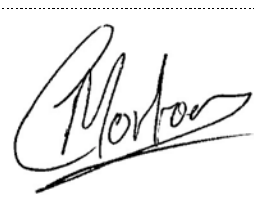
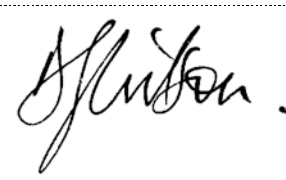


GEO-ENVIRONMENTAL DESK STUDY REPORT FOR LAND NORTH OF HARP HILL, CHELTENHAM



PREPARED FOR ROBERT HITCHINS LIMITED

Report No. 4360

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Site Name	Land North of Harp Hill, Cheltenham	
Client	Robert Hitchins Limited	
Report on	Geo-Environmental Desk Study	
Prepared by	Charles E Morton MGeol MSc FGS	
Approved by	David J Wilson BSc(Geol) CGeol FGS MIQ	
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GEO-ENVIRONMENTAL DESK STUDY REPORT FOR
LAND NORTH OF HARP HILL, OAKLEY, CHELTENHAM
PREPARED FOR ROBERT HITCHINS LIMITED

1 INTRODUCTION

- 1.1** The above site in Cheltenham is under consideration for a residential development. A geo-environmental desk study was requested in order to identify and evaluate the former site usage, environmental setting and its likely contamination status. This has enabled a preliminary qualitative risk assessment to determine any plausible pollutant linkages with regard to potential impact to human health and/or controlled waters, and therefore any requirement for appropriate intrusive investigation.
- 1.2** The Geo-environmental assessment has been carried out in accordance with BS10175:2011 “Code of Practice for the Investigation of Potentially Contaminated Sites” and EA document CLR 11 “Model Procedures for the Management of Land Contamination”.
- 1.3** This report has been prepared in accordance with email instruction from Edward Argent of Robert Hitchins Limited received on 12 June 2018. Reliance on this report is restricted to Robert Hitchins Limited.

2 SITE LOCATION AND DESCRIPTION

- 2.1** Centred on National Grid Reference 397160-222160 the site is located on the northern edge of the district of Battledown, some 2.2km east of Cheltenham town centre in Gloucestershire, as shown on drawing 4360/1.
- 2.2** The site comprises a 14.6 hectare broadly rectangular shaped plot of land on the northerly-facing slope of Harp Hill comprising several undeveloped fields, occupied in part by sheds and buildings relating to Oakley Farm, in the north of the site. The site is bounded to the south by Harp Hill road, to the north and west by recently-

established residential development, to the northeast by current residential development and to the east by Hewletts reservoirs (Severn Trent operated).

2.3 A walkover survey was undertaken by this Practice on 19 June 2018 and representative photos are presented in Appendix 2. This identified the site to comprise predominantly grass covered fields occupied in the central-northern part of the site by derelict farm buildings with locally suspected asbestos-containing material (ACM) forming roof tiles. Further inspection/assessment of the farm buildings/yards could not be performed due to restricted access. With regards to the mapped reservoirs immediately east of site, inspection and consultation with an on-site engineer revealed the northernmost reservoir to be empty and to have historically been partially infilled with unknown content; the southernmost reservoir is a covered structure which reportedly feeds water by gravity to local residential dwellings. A service box marked with 'water' was observed in the south eastern corner within a field boundary; it is suspected that this a service/monitoring point for pipework to/from the reservoir to the east. Field boundaries were coincident with hedgerows of predominantly beech and hawthorn, including a number of mature trees comprising predominantly oak, with occasional ash. A heavily vegetated incised channel runs broadly south east to northwest through site, although no water was observed within. There was no indication or suspicion of any near surface contamination within the site, although further inspection within/around the Oakley Farm buildings is likely to be required in due course.

2.4 Topographic mapping data provided as part of the Google Earth aerial mapping service indicates the site lies on a moderately steep slope falling from c128m above Ordnance Datum (AOD) in the south east to c83m in the northwest.

3 DESK STUDY RESEARCHES

Recorded Geology

3.1 The geology of the site is shown on the 1:10000 scale solid and drift version of Sheet SO92SE, published in 1983 by the Geological Survey of Great Britain. This mapping indicates the site to be underlain by "bedrock" of Charmouth Mudstone Formation (CMF), usually comprising firm to stiff, grey brown, plastic clay, which grades at depth into dark blue grey, fissured shaly mudstone. There are no recorded

superficial deposits and mapping indicates no apparent geological faulting or made ground on or within influencing distance of the site. Mapping does however record an extensive area of “landslip” across the western half of the site although there was no visual evidence of any such related features (e.g. back scars, hummocky terrain etc) identified during the reconnaissance; that said the long grass covering fields could be obscuring surface hummocks, if/where present. Mapping makes no distinction between active or dormant landslip, and therefore this blanket description covers the full range of historical deep-seated glacial slips to currently active mudslides. Any intrusive investigation will therefore need to investigate the presence and depth of any landslip mantle as well as establish any current/ongoing slope profile alterations as part of any site redevelopment.

Hydrogeology

- 3.2** The EA website confirms that the CMF is a ‘Secondary Undifferentiated’ aquifer, which means the EA has not been able to characterise the formation due to the variable characteristics of the rock type. This Practice’s experience of the CMF is that it mostly classifies as unproductive strata. The site does not lie inside or within 2km of a groundwater Source Protection Zone (SPZ). There are no groundwater abstractions and given the urban setting there are not expected to be any nearby private abstractions for potable usage.
- 3.3** Based upon the above information the site is considered to be within an area of low sensitivity in terms of groundwater resources.

Hydrology

- 3.4** The site does not contain any ponds or watercourses and the nearest surface water feature would appear to be the southernmost reservoir adjacent east of site, formerly comprising part of Cheltenham Water Works but now identified as a ‘covered reservoir’, operated by Severn Trent Water. The nearest ‘open’ water feature is the Wyman’s Brook, c186m north of site. The site is not located within an area at risk from tidal or fluvial flooding. The site is currently covered by soft landscaping, therefore rainwater infiltration at the site can be expected to be high, subject to natural permeability.
- 3.5** Based upon the foregoing information the site is considered to be within an area of low sensitivity in terms of controlled surface waters.

Site History

3.6 The history of the site has been deduced by inspection of historical Ordnance Survey maps dating back to 1883 together with historical aerial imagery provided as part of the online Google Earth mapping service, and a selection of relevant extracts is presented as drawing 4360/4. Any on and/or off-site points of interest that may affect or be affected by the proposed development have been summarised within Table 1 below.

