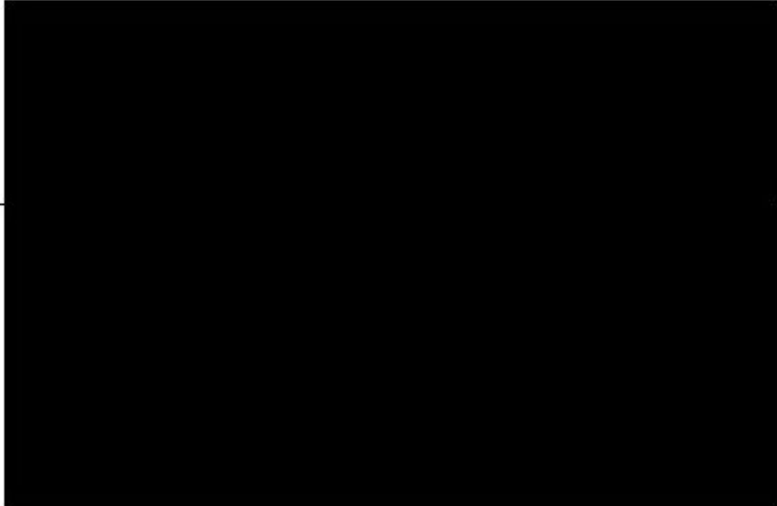


**GEO-ENVIRONMENTAL DESK STUDY REPORT
FOR
ROCKS BUNGALOW, ST BRIAVELS COMMON,
LYDNEY, GLOUCESTERSHIRE, GL15 6SE**



**PREPARED FOR
MR TOM ADAMS**

Report No. 4882

Report Production Record		
Report No	4882	
Site Name	Rocks Bungalow, St Briavels Common, Lydney, Gloucestershire, GL15 6SE	
Client	Mr Tom Adams	
Report on	Geo-Environmental Desk Study	
Prepared by	Richard J Stokes BSc (Hons) FGS Geo-Environmental Engineer	
Approved by	David J Wilson BSc(Geol) CGeol FGS Director	
Report Issue / Revision Record		
Issue No.	Date	Revision Details
1	31 August 2021	Final

COPYRIGHT AND NON-DISCLOSURE NOTICE

The contents and layout of this report are subject to copyright owned by Wilson Associates (2021) save to the extent that copyright has been legally assigned by us to another party or is used by Wilson Associates under licence. To the extent that we own the copyright of this report, it may not be copied or used without our prior written agreement for any purpose other than the purpose indicated in this report.

The methodology (if any) contained in this report is provided to you in confidence and must not be disclosed or copied to third parties without the prior written agreement of Wilson Associates. Disclosure of that information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests. Any third party who obtains access to this report by any means will, in any event, be subject to the Third Party Disclaimer set out below.

THIRD PARTY DISCLAIMER

Any disclosure of this report to a third party is subject to this disclaimer. The report was prepared by Wilson Associates at the instruction of, and for use by, our client named on the front of the report. It does not in any way constitute advice to any third party who is able to access it by any means. Wilson Associates excludes to the fullest extent lawfully permitted all liability whatsoever for any loss or damage howsoever arising from reliance on the contents of this report. We do not however exclude our liability (if any) for personal injury or death resulting from our negligence, for fraud or any other matter in relation to which we cannot legally exclude liability. Legal re-assignment to another party can be arranged - please contact this Practice for further details.

CONTENTS

REPORT	Page No.
1 INTRODUCTION	1
2 SITE LOCATION AND DESCRIPTION	1
3 BACKGROUND SETTING	3
<i>Recorded Geology</i>	3
<i>Hydrogeology</i>	3
<i>Hydrology</i>	3
<i>Site History</i>	4
<i>Landfill Gas and Radon Gas</i>	5
<i>Unexploded Ordnance Risk</i>	5
<i>Surrounding Land Use</i>	6
4 PROPOSED DEVELOPMENT	6
5 PRELIMINARY RISK ASSESSMENT AND CONCEPTUAL SITE MODEL	6
6 CONCLUSIONS AND RECOMMENDATIONS	9
7 REFERENCES	10

DRAWINGS	No.
SITE LOCATION	4882/1
PROPOSED SITE LAYOUT SHOWING WALKOVER PHOTOS	4882/2
EXTRACTS OF ORDNANCE SURVEY PLANS TO SHOW SITE HISTORY	4882/3

APPENDICES

1 SITE PHOTOGRAPHS	
2 CONTAMINATION STATUTORY FRAMEWORK/METHODOLOGY	

GEO-ENVIRONMENTAL DESK STUDY REPORT
FOR ROCKS BUNGALOW, ST BRIAVELS COMMON,
LYDNEY, GLOUCESTERSHIRE, GL15 6SE
PREPARED FOR MR TOM ADAMS

1 INTRODUCTION

- 1.1** It is proposed to convert the existing barn at the above site into a residential dwelling complete with private garden and parking. It is understood that whilst the Local Planning Authority (LPA) has granted permission, given the ‘high-sensitivity’ of the proposed development, a Condition has been placed requiring an assessment of the current contamination status in order to determine any potential risks to both human health and controlled waters. This Phase 1 geo-environmental desk study report has therefore been produced to address and satisfy the relevant Condition of the Planning Permission (**Forest of Dean District Council Ref: P0587/21/FUL**).
- 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 LCRM “Land Contamination Risk Management” (2020).
- 1.3** This report has been prepared in line with the agreed scope of works as set out within our proposal Q21159 dated 6th June 2021, with verbal instruction confirmed 4th August 2021 by Mr Tom Adams, to whom reliance on this report is presently restricted.

2 SITE LOCATION AND DESCRIPTION

- 2.1** Centred on National Grid Reference 355039, 203747 the site is located in the village of St Briavels, Gloucestershire some 8.6km north-west of Lydney as shown on drawing 4882/1.
- 2.2** The site comprises a roughly rectangular plot of land, covering an area of 0.11 Hectares that can be accessed from a lane to the east.

- 2.3** A walkover survey was undertaken by this Practice on 20th August 2021. Observations are recorded on proposed development layout drawing 4882/2 and a selection of representative photos are presented in Appendix 1. This identified the site to comprise the barn (destined for conversion) and an outbuilding with external water tank in the east, and a large grassed area to the west. The site is enclosed to the north and south by residential dwellings, to the west by open fields and to the east by a lane and open fields beyond.
- 2.4** **The Barn** comprises a single-storey concrete breeze-block structure with an older stone block foundation base and corrugated iron pitched roof sloping from east to west with rainwater goods on the down slope. Internally the floor surface comprises a concrete floor slab in reasonably good condition with no evidence of hydrocarbon impaction. The stone block foundation base formerly supported a corrugated iron chapel constructed in 1928; which was then subsequently converted to the present-day barn in 1971 by removing and repurposing the corrugated iron for a new roof on top of concrete breeze blocks, whilst retaining the existing stone block foundations. The barn has been used for cattle rearing and hay storage; a large gas bottle in the north-east corner and hay were noted on the barn floor which was otherwise empty with no evidence of contamination.
- 2.5** **The outbuilding** is of similar construction to the barn albeit without a stone block foundation base and the pitched roof is sloping from north to south. Internally the floor surface comprises a concrete floor slab in good condition with no evidence of hydrocarbon impaction. The outbuilding is presently used for the storage of fire wood, lawn mowers, tools and various other miscellaneous items.
- 2.6** The external grassed area to the west (proposed private garden) appeared healthy with no evidence of contamination. There is no evidence/record of any on-site fuel storage tanks, and the Client advises that the barn has never been used for storage of agricultural chemicals / fertilisers etc. during their c93 years family ownership.
- 2.7** Consultation of Google Earth indicates that the site has a recorded elevation of between 137m and 136m above Ordnance Datum (AOD) with a south-westerly fall of c1.0m in line with the surrounding topography.

