LAND CONTAMINATION REMEDIATION VERIFICATION REPORT

in connection with the proposed development at

254 KILBURN HIGH ROAD
CAMDEN

LBHGEO

LBH4631ver

February 2021

DOCUMENT CONTROL				
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FOREWORD – GUIDANCE NOTES

GENERAL

This report has been prepared for a specific client and to meet a specific brief. The preparation of this report may have been affected by limitations of scope, resources or time scale required by the client. Should any part of this report be relied on by a third party, that party does so wholly at its own risk and LBHGEO disclaims any liability to such parties.

The observations and conclusions described in this report are based solely upon the agreed scope of work. LBHGEO has not performed any observations, investigations, studies or testing not specifically set out in the agreed scope of work and cannot accept any liability for the existence of any condition, the discovery of which would require performance of services beyond the agreed scope of work.

VALIDITY

Any use of or reliance upon the report in circumstances other than those for which it was commissioned shall be at the client's sole risk. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should therefore not be relied upon in such altered circumstances.

THIRD PARTY INFORMATION

The report may present an opinion based upon information received from third parties. However, no liability can be accepted for any inaccuracies or omissions in that information.

1. INTRODUCTION

1.1 BACKGROUND

Planning permission was granted by the London Borough of Camden in December 2016 (Planning Ref: 2015/2775/P) for the redevelopment of this site into a multi-storey, mixed-use commercial and residential building occupying the majority of this site.

The roles of those involved on the project team are listed below:

- Previous Site owner — Aitch Group
- Developer — Godfrey London
- Main Contractor — Toureen
- Structural Engineer — RWA London
- Ground Investigation contractor — Jomas
- Gas membrane installer — Geoshield

The planning permission was subject to a following contaminated land related planning condition:

"9 At least 28 days before development commences (other than site clearance & preparation, relocation of services, utilities and public infrastructure, but prior to removal of any soil from the site),:

(a) a written programme of ground investigation for the presence of soil and groundwater contamination and landfill gas shall be submitted to and approved by the local planning authority in writing; and

(b) following the approval detailed in paragraph (a), an investigation shall be carried out in accordance with the approved programme and the results and a written scheme of remediation measures shall be submitted to and approved by the local planning authority in writing.

The remediation measures shall be implemented strictly in accordance with the approved scheme and a written report detailing the remediation shall be submitted to and approved by the local planning authority in writing prior to occupation.

Reason: To protect future occupiers of the development from the possible presence of ground contamination arising in connection with the previous industrial/storage use of the site in accordance with policy CS5 of the London Borough of Camden Local Development Framework Core Strategy and policy DP26 of the London Borough of Camden Local Development Framework Development Policies."

Partial discharge of the above condition was approved in May 2019 (Planning Ref: 2018/3924/P), following submission of the following documents:

- 2013 Sep — Desk Study — Jomas — Ref: P8591J338
- 2019 May — Ground Investigation — Jomas — Ref: P8591J338b, ver. 2.0
- 2019 May — Remediation Strategy — RWA London — Ref: 3891

Application to discharge the remainder of Condition 9 was initially made in February 2020 (Planning Ref: 2020/0633/P) but unfortunately, despite various supplementary submissions of additional evidence, the applicant was unable to assemble an acceptable report detailing completion of the approved scheme, and in July 2020 was advised by Camden to seek advice from a geoenvironmental consultant.

1.2 BRIEF

LBHGEO have been appointed to complete a remediation verification report in order to demonstrate that the approved remediation scheme has been satisfactorily completed.

This report will be submitted to London Borough of Camden to assist in the final discharge of Condition 9 as described above.

1.3 STANDARDS

The government's requirements for the management of land contamination are set out on the .gov.uk Land Contamination Risk Management (LCRM) website pages. LINK TO GOVERNMENT GUIDANCE.

All persons undertaking a land contamination risk assessment, appraising remediation options and preparing a remediation strategy are required to meet a particular standard of competency. These activities cannot be undertaken by individuals who do not have the appropriate technical knowledge, skills, experience and qualifications in dealing with the type of contamination and type of conditions present.

Competency can be demonstrated by the following qualifications:

- a Suitably Qualified Person (SQP) registered under the National Quality Mark Scheme (NQMS)
- the Society of Brownfield Risk Assessment (SoBRA) accreditation scheme
- a Specialist in Land Contamination (SiLC)
- a proven track record of dealing with land contamination[1]

This Verification Report has been prepared in line with the LCRM guidance for Stage 3: Remediation and Verification (Environment Agency, Dated 8th October 2020).

