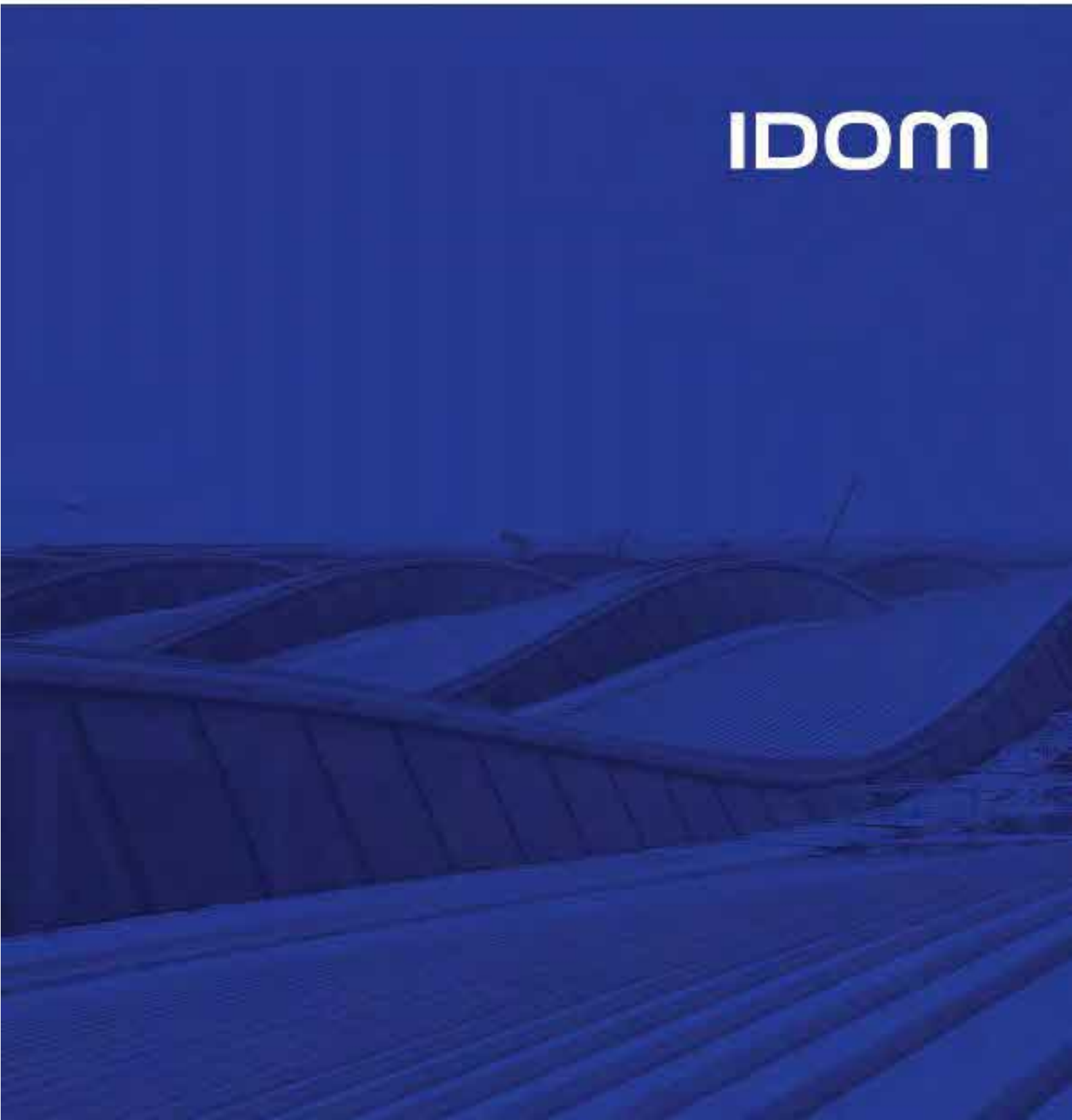
GEOENVIRONMENTAL AND GEOTECHNICAL ASSESSMENT
81-88 BERESFORD STREET
WOOLWICH
B WOOLWICH LTD
GEA-22277-23-283 REV 4
FEBRUARY 2024



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0	CMM	SE	31/07/2023	-
1	CMM	SE	31/07/2023	Update CSM
2	KM	SE	06/12/2023	Update preliminary pile design: Table 13 and Figure 5
3	CMM	SE	15/02/2024	Update following additional ground investigation
4	CMM	SE	16/02/2024	Update following client comments

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EXECUTIVE SUMMARY

A Geo-Environmental Assessment was requested by B Woolwich Ltd. The purpose of the assessment was to identify any contaminative or geotechnical issues associated with former land use at 81-88 Beresford Street, Woolwich which might impact on the site's redevelopment.

SITE DETAILS	
Approximate site area	0.1 ha
Current use / historic use	Catholic club and historically used for religious building and reside properties.
Proposed use	Multistorey residential tower block.

PHASE 1 NON-INTRUSIVE INVESTIGATION	
Expected geology	Limited made ground overlying superficial head deposits and solid geology of the Thanet Sand Formation to depths ranging between 17 and 19 m overlying chalk.
Groundwater	Thanet Sand Formation designated a Secondary A Aquifer. Undifferentiated Chalk designated a Principal Aquifer.
Surface water	River Thames 300m north. No surface water abstraction license and no risk of surface water flooding.
Other	UXO risk in London.

PHASE 2 EXPLORATORY INVESTIGATION	
Ground Conditions	Made ground encountered to between 0.74 and 2.50 m bgl; granular hea deposits encountered to between 3.10 and 3.80 m bgl. Dense to very dense Thanet Sand Formation encountered to between 17.80 and 17.90 m overlying Dm grade and B2 grade chalk. Groundwater stru chalk/Thanet interface, rose to between 11.5 and 10.6 m bgl under artesian pressures.
Contamination Assessment	Moderate exceedance of human health screening values for metals and PAH were noted however these are unlikely to present a significant risk to people and the environment. Asbestos was noted in one location.
Geotechnical Assessment	Near surface made ground and superficial soils unsuitable as bearing stratum. Dense to very dense Thanet Sand Formation suitable as a founding stratum. Undifferentiated chalk underlies the dense sands and is also suitable for deep piled foundations. Nearby Crossrail Tunnel and Thames Water assets a sensitive to ground movement; assessment has been carried out u separate cover. DS-1 and ACEC-1 for buried concrete. Unlikely to be suitable for a soakaway drainage system.

RECOMMENDATIONS	
Geotechnical	Raft foundation solution proposed with bored cast-in-situ piled foundations in highly loaded areas to control settlement of the raft. Ground move assessment undertaken for the foundation solution but further assessme required for temporary works. If piles are to end bear within, or close to, th chalk, then additional provision of a rotary cored borehole to better understand the properties of the chalk. Additionally Pilling Works Risk Assessn vibration assessment and working platform design may also be required.
Remediation	Limited to no remediation required; construction of the basement and development likely to remove or encapsulate contaminated soil.
Waste classification	At this stage, the ground materials identified are expected to be predominantly non-hazardous for the purpose of disposal. The detection of asbestos in one sample above the threshold for hazardous waste implies the ne additional testing of materials will be required when the existing structure i demolished.

SECTION 1 INTRODUCTION

1.1 B Woolwich Ltd proposes to redevelop an area of land located adjacent to Beresford Street, Woolwich currently occupied by a disused Catholic Club. The proposed redevelopment of the site comprises a 14-storey student accommodation tower block. The proposed development also includes:

i. Underground basement;

ii. Outdoor roof terrace atop the south-eastern half of the building.

1.2 IDOM Merebrook Limited (IDOM) has been commissioned by B Woolwich Ltd to undertake preliminary site investigation works and to advise on the geo-environmental and geotechnical implications of the proposed redevelopment and end use.

1.3 The objectives of the investigation are to:

i. Assess surface and sub-surface ground conditions present at the site;

ii. Identify hazards associated with ground contamination which may place constraints on the site and the proposed development;

iii. Evaluate the risks associated with any identified hazards;

iv. Provide preliminary recommendations for the mitigation of any significant risks identified;

v. Provide preliminary geotechnical comments on the feasibility of the proposed raft or piled foundation options;

vi. Evaluate risk associated with the geotechnical aspects of the proposed development.

1.4 A Phase 1 (Non-intrusive Investigation) has previously been completed for the site (Ref: DS-22277-21-94 REVA dated November 2021) and a Phase 2 (Exploratory Investigation) has now been undertaken for the subject site.

1.5 This report presents the findings of the geoenvironmental investigation and provides an interpretation of the geoenvironmental conditions that exist at the site. The contaminative status of the site and the implications with respect to development have been interpreted in accordance with the current government guidance on source-pathway-receptor risk assessment. This report uses a Tier 1 risk assessment to ascribe a conservative qualitative appraisal of the hazards associated with the site.

1.6 Additionally, this report presents an interpretation of the ground conditions in relation to the geotechnical aspects of the development. Preliminary calculations have been made to assess the feasibility of the proposed raft or piled foundation options. These calculations should not be considered a detail design of the foundation options;

further advice should be sought from the structural engineer and specialist foundation contractors.

1.7 This report has been prepared for B Woolwich Ltd for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult B Woolwich Ltd and IDOM as to the extent to which the findings may be appropriate for their use.

SECTION 2 PHASE 1 (NON-INTRUSIVE INVESTIGATION)

2.1 INTRODUCTION

2.1.1 The non-intrusive investigation has been conducted with reference to the documents and sources detailed in Table 1 below:

Table 1: Published Data and Information Sources

Source Data	Groundsure/Landmark Data
BGS 1:50,000 Series Geological Sheet 271	Ordnance Survey (OS) historical maps scaled at 1:10,560, 1:10,000, 1:2,500, 1:1,250 and 1:1,056 dated 1866 - 2021
BGS Geology of Britain 1:50,000 onl maps	Water abstraction, discharge and pollutior data
Radon: guidance on protection measure for new dwellings	Registered waste management sites
Environment Agency (EA) online data maps	Mining records and natural ground stability data
UK National Air Quality Archive, online	Protected areas of environmentally sensitive land use or conservation
Planning Records	Other relevant designations and/or authorisations and Trade Directory entries

2.1.2 The above sources are all authoritative and it is believed that they are reasonably reliable. However, independent verification of the information supplied has not necessarily been carried out and IDOM cannot be held liable for inaccuracies or deficiencies in the information.

2.2 SITE LOCATION AND SETTING

2.2.1 The site is located approximately 13.7 km east of London City centre to the northeast of Beresford Street, Woolwich. The National Grid Reference (NGR) for the approximate centre of the site is ^{5}43678 ^{1}79059. A site location plan is presented on the drawing 22277-001-001 in Appendix 1. Figure 1 shows the redline boundary of the site and nearby landmarks.

2.2.2 The site occupies an area of approximately 0.10 hectares. The southeastern boundary and part of the northeastern boundary is formed by a wooden fence. The southwestern and northwestern boundaries are formed by the existing building that covers the majority of the site and wooden fencing.

2.2.3 Beresford street is located immediately southwest of the site whilst the surrounding areas comprise recently constructed residential tower blocks, particularly to the north, and areas of public open space with some commercial buildings.

2.2.4 The site is almost completely occupied by an existing building that was formerly used as a Catholic Club. Access was granted through the building at the time of the investigation and the interior of the building comprised a bar and open areas

assumed to have been used historically for events. However, a detailed survey of the building was not conducted for potentially contaminative uses. The northern are of the site was occupied by temporary portacabins that support the adjacent Berkely construction office/welfare; although it is understood that most, if not all, of these cabins have recently been removed from the site. This are of the site is covered entirely by tarmac hardstanding and was used as pedestrian access to the Berkely office/welfare.

2.2.5 There are no trees located within the site area, however two semi-mature/mature maple trees are located a few meters beyond the southernmost corner of the site. No evidence of protected/invasive species were identified, although there was evidence of bird activity within the building.