3 BACKGROUND SETTING

Recorded Geology

- 3.1** The geology of the site is shown on the British Geological Survey (BGS) 1:10,000 scale sheet SO 50 SE and online, which indicates that it is entirely underlain by bedrock of the Tintern Sandstone Formation (TSF), which comprises a thick series of sandstones with occasional thin interbeds of clay. There are no areas of superficial deposits, mapped made ground, or geological faulting shown either on or within influencing distance of the site.
- 3.2** This Practice previously undertook a trial pitting investigation c490m south-west of the site which confirmed ground conditions to be commensurate with geological mapping, beneath a thin mantle of topsoil, trial pits encountered alternating beds of clay and sand of the recorded TSF. The BGS had no pertinent archive borehole records.

Hydrogeology

- 3.3** The EA classifies the TSF as a “Secondary A” aquifer, meaning that it comprises permeable strata capable of supporting water supplies at a local rather than strategic level and in some cases forming an important source of base flow to rivers. There are no recorded groundwater abstractors within influencing distance of the site and it does not lie within a groundwater Source Protection Zone (SPZ).
- 3.4** Based upon the above information the site is considered to be within an area of low to moderate sensitivity in terms of groundwater resources by virtue of the “Secondary A” aquifer classification.

Hydrology

- 3.5** The site itself contains no ponds or watercourses; the nearest surface water feature appears to be an unnamed brook some 120m to the north-west. The EA does not consider the site to be at risk of flooding from either rivers or seas. The site surface currently comprises a mixture of building cover and bare earth/soft landscaping suggesting that rainwater infiltration will be very low/negligible for the former and high for the latter, dependent upon either the existing drainage infrastructure (roof runoff drains via guttering and downpipes but ultimate discharge point is unknown) or the natural permeability. The site does not lie within a Nitrate Vulnerable Zone.

3.6 Based upon the above information the site is considered to be within an area of low sensitivity in terms of controlled surface waters.

Site History

3.7 The history of the site has been deduced by inspection of historical Ordnance Survey maps dating back to 1881 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 4882/3. 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 Features	Off-Site Features	Potential Contaminants with Potential To affect Site	Likelihood of Site Impact
1881 - 1886 (1:10,560 and 1:2,500)	Part of larger undeveloped agricultural field	Surrounding area generally given over to agriculture and sparse residential dwellings 136m E – small Quarry	Toxic and phytotoxic metals	Very Low/negligible
1902 - 1903 (1:10,560 and 1:2,500)	No significant change	136m E – quarry now annotated as “Old Quarry”	As above	Very Low/negligible
1921 - 1924 (1:10,560 and 1:2,500)	No significant change	136m E – Old Quarry no longer recorded, potentially infilled	As above plus landfill-type gases	Low
1928 - 1933 (Client info)	Chapel constructed	0m S - Rocks Bungalow and garden constructed	As above	Low
1954 (1:10,000)	Internal boundary divides site into two plots	No significant change	As above	Low
1971 - 1994 (1:10,000, 1:2,500 and Client info)	Chapel converted to barn	0m N – residential dwelling and garden constructed General increase in residential dwellings	As above	Low
2000 - 2021 (1:10,000, 1:2,500 google earth and site walkover)	Outbuilding constructed and now comprising single plot	No significant change	As above	Low

- 3.8** Please note that Ordnance Survey plans only represent periodic snapshots in time, and do not provide a continuous record of previous site usage, there is therefore a risk that the site may contain buried remnant foundations of former buildings or waste products associated with unrecorded previous site usage, which may not be evident from the site walkover inspection and desk study researches.

Landfill Gas and Radon Gas

- 3.9** Consistent with the site history researches the EA landfill register shows no record of either active or historic landfills within potential influencing distance of the site. However, site history researches indicate a small quarry shown on 1881 historical mapping c136m to the east, that is not shown on later editions (1921 – 2021) suggesting that it had become disused and could have potentially been infilled. Whilst there is a low risk that such a feature may have potentially been infilled with putrescible material that could represent a potential source of migrating landfill gas, given its significant age, likely shallow total depth, distance to the proposed conversion (across undeveloped, freely-venting ground of jointed sandstone bedrock) and the known permeable geological profile, the risk is considered to be very low. Further investigation of site history researches show that there are no additional local features such as old ponds or clay pits within influencing distance that may be suggestive of areas of potential methanogenic infill. On the basis of the foregoing gas protection measures are considered unnecessary in the proposed conversion at this site.

- 3.10** Consultation of the Public Health England “UK maps of radon” online resource indicates 10-30% of homes in this area to be above the actionable level, suggesting that full radon protection measures are required in new development at this site. This should as usual be confirmed with the relevant Building Control Officer, since depending upon the scope of demolition/rebuilding it may be difficult to apply such protection to the existing building.

UXO Risk

- 3.11** An online review of regional unexploded bomb data on the Zetica website indicates that this area of Gloucestershire is considered to constitute a low risk (less than fifteen bombs per thousand acres), and for which a more detailed unexploded ordnance (UXO) assessment is considered unnecessary.

Surrounding Land Use

- 3.12** Further research confirms that the site lies within the Wye Valley Area of Outstanding Natural Beauty (AONB).

4 PROPOSED DEVELOPMENT

- 4.1** The site is to be re-developed as a single-storey residential dwelling by converting the existing barn, complete with private garden and parking. The proposed development layout (based upon MR James Design Project No. 40-2136 Drawing A dated July 2020) has been reproduced as drawing 4882/2.

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 2. 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 remained as a predominantly undeveloped grassy field since the earliest available mapping of 1881; a Chapel was constructed within the barn footprint in 1928 which was then converted to the current barn in 1971, followed by the construction of the outbuilding in c2000, remaining 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	Topsoil and unrecorded made ground (unlikely)	Toxic and phytotoxic metals
	Tintern Sandstone Formation	Radon Gas
OFF-SITE	None	None

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 residents, proposed services and local environmental receptors are discussed in Table 3, with appropriate risk levels.

