

20 Greyfriars Road, Reading

Report on Phase 1 Ground Condition Assessment

On behalf of McKay Securities PLC



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1 Introduction

1.1 Preamble

Peter Brett Associates LLP (PBA) has been instructed by McKay Securities PLC (the Client) to undertake a Phase 1 Ground Condition Assessment for a site at postal address 20 Greyfriars Road, Reading, Berks, RG1 1PE.

This report has been prepared in a planning context (rather than a Part IIA statutory contaminated land context) and it is understood that the Client proposes to submit a planning application for change of use under Permitted Development rights.

The report presents the findings of desk study researches, together with the observations from a site walkover. It includes a preliminary land stability appraisal and a Tier 1 (preliminary/ qualitative) contamination risk assessment.

It should be noted that the Phase 1 is a land condition assessment and does not purport to be an ecological, flood risk or archaeological survey and additional specific surveys may be required to support a planning application.

Guidance on the use of this report is provided in **Section 6**.

1.2 Objectives

The National Planning Policy Framework (NPPF) (DCLG 2012) stipulates that planning policies and decisions should ensure that “the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation”; and that “after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and adequate site investigation information, prepared by a competent person, is presented.”

Guidance document “Planning Application Validation Information Requirements” issued by Reading Borough Council (RBC) in December 2016 states that a contamination assessment is required for developments for “sensitive end uses”, which includes residential. The RBC requirements, include a checklist which identifies the need for a desk study to list previous and current land-uses.

The objective of this report is to identify the likely ground conditions using published and publically available information (see below for sources of information accessed) and to assess whether there are land instability or contamination risks associated with the ground conditions that require management (remediation or mitigation).

1.3 Site Location and Setting

The site is located within the centre of Reading, some 150m to the south south west of Reading Railway Station.

The site is centred at National Grid Reference (NGR) SU 712 736. A site location plan is presented as **Figure 1**.

The plot is located within an area of predominately commercial land use.

Greyfriars Road forms the western boundary and Garrard Street the northern boundary.

An aerial photograph showing the site boundary is presented as **Figure 2**.

1.4 Proposed Development

It is understood that the Client intends to submit a planning application for a change of use for the internal floor space for residential use without external alterations.

1.5 Methodology

Assessment of Ground Conditions - Contamination

UK legislation on contaminated land from historical activities is principally contained in Part 2A of the Environmental Protection Act, 1990 (which was inserted into the 1990 Act by section 57 of the Environment Act 1995).

The Regulations and Statutory Guidance that accompanied the Act, including the Contaminated Land (England) Regulations 2006, have been revised with the issue of The Contaminated Land (England) (Amendment) Regulations 2012 (SI 2012/263) and the Contaminated Land Statutory Guidance for England 2012.

With the introduction of the NPPF, Planning Policy Statement 23 (PPS 23), which provided guidance on how to deal with contaminated land within a planning context, was withdrawn. However, the broad approach, concepts and principles behind land contamination management advocated by the Part 2A regime are still applied to the determination of planning applications. Contaminated Land Report 11 (CLR 11) of the Model Procedures for the Management of Contaminated Land (EA 2004) provides references to established technical and procedural practice.

CLR 11 presents a three stage process to the management of contaminated land:

- Stage 1 = risk assessment
- Stage 2 = options appraisal and
- Stage 3 = implementation of remedial strategy

Risk assessment is undertaken in a phased manner with the three tiers being:

- Tier 1 – “preliminary risk assessment” – a qualitative assessment forming part of a Phase 1 report,
- Tier 2 – “generic risk assessment” - a quantitative assessment using published criteria to screen site specific ground condition data forming part of a Phase 2 report and
- Tier 3 – “detailed risk assessment – a quantitative assessment involving the generation of site specific assessment criteria (SSAC).

The underlying principle is the evaluation of *pollutant linkages* in order to assess whether the presence of a source of contamination could potentially lead to harmful consequences. A pollutant linkage consists of the following three elements:

- A source of contamination or hazard that has the potential to cause harm or pollution;
- A pathway for the hazard to move along / generate exposure; and
- A receptor which is affected by the hazard.

Each tier of risk assessment comprises the following four stages:

- Hazard Identification – identifying potential contaminant sources on and off site;
- Hazard Assessment – assessing the potential for unacceptable risks by identifying what pathways and receptors could be present, and what pollutant linkages could result (forming the Conceptual Site Model (CSM));
- Risk Estimation – estimating the magnitude and probability of the possible consequences (what degree of harm might result to a defined receptor and how likely); and
- Risk Evaluation – evaluating whether the risk needs to be, and can be, managed.

The PBA methodology for ground condition assessment (contamination) is presented in **Appendix 1**.

Assessment of Ground Conditions – Instability

Planning Authorities are required (NPPF paragraphs 120 and 121) to consider if land instability poses a potentially unacceptable risk to development. In paragraph 121, the requirement to take account of potential hazards arising from natural hazards (such as natural cavities) or former activities such as mining is outlined. The preliminary ground stability assessment methodology adopted by PBA follows the guidance on preliminary land stability assessment given in the Planning Practice Guidance for Land Stability published by the Department for Communities and Local Government (DCLG 2014). The guidance at least requires a desk based study and a site inspection visit based on which the assessment is undertaken by an appropriately qualified person.

The desk based study comprises a review of existing readily available published sources of geological, geomorphological, hydrogeological and /or mining information on the site and its surroundings and a historical review including mapping and aerial imagery if appropriate.

The site inspection will assess the presence of potential instability features on site such as back scars, tension fissures and lateral shears and evidence of soil creep; seepage lines and wet areas which might indicate groundwater emergence; vegetation types indicative of a high water table or changes in soil type and condition; evidence of movement in existing structures and trees; evidence of past movement indicated by discrepancies between locations of features and field boundaries and those on past editions of Ordnance Survey maps or aerial photographs; evidence of movement due to mining or natural underground cavities; and evidence of previous changes to the structure of the site by infilling, man-made embankments or tips and cuttings e.g. for canals, reservoirs, roads, railways, quarries, mines etc.

The preliminary stability assessment includes, where relevant, a review of geological hazards for the site such as natural and man-made (mining) cavities, landslide, cambering and block movement, collapsible and compressible soils, running sand, and subsidence and heave due to volumetric change in the ground.

1.6 Sources of Information

The following sources of information were used in the preparation of this report:

- A walkover survey by a PBA representative to observe existing conditions both on the site and surrounding the land parcel – photographs are presented in **Appendix 2**.
- Envirocheck Report and historical maps provided by Landmark Information Group (LIG, 2017) which is presented in **Appendix 3**.
- Review of the Natural Cavity and Artificial non-coal (underground) mining cavity databases managed and enhanced by Peter Brett Associates LLP (PBA).

- Review of the information on coal mining held by the Coal Authority (CA) accessed via their viewer, mapapps2.bgs.ac.uk/coalauthority/home.html
- Review of geology and borehole records held by the British Geological Society (BGS) accessed via their website, <http://www.bgs.ac.uk/data/boreholescans/home.html>.
- Review of the MAGIC (Multi-Agency Geographic Information for the Countryside) web site, <http://www.magic.gov.uk>. The MAGIC website provides authoritative geographic information about the natural environment from across government. The information covers rural, urban, coastal and marine environments across Great Britain. It is presented in an interactive map which can be explored using various mapping tools.
- A search of the PBA project database to identify any ground condition reports in close proximity to the site (within 200m).
- A search of the planning portal for Reading Borough Council for developments on and in close proximity to the site.

2 Land Use Information

2.1 Introduction

This section presents a summary of current and historical land uses on and immediately adjacent to the site. Land use is used to inform the hazard identification element of the risk assessment.

Current land use information is based on an external walkover inspection undertaken by a representative of PBA on the 30th January 2017 together with information from Mr Griffiths of McKay Securities PLC who accompanied and provided access. Photographs taken during the site walkover (Plates 1 to 6) are presented in **Appendix 2**.

The historical land use information is based on Ordnance Survey maps and aerial photography provided by LIG presented in **Appendix 3**.

Plans of the ground floor and basement provided by the Clients planning agent are presented in **Appendix 4**.

2.2 Current Land Use

2.2.1 On-Site

The majority of the site area (approximately 95%) is occupied by a six storey building and associated car-parking. Car-parking is accessed off Garrard Street and occupies most of the ground level and a smaller area of basement.

The building is split into two, with No. 20 occupied by the Client and used as offices and No. 30 (also known as Greyfriars House) similarly used as offices but on a multiple let basis (part occupied at the time of the visit); including Thames Valley Probation Service. It is noted that for the purpose of this report that the proposed redevelopment relates solely to No.20, although the access and refuse storage bin area is common to both No.20 and No.30.

A communal refuse area is located at ground level, accessed off Garrard Street. The area was not accessed but visible from the street there were two large green wheeled bins located on concrete hardstanding.

Also on the ground floor within the car park is a store room which was accessed and observed to contain miscellaneous items such as furniture. There was no chemical storage. The floor was concrete hardstanding and appeared in good condition.

The plant room for No. 20 is located on the ground floor and contained air conditioning plant. There were no chemicals being stored at the time of the inspection but a single empty cut down 5L container was present which was labelled "toxic" and "caustic". The floor to the plant room was formed of a concrete hardstanding and appeared in good condition.

The lift motor room for No. 20 is located in the basement which was locked at the time of the visit.

The plant and motor room for No. 30 is located on the roof. A plan showing the roof layout obtained from the planning portal (planning reference 071282 in 2007) is presented in **Appendix 4**.

A room behind the reception area of No. 20 was observed to contain small quantities of cleaning products.

The small outside space comprises a paved courtyard with raised planters.

Mr. Griffiths stated that there were no back-up generators and no fuel or oil storage facilities on site.

Whilst technically beneath No.30 Greyfriars Road, within the basement floor a set of three square metal covers were observed opposite parking bay 27. Although a vent pipe was not located it is possible these indicate a three chamber interceptor. Breaks in the surrounding concrete indicate the floor has been broken for access or installation.

2.2.2 Off-Site

Multi storey buildings used as offices (some of which are vacant) are present to the south west, west and north. The rear of a site occupied by Sainsbury's is present to the south. On the opposite side of Garrard Street is a recently cleared plot/current construction activity and then an NCP multi-storey carpark.