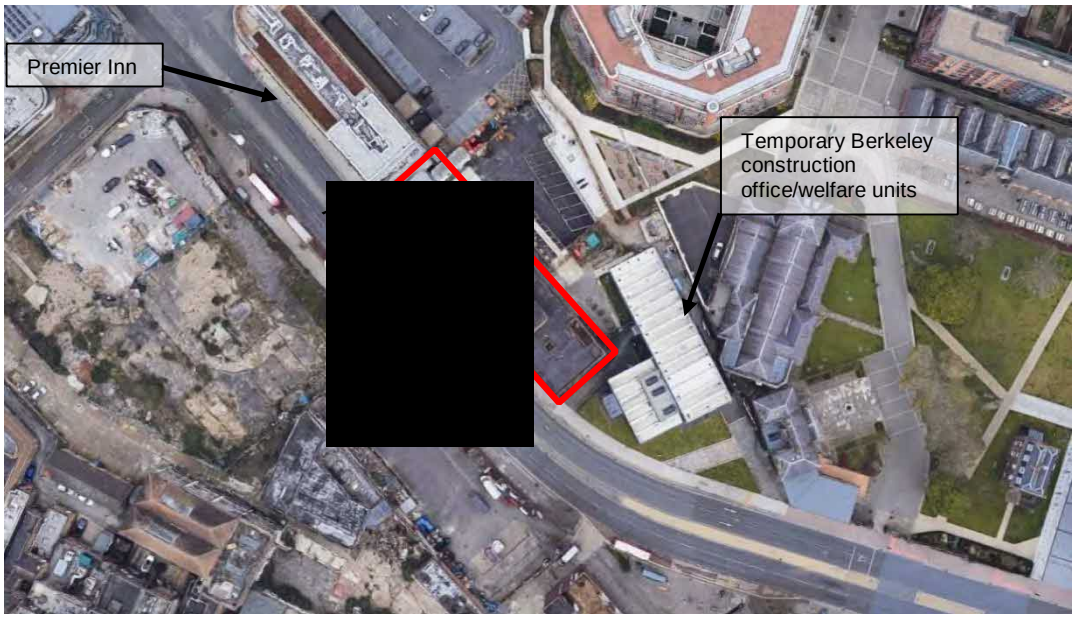


Figure 1: Recent satellite imagery of site (red boundary) and surrounding land.

2.2.6 As the subject site lies within the footprint of a pre-existing building, the site topography is flat. The existing site building is not adjoined to any other structures.

2.3 SITE HISTORY

2.3.1 The site history, based on a review of the historic and current maps, dating from 1866 to 2021 is summarised below. Potentially contaminative land uses are shown in **bold**. Copies of key maps used in this review are provided in Appendix 2.

Table 2: Summary of the key features shown on historic maps

DATA SOURCE	SITE / SURROUNDINGS
1866	Site: Site was occupied by unmarked buildings, presumed to b larger residential properties.

DATA SOURCE	SITE / SURROUNDINGS
(1:10,560 scale) and 1869 (1:2,500 scale) 1.	Surroundings: Beresford Street formed the southwestern boundary of the site and Rope Yard Rails (roadway) formed the north-eastern boundary. Terraced residential plots were present adjacent to the site. Within 30 m of site, an extensive **Military Store Department** was indicated with a gun yard, timber yard, and many unspecified large military buildings. In many of the later historical maps, the military ground was shown as blank presumably for security purposes. To the south and east comprised built up residential streets with a church within 50 m southeast of the site and a **Smithy** within 100 m west of the site boundary. A theatre was indicated within 90 m north of the site. A **Gas Works** existed approximately 200 m north of the site on the banks of the Thames with a large **Workshop** indicated approximately 300 m northwest of site. A training **Royal Artillery Barracks**, **Royal Marine Barracks**, **Naval Hospital** and a training barracks existed within 1 km west and southwest of the site **railway** line was indicated running within approximately 150 south of the site with a station roughly 300 m southeast of site.
1882, 1894 and 1894-1899 (1:10,560 scale), 1896 (1:1,056 scale) and 1897 (1:2,500 scale).	Site: No significant changes.
	Surrounding: Royal Arsenal West military-owned area (within 30 m east of the site) was shown blank and extends eastwards. The gas works to the north of site has been indicated as a **Timber Yard**. A Drill Hall and a School were indicated within 50 and 60 m west of the site and **Tramway** lines run along Beresford Street.
1916 (1:2,500 scale) and 1920 (1:10,560 scale).	Site: The site has become almost entirely occupied by a Bapti place of worship with only the southern section of the site occupied by a terraced residential plot.
	Surroundings: Royal Arsenal West military-owned area (wit 30 m east of the site) was shown blank and extends eastward The **Military Barracks** to the southwest has extended to withi 400 m of the site. The Workhouse and Timber Yard to the north of site have no longer been indicated.
1916 (1:2,500 scale) and 1920 (1:10,560 scale).	Site: The site has become almost entirely occupied by a Bapti place of worship with only the southern section of the site occupied by a terraced residential plot.
	Surroundings: Royal Arsenal West military-owned area (wit 30 m east of the site) was shown blank and extends eastward The **Military Barracks** to the southwest has extended to within 400 m of the site. The Workhouse and Timber Yard to the north of site have no longer been indicated.
1948 and 1962-1966 (1:10,560 scale), 1956-1957 (1:1,250 scale) and 1958 (1:2,500 scale)	Site: No significant changes.
	Surroundings: Royal Arsenal West military owned area remair blank / unmapped. The tramway line is no longer indicated Beresford Street. From 1957 mapping onwards, a car park h replaced terraced residential buildings directly north of Rope Yard Rails (within 10 m of site). A large **Works** building has been indicated approximately 200 m northwest of the site. Woolw

DATA SOURCE	SITE / SURROUNDINGS
	Polytechnic college has been indicated approximately 2! southwest of the site. Increased commercial buildings have beer indicated within 300 m southeast of the site, including a covere market, a cinema and a furniture depository.
1970-1971 (1:10,560 scale) and 1970-1971 (1:1,250 scale).	Site: The terraced residential property has been removed from the south of site.
	Surroundings: Royal Arsenal West military area remains blank unmapped. A **Garage** directly north of the site has been bu adjacent to the northern site boundary. Rope Yard Rails road has been divided by the garage. North of the garage, **builders' yards**, **works** and **factory** buildings have been indicated. Works building 250 m northwest of site is indicated as a **Power Station**.
1988-1990 and 1995 (1:10,000 scale) and 1988 and 1991 (1:1,250 scale).	Site: Building has been extended to cover the whole of site footprint as it is today.
	Surroundings: Royal Arsenal West military area remains blank unmapped. Beresford Street has extended to become a carriageway. The Power Station to the north of site has b developed into a car park.
2001 (1:10,000 scale) and 2003 (1:1,250 scale).	Site: No significant changes.
	Surroundings: **Royal Brass Foundry** is shown approximately 30 m from the site. Two **Royal Laboratory** buildings have been indicated from 100 m north and northeast of the site.
2010 (1:10,000 scale).	Site: No significant changes.
	Surroundings: Garage and works buildings to the north have been removed. Museums have been indicated 250 m northeast of th site.
2021 (1:10,000 scale).	Site: No significant changes.
	Surroundings: Neighbouring hotel building and car park have been constructed directly north of the site. Further high-rise residentia developments been built from approximately 50 m northeast of the site and extending northwards to the River Thames.

2.3.2 In summary, historic plans show that the subject site has been developed from residential buildings which pre-date 1866 up until 1910s, by which time the site was largely occupied by a Baptist Tabernacle. This remained *in situ* until the 1970s, when the building occupying the site today was constructed.

2.3.3 From historic mapping the nearby potential contaminative land uses within 250 m of the site have included a gas works, workshops, a power plant, a garage, builders and timber yards, and nearby barracks.

2.3.4 Former military land to the northeast known as the *Royal Arsenal London / Woolwich Warren* has existed from 21 m northeast of the site. Although this has not been indicated in many of the historical maps, it is known that the site was used for armaments manufacture, ammunition proofing, explosives research for British armed forces; Shell Filling factories/explosive factories on site/gas works and chemical works. Based on mapping data available online for the Royal Arsenal

history[1], the Laboratory Department buildings existed in closest proximity to the site (roughly 21 m northeast). Due to these activities existing on site until 1994, it is important that contamination derived from the Royal Arsenal London is considered for the subject site.

2.3.5 Given the nature of the historical mapping process (scale, representation of conditions at discrete time intervals frequency *etc*.), any such maps and plans may not provide a comprehensive account of a site's history. Identification of pertinent land uses and associated potentially contaminative activities, may therefore be absent from mapping records.

2.4 GEOLOGY

2.4.1 The British Geological Survey (BGS) indicates that the site is underlain by the following geological sequence:

Table 3: Summary of Published Geology

Geological Unit	Type	Description	Anticipated thickness on site (m)
Superficial	Head deposits	Clay, silt, sand and gravel	2
Solid	Thanet Sand Formation	Sand	15
Solid	Undifferentiated Chalk	Chalk	>30m

2.4.2 The BGS indicates two borehole records located approximately 12 m and 24 m northeast of the site, respectively. These boreholes both suggest up to 3 m of variable made ground. One of the boreholes records the presence of granular superficial river terrace deposits to a depth of 4 m. Underlying the made ground and superficial deposits, the Thanet Sand Formation is recorded from 3 m and 4 m, respectively; and comprises light brown sand. The undifferentiated chalk is recorded from 17.42 m and 18.60 m, respectively, to the base of the two boreholes. The chalk is generally described as moderately weak, high density white chalk, grades B2 and B3 within the rotary borehole which is considered to be more representative of the in-situ character of the chalk rather than the cable percussive boreholes which describes the chalk as very weak, medium density and from 28.00 m as comminuted chalk.

2.4.3 There is no reference to made/filled ground onsite from the Groundsure report.

2.5 HYDROGEOLOGY

2.5.1 The Aquifer status of groundwater held within the geological units, the presence of Source Protection Zones and related abstractions are summarised in Table 4.

[1] https://www.royal-arsenal-history.com/royal-arsenal-west---woolwich.html

Table 4: Summary of Published Geology

Geological Unit	Aquifer Designation	Source Protection Zone	Location of Abstraction
Superficial Head	Secondary Undifferentiated	None	None within 1 km
Thanet Sand Formation	Secondary A		
Undifferentiated Chalk	Principal Aquifer		

2.6 HYDROLOGY

2.6.1 There are two surface water features within 250m of the site. These are identified as insignificant ponds roughly 200 m south of the site. The River Thames lies approximately 300 m north of site.

2.6.2 There are no surface water abstraction licences within 1 km of the site.

2.6.3 The flood risk from EA mapping is negligible.

2.6.4 Groundwater flooding susceptibility is considered low risk on the site.

2.7 CURRENT SITE ISSUES

2.7.1 Potentially significant environmental issues have been investigated within relevant distances of the site, based on the database of records supplied by Groundsure. These relate to the following searches:

i. Water discharge or pollution incidents within 250 m of the site;

ii. Waste management sites within 250 m of the site;

iii. Statutory authorisations within 50 m of the site;

iv. Trade directory entries of possible contaminative use within 50 m of the site;

v. Special protection or conservation areas within 50 m of the site; and

vi. Any other relevant issues.

2.7.2 Potentially significant environmental issues identified by the above searches are summarised in Table 5.

Table 5: Potentially significant environmental issues.

ENVIRONMENTAL CATEGORY	DESCRIPTION
Water discharge or pollution incidents within 250 m	None identified.
Waste management sites within 250 m	A licenced waste transfer station existed from 1992 to 2009 22 m south est of site for commercial and industrial waste. This is considered unlikely to impact the subject site.
Statutory authorisations within 50 m	None identified.
Trade directory entries of possible contaminative use within 50 m	None identified.
Special protection or conservation areas within 50 m	None identified.
Other relevant issues	Crossrail 1 railway line (Elizabeth line) lies within proximity to the site. Nearby tunnel alignments exist 19 m and northeast of site.

2.8 INDICATIVE GROUND STABILITY HAZARDS

2.8.1 The following natural ground subsidence hazard rating have been prescribed:

Table 6: Summary of Natural Ground Subsidence Hazards

Geological Unit	Type	Hazard rating
Superficial Head	Shrink swell clays	Very Low
Thanet Sand Formation	Running sands	Very Low
Thanet Sand Formation	Compressible deposits	Very Low
Thanet Sand Formation	Collapsible deposits	Very Low
Thanet Sand Formation	Landslides	Very Low
Thanet Sand Formation	Ground dissolution of soluble rocks	Negligible

2.9 MINING, GROUND WORKINGS AND NATURAL CAVITIES

2.9.1 The historic maps do not record any evidence of historic mining within the vicinity of the site.

2.9.2 The Sand and Gravel Resources map for the London Boroughs suggest the site is underlain by bedrock sand and gravel resources relating to the Thanet Sand Formation. The nearest active mineral site is Peruvian Warf located on the opposite bank of the River Thames, approximately 1.7 km northwest of the site.

2.9.3 There is no evidence of the extraction of minerals such as coal, gypsum or brine extraction, and the underlying recorded geology is not suitable for the extraction of these resources.

