in the Municipal Borough of Tottenham, which sustained an overall high density of bombing, with an average of 103.9 items of ordnance recorded per 1,000 acres. Despite this, no bombing incidents are recorded on or immediately surrounding the site on available London bomb census and local bomb plot mapping. The closest recorded strike is located north of the site boundary, opposite Park View Road and does not appear to have had a significant impact on the site. Additionally, no anecdotal or published information was located to suggest the site was bombed during WWII. No damage is recorded on site or in the surrounding area in MCC damage mapping. Furthermore, no evidence could be found to suggest the site was not subject to frequent access during the war. Due to the industrial usage and positioning in a built-up urban area of the site, it is believed to have been subject to post-raid checks. The report therefore concludes that the risk from UXO contamination is not considered to be significantly higher than the 'background risk' for this area. It has therefore been determined that, although it is not possible to completely discount the risk from UXO, it is not recommended that any further action is taken for this site.

2.5 Geology

The British Geological Survey (BGS) viewer of the area (Sheet 256 as reproduced by Envirocheck below) indicates the site to be underlain by the Enfield Silt Member, overlying the Kempton Park Gravel over the London Clay Formation.



A search of the BGS borehole database has identified a record of a 20 m deep borehole (TQ39SW675) that was drilled roughly 60 m to the northeast of the site in 2006. Made ground, described as soft dark grey sandy clay and silty sand with brick, concrete, ash and roots, was encountered to a depth of 1.2 m. Below this, soils interpreted as River Terrace Deposits were encountered to a depth of 3.60 m, comprising an initial layer of firm grey brown and orange brown sandy clay with rare gravel to a depth of 1.50 m, below which medium dense becoming dense, grey brown silty sandy gravel was encountered to a depth of 3.60 m. The gravel was described as fine to coarse grained, subangular to subrounded and of flint. This was underlain by soils interpreted as London Clay to the full depth investigated of 20.00 m and was described as firm becoming stiff extremely closely fissured dark grey to grey brown slightly silty clay.

The BGS holds records of another borehole (TQ39SW3), located approximately 115 m to the northwest of the site, extending to a depth of 76.5 m. No date is provided on the map. 'Surface-earth and gravel' was encountered to a depth of 4.6 m, which is likely to comprise the made ground and Kempton Park Gravel. Below this 'Blue London Clay' was encountered to a depth of 25.9 m, underlain by the Lambeth Group, formerly known as Woolwich and Reading Beds and the Thanet Beds. This is split up into four different soil types on the log, comprising 'green sand' to a depth of 26.5 m, 'coloured clay' to a depth of 28.4 m, 'live sand' to a depth of 29.0 m, and 'dead sand' to a depth of 64.8 m. Below this, the Upper Chalk is present to the full depth investigated of 76.5 m.

2.6 Hydrology and Hydrogeology

The Enfield Silt and London Clay are classified by the Environment Agency (EA) as Unproductive Strata, which refers to rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. The Kempton Park Gravel and Lambeth Group are classified as Secondary 'A' Aquifers, which refers to permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

The London Clay is not capable of supporting a groundwater table, although isolated pockets of perched groundwater do occur within fissures and silt and sand partings. Published data for the permeability of the London Clay indicates the horizontal permeability to generally range between 1×10^{-11} m/s and 1×10^{-9} m/s, with an even lower vertical permeability.

The site is not located within a Groundwater Source Protection Zone, but a Zone II (Outer Protection Zone) is located 11 m to the southeast of the site.

No water abstractions are located within 500 m of the site, the nearest is located 572 m to the south of the site. EA records indicate that the site is within an area with potential for groundwater flooding to occur below ground level.

The site is located within a Flood Zone 2 and is therefore considered to be at medium risk of flooding from rivers of sea. A flood risk assessment must therefore be carried out.

The site is largely covered by concrete and tarmac hardstanding and buildings. The proposals are likely to increase the amount of soft landscaping on the site, but this is not likely to significantly alter the ratio of infiltration of rainwater beneath the site and surface runoff. The majority of surface runoff currently drains into combined sewers beneath the site, and this will continue. There is not expected to be an adverse impact on the surrounding area. There should not, therefore, be any requirement for any mitigation measures.

2.7 Preliminary 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.

2.7.1 Source

The findings of the desk study and the site walkover indicate that the site has had a potentially contaminative history by virtue of it having been occupied by a fuel filling station, various

warehouses for servicing and repairing vehicles, vehicle washing facilities, a refuse destructor, a spreading salt stockpile, and storage for bin lorries.

Reference to the relevant DoE Industry Profile^{3,4} indicates the principal form of contamination likely to be found at a filling station is from leakage of underground tanks. Historically, contamination of the ground from spillage was common due to overfilling or faulty pipes or caps. Spillages may also occur due to operator error. Contaminants such as lead, polycyclic aromatic hydrocarbons (PAHs), tetraethyllead (TEL), methyl tertiary butyl ether (MTBE), naphthalenes and long-chain aliphatic compounds are likely to be found on former filling station sites. Leakages / spillages would also give rise to a vapour risk due to the breakdown of hydrocarbons.

It is believed that only diesel tanks are present on site, and commonly used diesel fuel additives include anti-oxidants, metal deactivators, detergents most commonly alkyl sulphonates, corrosion inhibitors, cetane improvers, low temperature flow improvers and combustion modifiers.

As the site also contained a repair and servicing garage, other possible contaminants include those from waste oil such as PAHs, along with heavy metals, ethylene glycol from anti-freeze, polymerised glycols and ethers from brake fluid and various chlorinated and non-chlorinated solvents, such as methanol, xylene, dichloromethane and trichloroethylene. Other widely used solvents include paraffin and propriety degreasing compounds.

Contaminants arising from the vehicle wash areas predominantly comprise detergent constituents, including linear alkyl sulphones, sodium carbonate, sodium silicate, sodium hydroxide, ethylene diamine tetraacetic acid and nitrilotriacetic acid.

Potential contaminants arising from the former refuse destructor will depend on the type of waste disposed of, but may include heavy metals, PAHs and asbestos. The length of time that the refuse destructor was located on site means that there is a significant potential of contamination to the site, which will be dependent on the type of waste and disposal method used. Furthermore, the length of time the site has been utilised as a road haulage depot means that there is a potential of not only hydrocarbon and metal contamination, but also from solvents due to the washing area.

A gravel pit was present approximately 50 m to the east of the site in the mid to late 19th century, such that it is possible for an increased thickness of fill materials to be present, which can typically include elevated concentrations of heavy metals and polycyclic aromatic hydrocarbons. Such contaminants are of relatively low solubility, with any potential soluble contaminants unlikely to remain below the site, given that the infilling took place over 100 years ago. Equally, given the age of the fill, it is very unlikely that any organic material that was able to degrade to produce hazardous soil gas, would have degraded by now, such that any fills beneath the site are not considered to form a source of soil gases.

Soil gas arising from landfill is unlikely to be present due to the nearest historic landfill being 192 m away and closed in 1962.

³ Department of the Environment Industry Profile (1996) *Road vehicle fuelling, service and repair – garages and filling stations*. HMSO

⁴ Department of the Environment Industry Profile (1996) *Road vehicle fuelling, service and repair – transport and haulage centres*. HMSO

2.7.2 Receptor

The proposed redevelopment of the site for residential purposes will result in the end users representing relatively high sensitivity receptors. Groundwater within the underlying Kempton Park Gravel, classified as a Secondary 'A' Aquifer, is considered to be a moderately sensitive receptor, as are adjacent sites. Buried services and new buried concrete 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 in the soils during construction works.

2.7.3 Pathway

Within the site, end users will be isolated from direct contact with any contaminants present within the soil by the presence of buildings and hardstanding. However, any soft landscaping will present a potential exposure pathway. Site workers and building materials will be subject to direct contact with the soil. Given the presence of the underlying Secondary 'A' Aquifer, groundwater flows are a pathway by which contamination could transfer on and off site. The redevelopment of the site will not create any new pathways for contamination to reach shallow groundwater, nor will it create a pathway to adjacent sites.

2.6.4 Preliminary Risk Appraisal

On the basis of the above it is considered that there is a MODERATE risk of there being a significant contaminant linkage at this site, which would result in a requirement for major remediation work. Furthermore, as there is no evidence of filled ground within the vicinity of the site and no landfill sites, there is not considered to be a significant potential for hazardous soil gas to be present on or migrating towards the site.

3.0 EXPLORATORY WORK

In order to meet the objectives described in Section 1.2, eight boreholes were advanced to a depth of 30.00 m (-21.35 m OD) using a standard cable percussion rig. Additionally, 14 boreholes were advanced to depths of between 0.50 m and 5.50 m (8.54 m OD and 4.20 m OD) using an opendrive sampling rig to provide further coverage of the site.

A total of seven trial pits were manually excavated to provide foundation details of the existing buildings on site. During the initial phase of works, three slit trenches were hand excavated to a maximum depth of 0.90 m (8.82 m OD) to expose tree roots, although these were terminated at depths of between 0.40 m and 0.90 m (9.06 m OD and 8.82 m OD) due to the presence of suspected asbestos containing materials (ACM). An additional three slit trenches were excavated in May 2022 during the second phase of works with UKATA Category B trained operatives. Continuous asbestos air monitoring was also carried out during the works, to ensure airborne fibres remained below the control limit of 0.1 fibres/ml. These slit trenches were excavated to a maximum depth of 1.20 m (8.52 m OD) to expose tree roots. The three trenches were dampened with water and a suitable wetting agent throughout the works.

Standard Penetration Tests (SPTs) were carried out within the boreholes to provide an indication of the in-situ density of the soil.

Three mechanically excavated trial pits were excavated each to a depth of 1.00 m (8.65 m OD) using a mini excavator to undertake soakage testing broadly in accordance with BRE Digest 365. The soakage tests were conducted to provide information for soakaway design.

A selection of the samples recovered from the boreholes was submitted to a soil mechanics laboratory for a programme of geotechnical testing and an analytical laboratory for a

programme of contamination testing. The majority of the above work was carried out under the supervision of a geotechnical engineer from GEA.

Six in-situ California Bearing Ratio (CBR) tests were carried out on site, at depths of 0.40 m (9.19 m OD) and 0.60 m (8.99 m OD) in three different locations. Combined gas and groundwater monitoring standpipes were installed in Borehole Nos 1, 2, 5, 6, 12, 13 and 17A to depths of between 2.00 m and 5.00 m (6.93 m OD and 3.60 m OD) to determine the monitor of vapours arising from the breakdown of hydrocarbons and to allow for the recovery of groundwater samples for contamination testing. Six monitoring visits have now been carried out.

Headspace testing using a Photoionisation Detector (PID) was carried out within Borehole Nos 14, 14A, 14B, 14C, 17 and 17A due to the close proximity to the fuel filling station.