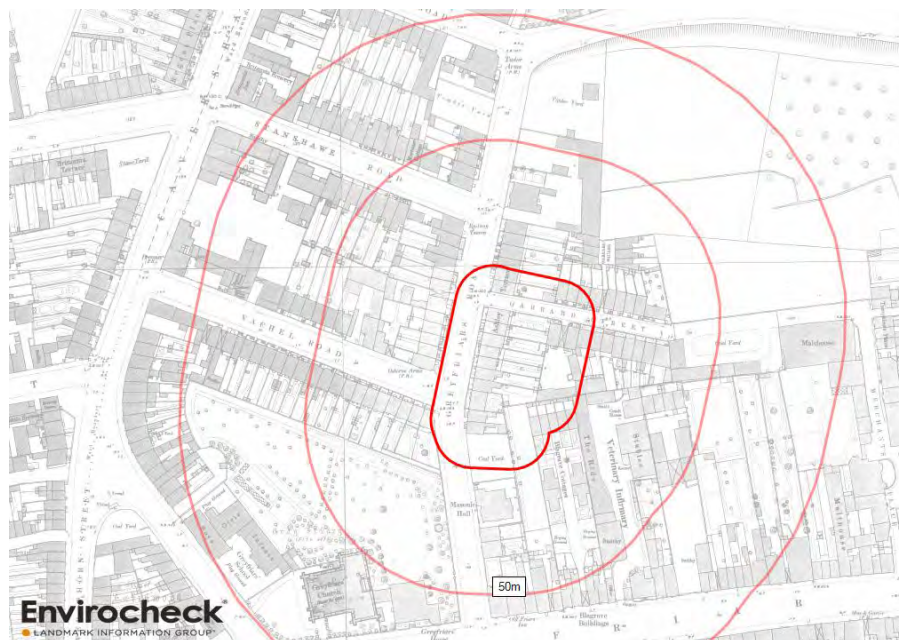
The Electricity Substation adjacent to the south eastern corner could not be viewed from site.

2.3 Summary of Historical Land Use

Copies of Historical Ordnance Survey (OS) Maps are provided in Appendix 3. The following text provides a brief summary, and is based upon the entire building footprint for Greyfriars House (ie No.20 and No.30 Greyfriars Road).

The earliest OS mapping provided is dated 1879 shows the site to be occupied by terraced housing labelled Albany Terrace. There is an area to the rear of the gardens accessed off Garrard Street that might be a yard (non-residential use). There is a small coal yard to the south but the area appears predominately residential immediately adjacent to the site. A "snap shot" of the 1879 OS map is presented below.

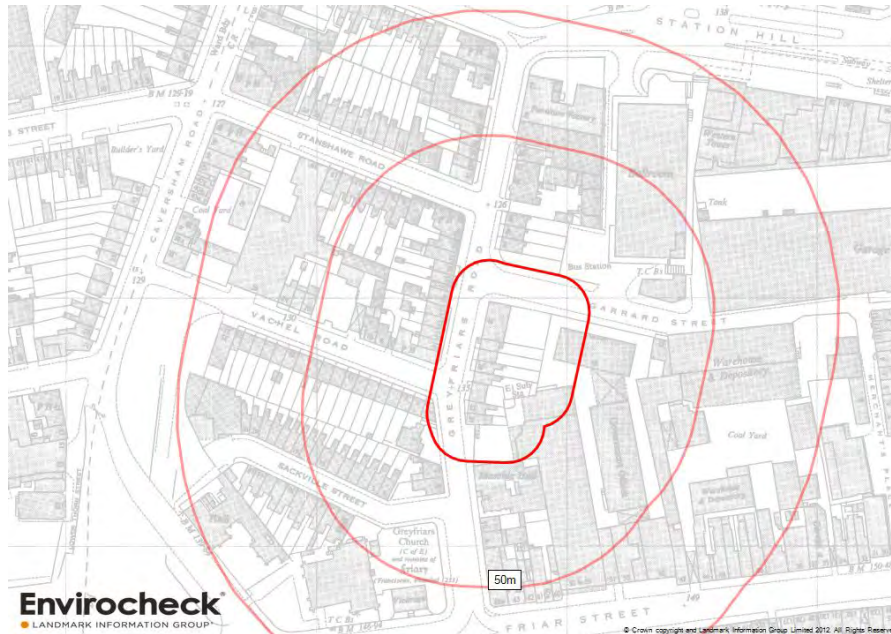
1879 Ordnance Survey Map



The land use remains the same on site in subsequent maps with the notable addition that the open field and orchard 50m north east are cleared and appear to have been replaced by a large surface water feature on the OS map dated 1899. This feature is identified as potentially infilled in the Envirocheck report (there are no known historical landfills within 500m). This area is labelled Station on the OS map dated 1911-13.

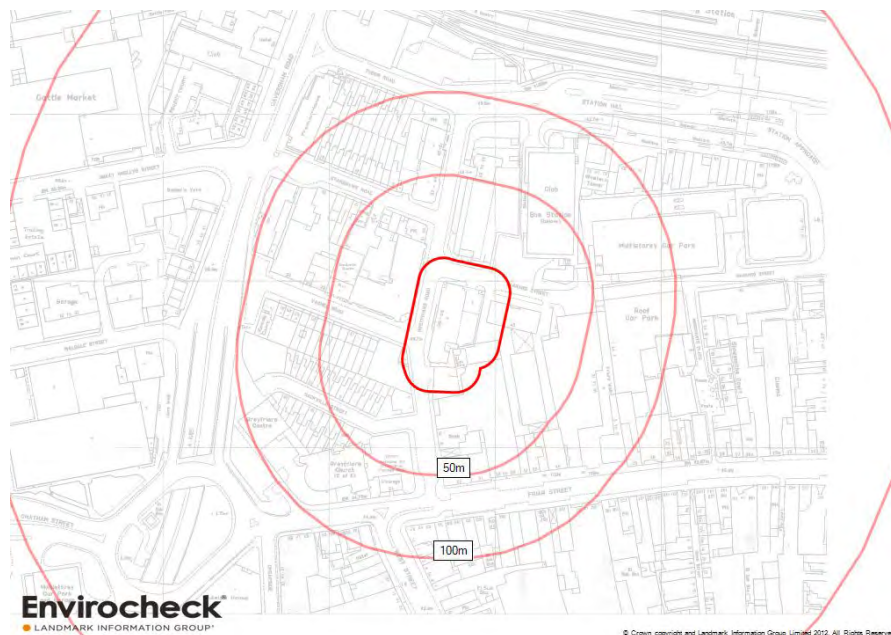
The OS map dated 1956 – 1960 shows that there is a large Garage 50m east of the subject site. The OS map dated 1962 – 1976 (snap shot below) shows the street numbering on the subject site to include Nos. 20 to 38, and an electricity substation is marked adjacent to the south eastern corner. The OS map dated 1973 – 1974 shows little change apart from the Garage site being cleared.

1962 -1976 Ordnance Survey Map



The OS map dated 1980-1988 shows the site as clear of structures. The present development is first shown on the 1988 OS map. This map shows the site on the opposite side of Greyfriars Road to be clear of structures. This neighbouring site is developed with the present day structure by 1993, a snap shot of the 1992 OS map is presented below.

1992 Ordnance Survey map



3 Environmental Setting

3.1 Published Geology

Information on the geological setting has been obtained from the British Geological Society (BGS) web site <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>. The viewer is delivered under the Open Government Licence and subject to the following acknowledgement accompanying the reproduced BGS materials: "Contains British Geological Survey materials © NERC [2016]". The following strata are shown:-

- Superficial – Taplow Gravel Formation - (Sand and Gravel of Quaternary age) with Alluvium (described as clay, silt, sand and gravel) to the north.
- Bedrock - Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) – (Chalk of Cretaceous age).

3.2 Geology from Ground Investigation Reports

The PBA project database contains a historical report for 20 – 38 Greyfriars Road, carried out for McKay Securities Ltd by PBA in November 1981. This report is presented in full in **Appendix 5**.

The ground investigation comprised two cable percussion boreholes drilled to a maximum depth of 16.45m bgl.

The boreholes identified the following sequence of strata:

- Made Ground proven to a maximum depth of 0.4m bgl.
- Valley Gravels (now known as Taplow Gravel Formation) proven to depths of 5.0m bgl and 2.35m bgl in the two boreholes respectively comprising variable proportions of silt, sand and gravel.
- Chalk was proven to a maximum depth of 16.45m bgl and interpreted as “weak to moderately weak” chalk.

The exploratory hole records confirm the anticipated sequence of strata beneath the site.

3.3 Ground Gases

Radon

The report (LIG, 2016) indicates that the subject site is located in a lower probability radon area as less than 1% of homes are above the action level as defined by the Health Protection Agency and that radon protection measures are not required in the construction of new dwellings or extensions at the subject site.

Permanent Gases

The identified underlying natural geology is unlikely to generate permanent ground gases (methane and carbon dioxide).

3.4 Estimated Soil Chemistry

The Estimated Ambient Background Soil Chemistry data presented in the LIG report, which is provided by BGS, indicates the estimated geometric mean concentrations (mg/kg) of arsenic (As), cadmium (Cd), chromium (Cr), nickel (Ni) and lead (Pb) in topsoil.

The information is considered to indicate that the natural ground chemistry should not be hazardous to human health for a residential end-use without home grown produce.

3.5 Naturally Occurring Geological Hazards

An assessment of potential geological hazards that may give rise to instability or adverse foundation or construction conditions as supplied by the British Geological Survey (BGS) from their National Geoscience Information Service (NGIS) are presented in the Envirocheck Report reproduced in **Appendix 3**. The generic assessment is generated automatically based on digital geological maps and the scope and the accuracy is limited by the methods used to create the dataset and is therefore only indicative for the search area.

The information contained in the report has been reviewed and where considered necessary reassessed considering the specific information available for the site. The modified assessment of the potential for geological hazards to be present on the site is summarised in **Table 3.1** below.

Table 3.1 Summary of Geological Hazards

Hazard	BGS-NGIS Assessed Hazard Potential On-site	PBA Assessment
Coal Mining Affected Areas	Highly Unlikely / Rare	Agree
Collapsible Ground Stability	No / Very Low	Agree
Compressible Ground Stability	Moderate / No	See below - No
Dissolution	Very Low / Low	See below - Moderate
Landslide Ground Stability	Very Low	Agree
Running Sand	Very Low / Low	See below – Low/Moderate
Shrinking or Swelling Clay	No / Very Low	Agree
Radon	No radon protection measures are required for the construction of new dwellings or extensions	Agree

3.5.1 Compressible Ground

It is assumed that the hazard potential of Moderate results from the possible on-site presence (suggested by BGS) of weak, organic alluvium that can be subject to settlement under loading. Borehole records suggest that alluvium is not be present within the site, and therefore PBA consider that there is not a compressible ground stability hazard.

3.5.2 Dissolution

The BGS-NGIS hazard assessment for soluble rocks within the site boundary is reported as very low and low.

PBA consider that there is a Moderate dissolution hazard. The site is located within an area of Reading that is underlain by geology susceptible to the formation of natural cavities. Records of nearby natural cavity incidences have been identified within areas of similar geology to that of the subject site, with the closest being 200m to the northwest of the site. The boreholes drilled at the site record a difference in level of 2.65m in the upper chalk surface, which may indicate a potentially karstic chalk geomorphology or possible scour feature.