2.10 RADON GAS

2.10.1 The site does not lie within a Radon Affected Area as defined by the former Health Protection Agency, now Public Health England (less than 1% of houses are above the action level). Guidance issued by the Buildings Research Establishment (BRE-211) indicates that no radon protective measures are necessary. Radon dataset maps are provided in Appendix 3.

2.11 UXO

2.11.1 Regional Unexploded Bomb Risk Maps published by Zetica have been consulted which show the area is at high risk from unexploded ordnance. A Luftwaffe target is recorded on the map approximately 300 m northwest of the site. It is recommended that further work is undertaken including a UXO Desktop Search / Preliminary UXO assessment

2.12 AIR QUALITY

2.12.1 The site lies within a designated Air Quality Management Area (AQMA) for the Royal Borough of Greenwich in relation to particulate matter (PM_{10}) 24-hour mean and nitrogen dioxide (NO_2) annual mean. Proposals for new development are likely to require an air quality assessment.

2.13 ECOLOGY AND WOODLAND

2.13.1 Information from environmental and ecological datasets was obtained from a review of the MAGIC (Multi-Agency Geographic Information for the Countryside) website and the Groundsure report. The data assessed indicates that the site lies within a SSSI Impact Risk Zone, however the development proposals are unlikely to trigger a requirement for consultation in this regard. No other environmental designations lie within 1 km of the site.

2.14 ARCHAEOLOGICAL SITES AND ANCIENT MONUMENTS

2.14.1 Information from the visual and cultural designations dataset was obtained from a review of the Groundsure Enviro data Viewer (https://wimby.co.uk/) website in order to identify any archaeological, historic building or historic site receptors that might be relevant to redevelopment of the site.

2.14.2 There are no ancient monuments recorded in the vicinity of the site. There are a number of listed buildings located near to the site that may be sensitive to vibrations associated with construction activity; including the Royal Brass Foundry located approximately 25 m northeast of the site and the Guard House located approximately 35 m east of the site. It may be necessary to undertake a vibration assessment if

significant vibrations are anticipated during construction activities such as a piled foundation.

2.14.3 It is understood that an Archaeological assessment of the site has been undertaken by specialist consultants and their report should be referred to in this regard.

2.15 PREVIOUS INVESTIGATIONS

2.15.1 On the Royal Borough Greenwich planning portal, some information from investigations exists in the area in relation to the wider Berkeley site (Planning reference: 13/0117/O) however, none of these reports include the subject site. A Subadra investigation in 2007 progressed one shallow borehole (to 1.2 m bgl) close to the northern boundary of the site. The extent of the made ground was not proven in the Subadra investigations; however, it was often described as gravelly sands with occasional black staining and rare red brick fragments. Taking information from the wider investigations it is likely that made ground is between 1 and 2 m thick.

2.15.2 Deeper ground investigation information relating to the Premier Inn to the north of the site suggests made ground to depths ranging between 2.50 and 3.60 m bgl, overlying superficial river terrace deposits of sandy gravels to depths raging between 3.50 and 5.30 m bgl. The Thanet Sand Formation is encountered underlying the superficial strata to a maximum depth of 17.60 m bgl, although the base was only proven in one of the exploratory holes. Chalk underlies the Thanet Sand Formation and is described as very weak or putty chalk to a maximum depth of 30 m bgl.

2.16 PRELIMINARY CONCEPTUAL SITE MODEL AND RISK ASSESSMENT

2.16.1 From the Phase 1 assessment a preliminary site conceptual model and risk assessment have been produced using the framework established in Part IIA of the *Environmental Protection Act 1990* and detailed in Contaminated Land Report *CLR11 - Model Procedures for the Management of Land Contamination*.

2.16.2 Risk from contamination has been assessed using the source-pathway-receptor and pollutant linkage methodology, whereby a risk can only exist if all elements of: source, pathway and receptor, are present.

2.16.3 Potential site derived sources of contamination are considered to be limited due to the site not being subject to significant industrial activity. There is potential made ground with contaminative impacts from the demolition, or usage, of the previous residential buildings that existed on the site.

2.16.4 Potential pathways for contamination to impact receptors would include:

i. ingestion of soils / dust / homegrown produce,

ii. inhalation of vapours / dust and

iii. direct contact with materials.

2.16.5 Potential receptors include current site users, future residents of the proposed development, construction workers, groundwater aquifers, new infrastructure, adjacent land and the nearby River Thames.

2.16.6 Pollutant Linkages and Risk Ratings

2.16.7 From the Phase 1 assessment a preliminary site conceptual model has been produced as Table 7 which identifies the potential pollutant linkages. These have been used to inform the Phase 2 intrusive investigation presented in the subsequent sections.

Table 7: Preliminary Conceptual Model

POSSIBLE POLLUTANT LINKAGE			RISK CHARACTERISATION
POTENTIAL SOURCES	**PATHWAYS**	**RECEPTORS**	
Heavy metals and hydrocarbons (made ground)	Contact with contaminated soil	Human health (current users)	**Low risk identified** Potential for made ground beneath existing building infrastructure which can contain elevated metals and hydrocarbons. Exposure limited.
	Ingestion and inhalation of contaminated soil and dust	Human health (current users)	
Heavy metals and hydrocarbons (made ground)	Contact with contaminated soil	Human health (future residents and construction workers)	**Low risk identified** Potential for made ground beneath existing building infrastructure which can contain elevated metals and hydrocarbons. Exposure limited.
	Ingestion and inhalation of contaminated soil and dust	Human health (future residents and construction workers)	
Asbestos (made ground)	Ingestion and inhalation of contaminated soil and dust	Human health (future residents)	**Low risk identified** Potential for made ground to contain asbestos from demolition of buildings. Exposure limited.
Asbestos (made ground)	Ingestion and inhalation of contaminated soil and dust	Human health (construction workers)	**Moderate risk identified** Potential for made ground to contain asbestos from demolition of buildings. Exposure likely.
Contamination (all forms)	Vertical migration to aquifer	Controlled waters	**Low to Moderate risk identified** Potential for localised low-level contamination (which is unlikely to be significantly leachable) to affect Secondary A aquifer.
Contamination (all forms)	Horizontal migration to surface water	Controlled waters	**Low risk identified** Potential for localised low-level contamination (which is unlikely to be significantly leachable) to affect the River Thames.
Hydrocarbons	Direct contact	Plastic water pipes	**Moderate risk identified** Cannot rule out presence of hydrocarbon contamination at this stage.
Hazardous Gas/Vapours In soil	Ingress into buildings and voids	Human health (future residents and construction workers)	**Moderate risk identified** Potential for made ground which could act as source of hazardous gas. Cannot rule out fuel spillages as source of vapours

POSSIBLE POLLUTANT LINKAGE			RISK CHARACTERISATION
POTENTIAL SOURCES	PATHWAYS	RECEPTORS	
Adjacent Land (Former Military Land to the east and northeast)	Leaching and migration via aquifer or run-off	Human health and infrastructure in subject site development	**Low to Moderate risk identified** The former Military land to the north and east has been subject to redevelopment in recent years, however, cannot rule out any unknown leachable contamination derived from the former land uses.
Adjacent Land (Former garage to the north)	Gas/vapours migration, leaching and migration via aquifer	Human health and infrastructure in subject site development	**Moderate risk identified** Potential for fuel spillages on the former garage to the north of site to impact the subject site.

SECTION 3 SITE INVESTIGATION RATIONALE

3.1 INTRODUCTION

3.1.1 A site investigation rationale has been devised in accordance with the findings of the Phase 1 investigation and the resultant preliminary conceptual site model and risk assessment.

3.1.2 Intrusive sampling locations was chosen on the basis of providing the required assessment of ground conditions for the proposed structure, particularly from a geotechnical perspective, whilst avoiding the existing site access constraints.

3.2 SITE INVESTIGATION METHODS

3.2.1 An intrusive investigation was carried out by IDOM between 22nd May and 6th June 2023. Initial delays occurred due to the risk from buried services and the ground investigation was primarily completed between 3rd and 6th June 2023. The investigation comprised the following scope of work:

i. One cable percussion borehole (MBH01) to a depth of 40 metres below ground level (m bgl).

3.2.2 A second phase of ground investigation was undertaken between 8th and 11th January 2024 in the northern corner of the site which was recently acquired by the Client as an extension to the existing site. The second phase of ground investigation comprised the following scope of works:

i. One cable percussion borehole (MBH201) to a depth of 40 metres below ground level (m bgl).

ii. Six windowless sample boreholes (MWS101 to MWS103b) to depths ranging between 0.40 and 5.00m bgl.

3.2.3 A combined exploratory hole location plan is presented on drawing 22277-304-001 Rev. B in Appendix 1. Logging of exploratory holes was undertaken by an IDOM Officer. Exploratory hole logs are provided in Appendix 4.

3.2.4 Initially, hand dug inspection pits were progressed for all the exploratory holes. Additional vacuum excavation was undertaken to progress MBH01 to a maximum depth of 1.50 m bgl due to a number of buried electric cables. Light cable percussion equipment was then used to advance the boreholes (MBH01 MBH201) to the required depth of 40 m bgl and tracked windowless sample rig was used to progress the shallow exploratory holes. In a number of the windowless boreholes, buried concrete obstructions were identified within the made ground and these borehole were terminated within the made ground.

3.2.5 Standard Penetration Tests (SPTs) were performed at approximate 1 metre intervals, to a depth of 5 m bgl and 1.5 m intervals beyond to a depth of 40 m bgl. The tests involved driving a steel cone tipped series of rods into the ground over a depth of 450 mm using the repeated blows of a 63.5 kg weight allowed to free fall over a height of 760 mm. The total number of blows required for the final 300 mm penetration (the 'N' value) is recorded on the borehole log.

3.2.6 In MBH01 undisturbed samples were collected at depths of 24.0, 27.0 and 30.0 m bgl, in favour of the SPT test, to be able to assess the chalk from an intact specimen; however, the samples did not recover any chalk and the character and grade was described based on limited recovery within the shoe sample. No further undisturbed sampling was conducted in MBH201.

3.2.7 Gas/groundwater monitoring standpipes were installed in a number of the exploratory holes. The standpipes and response zones are summarised in Table 8.

Table 8: Gas/groundwater monitoring standpipe details.

Hole ID	Response Zone (m bgl)	Targeted Strata
MBH01	3.00 – 10.00	Head deposits and Thanet Sand Formation
MBH02	1.00 – 10.40	Made ground, Head deposits and Thanet Sand Formation
MWS101	0.70 – 2.00	Made ground
MWS102c	0.20 – 0.70	Made ground
MWS103b	1.00 – 5.00	Made ground, Head deposits and Thanet Sand Formation

3.2.8 Representative soil samples were taken from various depths and strata to assess the contaminative status of the site. Soil samples were submitted to an MCERTS/ UKAS accredited laboratory for chemical analysis of a broad suite of potential contaminants. The results are provided in Appendix 5.

3.2.9 A programme of geotechnical laboratory testing was performed on selected soil samples obtained from the boreholes, comprising classification tests. Chemical testing was also undertaken to assess the aggressiveness of the ground with respect

to buried concrete. The results of the geotechnical laboratory testing are provided in Appendix 6.

SECTION 4 GROUND CONDITIONS

4.1 SURFACE GROUND CONDITIONS

4.1.1 The ground surface comprised a thin veneer or tarmacadam hardstanding that covered the entirety of the accessible site area (i.e., the area of the site not currently occupied by the existing building). Current ground level at which the boreholes were progressed ranges between +10.55 to 10.85 m AOD.

4.2 SUB-SURFACE GROUND CONDITIONS

4.2.1 A summary of the ground conditions encountered is presented in Table 9, whilst a more detailed assessment of the strata is contained in the following sections of the report.

Table 9: Summary of Sub-surface Ground Conditions

Strata	Depth to Top of Range (m AOD)	Thickness Range (m)
Made Ground	10.55 – 10.85	0.40 – 2.50
Superficial – Head deposits	8.30 – 9.20	0.60 – 2.20
Solid – Thanet Sand Formation	6.95 – 7.70	3.20 – 14.10
Solid – Undifferentiated Chalk	-7.15 – -7.10	22.10 – 22.20

4.2.2 Made Ground

4.2.2.1 Made ground was encountered in all the exploratory holes from the ground surface to a maximum depth of 2.50 m. The base of the made ground was only proven in three of the exploratory holes (MBH01, MBH201 and MWS103b). Underlying the tarmacadam hardstanding, the made ground was encountered as the following range of materials:

i. Light brown, gravelly clayey sand with low cobble content. The gravels comprise concrete, brick, flint, plastic and chalk whilst the cobbles comprise only concrete.

ii. Red, yellow and brown sandy, locally silty, gravel with gravels of concrete, flint and brick.

iii. Brown, sandy gravelly clayey silt with gravels of concrete, brick, metal, flint, chalk, coal, glass and clay pipe fragments.

iv. Grey concrete.

