

**PHASE I & PHASE 2 REPORT:
27 POYSER STREET,
WREXHAM**

2919/R01

VERSION 1

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Final

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This report has been prepared by GroundSolve Ltd with all reasonable care and diligence, within the best practice and guidance current at the time of issue within the proposed redline boundary and proposed Site end use as presented by the Client.

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EXECUTIVE SUMMARY

Introduction	GroundSolve Ltd (GSL) were commissioned by Tom Fletcher to undertake a [Land Contamination Risk Management (LCRM) Preliminary Risk Assessment] for an area of land referred to as 27 Poyser Street (the "Site").
Proposed land use	Current plans are to construct a pair of semi-detached properties with associated parking and gardens.
Geoenvironmental Setting	Topography: The site is generally flat. Geology & Hydrogeology: Glaciofluvial Sheet Deposits, Devensian - Sand and Gravel - Secondary A aquifer of high vulnerability. Etruria Formation - Mudstone - Secondary A aquifer of low vulnerability. Mining & Quarrying: On the basis of the geology of the area, the Coal Authority Report, and the historic maps, it is considered that the site is not likely to be at risk from ground movements due to previous mines or quarrying.
Phase 1 Preliminary Risk Assessment	Based on the former land uses at the site the potential for contamination to be present at the site is considered to be low to medium. Plausible contaminant linkages have been identified. The receptors of concern are human health, surface water and groundwater. 1% to 3% of properties affected by Radon – No protection measures required. The possible consequences on the plausible receptors are estimated to be MEDIUM and the probability of the identified risks occurring is considered to be from UNLIKELY to LIKELY Risk Evaluation Given the adoption of suitable construction practices the overall risk is considered to be LOW.
Scope of Phase 2 Site Investigation	The scope of ground investigation works carried out at the site by GroundSolve comprised: • 3 trial pits to a maximum depth of 2.1 mbgl; Laboratory chemical contamination testing.
Findings of the Phase 2 Ground Investigation	The ground conditions at the site (from ground level, down) comprise: • Topsoil - sand or sandy clay with roots and rootlets; or • Made Ground – sands, gravels, and clays, including some demolition rubble; over. • Glacial Till – generally slightly sandy slightly gravelly clay No Groundwater was encountered. There is no visual and olfactory evidence of petroleum hydrocarbon contamination in the Made Ground.
Phase 2 Conclusions – Geoenvironmental	Human Health: The Made Ground is present only in the hard landscaped areas. The chemical testing from the Made Ground has shown the presence of elevated lead and mercury. It is recommended that this material is not used within the soft landscaped areas. The proposed private garden areas do not comprise Made Ground material and the chemical testing show no elevated concentrations. GroundSolve conclude that the risk from contaminants to the proposed development is considered low and will not require any remediation except for the potential risk from ground gases. Due to the potential risks identified, it has been agreed with the local authority that Characteristic Situation 2 gas protection measures are adopted for the development in line with BS8485:2015+A1:2019. The installation of the ground gas protection measures will require independent verification in accordance with CIRIA C735. As the site is within a low radon risk area, no radon protection will be required for the proposed development. Whilst unexpected contamination is not anticipated, the proposed development could encounter previously unrecorded hotspots of contaminants. These will be assessed and mitigated in accordance with current good practice.

1 INTRODUCTION

GroundSolve Ltd (GSL) were commissioned by Mr Tom Fletcher (the client) to undertake a Phase I Preliminary Risk Assessment and Phase 2 Intrusive investigation referred to as 27 Poyser Street, Wrexham (the “Site”).

This report has been devised to generally comply with the relevant principles and requirements of a range of guidance including:

- Welsh Local Government Assoc- Development of Land Affected by Contamination Guide for Developers 2017
- Part IIA of the Environment Protection Act, 1990;
- BS5930:2015 +A1:2020 “Code of practice for site investigations”;
- BS10175: 2011 +A2:2017 “Investigation of Potentially Contaminated Sites - Code of Practice”;
- The Building Regulations 2010. Part C (HM Government 2013)
- Environment Agency: Land Contamination Risk Management (LCRM), Version 3, October 2020;
- Environment Agency (2017) “The Environment Agency’s Approach to Groundwater Protection” November 2018 Version 1.2;

1.1 PROPOSED DEVELOPMENT

Current plans are to construct a pair of semi-detached properties with associated parking and gardens.

Foundation loads are not known at this stage but based on experience are anticipated to be between 50 and 75kN/m run for two storey structures. Floor slab loadingS are anticipated to be low, probably not exceeding 5kN/m². In addition, development levels have not yet been set.

