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*GEOTECHNICAL ASSESSMENTS – ENVIRONMENTAL ASSESSMENT - DESKTOP STUDY – CONTAMINATED LAND*

***Report For :***

***Higgins Homes PLC***

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# Phase III REMEDIATION REPORT

***Site location :***

***Former Cherry Garden School,***
***Macks Road,***
***Bermondsey,***
***London***
***SE16 3XU***

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***June 2020***
***Report No. 15629***

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# DOCUMENT INFORMATION AND CONTROL SHEET

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***Qualifications***

***C.S.Gray***

- ONC, HNC, P.G.Cert, P.G.Dip, M.Sc, (Geotechnical Engineering)
- SNIFFER modelling course
- CONSIM Groundwater Assessment Course.
- (28 Years in Geotechnical and Environmental Engineering)
- Asbestos Awareness Course;
- Non-Licensed Work with Asbestos Including NNLW.
- Site Supervisors Safety Training Scheme, (SSSTS).
- First Aid Trained

Document Status and Approval Schedule

| Issue No | Status | Date | ***Prepared by :*** Chris Gray Signature / Date | ***Technical review by :*** Rebecca Chamberlain Martyn Smith Signature / Date | ***Checked By :*** Rebecca Chamberlain Chris Gray Signature / Date |
|---|---|---|---|---|---|
| 1 | Final | June 2020 |  |  |  |

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# 1 Introduction

## 1.1 Aims and objectives

At the request of Higgins Homes PLC, Herts & Essex Site Investigations have been asked to further assess and consider the site for the preparation of this Site Remediation Strategy Report to define, where appropriate, a strategy for the remediation and validation of the site to enable a fit for use classification upon completion of the development and hand over for sale.

The principal aim of this report is to provide a source document for regulatory authorities and other interested parties to review, in particular the Environment Agency, Planning and Higgins Homes PLC. Agreement from regulatory authorities will be required in order to satisfy planning conditions and to ensure that the site does not present a significant risk to potentially vulnerable receptors including future site users, controlled waters and the environment.

The main objectives of this Remediation Method Statement are as follows:

- To comply with the requirements of the Regulatory Authority requirements;
- To provide a summary of the remedial works, and specific methodology for removal of metal based pollutants that have impacted on soils;
- To provide details of good working practices during site remediation works, in accordance with current legislation and guidance.

This document has been reproduced in addition to the existing remediation strategy report in order to better and more clearly define the extent of remedial measures for the site. The existing state of reporting is detailed as follows:-

- Phase 1 Land Contamination Preliminary Risk Assessment prepared by Herts & Essex Site Investigations in October 2019, and;
- Phase 2 Geo Environmental Site Investigation Report prepared by Herts & Essex Site Investigations in December 2019.

## 1.2 Current Planning Status

The purpose of this Report is to satisfy the requirements of Planning Condition 10 of the granted planning decision notice, reference. EPF/2940/15, (File No 008303). This is assessed for contamination in conditions 8, 9, 10 and 11. Conditions 8, 9 and 10 have been approved by the reporting specified in Section 1.

## 1.3 Remediation Requirements

The preparation of this remediation strategy and any future verification plan is to ensure the site is suitable for future use when completed and habitable. The proposals laid out in this report have been proposed based on the plans provided to us by the client and submitted to the council and are in place to mitigate against future risk being in place.

This remediation strategy is based upon the findings of all previous reporting and assessments which have been completed jointly by Herts & Essex Site Investigations.

The remediation strategy and verification plan have been developed for the site in accordance with guidance documents :-

- Defra & Environment Agency, (2004), CLR 11 Model Procedures for Management of Land Contamination;
- BS 10175:2011+A2:2017, Investigation of potentially contaminated sites. Code of practice. Code of practice
- Environment Agency, (2010) GPLC1 Guidance Principles for Land Contamination;
- PPS23 Pollution and Planning, (ODPM 2004)
- Environment Agency, (2010) Science Report SC030114/R1 Verification of Remediation of Land Contamination;

- CL:AIRE, (2010) Framework for Assessing the Sustainability of Soil and Groundwater Remediation;
- CL:AIRE, (2008) The definition of Waste; Development Industry Code of Practice.

## 2 Background and Environmental Settings

### 2.1 Site Details

The site is located within a residential area of London, the details of which are summarised in Table 1 with the location plan of the site shown in Appendix 2, Sheet 1.

**Table 1 Site Detail**

| | |
|---|---|
| ***Site Address :*** | Former Cherry Garden School, Macks Road, Bermondsey, London SE16 3XU |
| ***Site assessed under*** | Site Owners Request - Aid as part of future planning |
| ***Current use of land :*** | Primary School |
| ***Previous use of site, (if known)*** | As above |
| ***Grid Reference*** | NGR 534340, 178850 |
| ***Site Area*** | 0.23 Hectares |
| ***Local Authority*** | Southwark Council |
| ***Gradient of the site*** | The site and the surrounding area form a level area of land. |
| ***Proximity of Controlled Waters, (if known)*** | The nearest surface water feature is recorded as 704 meters to the east of the site area, where a pond is in place with Southwark Park. |

### 2.2 Site Description

Within the east of the site area there is a tarmac parking area in place, this area is accessed from Mark Road to the west and Alexis Street to the north. Limited features are in place within this area, some surface drainage gullies were seen in place.

The main building is accessed from the car park area within the east. The building forms a partly single storey and some parts two storey buildings within the center and south of the site area. Limited access was possible at the time of the walk over although it is recorded that classrooms, and amenities are in place although is no longer in use. There is potential for a boiler room to be in place, housing the heating system for the site.

Within the east and south east of the site area hard landscaped recreational areas are in place, with various play equipment, seating area as well as smaller fenced off area. Some small plant beds are in place.

### 2.3 Brief Site History

- From the earliest map reference that site area is recorded as terraced residential dwellings with rear gardens, in about 1940 the area was redeveloped (likely due to bomb damage during the war) the site and land to the east, south and west remain residential land. From 1973 the site area was redeveloped to form the school which remains in place to date.
- Surrounding the site residential land remains in place to the east, south and west. Some commercial shops are in place to the south east of the site area. To the north of the site area a grassed recreational area is in place.

### 2.4 Desk Top Study Findings

- The nearest surface water feature is recorded as 704 meters to the east of the site which is recorded as a pond within Southwark Park.
- The nearest abstraction well is located 775 meters to the east of the site which is recorded as a Public Administration: Drinking, Cooking, Sanitary, Washing, (Small Garden) and Municipal Grounds: Make-Up or Top Up Water.
- The site does not lie within a Source Protection Zone
- The ground conditions based on geological maps and BGS information shows the site to be located within an area of Kempton Park Gravel Member within the superficial deposit which over lays Lambeth Group. To the south of the site area, 40m, there is Thanet Formation report in place below the Kempton Park Gravel Member.

### 2.5 Desk Top Study Conclusions

Considering the assessment of the site to incorporate the walk over survey we have completed we can confirm that risks identified in place form :-

**Table 2 Pollutant Risk**

| ***Risk Assessment*** | ***Land Use*** | ***Pollutant*** | |
|---|---|---|---|
| ***Risk Assessment A*** | ***Features On Site***<br><br>Parking area–W<br><br>School<br><br>Terrace dwellings and gardens- Redeveloped (possible bomb damage)<br><br>Made ground | ***Soil, Groundwater & Vapour Risk***<br><br>Moisture Content, pH, Electrical Conductivity, Cyanide, (Free), Cyanide, (Total), Organic Matter, Boron, Sulfate, (2:1 water soluble), Chromium, (Hexavalent), Sulfate, (Total), Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Zinc, Speciated PAH's, (EPA Priority 16), Phenols, Asbestos, Total Petroleum Hydrocarbons (aliphatic/ aromatic 8-Band), Naphthalene, $CO_2$, $CH_4$.<br><br>***Soil Sampling Groundwater & Vapour Assessment*** | |
| ***Spatial Sampling, (General Assessment)*** | | Moisture Content, pH, Electrical Conductivity, Cyanide, (Free), Cyanide, (Total), Organic Matter, Boron, Sulfate, (2:1 water soluble), Chromium, (Hexavalent), Sulfate, (Total), Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Zinc, Speciated PAH's, (EPA Priority 16), Phenols. | 25 meter Centres In accordance with BS10175: 2011+A2:2017. |
| | | Asbestos | 5-10 meter Centres In accordance with BS10175: 2011+A2:2017. |

## 2.6 Environmental Report Conclusions

### *2.6.1 Scope of site investigation Works completed*

The scope of works completed within the site investigation are recorded in the Site Investigation Reports and can be reviewed within this report. This confirms the following source data :-

The investigation works completed are as detailed below :-

1. The focus of the investigation was to confirm risks from the site which are detailed as follows :-
   a. Assessment of soils across the site area.
2. Spatial sampling around the remainder of the site to provide a general assessment.

***Initial Investigation – October 2019***

- 7 No Competitor Rig Windowless Sampler borehole sunk to depths of approximately 3.00 meters - Date of Works – Nov 2018 ( Access to the location of WS3 & WS5 was not possible).
- 2 No Shell and Auger Drilling Rig Boreholes were completed to a depth of 25 meters; - Date of Work – Nov 2019.
- Installation of 2 No standpipes to a depth of 6.00 meters for the purpose of ground water assessments.
- Chemical Sampling and Testing recovered from samples and sent to analytical chemist, (26 November 2019).