FIGURE 1: PRELIMINARY CONCEPTUAL SITE MODEL (NTS)

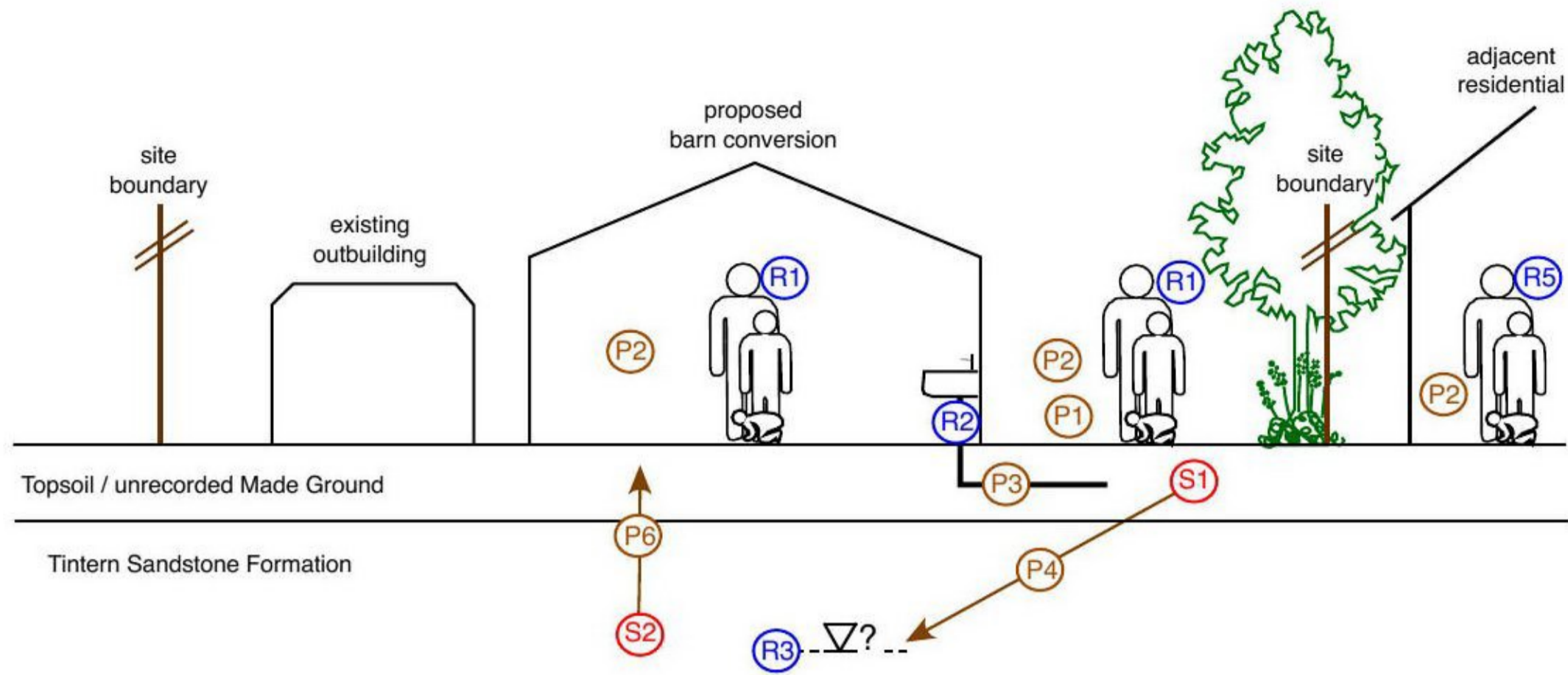


TABLE 3: SUMMARY OF PRELIMINARY POTENTIAL POLLUTANT LINKAGES

Potential Sources	Pathways	Receptors					Comments	Preliminary Risk Assessment
		R1	R2	R3	R4	R5		
ON SITE								
S1	P1	X					Proposed residential development; greatest risk within areas of proposed soft landscaping	Low
	P2	X						
	P3		X					
	P4			X				
	P5							
	P6							
S2	P1						Full radon protection required	High
	P2							
	P3							
	P4							
	P5							
	P6							
OFF SITE								
None								
SOURCES	S1	Possible elevated toxic and phytotoxic metals within near surface made ground (unlikely) / topsoil						
	S2	Natural radon gas emissions from TSF						
PATHWAYS	P1	Direct dermal contact or ingestion via soil attached to vegetables						
	P2	Inhalation of dust and vapours						
	P3	Permeation into new water supply pipework						
	P4	Vertical leaching of leachable contaminants in unsaturated zone and lateral migration in saturated zone						
	P5	Landfill gas migration through unsaturated zone and accumulation within confined spaces						
	P6	Radon gas migration through unsaturated zone and accumulation within confined spaces						
RECEPTORS	R1	Future occupants (critical residential receptor is female child age class 1-6)						
	R2	Potable water supply						
	R3	Groundwater (TSF classified as a 'Secondary A' aquifer)						
	R4	Surface waters (Unnamed Brook c120m NW)						
	R5	Adjacent site users (residential)						

- 5.5** The findings of the Phase 1 desk study suggest a low risk that the site may contain contaminants at elevations sufficient to pose a significant risk to human health or environmental receptors, on which basis soil sampling, testing and quantitative risk assessment is deemed unnecessary. That said future funders and/or insurers may insist on some level of routine 'due diligence' assessment, in which case we could assist as required.
- 5.6** Regarding radon, it is not possible to test for the presence of radon gas through intrusive methods until after the barn has been converted, instead therefore the recommendations of BRE and Public Health England should simply be followed; full radon protection measures should be installed during building conversion to prevent radon entry. This requires a minimum 1200 gauge membrane laid fully across / within the ground floor slab, tape sealed along overlapped sheet joints and around any service entries, and either lapped across cavities if an inner skin of blockwork is to be added, or otherwise lapped against / 'chased into' the external leaf, to the approval of the Building Control Inspector.

6 CONCLUSIONS AND RECOMMENDATIONS

- 6.1** The foregoing discussions and recommendations are based upon the results of a Phase 1 geo-environmental 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 remained as a predominantly undeveloped grassy field since the earliest available mapping of 1881; a Chapel was constructed within the barn footprint in 1928 which was then converted to the current barn in 1971, followed by the construction of the outbuilding in c2000, remaining until the present day.
- 6.3** The desk study and conceptual site model suggest a low risk of potential pollutant linkages to future site users, thus intrusive (Phase 2) ground investigation and sampling is considered unnecessary, although prospective funders/insurers may require some level of 'due diligence' assessment. Full radon protection is required in the converted building. As usual should unexpected or suspected ground

contamination become evident during ongoing site works, this Practice should be informed such that appropriate assessment can be instigated.

- 6.4** 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 geotechnical/geo-environmental specialist. This report is subject to our standard terms and conditions.

7 **REFERENCES**

Environmental

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

Environment Agency LCRM: Land Contamination Risk Management (2020)

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

Chartered Institute of Environmental Health (CIEH)/Land Quality Management Limited (LQM). *CIEH/LQM. 'S4ULs for Human Health Risk Assessment' (2015); Land Quality Press*

Department of the Environment, Transport & the Regions: '*The Environmental Protection Act 1990: Part IIA*' (2000)

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

British Standards Institute, BS8485: '*Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*' (2015)

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

Landmark Historical Ordnance Survey mapping (Ref: 283574106_1_1 dated 16th August 2021)

The Water Framework Directive (Standards and Classification) Directions (England and Wales)' (2015)

The Water Supply (Water Quality) Regulations 2000 (Amendment) Regulations (2007)

Environment Agency (www.environment-agency.gov.uk)

Health Protection Agency (www.hpa.org.uk)

Zetica (www.zetica.com)