1.4 REPORT STRUCTURE

The report commences with a summary of the site and a description of the project details, followed by a description of the approved remediation scheme.

Details of the remediation measures and procedures, and validation of these, undertaken during the development are then described. The evidence that has been collected as a record of the remediation activities is appended to this report.

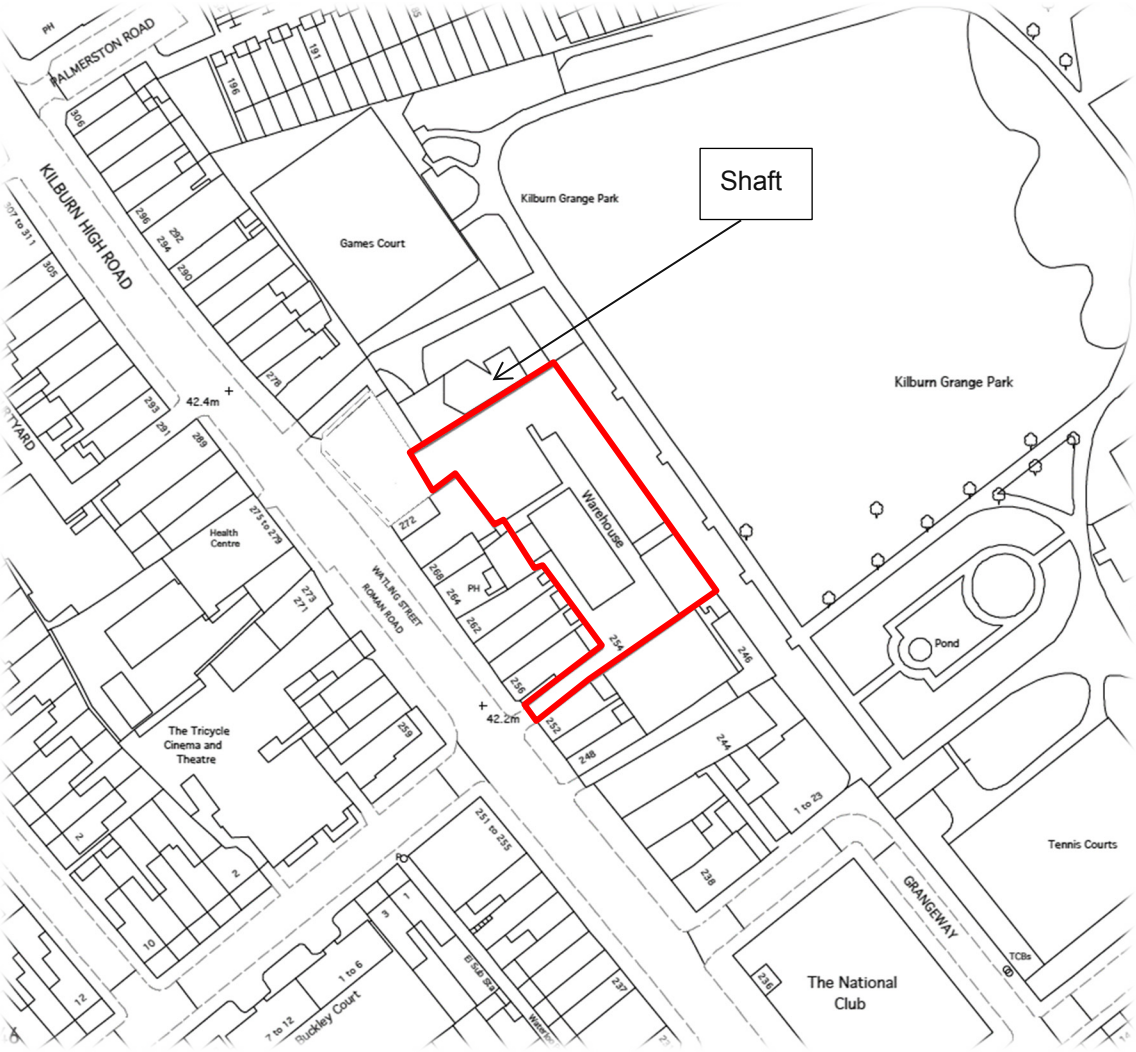
Finally, the verification makes a review assessment of the risks, the success of the remediation undertaken and whether the site is now suitable for commercial and residential occupation.