The recommendations in this report are based on these assumptions, consequently, they should be reviewed, and if necessary revised during the detailed design.

As such, in accordance with the ‘*Updated technical background to the CLEA model*’ (Environment Agency, 2009) and ‘*Suitable 4 Use Levels*’ (LQM / CIEH 2015) the proposed generic land use for this development is RESIDENTIAL WITH HOMEGROWN PRODUCE.

1.2 PREVIOUS REPORTS

No previous reports we made available for review.

1.3 OBJECTIVES

Considering the proposed development of the Site, the objectives of this appraisal were:

- To determine the historical and current land use.
- To establish the environmental setting of the Site.
- To evaluate whether past mining or other extractive industries could have an influence on the Site.
- To review previous pertinent third-party reports;
- To determine likely ground and groundwater conditions.
- To determine the potential risks to human health and the wider environment.
- To determine potential risks posed to the Site from hazardous ground gases and / or vapours.
- To derive a Preliminary Conceptual Site Model.
- Carry out an intrusive investigation comprising trial pits with associated sampling;
- Laboratory testing for potential contaminants purposes;
- Assess the general nature and extent of contamination at the site and carry out a contamination risk assessment to determine if the site poses a risk to potential receptors;
- Should the investigation indicate that remediation of contaminants be required, provide recommendations of feasible remedial measures to facilitate development of the site for commercial end use;

1.4 ASSUMPTIONS

The following assumptions are made in this report:

1. It is assumed that ground levels will not change significantly from those described in this report or as shown on proposed development drawings. If this is not the case, then amendments to the recommendations made in this report may be required.
2. Any references to observations of suspected asbestos-containing materials are for information only and should be verified by a suitably qualified asbestos specialist and/or confirmed by laboratory analysis.
3. The use of the term 'Topsoil' within this report is based on a visual identification only and that these materials have not necessarily been classified in accordance with BS3882:2015.
4. The comments and opinions presented in this report are based on the findings of the desk study performed by GroundSolve Ltd. There may be other conditions prevailing on the Site which have not been revealed by this investigation and which have not been considered by this report at this stage.
5. Responsibility cannot be accepted for any conditions not revealed by this investigation. Any diagram or opinion on the possible configuration of the findings is conjectural and given for guidance only. Confirmation of ground conditions should be undertaken if deemed necessary.
6. This report has been prepared for the sole use of the Client. No other third party may rely upon or reproduce the contents of this report without the written approval of GroundSolve Ltd. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk.

2 SITE DETAILS AND DESCRIPTION

Table 2.1 – Current Site Overview

Site name	27 Poyser Street
Site address	27 Poyser St, Wrexham LL13 7RT
National Grid Reference (NGR)	333117, 349839
Approximate Site area	0.04 Ha
	
Site shape	Roughly rectangular
Current land use on the Site	Residential gardens with small storage buildings located in SW corner of site and greenhouse located in NE corner of site.
Surrounding land uses	Residential properties with associated parking and gardens and a church to the west
General topography and ground levels	Relatively flat at approximately 86m AOD

Relevant site photographs are presented in **Appendix B**.