4.2.2.2 A weak hydrocarbon odour was noted within the made ground arisings of MWS103a. Other than the above localised olfactory evidence of contamination with the made ground and significant quantities of anthropogenic material within the soils, there was no further visual or olfactory evidence of contamination within the made ground and it is considered likely to have been placed during development / re-development of the site and establishing site levels.

4.2.2.3 Groundwater was not encountered within the made ground.

4.2.2.4 Three Standard Penetration Tests (SPT) were performed within the made ground at depths ranging between 1.20 to 1.50 m bgl. The recorded N-values range between 2 and 10 blows indicating the granular horizons are between very loose and loose relative density.

4.2.2.5 Due to the existing development of the site, the thickness and character of the made ground is likely to vary, a basement has been constructed as part of the existing development and is likely to mean that the thickness of the made ground is likely to be thinner beneath the basement, if present at all.

4.2.3 Head deposits

4.2.3.1 A thin veneer of superficial strata was identified in the three holes which fully penetrated the made ground (MBH01, MBH201 and MWS103b) from depths ranging between 1.60 and 2.50 m bgl. The head deposits were typically described as orangish brown, sandy clayey gravel or very gravelly sand. The gravels comprise chert, quartzite, flint and siltstone.

4.2.3.2 There was no visual or olfactory evidence of contamination and groundwater was not observed within the superficial strata.

4.2.3.3 Three SPTs were undertaken within the superficial strata at depths ranging between 2.00 and 3.00 m bgl. The SPT N-values range between 10 and 36 indicating that the granular superficial deposits are variable in nature and the relative density ranges between loose and dense.

4.2.4 Thanet Sand Formation

4.2.4.1 The Thanet Sand Formation was encountered underlying the superficial deposits from depths ranging between 3.10 and 3.80 m bgl. The stratum comprised medium to very dense, light grey and yellowish brown fine to medium grained sand.

4.2.4.2 There was no visual or olfactory evidence of contamination and groundwater was not observed within the Thanet Sand Formation.

4.2.4.3 SPTs were performed throughout the stratum at various depths. Within MBH01 every test recorded refusal (N-value of 50 blows) between 4.50 and 15.00 m bgl with amounts of penetration ranging between 122 and 280 mm. Only one test did not record refusal at a depth of 16.50 m with an N-value of 16 indicative of medium

dense sand. This lower value may be explained by drilling disturbance ahead of the test where the interface of the underlying chalk is recorded.

4.2.4.4 Within MBH201, at 4.0 m depth an N-value of 21 was recorded which indicates medium dense sands. Beyond this depth, all SPTs indicate granular soils that are at least dense with N-values ranging between 30 and 47 to a depth of 16.50 m bgl and only recorded refusal at two depths (12.00 and 13.50 m bgl) with amounts of penetration ranging between 229 and 247 mm.

4.2.4.5 In MWS103b, at 4.0 m depth an SPT N-value of 29 indicates medium dense sand whilst at 5.0 m depth refusal was recorded indicative very dense sand.

In summary, the SPTs generally indicate the Thanet Sand Formation is at least dense with only 3 tests indicating medium dense sands, two of which were recorded shallowly at 4.0 m depth and the deeper value in MBH01 at 16.50 m bgl may be anomalous due to drilling disturbance.

4.2.5 Undifferentiated Chalk

4.2.5.1 Undifferentiated Chalk deposits were encountered in the deeper boreholes only, underlying the Thanet Sand Formation from depths ranging between 17.80 to 17.90 m bgl. The chalk was generally recovered as structureless comminuted chalk and is initially classified as Grade Dm and Dc in-line with CIRIA Publication 574: Engineering in Chalk. Within MBH01, from a depth of 22.0 m the chalk is described as extremely weak, medium density chalk and classified as Grade B4 based on the limited shoe samples from SPTs and undisturbed samples, although the majority of stratum was still recovered as structureless comminuted chalk. Within MBH201 the chalk remained structureless comminuted chalk grade Dm and Dc throughout the whole depth.

4.2.5.2 No visual or olfactory evidence of contamination was identified within the chalk.

4.2.5.3 Groundwater was struck in both deep exploratory holes (MBH01 and MBH201) at depths of 17.90 and 18.00 m bgl, respectively. After 20 minutes the groundwater rose in both boreholes to 10.60 and 11.60 m bgl.

4.2.5.4 SPT N-values generally range between 29 and 39 throughout the chalk; however, N-values as low as 4 blows and as high as 50 blows were also encountered throughout the chalk. It is considered that the large range in SPT blow counts is a result of disturbance within the chalk during the drilling operations.

SECTION 5 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

5.1 GEOTECHNICAL SOIL TESTING RESULTS

5.1.1 A number of disturbed samples were recovered from the intrusive investigation for geotechnical laboratory testing. The rationale for the testing is highlighted below:

i. 2 no. sample of superficial head deposits and 1 no. sample of Thanet Sand Formation underwent Particle Size Distribution analysis for classification of the shallow underlying soils.

ii. 7 no. samples of undifferentiated chalk were tested for saturation moisture content, the bulk density and the dry density. However, due to the poor recovery of undisturbed samples, all three of these samples failed to comply with the volume requirements of the tests in accordance with BS1377:2.

iii. 17 no. samples (1 sample of made ground, 2 sample of head deposits, 7 samples of Thanet Sand Formation and 7 samples of undifferentiated Chalk) were tested for a full suite of sulphates in-line with BRE Special Digest 1.

5.1.1.2 The geotechnical test results are presented in Appendix 6 and summarised in the tables below. The results of sulphate testing are presented later in this report.

Table 10 – Results of particle size distribution analysis.

Sample ID (Stratum)	D60 (mm)	Uniformity Coefficient	Description	Series 600 Classification
MBH01 at 2.50 - 2.95 m (Head deposits)	12.6	45	Sandy GRAVEL	1A
MBH01 at 4.50 – 4.77 m (Thanet Sand Formation)	0.168	2.4	SAND	1B
MBH201 at 2.00 – 2.45 m (Head deposits)	11.9	52	Sandy GRAVEL	1A

Table 11 – Results of density testing of undifferentiated chalk samples.

Sample ID	Saturation Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)
MBH01 at 24.00 – 24.65 m	33	1.89	1.43
MBH01 at 27.00 – 27.65 m	30	1.93	1.50
MBH01 at 30.00 – 30.65 m	27	1.97	1.56
MBH201 at 18.00 – 18.45 m	30	1.94	1.49
MBH201 at 22.50 – 22.95	29	1.95	1.51
MBH201 at 30.00 – 30.45	31	1.92	1.47
MBH201 at 36.50 – 37.50	33	1.87	1.44

5.2 GEOTECHNICAL DESIGN PARAMETERS

5.2.1 The above laboratory geotechnical testing results combined with in-situ geotechnical testing have been analysed and characteristic values have been selected for the individual geologies. Characteristic soil parameters have been determined in accordance with BS 8004:2015: Code of practise for foundations.

5.2.2 SPT N-values have been corrected to $(N_1)_{60}$ values in accordance with BS EN ISO 22476-3:2005 to account for the effects of overburden pressure, theoretical hammer free fall energy and rod length. Where SPTs refused in the Thanet Sand Formation an extrapolated N-value has been determined for the full penetration depth based on the actual amount of penetration recorded; however, these values must be used with extreme caution and are considered not to have any merit above an N-value of 50 for the overall assessment of a characteristic design value.

5.2.3 Figure 2 below presents the relationship between $(N_1)_{60}$ values and depth for the individual geologies. The revised graph no longer presents historic data local to the area in light of the recently undertaken ground investigation which provides more substantial site-specific data. The figure presents the results from the 2023 and 2024 investigations separately.

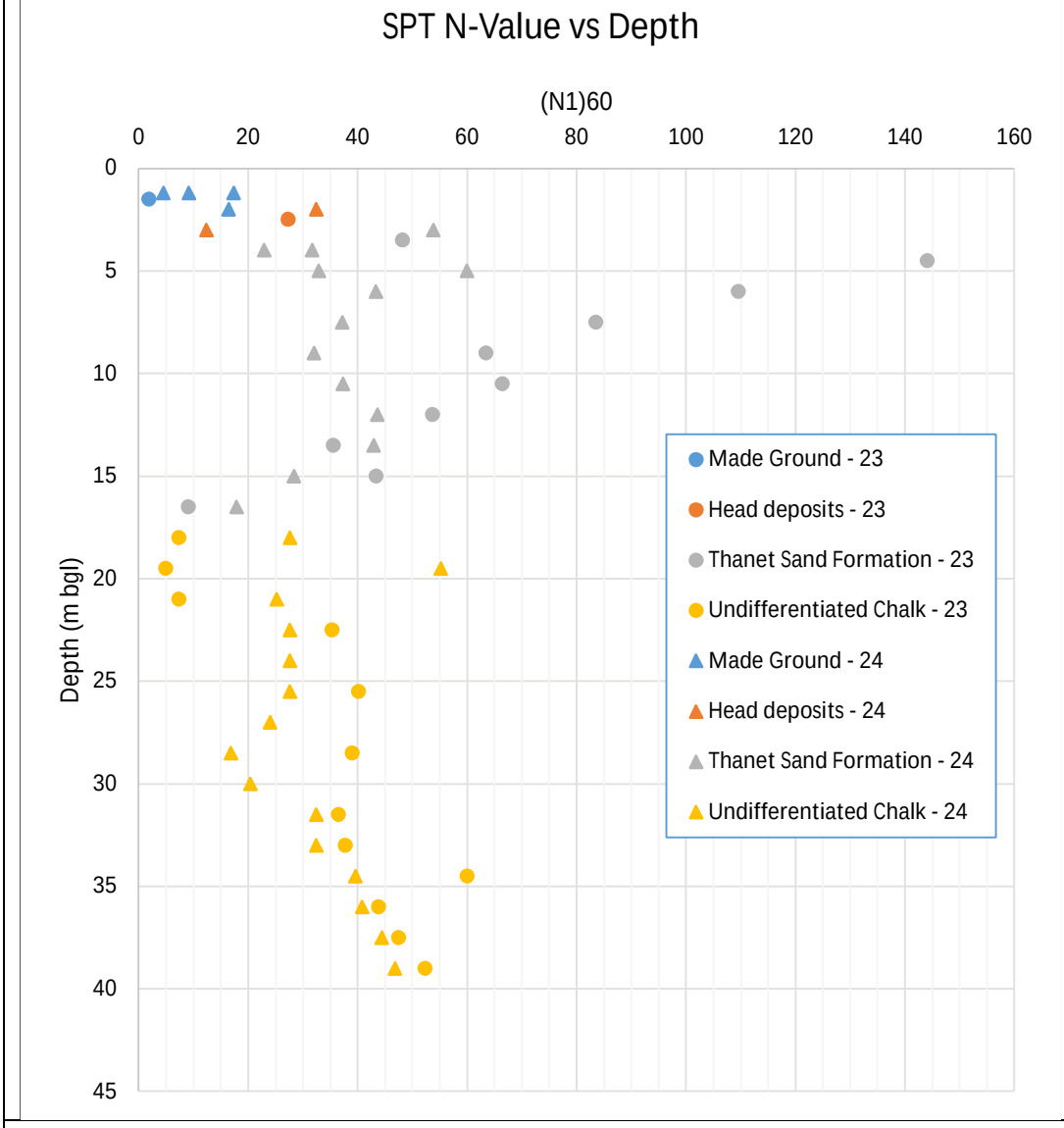


Figure 2 – $(N_1)_{60}$ vs depth.

5.2.4 The following are the design SPT values adopted for correlation to obtain the geotechnical parameters.

i. Made ground N = 3

ii. Heads Deposits N = 20

iii. Thanet Sand Formation N = 40

iv. Undifferentiated chalk N = 30

5.2.5 The angle of shearing resistance has been determined using well established empirical relationships with SPT N-value (Peck *et al.*, 1974) and through particle size distribution data and stratum descriptions provided on the logs in Appendix 4 in accordance with BS 8004:2015.

The table below presents the design parameters used in the foundation calculations.