[1] A proven track record means a regulator or consultant who regularly deals with land contamination. For example, someone with knowledge and experience of the Part 2A regime or someone who regularly deals with the technical aspects of land contamination.

2. THE SITE

2.1 SITE LOCATION

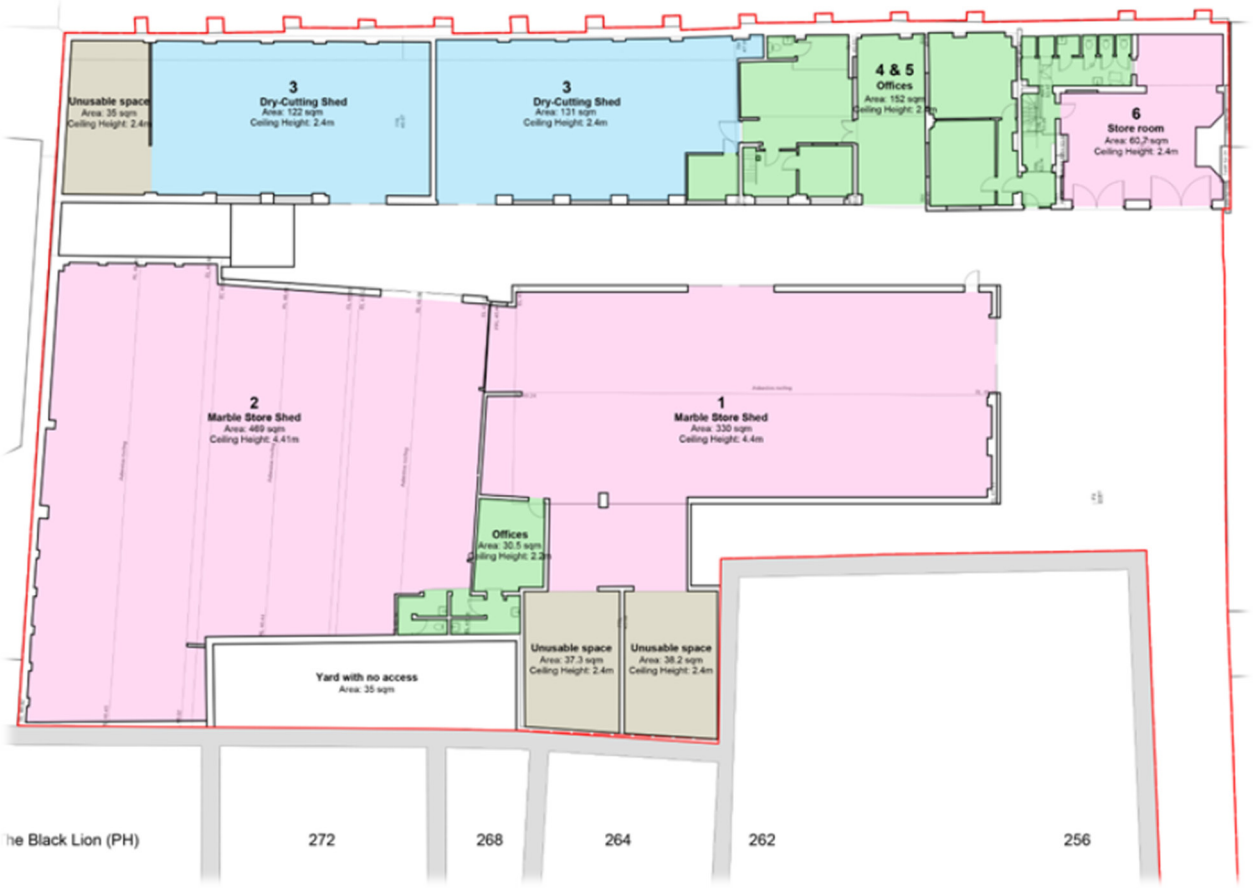
The site is located between a row of buildings fronting Kilburn High Road and Kilburn Grange Park and immediately adjacent to the 7.5m dia. Kilburn Grange Park ventilation intake shaft to the Elstree to St John's Wood National Grid Cable tunnel.