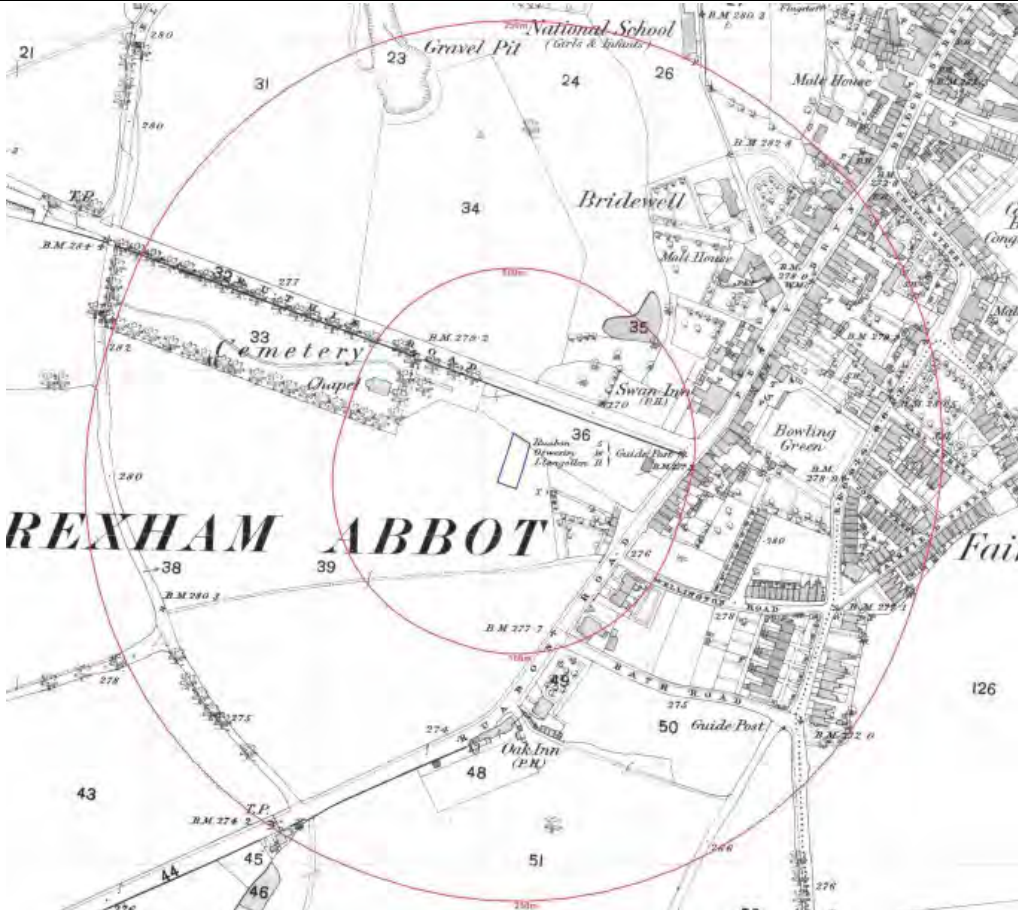
3 SITE HISTORY

3.1 SITE HISTORY REVIEW

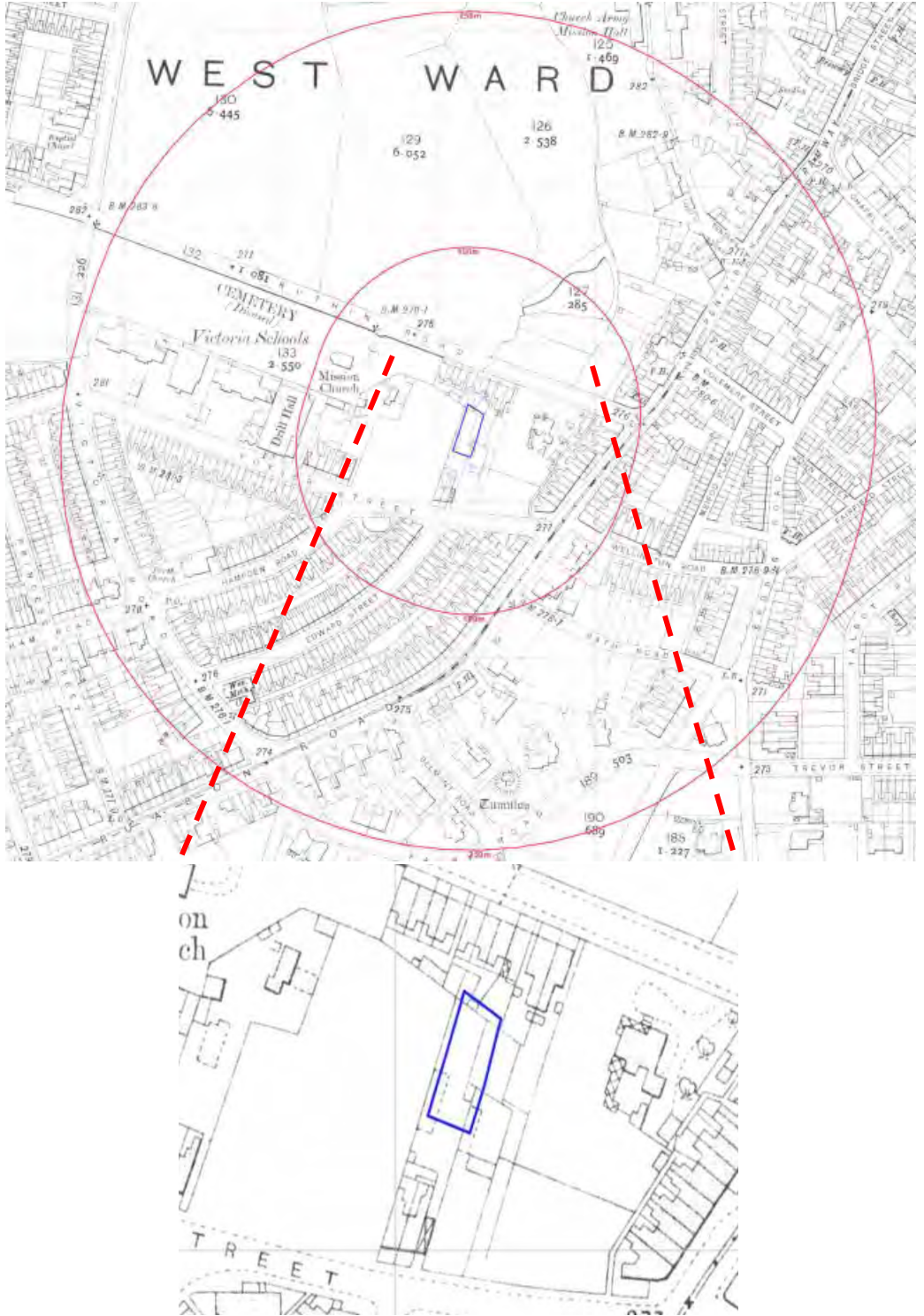
Extracts of Ordnance Survey (OS) plans dated from 1873 were reviewed. These were obtained as part of the Groundsure Report for the Site, which is presented in **Appendix C**.