The borehole and trial pit records are appended, along with the results of the laboratory analyses, together with a site plan indicating the borehole locations. The Ordnance Datum (OD) levels on the records have been interpolated from a survey drawing of the site provided by the consulting engineers carried out by Site Engineering Surveys Ltd., (job ref 11533, drawing number SES-11533-001, dated June 2021).

3.1 Sampling Strategy

The borehole locations were agreed with the consulting engineer, Civic Engineers, prior to fieldwork and were positioned by a geotechnical engineer from GEA whilst avoiding known and suspected buried services. Disturbed and undisturbed samples were obtained from the boreholes and trial pits for subsequent laboratory examination and testing.

A total of 36 samples of the shallow soil have been tested for the presence of contamination. For this investigation the analytical suite for the soil included a range of metals, total petroleum hydrocarbons (TPH), speciation of polycyclic aromatic hydrocarbons (PAH), total cyanide and monohydric phenols and a range of typical industrial contaminants for the purposes of general coverage. 35 soil samples were also screened for the presence of asbestos, as well as four bulk samples.

Leachate testing was also carried out on four samples, and contamination testing has been carried out on four groundwater samples.

The contamination analyses were carried out at an MCERTs accredited laboratory with the majority of the testing suite accredited to MCERTS standards. A summary of the MCERTs accreditation and test methods are included with the attached results and further details are available upon request.

4.0 GROUND CONDITIONS

The investigation has encountered the expected ground conditions in that, beneath a variable but generally moderate and locally significant thickness of made ground, the Enfield Silt was encountered, below which the Kempton Park Gravel Member was present overlying the London Clay Formation, whereupon Lambeth Group was encountered and proved to the full depth investigated, of 30.00 m (-21.35 m OD).

4.1 Concrete

The concrete surfacing was, on average, 0.23 m thick, but in excess of 1.00 m in Borehole No 15. Borehole Nos 14, 14A, 14B, 14C, 15, 16 and 17 were terminated at shallow depths due to the thickness of the concrete or other obstructions. Borehole No 15 was drilled in the location of the former refuse destructor.

4.2 Made Ground

The made ground was found to extend to depths of between 0.50 m and 3.80 m (8.15 m OD and 5.76 m OD), but generally to between 0.80 m and 1.50 m (7.67 m OD and 7.80 m OD) and comprised dark brown, orange-brown and yellowish brown slightly clayey gravelly sand with variable amounts of brick, concrete, flint gravel, plastic, metal, glass, carbonaceous material including suspected ash and clinker, ceramics, tile, suspected asbestos containing materials and roots and rootlets. A hydrocarbon odour was noted in Borehole No 17A, and staining was noted in Borehole No 12.

A total of 36 samples were recovered for subsequent contamination testing given the potentially contaminative history of the site and the results are detailed in section 4.8.

4.3 Enfield Silt

The Enfield Silt was encountered in all locations apart from Borehole Nos 2, 5 and 11, to depths of between 1.30 m and 3.00 m (7.17 m OD and 5.86 m OD) and comprised soft orange brown silty slightly sandy gravelly clay.

The results of laboratory classification tests indicate that the Enfield Silt is of low volume change potential. A slight hydrocarbon odour was noted in the Enfield Silt in Borehole No 17A and a sample was submitted for contamination testing.

4.4 Kempton Park Gravel

The Kempton Park Gravel was present to depths of between 4.50 m and 6.00 m (4.60 m OD and 2.67 m OD) and comprised dense and very dense orange brown slightly clayey gravelly sand and sandy gravel. The base of the gravel was not proved in the open drive sampler boreholes apart from Borehole No 11 due to the density of the gravel.

No visual or olfactory evidence of contamination was observed within this stratum.

4.5 London Clay Formation

The London Clay initially comprised firm becoming stiff dark brown fissured clay to depths of between 14.00 m and 17.00 m (-4.44 m OD and -7.79 m OD) with rare fine selenite whereupon very stiff dark grey slightly silty slightly sandy fissured clay with rare fine mica and occasional

bioturbation was present to depths of between 23.10 m and 25.80 m (-14.45 m OD and -16.59 m OD).

No visual or olfactory evidence of contamination was observed within this stratum. The results of laboratory classification tests indicate that the London Clay is of generally high-volume change potential. The results of the undrained triaxial tests indicate the clay to be of high becoming very high strength in the majority of boreholes and high becoming extremely high strength in Borehole No 5.

4.6 Lambeth Group

The Lambeth Group comprised very stiff dark grey and multicoloured silty sandy gravelly clay with rounded black pebbles and shells and dense light grey silty gravelly sand, also with rounded black pebbles, shells, fragments of siltstone and occasional fine chalk gravel. No visual or olfactory evidence of contamination was observed within this stratum. The results of laboratory classification tests indicate that the clay of the Lambeth Group is of low to medium-volume change potential.

Gas expulsion was noted in Borehole No 2 once the Lambeth Group was reached at a depth of around 24.50 m (-14.94 m OD) and is likely to be a result of high levels of pressurised deoxygenated air venting from the borehole.

4.7 Groundwater

During the drilling of the boreholes, groundwater was encountered at depths of between 3.00 m and 4.00 m in the Kempton Park Gravel, and at depths of 22.50 m and 24.50 m (-13.83 m OD and -15.64 m OD) rising to depths of between 21.00 m and 23.50 m (-12.14 m OD and -14.84 m OD) in the Lambeth Group.

Combined gas and groundwater monitoring standpipes were installed in Borehole Nos 1, 2, 5, 6, 12, 13, and 17A to depths of between 1.80 m and 6.00 m (6.73 m OD and 2.60 m OD). The standpipes have been monitored on six occasions to date, and the results are shown in the table below. Due to the demolition works, various boreholes have been inaccessible at times, only those that could be accessed on the given date are included in the table.

Date	Borehole No	Standpipe depth m	Depth to water m [Level m OD]
01/02/2022	1	4.75	2.06 [6.80]
	2	5.98	2.85 [6.71]
	5	4.95	2.45 [6.76]
	13	1.74	1.20 [7.73]
	17A	2.27	2.60 [6.06]
03/03/2022	2	5.98	2.50 [7.06]
	5	4.58	1.91 [7.30]
	13	1.78	0.74 [8.19]

Date	Borehole No	Standpipe depth m	Depth to water m [Level m OD]
18/03/2022	17A	2.15	1.25 [7.41]
	5	4.65	2.32 [6.89]
	17A	2.23	1.64 [7.02]
06/05/2022	2	5.98	2.93 [5.93]
	5	4.58	2.48 [7.08]
	12	2.40	2.02 [7.19]
	13	1.75	0.97 [7.96]
	17A	2.00	1.72 [6.94]
31/05/2022	2	6.02	2.96 []
	5	4.63	2.50 []
	12	2.45	2.06 []
	13	1.73	0.91 []
	17A	2.15	1.70 []
22/06/2022	2	6.01	2.95 []
	5	4.62	2.45 []
	12	2.49	2.00 []
	13	1.70	0.85 []
	17A	2.20	1.55 []

4.8 Soil and Groundwater Contamination

The table below sets out the values measured within the 36 samples of made ground and natural soils analysed; all concentrations are in mg/kg unless otherwise stated.

Determinant	Minimum concentration (mg/kg)	Maximum concentration (mg/kg)	Generic risk-based screening value	Number below limit of detection	Number of samples above screening value
pH	7.4	11.4	-	-	-
Arsenic	10	170	37	0	18
Cadmium	< 0.2	15	26	22	0
Chromium	19	120	910	0	0
Lead	21	4600	200	0	32

Determinant	Minimum concentration (mg/kg)	Maximum concentration (mg/kg)	Generic risk-based screening value	Number below limit of detection	Number of samples above screening value
Mercury	< 0.3	7.1	40	13	0
Selenium	1	1.5	350	35	0
Copper	25	3500	2,400	0	2
Nickel	19	840	180	0	3
Zinc	74	4900	3,700	0	2
Total Cyanide	< 1.0	61	140	28	0
Total Phenols	< 1.0	< 1.0	184	32	0
Total PAH	< 0.80	76.0	62.1	13	2
Sulphide	< 1.0	1600	50	5	9
Naphthalene	< 0.05	< 0.05	2.30	36	0
Fluoranthene	< 0.05	14	280	14	0
Benzo(a)anthracene	< 0.05	7.7	7.2	16	1
Benzo(b)fluoranthene	< 0.05	5.6	2.6	15	5
Chrysene	< 0.05	4.9	15	16	0
Benzo(a)pyrene	< 0.05	5.7	4.35	17	2
Dibenz(a,h)anthracene	< 0.05	1.1	0.24	29	7
TPH	< 10	5400	500	7	3
Total Organic Carbon %	0.3	5.1	6	0	0

Note: Figures in bold are elevated when compared to the relevant risk based screening values.

Groundwater samples were taken approximately one month after installation of the standpipes. Chemical analyses of the samples have indicated that elevated concentrations of nickel were present in Borehole Nos 13 and 17A and elevated concentrations of TPH were present in Borehole No 17A.

4.8.1 Generic Quantitative Risk Assessment

The use of a risk-based approach has been adopted to provide an initial screening of the test results to assess the need for subsequent site-specific risk assessments. Contaminants of concern are those that have values in excess of generic human health risk-based guideline values, which are either the CLEA⁵ Soil Guideline Values where available, the Suitable 4 Use Values⁶ (S4UL) produced by LQM/CIEH calculated using the CLEA UK Version 1.07⁷ software, or the DEFRA Category 4 Screening values⁸, assuming a residential end use with plant uptake. The key generic assumptions for this end use are as follows:

- that groundwater will not be a critical risk receptor;

⁵ Updated Technical Background to the CLEA Model (Science Report SC050021/SR3) Jan 2009 and Soil Guideline Value reports for specific contaminants; all DEFRA and Environment Agency.

⁶ The LQM/CIEH S4ULs for Human Health Risk Assessment S4UL3065 November 2014

⁷ Contaminated Land Exposure Assessment (CL|EA) Software Version 1.071 Environment Agency 2015

⁸ CL:AIRE (2013) Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination Final Project Report SP1010 and DEFRA (2014) Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination Policy Companion Document SP1010

-  that the critical receptor for human health will be young female children aged less than six years old;
-  that the exposure duration will be six years;
-  that the critical exposure pathways will be direct soil and indoor dust ingestion, consumption of home grown produce, consumption of soil adhering to home grown produce, skin contact with soils and dust, and inhalation of indoor and outdoor dust and vapours; and
-  that the building type equates to a two-storey small terraced house.

It is considered that these assumptions are acceptable for this generic assessment of this site. The tables of generic screening values derived by GEA and an explanation of how each value has been derived are included in the Appendix.

