

**REMEDIATION
STRATEGY
AND
VERIFICATION PLAN**

FOR

**PROPOSED DEVELOPMENT
AT
1-3 CASTLE CRESCENT
READING
RG1 6AQ**



Specialists in the investigation & reclamation of brownfield sites

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1 INTRODUCTION

1.1 Terms of Reference

- 1.1.1 Lucas Design ("The Client"), has commissioned Jomas Associates Ltd ('Jomas') to produce a remediation strategy prior to the development of 1-3 Castle Crescent, Reading RG1 6AQ.

1.2 Planning

- 1.2.1 Development permission is being granted by Reading Council (ref 151924) with a number of conditions.

- 1.2.2 Planning Condition 12 states:

No development shall take place until an assessment of the nature and extent of contamination has been submitted to and approved in writing by the Local Planning Authority. This assessment must be undertaken by a competent person, and shall assess any contamination on the site, whether or not it originates on the site.

(i) a survey of the extent, scale and nature of contamination;

(ii) an assessment of the potential risks to:

- human health,*
- property (existing or proposed) including buildings, crops, livestock, pets, woodland*
- and service lines and pipes,*
- adjoining land,*
- groundwaters and surface waters,*
- ecological systems,*
- archaeological sites and ancient monuments;*

- 1.2.3 Planning Condition 13 states:

No development shall take place until a detailed remediation scheme to bring the site to a condition suitable for the intended use by removing unacceptable risks to human health, buildings and other property and the natural and historical environment has been submitted to and approved in writing by the Local Planning Authority. The scheme must include all works to be undertaken, proposed remediation objectives and remediation criteria, an appraisal of remedial options, and proposal of the preferred option(s), and a timetable of works and site management procedures. The scheme must ensure that the site will not qualify as contaminated land under Part 2A of the Environmental Protection Act 1990 in relation to the intended use of the land after remediation.

- 1.2.4 Condition 14 states that:

The remediation scheme shall be implemented in accordance with the approved timetable of works. A validation report (that demonstrates the effectiveness of the remediation carried out) must be submitted to and approved by the Local Planning Authority prior to construction of the development.

- 1.2.5 Condition 15 states that:

In the event that contamination not previously identified is found at any time when carrying out the approved development, development must be halted on that part of the site and it must be reported in writing to the Local Planning Authority.

1.3 Previous Reports

1.3.1 The previous reports that have been utilised by Jomas for the purposes of this document comprise:

- Phase 1 Geo-environmental Desk Study Report, Lister Geotechnical Consultants, ref 15.07.030, August 2015
- Geo-environmental Assessment (Ground Investigation) Report, Final V2.0 P9864J1122, 22nd September 2017, Jomas Associates Ltd.
- Gas monitoring letter report, ref P9864J1122/ps, dated 21 December 2017, Jomas Associates Ltd.

1.3.2 This document should be read in conjunction with the above reports.

1.3.3 The previous reports have been submitted to Reading Council in relation to discharge of Condition 12. The detailed included herein are submitted in relation to discharge of Condition 13.

1.4 Objectives

1.4.1 The primary objectives of this document are as follows:

- To provide information on the site setting; identify ground conditions and potential environmental risks associated with the development.
- To provide an assessment of various options for remediation.
- To set out the remediation strategy that will provide a site that is suitable for the intended use and addresses any identified unacceptable risks.
- To provide relevant information to address anticipated planning conditions relating to contaminated land. A separate verification report will be required following the implementation of the remediation strategy.

1.4.2 This document provides an assessment of potential remedial strategies and describes the methodology for the proposed remedial action.

1.4.3 The remediation strategy and associated remediation criteria have been developed with reference to previous works carried out at the site. The remediation criteria used to develop the proposed remediation strategy will be used for the proposed verification works.

1.4.4 The Principal Contractor will be responsible for implementing the appropriate methodology and site management procedures to achieve the required outcome and comply with these principles.

1.4.5 The works will be undertaken by experienced personnel and will be managed in accordance with the Contractor's Construction Environmental Management Plan. Detailed construction method statements will be prepared for the impacted soil removal works. Jomas will be employed as Environmental Specialist, to supervise the works and undertake soil sampling and analysis as part of the validation process.

1.5 Limitations

- 1.5.1 Jomas Associates Ltd ('Jomas') has prepared this report for the sole use of Lucas Design in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.
- 1.5.2 This report provides an overview of conclusions drawn from previous investigations, some of which has been conducted by others. Third party information used is assumed to be correct, and Jomas has not validated any of the third party data provided. Jomas is unable to guarantee the accuracy of the information provided by others.