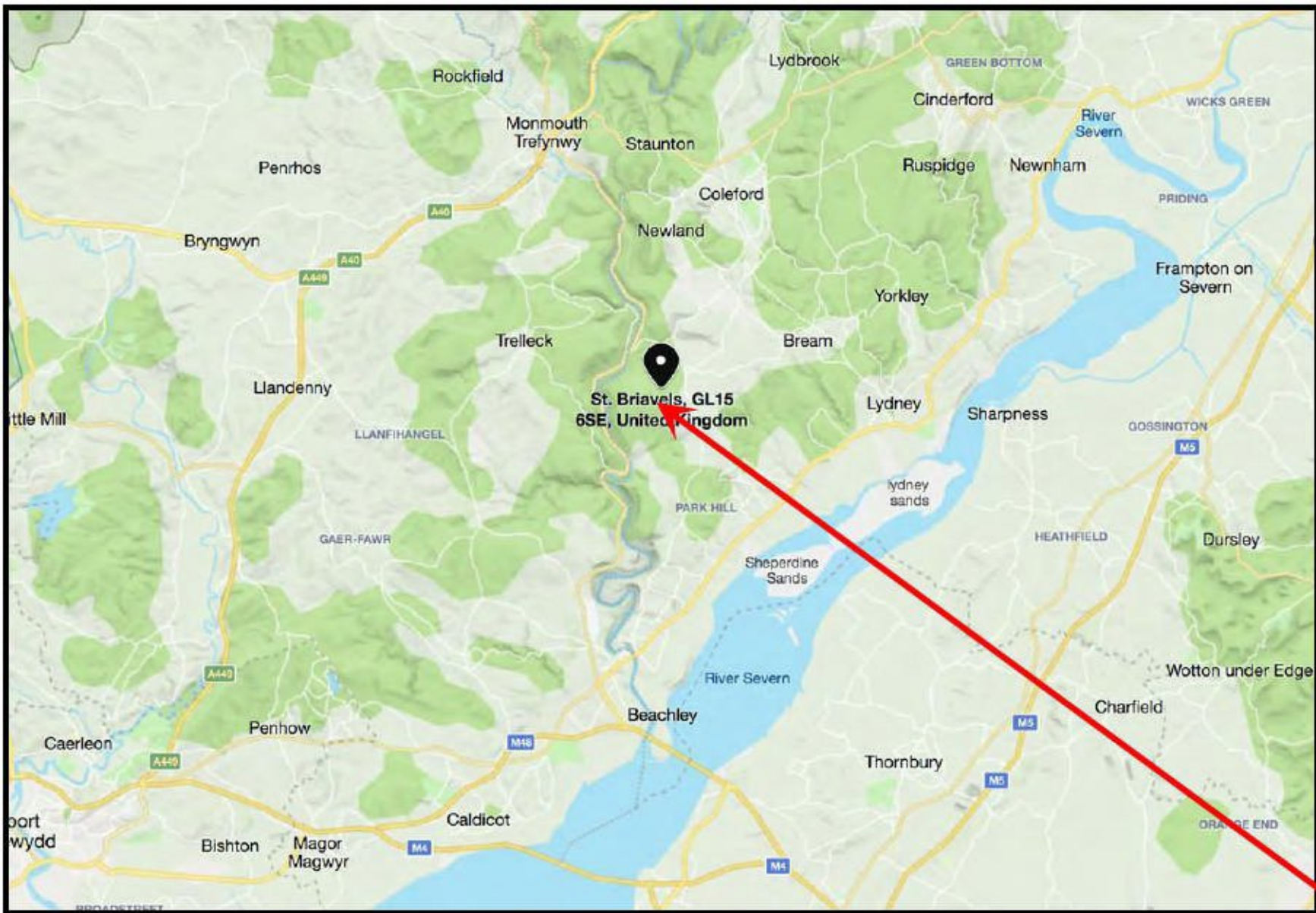
UK WIR report '*Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites*' (2010)

Department for Environment, Food and Rural Affairs "*MAGIC*" mapping (2020)

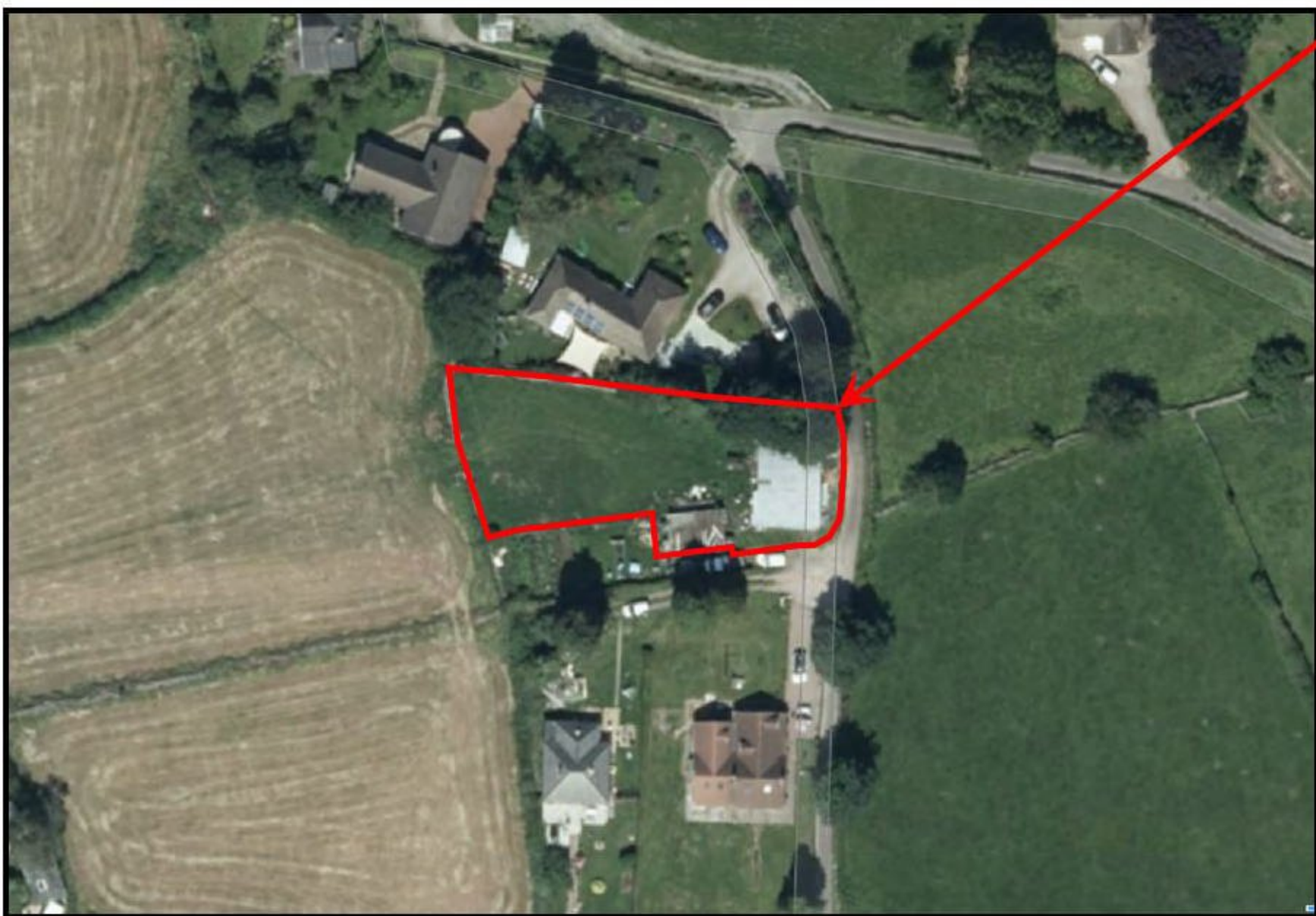
British Geological Survey 1:10,000 scale sheet SO 50 SE and 'on-line'

SITE LOCATION (based on Microsoft Bing Mapping)

Job No. 4882	Drawing No. 4882/1	Scale: NTS	Date: 20-08-21
-----------------	-----------------------	---------------	-------------------