Table 3.1 below presents a summary of the main aspects of the Site relevant to the current and proposed future end uses. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the Site, where these are not relevant to the land use.

Table 3.1 - Site History

Time Period	On-Site features	Off-Site features
Pre 1873		
	On Site Undeveloped agricultural land	Off Site - Gravel pit present 200m N - Pond approximately 90m NE - Ruthin Road to the north - Open arable land to the north south & west - Residential properties to the east - Cemetery and chapel located 100m to NW

Time Period	On-Site features	Off-Site features
1873 - 1899		
	On Site The northern part of the site is identified within the gardens of the properties to the north. However, there appears to be inaccuracies with the mapping and the whole site is still located within undeveloped agricultural land to the south.	Off Site - The gravel pit to the north of the site has been extended southwards - Increase in housing density to the south and west

Time Period	On-Site features	Off-Site features
1899 - 1912		
	On Site - The northern part of the site has remained undeveloped - There is now a rectangular building along the SW corner and a square building in the SE corner of the site	Off Site - Gravel pit to the north has been backfilled - Pond to the north has been extended - A new excavation approximately 260m N has been created - Increase in housing to the south of the site

Time Period	On-Site features	Off-Site features
1937		
	On Site New buildings are now present along the SE part of the site	Off Site - Pond to the north has changed size & shape - Excavation to the north has been backfilled - Open fields to the north are now recreation parks - St Michael's and Methodist Churches are now located to the west and east respectively

Time Period	On-Site features	Off-Site features
1937 - 1958		
	On Site The buildings in the south of the site are now identified as a Builders Yard	Off Site The pond to the north has reduced in size

Time Period	On-Site features	Off-Site features
1958 - 1975		
	On Site No Changes	Off Site - The pond to the north of site has been removed - The area to the north is now identified as a refuse tip

Time Period	On-Site features	Off-Site features
1975 - 1990		
	On Site No Changes	Off Site The refuse tip to the north is no longer shown on the mapping

Time Period	On-Site features	Off-Site features
1990 - 2003		
	On Site One of the buildings in the SW corner of the site is now no longer present	Off Site Belle Vue Garage is now present 60m to the NE of the northern boundary

4 ENVIRONMENTAL SETTING

4.1 GEOLOGY

Table 4.1 - Geological Summary

Maps and publications referenced	Wrexham Sheet 121 England and Wales Series 5 1990
Made ground / artificial ground	None recorded
Drift geology	Glaciofluvial Sheet Deposits, Devensian - Sand and Gravel
Solid geology	Etruria Formation - Mudstone
Faults	None
Coal seams	None

4.2 MINING AND QUARRYING

Table 4.2 - Coal Mining Activities

	Yes/No	Comments
Is the Site in an area of potential shallow coal workings?	No	
Is the Site in a high risk development area?	No	
Are there any known shafts, adits, tips, lagoons, or opencast workings likely to affect the Site?	No	
Is exploratory work required to investigate the potential risk from shallow mining or quarrying?	No	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered

1. No past underground mining recorded,
2. There are no probable unrecorded shallow workings beneath the site,
3. No spine roadways recorded at shallow depth,
4. No mine entries recorded within 100m of the site.