### *2.6.2 Geology*

The site has been reviewed and we can confirm that the geology within the site is as follows :-

**Table 3 Geological Profile**

| *Stratum* | *Description* | *Depth, Range* | *Thickness, Range* |
|---|---|---|---|
| ***Made Ground*** | Tarmac | 0.05 – 0.20 meters | 0.05-0.20 meters |
| | clayey brick, Concrete and gravel FILL<br>brown sand FILL<br>brown silty clay FILL | 0.50 - 1.70 meters | 0.40 – 1.59 meters |
| ***Kempton Park Gravel Member*** | Medium dense brown slightly claybound SAND | 1.30 – 1.80 meters | 0.60 – 1.30 meters |
| | Firm brown mottled grey sandy CLAY increasing in silt and sand content with depth | 1.20 - 1.60 meters | 1.00 meter |
| | Dense brown SAND & GRAVEL | 5.00 - 5.40 meters | 3.35 – 3.60 meters |
| ***Lambeth Group*** | Very stiff grey sandy slightly silty CLAY with shell fragments | 7.00 meters | 1.40m+ meters |
| | Very stiff grey sandy slightly silty CLAY with pockets of increase silt | 8.60 – 7.00 meters | 1.60 meters |

| | | | |
|---|---|---|---|
| | CLAY with rounded black gravel over SAND with black gravel | 9.00 – 9.70 meters | 1.00 - 1.10 meters |
| | Dense grey SAND | 25.00m + meters | 14.50+ meters |

***Ground Water*** : Groundwater has been identified within the scope of the site works within the Deeper Shell and auger boreholes at 6.00 and 6.20 meters. No long term monitoring has been completed to date.

### *2.6.3 Soil Contamination Risks*

Risk based on assessments of the site with a proposed use of Residential land use with plant uptake confirms that risk is in place as follows :-

Risk based on assessments of the site confirm that risk is in place as follows :-

**Table 4 Soil Contamination Risks**

| *Risk Factor* | *Risks in place* | *Remediation* |
|---|---|---|
| ***Targeted Risks*** | ***Lead*** Risk within the Fill<br>***WS7*** | Remediation action required.<br>Additional sampling to comply with the statistical data set. |
| ***Spatial Risks*** | None | None |

### *2.6.4 Ground and Surface Water Risks*

No risk is identified in place.

### *2.6.5 Land Gas Risks*

In accordance with CLR11, BS 10175:2011, BS 8485:2007, CIRIA C665 and CIRIA R149, risks from land gas were potentially recorded in place within site area due to the potential form increased depths of made ground.

Within the investigations completed the depth of fill within the site was recorded up to 1.70 meters in one location, the majority of the fill is recorded as a sandy Hardcore FILL. No elevated levels of organic matter are recorded within the site area.

Therefore, we would consider that sources of land gases are not in place within the site area.

### *2.6.6 Water Main Pipework*

Construction materials have been considered and elevated levels of PAHs have been identified within the site, therefore risk to the water main pipework will be in place and Conventional pipework should be used within the site area, all water main pipework should be laid in clean corridors to prevent future harm to the workforce used in maintenance of the system. To confirm :-

- New water main pipework should be laid in Conventional pipework system;
- Any water main pipework should be laid in clean corridors in order to prevent future risk to workforce used in the maintenance and repair of any water main system.

An assessment of risk in relation to water main pipework has been considered within the scope of the works and considering the pollution measured at the site. Based on a comparison of the WRAS Data and UKWIR, (Guidance for the selection of water supply pipework on brownfield sites), it can be seen that marginal levels of contamination, (In the form of fuels), have been identified and risk is directly in place to water main pipework. This would suggest that any new water main pipework should be installed using Protecta-Line pipework.

### *2.6.7 Building Risks*

Considering the risk from Sulphates to concrete we can confirm that the chemical testing completed confirms the sulphate levels in the ground which can identify risk to concrete and whether special sulphate resisting cement may be required.

Based on the information gained, we can confirm that a classification of DS2-AC1s should be adopted for the site. This would suggest that a conventional cement mix can be used for the development.

## 2.7 Conceptual Site Model

In order to assess the potential risks posed to human health and the surrounding environment from the site condition, a Generic Quantitative Risk Assessment has been used to consider whether risk is in place. This uses Source Pathway Receptor risk assessment methodology in accordance with CLR11.

The summary conceptual site model developed within the ground investigation reports has been re created below :-

**Table 5 Risk Assessment A**

| *Source* | *Receptors* | *Pathway* | *Mitigation / Discussion* |
|---|---|---|---|
| ***Lead*** | Site Users, (current and future); Construction Workers; Adjacent Site Users, Fauna. | Direct contact | Risk is likely to be isolated to WS7 |
| | | Ingestion dust and soil | |
| | | Ingestion of soils attached to vegetation | |
| | | Inhalation of asbestos fibers | Not Applicable |
| | | Inhalation of vapours, (gas and organic) | No vapour risk from Lead contamination identified |
| | | Explosive risk from Land Gas | Not Applicable |
| | | Ingestion of contaminated water through water main pipework | No risk in place from Lead contamination identified |
| | | Inhalation of vapours through contaminated ground waters | No vapour risk from Lead. |
| | | Direct contact with contaminated ground waters | Groundwater risk has been identified as low based on the information gained. |
| | Surface Water. | Lateral migration of shallow groundwater to a target receptor. | |
| | Ground Water; Abstraction Well. | Migration through fissures / cracks which may migrate to a groundwater receptor. | |
| | Plants; Vegetation. | Plant uptake; Direct contact. | Plant Risks are considered Low based on assessments with ICRCL old exposure levels. No specific plant risk assessment criteria is in place to date. |
| | Buildings; Construction Materials. | Direct contact with contaminated soils; | PAH's pose a low risk to the built environment. |
| | | Direct contact with contaminated groundwater | Groundwater risk has been identified as low based on the information gained. |

# 3 Remedial Strategy

## 3.1 Additional Site Investigation Works to Complete

Additional works which MUST be completed prior to the approval and implementation of this report form the following :-

- No additional works are required at this time. Based on the information gained, we can confirm that the site investigation works completed have appropriately defined the site risks.

## 3.2 Source Pathway Receptor Risk

place within the site which may require mitigation or remediation works in order to develop a suitable development. The methods of control or reducing the unacceptable risks are defined as follows :-

- Remove or treat the contamination at source to remove the risk;
- Remove the pathway in which contamination can impact on a receptor;
- Remove the receptor from the environment.


If the pollution chain is broken, the risk associated with pollution can be removed. If the source is removed or treated, the pollution has been removed and as such, risk is removed. If the pathway is broken, the contamination cannot impact on the receptor as no pathway is in place. If the receptor is removed, (however unlikely this is), features / receptors cannot be impacted on.

As such, if the pollution chain is broken, risk is removed.

Considering the development of the site a combination of remediation options are proposed for the site which will be detailed as follows:-

### *3.2.1 Source Removal*

The removal of source risk can be completed to include both removal of near surface soils to provide a capping system across the site where contaminated soils are placed directly over the underlying low-level contamination and provides a barrier between the human being and the underlying contamination. The depth of capping which is generally considered viable to remove risk is 0.60 metres.

A further source removal technique will form the removal of all contamination where contamination is identified as shallow. If the depth of capping is a minimum of 0.60 metres and the contaminated layer only extends to a depth of say 0.45 metres, if the full depth of contamination is removed and this exposes clean ground underlying this depth, clean soil will then overlie clean soil.

Confirmation will be required to confirm the level and extent of contamination which is in place within the base of any remediation cell.

### *3.2.2 Pathway Removal*

A combination of factors will be employed in the development of the site. This will incorporate placement of permanent hard surfaces over the contamination a mechanism to remove interaction with the contamination. Dermal contact, inhalation and ingestion pathways will be removed through the placement of hard cover across the site. These will include roads, pavements and driveways, although, will not include patio areas where future excavation may occur.

Protective pipework may be required to remove risk to the water mains.

### *3.2.3 Receptor Removal*

Receptors relate to the presence of human health interaction in the site upon completion of the development. This cannot change through the development.

Based on the above, the soils remediation process will comprise the following.