Table 12 – Geotechnical Design Parameters

Stratum	Bulk Unit Weight, (kN/m^3)	Undrained Shear Strength, cu (kN/m^2)	Angle of internal friction, ϕ' (°)
Made Ground	18	23	23
Head Deposits	17	-	32
Thanet Sand Formation	18	-	35
Undifferentiated Chalk	19	-	36*
*CIRIA C574: Engineering in Chalk			

5.3 FOUNDATIONS

5.3.1 The proposed development comprises a multistorey tower block for residential purposes and includes a basement. A total of 14 above-ground stories are proposed and the structural engineer has indicated that preliminary unfactored column loads are anticipated to be 4,500 kN.

5.3.2 The ground investigation findings suggest only a thin veneer of made ground and superficial strata underlie the site. The Thanet Sand Formation is encountered from 3.70 m bgl to a depth of 16.50 m where it is generally dense to very dense. Undifferentiated chalk deposits are encountered underlying the Thanet Sand Formation to the maximum depth of investigation of 40.00 m bgl.

5.3.3 Due to the scale of the structure and the anticipated column loads, traditional strip footings are considered not to be suitable for the proposed development. An 800-900 mm thick raft slab has been proposed by the structural engineer as the favoured foundation solution. Alternatively, a piled foundation solution could be considered. An appraisal of these foundation options is detailed below.

5.4 RAFT FOUNDATION SOLUTION

5.4.1 The proposed formation level of the raft is +5.40m AOD (approximately 5.0 m bgl). An existing Thames Water sewer is present along the northeast boundary of the site and a Crossrail tunnel is located further beyond the northeastern site boundary. Shallower Thames Water assets are also present on the southwest boundary along Beresford Street. Figure 3 presents the proposed raft foundation solution and Figure 4 presents a birds-eye view of the proposed development in relation to the existing Thames Water sewer and Crossrail tunnel.

5.4.2 As indicated in Figure 3, it is desirable that the load spread angle from the proposed raft foundation solution should not load the existing Thames Water sewer or

Crossrail tunnel. It is noted that Thames Water criteria for ground movement are stringent, of the order of millimetres and therefore, a ground movement assessment is required to assess the influence of the raft option on existing assets. Ground movement assessments for the Thames Water sewer and shallow assets and the Crossrail tunnel have been carried out by IDOM and issued under separate cover as reports:

i. Thames Water – GMA-22277-23-342 Rev 3

ii. Crossrail – GMA-22277-23-402 Rev 2

5.4.3 The respective ground movement assessments have been approved by Thames Water and Crossrail.

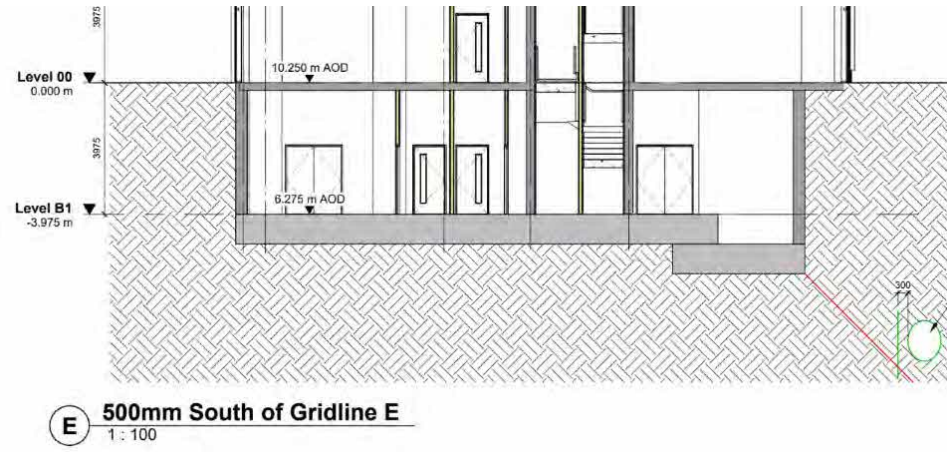


Figure 3. Proposed raft foundation solution.

5.4.4 Bearing Capacity

5.4.4.1 The Thanet Sand Formation was encountered between levels +6.95 m and +7.70 m OD and overlies the chalk at -7.10 m to -7.15 m OD. At the proposed raft foundation formation level of approximately +5.40 m AOD and below, the Thanet Sands were described as dense to very dense, with SPT N-values ranging between 38 and 50 blows.

5.4.4.2 Assuming raft foundation width B = 17 m, preliminary assessment indicates that the bearing capacity of 250-300 kN/m^2 is feasible in the Thanet Sand Formation.

5.4.5 Raft Foundation Settlement

5.4.6 The Thanet Sand Formation is cohesionless and therefore preliminary settlement was estimated using Burland and Burbridge's method for overconsolidated sand. Preliminary settlement assessment indicates that predicted settlements are up to 30 mm for B = 17 m anticipated for the proposed structure.

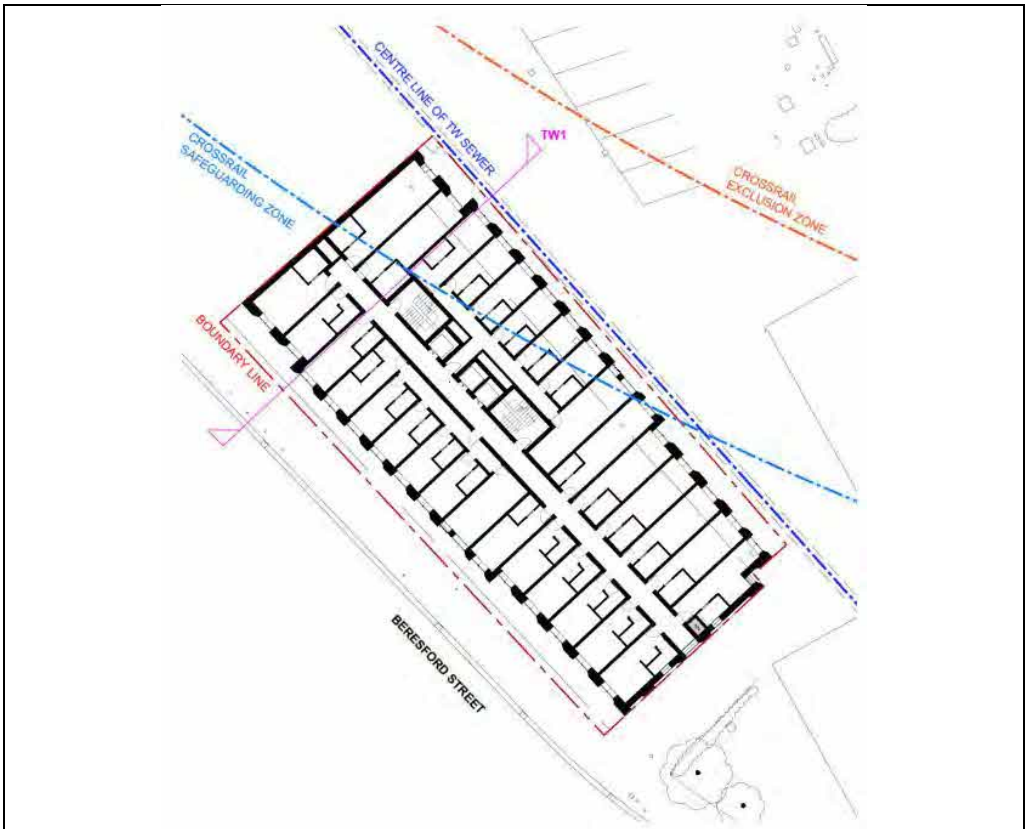


Figure 4 – Proposed development in relation to buried assets.

5.5 PILE FOUNDATIONS

5.5.1 Piling will be required under highly loaded areas of the raft in order to provide settlement control. Piling will also be required for the construction of basement walls. Pile design recommendations are provided below.

5.5.2 Based on the encountered geology underlying the site, it is considered that a driven pile foundation solution is unlikely to be a feasible piling method because precast piles are unlikely to penetrate the very dense Thanet Sand Formation. Additionally, due to the proximity of the site to existing residential properties and listed buildings, the vibrations associated with driven piles are likely to be considered unacceptable. Furthermore, if piles are to be progressed into the chalk, the Environment Agency are unlikely to approve the use of driven piles due to the potential pathway linkage to the underlying Principal Aquifer.

5.5.3 Preliminary pile capacity calculations have been undertaken for a single pile (ignoring the group effect) and assuming the type of piles adopted will be low displacement piles such as CFA or bored cast-in-situ piles which utilise a method of piling able to penetrate through the very dense sands.

5.5.4 Any positive frictional resistance along the pile shaft within the top 5.0 m of the pile have been ignored due to proposed basement. Furthermore, no allowance has been made at this stage for any potential down drag (negative skin friction) acting on the piles and any stresses associated with the retained soil acting on the basements.

5.5.5 Piles should ultimately be designed in accordance with BS-EN-1997-1 which requires knowledge of pile loads (actions). This information was not available at the time of preparing this report and in any case a Eurocode 7 compliant pile design is outside IDOM's current scope of works. In lieu of Eurocode calculations a traditional working stress assessment has been carried out based on the global factors of safety approach, to provide a preliminary indication of safe working capacities for piles of varying length and diameter. Preliminary pile calculations have been carried out in accordance with BS8004:2015.

5.5.6 Safe pile capacity has been determined using a factor of safety of 2.5 for skin friction and 3.0 for end bearing resistance within the Thanet Sand Formation. For piles that extend into the underlying chalk, a factor of safety of 2.5 has been applied to skin friction and 5.0 to base resistance in accordance with CIRIA Publication 574.

5.5.7 Whilst pile capacity calculations are well researched, they utilise empirical relationships and adjustment factors that are fundamentally uncertain given the range of ground conditions, types of piles and methods of installation. Therefore, a scheme of in-situ integrity testing should be agreed upon such as full-scale load tests to ensure the piles meet the requirements of the proposed development. Additional integrity testing may also allow for lower factors of safety and more economic design.

5.5.8 If a piled foundation solution is adopted where the piles end bear into the underlying chalk, then a Piling Works Risk Assessment should be carried out since the chalk is identified as a Principal Aquifer. Furthermore, if piles are adopted that end bear in, or within influencing of the chalk, then it is recommended that further ground investigation is undertaken using a rotary coring, or cable percussive drilling with rotary coring follow on, to retrieve core samples of the chalk for better assessment of the chalk characteristics and grade, and for geotechnical rock testing such as unconfined compressive tests.

5.5.9 Table 13 and Figure 5 present preliminary safe pile capacities for variously sized circular diameter piles installed to various depths. The results indicate a reduced capacity at 13 m below the base of the proposed basement coinciding with the interface of the Thanet Sand Formation with the Undifferentiated chalk and the associated reduction in vertical effective stress due to the sub-artesian water pressures existing in the Undifferentiated chalk.

5.5.10 Where piles are required it is recommended that the advice of a specialist contractor be sought to determine the most appropriate / cost effective system and to advise on pile diameters, depths, and safe working capacity.

5.5.11 A working platform will be required for the piling plant; once the type of piling rig is known IDOM can undertake a working platform design upon request.

Table 13: Preliminary safe pile capacities.