Table 4.3 - Other Extractive Industries

	Yes/No	Comments
Superficial drift deposits		
Evidence of extraction on or within 250 m of the Site?	Yes	Gravel pit present to the north and NE of the site
Action required?	No	
Solid Strata		
Any evidence of mineral extraction on or within 250 m of the Site?	No	
Action required?	No	

4.3 HYDROGEOLOGY

Table 4.4 - Groundwater Occurrence and Abstraction

	Presence/location	Comments
Environment Agency aquifer designation – Superficial Deposits	On Site	Secondary A High Vulnerability
Environment Agency aquifer designation – Bedrock	On Site	Secondary A Low Vulnerability
Anticipated groundwater depth(s)		
Direction of flow		
Current licensed abstractions – potable	None within 1000m	
Source Protection Zones	None within 500m	
Springs	None within 500m	

NR - none recorded.

For definition of Source Protection Zones, see **Appendix A**.

4.4 HYDROLOGY

Table 4.5 - Surface Water Features

	Presence/location	Comments
Nearest surface water feature	None within 250m	
Other surface water features	None within 250m	
Canals, ponds, lakes, etc.	None within 500m	
Water Framework Directive (WFD) Surface Water Bodies	On Site	River Catchment - Gwenfro
Licensed surface water abstractions	None within 250m	

Environment Agency GQA assessments: A = very good to E = poor

4.5 ENVIRONMENTAL DESIGNATIONS

Table 4.6 - Summary of Environmental Designations

	Presence/location	Comments
Sites of Special Scientific Interest (SSSI)	None within 1500m	
Conserved wetland sites (Ramsar sites)	None within 2000m	
Special Areas of Conservation (SAC)	None within 2000m	
Special Protection Areas (SPA)	None within 2000m	
National Nature Reserves (NNR)	None within 2000m	
Local Nature Reserves (LNR)	None within 2000m	
Designated Ancient Woodland	None within 500m	
Biosphere Reserves	None within 2000m	
Forest Parks	None within 2000m	
Marine Conservation Zones	None within 2000m	
Green Belt	None within 2000m	
Proposed Ramsar sites	None within 2000m	
Possible Special Areas of Conservation (pSAC)	None within 2000m	
Potential Special Protection Areas (pSPA)	None within 2000m	

	Presence/location	Comments
Nitrate Sensitive Areas	None within 2000m	
Nitrate Vulnerable Zones	None within 2000m	
SSSI Units	None within 2000m	

4.6 LANDFILL AND WASTE MANAGEMENT ACTIVITY

Table 4.7 - Waste Management Activities

	Presence/location	Comments
Active or recent landfill	None within 500m	
Historical landfill (BGS records)	None within 500m	
Historical landfill (LA/mapping records)	60m NE 63m NE	Refuse Tip – 1971 Mapping Parciau – Wrexham Council
Historical landfill (EA/NRW records)	97m NE	Parciau, Wrexham – Inert, industrial, commercial, household – Last recorded 31/12/1972
Historical waste sites	None within 250m	
Licensed waste sites	None within 500m	
Waste exemptions	None within 250m	
Evidence of other landfilling or potential infilling on or within 250m of Site	Off site	Surface ground workings to the north and east
Walkover evidence of fly-tipping on Site?	None	
Discussions with Local Authority (Wrexham County Borough Council)	Yes -17/06/2023	
Additional landfill/ground gas risk assessment required?	No	Ground Gas Protection recommended based on GS2 conditions

4.7 LOCAL INDUSTRIAL LAND USES

Other potentially contaminative activities are shown in **Table 4.8** below with those features considered pertinent to the conceptual site model highlighted in **bold**. The entries relate to activities within *circa* 250 m of the Site, with the exception of COMAH facilities where the assessment is extended to a distance of *circa* 500m from the Site.

Table 4.8 - Other Potentially Contaminative Processes in the Locality

	Location	Comments
Recent industrial land uses	69m NE 87m W 101m W 102m E 142m E 149m S, 164m NE, 165m SW	Belle Vue Garage – Repair and Servicing J Browse Motorcycles – Industrial Products Owens Motorcycles – Motoring Price Brothers & Sons Upholstery – Products National Tyres and Autocare – Repair Electricity Sub Station
Current or recent petrol stations	284m NW	Total – Ruthin Road, Victoria Road, Wrexham, LL13 7TT
Electricity cables	None within 500m	
Gas pipelines	None within 500m	
Sites determined as Contaminated Land	None within 500m	
Control of Major Accident Hazards (COMAH)	None within 500m	
Regulated explosive sites	None within 500m	
Hazardous substance storage/usage	None within 500m	
Historical licensed industrial activities (IPC)	None within 500m	
Licensed industrial activities (Part A(1))	None within 500m	
Licensed pollutant release (Part A(2)/B)	None within 500m	
Radioactive Substance Authorisations	None within 500m	
Licensed Discharges to controlled waters	None within 250m	
Pollutant release to surface waters (Red List)	None within 500m	
Pollutant release to public sewer	None within 500m	
List 1 Dangerous Substances	None within 500m	
List 2 Dangerous Substances	None within 500m	
Pollution Incidents (EA/NRW)	376m NE	08/03/2010 – Asbestos Water Impact: 4 (No Impact) Land Impact: 2 (Significant) Air Impact: 2 (Significant)