### 3.3 Proposed Remediation Options

***General Contamination Risks Brought Forward***

***Targeted Risks***

- ***FILL*** :- ***Isolated*** contamination from ***Lead*** to the areas of ***WS7 ONLY*** – ***additional testing and Remediation works will be required to this area***
- ***Concrete attack from the subsoil should will include concrete mix DS-2/AC1s***

***Spatial Risks***

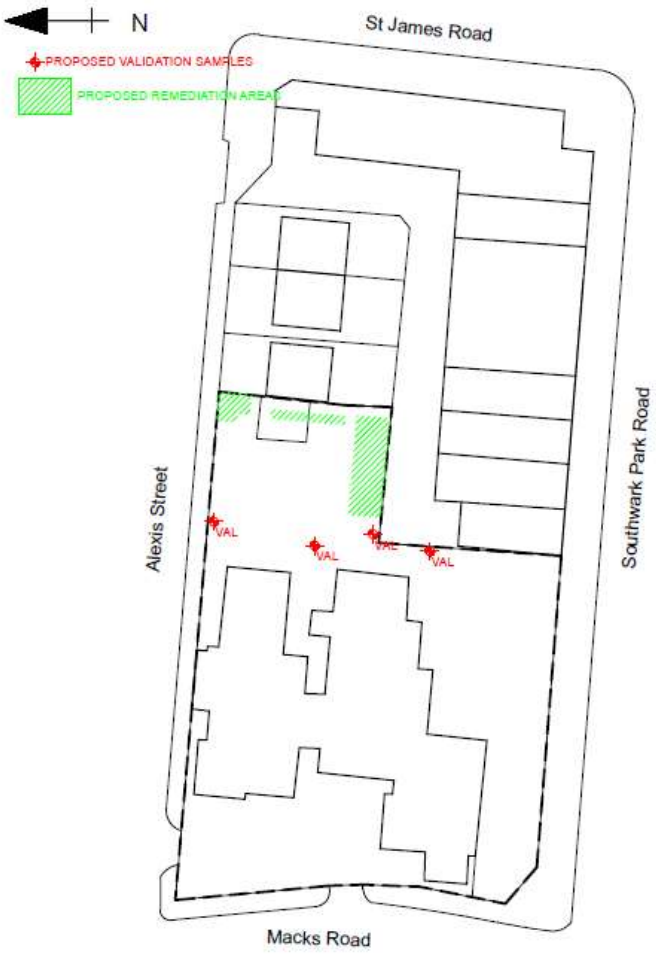
- None.

### 3.4 Human Health Risk

The extent of human health risks will be discussed in the following sections.

***Figure 1 – Remediation Plan***

***Existing Site Plan***




***Proposed Site Plan***

### *3.4.1 General Remediation Requirements and Possible Scenarios – Soft Landscaping*

- A number of possible remediation options may be in place when completing remediation of the site. These options are ***ONLY REQUIRED WHERE SOFT LANDSCAPING IS PROPOSED***

- This will include one of the following scenarios :-

**Scenario One** **Shallow Contamination, (>0.60m) with Validation Samples**

When the depth of made ground in locations across the remediation cell in full or part does not extend to the depth of proposed capping system. Therefore, removal of shallower depths of made ground, (say 0.30m), may remove all the contamination and expose clean ground, (either natural or made ground).

If this scenario occurs in full or part, validation sampling will be required at the base of the remediation cell to confirm that whilst the minimum capping depth has not been achieved, in fact no capping system is in place as the cell will ultimately form clean soil over natural or clean soils from the original site. In this scenario, the following assessments must be completed :-

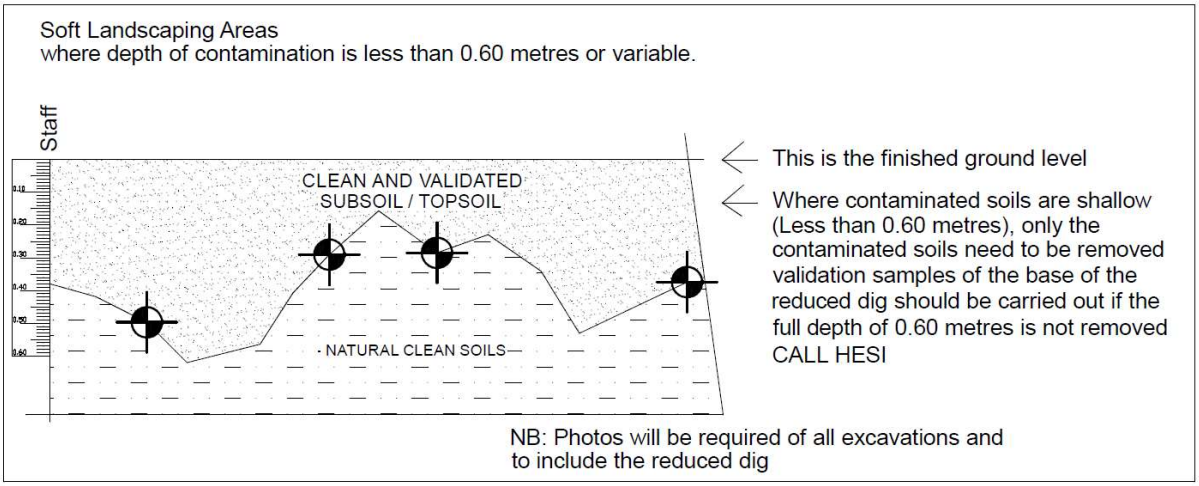
- A review of the site must be completed to ensure that hotspots, (large or small), do not remain in place amongst clean underlying soils which are proposed to remain in place. Full removal of contaminated soils should be completed and provided as part of a visual and olfactoral assessments completed by an external environmental engineer. This should also include photographic evidence of these remediation cells confirm the above does not take place.

- A visual appraisal of the base and sides of the remediation cell to consider any visual or olfactoral evidence that risks outside that defined in the environmental reporting completed to date are in place.

- Validation sampling from the sides of the excavation to confirm that the defined contamination originally identified in the remediation cell has been removed.

- Backfill the excavation with at least 0.60 metres, (or whatever depth has been removed to identify clean soil) of clean and inert soil, (tested to confirm its suitability for use within residential land uses with plant uptake).

***Figure 2 Shallow Contamination – Validation Sampling – Scenario 1***




**Scenario Two** **Full 0.60m Capping Layer with Geotextile**

When the full depth of capping is required to be removed as the depth of made ground is in excess of 0.60 metres which will need to implement a Geotextile at the base of the remediation cell as shown in Figure 2. In this scenario, the following assessments must be completed :-

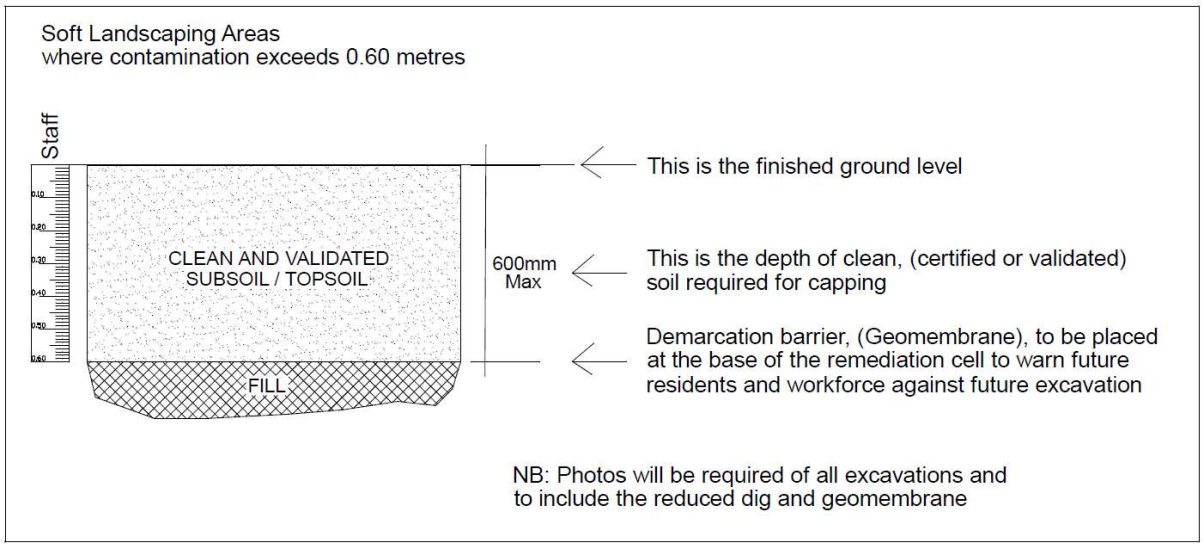
- If the density of Asbestos sampling has not been completed to a suitable density based on BS10175:2011+A2:2017, (Investigation of potentially contaminated sites. Code of practice. Code of practice), sampling should be completed across the base of the remediation cell to confirm the absence of Asbestos.

- A visual appraisal of the base and sides of the remediation cell to consider any visual or olfactoral evidence that risks outside that defined in the environmental reporting completed to date are in place.

- Validation sampling from the sides of the excavation to confirm that the defined contamination originally identified in the remediation cell has been removed.

- Backfill the excavation with at least 0.60 metres of clean and inert soil, (tested to confirm its suitability for use within residential land uses with plant uptake).