IDOM

Preliminary pile capacity design - Beresford Street

Pile Length (m)	Pile Diameter (mm)							Assumed stratigraphy
	375	400	450	600	750	800	900	
								Basemet to approx. 5m bgl
1.0	104	117	145	249	379	429	537	Dense Thanet Sand Formation
2.0	166	186	229	388	587	663	828	
3.0	233	261	321	537	808	911	1134	
4.0	307	343	420	697	1041	1172	1455	
5.0	388	432	527	866	1287	1446	1791	
6.0	474	527	641	1045	1546	1734	2142	
7.0	567	629	762	1235	1817	2035	2508	
8.0	666	738	892	1434	2100	2350	2889	
9.0	750	829	997	1588	2310	2579	3160	
10.0	819	902	1080	1699	2447	2726	3326	
11.0	894	982	1170	1819	2598	2886	3506	
12.0	975	1069	1268	1950	2761	3060	3702	
13.0	1063	1163	1373	2090	2936	3247	3913	
14.0	843	907	1038	1455	1907	2065	2394	Undifferentiated Chalk
15.0	921	990	1131	1579	2062	2231	2580	
16.0	1002	1076	1228	1709	2224	2404	2775	
17.0	1086	1166	1330	1844	2393	2584	2978	
18.0	1174	1260	1436	1985	2569	2772	3189	
19.0	1266	1358	1545	2131	2752	2967	3409	
20.0	1361	1459	1659	2283	2942	3170	3637	
21.0	1459	1564	1777	2440	3139	3380	3873	
22.0	1561	1673	1900	2603	3343	3597	4117	
23.0	1666	1785	2026	2772	3553	3822	4370	
24.0	1775	1901	2157	2946	3771	4054	4631	
25.0	1887	2021	2291	3126	3995	4293	4901	
26.0	2025	2170	2462	3367	4315	4641	5306	
27.0	2144	2297	2605	3558	4554	4895	5592	
28.0	2267	2428	2752	3754	4799	5157	5886	
29.0	2393	2562	2904	3956	5051	5426	6189	
30.0	2523	2700	3059	4164	5310	5702	6500	

Notes

1 - Stratigraphy based on MBH01 and MBH201

2 - Pile bearing capacity based on the N-values reported on the borehole logs and within CIRIA C574: Engineering in Chalk

3 - Basement assumed to be approximately 5m below ground level

4 - Shaft resistance factor of safety = 2.5

5 - Base resistance factor of safety = 3.0

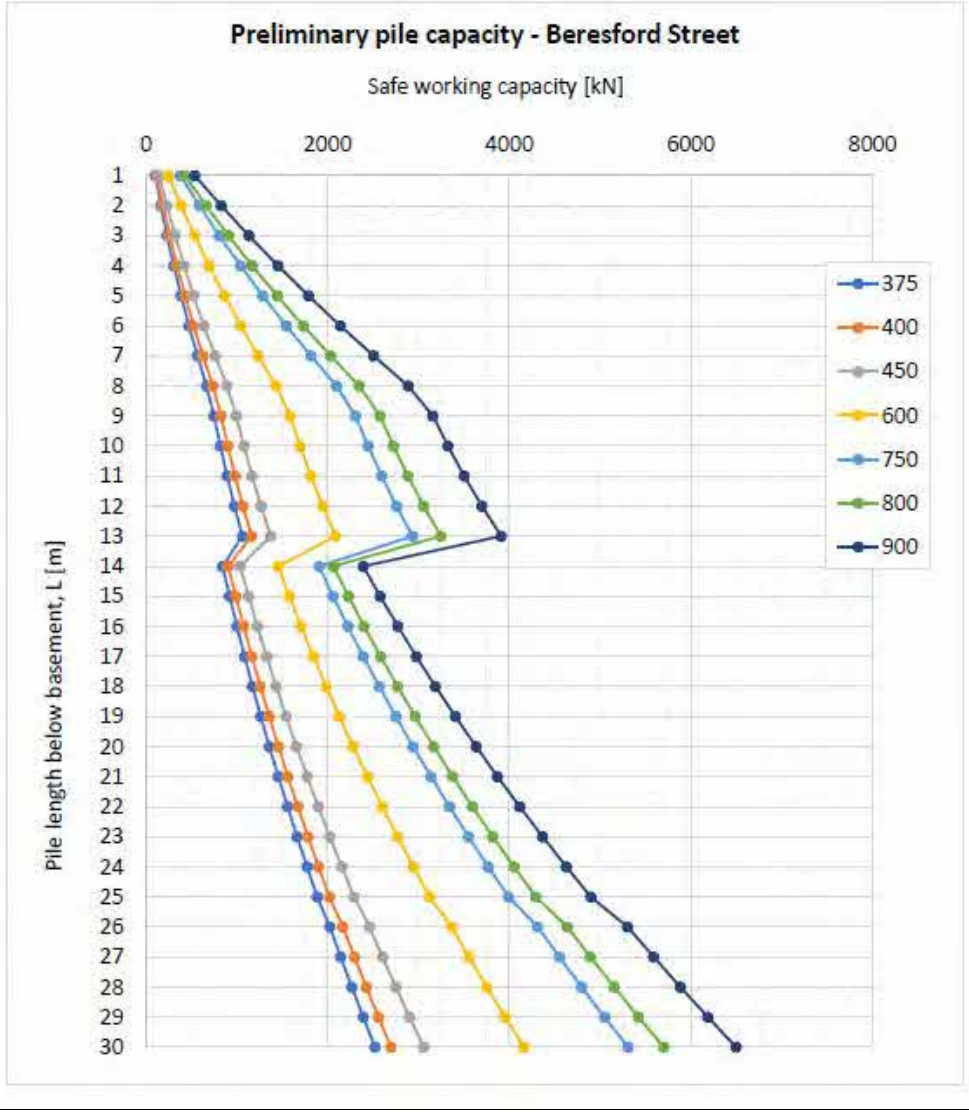


Figure 5 – Pile capacity vs depth plot.

5.6 FOUNDATION OPTIONS SUMMARY

5.6.1 Preliminary assessment of a raft foundation indicates that the raft foundation solution is feasible for the proposed structure. At the indicated formation level, a bearing capacity of 250 – 300 kN/m^2 has been assessed and settlements of up to 30 mm have been estimated. This information should be reviewed by the structural engineers as part of the feasibility study.

5.6.2 The feasibility of the raft foundation is subject to assessment of ground movements against the Thames sewer and Crossrail assets. Ground movement assessments have been carried out for both Thames Water and Crossrail assets and it has been

concluded that current proposals for the raft foundation will not adversely affect the assets.

5.6.3 Where piling is required, due to the dense sands underlying the site, CFA or bored cast in-situ piling methods are recommended. It is considered necessary to undertake further ground investigation work targeted at the underlying chalk if piles are anticipated to end bear within, or within influencing depth of the chalk. Furthermore, it is also recommended that a Piling Work Risk Assessment, vibration assessment and working platform design are undertaken for a piled foundation solution. The preliminary pile capacity calculations provided are indicative only and detailed calculations in accordance with Eurocode 7 should be undertaken for the pile group by a specialist contactor.

5.7 EXCAVATIONS AND GROUNDWATER

5.7.1 Granular soils underlying the site were encountered during the ground investigation. It is considered that excavations are unlikely to be stable in the short-term. Man-entry into excavations should be minimised. Excavations should be supported by shoring or otherwise battered back to a safe angle to protect the workforce from possible collapse of the excavation.

5.7.2 Groundwater was struck at 18.00 m bgl; it is considered unlikely that dewatering of shallow soils will be required. However, minor volumes of perched groundwater may exist within the made ground, and it is considered that only small-scale sump pumping will be required in shallow excavations.

5.8 FLOOR SLABS

5.8.1 Due to the proposed raft foundation solution, it is likely that a cast-in-situ ground bearing slab will be required with reinforcement to prevent cracking of the slab; the exact detail of the floor slab should be designed by the structural engineer.

5.9 BURIED CONCRETE

5.9.1 Recommendations given in BRE Special Digest 1:2005 *"Concrete in aggressive ground"* have been followed in order to give recommendations with respect to buried concrete.

5.9.2 Water soluble sulphate analysis was carried out on 17 soil samples obtained from depths of between 1.95 and 37.50 m bgl with soil pH determination also carried out on these samples. Water soluble sulphate contents ranged between 9.8 mg/l to 134 mg/l. In accordance with BRE guidelines the characteristic value is calculated by determining the mean of the highest 20 % of results. In this case the characteristic value is 96.5mg/l. On this basis the Design Sulphate Class is DS-1.

5.9.3 The pH values in the soil samples varied between 8.3 and 9.4. The mean of the lowest 20 % of values is 8.5 which represents the characteristic value. Mobile groundwater conditions have been assumed and, on this basis, the Aggressive Chemical Environment for Concrete (ACEC) class for the site is AC-1.

5.10 ROADS AND PAVED AREAS

5.10.1 For preliminary design purposes it is recommended that a California Bearing Ratio (CBR) value of < 2 % is assumed for the made ground. Once the positions of hardstanding have been finalised, testing could be undertaken to determine an appropriate design CBR value.

5.11 SOAKAWAYS

5.11.1 No infiltration data is available; however, it is considered unlikely that the site will be suitable for a soakaway drainage system due to the limited space within the site boundaries and the effect a soakaway system may have on the proposed foundation solution. If a soakaway system is proposed, then infiltration testing will be required in accordance with BRE Digest 365.

SECTION 6 ENVIRONMENTAL ASSESSMENT

6.1 SOIL QUALITY

6.1.1 A total of 11 soil sample of made ground was submitted to the laboratory for chemical analysis. The laboratory chemical analysis certificates are contained in Appendix 5. The results of the analysis are summarised in Table 14.

6.1.2 An initial screening exercise has been undertaken whereby contaminant concentrations recorded in soils have been assessed against *Suitable for Use Levels* (S4ULs) published in 2015 by LQM/CIEH[2]. These precautionary screening levels are designed to be representative of minimal risk to human health in a number of land use scenarios. In this report S4ULs have been selected for a residential land use without the possibility of consumption of homegrown produce exists and assuming a soil organic matter of 2.5 %. For lead the DEFRA Category 4 Screening Level[3] has been used as this is based on updated toxicological data and a low risk to human health.

6.1.3 An additional set of phytotoxin screening levels have been adopted from 'The Code of Agricultural Practice for the Protection of Soil' Ministry of Agriculture, Fisheries and Food (MAFF), 1993, which are protective of healthy plant growth.

[2] Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. *The LQM/CIEH S4ULs for Human Health Risk Assessment*. Land Quality Press, Nottingham. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3100. All rights reserved. Including August 2015 nickel update.

[3] SP1010 *Development of Category 4 Screening Levels Main Report* (Dec 2013) and SP1010 *Policy Companion Document* (Mar 2014).

Table 14: Summary of Soils Chemical Analysis Results

CONTAMINANT	No of Tests	MAX ($mg.kg^{-1}$)	MEAN ($mg.kg^{-1}$)	SCREENING LEVEL (SL) ($mg.kg^{-1}$)	No > SL*
HUMAN HEALTH RISK ASSESSMENT					
Asbestos in soil	11	0.727%	-	Detected	2
pH	6	11.1	9.5	5 – 9	4
Arsenic	6	29.0	15.6	40	0
Barium	6	380.0	180.5	1300	0
Cadmium	6	0.0	-	85	0
Chromium (III)	6	30.0	22.3	910	0
Hexavalent Chromium	6	0.0	-	6	0
Lead	6	970.0	401.0	310	3
Mercury	6	1.4	0.7	56	0
Nickel	6	24.0	18.7	180	0
Selenium	6	0.0	-	430	0
Vanadium	6	49.0	38.0	1200	0
TPH Aliphatic >EC_5 - EC_6	6	0.000	-	42	0
TPH Aliphatic >EC_6 - EC_8	6	0.000	-	100	0
TPH Aliphatic >EC_8 - EC_{10}	6	0.000	-	27	0
TPH Aliphatic >EC_{10} - EC_{12}	6	0.00	-	130	0
TPH Aliphatic >EC_{12} - EC_{16}	6	3.60	3.15	1100	0
TPH Aliphatic >EC_{16} - EC_{21}	6	14.00	14.00	65000	0
TPH Aliphatic >EC_{21} - EC_{35}	6	130.00	66.00	65000	0
TPH Aromatic >EC_5 - EC_7	6	0.000	-	370	0
TPH Aromatic >EC_7 - EC_8	6	0.000	-	860	0
TPH Aromatic >EC_8 - EC_{10}	6	0.000	-	47	0
TPH Aromatic >EC_{10} - EC_{12}	6	1.40	1.40	250	0
TPH Aromatic >EC_{12} - EC_{16}	6	6.00	4.57	1800	0
TPH Aromatic >EC_{16} - EC_{21}	6	41.00	23.33	1900	0
TPH Aromatic >EC_{21} - EC_{35}	6	140.00	60.67	1900	0
Benzene	0	<0.005	<0.005	0.38	0
Toluene	0	<0.005	<0.005	880	0
Ethylbenzene	0	<0.005	<0.005	83	0
Xylene	0	<0.005	<0.005	79	0
Naphthalene	6	0.24	0.13	2.3	0
Acenaphthylene	6	0.34	0.20	2900	0
Acenaphthene	6	0.50	0.20	3000	0
Fluorene	6	0.34	0.16	2800	0
Phenanthrene	6	10.00	2.89	1300	0
Anthracene	6	2.80	0.72	31000	0
Fluoranthene	6	20.00	5.67	1500	0
Pyrene	6	17.00	5.00	3700	0

Benzo(a)anthracene	6	9.10	2.74	11	0
Chrysene	6	7.60	2.39	30	0
Benzo(b)fluoranthene	6	8.90	2.83	3.9	1
Benzo(k)fluoranthene	6	3.00	1.09	110	0
Benzo(a)pyrene	6	7.20	2.37	3.2	1
Indeno(1,2,3-c,d)pyrene	6	3.30	1.20	45	0
Dibenzo(a,h)anthracene	6	1.00	0.35	0.31	1
Benzo(g,h,i)perylene	6	3.70	1.32	360	0
Phenol	6	0.0	-	440	0
PHYTOTOXICITY RISK ASSESSMENT					
Copper	6	86.0	49.0	200	0
Nickel	6	24.0	18.7	110	0
Zinc	6	400.0	158.3	300	1

Notes: * Number of samples exceeding screening level nd = not detected

6.1.4 Zootoxic Metals (harmful to human health)

6.1.4.1 Three exceedances of the screening level was identified within made ground samples. This are all for lead and were concentrations of 970 mg/kg (BH01 at 1.5 m), 600 mg/kg (MWS101 0.6 m) and 330 mg/kg (MWS101 at 1.8 m) compared to the screening value of 310 mg/kg.