	Location	Comments
Pollution inventory substances	None within 500m	
Pollution inventory waste transfers	None within 500m	
Pollution inventory radioactive waste	None within 500m	

COMAH – Control of Major Accident Hazards (regulations); NIHHS – Notification of Installations Handling Hazardous Substances (regulations).

4.8 RADON RISK

Table 4.9 - Radon Risk Status

	Comments
Estimated properties affected	Between 1% and 3%
Radon Protection Measures required?	None

5 PRELIMINARY GEOTECHNICAL ASSESSMENT

In addition to the environmental hazards, there are also geotechnical hazards associated with the stability of the ground (including load bearing capacity, slope stability and effects of ground (mining cavities). Local Authorities follow NPPF (2019) which requires that “site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining.” A summary of the geotechnical considerations is provided below:

Table 5.1 - Summary of Geotechnical Hazards

Geohazards:	
Highly Compressible Ground	Negligible. There is no potential for deep made ground present on the site. The superficial deposits are likely to comprise Glaciofluvial Deposits and Glacial Till. The underlying bedrock comprise Etruria Formation – Mudstone.
Collapsible Soils	Very low, deposits with potential to collapse unlikely to be present. No special actions required
Swelling Clay	Negligible– ground conditions are non-plastic or low plasticity.
Running Sand	Very low - unlikely. No identified constraints.
Ground Dissolution	Negligible
Landslip	Very low, consideration to adjacent areas should always be considered
Mining & Quarrying (see section 4.2)	There is no evidence of mineral extraction or quarrying at or adjacent to the site. There is no significant risk from historic coal mining at the site
Geotechnical Design Considerations	
Site Clearance	Further site clearance will be required
Trees	Trees present on site but not thought to impact site investigation.
Existing Buildings / Obstructions	There are no current buildings present on site. However buried foundations from the historical buildings may still be present and may require removing.
Foundations	Shallow foundation solutions anticipated unless deep made ground are encountered.
Floor Slabs	Suspended floor slabs to be incorporated into the gas protection measures.
Groundwater	Groundwater level is likely to be perched within the drift deposits
Earthworks	Removal of existing hard standing and soils required to reach formation level.
Slopes & Retaining Walls	Not applicable.
Chemically aggressive ground conditions	Possibility for low pH and high sulphate concentrations which could be detrimental to below ground concrete.

6 PRELIMINARY CONCEPTUAL SITE MODEL

6.1 INTRODUCTION

Based on the information provided in the previous sections of this report a combined preliminary conceptual site model and conceptual exposure model has been developed for the proposed future land use. This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors. In assessing the likely contaminants of concern present at the Site, reference has also been made to Defra and Environment Agency supporting documentation. A preliminary qualitative risk assessment has also been made of the likelihood of the linkage operating and its potential significance in accordance with CIRIA C552.

The preliminary conceptual model is presented in schematic form in section 6.9. The potential pollutant linkages identified and the qualitative risk assessment for these are presented in Conceptual Site Model.

The terms used in the preliminary qualitative risk assessment are defined in **Appendix A**.

The following sections discuss all the identified potential on and off-site sources, pathways, and receptors in the context of the proposed development and plausible pollutant linkages which may represent a risk to identified receptors such as human health and/or controlled waters from the data gained from the desk study. At this stage, the assessment is qualitative and aimed to determine all pollutant linkages, irrespective of significance or allowing for uncertainty.

Three impact potentials exist for any given site, these are:

- The site impacting upon itself;
- The site impacting on its surroundings; and
- The surroundings impacting on the site.

All three impacts need to be considered in a risk assessment.

- Sources; these are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g., Made Ground, infilled ground etc).
- Pathways; a pathway is defined as a mechanism or route by which a contaminant encounters, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted upon in the context of the proposed development.
- Receptors; receptors are defined as people, living organisms, ecological systems, controlled waters, atmosphere, structures, and utilities that could be adversely affected by contaminant(s).