3.5.3 Running Sand

Given the anticipated high groundwater table and presence of silts and sands within the Taplow Gravel Formation. It is considered that were such deposits are present that there is a Low to Moderate Hazard of running sands.

3.6 Controll ed Waters - Ground water

The following table summarises information recorded in the Groundsure report regarding hydrogeology and groundwater vulnerability.

Table 3.2 Summary of Hydrogeology and Groundwater Vulnerability Related Information

Item	Details
Aquifer Classification	Superficial – Secondary A Bedrock – Principal
Depth to Groundwater	Shallow (~1- 3m bgl) in the superficial deposits. Overnight groundwater rest levels during boring were recorded between 2.95m and 3.35m bgl in the two boreholes on-site; resting within the Taplow Gravels in BH1 and the Chalk in BH2.
Vulnerability	High
Groundwater Flow Direction	Expected to be north towards the Thames
Source Protection Zone (SPZ)	Not within 500m of a Source Protection Zone
Groundwater Abstraction	There is 1 groundwater abstraction within 250m (150m SW) for uses including drinking and a further 16 within 1km.
Drinking Water Safeguard Zone	No
Groundwater Flooding	Potential for flooding at surface

3.7 Controll ed Waters - Surf ac e Water

The following table summarises the information recorded in the Groundsure report regarding hydrology.

Table 3.3 Summary of Surface Water Related Information

Item	Description
Name	Extended culvert (not a drain) 200m N links to the Thames Holy Brook (secondary river) 400m SE Thames 736m North
Quality	Chemical Quality Grade A
Abstraction	None within 500m.
Pollution Incidents	No water impacts within 250m
Discharge Consents	None within 250m.
River Flood Risk *	Not identified
Flood Warning/Alert Zone	No
Groundwater Flood Risk*	Potential for flooding at surface
Drinking Water Safeguard Zone	Yes

* The scope of this report does not include a flood risk assessment.

3.8 Ecologic al Systems

There are no designated environmentally sensitive sites recorded within 2000m of the site boundary.

The site is shown as being in a Nitrate Vulnerable Zone (surface water).

It should be noted the statement regarding ecological systems does not purport to be an ecological risk assessment which might require a separate commission.

3.9 Property – Buildings (not buried services)

The site is not located in close proximity to buildings and as such consideration is not given to the potential for structural failure, substantial damage or substantial interference with any right of occupation.

From a search of the MAGIC website it has been established that there are no listed buildings located on site or in the immediate vicinity. The nearest record is for Greyfriars Church approximately 50m South West.

It should be noted the statement regarding historic building and ancient monuments does not purport to be a formal assessment and this aspect may require a separate commission.

3.10 Property – Animal or Crop Effect

This receptor is not present on-site.

Domestic pets may be present in the vicinity.

4 Tier 1 Preliminary Risk Assessment

4.1 Introduction

The methodology developed and adopted by PBA for the assessment of ground conditions is presented in **Appendix 1**. In accordance with guidance presented in CLR 11 (EA Model Procedures for the Management of Land Contamination) we adopt a staged approach to risk assessment and this report presents a Tier 1 assessment or first stage.

The underlying principle to ground condition assessment is the identification of *pollutant linkages* in order to evaluate whether the presence of a source of contamination could potentially lead to harmful consequences.

4.2 Conceptual Site Model

The Tier 1 Preliminary Risk Assessment includes the development of a conceptual site model (CSM). The CSM describes the types and locations of potential contamination sources, the identification of potential receptors and the identification of potential transport/migration pathways.

For a pollutant linkage to be identified a connection between all three elements (source-pathway-receptor) is required.

A pictorial CSM is presented as **Figure 3**.

4.3 Summary of Geological Hazards

4.3.1 The following summarises the finding in relation to geological hazards:-

- Naturally occurring permanent ground gases - not identified.
- Natural geological hazards – possible moderate risk of solution features.
- Anthropogenic – no mining activities identified.

4.4 Potential Pollutant Linkages

For a pollutant linkage to be identified a connection between all three elements (source/hazard-pathway-receptor) is required. Potential pollutant linkages have been identified using the information on potential sources (hazards), receptors and exposure pathways.

Potential Sources (Hazards) and Contaminants of Concern

Naturally occurring hazards such as permanent ground gases have not been identified.

Site-wide potential sources of contamination were not identified on site which historically appears to have been for residential use and currently commercial (office) use. The possible interceptor in the basement beneath No.30 Greyfriars Road could be a source of hydrocarbon oil contamination, however, the current development is of relatively recent construction (1988-1993) and it is considered that any contamination is likely to be localised /small scale.

The potential for site wide contamination to be present based on the past and present use is assessed as Low with a classification score of 2 out of 5 (see Table 1, **Appendix 1**).

The site is located in a densely developed urban area with a long history of development including small scale industrial usage in the immediate vicinity. There is a possible infilled water

feature less than 50m north but this area has been developed subsequently and is located hydraulically down gradient of the site. The potential for site wide contamination to be present based on the past and present use is assessed as Low with a classification score of 2 out of 5 (see Table 1, **Appendix 1**). Table 4.1 summarises the potential sources of contamination (PSC) and contaminants of concern (COC)

Table 4.1 Summary of Potential Sources of Contamination (PSC) and Contaminants of Concern (COC)

PSC Reference	Description	COC
1	Historical development (terrace housing) on-site	Domestic fires (metals and PAHs)
2	Possible interceptor – on-site current	Oils
3	Infilled water feature off-site <50m N	Metals, hydrocarbons and gases

Potential Receptors and Sensitivity Score

The receptors considered as part of this land contamination assessment are summarised below and based on the information reviewed either eliminated from further consideration or allocated a sensitivity score in accordance with the PBA Methodology. The sensitivity score informs the consequence element of the risk estimation process.

Table 4.2 Potential Receptors and Sensitivity Score

Receptor Type	Comment	Sensitivity Score
Human Health - Current	Offices	5
Human Health – Future	Residential	5
Human Health – Construction	It is understood that external in-ground works are not proposed	Eliminated
Human Health – Off Site	Residential	5
Surface Waters	None within 250m	Eliminated
Groundwater	Secondary A aquifer and Principal	3
Property - Buildings	Structures are and will be present on site	1
Property - Animal or Crop Effect	No grazing animals or crops within 250m	Eliminated
Ecological Systems	No designated sites within 1km	Eliminated

Potential Exposure Pathways

Table 2 in the PBA methodology describes possible exposure pathways for each receptor type. Each of these possible pathways is then identified as viable or not when assessing the probability of the source of contamination causing a consequence to a defined receptor.

In relation to human health the potential human health exposure pathways occupational phase of both the current and proposed development are limited to ingestion of contaminated water due to permeation into water supply pipes as there are no areas of exposed soil (therefore no dermal, ingestion and inhalation of dust) and the presence of the ventilated carpark will mitigate inhalation of gases/vapours from both on and off site sources.

4.5 Risk Estimation

When there is a pollutant linkage (and therefore some measure of risk) it is necessary to determine whether the risk matters and therefore whether further action is required.

Risk estimation involves predicting the likely consequence (what degree of harm might result) and the probability that the consequences will arise (how likely the outcome is).

Based on the information available, and assuming a worst case scenario for consequence, the estimated risks have been designated as follows:

- Human Health – Very Low – the likelihood of ingestion of contaminated water due to permeation into water supply pipes is limited by the very small scale of any potential hydrocarbon source on site.
- Groundwater – Very Low – the likelihood is limited by the presence of site-wide hardstanding preventing infiltration and leaching of contaminants.
- Buildings / Services –Low

4.6 Risk Evaluation

Possible pollutant linkages are determined using professional judgement. If a linkage is considered possible, it is considered that this represents a potentially 'unacceptable risk' and therefore requires further consideration. This may be through remediation or mitigation or through further tiers of assessment.

Possible pollutant linkages have been identified for human health, groundwater and buildings, although the level of risk is generally Very Low. The potential for exposure is increased during redevelopment.

4.7 Data Gaps and Uncertainty

It is considered that there is a reasonable level of confidence that the information presented in this report provides a good understanding of the likely ground conditions and enables identification of potential risks.

5 Conclusions and Recommendations

5.1 Preliminary Stability Appraisal

Anthropogenic (mining) activities that could cause instability have not been identified.

Experience of local ground conditions generally suggests that while the Chalk/ Taplow Gravel Formation interface level may be variable it is possible for solution pipe or scour features to be present. The search results show that solution features exist where the same geological conditions are present. Given the relatively high water table across the site, the potential for solution features to be reactivated given the proposed change of use, which will have no in ground works the risk of ground instability is considered to be Low.

Similarly, whilst there is considered to be a low to moderate risk of running sand conditions prevailing at the site, given that there are no anticipated ground excavations associated with the change in use the risk of ground instability is considered to be Low.

5.2 Contamination Appraisal

The potential for site wide contamination to be present on site based on the past and present use is assessed as Very Low. Given the recent construction / short period of operation it is considered that any contamination is likely to be localised /small scale.

It is considered unlikely that the site would be designated statutory contaminated land under Part 2A of the Environmental Protection Act 1990.

The site is considered to represent a Very Low risk in terms of contamination which is defined as “there is a **low** possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.”

It is recommended that if there is an interceptor present beneath No.30 Greyfriars Road that the condition should be ascertained and decommissioned if the facility is redundant. It is recommended that the surface water drainage systems, including any interceptors and chambers for the site are inspected for signs of any damage and repairs undertaken as necessary to prevent any uncontrolled spills or leaks of hydrocarbons.

6 Essential Guidance for Report Readers

This report has been prepared within an agreed timeframe and to an agreed budget that will necessarily apply some constraints on its content and usage. The remarks below are presented to assist the reader in understanding the context of this report and any general limitations or constraints. If there are any specific limitations and constraints they are described in the report text.

The opinions and recommendations expressed in this report are based on statute, guidance, and best practice current at the time of its publication. Peter Brett Associates LLP (PBA) does not accept any liability whatsoever for the consequences of any future legislative changes or the release of subsequent guidance documentation, etc. Such changes may render some of the opinions and advice in this report inappropriate or incorrect and the report should be returned to us and reassessed if required for re-use after one year from date of publication. Following delivery of the report PBA has no obligation to advise the Client or any other party of such changes or their repercussions.

Some of the conclusions in this report may be based on third party data. No guarantee can be given for the accuracy or completeness of any of the third party data used. Historical maps and aerial photographs provide a “snap shot” in time about conditions or activities at the site and cannot be relied upon as indicators of any events or activities that may have taken place at other times.

The conclusions and recommendations made in this report and the opinions expressed are based on the information reviewed and/or the ground conditions encountered in exploratory holes and the results of any field or laboratory testing undertaken. There may be ground conditions at the site that have not been disclosed by the information reviewed or by the investigative work undertaken. Such undisclosed conditions cannot be taken into account in any analysis and reporting.