Where contaminant concentrations are measured at concentrations below the generic screening value it is considered that they pose an acceptable level of risk and thus further consideration of these contaminant concentrations is not required. However, where concentrations are measured in excess of these generic screening values there is considered to be a potential that they could pose an unacceptable risk and thus further action will be required which could include;

-  additional testing to zone the extent of the contaminated material and thus reduce the uncertainty with regard to its potential risk;
-  site-specific risk assessment to refine the assessment criteria and allow an assessment to be made as to whether the concentration present would pose an unacceptable risk at this site; or
-  soil remediation or risk management to mitigate the risk posed by the contaminant to a degree that it poses an acceptable risk.

A residential with plant uptake end use is deemed acceptable for the proposals as it is understood that private gardens are to be included which may contain home grown produce.

The results of the contamination testing indicate the presence of elevated concentrations of lead in 32 samples tested, arsenic in 18 samples tested, sulphide in nine samples tested, TPH in two samples tested, nickel in three samples tested, and copper and zinc in two samples tested, when compared to the generic risk-based screening values for a residential with plant uptake. Whilst overall levels of total PAH were only elevated above the screening values in two samples tested, speciation of the PAH results has indicated elevated concentrations of dibenz(a,h)anthracene in seven samples tested, benzo(b)fluoranthene in five samples tested, benzo(a)pyrene in two samples tested and benzo(a)anthracene in a single sample tested.

Additionally, elevated TPH contamination was identified in the Enfield Silt in Borehole No 17A at a depth of 2.40 m (6.26 m OD).

Leachate testing was carried out on four of the soil samples and indicate elevated concentrations of lead in all four samples tested and zinc in a single sample tested above the relevant groundwater screening values.

35 samples of shallow made ground were also screened for the presence of asbestos and was detected in three samples. Subsequent quantification testing revealed concentrations of 0.018 % and < 0.001 %. Additionally, four bulk samples of suspected asbestos containing materials were screened for the presence of asbestos and all were found to comprise chrysotile in the form of a hard / cement type material.

Asbestos air monitoring was carried out during the excavation, logging, and reinstatement of the three slit trenches excavated during the second phase of works. A total of 32 air tests were conducted and all tests recorded a result of < 0.01 fibres/ml. The full results are provided in the appendix.

The results of the chemical analyses within the groundwater indicate that elevated concentrations of nickel and TPH are present with respect to the screening values for groundwater.

The significance of these results is considered further in Part 2 of the report.

4.9 Soil Gas

In order to provide an assessment of the requirement for gas protection measures, given the thickness of made ground encountered in some areas and the history of the site, standpipes have been installed into seven of the boreholes to depths of between 1.80 m and 5.00 m. A programme of gas monitoring comprising six monitoring visits has now been carried out. Borehole No 6 was not accessible during any visit and Borehole No 1 was only accessible during the first visit. Additionally, Borehole No 12 was not accessible until the fourth visit, but was accessible for the remainder of the programme, and only Borehole Nos 5 and 17A were accessible during the third visit due to demolition works.

The results from the first visit indicated that Borehole Nos 2 and 17A are at near normal oxygen levels of 17.6 % and 17.7 % respectively, Borehole No 13 has slightly reduced oxygen levels of 13.7 % and Borehole Nos 5 and 13 had significantly reduced oxygen levels of 7.7 % and 7.2 % respectively. Oxygen concentrations in all boreholes that could be accessed during the remaining visits had recovered to near normal. Reduced oxygen concentrations were recorded in Borehole No 12 during the fourth visit, but this was the first time this borehole was accessible, and the gas tap was noted to have been closed, which could have allowed for a build-up in concentrations. Negligible carbon dioxide concentrations were recorded in Borehole No 12 in subsequent visits.

Slight carbon dioxide levels were recorded in all boreholes of between 0.2 % in Borehole No 13 and 2.2 % in Borehole No 1 during the first visit. Carbon dioxide concentrations were all at 0.1 % during the second visit and between 0.1 % and 0.9 % during the remaining visits, apart from Borehole No 12 which is discussed above. No methane, carbon monoxide, or hydrogen sulphide was identified in any of the four visits.

All boreholes were also tested for volatile organic compounds (VOCs) using a Photoionisation Detector (PID) and recorded a maximum concentration of between 4.3 ppm in Borehole No 17A during the second visit, but concentrations of 0.0 ppm and 0.054 ppm were recorded in this borehole during the first and third visits respectively. A moderate to significant flow was recorded in Borehole Nos 1, 5 and 13 of 4.0 l/h, 19.9 l/hr and 20.2 l/hr respectively during the first visit, but no flow was recorded during the remaining five visits. Relative downhole pressure was measured at between 3 mb and 245 mb also during the first visit but was measured to be 0 mb during the remaining five visits. Breezy conditions were observed on the day of the first monitoring visit, which is likely to have affected the flow readings. This appears to have been

confirmed with the further five monitoring visits, and as such the average flow rate should be considered to be < 0.1 l/hr. It is recommended the monitoring programme be extended with an additional three visits to confirm this view. The full results of gas and groundwater monitoring are appended.

In determining the significance of soil gas concentrations both the gas concentrations and borehole flow rates are used to define a characteristic situation for a site based on the limiting borehole gas volume flow, renamed as the Gas Screening Value (GSV) for methane and carbon dioxide. In this case the following GSVs have been determined, in accordance with guidance provided by CIRIA⁹.

Gas	Max concentration % vol.	Avg flow rate l/hr	GSV
Methane	0.0	< 0.1	N/A
Carbon dioxide	6.1	< 0.1	0.0061

The gas screening value is calculated using the following formula:

$$\text{GSV} = \text{flow rate} \times (\text{concentration of gas}/100)$$

The gas screening value of less than 0.07 l/hr indicates Characteristic Situation 1 (CS1). For a carbon dioxide concentration of above 5 %, consideration should usually be given to increasing to a Characteristic Situation 2 (CS2), but the carbon dioxide concentration has not been replicated since, and this was recorded during the first monitoring visit for that standpipe, such that gas is likely to have been able to build up. The additional three recommended visits will confirm this view.

4.10 Existing Foundations

The findings of the trial pits are summarised in the table below. Sketches and photographs of the pits are included in the appendix.

Trial Pit No	Structure	Foundation detail	Bearing Stratum
1	Southeastern wall of building along northwestern extent of site	Brick wall over mass concrete pad Top 0.26 m Base 0.58 m Lateral projection 380 mm	MADE GROUND.
2	Southern wall of main workshop in north of site	Brick wall of concrete strip Top 0.30 m Base 0.58 m Lateral projection 0 mm	MADE GROUND.
3	Northern wall of office building extension	Brick wall over mass concrete pad Top 0.64 m Base 0.92 m Lateral projection 260 mm	Soft orange brown sandy SILT.
4	Concrete block associated with main workshop in north of site	Mass concrete pad Top 0.60 m Base not proved Lateral projection 400 mm	Not proved – trial pit terminated at a depth of 0.62 m due to presence of suspected asbestos containing material.

⁹ Wilson, S, Oliver, S, Mallett, H, Hutchings, H and Card, G (2006) *Assessing risks posed by hazardous ground gases to buildings* CIRIA Report C659

Trial Pit No	Structure	Foundation detail	Bearing Stratum
5	Northern wall of office building	Brick wall over mass concrete pad Top 0.44 m Base 0.74 m Lateral projection 230 mm	MADE GROUND.
6	Southwestern corner of office block in south of site	Brick wall over mass concrete pad Top 0.28 m Base 0.42 m Lateral projection 200 mm	MADE GROUND.
7	Southeastern corner of office block in southeast of site	Mass concrete pad Top 0.00 m Base 0.96 m Lateral projection 400 mm	Soft orange brown sandy slightly gravelly SILT.

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 the proposed development.

5.0 INTRODUCTION

It is understood that it is proposed to demolish the existing buildings and subsequently construct a new residential development providing a total of 272 homes, comprising a number of apartment blocks of between four storeys and 12 storeys in addition to two-storey houses, with associated areas of public realm, private and communal soft landscaping and new roads and pavements.

It is understood that one of the buildings in the northeastern corner of the site is proposed to include a 5.5 m deep basement.

6.0 GROUND MODEL

The findings of the desk study and the site walkover indicate that the site has had a potentially contaminative history by virtue of it having been occupied by a fuel filling station, various warehouses for servicing and repairing vehicles, vehicle washing facilities, a refuse destructor, a spreading salt stockpile, and storage for bin lorries. On the basis of the fieldwork, the ground conditions at this site can be characterised as follows:

-  beneath a variable but generally moderate and locally significant thickness of made ground, Enfield Silt was encountered, below which the Kempton Park Gravel Member was encountered overlying the London Clay Formation, whereupon Lambeth Group was encountered and proved to the full depth investigated of 30.00 m (-21.35 m OD);
-  a concrete surfacing is present across the site on average 0.23 m thick, but in excess of 1.00 m in some locations;
-  made ground extends to depths of between 0.50 m and 3.80 m (8.15 m OD and 5.76 m OD), but generally to between 0.80 m and 1.50 m (7.67 m OD and 7.80 m OD) and comprises dark brown, orange-brown and yellowish brown slightly clayey gravelly sand with variable amounts of brick, concrete, flint gravel, plastic, metal, glass, carbonaceous material including suspected ash and clinker, ceramics, tile, suspected asbestos containing materials and roots and rootlets;
-  the Enfield Silt comprises soft orange-brown silty slightly sandy gravelly clay and is present to depths of between 1.30 m and 3.00 m (7.17 m OD and 5.86 m OD);
-  the Kempton Park Gravel comprises dense and very dense orange brown slightly clayey gravelly sand and sandy gravel, present to depths of between 4.50 m and 6.00 m (4.60 m OD and 2.67 m OD);
-  the London Clay initially comprises a layer of firm becoming stiff dark brown fissured clay to depths of between 14.00 m and 17.00 m (-4.44 m OD and -7.79 m OD) with rare fine selenite, whereupon very stiff dark grey slightly silty slightly sandy fissured

- clay with rare fine mica and occasional bioturbation is present to depths of between 23.40 m and 26.00 m (-14.45 m OD and -16.59 m OD);
-  the Lambeth Group comprises very stiff dark grey and multicoloured silty sandy gravelly clay with rounded black pebbles and shells and dense light grey silty gravelly sand, also with rounded black pebbles, shells, siltstones and occasional fine chalk gravel, present to the full depth investigated of 30.00 m (-14.94 m OD);
 -  groundwater is present within the Kempton Park Gravel at depths of between 3.00 m and 4.00 m and was encountered at depths of between 22.50 m and 24.50 m (-13.83 m OD and -15.64 m OD) rising to depths of between 21.00 m and 23.50 m (-12.14 m OD and -14.84 m OD) in the Lambeth Group;
 -  subsequent groundwater monitoring has measured groundwater at depths of between 0.74 m and 2.85 m (8.19 m OD and 6.71 m OD);
 -  contamination testing has measured elevated concentrations of lead, arsenic, nickel, copper, zinc, sulphide, TPH, dibenz(a,h)anthracene, benzo(b)fluoranthene, benzo(a)anthracene and benzo(a)pyrene within the made ground and TPH within the Enfield Silt;
 -  testing of groundwater samples has indicated elevated concentrations of nickel and TPH and leachate testing has indicated elevated concentrations of lead and zinc above the relevant groundwater screening values;
 -  asbestos was detected in three samples of 29 tested and subsequent quantification testing indicated concentrations of 0.018 % and < 0.001 %; and
 -  gas monitoring carried out to date suggests the site falls under a Characteristic Situation 1, however it is recommended an additional three visits are carried out to confirm this view.