TABLE 1: SUMMARY OF SITE HISTORY

Date (Source Map Scale)	On-Site	Off-Site	Potential Contaminants that may affect site	Likelihood of Site Impact
1883-1885 (1:10,560)	Site consists undeveloped fields and Oakley Farm, at its central northern border	S adjacent – road already established (later identified as Harp Hill) 0-300m W – Clay pits 0-30m W – Ponds within clay pits 90m W – Harp Hill brick works 0-210m E – two reservoirs relating to Cheltenham Water works (later named Hewlett's Reservoir) 200m S – Hewletts Camp (Iron age fort)	Toxic metals and PAHs within general topsoil / made ground	Very low
1903 (1:10,560)	No significant change	No significant change	As above	Very low
1938 (1:10,560)	No significant change	10m S – Residential properties constructed along Harp Hill road	As above	Very low
1954 (1:10,000)	No significant change	60m N – Multiple suspected offices/commercial buildings constructed	As above; possible inclusion of insecticides	Low
1978 (1:10,000)	No significant change	30m N – Further offices, complex now marked as GCHQ 10m S – Further residential development 0-210m E – Northernmost reservoir marked as dry 0-300m W – Clay pits and associated ponds, no longer present, suspected infill?	As above, possibly including from infilled ponds/clay pits methanogenic landfill gases	Low to moderate
1991 (1:10,000)	No significant change	No significant change	As above	Low to moderate
2006 – Present Day (Walkover and Google Earth Aerial Imagery)	No significant change	N and E – GCHQ buildings replaced by residential development 0-210m E southernmost reservoir is 'covered', northernmost reservoir has been partially infilled	As above; possibly including methanogenic landfill gases from partially infilled reservoir	Low to moderate

- 3.7** Ordnance Survey plans only represent periodic snapshots in time and do not provide a continuous record of previous site usage, however on the basis of the available mapping reviewed the likelihood that the site may contain potentially significant contamination is considered to be very low.

Landfill Gas and Radon Gas

- 3.8** The EA landfill register records one historical landfill, identified as 'Recreation Ground at Oakley' c180m north of site, although there are no records of age, material content or structure (capping, venting measures etc). Inspection of this feature during the site walkover confirmed the landfill site to comprise a grass covered playing field, with no evidence of gas wells or vent pipes. Further to this record, the anecdotal evidence of the infilling of the northernmost reservoir with unknown material poses a possible yet low risk to site. In addition to the foregoing, historical researches identified the possible infilling of former clay pits and related ponds to the immediate west although inspection of this area during the site walkover, recorded no evidence of infilled clay-pits with the area instead now occupied by dwellings and gardens along Wessex Drive. Despite the aforementioned, given the clay geology beneath site, the risk to future development from migrating landfill-type gases is considered to be low. However, given that phase two intrusive investigation will be required to investigate the geotechnical properties of soil beneath site, it would nevertheless be prudent to install gas wells to identify any ground gases which may be present.
- 3.9** With reference to BGS Radon Report GR_218613/1 (attached), which consults BRE 211 report: Guidance on Protective Measures for New Buildings, the site is located in an area in which no radon protection measures are necessary within new construction.

4 PROPOSED DEVELOPMENT

- 4.1** The site is being considered for a residential end use. No proposed development layout plan was available at the time of writing.

5 PRELIMINARY RISK ASSESSMENT AND CONCEPTUAL SITE MODEL

5.1 The site and its immediate surroundings have been assessed in terms of current and historical land use and the environmental, geological and hydrogeological setting; the methodology of which is described in Appendix 1. In view of the proposed residential development, for risk assessment purposes the **critical receptor** would be a female child (age class 1-6) and our assessment has been progressed on this basis.

5.2 Review of historical mapping suggests that the site has remained predominately undeveloped with the exception of Oakley Farm since the earliest available mapping of 1883 until the present day.

5.3 In view of the foregoing the potential sources and the **principal contaminants of concern** are presented in Table 2 below.

TABLE 2: POTENTIAL SOURCES AND PRINCIPAL CONTAMINANTS OF CONCERN

Potential Sources		Principal Contaminants of Concern
ON-SITE	'General' topsoil/made ground as part of agricultural land	Metals, PAHs, insecticides
	Charmouth Mudstone Formation	Naturally elevated sulphates/sulphides
	Oakley Farm buildings – ACM roof panels	Asbestos
OFF-SITE	Possibly infilled clay pits, reservoir and recorded historical Oakley Recreation Ground landfill	Methanogenic landfill gases

5.4 The above information is converted into the preliminary Conceptual Site Model shown in Figure 1 below, and the potential pollutant linkages involving future site users, proposed services and local environmental receptors are discussed in Table 3, with appropriate risk levels.

Potential Sources	Pathways	Receptors						Comments	Preliminary Risk Assessment
		R1	R2	R3	R4	R5	R6		
ON-SITE									
S1	P1	X						Possible contamination from historic agricultural use	Low
	P2	X							
	P3		X						
	P4			X					
	P5								
	P6								
	P7								
S2	P1							Oakley Farm buildings contain suspected ACM	Low
	P2	X							
	P3								
	P4								
	P5								
	P6								
	P7								
S3	P1							Natural Charmouth Mudstone Formation may contain naturally elevated sulphate	Low
	P2								
	P3								
	P4								
	P5					X			
	P6								
	P7								
OFF-SITE									
S4	P1							Landfill gases may have formed within infilled ground off-site	Low
	P2								
	P3								
	P4								
	P5								
	P6	X							
	P7								
SOURCES	S1	General topsoil / made ground as part of agricultural land							
	S2	Oakley Farm buildings - ACM roof panels							
	S3	Natural Charmouth Mudstone Formation may contain naturally elevated sulphate levels							
	S4	Off-site infilled clay pits and historic landfill							
PATHWAYS	P1	Direct dermal contact or ingestion and via soil attached to vegetables							
	P2	Inhalation of dust & vapours							
	P3	Permeation into new water supply pipework							
	P4	Vertical leaching of leachable contaminants in unsaturated zone and lateral migration in saturated zone							
	P5	Direct contact with high sulphate-bearing clay							
	P6	Landfill gas migration through unsaturated zone and accumulation within confined spaces							
	P7	Radon gas migration through unsaturated zone and accumulation within confined spaces							
RECEPTORS	R1	Future site users (critical residential receptor is female child age class 1-6)							
	R2	Potable water supply							
	R3	Groundwater							
	R4	Surface waters							
	R5	Concrete foundations							
	R6	Adjacent site users (residential and commercial)							

- 5.5** The findings of the Phase 1 desk study suggest a generally low risk of the site being adversely affected by its historic agricultural usage (although Oakley Farm will require further inspection), whilst the risk that proposed development may be affected by landfill gas generated within locally infilled ground off site sufficient to pose a significant risk to human health should not be discounted. Furthermore, inspection of the 1:10,000 geological map (included as drawing 4360/3) shows the western half of site to constitute landslip terrain; as such intrusive investigation will be required to determine the geotechnical properties of the ground, at which time samples can be taken to inform a contamination risk assessment. During this stage, it is recommended that a minimum of three gas wells are installed to identify whether any potentially harmful landfill gases are present on site.