This report has been written for the sole use of the Client stated at the front of the report in relation to a specific development or scheme. The conclusions and recommendations presented herein are only relevant to the scheme or the phase of project under consideration. This report shall not be relied upon or transferred to any other party without the express written authorisation of PBA. Any such party relies upon the report at its own risk.

The interpretation carried out in this report is based on scientific and engineering appraisal carried out by suitably experienced and qualified technical consultants based on the scope of our engagement. We have not taken into account the perceptions of, for example, banks, insurers, other funders, lay people, etc, unless the report has been prepared specifically for that purpose. Advice from other specialists may be required such as the legal, planning and architecture professions, whether specifically recommended in our report or not.

Public or legal consultations or enquiries, or consultation with any Regulatory Bodies (such as the Environment Agency, Natural England or Local Authority) have taken place only as part of this work where specifically stated.

7 References

- BGS, 2016 <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>
- BRE, 2015 Radon: Guidance on protective measures for new buildings. Report BR211, Building Research Establishment, Garston, Hertfordshire, 2015.
- DCLG, 2012 National Planning Policy Framework (NPPF). Department for Communities and Local Government, London, 2012.
- EA, 2004 Model procedures for the Management of Land Contamination – Contaminated Land Report 11 (CLR11). Published by the Environment Agency (EA), 2004.
- LIG, 2017 Envirocheck Report and historical maps provided by Landmark Information Group (LIG)

Figures



0 500 1000
metres

Grid Ref: SU 712 736

Nearest Post Code: RG1 1PE



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Client

McKay Securities PLC

Contains Ordnance Survey data © Crown
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20 GREYFRIARS ROAD, READING

SITE LOCATION PLAN

Date 13.04.2017

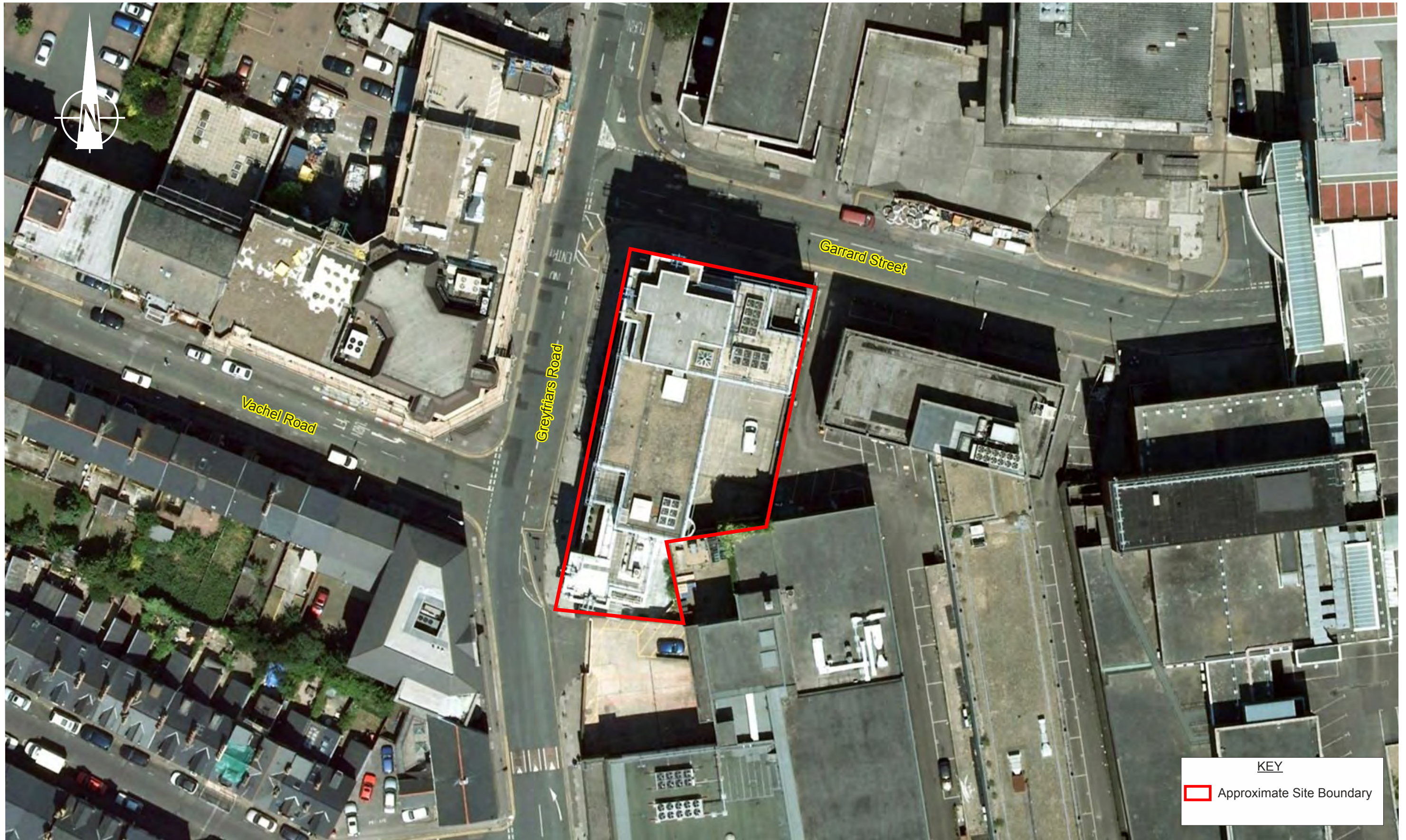
Scale 1:25 000

Drawn by davco

Checked by PJ

Revision -

FIGURE 1



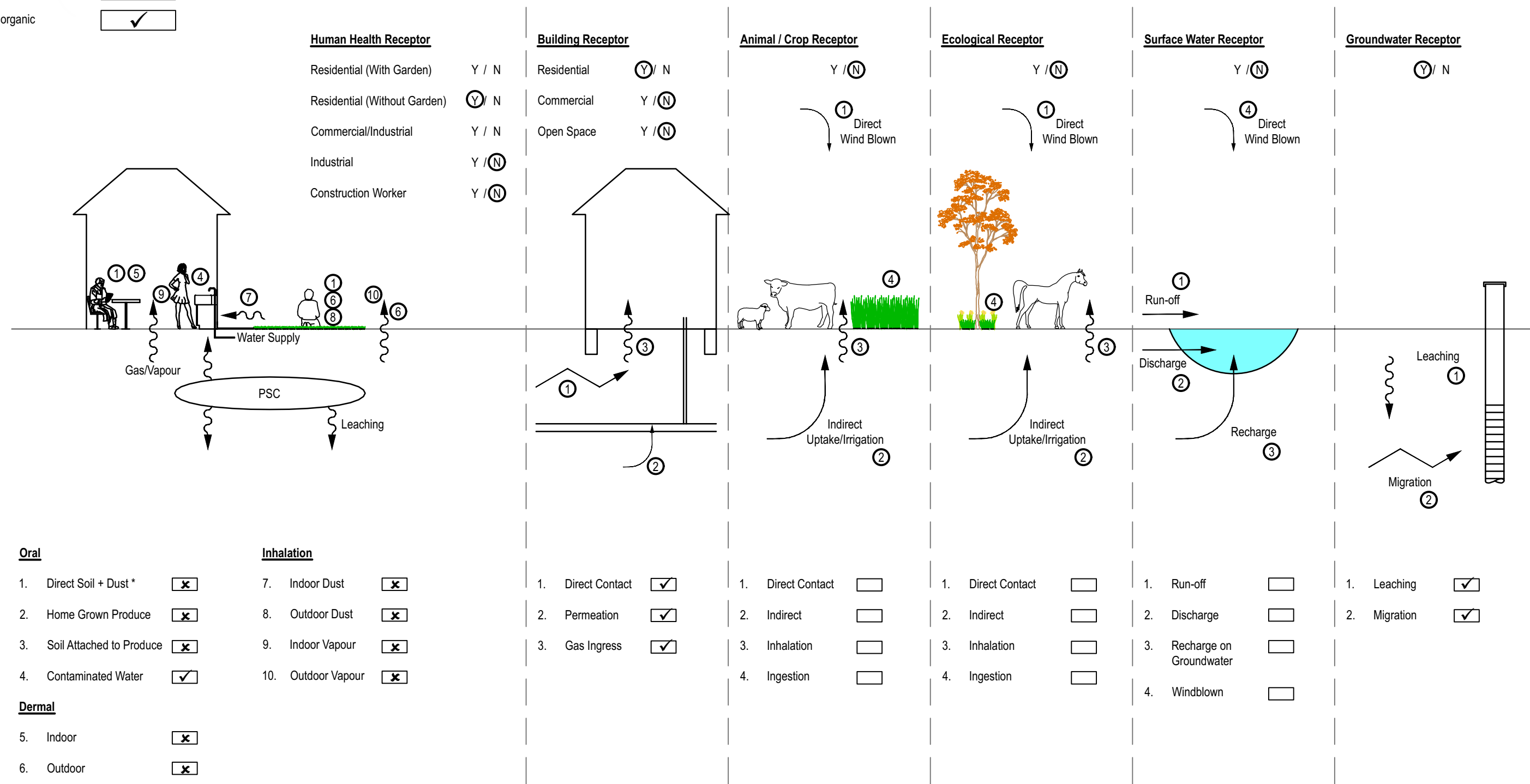
KEY

Approximate Site Boundary

Potential Types of Contamination

Gas	☒
EPH/Solvent	☒
PAH/PCB	☒
Metals	☒
Inorganic	☒

Residential without Private Gardens



* CLEA does not differentiate



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20 GREYFRIARS ROAD, READING
CONCEPTUAL SITE MODEL

Date	14.04.2017
Scale	nts
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Checked by	PJ
Revision	-

FIGURE 3

Appendix 1

PBA Methodology for Assessing Land Contamination in England

1 Introduction

This document defines the approach adopted by PBA in relation to the assessment of land contamination in England. The aim is for the approach to (i) be systematic and objective, (ii) provide for the assessment of uncertainty and (iii) provide a rational, consistent, transparent framework.

When preparing our methodology we have made reference to various technical guidance documents and legislation referenced in Section 7 of which the principal documents are (i) Contaminated Land Statutory Guidance (Defra 2012), (ii) the Model Procedures for the Management of Contamination (CLR 11) (EA 2004), (iii) Contaminated land risk assessment: A guide to good practice (C552) (CIRIA 2001) and (iv) National Planning Policy Framework (DCLG 2012).

2 Dealing with Land Contamination

Government policy on land contamination aims to prevent new contaminated land from being created and promotes a risk based approach to addressing historical contamination. With regard to historical contamination, regulatory intervention is held in reserve for land that meets the legal definition and cannot be dealt with through any other means, including through planning. Land is only considered to be "contaminated land" in the legal sense if it poses an unacceptable risk.