2 SITE SETTING & REDEVELOPMENT PROPOSALS

2.1 Site Information

2.1.1 The site currently comprises a disused residential building with associated soft landscaping.

2.2 Proposed Development

2.2.1 Refurbishment of the existing residential building to provide 5No residential dwellings including internal and external alterations.

2.2.2 Demolition of existing coach house and garage along eastern boundary of the site and development of 8No. residential dwellings. All associated works include vehicular and pedestrian access, parking, landscaping and bin store provision.

3 CONTAMINATION OVERVIEW

3.1 Desk Study Findings

- 3.1.1 A Desk Study report has been produced for the site and issued separately, by others (Listers Geotechnical Consultants, August 2015). A brief overview of the desk study findings is presented below. Reference should be made to the full report for detailed information.
- 3.1.2 A review of historical ordnance survey maps indicates that the site was developed as early as 1879 with a large detached house in the centre, and a row of terraced properties along the eastern boundary (similar to the current site layout). A row of garages are noted from 1976 trending north-south through the centre of the site, to the south of the detached house.
- 3.1.3 The surrounding area has been utilised predominantly for residential use, with some commercial uses recorded including a brick, tile and pottery works 300m south-west. A possible area of worked ground is shown approximately 100m south-east, with two others shown 100m south-east. Approaching the 1970s, an industrial estate is shown from approximately 100m to 1km south-east of the site including numerous factories and industrial units.
- 3.1.4 The British Geological Survey indicates that the site is directly underlain by superficial deposits of the Lynch Hill Gravel above Lambeth Group clays. There are further underlain at depth by the Seaford and Newhaven Chalk Formations.
- 3.1.5 The superficial deposits directly underlying the site are identified as a Secondary A Aquifer, with the underlying solid deposits also identified as a Secondary A Aquifer. The underlying chalk is designated as a Principal Aquifer.
- 3.1.6 A review of the EnviroInsight report indicates that the site is not located directly within a groundwater source protection zone.
- 3.1.7 There is one groundwater abstraction located 720m north of site.
- 3.1.8 The nearest surface watercourse is the Holy Brook, which flows north approximately 263m to the east of site. The River Kennet is also located approximately 380m east of site.
- 3.1.9 The conceptual site model provided within the report identifies the following potential sources, pathways and receptors. The report indicates the following potential sources of contamination:
- Made Ground is likely to be present at the site associated with historical construction and demolition work
 - Potential for deep Made Ground associated with historical chalk mining
 - Contaminants associated with the burning of waste on site or the storage of contaminants such as oils in the garages on site.
 - Migrating ground gases from unrecorded landfilling of nearby chalk pits.
- 3.1.10 The conceptual site model identifies the following potential pathways:
- Direct soil ingestion of soil in exposed soft landscaped areas
 - Inhalation of indoor and outdoor vapours particularly volatile organic compounds
 - Inhalation of indoor and outdoor dust
 - Migration of ground gases into the buildings
 - Migration of contaminants through the unsaturated zone

- Migration of contaminants through the groundwater
- Movement of contaminants through drains or services runs

3.1.11 The conceptual site model identifies the following potential receptors:

- End users of the site (residents)
- Surrounding residents
- Construction workers for the new development/demolition contractors
- Controlled waters (Holy Brook)
- Controlled waters (Aquifers)

3.2 Intrusive Investigation

3.2.1 The ground investigation was undertaken by Jomas on 21 July 2017, and consisted of the following:

- 6 No. window sampling boreholes, drilled up to 3.5m below ground level (bgl)
- 3 No. monitoring standpipes;
- Laboratory analysis for chemical and geotechnical purposes.

3.2.2 The results of the ground investigation revealed a ground profile comprising a variable thickness of Made Ground (up to 1.2 bgl depth), overlying deposits of medium dense to very dense sandy gravel, to a maximum depth of 2.8m bgl. These deposits were interpreted as the Taplow Gravel. In one borehole (WS1), cohesive deposits were found to underlie the granular Taplow Gravel, from a depth of 2.80m to the base of the borehole at 3.5m bgl. No materials considered to represent the expected Chalk beneath the site were encountered.

3.2.3 Groundwater was not encountered in the exploratory holes during drilling. During return monitoring visits, water was only reported within WS1, at depths between 2.69mbgl and 2.73mbgl.

3.2.4 Visual or olfactory evidence of contamination was not observed during the course of the investigation.

3.2.5 Following generic risk assessments, a two soil samples were found to contain concentrations of lead in excess of generic assessment criteria for a residential without plant uptake end use scenario.

3.2.6 In addition, one sample was found to contain zinc concentrations in excess of threshold levels for phytotoxic effects.