THE SITE



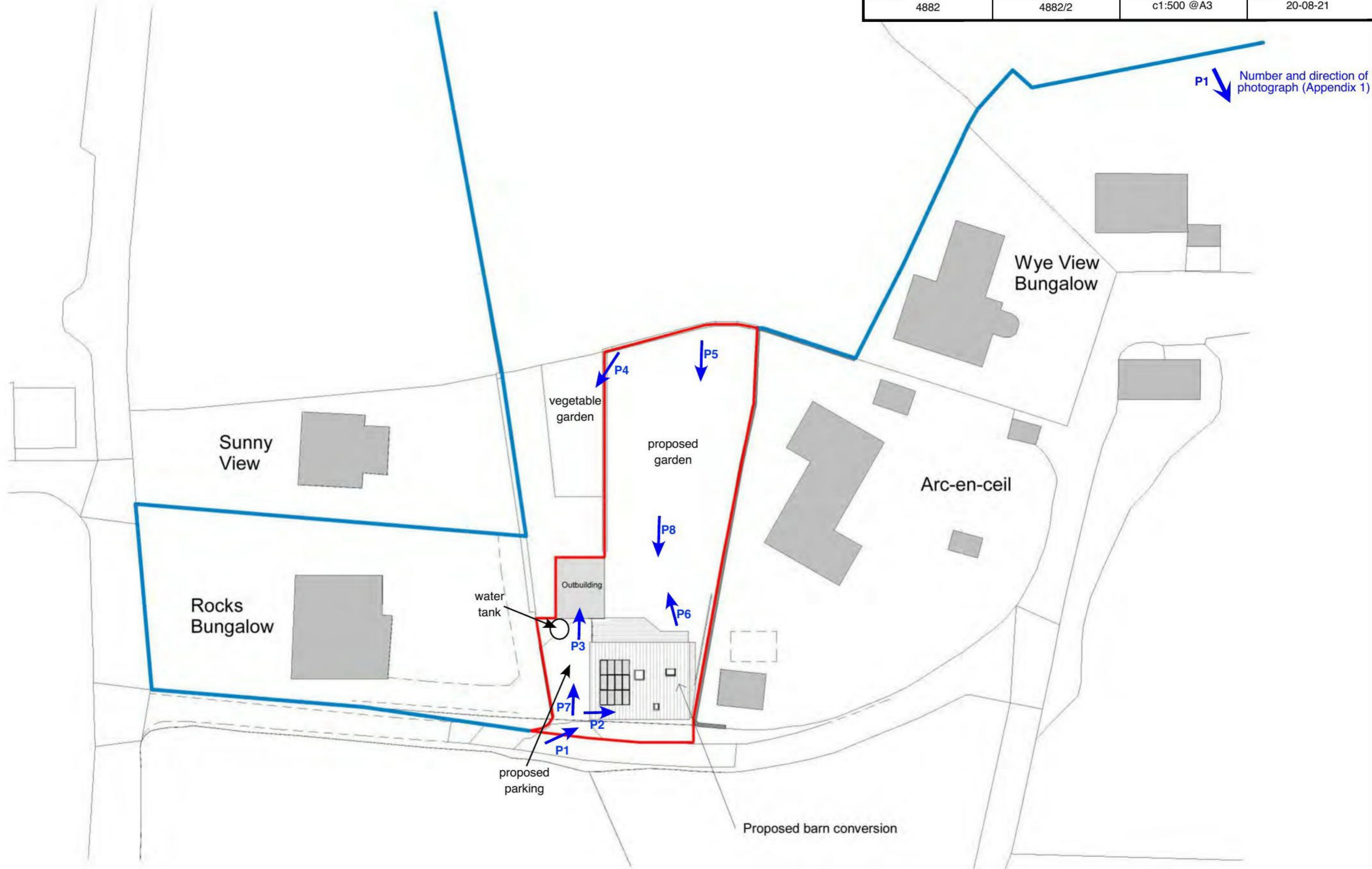


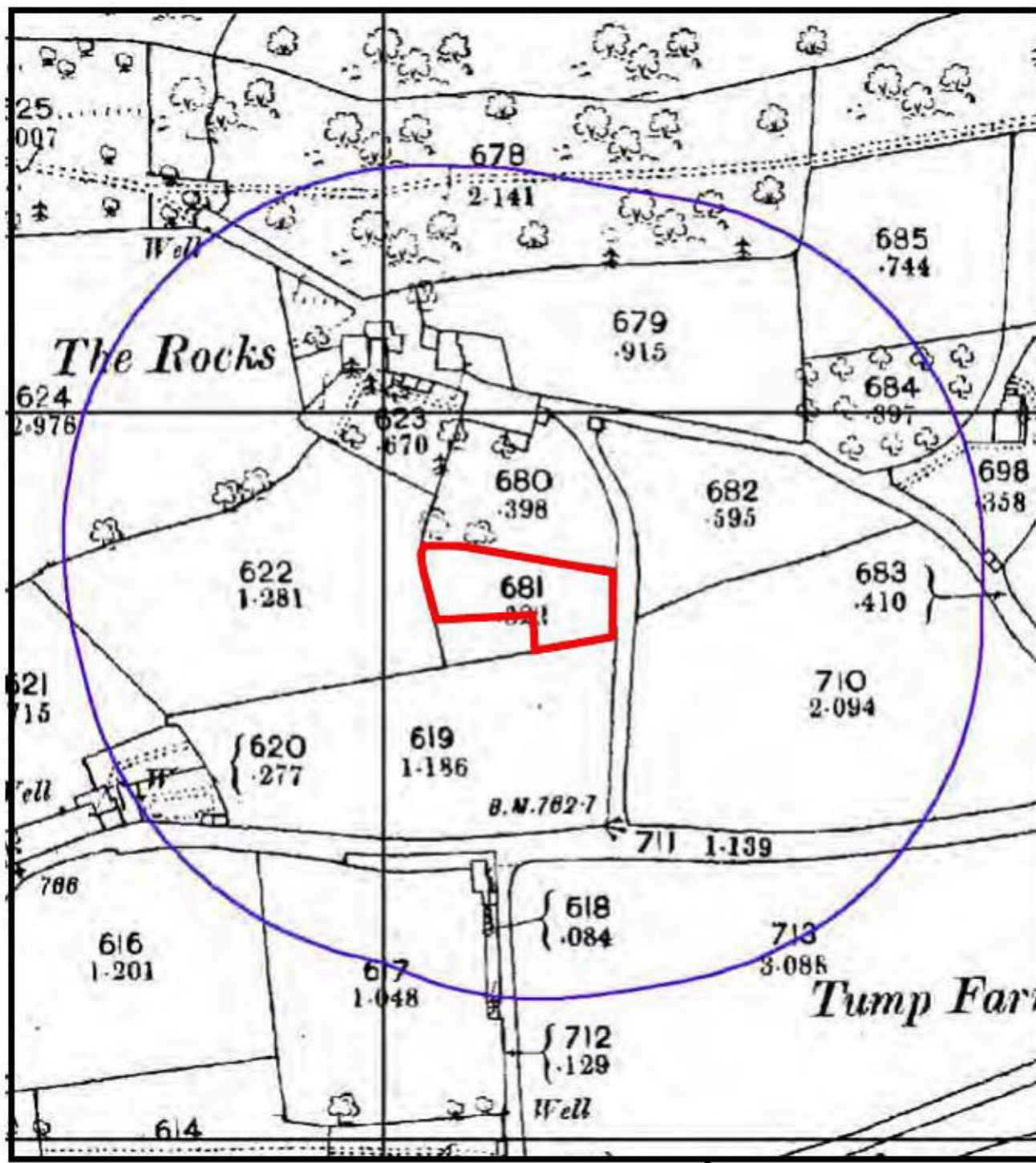
ROCKS BUNGALOW, ST BRIAVELS COMMON, COLEFORD,
GLOS GL15 6SE



PROPOSED DEVELOPMENT LAYOUT (based upon MR James Design drg 40-2136, dated July 2020) SHOWING WALKOVER NOTES