7.0 ADVICE AND RECOMMENDATIONS

In view of the thickness of made ground and the anticipated high loads, spread foundations may only be appropriate for the lower rise structures, whilst piled foundations will be required to support the larger new structures.

The excavation for the proposed basement structure in the northeast of the site will require temporary support to prevent any excessive ground movements. Whilst groundwater was not encountered during drilling, subsequent monitoring has recorded shallow groundwater at depths of between 2.50 m and 2.93 m (7.06 m OD and 5.93 m OD) in Borehole No 2, drilled close to the proposed basement, which is above the formation level of 5.50 m below ground level.

Basement formation level is expected to be towards the base of Kempton Park Gravel, which was present to a depth of 5.60 m (3.96 m OD) in Borehole No 2, below which the London Clay was encountered.

7.1 Basement Excavation

7.1.1 Basement Construction

It is understood that the proposed basement will extend to a depth of approximately 5.50 m below ground level, such that formation level is likely to be towards the base of the dense gravel of the Kempton Park Gravel. The groundwater monitoring has indicated groundwater to be present at depths of between 2.50 m and 2.96 m (7.06 m OD and 5.90 m OD) in Borehole No 2, located close to the proposed basement, which is above the proposed basement level. On this basis, groundwater inflows are likely to be encountered within the excavation and a requirement for groundwater protection should be assumed.

Shallow inflows of perched water may also be encountered from within the made ground particularly in the vicinity of existing structures. However, any such inflows are likely to be relatively minor in nature and should be adequately dealt with through sump pumping, although it would be prudent for the chosen contractor to have a contingency plan in place to deal with more significant or prolonged inflows as a precautionary measure. It would also be prudent, once access is available, to carry out a number of trial excavations to depths as close to the full basement depth as possible to provide an indication of the likely ground water conditions, following which groundwater control measures can be finalised.

There are a number of methods by which the sides of the basement excavation could be supported in the temporary and permanent conditions. The choice of wall will be governed, to a large extent, by whether it is to be incorporated into the permanent works and have a load bearing function. Consideration should also be given to the need to protect nearby structures from movements, the required overall stiffness of the support system and the potential need to control groundwater movement through the wall in the temporary condition.

Given the size of the development, the most appropriate method of constructing the basement and supporting the excavation will be through the use of a secant or contiguous bored piled wall. On the basis that groundwater will be encountered within the basement excavation, a secant piled wall may be the most suitable option and may remove a requirement for secondary groundwater control and also maximise the usable space within the basement structure. The use of sheet piles is not considered to be a viable option due to the noise and vibrations associated with their installation.

The ground movements associated with the basement excavation will depend on the method of excavation and support and the overall stiffness of the basement structure in the temporary condition. Thus, a suitable amount of propping will be required to provide the necessary rigidity. In this respect the timing of the provision of support to the wall will have an important effect on movements. The stability of the adjacent foundations will need to be ensured at all times.

A ground movement analysis and building damage assessment may be required in due course.

7.1.2 Retaining Walls

The following parameters are suggested for the design of the permanent basement retaining walls.

Stratum	Bulk Density (kg/m ³)	Effective Cohesion (c' – kN/m ²)	Effective Friction Angle (Φ' – degrees)
Made Ground	1750	Zero	27
Kempton Park Gravel	1950	Zero	36
London Clay	2000	Zero	23

Provided a fully effective drainage system can be ensured in order to prevent the build-up of groundwater behind the retaining walls from surface water runoff and periodic seepages within the made ground, it should be possible to design the excavation on the basis that water will not collect behind the walls. If an effective drainage system cannot be ensured, then a water level of two-thirds of the basement depth should be assumed. The advice in BS8102:2009¹⁰ should be followed in this respect and with regard to the provision of suitable waterproofing and groundwater monitoring should be continued.

7.1.3 Basement Heave

The 5.50 m deep excavations to form the proposed basements will result in a net unloading of up to approximately 110 kN/m².

This unloading will result in elastic heave and long-term swelling of the underlying clay soils, although these movements will to a certain extent be counteracted by the applied loads from the proposed development. These movements could be mitigated through the use of tension piles, or the provision of compressible material below the slab, but further consideration should be given to these aspects once the loads are known.

7.2 Spread Foundations

Moderately sized pad or strip foundations bearing in the dense Kempton Park Gravel may be designed to apply a net allowable bearing pressure of 225 kN/m² at a minimum depth of 0.90 m, allowing for restricted new planting in accordance with National House Building Council (NHBC) guidelines for low volume change potential clay. This value incorporates an adequate factor of safety against bearing capacity failure and should ensure that settlement remains within normal tolerable limits.

Foundations should bypass the made ground and soft Enfield Silt which will make spread foundations uneconomic in some locations. Additional ground investigation would be required to check that spread foundations could be adopted.

7.3 Piled Foundations

For the ground conditions at this site, the moderate thickness of granular soils and the presence of groundwater, continuous flight auger (CFA) piles would be the most appropriate which would not require the provision of any casing.

The following table of ultimate coefficients may be used for the preliminary design of piles, although these values may change following the completion of geotechnical testing.

¹⁰ BS8102 (2009) *Code of practice for protection of below ground structures against water from the ground*

Stratum	Depths m	kN / m ²
Ultimate Skin Friction		
Made Ground / Enfield Silt	GL to 2.00	Ignore
Kempton Park Gravel	2.00 to 6.00	10
London Clay ($\alpha = 0.5$)	6.00 to 24.00	Increasing linearly from 34 to 95
Lambeth Group	24.00 to 30.00	90
Ultimate End Bearing		
London Clay	10.00 to 24.00	Increasing linearly from 850 to 1475
Lambeth Group	24.00 to 30.00	2000

In the absence of pile tests, guidance from the London District Surveyors Association (LDSA)¹¹ suggests that a factor of safety of 2.6 should be applied to the above coefficients in the computation of safe theoretical working loads within the London Clay.

On the basis of the above coefficients, the following pile capacities have been estimated.

Pile diameter mm	Depth Below Ground Level m	Safe Working Load kN
300	12	135
	15	225
	20	345
	25	510
	28	625
450	12	225
	15	360
	20	550
	25	810
	28	980
600	12	330
	15	510
	20	775
	25	1125
	28	1350
750	12	445
	15	680

¹¹ LDSA (2017) *Guidance notes for the design of straight shafted bored piles in London Clay*. LDSA

Pile diameter mm	Depth Below Ground Level m	Safe Working Load kN
	20	1025
	25	1490
	28	1740

The above examples are not intended to constitute any form of recommendation with regard to pile size or type, but merely serve to illustrate the use of the above coefficients and may change in light of the geotechnical testing. Specialist piling contractors should be consulted with regard to the design of a suitable piling scheme and their attention should be drawn to the potential for the presence of groundwater inflows within the Kempton Park Gravel and Lambeth Group, as well as the potential presence of sand lenses within the London Clay.

7.4 Shallow Excavations

On the basis of the borehole and trial pit findings, it is considered likely that it will be feasible to form relatively shallow excavations terminating within the made ground or Enfield Silt without the requirement for lateral support in the short term.

Significant inflows of groundwater into shallow excavations are not generally anticipated. Seepages may be encountered from perched water tables within the made ground, although such inflows should be suitably controlled by sump pumping.

If deeper excavations are considered or if excavations are to remain open for prolonged periods it is recommended that provision be made for battered side slopes or lateral support and the requirement for groundwater protection. Where personnel are required to enter excavations, a risk assessment should be carried out and temporary lateral support or battering of the excavation sides considered in order to comply with normal safety requirements.

7.5 Floor Slabs

The ground floor slab is likely to be formed within the made ground, such that a suspended slab is likely to be required.

Gas monitoring carried out to date has suggested the site falls under a CS1, but it is recommended an additional three visits are carried out to confirm this view.

Following the excavation of the basement, it is likely that the floor slab for the proposed basement will need to be suspended over a void to accommodate the anticipated heave unless the slab can be suitably reinforced to cope with these movements. This should be reviewed once the levels and loads are known.

7.6 Pavement Design

A total of six in situ CBR tests were carried in three locations at depths of 0.40 m and 0.60 m (9.19 m OD and 8.99 m OD). CBR values of between 5.1 % and 25.0 % were recorded at 0.40 m (9.19 m OD) and between 7.6 % and 36.0 % at 0.60 m (8.99 m OD), although the higher results are likely to be due to the presence of gravel at each depth, and as such a CBR value 5.0 % should be achievable. Where formation level for hardstanding and access roads is likely to be within the made ground, all pavements should be designed on the basis of a CBR value of less than 2 %.

Two soaked laboratory CBR tests were also carried out on samples retrieved from 1.00 m which gave CBR values of between 2.2 % and 2.4 %.

Formation level should be proof rolled any soft spots revealed should be removed and replaced with suitable granular fill or lean mix concrete.

7.7 Disposal of Surface Water

In order to provide an indication of the suitability of shallow drainage for the disposal of surface water, soakage tests were carried out in three trial pits. Three tests were carried out in Infiltration Test locations 2 and 3 and two tests were carried out in Infiltration Test location 1. The results of the soakage testing and ground conditions are summarised below.

Infiltration Test Location	Ground conditions	Test Number	Test Depth (m) [m OD]	Infiltration rate (m/s)	Infiltration rate (m/day)
1	MADE GROUND	1	1.00 [7.88]	4.27×10^{-6}	0.37
		2		1.35×10^{-6}	0.12
2	MADE GROUND	1	1.00 [8.60]	9.43×10^{-6}	0.81
		2		6.39×10^{-6}	0.55
		3		4.49×10^{-6}	0.39
3	MADE GROUND	1	1.00 [7.67]	6.29×10^{-6}	0.54
		2		4.68×10^{-6}	0.41
		3		4.71×10^{-6}	0.41

The tests yielded soakage rates of between 9.43×10^{-6} m/s to 1.35×10^{-6} m/s in the made ground; these assessments are based on the linear portion of the graphs, unless otherwise stated. Slightly lower infiltration rates were recorded in Infiltration Test Location 1 which had a much higher clay content than the other locations and as such only two tests were possible in the time.