6.2 CONCEPTUAL SITE MODEL

Based on the data available the following Conceptual Site Model has been developed. The various components of the potential “source–pathway–receptor” pollutant linkages identified at the site.

6.3 HAZARDS IDENTIFIED WITH THE PROPOSED DEVELOPMENT

The hazard identification is based on the assumptions presented below:

- the site will be a residential development;
- the previous properties and outbuildings are a source of contamination.
- drinking water will be from mains supply.

6.4 POTENTIAL SOURCES OF CONTAMINATION

For the purpose of this assessment the potential contaminants of concern have been considered according to whether they are likely to have originated from on-site or off-site sources.

Potential On-site Sources of Contamination

- Old Builders Yard - TPHs, heavy metals (primarily lead) and PAHs, asbestos
- Gardens - heavy metals and PAHs

Potential Off-site Sources of Contamination

- Closest Refuse Tip 100m north – potential ground gas source
- Old infilled gravel pit 110m north – potential ground gas source
- Existing and former vehicle repair Garages – closest 60m to NE – potential source of hydrocarbon contamination, however unlikely to impact the development site.
- Cemetery – 50m to NW – no credible sources of contamination to proposed development.
- Substation – closest is located 140m south. The substation was built in 1982, therefore is unlikely to be a source of PCBs contamination. The distance from the substation to the site means it would not be a source of contamination.