SITE LOCATION PLAN (SHOWING THE PRE-DEVELOPMENT LAYOUT)

2.2 SITE DESCRIPTION

Prior to the present development the site comprised a mixed set of early- to mid-20th Century sheds and warehouses with access from Kilburn High Road. The site was in use as a marble cutting and storage depot as indicated on the following plan.



PRE-DEVELOPMENT SITE LAYOUT

Beneath a variable covering of made ground the site is underlain by the London Clay Formation. The London Clay may be regarded as impermeable and hence there is no groundwater table below the site.

The development was completed last year and was constructed using bored pile foundations with a suspended reinforced concrete ground floor slab underlain by a damp-proof membrane (DMP) and heave protection.

3. REMEDIATION REQUIRED

This section presents a summary of the Ground Remediation Strategy prepared by RWA London[2], with particular focus on the required remediation measures and the validation methodology setting out validation evidence required.

3.1 GROUND REMOVAL

The strategy envisaged that there would be a need to remove soil from the site in order to achieve space to place clean soils for soft landscaping and trees. The requirement was to remove any contaminated soil to a depth of 600mm in soft landscaped areas with a deeper provision of 1m where trees were proposed.

In the event, as described in the soft landscaping section below, there are no garden areas and the site is actually entirely hard-surfaced aside from a single narrow planter around the southern courtyard. This variation is understood to have been in order to meet London Fire Brigade access requirements.

The off-site disposal of soil has to be undertaken in compliance with the Waste Regulations and the developer needs to demonstrate that their duty of care under these regulations has been exercised through the preparation and retention for examination of all waste transfer certificates and consignment notes.

3.2 GAS PROTECTION

The approved strategy required the buildings to be provided with gas protection to accommodate a Characteristic Situation (CS) 2.