6.1.5 Phytotoxic Metals (harmful to plant health)

6.1.5.1 One exceedances of phytotoxic metals potentially harmful to plant health. This was 400 mg/kg (MWS101 at 0.6 m) in comparison with a screening value of 300 mg/kg.

6.1.6 Organic Contaminants

6.1.6.1 A single sample (MWS102c at 0.6 m) showed the presence of three polyaromatic hydrocarbon species at concentrations in excess of the screening value. A slight hydrocarbon odour was noted in MWS103a but testing did not identify any hydrocarbon presence likely to be of significance.

6.1.7 Inorganic Contaminants

6.1.7.1 No exceedances of inorganic contaminants were identified.

6.1.8 Asbestos

6.1.8.1 a total of 11 samples were tested for asbestos content. Nine of these did not detect asbestos. Two samples from a single location (MWS101 at 1.3 m and 1.8 m) showed the presence of asbestos at 0.727% and <0.001 % respectively.

6.1.9 pH

6.1.9.1 Elevated levels of pH above screening values were noted in three samples

6.1.10 Summary

6.1.10.1 Lead, zinc, PAH s and pH have been identified as contaminants that exceeded the screening level for residential end-use without plant uptake. The proposed development does not include any areas of soft landscaping where end-users may be in contact with the soil. Due to the absence of a pathway to end-users it is considered that the identified contamination presents a negligible risk to end-users. Furthermore, during the re-development of the site, the construction of the basement is likely remove, most, if not all of the impacted made ground soils.

6.2 LEACHABILITY

6.2.1 A significant source of contamination has not been identified within the underlying soils. The made ground is considered to be of limited thickness and lateral extent due to the existing basement. Leachability testing has not been undertaken; however, a significant source of contamination has not been identified. Whilst a minor exceedance has been identified for lead concentrations, it is likely that most, if not all of the made ground impacted soil will be removed from site during construction of the basement.

6.3 GROUNDWATER

6.3.1 Groundwater level monitoring and sampling has so far been undertaken on a maximum of six occasions.

6.3.2 No groundwater was encountered in the window sample boreholes.

6.3.3 Groundwater strikes were noted in BH01 and BH201 at the top od chalk and were observed to rise to 10.6 m bgl and 11.5 m bgl respectively.

6.3.4 On the first three rounds on monitoring of MBH01, the installation was dry. On the final three rounds, water was detected at just above the base of the standpipe.

6.3.5 Similarly water levels were detected in boreholes MBH201 jus above the base of the installed standpipe on the two monitoring rounds undertaken.

6.3.6 It is considered that groundwater in the chalk is partially confined by the fairly low permeability fine sand of the Thanet Formation but that over the two strata an approximately resting water level of c 9.5 m bgl is likely to be sustained.

6.3.7 No evidence of odours or visible contamination was noted in waters.

6.4 HAZARDOUS GAS

6.4.1 Gas monitoring has so far been undertaken on six occasions. Levels of methane, carbon dioxide and oxygen were recorded in the standpipe, together with associated parameters including borehole flow and ambient air pressure. The results of these gas monitoring rounds are contained in Appendix 7.

6.4.2 The monitoring round was undertaken at a barometric pressures ranfging from 1002 to 1029 mb and a peak positive flow of 0.9 l/hr was recorded. Methane (CH_4) was not detected in any round whilst carbon dioxide (CO_2) was detected to a maximum of 4.70 % v/v with a corresponding slightly depleted oxygen concentration of 17.3 % v/v.

6.5 **WASTE CLASSIFICATION, OFF-SITE DISPOSAL OR RE-USE**

6.5.1 Waste Considerations

6.5.1.1 A HazWasteOnline assessment of the made ground samples has been undertaken and suggests the ground should be considered generally non-hazardous.

6.5.1.2 Asbestos was however identified in two samples from one location. The asbestos presence was not observed by site engineers and was only detected by microscopic analysis. Nonetheless, matrail containing asbestos at concentrations of >0.1% would be hazardous waste if disposed. If similar conditions are detected or visible asbestos sis detected, appropriate disposal such material whilst and the adoption of safe working protocols will be required.

6.5.1.3 Natural soils are likely to be considered inert for disposal purposes.

6.5.1.4 Materials, including waste soils which are not to be retained on site, should be removed and disposed of in accordance with all relevant statues including the *Environmental Protection Act 1990* (as amended), *The Controlled Waste Regulations 2012* (as amended), *The Waste (England and Wales) Regulations 2011* (as amended) , *The Hazardous Waste (England and Wales), Regulations 2005* as amended, *The Waste Management (England and Wales) Regulations 2006*, and *The Environmental Permitting (England and Wales) Regulations 2016* (as amended).

6.5.1.5 It is a requirement of these regulations that waste sent to landfill should have been subject to measures to reduce the amount of waste, reduce harmful or hazardous properties and facilitate recycling. These requirements may be satisfied by measures such as segregation and screening of wastes to recover suitable fill and material for crushing, segregation of inert materials and putrescible wastes.

6.5.2 Re-use Considerations

6.5.2.1 There is likely to be only limited excess material from the re-development of the site. Due to the existing site levels, it is considered unlikely that there will be a use for any excess soil.

SECTION 7 RISK ASSESSMENT

7.1 The potential sources of contamination at the site and the implications with respect to development have been interpreted in accordance with the current government guidance on source-pathway-receptor risk assessment.

7.2 The investigations demonstrate that the former uses of the site have resulted in minor exceedance it the concentration of lead. It is considered likely that the contamination is a result of anthropogenic materials within the made ground during the historic development of the site. These materials are considered for their potential to act as sources for a number of pollutant linkages.

7.3 The potential impacts of contamination sources have been considered with respect to the following receptors:

i. The general public and present site users,

ii. Residents of future development,

iii. Groundwater,

iv. Surface water,

v. Construction workers,

vi. Adjacent land, and

vii. Infrastructure.

7.4 In each case the existence of a pollutant linkage requires a pathway by which the receptor could be exposed to the source. A qualitative assessment of risk is thus considered in the first instance with respect to the site in its current condition and is summarised in the sections below.

7.5 **The general public and present site users**

7.5.1 Currently there is no direct pathway to the general public and present site users due to the presence of hardstanding and the existing building which covers the entire site area. In the absence of a pathway the risk to current users is considered to be negligible.

7.6 **Residents of future development**

7.6.1 Soil contamination (chemical)

7.6.1.1 Analysis has identified levels of lead, zinc and PAH and pH contamination which moderately exceeds the screening level; however during redevelopment of the site, it is likely that most, if not all, of the existing made ground will be removed to construct a basement. Furthermore, there are no areas of soft landscaping or gardens within the proposed redevelopment of the site and therefore there is considered to be negligible risk to end users.

7.6.2 Asbestos

7.6.2.1 Asbestos analysis was undertaken on 11 samples and was detected in two of these from one location. This observation demonstrates that asbestos is present within made ground. While the presence of asbestos is consistent with the history of the

site which includes several phases of development and demolition, it is noted that the asbestos survey of the current structure did not discover any asbestos building materials. It is presumed that other asbestos containing materials are likely to be present in made ground and site works should be cognisant of this.

7.6.2.2 The risk to the end-users from asbestos is considered very low, assuming that any in-situ asbestos is appropriately removed from the existing building and that existing made ground is not left exposed in the completed development.

7.6.3 Hazardous Soil Gas/Vapours (including hydrocarbon vapours/radon)

7.6.3.1 Gas Screening Values (GSV) for methane and carbon dioxide have been calculated following BS8485[4] guidance. For methane, the maximum concentration and maximum gas flow rate are used to calculate the GSV because consequences are instantaneous, while for carbon dioxide, the GSV is calculated using the steady state concentration and steady state flow rate as the consequences are more gradual.

7.6.3.2 BS8485(2015+A1:2019) has been followed to assess the recorded soil gas and flow conditions. Calculations are presented in Appendix 8 which suggest that the gas regime presents a very low risk and the site is assessed to be Characteristic Situation 1 where gas protection measures are not required.

7.7 Controlled waters

7.7.1 Moderate exceedances of human health criteria for lead, zinc and PAH compounds was noted in a small number of sample, within the made ground. However, most, if not all, of the made ground will be removed during construction of the basement and the site will be capped by the development proposed. As a result, a significant source of contamination will not be present on-site from the proposed development and therefore the risk to controlled waters is considered negligible. Groundwater is expected to be at approximately 10 m and not in contact with any made ground. Furthermore, the distance and intervening land-uses to the surface water feature (River Thames) means that the migration of contaminants to surface water features will be negligible.

7.8 Construction workers

7.8.1 Construction workers are potentially at the greatest risk from exposure to hazardous contamination initially due to excavation works and during the handling of materials. Providing that dust levels are kept within statutory limits and appropriate health and safety procedures are adhered to during the construction phase, there is considered to be a very low risk to the health of construction workers. Asbestos was detected in made ground and construction management plans should ensure that appropriate safe working procedures are adopted.

[4] Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. BS 8495:2015 + A1:2019.

7.9 **Adjacent land**

7.9.1 No sources of mobile contamination capable affecting adjacent land have been identified.

7.9.2 The risk to adjacent land is assessed as very low.

7.10 **Infrastructure**

No significant hydrocarbon contamination has been identified on the site and it is considered that standard PE water pipes will be sufficient for the proposed development; however, it is recommended that the utility provider is consulted with respect to their requirements for water supply pipes.

SECTION 8 UPDATED CONCEPTUAL MODEL

8.1 Following completion of phases 1 and 2 of the investigation and a qualitative risk assessment, the conceptual model for the site, with relation to pollutant linkages, has been updated. The revised model is presented in Table 15 below.

Table 15: Revised Conceptual Model

POSSIBLE POLLUTANT LINKAGE			RISK CHARACTERISATION
POTENTIAL SOURCES	PATHWAYS	RECEPTORS	
Heavy metals (Lead in made ground)	No pathway identified	Human health (current users)	**Negligible risk identified**
		Human health (future residents)	
Heavy metals (Lead in made ground)	Contact with contaminated soil	Human health (construction workers)	**Very Low risk identified** Potential for made ground beneath existing building infrastructure which can contain elevated metals and hydrocarbons. Exposure limited.
	Ingestion and inhalation of contaminated soil and dust	Human health (construction workers)	
Asbestos (made ground)	Ingestion and inhalation of contaminated soil and dust	Human health (future residents)	**Very Low risk identified** Potential for made ground to contain asbestos from demolition of buildings.
Asbestos (made ground)	Ingestion and inhalation of contaminated soil and dust	Human health (construction workers)	**Low to Moderate risk identified** Potential for asbestos to be present within made ground.
Heavy metals (Lead in made ground) – Source likely to be removed	Vertical migration to aquifer	Controlled waters	**Very Low risk identified** Low-level lead contamination is unlikely to remain on-site within the made ground during redevelopment of the site; unlikely to be significantly affect Secondary A aquifer. No water present in monitoring borehokles

POSSIBLE POLLUTANT LINKAGE			RISK CHARACTERISATION
POTENTIAL SOURCES	PATHWAYS	RECEPTORS	
Heavy metals (Lead in made ground) – Source likely to be removed	Significant horizontal migration to surface water unlikely	Controlled waters	**Very Low risk identified** Low-level lead contamination is unlikely to remain on-site within the made ground during redevelopment of the site; additionally, horizontal migration considered to be very unlikely to the River Thames or other sensitive receptor.
Hydrocarbons	Direct contact	Plastic water pipes	**Low risk identified**
Hazardous Gas/Vapours In soil	Ingress into buildings and voids	Human health (future residents and construction workers)	**Low Risk Identified** but ongoing gas monitoring

SECTION 9 REMEDIATION AND VERIFICATION STRATEGY

9.1 GENERAL

9.1.1 The identified risks at the site can be mitigated by removal of either the source, pathway or receptor. With reference to the conceptual model for the site a remediation strategy, based on source or pathway removal, has been designed.