***Figure 3 Capping System – 0.60m Cap & Geotextile Barrier – Scenario 2***




**Scenario Three** **Full 0.60m Capping layer with Capillary Break Layer**

When the full depth of capping is required to be removed as the depth of made ground is in excess of 0.60 metres. In addition to this, the underlying contamination will be shown to be elevated above a commercial level or in a form in which capillary rise has a potential to occur and warrant the need for a capillary break layer and also de-clogging / warning layer, as shown in Figure 4. In this scenario, the following assessments must be completed :-

- Excavation of the required minimum capping layer depth of 0.60m within the remediation cell;

- Additionally, excavate a further 0.20 metres within the remediation cell such that the remediation cell totals a depth of 0.80 metres;

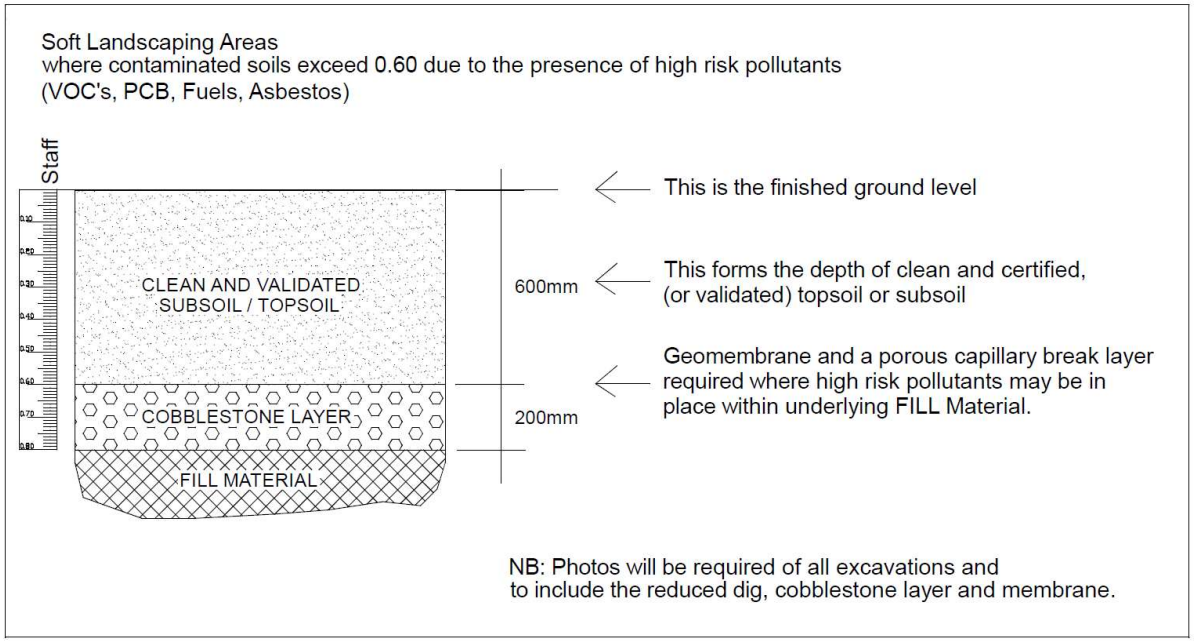
- If the density of Asbestos sampling has not been completed to a suitable density based on BS10175:2011+A2:2017, (Investigation of potentially contaminated sites. Code of practice. Code of practice), sampling should be completed across the base of the remediation cell to confirm the absence of Asbestos;

- Validation sampling from the sides of the excavation to confirm that the defined contamination originally identified in the remediation cell has been removed;

- Backfill the excavation with at least 0.20 metres of crushed concrete, (tested to confirm that the material does not contain Asbestos);

- Place a geotextile across base of the remediation cell, (on top of the crushed concrete) such that a capping layer of at least 0.60 metres can be placed within the remediation cell as a completion layer.

***Figure 4 Capping System – 0.60m Cap & Geotextile Barrier – Scenario 3***

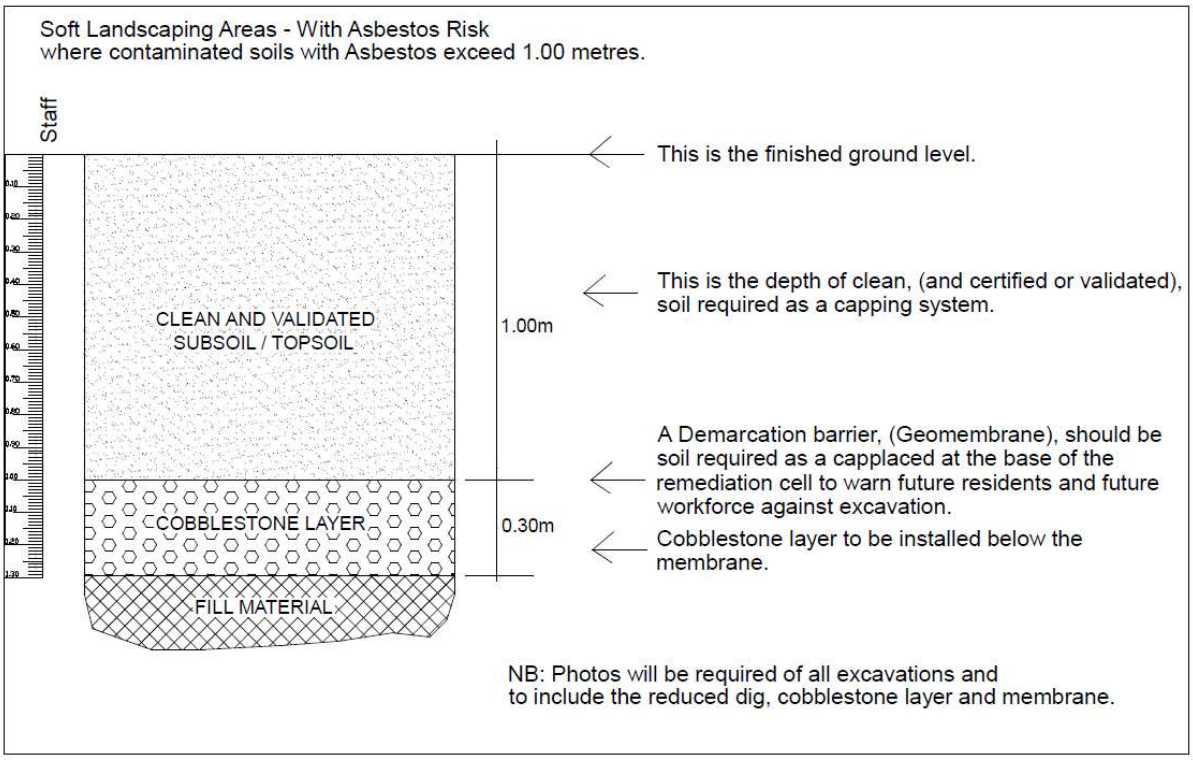



**Scenario Four** **Extended Capping System – High Risk Pollutants - Asbestos**

When high risk pollutants are identified within a site, additional depths of capping are required to provide in ground barriers between future residents and the high-risk pollution. In these scenarios, at least 1.00 metre of clean cap will be required with the addition of an additional no dig barrier developed at the base of the remediation cell. This should form at least 0.20 metres of compacted and crushed concrete with a geotextile barrier laid over the top, as shown in Figure 5. In this scenario, the following assessments must be completed :-

- Excavation of the required minimum capping layer depth of 1.00m within the remediation cell;
- Additionally, excavate a further 0.20 metres within the remediation cell such that the remediation cell totals a depth of 1.20 metres;
- Validation sampling from the sides of the excavation to confirm that the defined contamination originally identified in the remediation cell has been removed;
- Backfill the excavation with at least 0.20 metres of well compacted crushed concrete;
- Place a geotextile across base of the remediation cell, (on top of the crushed concrete) such that a capping layer of at least 1.00 metres can be placed within the remediation cell as a completion layer.

***Figure 5 Capping System – 1.00m Cap & No Dig Barrier – Scenario 4 – High Risk***




**Scenario Five**

When the remediation is to be completed in an area where tree preservation orders are in place and therefore root protection areas exist in the remediation cell, we can confirm that where the protection of the tree will take precedence over human health, a shallow strip of soil should take place as shown in Figure 5 below. In this scenario, the following assessments must be completed :-

- Excavation should take place by hand until roots are identified using hand dug means of excavations. Roots should be protected in this scenario and maintained in all circumstances;

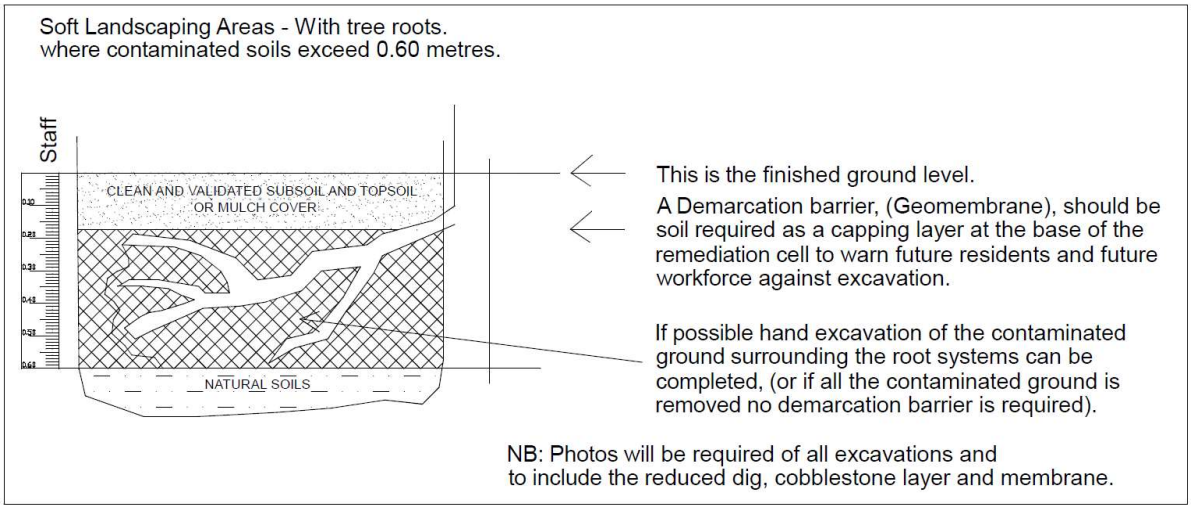
- If through service trenches, foundation excavations or similar, root systems extend away from the source tree which are broken through these trenches, it is deemed that anything beyond the trench, (unless another tree takes precedence), no longer has ties with the tree and full remediation can take place, as required in other scenarios;

- If the density of Asbestos sampling has not been completed to a suitable density based on BS10175:2011+A2:2017, (Investigation of potentially contaminated sites. Code of practice. Code of practice), sampling should be completed across the base of the remediation cell to confirm the absence of Asbestos;

- Validation sampling from the sides of the excavation to confirm that the defined contamination originally identified in the remediation cell has been removed;

- Place a geotextile across base of the remediation cell, (on top of the crushed concrete) such that a capping layer to cap the remediation cell is completed.