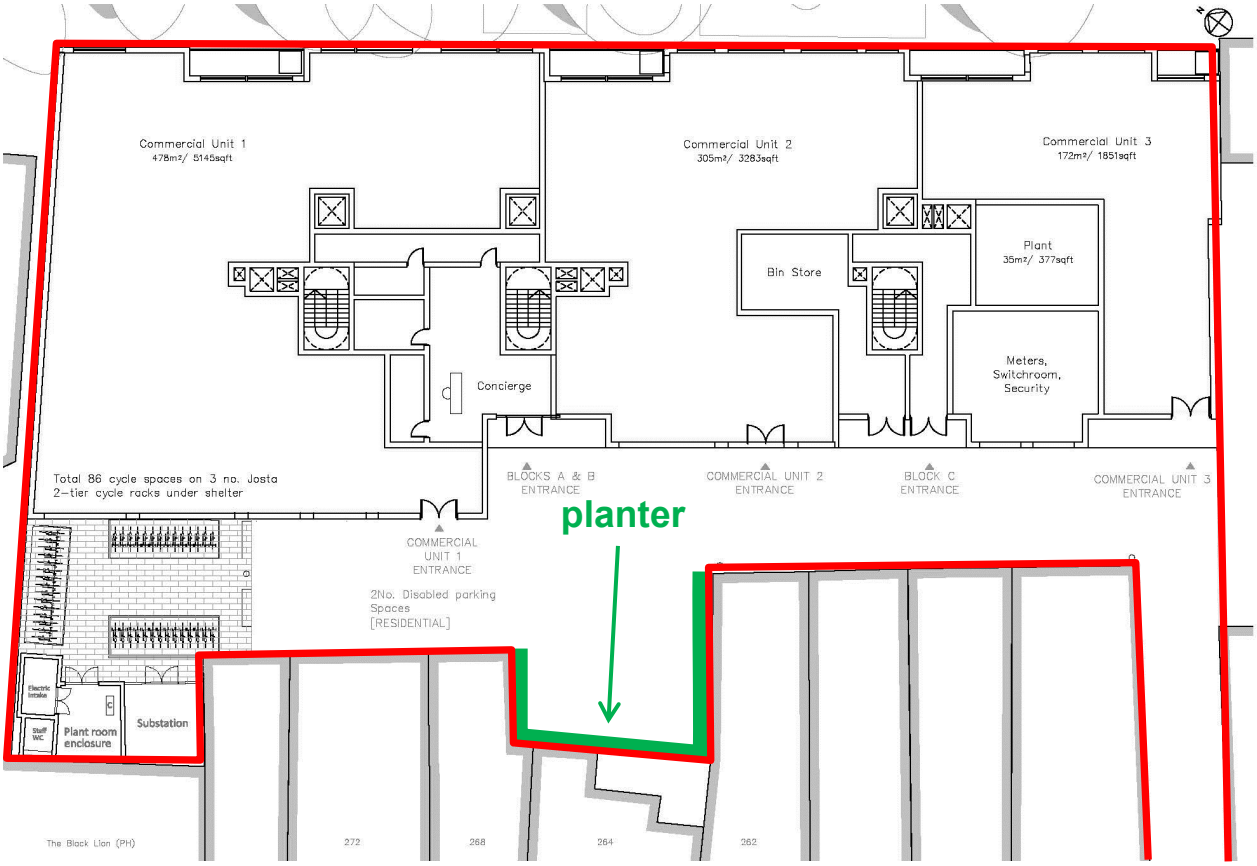
3.3 SOFT LANDSCAPING

The strategy proposed a 600mm thickness of clean imported topsoil cover for soft landscaping and increased to 1m where trees are proposed.

However, as stated above, in the event the landscaping has been limited to a single narrow planter around the southern courtyard, as indicated on the plan on the next page.

The strategy proposed the positioning of a geotextile membrane/marker sheet and the placement of clean imported soil accompanied by supplier certification confirming suitability.

[2] May 2019, Ref 3891



3.4 POTABLE WATER

The approved strategy required sharing of the site investigation testing with the utility providers and the incorporation of their requirements into the specification for potable water pipework at the site.

3.5 SULPHATE EFFECTS ON BURIED CONCRETE

The strategy required the use of DS-2 AC-2 buried concrete in accordance with BRE Special Digest 1.

3.6 VALIDATION REQUIREMENTS

The approved remediation strategy did not include a validation plan, but based upon its contents and an assumption of the intended remediation objectives and criteria, a summary of the validation evidence judged appropriate is described in the table below:

REMEDIATION ISSUE	VALIDATION EVIDENCE REQUIRED
Ground Removal	• Evidence of removal of contaminated material to 600mm depth in soft landscaped areas, with deeper provision, 1m minimum, where trees are proposed • Evidence of waste classification testing • Waste transfer notes or consignment notes for soil disposal
Gas Protection	• Evidence of correct installation of gas protection system meeting the BS 8485 requirements for CS 2.
Soft Landscaping	• Evidence of provision of imported soil clean cover of a minimum 600mm depth in soft landscaped areas, with deeper provision, 1m minimum, where trees are proposed
Potable Water	• Evidence of relevant correspondence with the utility suppliers • Evidence of use of correct pipework
Sulphate Effects on Buried Concrete	• Evidence of use of DS-2 AC-2 buried concrete

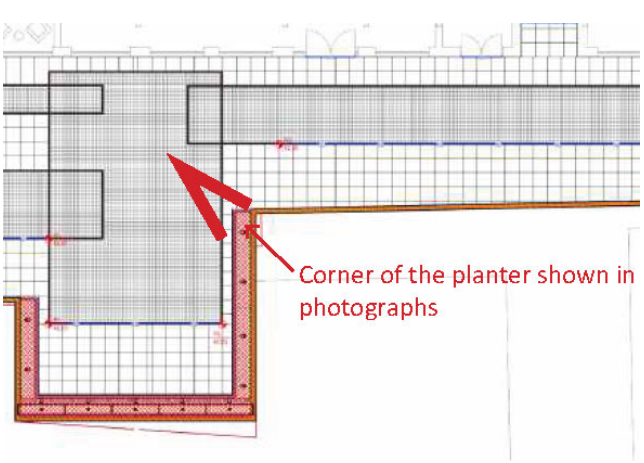
4. EVIDENCE OF REMEDIATION UNDERTAKEN

This section sets out the evidence that has been gathered to demonstrate that the required remediation has been satisfactorily completed.

4.1 GROUND REMOVAL

Although there are a number of ground removal / waste disposal activities associated with the development, the only ground removal associated with the remediation strategy is to permit the creation of a narrow planter around the southern courtyard.

Evidence of removal of existing made ground soil to a depth of approximately 800mm in the area of the planter is provided in the photograph below (extracted from Appendix A).