6 CONCLUSIONS AND RECOMMENDATIONS

- 6.1** The foregoing remarks and recommendations are based upon the results of a Phase 1 desk study. As always however the ground profile can vary from that envisaged from the desk study research, thus a careful watch should be maintained during site clearance and/or development for any abnormalities that might require referral back to this Practice.
- 6.2** Based upon historic Ordnance Survey mapping the site appears to have been predominantly undeveloped (presumed agricultural usage) since the earliest available mapping of 1883 with the exception of Oakley Farm and associated buildings. There has been evidence of clay extraction off-site to the immediate west since earliest available mapping; these features were apparently infilled by 1978. Similar infilling of a reservoir to the immediate east occurred post 2006. The majority of site has remained undeveloped until the present day.
- 6.3** The former site usage does not appear to have left obvious residual ground contamination and given that the site has not had any construction across the majority the risk of any residual human health risk is considered to be very low, provided that the observed ACM is removed and disposed of by a relevant specialist; further inspection of Oakley Farm will be required in due course (inaccessible during the reconnaissance). Considering off-site features, a number of potential sources of landfill gas have been identified, including: the partially infilled reservoir to the immediate east of site, the infilled ponds and clay pits to the immediate west of site

and the historic landfill c180m north of site. There are no records of what material these features have been infilled with, and despite the mapped 'impermeable' clay geology beneath the site a residual low risk to human health remains. It is considered that intrusive Phase 2 investigation is necessary at this site, not only to investigate the potential of landfill gas influencing the site, but to also obtain soil samples to inform a quantitative risk assessment.

- 6.4** Geological mapping has identified landslip terrain across the western half of the site, and whilst this does not necessarily suggest active/ongoing ground movement, investigation is nevertheless recommended to clarify the geological setting.
- 6.5** The above recommendations must not be used in respect of any development differing in any way from the proposals described in this report, without reference back to this Practice or to another geo-environmental specialist.

7 REFERENCES

British Geological Survey Radon Report: England and Wales, GR218613/1 dated June 2018

British Geological Survey Sheet SO 92 SE and 'on-line'

British Standards Institute, BS 10175: '*Code of Practice for the Investigation of Potentially Contaminated Sites*' (2011)

British Standards Institute, BS 8485: '*Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*' (2015)

British Standards Institute, BS5930:2015 '*Code of Practice for Ground Investigations*'

Building Research Establishment (BR211): Radon – '*Guidance on Protective Measures for New Buildings*' (2015)

Building Research Establishment (BRE 414): '*Protective Measures for Housing on Gas-Contaminated Land*' (2001)

Construction Industry Research & Information Association (CIRIA) 665: '*Assessing Risks Posed by Hazardous Ground Gases to Buildings*' (2007)

Environment Agency CLR 11: '*Model Procedures for the Management of Land Contamination*'

Environment Agency/National House Building Council (NHBC) R&D 66 '*Guidance for the Safe Development of Housing on Land Affected by Contamination*' (2000)

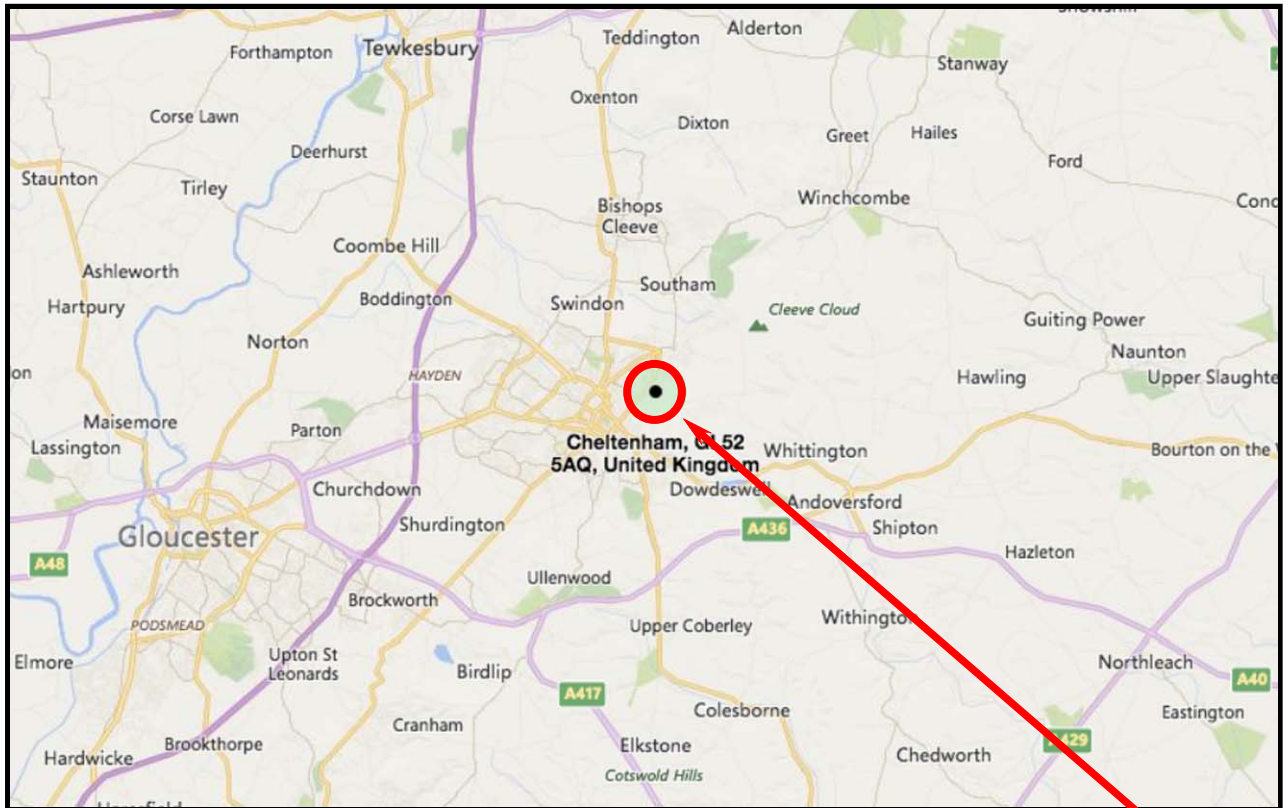
Landmark Historical Mapping Ref EC65735794_1_1 dated Mar 2015

LAND NORTH OF HARP HILL, CHELTENHAM, GL52 5AQ



SITE LOCATION (based on Microsoft Bing Mapping)

Job No.	Drawing No.	Scale:	Date:
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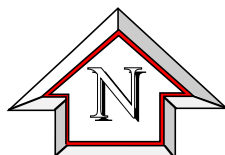


THE SITE





P1
Number and direction of photograph (Appendix 2)



LAND NORTH OF HARP HILL, CHELTENHAM,
GL52 5AQ



EXISTING SITE LAYOUT (based on Aerial Image from Google Maps) SHOWING WALKOVER PHOTO LOCATIONS

Job No.

4360

Drawing No.