***Figure 4 Capping System – 0.60m Cap & Geotextile Barrier – Scenario 3***




### *3.4.2 General Remediation Requirements and Possible Scenarios – Ground Gases*

No risk is in place from ground gases.

### *3.4.3 Specific Remediation Works*

***Remediation Cell 1 –Isolated to WS7 Location ONLY.***

- Considering the nature of the contamination identified, ***(i.e. Lead)***, we would suggest that the depth of capping should form a conventional capping system with a geotextile layer laid over the top as defined within ***Scenario 2*** above. As the depth of made ground in the location of WS7 extends to a depth of 1.70 metres, a capping system would likely be required to provide optimum remediation.
- A review of the reduced dig area of the remediation cells should be made upon completion of the removal of at least 0.60 meters of the soils and sampling completed across these remediation cells to confirm the absence of Asbestos, (as a general rule), and that the levels of contamination from Lead are not above a commercial level. As such, the test criteria for the reduced dig and sides of the excavation of the remediation cell will form Lead and Asbestos in this Remediation Cell.
- Validation testing should be undertaken to the sides and base of the remediation cell which should include say 6-8 samples across the base of the remediation cell and 8-10 samples around the perimeter of the remediation cell to be tested for Lead and Asbestos, (presence / absence) with further works undertaken if risk identified and the remediation works repeated until clean soils are recorded.
- If no Asbestos is identified and the levels of Lead are broadly in line with that defined within this report, (i.e. below commercial levels), a no dig barrier in the form of geotextile should be laid across the remediation cell to ward against future excavation.
- If Asbestos is identified within the remediation cells, the procedure adopted in ***Scenario 4*** should be completed.

- If the levels of Lead are identified above a commercial level in the base of the remediation cell made ground / contamination remains in place at this depth excavate a further 0.20 meters of soil to achieve a total remediation cell depth of 0.80 meters in depth. At this point, place approximately 0.20 meters of crushed concrete or porous stone into the base of the remediation cell to provide the necessary start of a capillary break layer. A layer of porous membrane, (preferably hi-visibility), should be placed across the capillary break layer as both a layer to prevent clogging of the capillary break layer and also as a warning to possible future excavation that risk may be below. This will be in line with ***Scenario 3*** above.
- A record of the soils to remain in place at the base of the remediation cell should be kept, through site notes and photos, for validation.
- A Materials Management Plan, (MMP), will be required in order to provide adequate confidence that cross contamination from both the demolition process of existing site features and structures and also the potential for soils to become cross contaminated to other areas of the site which may increase costs for site remediation does not occur. The groundworks contractor / remediation contractor will be required to provide adequate reporting that cross contamination has been fully prevented and validation that the proposals have worked.

***General***

Detailed notes will be required through the development to confirm the extent of options above and where contamination extends to depth and where full contamination has been removed and different scenarios as recorded. This should be documented on detailed plans by the onsite contractor for use in a verification plan.

Validation of these remediation cells is required see section 4.1.

The remediation of the area could either be undertaken :-

- At the start of the development so that all contamination is removed from the site prior to any other ground works being undertaken. This is sometimes completed at the time of the demolition and clearance of the feature currently within the site area.

Or

- At the end of the development when all the areas of the proposed gardens and communal landscaping within this remediation cell will need to be remediated as above. This scenario is likely to incur cross contamination and as such, is not recommended.

A method statement for the movement of soils around the site for off site disposal must be developed and submitted to ourselves for approval for the movement and off site disposal of the remediation cells at the site.

***It should be noted that a significant cause of cross contamination form the mixing of site based remediation cells with clean areas of soils, particularly in the case of Asbestos which can spread to clean areas. As such, a defined Materials Movement Plan should be developed and followed to avoid cross contamination risks. This should be designed in accordance with Definition of Waste – Code of Practice.***

### *3.4.4 Semi Permanent Landscaping, (Patio Areas)*

Treat as Soft Landscaping if in defined remediation cells.

### *3.4.5 Building Materials*

Based on the information shown, we can confirm that the risk from explosive land gases is low based on the information identified. The justification for low ground gas risk has been identified and reviewed in Section 10.6.

Considering the risk from Sulphates to concrete we can confirm that the chemical testing completed confirms the sulphate levels in the ground which can identify risk to concrete and whether special sulphate resisting cement may be required.

Based on the information gained, concrete has been identified as a risk and as such, any cement used within the development of the site should be a DS2-AC1s classification sulphate resisting cement.

### *3.4.6 Permanent Hard Landscaping, (Main Driveway)*

Permanent hard landscaping could form the main driveway and parking area which is laid to tarmac and cannot be removed by the residents.

The hard standing will cap off any contamination and removed the pathway, no additional works are required.

If these areas of permanent hard landscaping fall within areas of Asbestos, a file note should be made to confirm that this is the case and potential future risk is in place within this area.

## 3.5 Workforce

- All Site Staff and visitors to the site should be made aware of the contamination risk within the site area (Lead).
- Appropriate PPE and RPE should always be worn;
- Washing facilities should be made available for washing hands prior to consumption of any food or water within the site area.

## 3.6 Groundwater Risk

Groundwater is identified as a low risk.

## 3.7 Process of Remediation

The development of the site is anticipated to incorporate the following phases :-

- Materials Movement Plan to be developed and approved.
- Evidence of implementation of MMP an validation of works completed.
- Demolition of any and all features within the site.
- Site Strip in preparation for the development of the site.
- Full soil remediation works implemented.
    - Full remediation and validation of PAH Contamination.
- Foundation Construction.
- Main development.
- Placement of hard standing.
- Install clean and certified topsoil within soft landscaping (if not completed within an earlier phase).
- Landscaping and installation of clean capping layer.
- Verification Reporting.

# 4 Validation requirements

No permanent monitoring proposals are in place in relation to the site.

Soils which fail the human health criteria will not be permitted to be re-used within the site development. Any soils which fail the criteria should be removed from the site with appropriate waste tickets retained.

## 4.1 Validation Requirements for Remediation Cells

The extent of validation works which should be implemented will incorporate the following details which should be completed, retained and reported as evidence of appropriate validation within any validation reporting:

- Validation that the excavation and removal of the PAH contaminated soils has been completed, by an external environmental engineer and recover photographic evidence and validation samples of the excavation for use in a validation report.
- Validation that the excavation and removal of contaminated soils has been completed or that a sufficient clean capping has been installed, to all areas of soft landscaping by an external environmental engineer and recover photographic evidence of the excavation for use in a validation report, OR provide evidence and plans where full removal has taken place and no capping is present, (i.e. clean natural soils overlain by clean imported soils.

- Retain all 'Muck Away Certificates' which have been received as a result of the excavation of remediation cells only. Muck away certificates relating to muck away for say pile arisings will not be required under validation criteria.
- Where the depth of made ground extends to depths below the capping system and a demarcation barrier has been placed in areas of soft landscaping, a file note and plan should be completed of these locations. Recover photographic evidence of the membrane installation.
- Replace the remediation cell void with fully certified and tested topsoil or subsoil, (as required), to make up the required minimum depth of 0.60 meters of 'Clean Capping'.
- Evidence of specific segregation of waste product must be completed along with all lines of evidence to confirm that cross contamination has not taken place, (as should be designed within a materials management plan).

**Table 6 Remediation & Validation Requirements**

| ***Location*** | ***Remediation Cell No*** | ***Validation Sampling*** | ***Testing Criteria*** |
|---|---|---|---|
| ***WS7*** | Remediation Area 1 | 8-10 Samples from the side of each remediation cell.<br><br>6-8 Samples from the base of each remediation cell | ***Asbestos and Lead*** |

### 4.2 Photographs

Photographs will be required at key stages of the development which should be included within a validation report. Specifically, these will need to include :-

- Photos should also be taken of the key stages of the development and any contamination encountered, including unexpected contamination.
    - This should include points of construction or groundworks which would provide additional comfort that the site does not pose a risk of contamination.
- Photographs of any reduced digs carried out within the site area, especially if natural soils are encountered.
- Photographs of all reduced dig areas which form remediation cells.
- Photographs of the exposed remediation cell to soft landscaping which exposes the underlying soils and includes measuring staff.
- Photographs of the remediation cell to soft landscaping which exposes the demarcation barrier.
- Photographs of the finished final site condition.
- Photographs of all stages of the installation of gas protective measures to include structural barriers, gam membrane barriers and ventilation systems.