Waste transfer documentation (see Appendix A) provided by the groundworks contractor, Toureen Group, indicates the transfer of 60 tonnes (approximately 30m^3) of soil between 25th May 2019 and 1st June 2019 under Carrier Licence No. 107956 to the FCC Environment landfill site at Bletchley (former Newton Longville Brickworks) as Non-Hazardous soil 17-05-04. This classification is supported by the Non-Hazardous waste classification demonstrated in Toureen's earlier testing dated 3rd May 2017 (see Appendix A).

It is noted that the tickets support a transfer volume of 30m^3 and that this compares well to the predicted total volume of excavated soils/material to be removed for off-site disposal estimated in the RWA remediation strategy of 38.7 m^3, given that the latter figure included an unused allowance for removing soil from beneath a significantly larger soft landscaped area than resulted.

4.2 GAS PROTECTION

On the basis of the building being regarded as either Type A or Type B, a BS8485 score of 3.5 is required for CS 2 conditions.

The following scores can be assigned to the measures that have been provided at this site

- Reinforced cast in situ suspended floor slab with minimal penetrations SCORE 1.5
- Cordek Sub Cellvent 205 HX9/13 Sub-Floor Ventilation SCORE 2.0

TOTAL SCORE 3.5

The above scoring shows that sufficient gas protection measures have been installed to meet the requirements of BS 8485.

Inspections of the site were undertaken as follows

- Cordek 7th July 2017 Cordek Inspection letter dated 24th October 2017
- Geoshield 9th December 2019 Geoshield report ref: 100718 002
- Geoshield 3rd June 2020 Geoshield report ref: 100718 003

The above reports are included in Appendix B and provide verification evidence that the floor slab and sub-floor venting have been correctly installed.

The attention of the reader of this document is drawn to the fact that there were unfortunately errors in the application of BS8485 contained both in the RWA remediation strategy and in the subsequent Geoshield reports. For the sake of clarity these errors are described in the following sections. (For assurance it may be noted that the author of this report is one of the authors of the BS 8485 guidance.)

4.2.1 ERROR IN RWA REMEDIATION STRATEGY:

The RWA remediation statement incorrectly implied that BS8485 gas protection measures should comprise either:

> *"a) Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft) with at least 1200 g damp proof membrane and underfloor venting; or*
>
> *b) Beam and block or pre-cast concrete and 2000 g DPM/reinforced gas membrane and underfloor venting."*

To meet the requirements for the assessed situation the BS 8485 guidance requires that a minimum of two components (floor slab / membrane / venting) should be used to achieve the required scoring, whereas the above statement incorrectly implied that all three components are necessary. In practice, owing to the scores achieved for the slab and venting alone, the membrane can be viewed as redundant and not requiring any score.

4.2.2 ERROR IN GEOSHIELD REPORTS:

The Geoshield reports incorrectly assigned a score of 2 for the structural floor and 1.5 for the venting.

BS8485 Table 5 permits a maximum score of 1.5 for a reinforced cast in situ suspended floor slab.

Fortunately, Geoshield also mis-scored the venting arrangement.

BS8485 App B7 for polystyrene void formers assigns a score of 2 points for polystyrene shuttering with an equivalent clear void depth of less than 60mm and side ventilation openings meeting the requirements of BS8485 App B6, which for CS2 requires a minimum area of side ventilation of 1,500 mm2/m run of wall on at least two opposite sides.

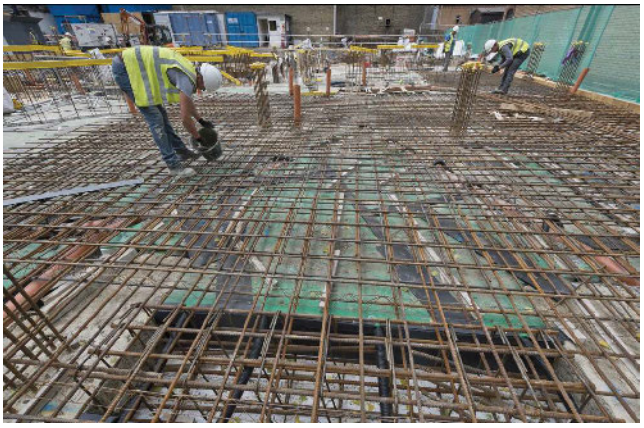
Additionally and possibly as a result of confusion, it seems that Geoshield incorrectly also assessed the installation of the DPM as part of the gas protection measures. As per the tabulated score at the top of this page, a membrane is not required for this project to meet the requirements of BS8485.