UK legislation on contaminated land is principally contained in Part 2A of the Environmental Protection Act, 1990 (which was inserted into the 1990 Act by section 57 of the Environment Act 1995). Part 2A was introduced in England on 1 April 2000 and provides a risk-based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment. In 2004 the Model Procedures for the Management of Contamination (CLR 11) were published providing guidance on how the statutory requirements were to be delivered. The approach, concepts and principles for land contamination management promoted by CLR 11 are applied to the determination of planning applications.

Other legislative regimes may also provide a means of dealing with land contamination issues, such as the regimes for waste, water, environmental permitting, and environmental damage. Further, the law of statutory nuisance may result in contaminants being unacceptable to third parties whilst not attracting action under Part 2A or other environmental legislation.

2.1 Part 2A

The Regulations and Statutory Guidance that accompanied the Act, including the Contaminated Land (England) Regulations 2006, has been revised with the issue of The Contaminated Land (England) (Amendment) Regulations 2012 (SI 2012/263) and the Contaminated Land Statutory Guidance for England 2012.

Part 2A defines contaminated land as "*land which appears to the Local Authority in whose area it is situated to be in such a condition that, by reason of substances in, on or under the land that significant harm is being caused, or there is a significant*

possibility that such harm could be caused, or pollution of controlled waters is being, or likely to be, caused".

Harm is defined as "*harm to the health of living organisms or other interference with the ecological systems of which they form part, and in the case of man, includes harm to his property*".

For the purposes of Part 2A, land is contaminated if it poses a significant possibility of significant harm (SPOSH).

Part 2A provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment, and under the guidance enforcing authorities should seek to find and deal with such land. It states that "*under Part 2A the starting point should be that land is not contaminated land unless there is reason to consider otherwise. Only land where unacceptable risks are clearly identified, after a risk assessment has been undertaken in accordance with the Guidance, should be considered as meeting the Part 2A definition of contaminated land*". Further the guidance makes it clear that "*regulatory decisions should be based on what is reasonably likely, not what is hypothetically possible*".

The overarching objectives of the Government's policy on contaminated land and the Part 2A regime are:

- "(a) To identify and remove unacceptable risks to human health and the environment.
- (a) To seek to ensure that contaminated land is made suitable for its current use.
- (b) To ensure that the burdens faced by individuals, companies and society as a whole are proportionate, manageable and compatible with the principles of sustainable development".

The enforcing authority may need to decide whether and how to act in situations where decisions are not straight forward, and where there is uncertainty. "*In so doing, the authority should use its judgement to strike a reasonable balance between: (a) dealing with risks raised by contaminants in land and the benefits of remediating land to remove or reduce those risks; and (b) the potential impacts of regulatory intervention including financial costs to whoever will pay for remediation, health and environmental impacts of taking action, property blight, and burdens on affected people*". The authority is required to "*take a precautionary approach to the risks raised by contamination, whilst avoiding a disproportionate approach given the circumstances of each case*". The aim is "*that the regime produces net benefits, taking account of local circumstances*".

The guidance recognises that "*normal levels of contaminants in soils should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise*".

Normal levels are quoted as:

- "a) natural presence of contaminants' such as from underlying geology 'that have not been shown to pose an unacceptable risk to health and the environment
- b) ...low level diffuse pollution, and common human activity..."

PBA Methodology for Assessment of Potentially Contaminated Land

Similarly the guidance states that significant pollution of controlled waters is required for land to be considered contaminated and the *"fact that substances are merely entering water"* or *"where discharge from land is not discernible at a location immediately downstream"* does not constitute contaminated land.

To help achieve a more targeted approach to identifying and managing contaminated land in relation to the risk (or possibility) of harm to human health, the revised Statutory Guidance presented a new four category system for considering land under Part 2A, ranging from Category 4, where there is no risk that land poses a significant possibility of significant harm (SPOSH), or the level of risk is low, to Category 1, where the risk that land poses a significant possibility of significant harm (SPOSH) is unacceptably high.

For land that cannot be readily placed into Categories 1 or 4 further assessment is required. If there is a sufficiently strong case that the risks are of sufficient concern to cause significant harm/pollution or have the significant possibility of significant harm/pollution the land is to be placed into Category 2. If the concern is not met land is considered Category 3.

The technical guidance clearly states that the currently published SGV and GAC's represent *"cautious estimates of level of contaminants in soils"* which should be considered *"no risk to health or, at most, a minimal risk"*. These values do not represent the boundary between categories 3 and 4 and *"should be considered to be comfortably within Category 4"*.

At the end of 2013 technical guidance in support of Defra's revised Statutory Guidance (SG) was published (CL:AIRE 2013) which provided:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

2.2 Planning

The Local Planning Authority (LPA) is responsible for the control of development, and in doing so it has a duty to take account of all material considerations, including contamination.

Section 11, Paragraph 109 of the National Planning Policy Framework (NPPF) (DCLG 2012) states the planning system should contribute to and enhance the natural and local environment by *"preventing both new and existing developments from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water pollution"* and *"remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate"*. Paragraphs 120 and 121 describe the policy considerations the Government expects LPA to have in regard to land affected by contamination when preparing policies for development plans and in taking decisions on applications.

For planning purposes, the NPPF requires that the assessment of risks arising from contamination and remediation requirements should be considered on the

basis of the current environmental setting, the current land use, and the circumstances of its proposed new use. The NPPF stipulates that planning policies and decisions should ensure that *"the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation"*; and that *"after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and adequate site investigation information, prepared by a competent person, is presented."*

The level at which contamination is deemed to be unacceptable, or, gives rise to adverse effects under a planning context has not been identified but is envisaged to be more precautionary than the level required to determine land as contaminated under Part 2A.

In paragraph 121 the developer is required to ensure that land, after development, is not capable of being determined as contaminated land under Part 2A of the EPA 1990.

The principal planning objective is to ensure that any unacceptable risks to human health, buildings and other property and the natural and historical environment from the contaminated condition of the land are identified so that appropriate action can be considered and taken to address those risks. In order to grant a planning permission the Local Planning Authority (LPA) has to be satisfied that there is sufficient information about the condition of the land, its impacts and the availability of viable remedial options. NPPF Paragraph 21 states that *"planning policies and decisions should also ensure that adequate site investigation information, prepared by a competent person, is presented"*. Site investigation information is further defined in the NPPF Glossary page 56 and that also states that investigations should be carried out in accordance with established procedures, including BS10175 (BSI 2011) that in turn links procedure to the requirements of CLR11.

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a):

"SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health."

A letter from Lord de Mauley dated 3rd September 2014 provides more explicit direction to local authorities on the use of the C4SL in a planning context. The letter identifies four key points:

- 1) that the screening values were developed expressly with the planning regime in mind
- 2) their use is recommended in DCLG's planning guidance
- 3) soil concentrations below a C4SL limit are considered to be 'definitely not contaminated' under Part IIA of the 1990 Environmental Protection Act and pose at most a 'low level of toxicological concern' and
- 4) exceedance of a C4SL screening value does not mean that land is definitely contaminated, just that further investigation may be warranted.

PBA Methodology for Assessment of Potentially Contaminated Land

2.3 Building Control

The building control department of the local authority or private sector approved inspectors are responsible for the operation and enforcement of the Building Regulations (DCLG 2010) to protect the health, safety and welfare of people in and around buildings. Approved Document C requires the protection of buildings and associated land from the effects of contamination, to be applied (non-exclusively) in all changes of use from commercial or industrial premises, to residential property.

3 Approach

CLR 11 recommends a phased or tiered approach to risk assessment with the three tiers being:-

- Tier 1 - preliminary – a qualitative assessment forming part of a Phase 1 report,
- Tier 2 - generic - a quantitative assessment using published criteria to screen site specific ground condition data forming part of a Phase 2 report
- Tier 3 - detailed – a quantitative assessment involving the generation of site specific assessment criteria

Each tier of risk assessment comprises the following four stages:-

1. Hazard Identification – identifying potential contaminant sources on and off site;
2. Hazard Assessment – assessing the potential for unacceptable risks by identifying what pathways and receptors could be present, and what pollutant linkages could result (forming the Conceptual Site Model (CSM));
3. Risk Estimation – estimating the magnitude and probability of the possible consequences (what degree of harm might result to a defined receptor and how likely); and
4. Risk Evaluation – evaluating whether the risk needs to be, and can be, managed.

A PBA Phase 1 report normally comprises a desk study, walkover and Tier 1 risk assessment (the project specific offer defines the actual scope of work). This is the minimum requirement as defined by the NPPF, pp56. At Tier 1 the PBA approach to risk estimation involves identifying the magnitude of the potential consequence (taking into account both the potential severity of the hazard and the sensitivity of the receptor) and the magnitude of the likelihood i.e. the probability (taking into account the presence of the hazard and the receptor and the integrity of the pathway). This approach is promoted in current guidance such as R&D 66 (NHBC 2008).

The PBA approach is that if a pollution linkage is identified then it represents a potential risk which requires further consideration and either (1) remediation / direct risk management or (2) further tiers of assessment.

A PBA preliminary Phase 2 report comprises an intrusive investigation to collect site specific information, a Tier 2 quantitative generic risk assessment and a refinement of the CSM using the site specific data. Depending on the findings further investigation and/or progression to Tier 3 risk assessment and the generation of site specific assessment criteria may be required.

The PBA methodology provides an estimate of the level of risk, it does not identify a risk level at which the risk is considered “significant” and/or “unacceptable” as this is dependant on the view of the individual / stakeholder. For example; to a risk adverse stakeholder even a risk level of “very low” may be considered unacceptable and as such this stakeholder may require risk management options to be implemented.

4 Identification of Pollutant Linkages and Conceptual Site Model (CSM)

For all Tiers the underlying principle to ground condition assessment is the identification of *pollutant linkages* in order to evaluate whether the presence of a source of contamination could potentially lead to harmful consequences. A pollutant linkage consists of the following three elements:-

- A source/hazard – a substance or situation which has the potential to cause harm or pollution;
- A pathway – a means by which the hazard moves along / generates exposure; and
- A receptor/target – an entity which is vulnerable to the potential adverse effects of the hazard.

The *Conceptual Site Model* identifies the types and locations of potential contaminant sources/hazards and potential receptors and potential migration/transportation pathway(s). The CSM is refined as the assessment progresses through the Tiers.

4.1 Hazard Identification

A hazard is a substance or situation that has the potential to cause harm. Hazards may be chemical, biological or physical (e.g. explosive gases).

At Tier 1 the potential for hazards to be present is determined from consideration of the previous or ongoing activities on or near to the site in accordance with the criteria presented in the **Table 1**.

Based on the land use information Potential Contaminants of Concern (PCOC) are identified. The PCOC direct the scope of the collection of site specific data and the analytical testing selected for subsequent Tiers.