The soakage results have indicated that the design soakage value of 4.49×10^{-6} m/s should be adopted and as such it is unlikely to be feasible to adopt soakaways in the made ground. The full results of the soakage testing are appended.

Given that the identified elevated concentrations of contaminants, discussed further in Section 7.8, are unlikely to be in a soluble form and should not pose a risk to groundwater, in addition to the recorded depth to groundwater, the use of permeable paving should provide an appropriate means for the disposal of surface water. The use of permeable paving should not pose a risk to shallow foundations or slope stability.

Guidance provided within CIRIA C753¹² and by NHBC¹³ should be referred to for the design of permeable paving.

7.8 Effect of Sulphates

Chemical analyses of the made ground have revealed reasonably high concentrations of soluble sulphate and near neutral pH in the made ground, in accordance with Class DS-4 conditions of Table C2 of BRE Special Digest 1:SD Third Edition (2005). The measured pH values of the

¹² The SUDS Manual CIRIA C753 (2015)

¹³ NHBC (2010) *A simple guide to Sustainable Drainage Systems for housing*.

samples show that an ACEC class of AC-4 would be appropriate which assumes a mobile water condition at the site.

Chemical analyses of the natural soils have revealed much lower concentrations of soluble sulphate and near neutral pH in the made ground, in accordance with Class DS-2 conditions of Table C2 of BRE Special Digest 1:SD Third Edition (2005). The measured pH values of the samples show that an ACEC class of AC-2 would be appropriate. These values assume a mobile water condition at the site. The guidelines contained in the digest should be followed in the design of foundation concrete.

7.9 Site Specific Risk Assessment

The findings of the desk study and the site walkover indicate that the site has had a potentially contaminative history by virtue of it having been occupied by a fuel filling station, various warehouses for servicing and repairing vehicles, vehicle washing facilities, a refuse destructor, a spreading salt stockpile, and storage for bin lorries. The contamination testing has identified elevated concentrations of lead, arsenic, nickel, copper, zinc, sulphide, TPH and PAH within the made ground and TPH within the Enfield Silt.

The source of the lead, arsenic, copper, zinc and nickel contamination is unknown but the made ground was noted as containing fragments of extraneous material and it is possible that fragments of such material could account for the elevated concentrations. The lead contamination was encountered across the site in 32 of the 36 samples tested, the highest concentrations were recorded in CBR Test Location 2, Trial Pit Nos 101, 101A and 103A, and Borehole Nos 5, 9 and 14, all of which are located in the former bin lorry storage area. The made ground in these areas was noted to contain ash and clinker.

The elevated concentrations of arsenic were identified in 18 samples across the site, the highest concentrations were encountered in Borehole Nos 2, 3 and 9, Trial Pit No 101A, CBR Test Location 2 and Infiltration Test Location 2 all located in the northeast of the site. The elevated concentrations of nickel and copper were identified in three and two samples tested respectively retrieved from Borehole No 2, Trial Pit No 101A and Infiltration Test Location 2, again located in the northeast of the site. The elevated concentrations of zinc were identified in two samples tested retrieved from Borehole No 3 and CBR test location 2, both of which are, again, located in the northeast of the site.

Leachate testing carried out on four soil samples that contained the highest metal concentrations were found to contain elevated concentrations of lead in all four samples tested and zinc in a single sample tested above the relevant groundwater screening values. As such, a risk to groundwater has been identified. Groundwater testing has also been carried out on four samples, two of which were found to contain elevated concentrations of nickel retrieved from Borehole Nos 13 and 17A located in the centre of the site and just to the south of the fuel filling station respectively. The sample from Borehole No 17A was also found to contain elevated concentrations of TPH, specifically bands C16-C21 and C21-C35.

The source of the PAH contamination is not known, but speciation of the results has indicated elevated concentrations of dibenz(a,h)anthracene in seven samples tested, benzo(b)fluoranthene in five samples tested, benzo(a)pyrene in two samples tested and benzo(a)anthracene in a single sample tested. The elevated concentrations were again recorded in samples taken from the northeast corner of the site. Based on the proportions of individual PAH compounds, the identified concentrations are indicative a pyrogenic origin comprising typical made ground with ash etc containing part burnt coal. The specific proportions of

individual PAHs are indicative of this material being degraded oil / bitumen. The PAH contamination identified is unlikely to be in a soluble form.

The TPH contamination was present within the made ground at depth of 0.50 m in Borehole No 14 and Trial Pit No 4, but no individual hydrocarbon chains were above the generic risk-based screening values for a residential without plant uptake end use. TPH contamination was also present within the Enfield Silt in Borehole No 17A, with significantly elevated concentrations of C21+ which is most likely to be attributable to spillages of diesel. Borehole No 14 was drilled to the north of the fuel filling station and Borehole No 17A to the south and therefore the contamination is likely attributable to localised spillages of diesel and leakage of the underground tanks or fuel interceptors. Elevated concentrations of TPH, specifically C21+, were also measured in the groundwater retrieved from Borehole No 17A. The fuel tanks and any grossly contaminated should be removed which will remove the source. Additional investigation should be carried out prior to the tank removal to determine whether contaminated soil removal is sufficient or if some form of remediation may be required.

Asbestos screening was undertaken in the laboratory under electron microscope on 35 shallow soil samples given the history of the site and was identified in two samples. Chrysotile has been identified in Trial Pit Nos 102 and 103A in the northeast of the site and in CBR Test Location 3 in the south of the site both at a depth of 0.40 m. Subsequent asbestos quantification has been carried out and recorded concentrations of 0.018 % in Trial Pit No 102 and < 0.001 % in both Trial Pit No 103A and CBR Test Location 3. Asbestos containing materials were also identified in Trial Pit Nos 101A and 102A. Four bulk samples of suspected asbestos containing materials were screened for the presence of asbestos and all were found to comprise chrysotile in the form of a hard / cement type material. It is likely that asbestos may be present elsewhere within the made ground in areas that have not been investigated.

A moderate to significant thickness of made ground is present beneath the site, and it would be prudent to keep the made ground separate from the natural soils and carry out additional asbestos screening of samples of made ground to be removed from the site to determine if any further asbestos from the building has entered the made ground.

The presence of elevated concentrations of sulphide should not pose a risk to end users.

As the site is underlain by the Enfield Silt, classified as Unproductive Stratum, the contamination would not normally pose a risk to groundwater, but the Enfield Silt was granular in some places and absent in others, and the made ground is directly underlain by the Kempton Park Gravel. The Gravel is classified as a Secondary 'A' Aquifer, and therefore groundwater should be considered a sensitive receptor. Given that the observed contamination is relatively immobile and unlikely to be in a soluble form and is considered to be non-volatile or of a low volatility, the contamination does not present a significant risk to groundwater through leaching, migration to adjacent sites or vapour risk.

7.9.1 End Users

In areas of soft landscaping, a pathway will exist by which end users can come into contact with any contamination in the shallow soils, via direct contact, accidental ingestion of soil and soil-derived dust and soil adhering to homegrown produce. The proposed development in the northeast of the site, where the highest concentrations of contamination were encountered, comprises the excavation of a basement which will remove the entirety of made ground in this area, along with the grossly contaminated soils.

The critical exposure pathways identified will be direct soil and dust ingestion, consumption of homegrown produce, consumption of soil adhering to homegrown produce, skin contact with soils

and dust, and inhalation of dust. The initial site strip is likely to result in the removal of much of the made ground, but if any remains below gardens or landscaped areas clean soil should be imported to provide a cover thickness of clean subsoil and topsoil in garden areas of 600 mm and 300 mm below communal grassed areas, in accordance with recommendations from BRE¹⁴ with a geotextile marker layer at the base over the made ground. Where this requirement results in the removal of the entire remaining thickness of made ground, the thickness of clean soil can be reduced accordingly, although it would be prudent to test the formation level as well as the imported soil.

It is recommended that a watching brief be maintained during ground works by the contractor and any suspected contamination, especially in areas not covered by the investigation, should be brought to the attention of a geoenvironmental engineer.

7.9.2 Site Workers

Site workers should be made aware of the contamination and a programme of working should be identified to protect workers handling any soil. The method of site working should be in accordance with guidelines set out by HSE¹⁵ and CIRIA¹⁶ and the requirements of the Local Authority Environmental Health Officer.

If suspicious soils are encountered during the construction works, then a suitably qualified engineer should inspect the soils and further testing should be carried out if required.

7.9.3 Buried Plastic Services

Consideration may need to be given to the protection of buried plastic water supply services laid within the made ground. Details of the proposed protection measures for buried plastic services will in any case need to be approved by the EHO and the relevant service authority prior to the adoption of any scheme. It is likely that barrier pipe will be required.

7.9.4 Asbestos

The asbestos-containing material is only a risk to humans if the asbestos fibres become airborne. Given the positive identification of asbestos within three samples of the made ground, as well as four bulk samples, it can be assumed that some of the made ground contains a degree of asbestos. Quantification testing revealed that the concentration of asbestos found in Trial Pit No 102 was 0.018 % and in CBR Test Location 3 and Trial Pit No 103A was 0.018 % and < 0.001 % respectively. The bulk samples were found to comprise chrysotile in the form of a hard / cement type material.

As asbestos is insoluble and was found to be present as loose fibres, it is not considered to pose any meaningful risk to groundwater, the development or to neighbouring sites through migration in the ground. It is however potentially hazardous to human health as airborne fibres and could thus pose a risk through inhalation. In wet soil, the asbestos is highly unlikely to be released so the risk is minimal, but it is essential that the soil is not allowed to dry out and produce dust and this could be achieved by capping or damping down. If encountered, bonded asbestos cement boarding may be excavated safely, so long as the material is kept wet at all times, workers wear appropriate PPE (i.e. disposable overalls, gloves and FFP3 face masks) and the material is double bagged in clearly labelled heavy duty polythene bags.

However, the local authority and / or HSE should be consulted prior to commencement of any excavations. The local authority or Environment Agency will also be able to provide

¹⁴ BRE (2004) *Cover systems for land regeneration. Thickness of cover systems for contaminated land.* BRE pub 465

¹⁵ HSE (1992) HS(G)66 *Protection of workers and the general public during the development of contaminated land*
HMSO

¹⁶ CIRIA (1996) *A guide for safe working on contaminated sites* Report 132, Construction Industry Research and Information Association

information on the nearest suitable waste disposal facility licensed to accept asbestos. It is recommended that an asbestos expert is consulted, and that air monitoring is carried out during groundworks. Site workers should be made aware of the contamination and a programme of working should be identified to protect site workers¹⁷ handling any soil.