3.2.7 UBM BARGE bioavailability testing has been undertaken on the samples displaying elevated lead levels to determine whether the elevated lead levels pose a risk to human health. The results indicate that a significant proportion of the lead content is biologically available, and therefore the quantity of bioavailable lead exceeds the generic screening criteria and therefore poses a potential risk to future residents.

3.2.8 Groundwater analysis has not reported elevated levels of contaminants contained within the testing suite. On this basis, the site is not considered to pose a risk to controlled waters.

3.2.9 Ground gas assessments have concluded that the site should be characterised as CS1, for which no gas protection measures are required.

3.2.10 It is anticipated that polyethylene pipes will be sufficient for the proposed development, although advice should be sought from the proposed utility provider.

3.3 Conceptual Site Model

3.3.1 The conceptual model for the site is presented below in Table 3.1

Table 3.1: Plausible Pollutants Linkages Summary (Pre Remediation)

Potential Source (from desk study)	Pathway	Receptor	Relevant Pollutant Linkage?	Comment
- Made Ground is likely to be present at the site associated with historical construction and demolition work - Potential for deep Made Ground associated with historical chalk mining - Contaminants associated with the burning of waste on site or the storage of contaminants such as oils in the garages on site. - Migrating ground gases from unrecorded landfilling of nearby chalk pits	- Direct soil ingestion of soil in exposed soft landscaped areas - Inhalation of indoor and outdoor vapours particularly volatile organic compounds - Inhalation of indoor and outdoor dust	- End users of the site (residents) - Surrounding residents - Construction workers for the new development/demolition contractors.	Y	Remedial measures required
	Migration of ground gases into the buildings		X	Gas protection measures are not required
	- Migration of contaminants through the unsaturated zone - Migration of contaminants through the groundwater - Movement of contaminants through drains or services runs	- Controlled waters (Holy Brook) - Controlled waters (Aquifers)	X	No risk to controlled waters identified.

4 PROPOSED REMEDIATION STRATEGY

4.1 Introduction

4.1.1 The proposed remediation scheme serves to address the potential unacceptable risks identified in the context of the proposed redevelopment of the site.

4.1.2 The remedial measures comprise;

- the encapsulation of impacted soils below areas of building footprint or hardstanding,
- Within areas of soft landscaping, a cover layer comprising a minimum 450mm thickness of certified clean topsoil laid over a geotextile membrane will be utilised,
- Validation testing will be undertaken upon soils imported to site to confirm their suitability for use as a clean capping layer.

4.2 Remediation Strategy

Impacted Soils Encapsulation

4.2.1 Where buildings or hardstanding are proposed, no formal remedial works are considered necessary, as the construction of the building / hardstanding should provide an appropriate barrier to impacted soils. External hardstanding within private areas should be of a construction that discourages possible removal by future occupiers.

4.2.2 Within areas of soft landscaping, soils will be encapsulated below a cover layer of imported clean subsoil / topsoil. This should comprise a minimum 450mm thickness of soil laid over a geotextile membrane.

4.2.3 Where topsoil and sub-soil is imported to the site, the soil should be chemically suitable for use. All imported soil should conform to the following chemical specification:

Table 4.1: Topsoil Requirements

Determinand	Unit	Screening Criteria	
Arsenic	mg/kg	S4UL	37
Boron	mg/kg	S4UL	290
Cadmium	mg/kg	S4UL	11
Chromium	mg/kg	S4UL	910
Lead	mg/kg	C4SL	200
Mercury	mg/kg	S4UL	40
Nickel	mg/kg	S4UL	180
Selenium	mg/kg	S4UL	250
Copper	mg/kg	S4UL	2400
Zinc	mg/kg	S4UL	3700
Asbestos	%	S4UL	None Detected
pH	-	S4UL	5-9

Determinand	Unit	Screening Criteria	
Naphthalene	mg/kg	S4UL	2.3
Acenaphthylene	mg/kg	S4UL	170
Acenaphthene	mg/kg	S4UL	210
Fluorene	mg/kg	S4UL	170
Phenanthrene	mg/kg	S4UL	95
Anthracene	mg/kg	S4UL	2400
Fluoranthene	mg/kg	S4UL	280
Pyrene	mg/kg	S4UL	620
Benzo(a)anthracene	mg/kg	S4UL	7.2
Chrysene	mg/kg	S4UL	15
Benzo(b)fluoranthene	mg/kg	S4UL	2.6
Benzo(k)fluoranthene	mg/kg	S4UL	77
Benzo(a)pyrene	mg/kg	S4UL	2.2
Indeno(123-cd)pyrene	mg/kg	S4UL	27
Dibenzo(ah)anthracene	mg/kg	S4UL	0.24
Benzo(ghi)perylene	mg/kg	S4UL	320
TPH C ₅ -C ₆	mg/kg	S4UL	42
TPH C ₆ -C ₈	mg/kg	S4UL	100
TPH C ₈ -C ₁₀	mg/kg	S4UL	27
TPH C ₁₀ -C ₁₂	mg/kg	S4UL	74
TPH C ₁₂ -C ₁₆	mg/kg	S4UL	140
TPH C ₁₆ -C ₂₁	mg/kg	S4UL	260
TPH C ₂₁ -C ₃₅	mg/kg	S4UL	1100