4360/2

Scale:

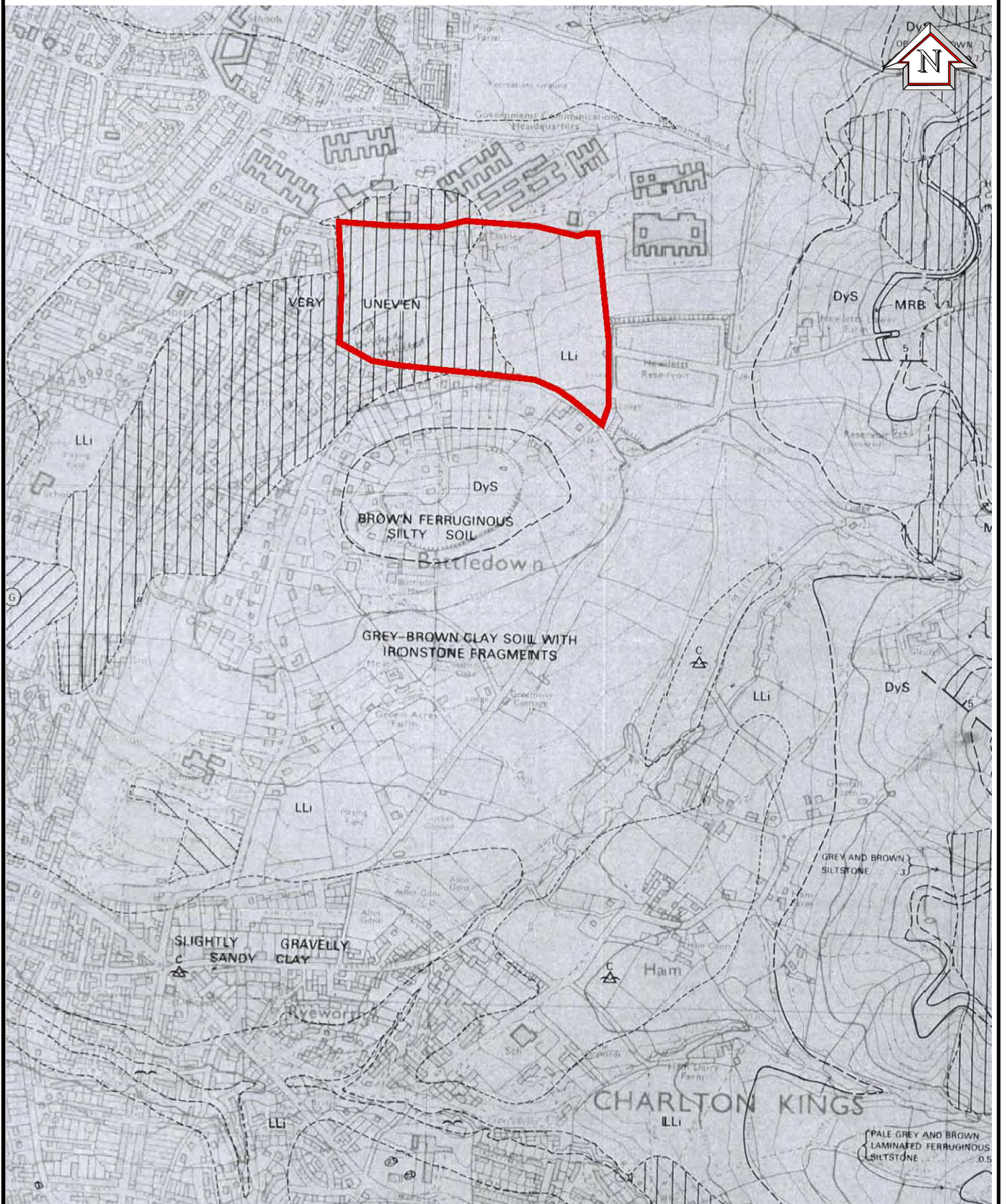
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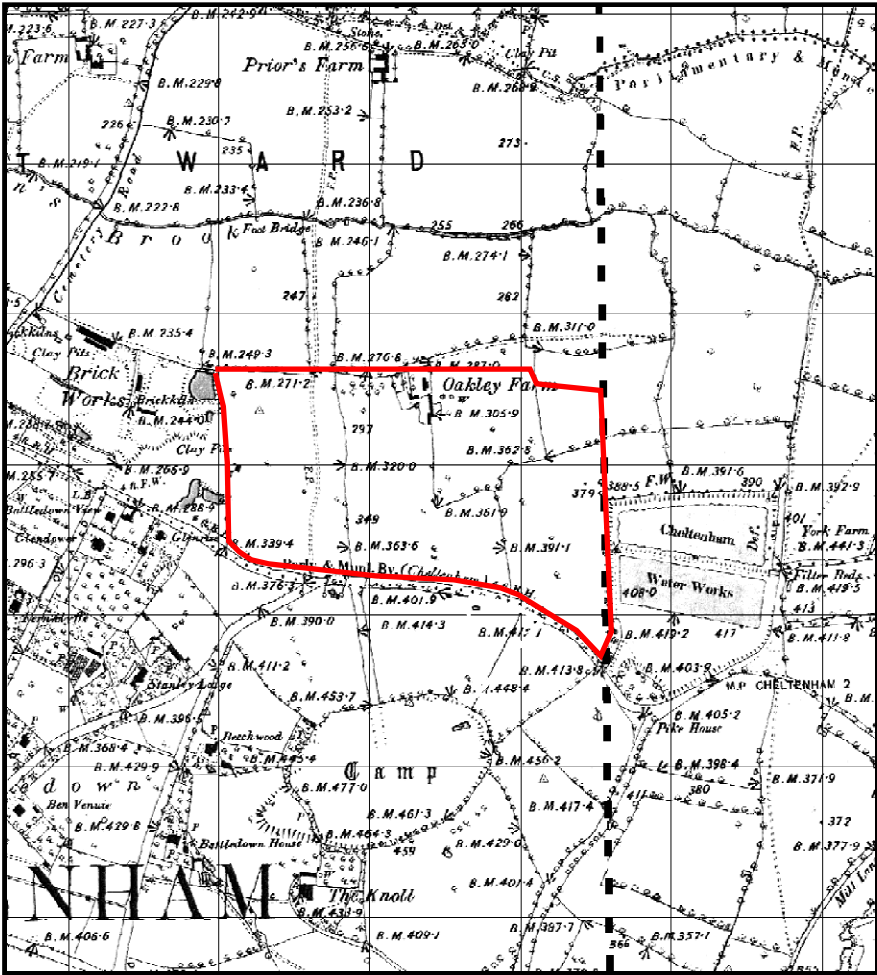
Date:

20-06-18

GEOLOGICAL MAPPING EXTRACT (form BGS sheet SO91SE (1983)) SHOWING EXTENT OF MAPPED LANDSLIP
ACROSS SITE

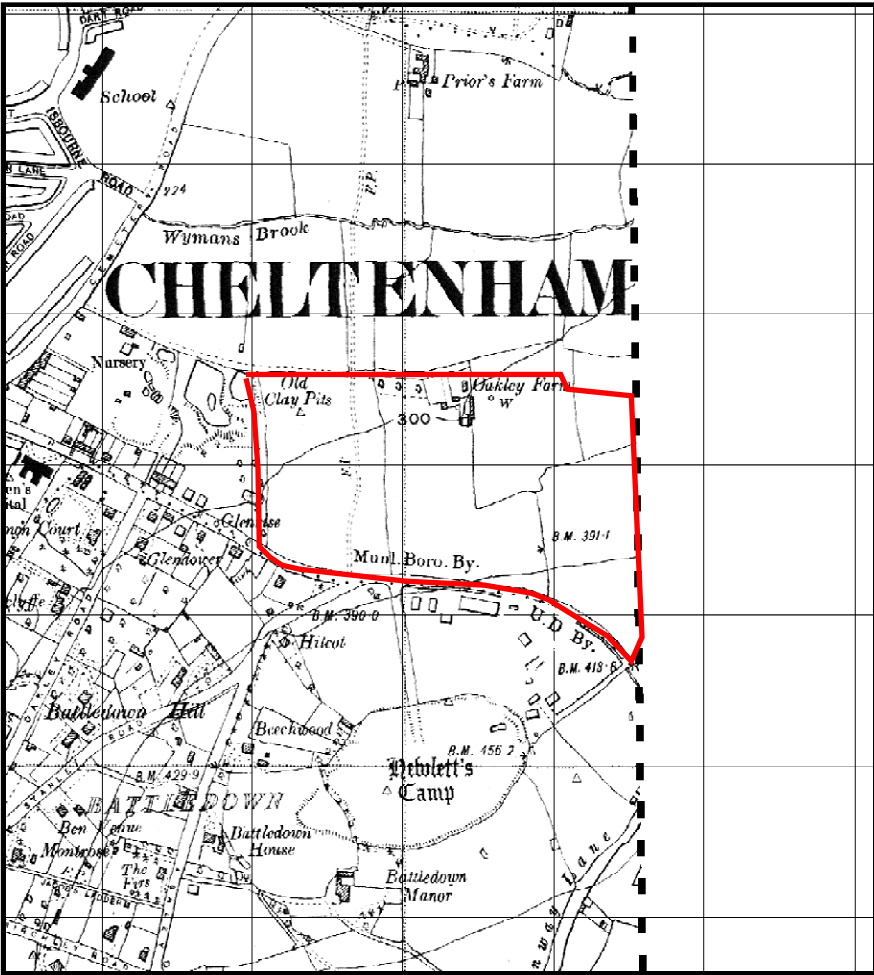
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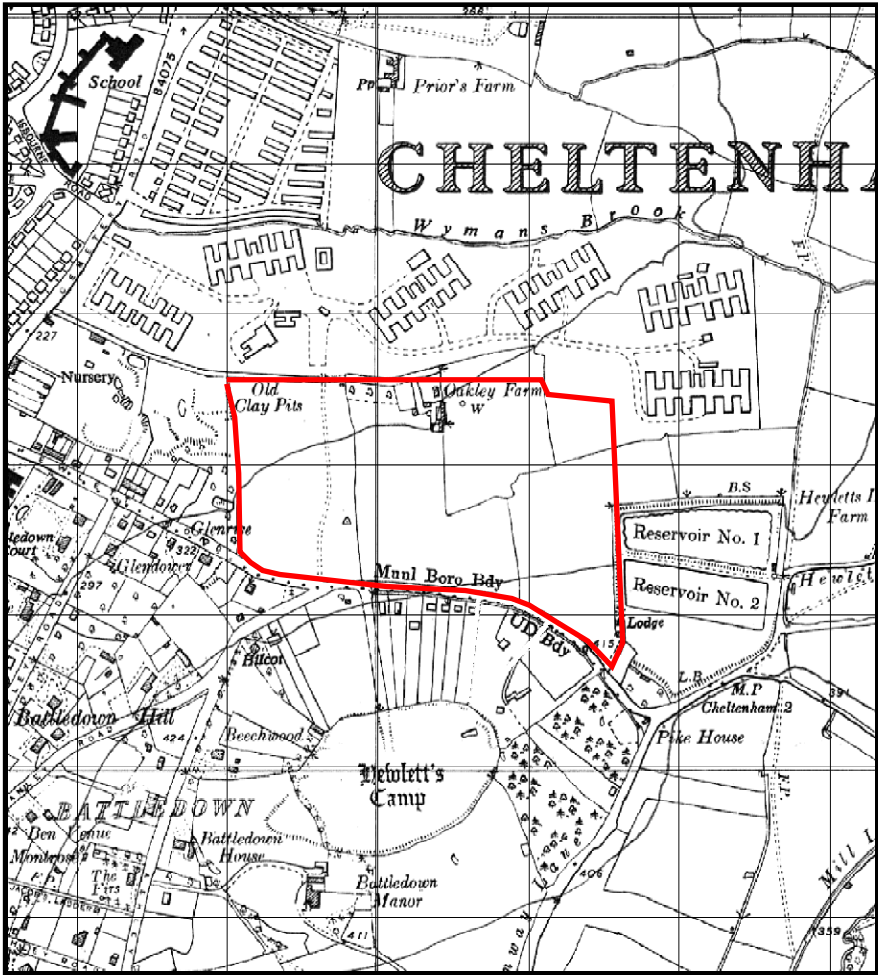
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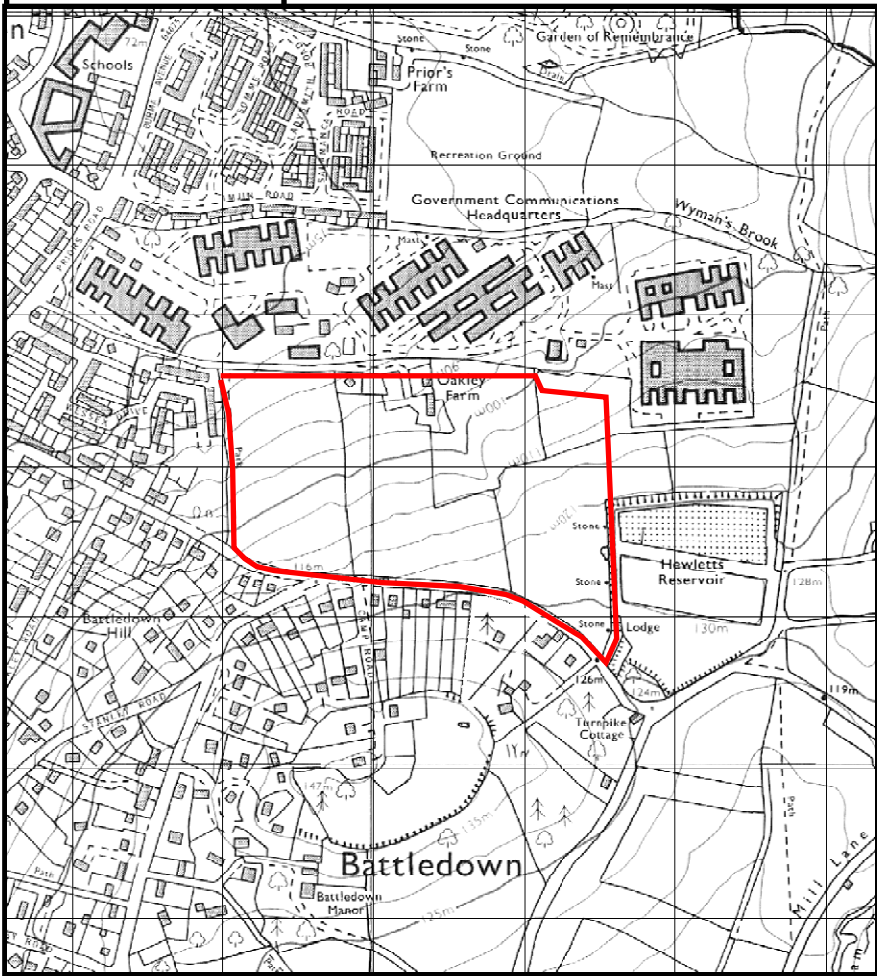
1938