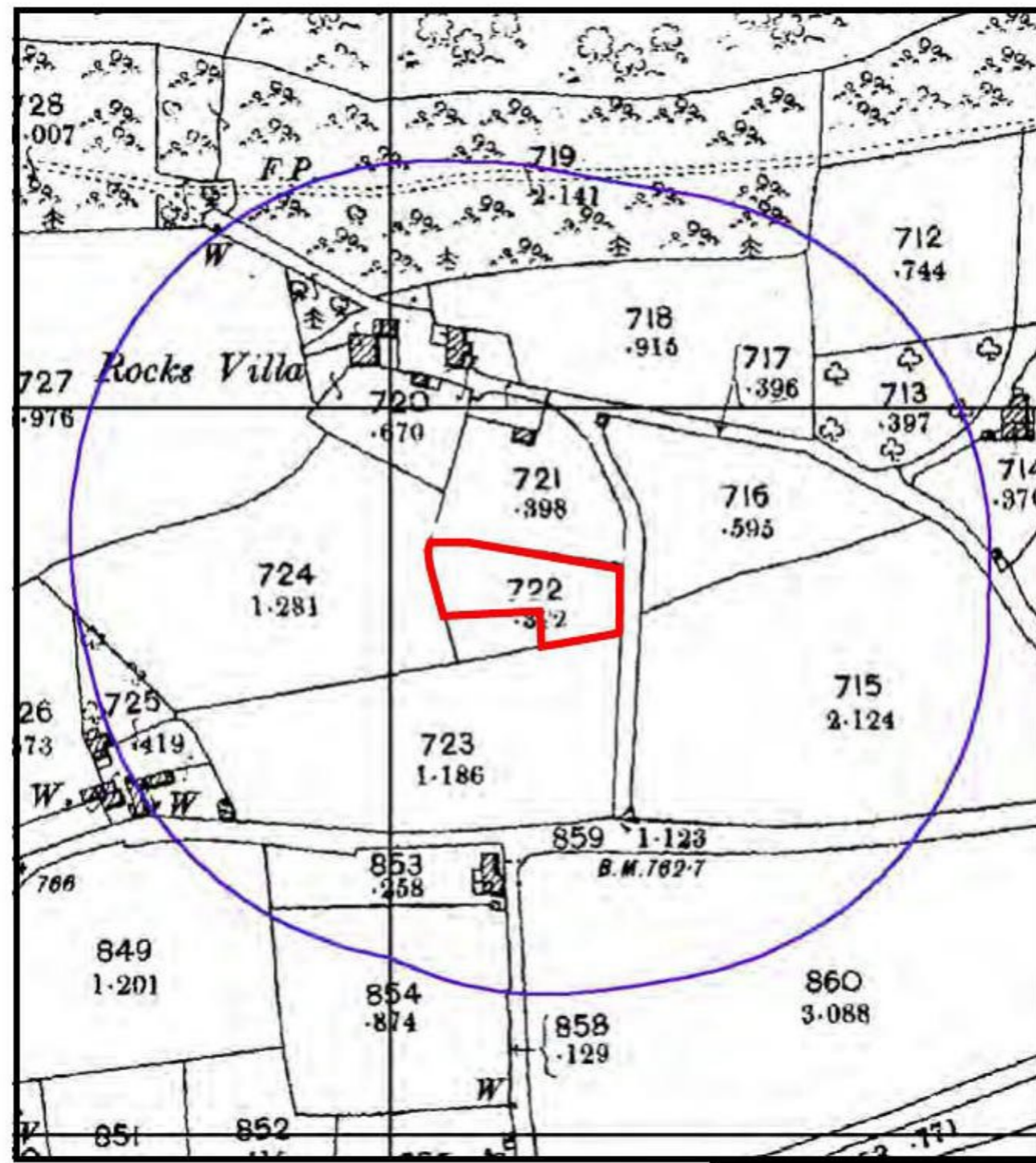
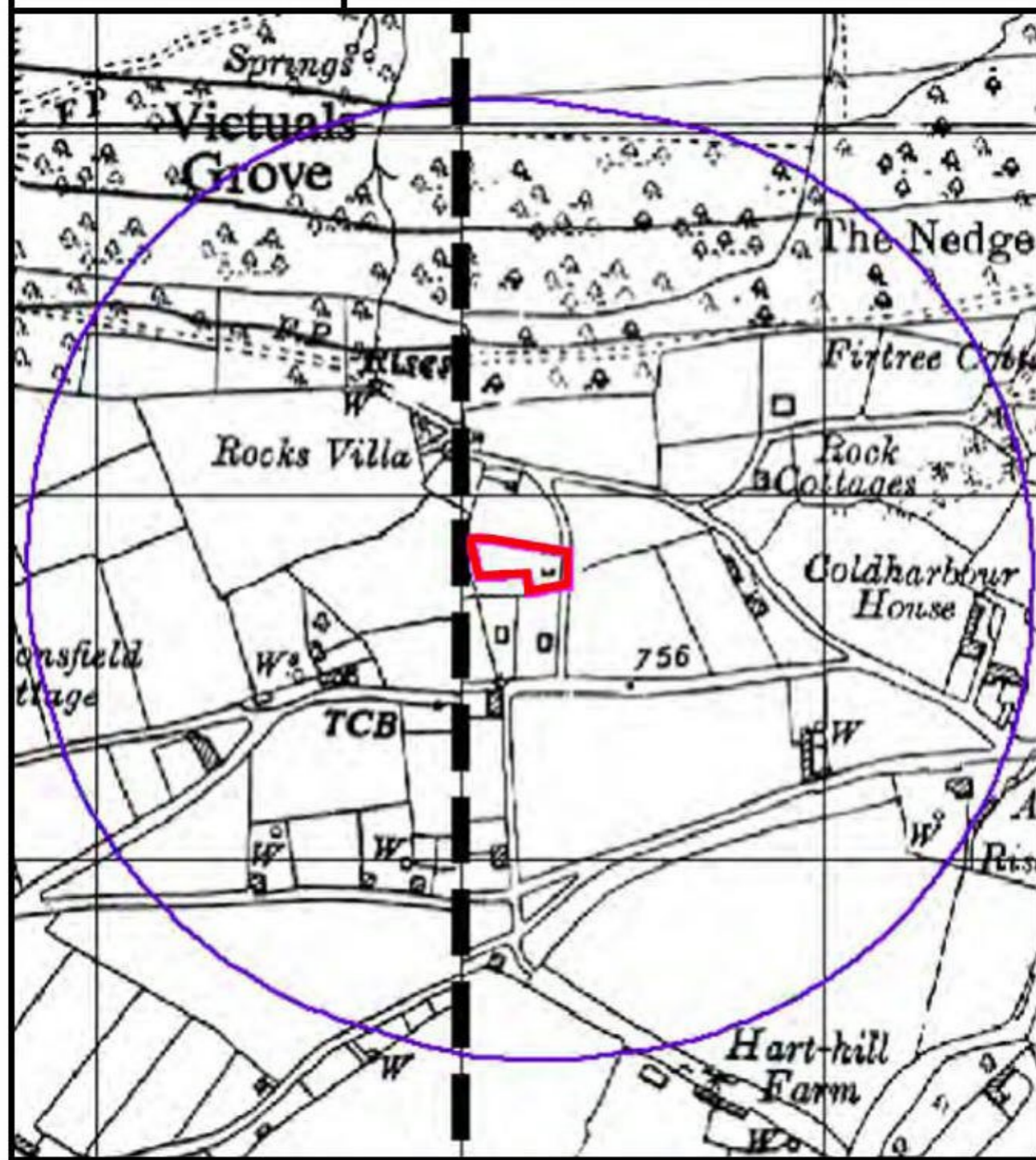
Job No. 4882	Drawing No. 4882/2	Scale: c1:500 @A3	Date: 20-08-21
-----------------	-----------------------	----------------------	-------------------