4.3 Health and Safety / PPE

- 4.3.1 Excavations will have suitable barriers and access points through the barriers, with pedestrian routes clearly marked. Appropriate safety signage and instructions will be clearly visible, with accesses to be kept clear of debris, materials and cables.
- 4.3.2 Operatives will be briefed on sharps protection in order to ensure safety. Clean/dirty rooms will be provided for operatives working within contaminated areas
- 4.3.3 Standard PPE will be required at all times, namely:
- Hard hat
 - Safety spectacles
 - Hi-viz waistcoat or jacket
 - Gloves
 - Boots or shoes with steel toe and midsole protection
- 4.3.4 Other items may be required as per detailed in the specific method statement;
- Harness
 - Dust protection
 - Ear protection

- Other specialist equipment

4.3.5 A method statement will be produced by the chosen contractor.

4.4 Unexpected Contamination

4.4.1 To accord with best practice if, during the construction of the development, contamination and/or materials not previously identified are found to be present at the site, then no further development (unless otherwise agreed in writing with the Local Planning Authority) shall be carried out until Jomas' (or qualified environmental engineer) has been informed, and a suitable strategy implemented to the approval of the engineer and/or the Local Planning Authority.

4.4.2 Examples of such materials include:

- buried drums, tanks, pipework or containers
- soil or water with colour or odour
- non-natural materials and wastes
- other evidence of contamination, for example iridescent sheens (like oil or diesel) on soil or water.

4.5 Operational Standards – Summary

4.5.1 As a minimum, the following standards shall be employed during the full course of this remediation site works;

- All materials subject to excavation and disposal must be tracked throughout and evidence generated to provide an auditable trail.
- Any excavated soils will be stockpiled/stored in a designated area on site, with plastic sheeting placed at ground surface to prevent cross-contamination. The contractor shall be responsible for the removal of spoil from the site.
- Personal protective equipment shall be employed by all site remediation and ground worker personnel in accordance with site specific risk assessments. These are to be completed by all contractors following consideration of the potentially hazardous properties of contaminants within the site.
- A copy of this remediation statement together with all previous geo-environmental assessment reports shall be retained on site for reference during the full course of remediation activities.

5 VERIFICATION PLAN

5.1 Proposals for Validation & Verification

5.1.1 A qualified environmental engineer shall undertake the following tasks to monitor the remedial activities described in this statement.

- The thickness of the clean cover layer and the presence of a geotextile marker layer will be verified by a series of hand dug pits in areas of soft landscaping, with accompanying photographs.
- Following importation of topsoil to site, representative samples will be obtained prior to laying of the material. It is anticipated that 1No sample will be taken per 100m³ of soil imported.
- These samples shall be sent directly to an MCERTS and UKAS accredited laboratory for testing for suite of analyses comprising the determinands detailed in Table 4.1.
- The results will be screened against the criteria detailed within Table 4.1, which comprise current published Environment Agency residential end-use soil guideline values (SGVs) or where unavailable, LQM or S4UL generic assessment criteria – safe for use levels for human health risk assessment. If these values become out of date, reference shall be made to industry approved superseded values.

5.2 Remediation Verification/Completion Report

5.2.1 The Remediation Completion Report shall include the following information:

- Summary of all works undertaken
- Photographic log of the works.
- A full chemical soil analysis results schedule.
- Full details of any further contamination reported during construction works
- Disposal documentation for any spoil or asbestos materials spoil.

5.3 Reporting

5.3.1 All activities will be documented (including photographs) to show compliance with the Remediation Strategy. This documentation will be kept on site at all times during the works and updated daily as part of a field record as the works progress, which would be available for regulatory inspection at any time. All documentation would be included in a final verification report to be presented to the Local Authority.

6

REFERENCES

- A possible approach for generating site specific assessment criteria for polycyclic aromatic hydrocarbons (draft internal HPA briefing note)
- CIEH & CL:AIRE (2008) *Guidance on comparing soil contamination data with a critical concentration*. London: Chartered Institute of Environmental Health (CIEH) and CL:AIRE
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