4.2.3 GAS PROTECTION CONCLUSION

It should be noted that the errors noted in the previous two sections do not affect the satisfactory assessment of the gas protection measures that have been provided.

The final assessment is that there is no residual gas risk to the development as it has been constructed.

SIDE VENTILATION



REINFORCED CAST IN SITU FLOOR SLAB

SUB-FLOOR VENTILATION POINTS

4.3 SOFT LANDSCAPING

The photograph below (extracted from appendix C) provides evidence of filling of the planter with topsoil with a depth of topsoil in excess of the 600mm requirement in the approved Remediation Strategy.

Appendix C contains evidence of the topsoil purchase ($5m^3$) together with the suppliers certificate of compliance with BS3882:2015 - Specification for topsoil and requirements for use.

It is noted that the London Borough of Camden have indicated that they require validation of top soil cover to be in accordance with the guidance on verifying cover systems set out in the NHBC Technical Extra Issue 08 November 2012 to ensure that the imported materials used do not themselves pose a health risk

due to contamination and are suitable for their intended use. It is confirmed that the supplier certification to BS 3882 as provided meets these NHBC requirements.

It is noted that there is no evidence of a geotextile marker having been placed at the base of the assuredly clean soil. Although this detail was included in the approved remediation strategy it is considered unnecessary in the light of the extremely small scale of the soft landscaped area involved.

A marker membrane is usually incorporated as a warning sign only where there is perceived to be a potentially significant risk posed to future ground workers digging below the marker level. At this site the soil contaminant concentrations that were detected in the underlying made ground are consistent with urban soils and, in the absence of any detected asbestos risk, it is felt that the omission of the marker is appropriate.

4.4 POTABLE WATER

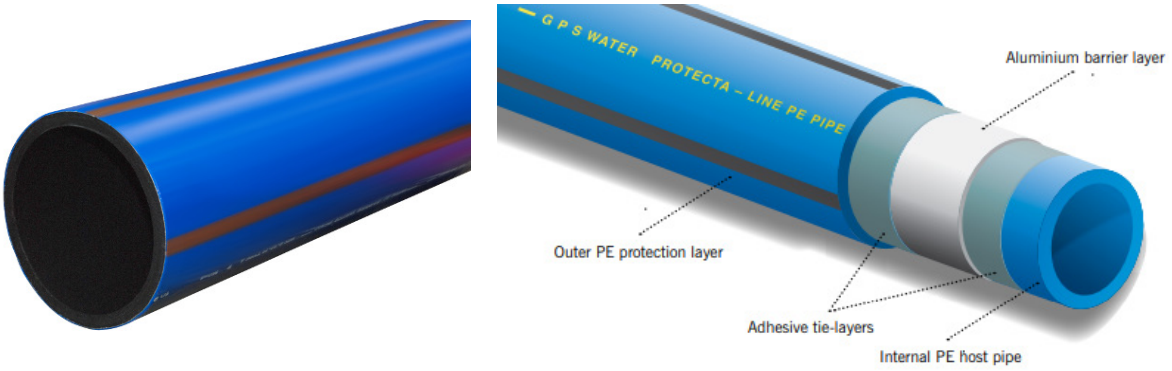
Correspondence with Thames Water – the local utility supplier for potable water – is provided in Appendix D, confirming their requirement for Barrier Pipes to be installed at the site.

Photographic evidence of the use of Barrier Pipes is included in Appendix D and, as can been seen from the photos below extracted from Appendix D, it is identified as GPS PE Protecta-Line.

GPS PE Protecta-Line is usually accepted as a Barrier Pipe for the transportation of water through brownfield sites / contamination land and is understood to comply with BS 8588:2017 *Polyethylene pressure pipe with an aluminium barrier layer and associated fittings for potable water supply in contaminated land.*

SITE PHOTO SHOWING BARRIER PIPE BEING INSTALLED

LOCATION VERIFICATION PHOTO



GPS PE Protecta-Line Barrier Pipe

4.5 SULPHATE EFFECTS ON BURIED CONCRETE

Evidence that the structural engineer has specified the correct class of sulphate resisting concrete for the foundations, DS-2 AC-2 buried concrete (BRE Special Digest 1), is contained in Appendix E, together with the concrete supplier's DS-2 Mix Design for this site.