7.10 Waste Disposal

Under the European Waste Directive, waste is classified as being either Hazardous or Non-Hazardous and landfills receiving waste are classified as accepting hazardous or non-hazardous wastes or the non-hazardous sub-category of inert waste in accordance with the Waste Directive. Waste classification is a staged process, and this investigation represents the preliminary sampling exercise of that process. Once the extent and location of the waste that is to be removed has been defined, further sampling and testing may be necessary. The results from this ground investigation should be used to help define the sampling plan for such further testing, which could include WAC leaching tests where the totals analysis indicates the soil to be a hazardous waste or inert waste from a contaminated site. It should however be noted that the Environment Agency guidance WM3¹⁸ states that landfill WAC analysis, specifically leaching test results, must not be used for waste classification purposes.

Any spoil arising from excavations or landscaping works, which is not to be re-used in accordance with the CL:AIRE¹⁹ guidance, will need to be disposed of to a licensed tip. Waste going to landfill is subject to landfill tax at either the standard rate of £98.60 per tonne (about £185 per m³) or at the lower rate of £3.15 per tonne (roughly £6.10 per m³). However, the classifications for tax purposes and disposal purposes differ and currently all made ground and topsoil is taxable at the 'standard' rate and only naturally occurring soil and stones, which are accurately described as such in terms of the 2011 Order, would qualify for the 'lower rate' of landfill tax.

Based on the technical guidance provided by the EA it is considered likely that the soils encountered during this ground investigation, as represented by the chemical analyses carried out, would be generally classified as follows;

Soil Type	Waste Classification (Waste Code)	WAC Testing Required Prior to Landfill Disposal?	Current applicable rate of Landfill Tax
Made ground	Non-Hazardous (17 05 04)	No	£98.60 / tonne (Standard rate)
Made ground	Non-Hazardous (containing asbestos) (17 05 04)	No	£98.60 / tonne (Standard rate)
Made ground containing elevated copper, lead, and nickel	Hazardous (17 05 03)	Should not be required but confirm with receiving landfill	£98.60 / tonne (Standard rate)
Natural soil	Inert (17 05 04)	Should not be required but confirm with receiving landfill	£3.15 / tonne (Reduced rate for uncontaminated naturally occurring rocks and soils)

Any soils containing asbestos may be classified as HAZARDOUS waste if the concentration is over 0.1%. It would be prudent to screen made ground for asbestos before exporting off-site.

Under the requirements of the European Waste Directive all waste needs to be pre-treated prior to disposal. The pre-treatment process must be physical, thermal, chemical or biological, including sorting. It must change the characteristics of the waste in order to reduce its volume,

¹⁷ The Release of Dispersed Asbestos Fibres from Soils, Addison et. al., 1988 http://www.iom-world.org/pubs/IOM_TM8814.pdf
¹⁸ Environment Agency 2015. *Guidance on the classification and assessment of waste*. Technical Guidance WM3 First Edition
¹⁹ CL:AIRE March 2011. *The Definition of Waste: Development Industry Code of Practice* Version 2

hazardous nature, facilitate handling or enhance recovery. The waste producer can carry out the treatment but they will need to provide documentation to prove that this has been carried out. Alternatively, the treatment can be carried out by an approved contractor. The Environment Agency has issued a position paper²⁰ which states that in certain circumstances, segregation at source may be considered as pre-treatment and thus excavated material may not have to be treated prior to landfilling if the soils can be segregated onsite prior to excavation by sufficiently characterising the soils insitu prior to excavation.

The above opinion with regard to the classification of the excavated soils is provided for guidance only and should be confirmed by the receiving landfill once the soils to be discarded have been identified.

The local waste regulation department of the Environment Agency (EA) should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The tips will be able to provide costs for disposing of this material but may require further testing.

8.0 OUTSTANDING RISKS AND ISSUES

This section of the report aims to highlight areas where further work is required as a result of limitations on the scope of this investigation, or where issues have been identified by this investigation that warrant further consideration. The scope of risks and issues discussed in this section is by no means exhaustive but covers the main areas where additional work may be required.

The ground is a heterogeneous natural material and variations will inevitably arise between the locations at which it is investigated. This report provides an assessment of the ground conditions based on the discrete points at which the ground was sampled, but the ground conditions should be subject to review as the work proceeds to ensure that any variations from the Ground Model are properly assessed by a suitably qualified person.

Upon completion of the gas monitoring programme comprising six visits, the site likely falls under a Characteristic Situation 1. However, in light of recording a single high concentration of carbon dioxide and a relatively high flow rate, it is recommended an additional three visits are carried out to confirm this view. In any case, monitoring of the standpipes should be carried out over as long a period as possible to determine the extent of any seasonal variations.

It is recommended that further exploratory work should be undertaken once the buildings on site have been demolished in order to access areas of the site beneath the footprint of existing structures and to focus on the presence of contamination in proposed landscaped areas.

The leaching tests have indicated that some of the contaminants in the made ground have the potential to affect the groundwater and groundwater testing has identified the presence of elevated concentrations of nickel and TPH.

A specialist should be contacted with regard to the presence of asbestos fibres within the made ground and an asbestos survey should be undertaken within the buildings on site prior to their demolition.

²⁰ Environment Agency 23 Oct 2007 *Regulatory Position Statement Treating non-hazardous waste for landfill - Enforcing the new requirement*

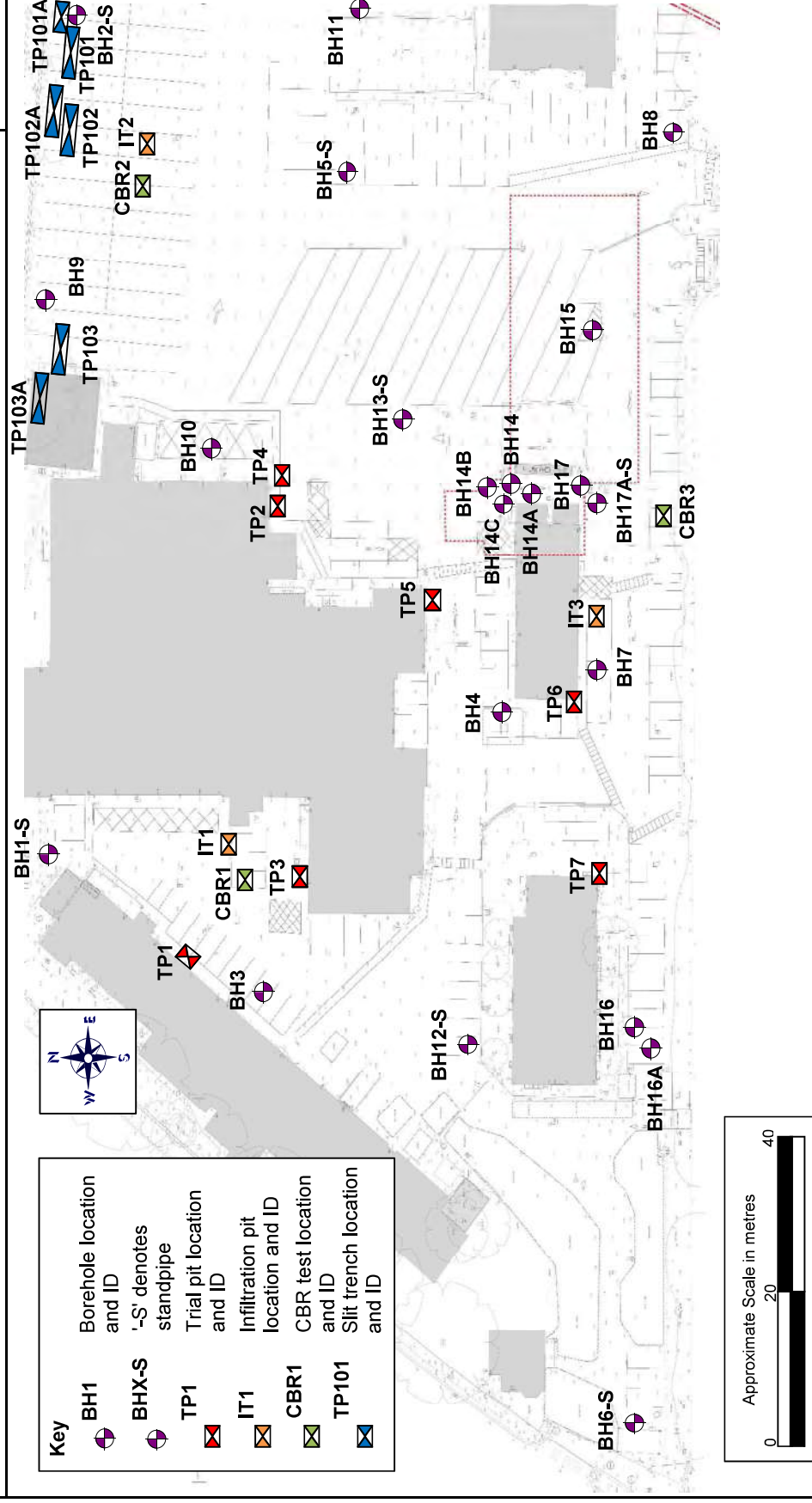
This investigation has indicated the presence of contamination and recommendations have been made for the mitigation of this contamination in light of the current development proposals. This report should be viewed as the first stage in a process which culminates in the provision of a Verification Report confirming that the remediation has been carried out satisfactorily. The next stage in this process should be consultation with the Local Environmental Health Officer (EHO) and Environment Agency (EA) and the provision of Remediation Proposals that can be agreed with these parties as a basis for the remediation of the contamination.

If during ground works any visual or olfactory evidence of contamination is identified, it is recommended that further investigation be carried out and that the risk assessment is reviewed. These areas of doubt should be drawn to the attention of prospective contractors and further investigation will be required or sufficient contingency should be provided to cover the outstanding risk.