### 4.3 Removal of Contaminated Soils

- Contaminated soils should be removed from site via a licensed haulier.
- All waste consignment notices should be retained as evidence that the soils have been removed from site.
- Segregation of waste must be completed and reported on with appropriate validation works. Ensure cross contamination does not take place. .
- We would suggest that WAC testing must be completed in order to safely and appropriately dispose of waste soils.

### 4.4 Validation of Imported Soils

- Upon importing of subsoil, (if any), and topsoil, samples will be required for chemical analysis. It should be noted that soils which are placed in the site are recommended for pre-validation such that confirmation that these soils will form clean and acceptable materials based on the validation criteria shown within Table 8. It is often the case that soils are manufactured in landfill sites or waste management facilities which still promote an unacceptable risk based on an end use of residential land uses. This should be noted within the importing status of any soils to the site.
- In accordance with guidance produced by Essex Local Authorities, 'Land Affected by Contamination 2nd Edition – Technical Guidance for Applicants and Developers', we would recommend that a single sample should be recovered per 15m³ of imported soils and tested for full Standard Environmental Suite including Speciated Poly Aromatic Hydrocarbons and Speciated Total Petroleum Hydrocarbons.
- The above along with a current certificate from the supplier, if available, will confirm the topsoil or subsoil to confirm that the contamination status for confirm the material is suitable for use in a residential land use scenario, (Sensitive Land Use).

### 4.5 Validation Protocol

HESI have derived soil remediation targets for the principal contaminants of concern in for materials which are proposed to be brought onto the site. These conform to current UK residential land use standards for contaminated soils and as such are stringent levels. As a result of these levels, we would suggest that initial pre-validation of soils is undertaken prior to placement or even bringing the soils on site such that confirmation is gained that the soils are suitable.

We would suggest that for validation of both subsoil and topsoil, the parameters below are met:-

**Table 7 Imported soils criteria - Residential Land Use Standards**

| *Pollutant* | *Allowable Level* ($mg/kg^{-1}$) | *Source* |
|---|---|---|
| ***Asbestos*** | Absent /Present | |
| ***Inorganic Arsenic*** | 37 | ***At Risk Soils*** |
| ***Beryllium*** | 1.7 | ***LQM/CIEH S4UL*** |
| ***Cadmium*** | 22.1 | ***At Risk Soils*** |
| ***Chromium, (III)*** | 910 | ***LQM/CIEH S4UL*** |
| ***Chromium, (VI)*** | 6 | ***LQM/CIEH S4UL*** |
| ***Copper*** | 4730 | ***At Risk Soils*** |
| ***Lead*** | 200 | ***At Risk Soils*** |
| ***Mercury, (Elemental)*** | 0.0863 | ***At Risk Soils*** |
| ***Mercury, (Inorganic)*** | 180 | ***At Risk Soils*** |
| ***Mercury, (Methyl)*** | 8.81 | ***At Risk Soils*** |
| ***Nickel*** | 136 | ***At Risk Soils*** |
| ***Selenium*** | 375 | ***At Risk Soils*** |
| ***Vanadium*** | 136 | ***At Risk Soils*** |
| ***Zinc*** | 20000 | ***At Risk Soils*** |
| ***Boron*** | 290 | ***LQM/CIEH S4UL*** |
| ***TPH, (Total)*** | >20 required Speciated assessment | |
| ***Phenols*** | 390 | ***LQM/CIEH S4UL*** |

| *Pollutant* | *Allowable Level* ($mg/kg^{-1}$) | *Source* |
|---|---|---|
| ***Naphthalene*** | 5.6 | ***LQM/CIEH S4UL*** |
| ***Acenapthylene*** | 420 | |
| ***Acenapthene*** | 510 | |
| ***Flourene*** | 400 | |
| ***Phenanthrene*** | 220 | |
| ***Anthracene*** | 5400 | |
| ***Flouranthene*** | 560 | |
| ***Pyrene*** | 1000 | |
| ***Benzo(a)anthracene*** | 11 | |
| ***Chrysene*** | 22 | |
| ***Benzo(b)flouranthene*** | 3.3 | |
| ***Benzo(k)flouranthene*** | 93 | |
| ***Benzo(a)pyrene*** | 2.7 | |
| ***Dibenzo(ah)anthracene*** | 0.28 | |
| ***Indeno(1,2,3-cd)pyrene*** | 36 | |
| ***Benzo(g,h,i)perylene*** | 340 | |

**Table 8** *Imported soils criteria – Residential Land Use with home grown produce Standards .... Continued*

| *Pollutant* | *1% Soil Organic Matter* | *2.5% Soil Organic Matter* | *6% Soil Organic Matter* | *Source* |
|---|---|---|---|---|
| ***Total Petroleum Hydrocarbons*** | | | | |
| ***Aliphatic Fractions*** | | | | |
| EC > 5-6 | 42 | 78 | 160 | |
| EC > 6-8 | 100 | 230 | 530 | |
| EC > 8-10 | 27 | 65 | 150 | |
| EC > 10-12 | 130 | 330 | 760 | ***LQM/CIEH S4UL*** |
| EC > 12-16 | 1100 | 2400 | 4300 | |
| EC > 16-35 | 65000 | 92000 | 110000 | |
| EC > 35-44 | 65000 | 92000 | 110000 | |
| ***Aromatic Fractions*** | | | | |
| EC > 5-7 | 70 | 140 | 300 | |
| EC > 7-8 | 130 | 290 | 660 | |
| EC > 8-10 | 34 | 83 | 190 | |
| EC > 10-12 | 74 | 180 | 380 | ***LQM/CIEH S4UL*** |
| EC > 12-16 | 140 | 330 | 660 | |
| EC > 16-21 | 260 | 540 | 930 | |
| EC > 21-35 | 1100 | 1500 | 1700 | |

# 5 Implementation Process

## 5.1 Remediation Team

This report confirms the required level of remediation needed to remediate the site to a suitable and fit for purposes standard. We can confirm that at this time, the following parties are involved in the remediation proposals at this site :-

***The Client:*** *the client will ultimately be responsible for the remediation of the site and appointing appropriate personnel to provide lines of evidence that remediation works have been undertaken and that validation works have been completed sufficiently to provide the relevant Local Authority, with documentary evidence that works have been completed to a suitable standard.*
***Consultant :*** *the consultant will undertake validation that the remediation works have been undertaken to a suitable standard although, will require instruction from 'the client' as and when appropriate levels of remediation have been achieved.*
***Principle Contractor:*** *The principle contractor will likely undertake initial site works which will remove contamination from the site as part of the initial site development. It is possible that these works may remove the depths of made ground, (contamination), to remove any and all risk within the site.*

## 5.2 Watching Brief

During the course of the development it will be the responsibility of the on-site manger to ensure watching briefs are kept. A watching brief consists of a record of:

- Any observations of contamination made during the course of development by any member of site staff, contractor or visitor
- A photographic record of the key stages of development and key occurrences including any contamination found during the course of the development, the formation levels of excavations, any reduced level dig/mass excavation, formation of landscaped or garden areas, etc.
- Contact the Environmental Engineer and strategic points within the development of the site where contamination validation elements will be required.

In areas of the site where there is a greater chance of finding contaminated soil and/or water an area specific watching brief will need to be kept. Such a brief will need to be completed by an appropriately qualified site manager and/or an environmental consultant. The following table specifies works in specific parts of the site that require an area specific watching brief, identifying who must complete the watching brief.

**Table 9 Watching Brief – Targeted areas for observation**

| *Area of site* | *Works to be observed* | *Person to observe works* |
|---|---|---|
| Remediation Cell 1 | Ensure minimum depth of capping soils have been completed at the site and ensure a warning membrane has been installed at the base prior to install of topsoil / subsoil | Site Agent / Groundworker / Environmental Engineer. |
| Foundation Excavations | General watching brief through foundation excavations. | |

Upon completion of associated works, a written and signed statement will be obtained by the following parties:

- Ground works contractor(s) upon completion of foundations and ground works
- On site manager upon completion of groundworks and landscaping work
- Environmental Consultant upon completion of groundworks and landscaping works

The written statement must clearly state whether or not evidence of contamination was identified during the course of the development and the action that was taken. An example statement is provided below.

“I am [insert name] from [insert company]. We undertook [insert works undertaken] between the [start date] and [finish date]. During the course of work at [insert site name and address] we observed [delete were not applicable: no potential contamination / evidence of contamination / significant evidence of contamination].

***Where contamination is identified***

The contamination identified:

[include a description of the observations of the contamination]
[identify the location of the observations of contamination and mark the locations on a plan]
[Who was notified of the observations]
[What action was taken to mitigate/clear up contamination]”

The on site manager statement must include confirmation of whether all site staff and contractors received an appropriate brief regarding the potential presence of contamination.