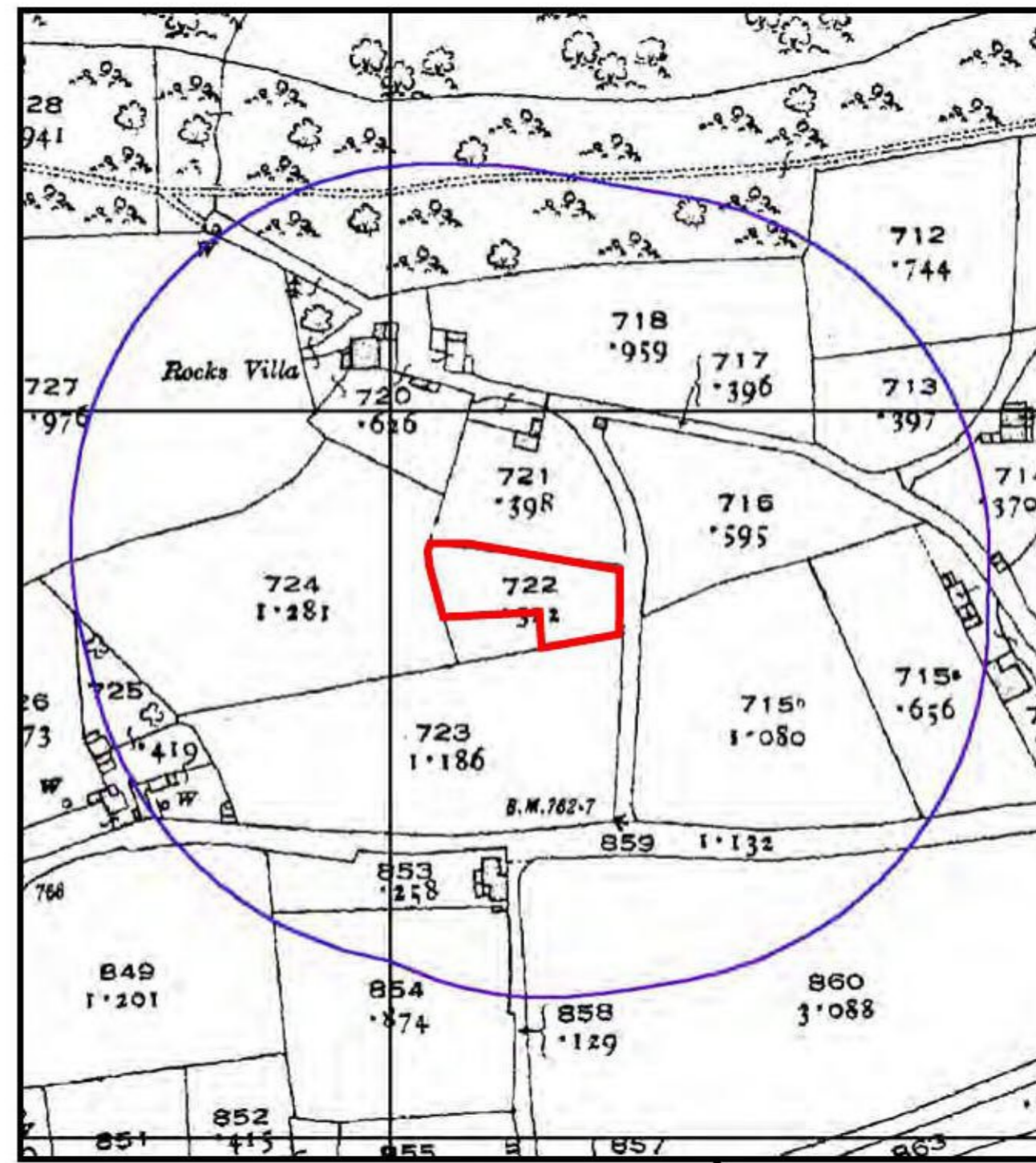
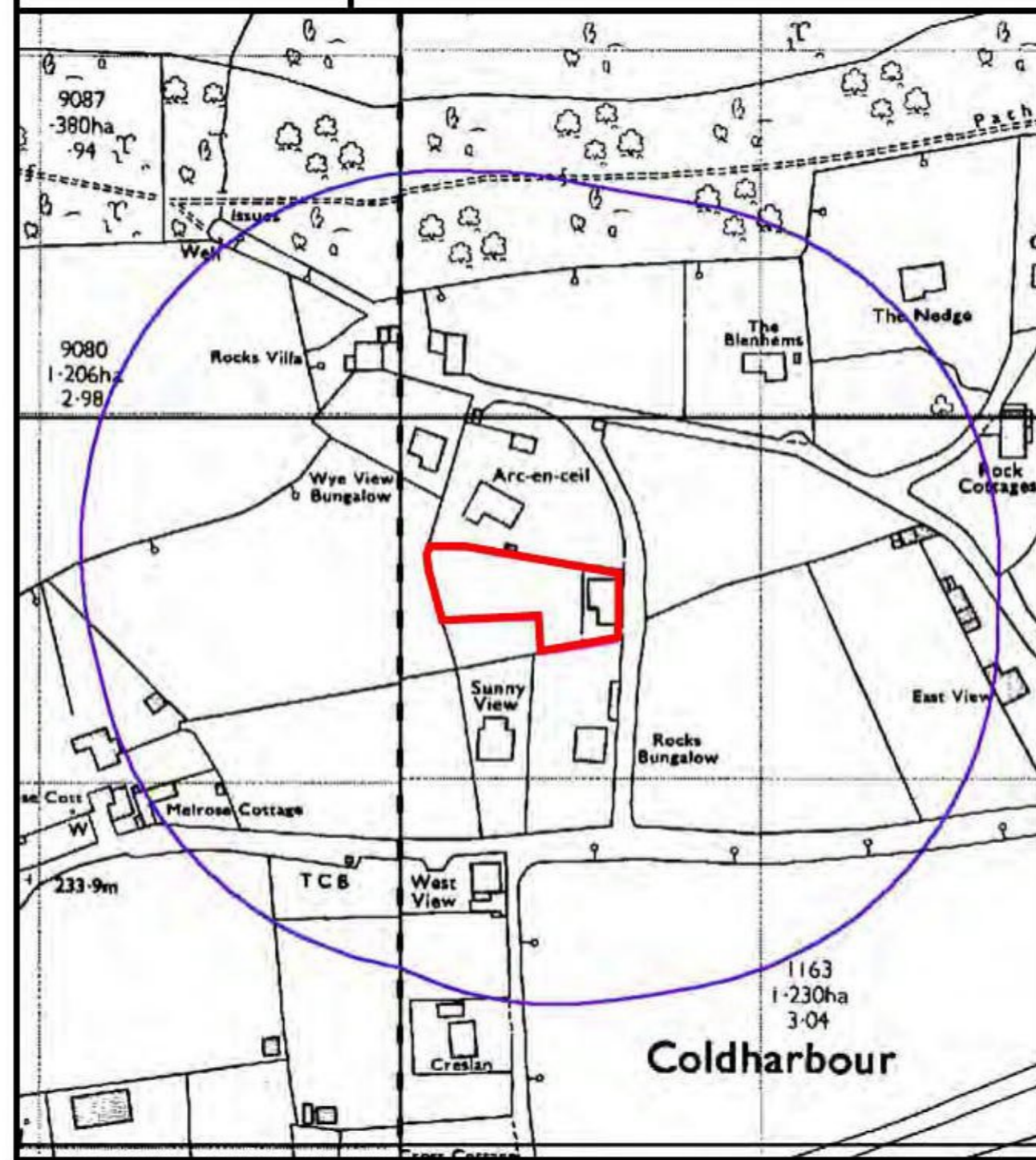
1881
(scale 1:2500)