APPENDIX

Site Plan
Borehole Records
Trial Pit Records
Slit Trench Records
Geotechnical Test Results
SPT Cohesion Depth Plot
In-situ CBR Test Results
Soakage Testing Results
Contamination Test Results
Asbestos Air Monitoring Results
Gas Monitoring Results
Generic Risk Based Screening Values
Groundwater Screening Values
Envirocheck Report
Envirocheck Extracts
Historical Maps
London Fire Brigade Environmental Search
Preliminary UXO Risk Assessment

Site	Ashley Road Depot, Ashley Road, Tottenham
Client	Haringey Council
Engineer	Civic Engineers
Job Number	J21294
Sheet	1 / 1



Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH1
Job No J21294	Date 01-12-21 02-12-21	Ground Level (m OD) 8.86	Co-Ordinates () E 534,433.0 N 190,173.0	
Client Haringey Council		Engineer Civic Engineers		Sheet 1 of 4

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.30	ES1	1,1/2,2,3,3 N60 = 9		8.63		0.23	CONCRETE	
0.50	B1			8.36		0.50	MADE GROUND (brick and concrete rubble).	
1.00	D2						Soft orange brown silty sandy CLAY with occasional flint gravel.	
1.20	D3	20 blows						
1.75	D4					(2.50)		
2.00	U1001							
2.75	D5	3,4/6,6,8,10 N60 = 28		5.86		3.00	Medium dense orange brown slightly sandy GRAVEL. Gravel is fine to coarse grained, angular to subrounded and of flint. Sand is fine to coarse.	
3.00	B2							
3.75	D6					(1.80)	Medium strength becoming high strength, firm becoming stiff blueish grey slightly sandy fissured CLAY with occasional fine selenite.	
4.00	B3	6,6/8,9,9,11 N60 = 34						
4.75	D7	2,2/3,4,5,5 N60 = 16		4.06		4.80		
5.00	D8							
6.00	D9							
6.50	U1002	30 blows						
7.50	D10							

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. 50 mm diameter gas and groundwater monitoring standpipe installed to a depth of 5.00 m, with a response zone from 4.00 m and 5.00 m. Groundwater strike at a depth of 24.50 m, rising to 21.00 m after 30 mins. Filling water drums for aiding drilling for 30 mins.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable percussion rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH1	
Job No J21294	Date 01-12-21 02-12-21	Ground Level (m OD) 8.86	Co-Ordinates () E 534,433.0 N 190,173.0		
Client Haringey Council		Engineer Civic Engineers		Sheet 2 of 4	

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
8.00	D11	3,4/5,5,6,7 N60 = 21					Medium strength becoming high strength, firm becoming stiff blueish grey slightly sandy fissured CLAY with occasional fine selenite.(continued)	
9.00	D12							
9.50	U1003	33 blows				(10.20)		
10.50	D13							
11.00	D14	3,4/6,6,8,10 N60 = 28						
12.00	D15						Very high strength, stiff becoming very stiff dark grey fissured slightly sandy CLAY with occasional fine mica and rare bioturbation.	
12.50	U1004	38 blows						
13.50	D16							
14.00	D17	2,5/6,8,8,11 N60 = 30						
15.00	D18			-6.14		15.00		
15.50	U1005	42 blows						

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. 50 mm diameter gas and groundwater monitoring standpipe installed to a depth of 5.00 m, with a response zone from 4.00 m and 5.00 m. Groundwater strike at a depth of 24.50 m, rising to 21.00 m after 30 mins. Filling water drums for aiding drilling for 30 mins.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable percussion rig	Logged By JW
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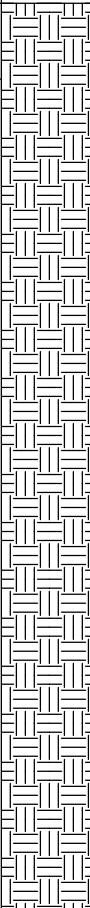
Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH1	
Job No J21294	Date 01-12-21 02-12-21	Ground Level (m OD) 8.86	Co-Ordinates () E 534,433.0 N 190,173.0		
Client Haringey Council		Engineer Civic Engineers		Sheet 3 of 4	

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
16.50	D19						Very high strength, stiff becoming very stiff dark grey fissured slightly sandy CLAY with occasional fine mica and rare bioturbation.(continued)	
17.00	D20	5,6/8,8,10,12 N60 = 35						
18.00	D21						18.00 ...light grey fine SAND.	
18.50	U1006	48 blows						
19.50	D22					(9.50)		
20.00	D23	5,7/9,10,12,14 N60 = 41						
21.00	D24		1					
21.50	U1007	53 blows						
22.50	D25							
23.00	D26	6,8/10,11,13,14 N60 = 44						

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. 50 mm diameter gas and groundwater monitoring standpipe installed to a depth of 5.00 m, with a response zone from 4.00 m and 5.00 m. Goundwater strike at a depth of 24.50 m, rising to 21.00 m after 30 mins. Filling water drums for aiding drilling for 30 mins.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable percussion rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH1	
Job No J21294	Date 01-12-21 02-12-21	Ground Level (m OD) 8.86	Co-Ordinates () E 534,433.0 N 190,173.0		
Client Haringey Council		Engineer Civic Engineers		Sheet 4 of 4	

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
24.00	D27			-15.64		24.50	Very high strength, stiff becoming very stiff dark grey fissured slightly sandy CLAY with occasional fine mica and rare bioturbation.(continued)	
24.50	U1008	60 blows					Very stiff grey sandy gravelly CLAY with shells. Gravel coarse and rounded.	
25.50	D28							
26.00	D29	8,11/13,16,13,19 N60 = 56						
27.00	D30					(5.50)		
27.50	D31	25/50 N = 50/75 mm						
28.50	D32							
29.00	D33	10,14/16,19,17,23 N60 = 69						
30.00	D34	25/50 N = 50/75 mm		-21.14		30.00		

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. 50 mm diameter gas and groundwater monitoring standpipe installed to a depth of 5.00 m, with a response zone from 4.00 m and 5.00 m. Groundwater strike at a depth of 24.50 m, rising to 21.00 m after 30 mins. Filling water drums for aiding drilling for 30 mins.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable percussion rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH2	
Job No J21294	Date 29-10-21 02-11-21	Ground Level (m OD) 9.56	Co-Ordinates () E 534,541.0 N 190,166.0		
Client Haringey Council		Engineer Civic Engineers		Sheet 1 of 4	

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.30	D1	0,1/0,1,1,1 N60 = 3		9.26		0.30	CONCRETE	
0.50	B1						MADE GROUND (dark brown very clayey gravelly sand with flint gravel, occasional brick, abundant concrete, rare road, plastic, glass and carbonaceous material).	
1.00	D2							
1.20	D3							
1.25	D4	25/50 N = 50/75 mm						
2.00	D5					(3.50)		
2.25	D6							
3.00	D7							
3.75	D8	3,5/7,10,12,12 N60 = 38		5.76		3.80	Dense orange brown sandy GRAVEL. Gravel is fine to coarse grained, angular to subrounded and of flint. Sand fine to coarse.	
4.00	B2					(1.80)		
4.75	D9							
5.00	B3							
6.00	D10	4,6/8,10,14,11 N60 = 39		3.96		5.60	High strength becoming very high strength, firm becoming stiff dark brown fissured CLAY with occasional fine selenite.	
6.50	U1001							
7.50	D11							

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. 50 mm diameter gas and groundwater monitoring standpipe installed to a depth of 6.00 m, with a response zone from 4.00 m and 6.00 m. Groundwater strike at a depth of 24.50 m, rising to 23.00 m after 20 mins. Filling water drums for aiding drilling for 30 mins. Bagging up spoil, reinstating borehole and tidying up for 2 hours.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable Percussion Rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH2
Job No J21294	Date 29-10-21 02-11-21	Ground Level (m OD) 9.56	Co-Ordinates () E 534,541.0 N 190,166.0	
Client Haringey Council		Engineer Civic Engineers		Sheet 2 of 4

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
8.00	D12	3,3/4,4,5,7 N60 = 18					High strength becoming very high strength, firm becoming stiff dark brown fissured CLAY with occasional fine selenite.(continued)	
9.00	D13							
9.50	U1002	34 blows				(8.40)		
10.50	D14							
11.00	D15	3,4/4,6,8,8 N60 = 24						
12.00	D16						Very high strength, stiff becoming very stiff dark grey fissured CLAY with occasional fine mica and bioturbation towards the base.	
12.50	U1003	38 blows						
13.50	D17							
14.00	D18	4,6/8,8,10,10 N60 = 33		-4.44		14.00		
15.00	D19							
15.50	U1004	42 blows						

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. 50 mm diameter gas and groundwater monitoring standpipe installed to a depth of 6.00 m, with a response zone from 4.00 m and 6.00 m. Groundwater strike at a depth of 24.50 m, rising to 23.00 m after 20 mins. Filling water drums for aiding drilling for 30 mins. Bagging up spoil, reinstating borehole and tidying up for 2 hours.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable Percussion Rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH2	
Job No J21294	Date 29-10-21 02-11-21	Ground Level (m OD) 9.56	Co-Ordinates () E 534,541.0 N 190,166.0		
Client Haringey Council		Engineer Civic Engineers		Sheet 3 of 4	

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
16.50	D20						Very high strength, stiff becoming very stiff dark grey fissured CLAY with occasional fine mica and bioturbation towards the base.(continued)	
17.00	D21	5,7/10,10,11,13 N60 = 40						
18.00	D22							
18.50	U1005	47 blows				(9.50)		
19.50	D23						22.50 ...light greenish grey fine SAND.	
20.00	D24	7,9/11,14,13,16 N60 = 50						
21.00	D25							
21.50	D26	6,9/12,15,17,16 N60 = 55						
22.50	D27						Stiff greenish grey gravelly CLAY with shells. Gravel coarse and rounded.	
23.00	D28	8,12/15,17,21,23 N60 = 70						
			1 ▽	-13.94		23.50		

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. 50 mm diameter gas and groundwater monitoring standpipe installed to a depth of 6.00 m, with a response zone from 4.00 m and 6.00 m. Groundwater strike at a depth of 24.50 m, rising to 23.00 m after 20 mins. Filling water drums for aiding drilling for 30 mins. Bagging up spoil, reinstating borehole and tidying up for 2 hours.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable Percussion Rig	Logged By JW
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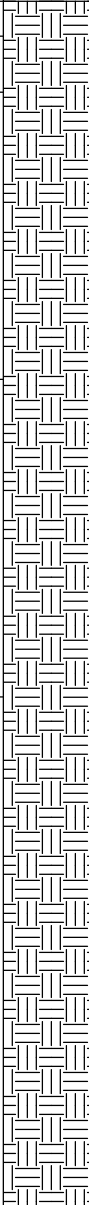
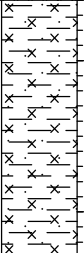
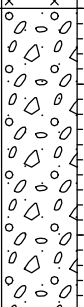
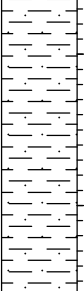
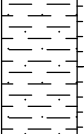
Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH2
Job No J21294	Date 29-10-21 02-11-21	Ground Level (m OD) 9.56	Co-Ordinates () E 534,541.0 N 190,166.0	
Client Haringey Council		Engineer Civic Engineers		Sheet 4 of 4

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
24.00	D29			-14.94	(1.00)	24.50	Stiff greenish grey gravelly CLAY with shells. Gravel coarse and rounded.(continued)	
24.50	D30	6,8/11,13,15,18 N60 = 52				(1.50)	Dense light grey clayey SAND with occasional claystones.	
25.50	D31			-16.44		26.00		
26.00	D32	5,9/11,14,15,18 N60 = 53				(4.00)	Dense light grey silty gravelly SAND	
27.00	D33							
27.50	D34	25/50 N = 50/75 mm						
28.50	D35							
29.55	D36	25/50 N = 50/75 mm		-20.44		30.00		