(scale 1:10000)



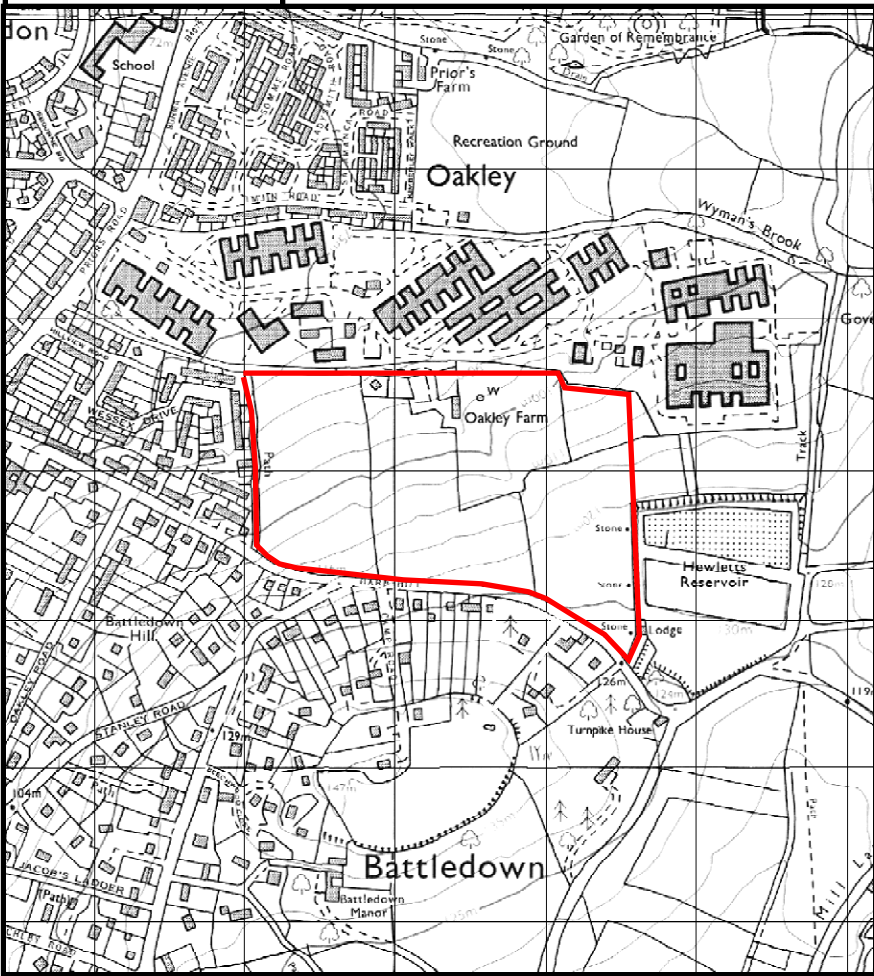
1954

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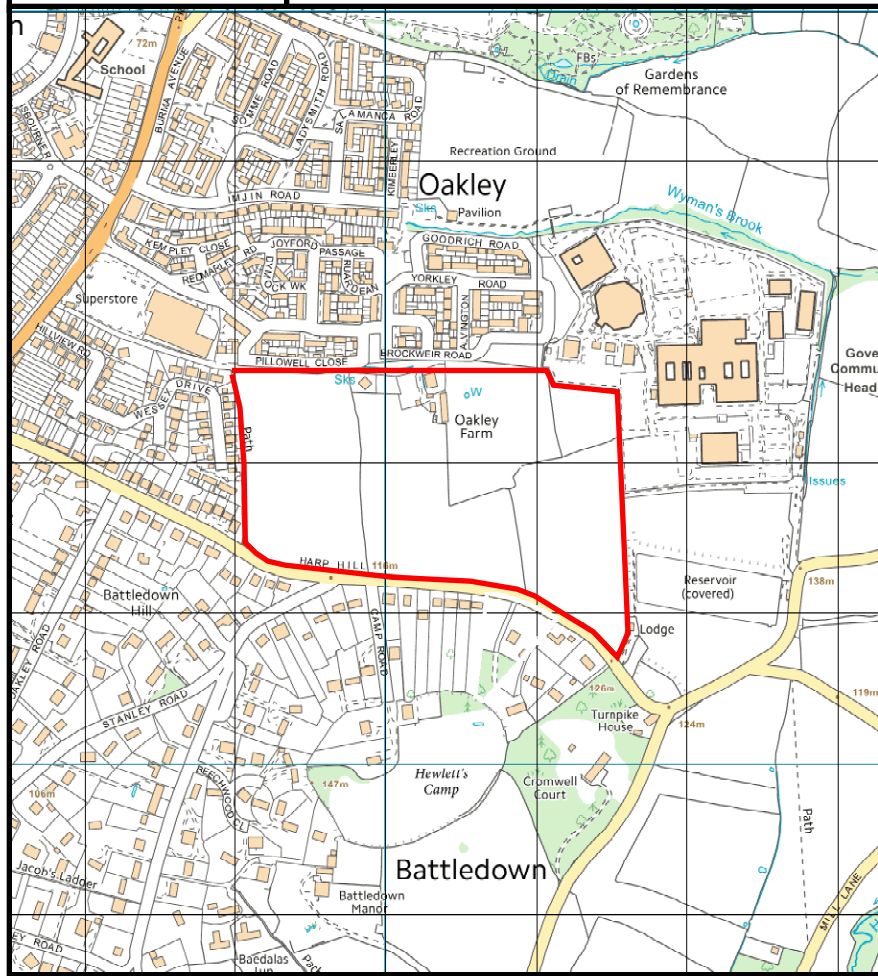
1978

(scale 1:10000)



1991

(scale 1:10000)



2014

(scale 1:10000)



LAND NORTH OF HARP HILL, CHELTENHAM, GL52 5AQ

EXTRACTS OF ORDNANCE SURVEY PLANS TO SHOW SITE HISTORY

Job No.

4360

Drawing No.

4360/4

Scale:

as shown

Date:

19-06-18



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APPENDIX 1

CONTAMINATION STATUTORY FRAMEWORK / METHODOLOGY

A1 CONTAMINATION RISK ASSESSMENT***Statutory Framework***

A1.1 Part 2A of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act and the statutory guidance document on the Contaminated Land (England) Regulations 2000, the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only 'contaminated land' where it appears to the regulatory authority, by reason of substances within or under the land, that:

- Significant harm is being caused or there is significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused.