5. EVALUATION

It is apparent that the documents associated with both the assessment and the management of the land contamination issues at this site are not reflective of best practice levels of competence.

However, although it is considered that incorrect conclusions have been drawn at several stages by various different firms associated with the remediation at this site, it should be noted that the degree of required mitigation set out in the approved remediation strategy may, certainly, be considered an overestimate rather than an underestimate.

This report provides lines of evidence that the intended remediation works have been satisfactorily completed in accordance with the approved remediation strategy.

A complete record of all the evidence regarding remediation associated with each of the five issues identified in the remediation strategy is contained in the appendices as follows.

Appendix A Ground Removal

Appendix B Gas Protection

Appendix C Soft Landscaping

Appendix D Potable Water

Appendix E Sulphate Effects on Buried Concrete

5.1 UPDATED CONCEPTUAL SITE MODEL

A pollution linkage requires there to be a source of contamination, a sensitive target that can be adversely affected by the contamination and a pathway via which contamination can reach the target. The conceptual model of envisaged contamination risks affecting the site can be presented in the form of this source-pathway-receptor pollutant linkage concept.

In order to evaluate the post-remediation contamination risks at this site the severity of the risk in terms of the magnitude of the potential consequence of the linkage occurring has been compared with the likelihood of the linkage existing.

The likelihood and consequence of a problem involving each particular pollutant linkage has been attributed a risk rating as shown in the table below:

RATING	1	2	3	4	5
LIKELIHOOD	Very unlikely	Unlikely	Evens	Probable	Highly probable
CONSEQUENCE	Negligible	Minor minor injury / minimum cost / minor health risk	Mild / Medium chronic health risk / risk of injury / appreciable costs to meet regulatory standards		Severe Death / major injury / explosion / maximum cost

On the basis of this qualitative rating system the various potential pollutant linkages have been attributed a risk ranking on the basis of the value of the product of the likelihood and consequence ratings, where a value of less than five is low, between five and ten is medium and above ten is high. A table estimating the residual risk associated with the identified principal possible pollutant linkages for the site is presented below.

CONCEPTUAL SITE MODEL (POST-REMEDIATION)					
SOURCE	RECEPTOR	PATHWAY	LIKELIHOOD	CONSEQUENCE	RISK RANKING
Soil contamination	End-users	Ingestion of soil or dust, skin contact or inhalation	1	3	3 (LOW)
	Buried services	Direct contact	1	2	2 (LOW)
	Foundations	Direct contact	1	2	2 (LOW)
Harmful soil gas	End-users	Asphyxiation/ inhalation	1	3	3 (LOW)
	Buildings	Explosion	1	3	3 (LOW)

SUMMARY OF REMEDIATION CRITERIA ACHIEVED		
ISSUE	**OBJECTIVE**	**LINES OF EVIDENCE**
Ground Removal	Compliance with Waste Regulations	Waste documentation, photos, test results
Gas Protection	Install gas protection measures in compliance with BS8485 CS2	Verification reports, photos
Soft Landscaping	Install 600mm clean cover layer	Photos, purchase documents, test results
Potable Water	Adopt protective barrier supply pipework if required	Photos, correspondence
Sulphate	Adopt correct concrete mix design	Engineers specification on drawing, concrete suppliers documentation

5.2 POST TREATMENT MANAGEMENT

No ongoing or future monitoring of the site following the issue of this report is required as it is apparent that all the remediation requirements have been met.

There is no requirement for ongoing monitoring or periodic maintenance to maintain the effectiveness of the mitigation in the future.

Any future construction work that penetrates either the building ground floor slab or the external hard surfacing must be planned and undertaken with due regard to the remedial barrier measures that have been installed and must ensure that these are preserved.

There are no envisaged restrictions required on future activities, land use, maintenance or building operations, so long as these take account of the need to preserve the remedial measures that have been installed.

6. CONCLUSION

This report provides a verification record that the required remediation has been successful completed to adequately reduce the identified land contamination risks at this site to an acceptable level.

With regards to land contamination, the buildings may now be considered suitable for occupation. The risk assessment provided I section 5.1 above must be reviewed in the event of any future development or construction or maintenance activities that could interfere with the remedial measures.

This report should be submitted to the Local Authority to enable a full discharge of planning Condition 9 of application 2015/2775/P. There are no other regulators or organisation required to be consulted on this verification report.