### 5.3 Site Staff Training / Briefing

All site staff, site contractors and, where significant contamination is expected site visitors, will be briefed on the potential presence of land, water or air bourn contamination before commencing work on the site. Apart from any standard Health & Safety practices this will include the following information:

- Health & Safety considerations;
- Asbestos Awareness course;
- The type of land, water or air bourn contamination expected at the development site based on previous use and available site investigation information.
- Any particular areas of the site which are likely to be affected.
- Staff responsibilities under the discovery strategy.

The on-site manager will need to provide written confirmation that site staff were briefed about contaminated land in line with these recommendations.

### 5.4 Discovery Strategy

The discovery strategy sets out the actions that must be taken if contamination is encountered during the course of a development.

A significant observation includes any observation of contamination. Examples of the types of observations that would be considered significant are set out in the following table.

**Table 10 Discovery Strategy – Examples of Observations**

| *Evidence* | *Description* |
|---|---|
| Visual | • Fuel or oil like substances mixed in with or smeared on the soil or floating on perched, groundwater or surface waters.<br>• Waste materials (refuse, barrels, industrial wastes, ash, tar, etc.) buried at specific location or across the site.<br>• Marked variation in colour. For example red, orange, yellow, green, light or dark blue, etc. may indicate contamination from a variety of contaminants.<br>• Soils including large amounts of ash and clinker where such contamination of soils wasn't expected. |
| Odours | • Fuel, oil and chemical type odours<br>• Unusual odours such as sweet odours or fishy odours |
| Wellbeing | • Light headedness and/or nausea when in excavations, at the working face of an excavation, when visual or olfactory evidence of contamination exists, etc.<br>• Burning of nasal passages, throat, lungs or skin.<br>• Blistering or reddening of skin due to contact with soil |

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

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

**Table 11 Discovery Strategy – Action to be taken if risks are encountered**

| *Person observing contamination* | *To be reported to:* | *Action to be taken* |
|---|---|---|
| Site visitor | Must report observations to the site manager | None |
| Contractor | Must report observations to the site manager | Stop work and where possible make area safe and secure area before reporting to site manager |
| On site manager | Must report observations to their direct manager, the appointed Environmental Consultant, the Planning Authority and Contaminated Land Officer at the Local Authority | Stop work and where possible make area safe and secure area before reporting to others |
| Environmental Consultant | Must report observations to the site manager, the Planning Authority and Contaminated Land Officer at the Local Authority | Advise that work stops and where possible that the area is made safe before reporting to others |

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

**Table 12 Discovery Strategy – Organisations to be contacted if risks are encountered**

| *Occurrence* | *Description* | *Contact* |
|---|---|---|
| Risk to the public | If at any point residents, the public or others may be at risk as a result of contamination found during the course of investigation, remediation or development works | · Contact the emergency services if there is a risk to life<br>· Contaminated Land Officer/Planning Authority<br>· Health & Safety Executive |
| Nuisance to residents/the public | If a nuisance has been or is likely to be caused to nearby residents, the public and others – for example odours, dust, noise, vibration, etc. | · Pollution Control Team at the Local Authority (and other council's where necessary) |
| Pollution of controlled waters | If any surface, culverted or groundwater has been polluted – for example slurry, contaminated soil/water or a chemical spillage entering a river or canal. | · Environment Agency<br>· Planning Authority and Contaminated Land Officer at the Local Authority |
| Pollution of adjoining land | If land outside the boundary of the development site is polluted from site activities – for example slurry, contaminated soil/water or a chemical spillage | · The owner of the land<br>· Planning Authority and Contaminated Land Officer at the Local Authority |

### 5.5 Validation Report

The following forms the verification requirements that will be needed in order to prepare and complete a Verification Report for the site and as such, where 'the client' does not provide suitable evidence, further testing may be required.

- Appropriate method of waste management of soils on site to avoid cross contamination.
- Provide Method Statement for management of waste and segregation of contaminated soils.
- Volumes of soils disposed off site.
- Results of topsoil analysis of any subsoil/topsoil/capping to the site.
- Plans showing verification sample locations.
- Photographic records of all remediation works.
- Confirmation that the appropriate pipework has been installed within the site.
- Documentation of variations and unforeseen conditions.
- Written signed statements to confirm the watching brief was completed.
- Records of offsite disposal of soil and groundwater.
- Waste Consignment Notices (muck away tickets) and Disposal Register for Duty of Care.
- Consents, permits and approvals gained.
- 'As built' drawings.
- Other records, (e.g. correspondence, photographs etc).

It should be noted that this list may vary dependent upon conditions met on site and therefore is not complete. Upon completion of any and all remediation works which comply with this strategy and a risk assessment and site conceptual model can be completed to confirm no risk is in place to the future user or environment, a site verification report should be completed for submission to the Local Authority and any other interested parties to confirm the site status.

Should the quality of remediation data not be completed in accordance with this report, reasonable attempts to confirm that the works have been undertaken retrospectively should be made. This may involve further more detailed site assessments and testing, monitoring and evidence which will likely incur additional costs.

A validation report will be compiled by HESI or others to document the remediation works undertaken.

### 5.6 Collection of all Necessary Validation Data

The above forms a method of remediation and validation works which will be required as part of the process of discharging of planning conditions. Failure to collect this information in part or in full will result in a failure to discharge conditions relating to contaminated land and lead to potentially significant retrospective site investigation works to enable the collection of this data.

It is the responsibility of the developer to action all necessary remediation works on site and inform the remediation contractor of the need to obtain any and all relevant validation data.

It is possible that the sourcing of this validation data could be recovered by the developer, the main contractor, groundworks contractor, a specific remediation contractor or an external environmental engineer. The selection of the right person to collect the validation data should be carefully selected to ensure that no validation bias in relation to the works is in place upon completion of the development and we would always recommend that the validation data is collected by either a separate remediation contractor or external environmental engineer.

PLEASE BE AWARE THAT THE SOURCING OF VALIDATION DATA AFTER COMPLETION OF THE DEVELOPMENT IS NOT SOMETHING THAT COULD BE EASILY OBTAINED AND AS SUCH, MAY LEAD TO A FAILURE IN DISCHARGING OF ANY PLANNING CONDITIONS ASSOCIATED WITH THE SITE AND THEREFORE THE ABILILTY TO SELL THE DEVELOPMENT ON.

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| Appendix No | 1 |
| Sheet No | 1 |
| Job No | 15629 |
| Date | June 2020 |

Former Cherry Garden School, Macks Road, Bermondsey, London SE16 3XU

Location Plan

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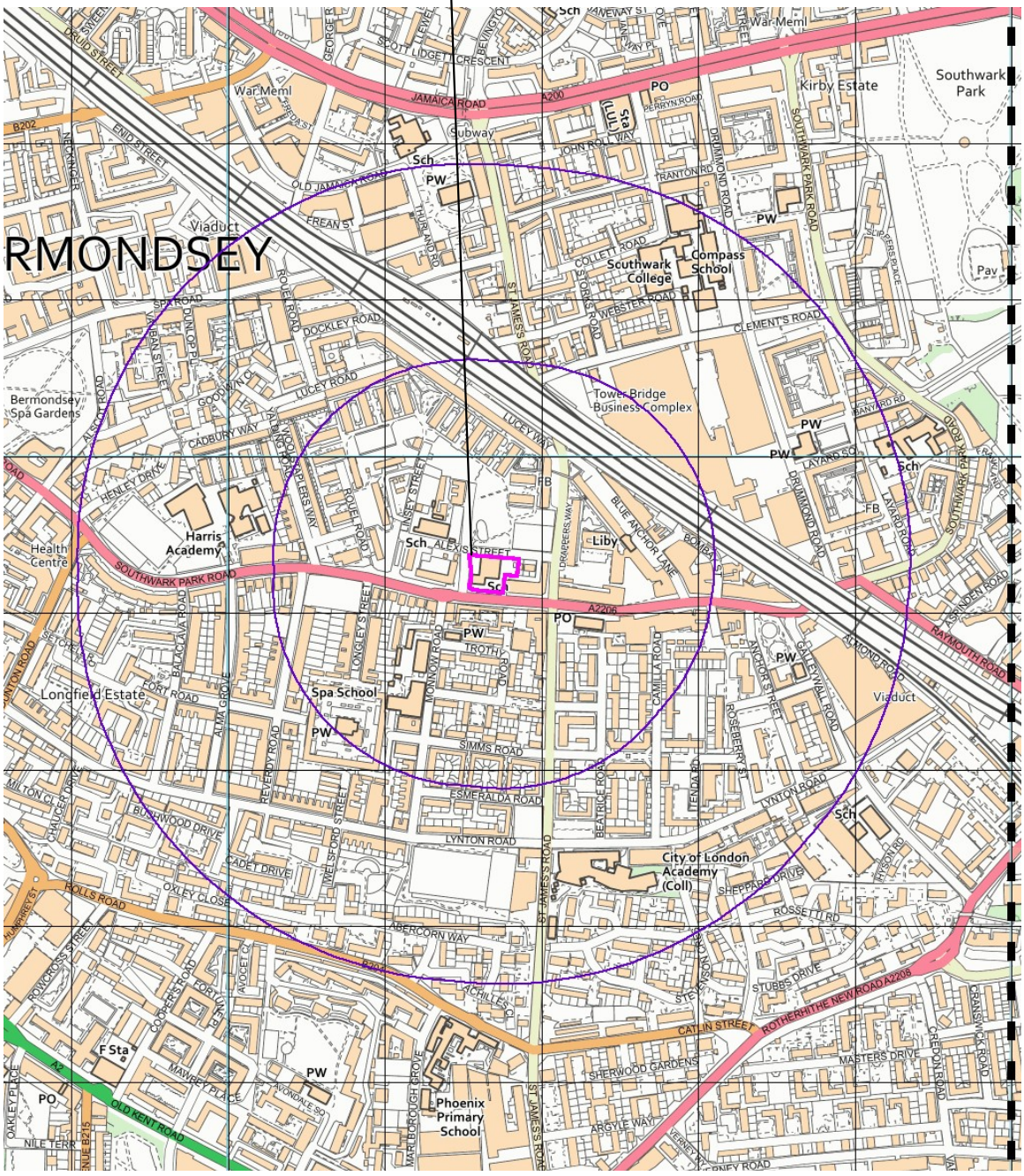
The Site