At Tier 2 the site specific data is screened using published assessment criteria (refer to PBA document entitled Rationale for the Selection of Tier 2 Assessment Criteria). In general, published criteria have been developed using highly conservative assumptions and therefore if the screening criterion is not exceeded then the PCOC is eliminated as a potential Hazard. It should be noted that exceedance does not necessarily indicate that a site is contaminated and/or unsuitable for use only that the PCOC is retained as a potential Hazard. Published criteria are generated using models based on numerous and complex assumptions. Whether or not these assumptions are appropriate in a site-specific context requires confirmation on a project by project basis and would form part of a Tier 3 assessment.

When reviewing or assessing site specific data PBA utilise published guidance on comparing contamination

PBA Methodology for Assessment of Potentially Contaminated Land

data with a critical concentration (CL:AIRE/CIEH 2008) which presents a structured process for employing statistical techniques for data assessment purposes. The benefit of the statistical tool is uncertainty is quantified and decisions are made knowing the strength of the evidence. Correct decision probability is a function of sample size, difference in the mean and the critical concentration, variation in measured values and the significance level.

4.2 Receptor and Pathway Identification

For all Tiers the potential receptors (for both on site and adjoining land) that will be considered are:

- Human Health – including current and future occupiers, construction and future maintenance workers, and neighbouring properties/third parties;
- Ecological systems; ^{*1}
- Controlled waters ^{*2} – including surface water and groundwater;
- Property, Animal or Crop (existing or proposed) - including buildings, service lines and pipes, crops, livestock, pets, woodland; and
- Archaeological sites and ancient monuments.

^{*1} International or nationally designated sites (as defined in the statutory guidance (Defra Circular 04/12)) “in the local area” will be identified as potential ecological receptors. A search radius of 1, 2 or 5km will be utilised depending on the site specific circumstances (see also pathway identification). The Environment Agency has published an ecological risk assessment framework (EA 2008) which promotes (as opposed to statutorily enforces) consideration of additional receptors to include locally protected sites and protected or notable species. These additional potential receptors will only be considered if a Phase 1 habitat survey, undertaken in accordance with guidance (JNCC 1993), is commissioned and the data provided to PBA. It should be noted that without such a survey the Tier 1 risk assessment may conclude that the identification of potential ecological receptors is inconclusive (refer to PBA Specification for Phase 1).

^{*2} the definition of “pollution of controlled water” was amended by the introduction of Section 86 of the Water Act 2003. For the purposes of Part 2A groundwater does not include waters above the saturated zone and our assessment does not therefore address perched water other than where development causes a pathway to develop.

If a receptor is taken forward for further assessment it will be classified in terms of its sensitivity, the criteria for which are presented in **Table 2**. Table 2 has been generated using descriptions of environmental receptor importance/value given in various guidance documents including R&D 66 (NHBC 2008) and Transport Analysis Guidance (based on DETR 2000). Human health and buildings classifications have been generated by PBA using the attribute description for each class.

The exposure pathway and modes of transport that will be considered are presented in **Table 3**.

4.3 Note regarding Ecological Systems

The Environment Agency (EA) has developed an ecological risk assessment framework which aims to provide a structured approach for assessing the risks to ecology from chemical contaminants in soils (EA 2008). In circumstances where contaminants in water represent a potential risk to aquatic ecosystems then risk assessors will need to consider this separately.

The framework consists of a three tiered process:-

- Tier 1 is a screening step where the site soils chemical data is compared to a soil screening value (SSV)
- Tier 2 uses various tools (including surveys and biological testing) to gather evidence for any harm to the ecological receptors
- Tier 3 seeks to attribute the harm to the chemical contamination

Tier 1 is preceded by a desk study to collate information about the site and the nature of the contamination to assess whether pollutant linkages are feasible. The framework presents ten steps for ecological desk studies and development of a conceptual site model as follows.

- 1 Establish Regulatory Context
- 2 Collate and Assess Documentary Information
- 3 Summarise Documentary Information
- 4 Identify Potential Contaminants of Concern
- 5 Identify Likely Fate Transport of Contaminants
- 6 Identify Potential Receptors of Concern
- 7 Identify Potential Pathways of Concern
- 8 Create a Conceptual Site Model
- 9 Identify Assessment and Measurement Endpoints
- 10 Identify Gaps and Uncertainties

The information in a standard PBA Phase 1 report covers Steps 1 to 4 inclusive. Step 5 considers fate and transport of contaminants and it should be noted that our standard report adopts a simplified approach considering only transport mechanisms. A simplified approach has also been adopted in respect of Steps 6 and 7 receptors (a detailed review of the ecological attributes has not been undertaken) and pathways (a food chain assessment has not been undertaken). Step 9 is outside the scope of our standard Phase 1 report.

It should be noted that the Tier 1 assessment for ecological systems (i.e. where designated sites are identified) as part of a Phase 1 report will assess the viability of the mode of transport given the site specific circumstances not specific pathways.

The Tier 1 risk assessment may conclude that the risk to potential ecological receptors is inconclusive (see PBA Specification for Phase 1).

4.4 Note regarding Controlled Waters

Controlled Waters are rivers, estuaries, coastal waters, lakes and groundwaters, but not perched waters.

The EU Water Framework Directive (WFD) 2000/60/EC provides for the protection of sub-surface, surface, coastal and territorial waters through a framework of river basin management. The EU Updated Water Framework Standards Directive 2014/101/EU amended the EU WFD to update the international standards therein; it enters into force on 20 November 2014 and its provisions must be transposed in Member State law by 20 May 2016. Other EU Directives in the European water management framework include:

- the EU Priority Substances Directive 2013/39/EU;

PBA Methodology for Assessment of Potentially Contaminated Land

- EU Groundwater Pollutants Threshold Values Directive 2014/80/EU amending the EU Groundwater Directive 2006/118/EC; and
- EU Biological Monitoring Directive 2014/101/EU.

The Ground Water Daughter Directive (GWDD) was enacted by the Groundwater Regulations (2009), which were subsumed by the Environmental Permitting Regulations (2010) which provide essential clarification including on the four objectives specifically for groundwater quality in the WFD:-

- Achieve 'Good' groundwater chemical status by 2015, commonly referred to as 'status objective';
- Achieve Drinking Water Protected Area Objectives;
- Implement measures to reverse any significant and sustained upward trend in groundwater quality, referred to as 'trend objective'; and
- Prevent or limit the inputs of pollutants into groundwater, commonly referred to as 'prevent or limit' objectives

The Water Act 2003 (Commencement No.11) Order 2012 amends the test for 'contaminated land' which relates to water pollution so that pollution of controlled waters must now be "significant" to meet the definition of contaminated land.

River Basin Management Plans (RBMP) have been developed for the 11 River Basin Districts in England and Wales. These were released by Defra in 2009 (Defra 2009).

These RBMP's establish the current status of waters within the catchments of the respective Districts and the current status of adjoining waters identified. As part of a Tier 2 risk assessment water quality data is screened against the WFD assessment criteria. Compare to the RBMP's current status of waters for the catchment under consideration would form part of a Tier 3 assessment.

5 Risk Estimation

Risk estimation classifies what degree of harm might result to a receptor (defined as consequence) and how likely it is that such harm might arise (probability).

At Tier 1 the consequence classification is generated by multiplying the hazard classification score and the receptor sensitivity score. This approach follows that presented in the republished R&D 66 (NHBC 2008).

The criteria for classifying probability are set out in **Table 4** and have been taken directly from Table 6.4 CIRIA C552 (CIRIA 2001). Probability considers the integrity of the exposure pathway.

The consequence classifications detailed in **Table 5** have been adapted from Table 6.3 presented in C552 and R&D 66 (Annex 4 Table A4.3).

The Tier 1 risk classification is estimated for each pollutant linkage using the matrix given in **Table 6** which is taken directly from C552 (Table 6.5). Subsequent Tiers refine the CSM through retention or elimination of potential hazards and pollutant linkages.

6 Risk Evaluation

In order to put the Tier 1 risk classification into context the likely actions are described in **Table 7** which is taken directly from C552 (Table 6.6). Subsequent Tiers identify potential risk management options through remediation and/or mitigation measures.

7 References

- BSI 2007 BS 8485 Code of Practice for characterisation and remediation from ground gas in affected developments.
- BSI 2011 BS 10175 (2011) Code of practice - Investigation of potentially contaminated sites
- CIRIA 2001: Contaminated land risk assessment – a guide to good practice C552.
- CIRIA 2008: Assessing risks posed by hazardous ground gases to buildings C655
- CL:AIRE/EIH 2008 Guidance on Company Soil Contamination Data with a Critical Concentration. Published by Contaminated Land: Applications in Real Environments (CL:AIRE)
- CL:AIRE 2013 SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report published by Contaminated Land: Applications in Real Environments (CL:AIRE) 20th December 2013
- DCLG 2010 Building Regulations 2010 Approved Document C Site preparation and resistance to contaminants and moisture.
- DCLG 2012 National Planning Policy Framework.
- DETR 2000 Methodology for Multi Modal Studies. Volume 2 Section 4. The Environmental Objective.
- Defra Circular 01/2006
- Defra Circular 04/2012 Environmental Protection Act 1990: Part 2A. Contaminated Land Statutory Guidance.
- DEFRA, 2006 The Contaminated Land (England) Regulations 2006.
- DEFRA, 2012 The Contaminated Land (England) (Amendment) Regulations 2012 (SI2012/263).
- DEFRA, 2012 Environmental Protection Act 1990: Part 2A. Contaminated Land Statutory Guidance. April 2012.
- DEFRA, 2013 Environmental Damage (Prevention and Remediation) Regulations 2009: Guidance for England and Wales
- Defra '2009 Water for Life and Livelihoods. River Basin Management Plan. (11 Districts: Anglia, Dee, Humber, Northumbria, Northwest, Severn, Solway and Tweed, Southeast, Thames, Western Wales) December 2009
- EA 2004: The Model Procedures for the Management of Land Contamination CRL 11 published by the Environment Agency (EA).
- EA 2008 Ecological Risk Assessment Science Report Series SC070009 published by the Environment Agency (EA).
- JNCC 1993 Handbook for Phase 1 Habitat Survey – A Technical for Environmental Audit prepared by the Joint Nature Conservancy Council (JNCC)
- NHBC/EA/CIEH 2008: R&D Publication 66 Guidance for the safe development of housing on land affected by contamination.

Table 1: Criteria for Classifying Hazards / Potential for Generating Contamination

Classification/Score	Potential for generating contamination/gas based on land use
Very Low 1	Land Use: greenfield Contamination: None. Gas generation potential : Inert Made Ground
Low 2	Land Use: residential, retail or office use, recent small scale industrial. Contamination: None or locally slightly elevated concentrations. Gas generation potential : Shallow thickness of Alluvium
Moderate 3	Land Use: railway yards, collieries, scrap yards, light industry, engineering works. Contamination: Locally elevated concentrations. Gas generation potential : Dock silt and substantial thickness of organic alluvium/peat
High 4	Land Use: gas works, chemical works, heavy industry, non-hazardous landfills. Contamination: Possible widespread elevated concentrations. Gas generation potential : Shallow mine workings Pre 1960's landfill
Very High 5	Land Use: hazardous waste landfills. Contamination: Likely widespread elevated concentrations. Gas generation potential : Domestic landfill post 1960

"Greenfield" is land which has not been developed including not used for crop production or animal husbandry and no contamination source therefore no pollutant linkages.