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. 50 mm diameter gas and groundwater monitoring standpipe installed to a depth of 6.00 m, with a response zone from 4.00 m and 6.00 m. Groundwater strike at a depth of 24.50 m, rising to 23.00 m after 20 mins. Filling water drums for aiding drilling for 30 mins. Bagging up spoil, reinstating borehole and tidying up for 2 hours.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable Percussion Rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH3
Job No J21294	Date 03-12-21 06-12-21	Ground Level (m OD) 8.88	Co-Ordinates () E 534,415.0 N 190,141.0	
Client Haringey Council		Engineer Civic Engineers		Sheet 1 of 4

SAMPLES & TESTS			Water	STRATA			Instrument / Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)		DESCRIPTION
0.30	ES1 B1	1,1/1,2,1,2 N60 = 6		8.65		0.23	CONCRETE	
0.50				8.28		0.60	MADE GROUND (brick and concrete rubble).	
1.00					(1.90)	Soft orange brown silty sandy CLAY with occasional flint gravel with black staining and hydrocarbon odour.		
1.20	D3	1,1/1,2,1,2 N60 = 6						
1.75	D4	25 blows						
2.00	U1001	25 blows	6.38		2.50	Medium dense orange brown sandy GRAVEL. Gravel is fine to coarse grained, angular to subrounded and of flint. Sand is fine to coarse.		
2.75	D5	6,7/9,10,10,12 N60 = 38		(2.10)	Medium strength, firm becoming stiff blueish grey slightly sandy fissured CLAY.			
3.00	B2							
3.75	D6							
4.00	B3	4,6/7,9,8,7 N60 = 28	4.28		4.60			
4.75	D7	3,4/6,6,5,6 N60 = 21						
5.00	D8							
6.00	D9							
6.50	U1002	30 blows						
7.50	D10							

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. Goundwater strikes at depths of 3.50 m rising to 2.80 m after 20 mins and 24.00 m, rising to 22.00 m after 30 mins. Filling water drums for aiding drilling for 30 mins.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable percussion rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH3	
Job No J21294	Date 03-12-21 06-12-21	Ground Level (m OD) 8.88	Co-Ordinates () E 534,415.0 N 190,141.0		
Client Haringey Council		Engineer Civic Engineers		Sheet 2 of 4	

SAMPLES & TESTS			STRATA					Instrument / Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
8.00	D11	3,5/6,7,8,8 N60 = 27					Medium strength, firm becoming stiff blueish grey slightly sandy fissured CLAY.(continued)	
9.00	D12					(9.40)		
9.50	U1003	32 blows						
10.50	D13							
11.00	D14	4,6/6,8,8,11 N60 = 30						
12.00	D15							
12.50	U1004	35 blows						
13.50	D16							
14.00	D17	4,6/8,8,10,12 N60 = 35		-5.12		14.00	High strength, stiff becoming very stiff dark grey fissured CLAY with rare fine mica.	
15.00	D18							
15.50	U1005	40 blows						

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. Goundwater strikes at depths of 3.50 m rising to 2.80 m after 20 mins and 24.00 m, rising to 22.00 m after 30 mins. Filling water drums for aiding drilling for 30 mins.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable percussion rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH3	
Job No J21294	Date 03-12-21 06-12-21	Ground Level (m OD) 8.88	Co-Ordinates () E 534,415.0 N 190,141.0		
Client Haringey Council		Engineer Civic Engineers		Sheet 3 of 4	

SAMPLES & TESTS			STRATA					Instrument / Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
16.50	D19						High strength, stiff becoming very stiff dark grey fissured CLAY with rare fine mica.(continued)	
17.00	D20	3,6/8,10,11,14 N60 = 39					17.00 ...light grey fine SAND.	
18.00	D21							
18.50	U1006	48 blows						
19.50	D22							
20.00	D23	5,8/9,11,13,15 N60 = 44						
21.00	D24							
21.50	U1007	52 blows						
22.50	D25							
23.00	D26	6,8/10,13,15,17 N60 = 50						
				-15.12		24.00		

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. Goundwater strikes at depths of 3.50 m rising to 2.80 m after 20 mins and 24.00 m, rising to 22.00 m after 30 mins. Filling water drums for aiding drilling for 30 mins.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable percussion rig	Logged By JW
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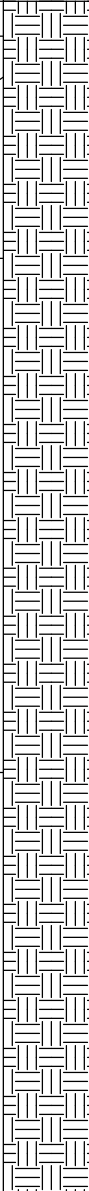
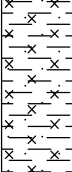
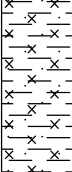
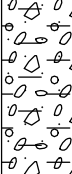
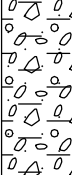
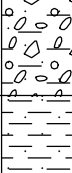
Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH3
Job No J21294	Date 03-12-21 06-12-21	Ground Level (m OD) 8.88	Co-Ordinates () E 534,415.0 N 190,141.0	
Client Haringey Council		Engineer Civic Engineers		Sheet 4 of 4

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
24.00	D27						Very stiff grey clayey gravelly SAND. Gravel fine to coarse, rounded and of flint.	
24.50	D28	9,11/13,15,18,21 N60 = 61						
25.50	D29							
26.00	D30	6,8/11,14,16,14 N60 = 50						
27.00	D31					(6.00)		
27.50	D32	9,12/15,18,20,19 N60 = 66						
28.50	D33							
29.00	D34	25/50 N = 50/75 mm						
30.00	D35	25/50 N = 50/75 mm		-21.12		30.00		

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. Goundwater strikes at depths of 3.50 m rising to 2.80 m after 20 mins and 24.00 m, rising to 22.00 m after 30 mins. Filling water drums for aiding drilling for 30 mins.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable percussion rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH4	
Job No J21294	Date 02-12-21 05-12-21	Ground Level (m OD) 8.65	Co-Ordinates () E 534,455.0 N 109,108.0		
Client Haringey Council		Engineer Civic Engineers		Sheet 1 of 4	

SAMPLES & TESTS			Water	STRATA			Instrument / Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		DESCRIPTION
0.50	ES1	1,0/1,0,1,0 N60 = 2		8.42		0.23	CONCRETE with reinforcement	
				8.15		0.50	MADE GROUND (dark brown brick and concrete rubble with carbonaceous material).	
						(1.20)	Soft grey brown silty very sandy CLAY with occasional flint gravel.	
1.00	D2	1,0/1,0,1,0 N60 = 2						
1.20	D3							
1.75	D4	1,1/1,1,2,2 N60 = 5		6.95		1.70	Loose brown clayey very sandy GRAVEL. Gravel fine to coarse grained, subangular to subrounded and of flint.	
2.00	B1							
2.75	D5	5,7/8,10,10,12 N60 = 30						
3.00	B2							
3.75	D6	4,7/8,10,9,7 N60 = 26						
4.00	B3							
4.75	D7	2,2/3,3,4,4 N60 = 11						
5.00	B4							
6.00	D8	2,3/4,5,6,7 N60 = 17		3.55		5.10	Medium strength becoming very high strength, firm becoming very stiff blueish grey slightly sandy fissured CLAY with rare fine mica.	
6.50	D9							
7.50	D10							

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. Groundwater strike at a depth of 22.90 m. Filling water drums for aiding drilling for 30 mins. Bagging up spoil, reinstating borehole and tidying up for 2 hours.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable Percussion Rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH4	
Job No J21294	Date 02-12-21 05-12-21	Ground Level (m OD) 8.65	Co-Ordinates () E 534,455.0 N 109,108.0		
Client Haringey Council		Engineer Civic Engineers		Sheet 2 of 4	

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
8.00	U1001	20 blows					Medium strength becoming very high strength, firm becoming very stiff blueish grey slightly sandy fissured CLAY with rare fine mica.(continued)	
9.00	D11							
9.50	D12	3,3/4,5,6,8 N60 = 17						
10.50	D13							
11.00	U1002	25 blows						
12.00	D14							
12.50	D15	4,5/7,7,8,8 N60 = 23						
13.50	D16							
14.00	U1003	25 blows				(18.00)		
15.00	D17							
15.50	D18	5,7/7,8,8,12 N60 = 26						

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. Goundwater strike at a depth of 22.90 m. Filling water drums for aiding drilling for 30 mins. Bagging up spoil, reinstating borehole and tidying up for 2 hours.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable Percussion Rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH4
Job No J21294	Date 02-12-21 05-12-21	Ground Level (m OD) 8.65	Co-Ordinates () E 534,455.0 N 109,108.0	
Client Haringey Council		Engineer Civic Engineers		Sheet 3 of 4

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
16.50	D19						Medium strength becoming very high strength, firm becoming very stiff blueish grey slightly sandy fissured CLAY with rare fine mica.(continued)	
17.00	U1004	40 blows						
18.00	D20	6,8/9,8,9,14 N60 = 30						
18.50	D21							
19.50	D22							
20.00	U1005	50 blows					20.00 - 23.10 ...increasing fine grey sand bands with depth.	
21.00	D23							
21.50	D24	6,8/10,10,11,15 N60 = 35						
22.50	D25							
23.00	D26	25/50 N = 50/75 mm		-14.45		23.10	22.90 ...dark grey cemented siltstone. Dense grey clayey gravelly SAND with shells becoming reddish grey silty CLAY with depth. Gravel fine to coarse, rounded and of flint.	

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. Goundwater strike at a depth of 22.90 m. Filling water drums for aiding drilling for 30 mins. Bagging up spoil, reinstating borehole and tidying up for 2 hours.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable Percussion Rig	Logged By JW
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Project Ashley Road Depot, Ashley Road, London				BOREHOLE No BH4
Job No J21294	Date 02-12-21 05-12-21	Ground Level (m OD) 8.65	Co-Ordinates () E 534,455.0 N 109,108.0	
Client Haringey Council		Engineer Civic Engineers		Sheet 4 of 4

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
24.00	D27	8,12/14,18,20,23 N60 = 56					Dense grey clayey gravelly SAND with shells becoming reddish grey silty CLAY with depth. Gravel fine to coarse, rounded and of flint.(continued)	
24.50	D28							
25.50	D29							
26.00	D30	25/50 N = 50/75 mm				(6.90)		
27.00	D31							
27.50	D32							
28.50	D33	7,15/17,16,17,18 N60 = 51						
29.00	D34							
30.00	D35							
		25/50 N = 50/75 mm		-21.35		30.00		

Boring Progress and Water Observations						GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	
						Breaking out concrete for 30 mins. Services inspection pit excavated to a depth of 1.20 m for 1 hour. Erecting Heras fencing for 30 mins. Goundwater strike at a depth of 22.90 m. Filling water drums for aiding drilling for 30 mins. Bagging up spoil, reinstating borehole and tidying up for 2 hours.

All dimensions in metres Scale 1:50	Method/ Plant Used Cable Percussion Rig	Logged By JW
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