A1.2 In 2012 revised Statutory Guidance for Part 2A of the Environmental Protection Act (1990) came into force for England and Wales. This introduced a new four category approach for classifying land affected by contamination to assist decisions by regulators in cases of Significant Possibility of Significant Harm (SPOSH) to specified receptors, including humans, and significant pollution of controlled waters.

Category 1 describes land which is clearly problematic e.g. because similar sites are known to have caused a significant problem in the past. The legal definition is where "there is an unacceptably high probability, supported by robust science-based evidence, that significant harm would occur if no action is taken to stop it".

Categories 2 and 3 cover land where detailed consideration is needed before deciding whether it may be contaminated land. Category 2 is defined as land where "there is a strong case for considering that the risks from the land are of sufficient concern that the land poses a significant possibility of significant harm". Category 3 is defined as land where there is not the strong case described in the test for Category 2, and may include "land where the risks are not low, but nonetheless the authority considers that regulatory intervention under Part 2A is not warranted". The decision basis is initially related to human health risks, and if this is not conclusive due to uncertainty over risks, wider socio-economic factors (e.g. cost, local perception etc).

Category 4 describes land that is clearly not contaminated land, where there is no risk or the level of risk posed is low.

This same 4 category system has also been introduced to assist in identifying whether there is a significant possibility of significant pollution of controlled waters. Part 2A states that normal levels of contaminants in soil should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise.

Following publication of the revised Statutory Guidance, DEFRA commissioned a research project to develop new Category 4 Screening Levels (C4SLs) to provide a simplified test for regulators to aid decision-making on when land was suitable for use and definitely not contaminated land under the statutory regime. The output from this research project was published by CL:AIRE in December 2013, with Policy Companion Documents published in England by DEFRA in March 2014 and the Welsh Government in May 2014. The culmination of this work was the development of a framework and methodology for deriving C4SLs and the publication of final C4SLs for use as new screening values for six common contaminants.

Further research by LQM on behalf of CIEH led to the publication in 2015 of the Suitable for Use Levels known as S4ULs, and these are now widely adopted as a robust and authoritative source of guidance (see A1.14 below).

Once land has been determined as contaminated land, the enforcing authority must consider how it should be remediated and, where appropriate, it must issue a remediation notice to require such remediation. The enforcing authority for the purposes of remediation may be the local authority which determined the land, or the Environment Agency which takes on responsibility once land has been determined if the land is deemed to be a “special site”. The rules on what land is to be regarded as special sites, and various rules on the issuing of remediation notices, are set out in the Contaminated Land (England) Regulations 2006

- A1.3** The UK guidance on the assessment of land contamination has developed as a direct result of the introduction of the above two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document (CLR 11 was

published in 2004. In 2008 CLR reports 7 to 10 were withdrawn by the Department of Environment Food & Rural Affairs and the Environment Agency and updated versions of CLR 9 and 10 were produced in the form of Science Reports SR2 and SR3.

A1.4 The guidance defines 'risk' as the combination of:

- The probability, or frequency, of occurrence of a defined hazard (e.g. exposure of a property to a substance with the potential to cause harm); and
- The magnitude (including the seriousness) of the consequences.

A1.5 For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- A source, i.e. a substance that is capable of causing pollution or harm;
- A pathway, i.e. a route by which the contaminant can reach the receptor; and
- A receptor (or target), i.e. something which could be adversely affected by the contaminant.

A1.6 If any one of these elements is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

A1.7 The presence of contamination is also a material issue in the determination of planning applications, and where a change of use is proposed, especially on brownfield (former industrial) land, investigation, assessment and remediation of contamination is often a requirement of the Planning Authority. The presence of contamination may consequently require remedial action prior to redevelopment, in circumstances which would otherwise be unlikely to result in the determination of the land as contaminated land as defined in the above legislation.

Contamination Assessment Methodology

A1.8 The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the preliminary conceptual site model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

A1.9 Stages 1 and 2 develop a '*preliminary conceptual model*' based upon information collated from desk studies and usually a site walkover inspection. The formation of a conceptual site model is an iterative process, and it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

A1.10 The information gleaned from the desk studies and associated enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the preliminary conceptual site model. CLR 8, together with specific DoE 'Industry Profiles' provides guidance on the nature of contaminants relating to specific industrial processes. Whilst it is acknowledged that CLR 8 has been withdrawn no replacement guidance has yet been published that lists the contaminants likely to be present on contaminated sites, thus CLR 8 guidance is still considered relevant.

A1.11 If the preliminary conceptual model identifies potential pollutant linkages, a Phase 2 site investigation is normally recommended, unless appropriate mitigation measures can be incorporated into the proposed development sufficient to negate the identified risks, subject to local planning authority approval. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the preliminary conceptual model can be updated and relevant pollutant linkages identified.

Preliminary Risk Assessment

A1.12 By considering the various potential sources, pathways and receptors, a preliminary assessment of potential risk is made based upon the likelihood of the occurrence and the severity of the potential consequence, the latter being a function of the

sensitivity of the receptor. At Phase 1 desk study stage the qualitative risk assessment is based on the categories tabulated below.

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution to controlled waters
Moderate	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species

A1.13 The likelihood of an event (probability) takes into account both the presence of the hazard and receptor and viability of the pathway, and is based on the categories tabulated below.

Category	Definition
Highly likely	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Possible	Pollution linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

A1.14 On this basis potential hazards are assigned a risk rating as shown below.

Probability (Likelihood)	Consequence				
		<i>Severe</i>	<i>Moderate</i>	<i>Mild</i>	<i>Minor</i>
	Highly likely	very high	high	moderate	low
	Likely	high	moderate	low/moderate	low
	Possible	moderate	low/moderate	low	very low
	Unlikely	low/moderate	low	very low	very low

- A1.15** At Phase 2 stage, quantitative assessment of human health risk posed by ground contamination is achieved by comparison of soil concentrations with Tier 1 Category Four Screening Levels (C4SL) published by DEFRA (2014), and/or Suitable for Use Levels (S4UL) as published by LQM/CIEH (2015). The official Soil Guideline Values utilise a soil organic matter content of 6% which is considered to be higher than typical UK soils, however three sets of S4UL's have been developed for organic matter contents of 1%, 2.5% and 6%, thus the most appropriate set is selected based upon proven site conditions.
- A1.16** Contaminant concentrations below the threshold screening values are considered not to warrant further risk assessment. Concentrations of contaminants above these screening values require further consideration of potential pollutant linkages and may indicate potentially unacceptable risks to site users. Such exceedances may trigger a Tier 2 detailed quantitative risk assessment (DQRA) where site-specific parameters are used to derive site specific assessment criteria (SSAC), usually by using the CLEA Model (V1.06 at time of writing). It should be noted that exceedance of a screening value does not necessarily indicate that the site requires remediation.
- A1.17** In order to assess any risk to controlled waters posed by contaminants within the underlying soils and groundwater, laboratory results have been screened against Level 1 Environmental Quality Standard (EQS) values derived from the Water Framework Directive (Standards & Classification) Directions (England & Wales) 2015 and the current UK Drinking Water Supply (Water Quality) Regulations (DWS), dependent upon the most vulnerable receptor. The EQS is usually an upper concentration set for the receiving watercourse and not the discharge itself. The DWS is established for compliance at the point of use or abstraction and not the source area.