9.1.2 The only significant risk to receptors which has been identified is due to the presence of asbestos in made ground. This was detected in one window sample at two depths. Given the development history of the site it is reasonable to assume that other asbestos containing materials may be present. It is noted that a building survey of the existing structure on the site did not identify the presence of asbestos and therefore concluded likely that any asbestos is more likely to have arisen due the demolition of earlier generations of structure.

9.2 OPTIONS APPRAISAL

9.2.1 As no contamination has been identified which is required to be removed from site to mitigate an identified risk, no remediation options appraisal is applicable of required. It is however accepted that the construction process will bring site workers into proximity with made ground soils which may contain asbestos and therefore precautions will be necessary to prevent harmful exposure associated with the development.

9.3 REMEDIATION STRATEGY

9.3.1 Potential risks to construction workers have been identified particularly with respect to asbestos presence. The adoption of appropriate Health and Safety procedures will be necessary to ensure that any asbestos containing materials encountered do not present a risk to site workers or any other receptors.

9.3.2 Due diligence should be exercised for the presence of any asbestos contaminated material.

9.3.3 Operatives should not be allowed to eat, drink or smoke on site except in designated areas and should be required to wash all exposed skin at the end of each shift. Operatives should be informed of the potential hazards at the site and should be required to report any observations of suspect material.

9.3.4 No gas protection is considered necessary.

9.4 **VERIFICATION PLAN**

9.4.1 As no prestart remedial action beyond operating good safety precautions is proposed, the full scope of verification measures cannot be specified.

9.4.2 If significant asbestos containing materials or other materials with significant contamination potential are identified, appropriate resources should be deployed to characterise the discovery and undertake additional risk assessment.

9.4.3 If the assessment concludes that remediation action is required an updated verification plan should be prepared.

9.4.4 If remediation entails removal of material from site for the purposes of risk reduction, testing should be carried out to confirm that the removal has been effected satisfactorily

9.5 **ADDITIONAL RECOMMENDATIONS**

9.2 Materials, including waste soils which are not to be retained on site, should be removed and disposed of in accordance with all relevant statues including the *Environmental Protection Act 1990* (as amended), *The Controlled Waste Regulations 2012* (as amended), *The Waste (England and Wales) Regulations 2011* (as amended) , *The Hazardous Waste (England and Wales), Regulations 2005* as amended, *The Waste Management (England and Wales) Regulations 2006*, and *The Environmental Permitting (England and Wales) Regulations 2016* (as amended).

9.3 It is recommended that this report is submitted to the regulators Local Authority EHO and Planners in support of application to discharge Condition 29 prior to commencement of the works.

9.4 Any observations of ground conditions atypical of those already described should be reported to IDOM immediately so that an assessment of appropriate action can be made.

SECTION 10 CONCLUSIONS

10.1 The ground conditions encountered during this investigation comprise a thin veneer of made ground and superficial head deposits overlying sands of the Thanet Sand

Formation to a depth of 17.80 to 17.90 m bgl with chalk encountered to the base of the borehole at 40 m bgl.

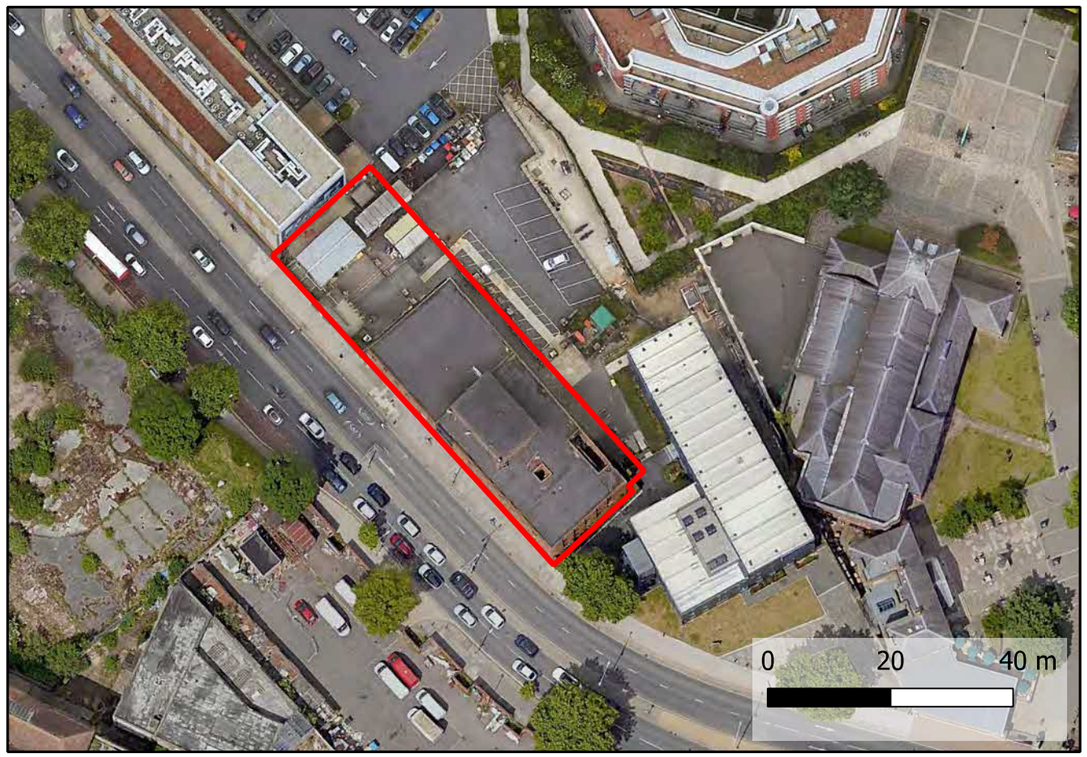
10.2 The proposed development comprises a 14 storey tower block with a basement. A raft is the preferred foundation solution for the proposed structure and a bearing capacity of 250-300kN/m^2 has been assessed at the proposed formation level with anticipated settlements of up to 30 mm. Ground movement assessments have been undertaken to assess the effects of the raft solution on Thames Water and Crossrail buried assets. Reports have been provided under separate cover and conclude that there will be no detrimental impact on the existing buried assets. Where piles are required (for example for settlement control under the raft) then a CFA or bored cast-in-situ pile foundation solution is likely to be required. Preliminary pile calculations have been provided for a single pile; however, detailed calculations in accordance with BS-EN-1997-1 will be required by a specialist contractor for the pile group and advice sort as to the exact dimensions and layout of the piles. Furthermore, if a piled foundation solution is adopted it is likely that further ground investigation will be required into the underlying chalk and further work including a Piling Works Risk Assessment, vibration assessment and a working platform designed specific to the proposed piling plant will be required.

10.3 It is considered that it will not be feasible to incorporate a soakaway drainage system will into the proposed development due to the low available space within the site boundary and due to the potential impact of the soakaway on the proposed foundation solution. CBR values of <2% should be assumed for pavement design within the made ground

10.4 Limited contamination has been identified within the made ground. This contamination presents a negligible risk to current and future end-users due to the presence of hardstanding. The construction of a basement is likely to remove most, if not all, of the impacted soils. and in the absence of a source, presents a negligible risk to the underlying aquifers with the redevelopment of the site. Asbestos was observed in made ground and construction management plans should ensure appropriate safe working procedures are adopted.

10.5 It is likely that any soils removed from the site will be considered non-hazardous waste; however any material is to be disposed in which visible asbestos is detected or which when tested has asbestos content above 0.1% , then that material would have hazardous classification.

APPENDIX 1 Drawings



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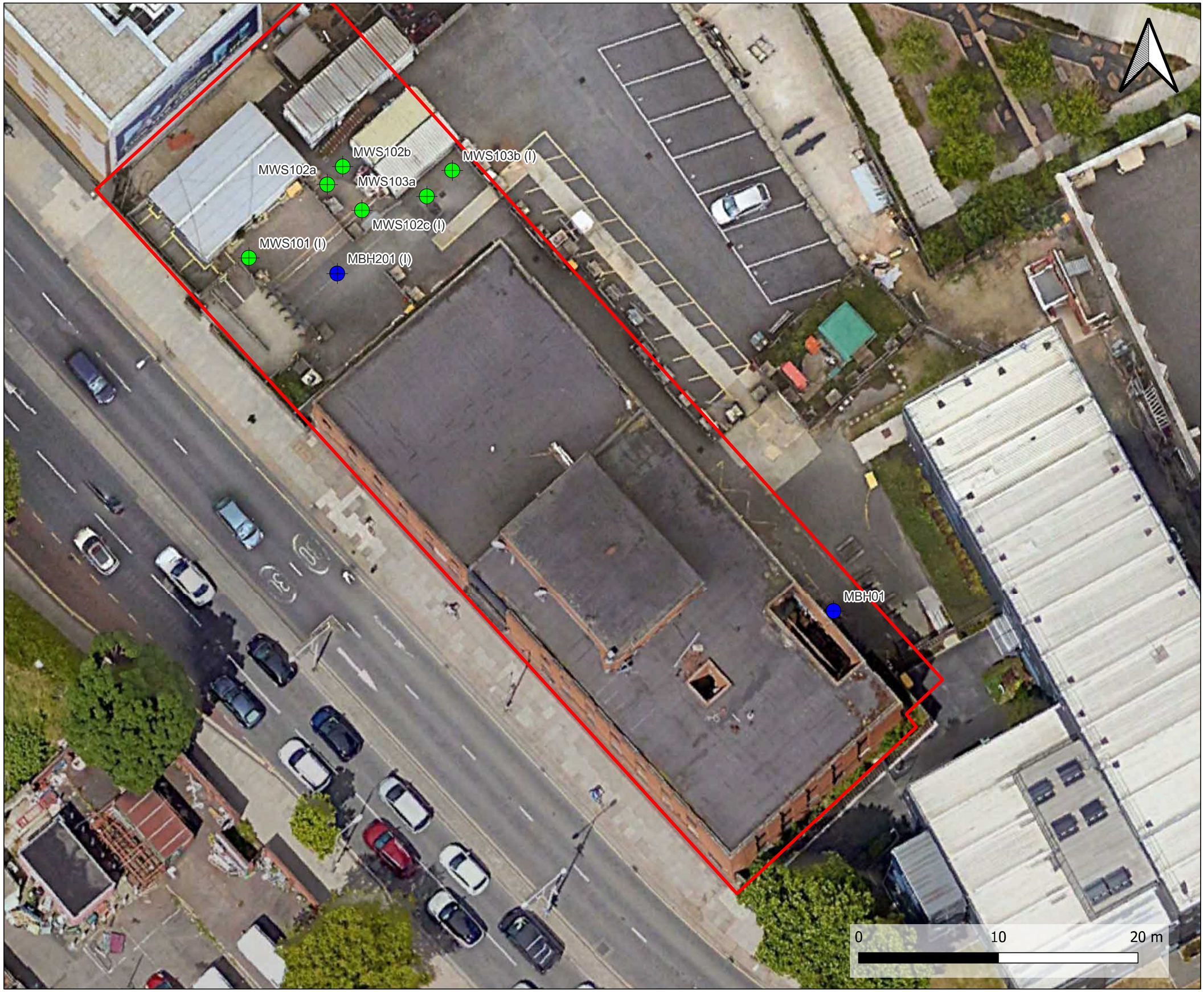
Client/Project	Map Title	Job no.	Drawing No.	Revision
81 - 88 Beresford Street **B Woolwich Ltd**	**Site Location Plan**	22277	22277-001-001	A
		Scale	Date 08/02/2024	Frame dimensions A3
		Drawn CMM	Checked SE	Approved SE



Legend

- Site Boundary
- Cable Percussive Borehole
- Windowless Sample Borehole

Issue Details	Dwn	Chd	App'd
Update following additional ground investigation	CMM	SE	SE
	07/02/2024		B
First Issue	CMM	SE	SE
	31/07/2023		A

Client

B Woolwich Ltd

Project

81-88 Beresford Street

Dwg Title

Exploratory Hole Location Plan

Drawing No.	Revision
22277-304-001	B

Scale	Date	Frame dimension mm
1:250	08/02/2024	(A3) 392 x 277

Drawn	Checked	Approved
CMM	SE	SE

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