1954
(scale 1:5000)

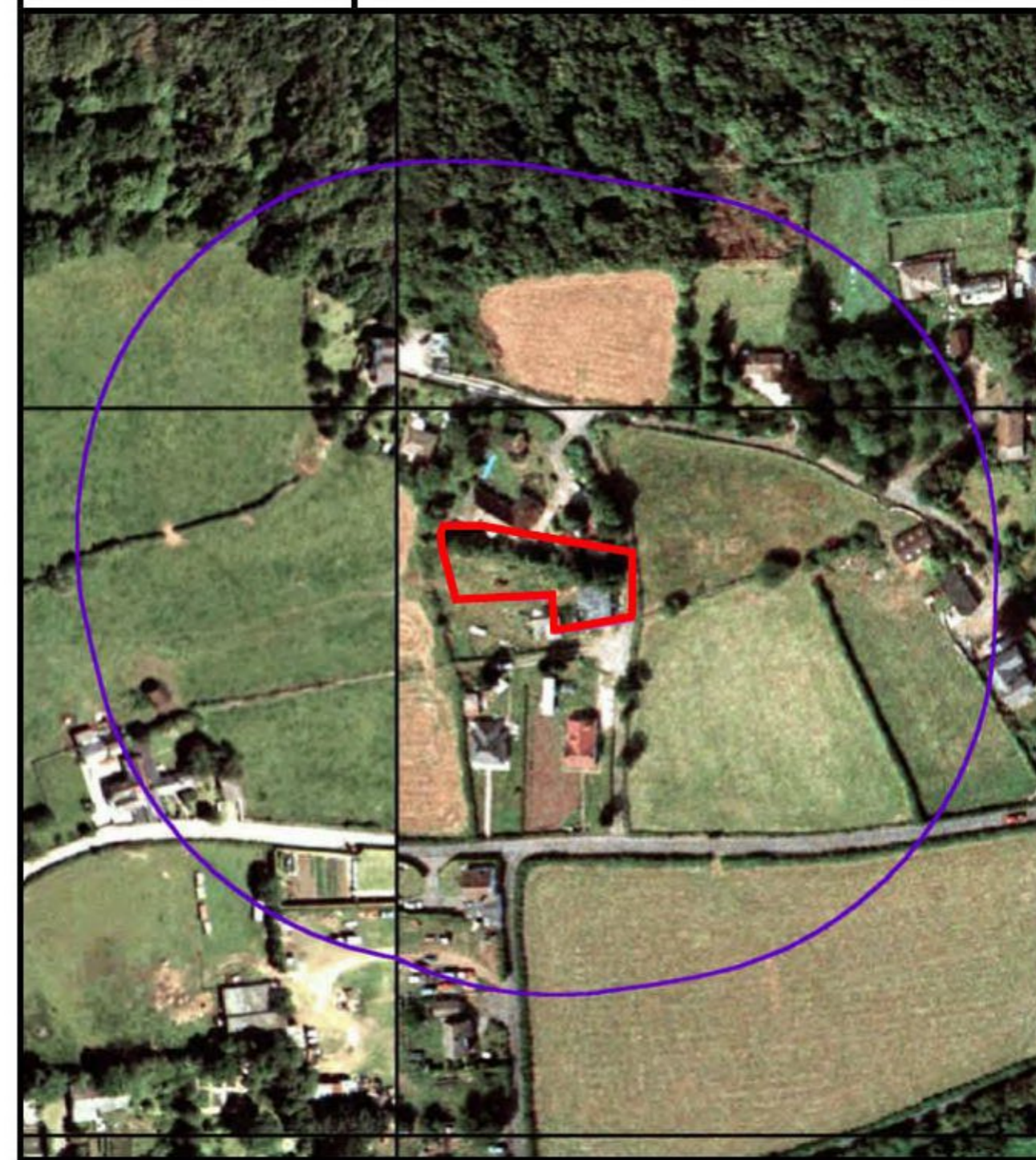


1902
(scale 1:2500)

1972
(scale 1:2500)



2000
(scale 1:2500)



ROCKS BUNGALOW, ST BRIAVELS COMMON, COLEFORD
GLOS GL15 6SE

EXTRACTS OF ORDNANCE SURVEY PLANS TO SHOW SITE HISTORY

Job No.	4882	Date:	23-08-21
Drawing No.	4882/3	Scale:	as shown



Reproduced from/based upon Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationary Office © Crown copyright
Licence No: LAN 1000019

APPENDIX 1

SITE PHOTOGRAPHS



Photograph P1



Photograph P2



Photograph P3



Photograph P4



Photograph P5



Photograph P6



Photograph P7



Photograph P8

APPENDIX 2

CONTAMINATION STATUTORY FRAMEWORK / METHODOLOGY

A2 **CONTAMINATION RISK ASSESSMENT**

Statutory Framework

A2.1 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.

A2.2 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 1 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 1 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 or 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 2011, 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 lead 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 A2.14 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

A2.3 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 SR1.

A2.4 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.

A2.5 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.

A2.6 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.

A2.7 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

A2.8 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).
1	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.

A2.9 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.

A2.10 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.

A2.11 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

A2.12 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

A2.11 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

A2.14 On this basis potential hazards are assigned a risk rating as shown below.

	Consequence				
		<i>Severe</i>	<i>Moderate</i>	<i>Mild</i>	<i>Minor</i>
Probability (Likelihood)	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

A2.15 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.

- A2.16** 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 (v1.07 at time of writing). It should be noted that exceedance of a screening value does not necessarily indicate that the site requires remediation.
- A2.17** 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.
- A2.18** In terms of controlled off-site disposal to landfill of site arisings, if/where intended, waste classification has been carried out in line with European Waste Catalogue (EWC) and Technical Guidance Waste Management 3 (TGWM3, EA Version 3, May 2015 – replacing the outgoing TGWM2) using contamination test results obtained for that material. The assessment utilises the 'HazWasteOnline' software to establish a 'Hazardous' (170503) / 'Non-hazardous' (170504) classification. Where required, the foregoing may be supplemented by Waste Acceptance Criteria (WAC) analysis, in order that the waste can further be designated as 'Hazardous' / 'Stable non-reactive' / 'Inert', for use by the receiving landfill operator. It should be noted that WAC is only required for disposal of wastes at certain classes of landfill; if arisings are not intended for removal to landfill, then WAC testing is not applicable.