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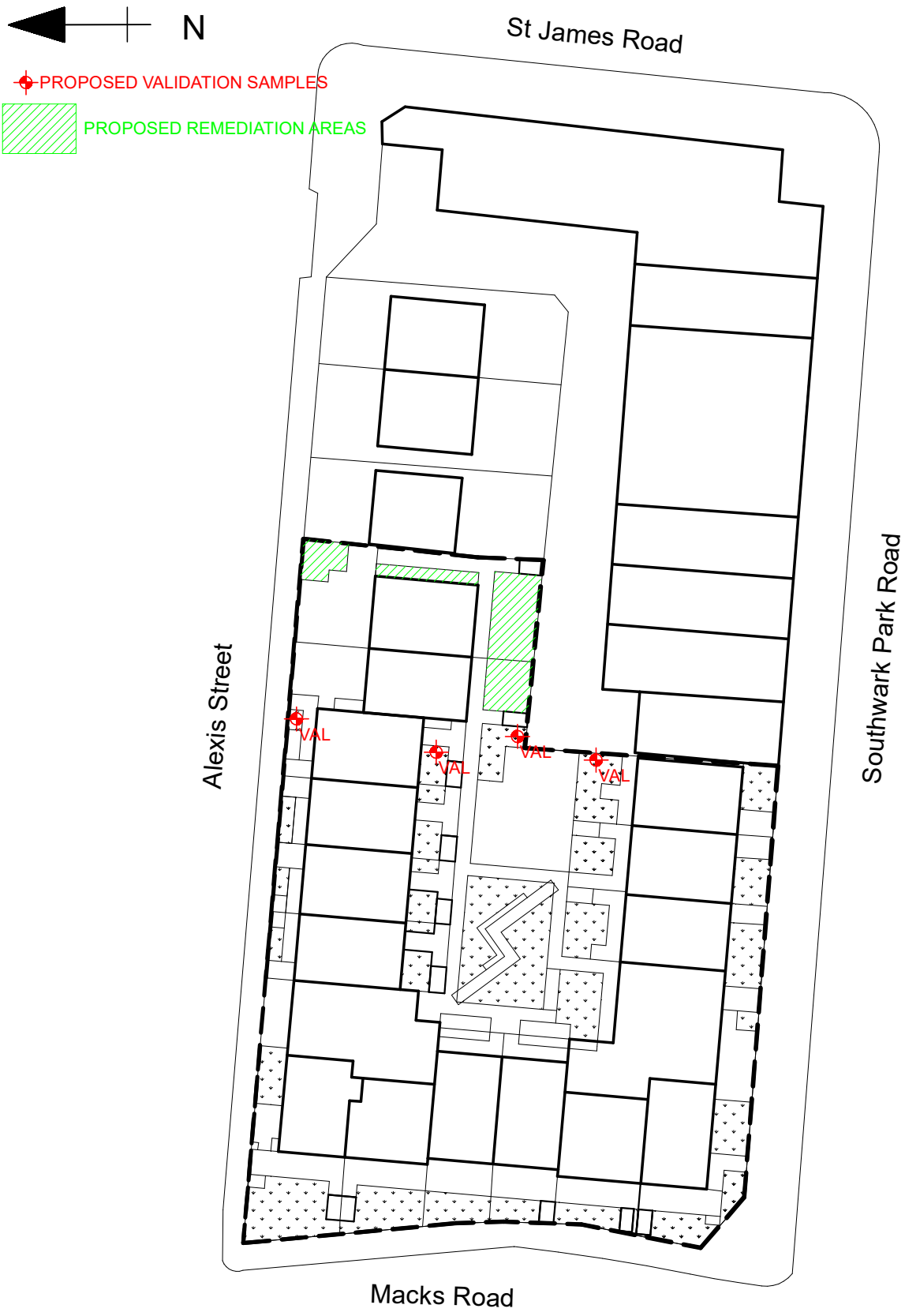
Proposed Site Plan with Sample Locations

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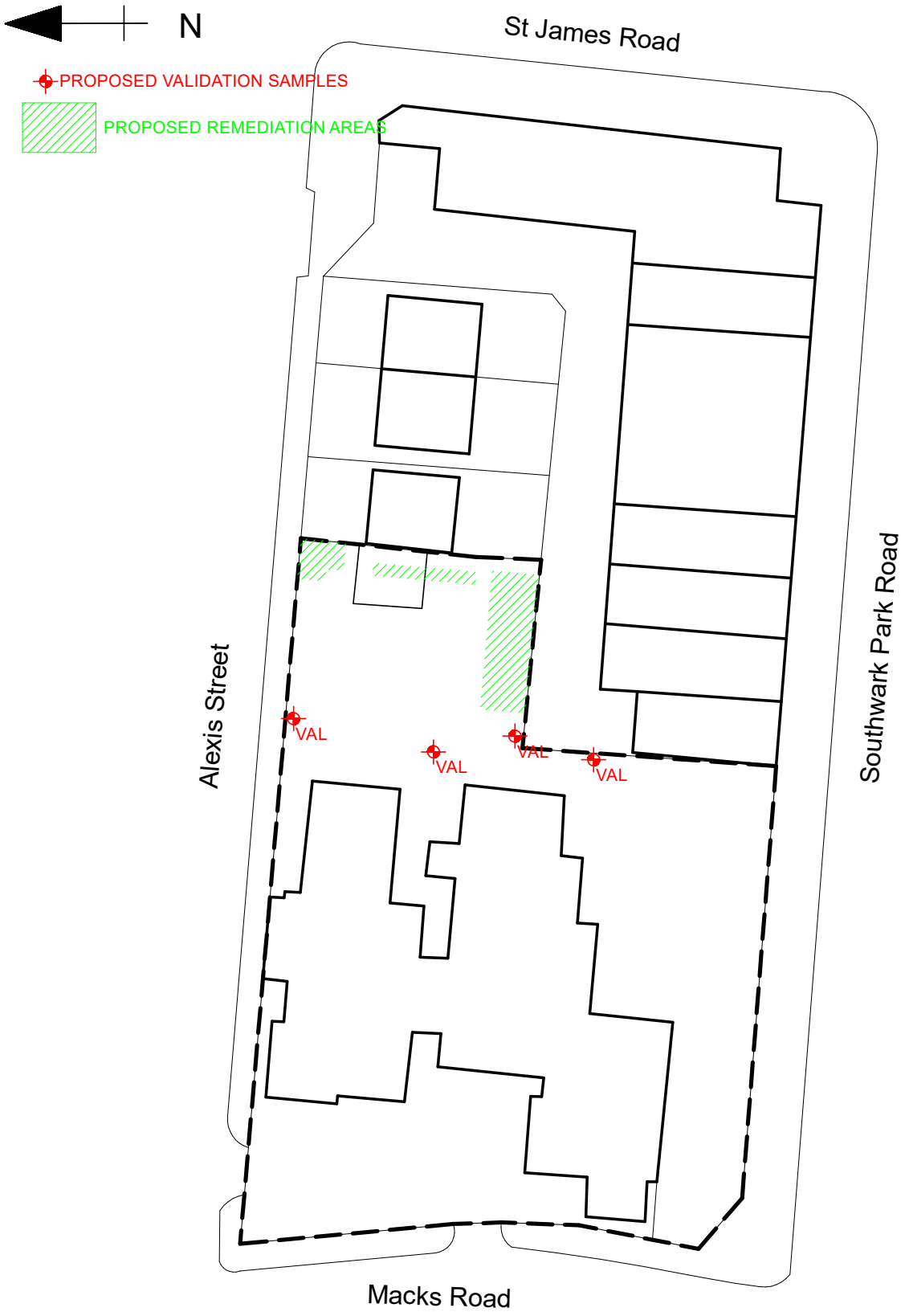
| Appendix No | 1 |
| Sheet No | 2 |
| Job No | 15629 |
| Date | June 2020 |

Former Cherry Garden School, Macks Road, Bermondsey, London SE16 3XU

Existing Site Plan with Sample Locations

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