Table 2: Criteria for Classifying Receptor Sensitivity/Value

Classification/Score	Definition
Very Low 1	Receptor of limited importance Groundwater: Non aquifer Surface water: GQA Grade F Ecology: No local designation Buildings: Replaceable Human health: Unoccupied/limited access
Low 2	Receptor of local or county importance with potential for replacement Groundwater: Secondary aquifer Surface water: GQA Grade D/E Ecology: local habitat resources Buildings: Local value Human health: Minimum score 4 where human health identified as potential receptor
Moderate 3	Receptor of local or county importance with potential for replacement Groundwater: Principal aquifer Surface water: GQA Grade B/C Ecology: County wildlife sites, Areas of Outstanding Natural Beauty (AONB) Buildings: Area of Historic Character Human health: Minimum score 4 where human health identified as potential receptor
High 4	Receptor of county or regional importance with limited potential for replacement Groundwater: Source Protection Zone 2 Surface water: GQA Grade A Ecology: SSSI, National or Marine Nature Reserve (NNR or MNR) Buildings: Conservation Area Human health: Minimum score 4 where human health identified as potential receptor
Very High 5	Receptor of national or international importance Groundwater: Source Protection Zone 1 Surface water: GQA Grade A Ecology: Special Areas of Conservation (SAC and candidates), Special Protection Areas (SPA and potentials) or wetlands of international importance (RAMSAR) Buildings: World Heritage site Human health: Residential, open spaces and uses where children are present

Table 3: Exposure Pathway and Modes of Transport

Receptor	Pathway	Mode of transport
Human health	Ingestion	Fruit or vegetable leaf or roots
		Contaminated water
		Soil/dust indoors
		Soil/dust outdoors
	Inhalation	Particles (dust / soil) – outdoor
		Particles (dust / soil) - indoor
		Vapours – outdoor - migration via natural or anthropogenic pathways
		Vapours - indoor - migration via natural or anthropogenic pathways
	Dermal absorption	Direct contact with soil
		Direct contact with waters (swimming / showering)
		Irradiation
Groundwater	Leaching	Gravity / permeation
	Migration	Natural – groundwater as pathway Anthropogenic (e.g. boreholes, culverts, pipelines etc.)
Surface Water	Direct	Runoff or discharges from pipes
	Indirect	Recharge from groundwater
	Indirect	Deposition of wind blown dust
Buildings	Direct contact	Sulphate attack on concrete, hydrocarbon corrosion of plastics
	Gas ingress	Migration via natural or anthropogenic paths
Ecological systems	See Notes	Runoff/discharge to surface water body
	See Notes	Windblown dust
	See Notes	Groundwater migration
	See Notes	At point of contaminant source
Animal and crop	Direct	Wind blown or flood deposited particles / dust / sediments
	Indirect	Plants via root up take or irrigation. Animals through watering
	Inhalation	By livestock / fish - gas / vapour / particulates / dust
	Ingestion	Consumption of vegetation / water / soil by animals

Table 4: Classification of Probability

Classification	Definition
High likelihood	There is a pollution linkage and an event either appears very likely in the short-term and almost inevitable over the long-term, or there is already evidence at the receptor of harm / pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter-term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long-term.

PBA Methodology for Assessment of Potentially Contaminated Land

Table 5: Classification of Consequence (score = magnitude of hazard Table 1 and sensitivity of receptor Table 2)

Classification / Score	Examples
Severe 20-25	Human health effect - exposure likely to result in "significant harm". Significant harm to humans is defined in circular 01/2006 as death, disease, serious injury, genetic mutation, birth defects or impairment of reproductive function. Controlled water effect - short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Equivalent to EA Category 1 incident (persistent and/or extensive effects on water quality leading to closure of potable abstraction point or loss of amenity, agriculture or commercial value. Major fish kill. Ecological effect - short-term exposure likely to result in a substantial adverse effect. Catastrophic damage to crops, buildings or property
Medium 13-19	Human health effect - exposure could result in "significant harm". Significant harm to humans is defined in circular 01/2006 as death, disease, serious injury, genetic mutation, birth defects or impairment of reproductive function. Controlled water effect - equivalent to EA Category 2 incident requiring notification of abstractor Ecological effect - short-term exposure may result in a substantial adverse effect. Damage to crops, buildings or property
Mild 6-12	Human health effect - exposure may result in "significant harm". Significant harm to humans is defined in circular 01/2006 as death, disease, serious injury, genetic mutation, birth defects or impairment of reproductive function. Controlled water effect - equivalent to EA Category 3 incident (short lived and/or minimal effects on water quality). Ecological effect - unlikely to result in a substantial adverse effect. Minor damage to crops, buildings or property. Damage to building rendering it unsafe to occupy (for example foundation damage resulting in instability).
Minor 1-5	No measurable effect on humans. Protective equipment is not required during site works. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects to crops, buildings or property. The loss of plants in a landscaping scheme. Discolouration of concrete.

Table 6: Classification of Risk (Combination of Consequence Table 5 and Probability Table 4)

	Consequence			
Probability	Severe	Medium	Mild	Minor
High likelihood	Very high	High	Moderate	Low
Likely	High	Moderate	Moderate/low	Low
Low likelihood	Moderate	Moderate/low	Low	Very low
Unlikely	Moderate/low	Low	Very low	Very low

Table 7: Description of Risks and Likely Action Required

Risk Classification	Description
Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation is likely to be required in the short term.
High risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer-term.
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Appendix 2



Plate 1

View of NCP Car Park on opposite side of Garrard Street



Plate 2

Access to Car Park and Refuse Area



Plate 3

Three Covers in Basement (possible interceptor)



Plate 4

Greyfriars House from Greyfriars Road

	Client	Photographic Plates from Site Walkover	Date	12.04.17
	McKay Securities PLC		A4 Scale	N/A
			Drawn	PJ
			Checked	PJ
			Figure	Appendix 2
Caversham Bridge House, Waterman Pl, Reading, RG1 8DN Tel 0118 950 0761				

Appendix 3

Historical Mapping Legends

Ordnance Survey County Series 1:10,560

	Gravel Pit		Sand Pit		Other Pits
	Quarry		Shingle		Orchard
	Osiers		Reeds		Marsh
	Mixed Wood		Deciduous		Brushwood
	Fir		Furze		Rough Pasture
	Arrow denotes flow of water		Trigonometrical Station		
	Site of Antiquities		Bench Mark		
	Pump, Guide Post, Signal Post		Well, Spring, Boundary Post		
	Surface Level				
	Sketched Contour		Instrumental Contour		
	Main Roads		Minor Roads		
	Sunken Road		Raised Road		
	Road over Railway		Railway over River		
	Railway over Road		Level Crossing		
	Road over River or Canal		Road over Stream		
	Road over Stream				
	County Boundary (Geographical)				
	County & Civil Parish Boundary				
	Administrative County & Civil Parish Boundary				
	County Borough Boundary (England)				
	County Burgh Boundary (Scotland)				
	Rural District Boundary				
	Civil Parish Boundary				

Ordnance Survey Plan 1:10,000

	Chalk Pit, Clay Pit or Quarry		Gravel Pit
	Sand Pit		Disused Pit or Quarry
	Refuse or Slag Heap		Lake, Loch or Pond
	Dunes		Boulders
	Coniferous Trees		Non-Coniferous Trees
	Orchard		Scrub
	Bracken		Heath
	Marsh		Reeds
	Building		Glasshouse
	Sloping Masonry		Pylon
	Cutting		Embankment
	Road Under		Road Over
	Level Crossing		Foot Bridge
	Standard Gauge Multiple Track		Standard Gauge Single Track
	Siding, Tramway or Mineral Line		Narrow Gauge
	Geographical County		Administrative County, County Borough or County of City
	Municipal Borough, Urban or Rural District, Burgh or District Council		Borough, Burgh or County Constituency
	Civil Parish		
	Boundary Post or Stone		Police Station
	Church		Post Office
	Club House		Public Convenience
	Fire Engine Station		Public House
	Foot Bridge		Signal Box
	Fountain		Spring
	Guide Post		Telephone Call Box
	Mile Post		Telephone Call Post
	Mile Stone		Well

1:10,000 Raster Mapping

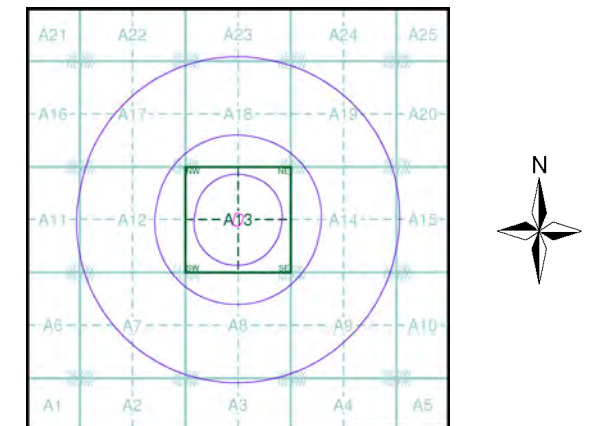
	Gravel Pit		Refuse tip or slag heap
	Rock		Rock (scattered)
	Boulders		Boulders (scattered)
	Shingle		Mud
	Sand		Sand Pit
	Slopes		Top of cliff
	General detail		Underground detail
	Overhead detail		Narrow gauge railway
	Multi-track railway		Single track railway
	County boundary (England only)		Civil, parish or community boundary
	District, Unitary, Metropolitan, London Borough boundary		Constituency boundary
	Area of wooded vegetation		Non-coniferous trees
	Non-coniferous trees (scattered)		Coniferous trees
	Coniferous trees (scattered)		Positioned tree
	Orchard		Coppice or Osiers
	Rough Grassland		Heath
	Scrub		Marsh, Salt Marsh or Reeds
	Water feature		Flow arrows
	Mean high water (springs)		Mean low water (springs)
	Telephone line (where shown)		Electricity transmission line (with poles)
	Bench mark (where shown)		Triangulation station
	Point feature (e.g. Guide Post or Mile Stone)		Pylon, flare stack or lighting tower
	Site of (antiquity)		Glasshouse
	General Building		Important Building



Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Oxfordshire	1:10,560	1882	3
Berkshire	1:10,560	1883	4
Oxfordshire	1:10,560	1900	5
Berkshire	1:10,560	1900	6
Berkshire	1:10,560	1901	7
Oxfordshire	1:10,560	1901	8
Berkshire	1:10,560	1913 - 1914	9
Berkshire	1:10,560	1932 - 1933	10
Berkshire	1:10,560	1938	11
Berkshire	1:10,560	1938	12
Historical Aerial Photography	1:10,560	1947 - 1949	13
Ordnance Survey Plan	1:10,000	1960 - 1962	14
Ordnance Survey Plan	1:10,000	1968	15
Ordnance Survey Plan	1:10,000	1970 - 1976	16
Ordnance Survey Plan	1:10,000	1979	17
Ordnance Survey Plan	1:10,000	1983 - 1984	18
Ordnance Survey Plan	1:10,000	1990 - 1992	19
Reading	1:10,000	1990	20
Ordnance Survey Plan	1:10,000	1995	21
10K Raster Mapping	1:10,000	1999	22
10K Raster Mapping	1:10,000	2006	23
VectorMap Local	1:10,000	2017	24

Historical Map - Slice A



Order Details

Order Number: 112039051_1_1
Customer Ref: 40388
National Grid Reference: 471280, 173670
Slice: A
Site Area (Ha): 0.41
Search Buffer (m): 1000

Site Details

Mckay Securities Plc, 20, Greyfriars Road, READING, RG1 1NL



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

Russian Military Mapping Legends

1:5,000 and 1:10,000 mapping

a. Not drawn to scale b. Drawn to scale

Government and Administrative Buildings Military and Industrial Buildings

Military and Communication Areas Subway Entrance

Fireproof Building Prominent Fireproof Building

Non-fireproof Building Non-fireproof Building (non-dwelling)

Factory, mill, and flour mill, with chimneys Factory, mill, and flour mill, without chimneys

Power Station, drawn to scale Hydroelectric Power Station

Radio Station, drawn to scale Telephone Station, drawn to scale

Abandoned Open-pit Mine or Quarry Open-pit Salt Mine

Pit Oil Deposit or Well Oil Seepage

Tailings Pile Fuel Storage Tanks Natural Gas Tank

Bench Mark Drill Hole Burial Mound Triangulation Point on Burial Mound

Single-track Railroad Double-track Railroad and Station Building

Coniferous Forest Deciduous Forest Mixed Forest

Lawns Citrus Orchard Wet Ground Scattered Vegetation

243.8 Values for prominent elevations

186.0 Numbers for spot elevations, depth soundings, contour lines, etc.

0.2 Velocity of the current, width of river bed, depth of river

180/12 Fractional terms: length and capacity of bridges; depth of fords and condition of the river bottom; height of forest and the diameter of trees

Russian Alphabet (For reference and phonetic interpretation of map text)

А а (A)	З з (Z)	П п (P)	Ч ч (CH)
Б б (B)	И и (I)	Р р (R)	Ш ш (SH)
В в (V)	Й й (Y)	С с (S)	Щ щ (SHCH)
Г г (G)	К к (K)	Т т (T)	Ъ (-)
Д д (D)	Л л (L)	У у (U)	Ы (Y)
Е е (E)	М м (M)	Ф ф (F)	Ь (')
Ё ё (YO)	Н н (N)	Х х (KH)	Э э (E)
Ж ж (ZH)	О о (O)	Ц ц (TS)	Ю ю (YU or IU)
			Я я (YA or IA)

1:25,000 mapping

a. Not drawn to scale b. Drawn to scale

Government and Administrative Buildings Military and Industrial Buildings

Military and Communication Areas Subway Entrance

Partly Demolished Buildings Demolished Buildings

Built-Up Area with Fireproof Buildings Predominant Built-Up Area with Non-Fireproof Buildings Predominant

Individual Fireproof Building Prominent Industrial Building

Individual Dwelling, Fireproof Ruins of an Individual Dwelling

Factory or Mill Chimney Factory or Mill with Chimney Factory or Mill without Chimney Mine or Open Pit Mine

Operating Shaft or Mine Non-Operating Shaft or Mine Salt Mine Tailings Pile

Pit Stone Quarry Gas Pump or Service Station Fuel Storage or Natural Gas Tank

Oil or Natural Gas Derrick Small Hydroelectric Power Station Power Station Transformer Station

Cemetery Burial Mound (height in metres) Triangulation Point on Burial Mound Triangulation Point

Bench Mark Bench Mark (monumented) Telegraph Office Telephone Station

Radio Station Radio Tower Airfield or Seaplane Base Landing Strip

Telegraph/Telephone Lines Main Highway Highway under Construction Improved Dirt Road (former truck road)

Double-track Railroad with First Class Station Dismantled Railroad Railroad Under Construction

Shore Embankment River or Ditch with Embankment Direction and velocity of current Water Gauge Water Level Mark

Well Water Reservoir or Rain Water Pit Spring Isobath with value

Heavy (Index) Contour Line Contour Line and Value Half Contour Line Spot Elevation Value

Coniferous Deciduous Mixed Scrub

Key to Numbers on Mapping

SU77SW_Reading

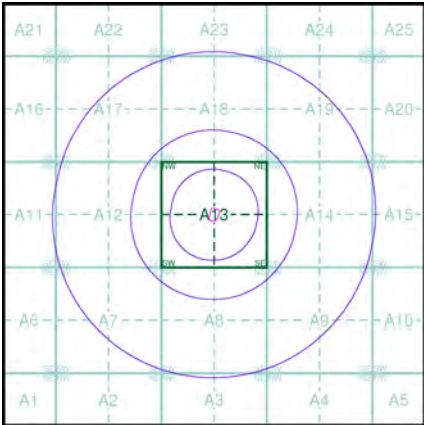
No.	Description
3	Factories (Including Machinery, Radio Electronics And Tubing)
7	Factory (Use Unknown)
14	Factory (Use Unknown)
19	Factories (Radio Electronics And Electro Technical)
26	Police Station/Headquarters
40	Railway Station (Freight)
41	Railway Station (Freight And Passenger)
57	Prison



Historical Mapping & Photography included:

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Berkshire	1:10,560	1883	4
Oxfordshire	1:10,560	1900	5
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10K Raster Mapping	1:10,000	2006	23
VectorMap Local	1:10,000	2017	24

Russian Map - Slice A



Order Details

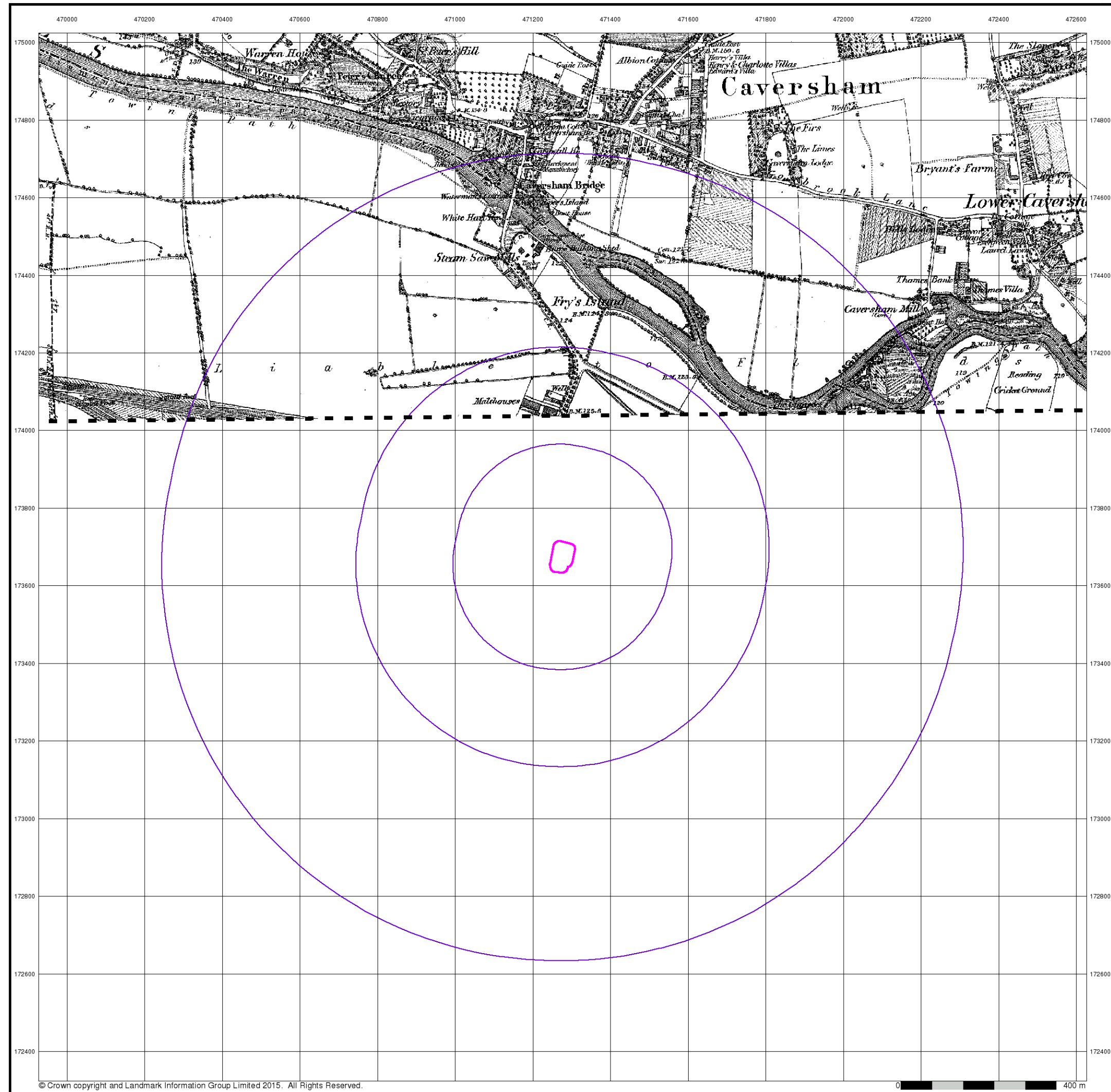
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Slice: A
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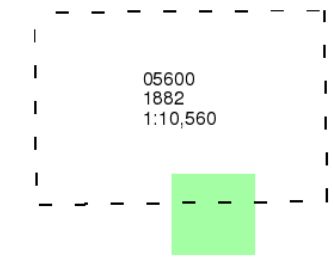
Oxfordshire

Published 1882

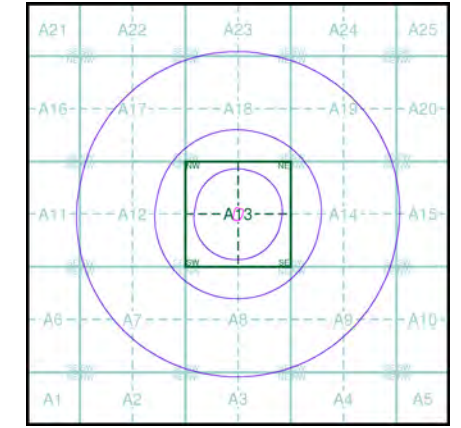
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

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Customer Ref: 40388
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