APPENDIX 2

SITE PHOTOGRAPHS



Photograph **P1**



Photograph **P2**



Photograph **P3**



Photograph **P4**



Photograph P5



Photograph P6



Photograph **P7**



Photograph **P8**

APPENDIX 3

BGS RADON REPORT: ENGLAND AND WALES



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

GeoReports

**Charlie Morton
Wilson Associates (Consulting) Limited
36 Brunswick Road
Gloucester
Gloucestershire
GL1 1JJ**

Radon Report: England and Wales

Advisory report on the requirement for radon protective measures in new buildings, conversions and extensions to existing buildings. The report also indicates whether a site is located within a radon Affected Area

Report Id: GR_218613/1

Client reference: 4360/CM

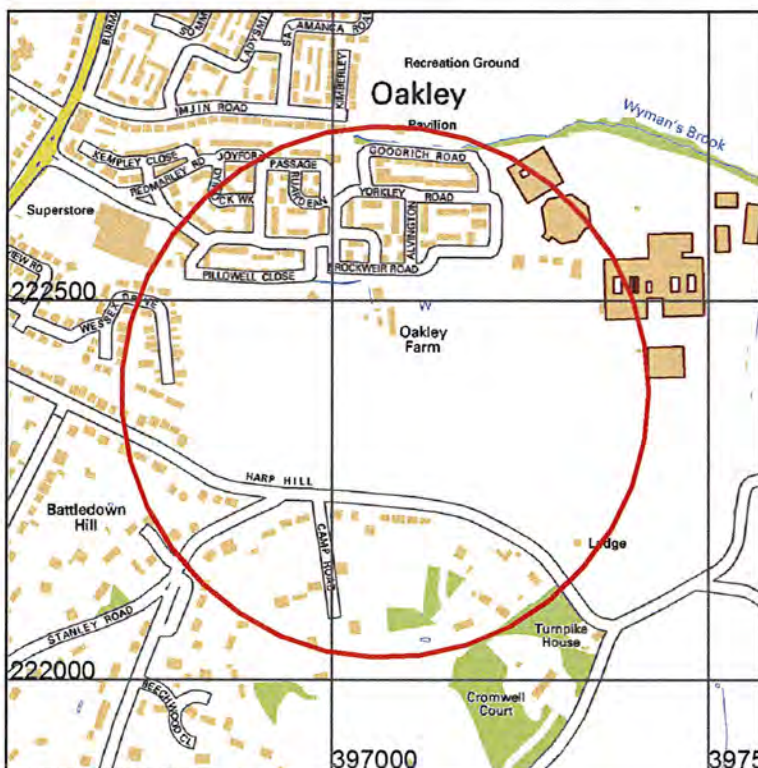
Search location



This report describes a site located at National Grid Reference 397071, 222380. Note that for sites of irregular shape, this point may lie outside the site boundary. Where the client has submitted a site plan the assessment will be based on the area given.

Search location indicated in red

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Scale: 1:10 000 (1cm = 100 m)



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Radon Report: England and Wales

When extensions are made to existing buildings in high radon areas, or new buildings are constructed in these areas the Building Regulations for England, Wales and Scotland require that protective measures are taken against radon entering the building.

This report provides information on whether radon protective measures are required. Depending on the probability of buildings having high radon levels, the Regulations may require either:

1. No protective measures
2. Basic protective measures
3. Full protective measures

This is an advisory report on the requirement for radon protective measures in new buildings, conversions and extensions. The report also indicates whether a site is located within a radon Affected Area

Requirement for radon protective measures

The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2015 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required.

NO RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.

More details of the protective measures required are available in *BR211 Radon: Guidance on protective measures for new buildings (2015 Edition)*. Additional information and guidance is available from the Building Research Establishment website (<http://www.bre.co.uk/radon/>).

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

Radon Affected Area

Is this property in a radon affected area – **YES**

The answer to the standard enquiry on house purchase known as **CON29 Standard Enquiry of Local Authority 3.13 Radon Gas: Location of the Property in a radon Affected Area** is **YES** this property is in a Radon Affected Area as defined by Public Health England (PHE).

The estimated probability of the property being above the Action Level for radon is: **1-3% (INTERMEDIATE PROBABILITY)**.

Public Health England (PHE) recommends a radon 'Action Level' of 200 becquerels per cubic metre of air for the annual average of the radon gas concentration in a home. Where 1% or more of homes are estimated to exceed the Action Level (i.e. are in an Intermediate or Higher probability radon area) the area should be regarded as a radon Affected Area.

This report informs you whether the property is in a radon Affected Area as defined by PHE and the percentage of homes that are estimated to be at or above the radon Action Level. This does not necessarily mean there is a radon problem in the property; the only way to find out whether it is above or below the Action Level is to carry out a radon measurement in an existing property.

PHE advises that radon gas should be measured in all properties within radon Affected Areas and that homes with radon levels above the Action Level (200 Bq m⁻³) should be remediated, and where achievable to below the Target Level of 100 Bq m⁻³. Householders with levels between the Target Level and Action Level should seriously consider reducing their radon level, especially if they are at greater risk, such as if they are current or ex smokers. Whether or not a home is in fact above or below the Action Level or Target Level can only be established by having the building tested. PHE provides a radon testing service which can be accessed at www.ukradon.org.

The information in this report provides an answer to one of the standard legal enquiries on house purchase in England and Wales, known as Law Society CON29 Enquiries of the Local Authority (2016); 3.14 Radon Gas: Do records indicate that the property is in a "Radon Affected Area" as identified by Public Health England. The data can also be used to advise house buyers and sellers in Scotland.

If you are buying a new build property in a Radon Affected Area, you should ask the builder whether radon protective measures were incorporated in the construction of the property.



If you are buying a currently occupied property in a Radon Affected Area you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were above the Radon Action Level and if so whether remedial measures were installed, radon levels were retested, and the that the results of re-testing confirmed the effectiveness of the measures.

Further information on radon is available from PHE or www.ukradon.org.



What is radon?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre (Bq m^{-3}). The Government advises householders that, where the radon level exceeds the Action Level, measures should be taken to reduce the concentration.

Radon in workplaces

The Ionising Radiation Regulations, 1999, require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293): **Radon in the workplace**. BRE publications may be obtained from the BRE Bookshop, Tel: 01923 664262, email: bookshop@bre.co.uk website: www.brebookshop.com



Contact Details

Keyworth Office

British Geological Survey
Environmental Science Centre
Nicker Hill
Keyworth
Nottingham
NG12 5GG
Tel: 0115 9363143
Fax: 0115 9363276
Email: enquiries@bgs.ac.uk

Wallingford Office

British Geological Survey
Maclean Building
Wallingford
Oxford
OX10 8BB
Tel: 01491 838800
Fax: 01491 692345
Email: hydroenq@bgs.ac.uk

Edinburgh Office

British Geological Survey
Lyell Centre
Research Avenue South
Edinburgh
EH14 4AP
Tel: 0131 6671000
Email: enquiry@bgs.ac.uk



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