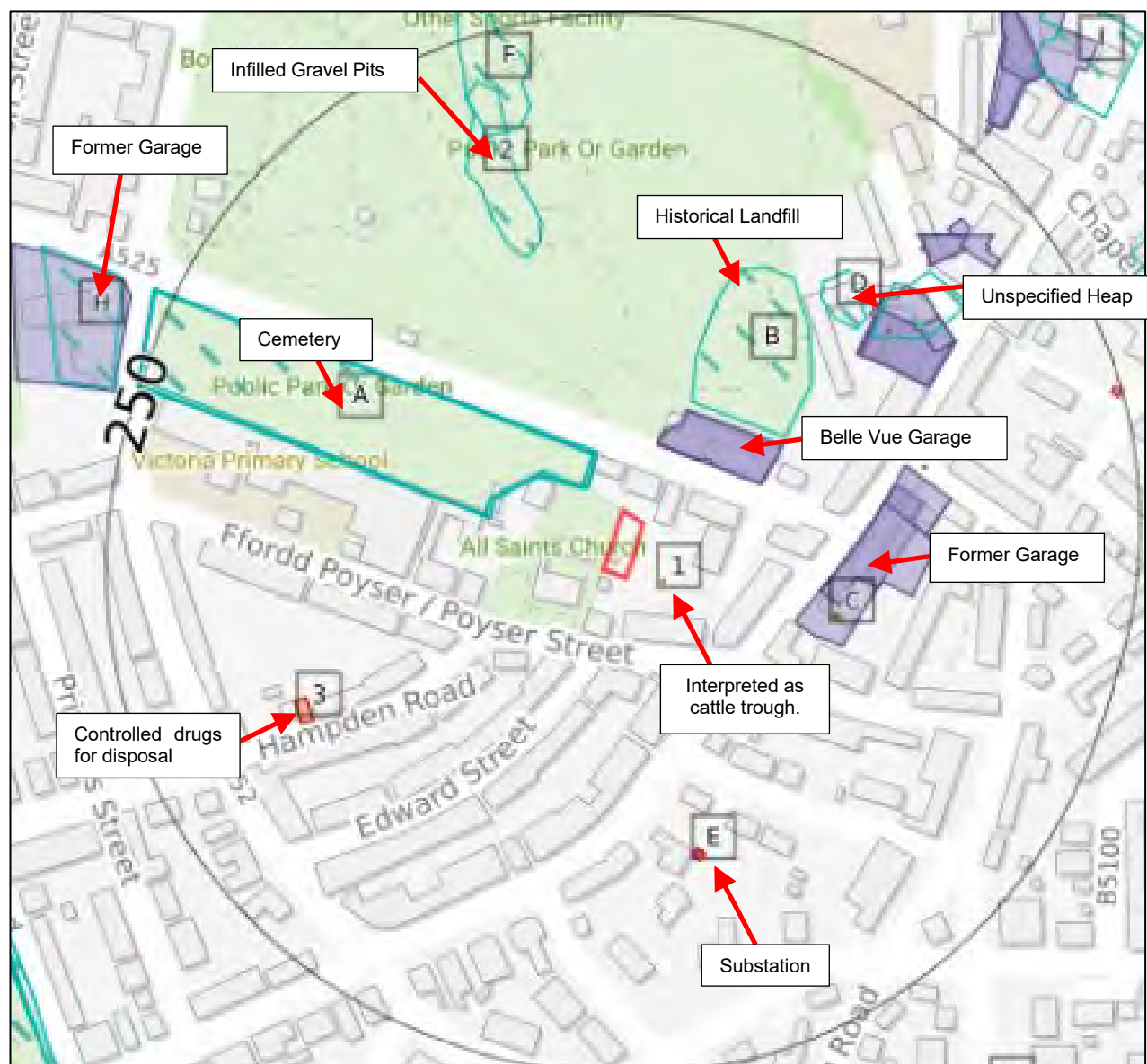


Figure 1 – Extract from Groundsure Report GS-UQ7-1BY-YTO-AFG – Past Land uses

6.5 POTENTIAL RECEPTORS OF CONTAMINATION

Based on the data previously discussed, the following potential receptors to contamination have been identified:

Table 6.1 - Identified Potential Receptors

Sensitive Receptors	
A	Humans – Predevelopment completion, i.e., working on site during demolition and construction.
B	Humans living on the site post construction.
C	Controlled waters – Surface Waters (rivers and streams)
D	Groundwater in the secondary A aquifer.
E	Local flora and fauna during and post construction.
F	Building structure and services.

The possible contaminant linkages are discussed below. It should be noted not all may be formed between all sources and receptors.

The preliminary assessment of risks undertaken for the development considers potential risks to receptors A to F in **Table 6.1** above. The receptors A to F incorporate each of the receptors normally required by the Local Authority to be considered in their planning conditions relating to land contamination:

- Human Health (A & B)
- Property (including buildings, crops, livestock, pets, woodland, service lines) (E & F)
- Adjoining land (D & F)
- Groundwater and surface water (C & D)
- Ecological systems (E)
- Buildings and structures (F)

It should be noted that there are no archaeological sites or ancient monuments considered to be within the zone of influence of the site. They are therefore not considered in the risk assessment.

6.6 IDENTIFICATION OF PATHWAYS

Pathways to Human Health

There are various routes by which a potential contaminant may reach a receptor. For example, in areas where contaminated material is exposed, dermal contact with the material, inhalation or ingestion of dust may occur.

Inhalation or ingestion of dust and water could occur during the construction and development phase at the site. Pathways from dermal contact with soil and groundwater may also arise. It is considered that the risk of short-term exposure for ground workers and other construction workers is low unless there are asbestos fibres are encountered.

Post construction, the surface of the development area will be occupied with buildings and hard standing, with smaller garden areas. This will effectively eliminate the persistence of potential pathways such as long-term direct contact and dust inhalation/ingestion as long as the soil in the garden areas has no significant concentrations of contaminants.

Ground Gas

There is no credible on-site ground gas source unless deep organic rich Made Ground is encountered.

There is the potential for ground gases may migrate from the historical landfill / infilled gravel pits further to the north. The site and surrounding areas are potentially underlain by glaciofluvial deposits with moderate gas permeability. After discussions with Characteristic Situation 2 gas protection measures in line with BS8485:2015+A1:2019.

Pathways to Controlled Waters

Groundwater levels at the site are anticipated to be at a depth of more than 5 m within the bedrock. However, there is the likelihood that perched groundwater will be present within / at the base of the glaciofluvial deposits. Lateral migration of potentially contaminated groundwater offsite (either via permeable made ground or the underlying aquifer) must be considered.

The vertical leaching of contaminants from any potential Made Ground into the groundwater is a potential pathway for contaminants to impact upon groundwater. The glaciofluvial deposits are anticipated to be underlain by Glacial Till (Clay) and therefore it is very unlikely for contaminants to make their way into the groundwater within the bedrock. The site is not located within a groundwater source protection zone.

Surface run off from contaminated areas into surface watercourses must also be considered. Due to a lack of a hard standing site surface, this will be uncontrolled prior to and during the groundworks phase when this must be carefully managed.

Post construction the majority of the site and surface run-off will be limited and controlled through drains.

There are no surface water features within 250m of the site. There is limited viable overland migration pathways for surface run off to reach any surface water receptor.

Other Pathways

Other potential pathways that are possibly less significant to the site but still require consideration are: potential phytotoxic effects on sensitive landscaping plants; chemical attack on foundations and services and permeation of contaminants through domestic water pipes. The risk to buildings from ground gases has been discussed under human health above.

6.7 CONTAMINANT LINKAGES

For each contamination source there are potential contaminant linkages with all receptors. However, in the context of this site, not all of the contaminant linkages are plausible, particularly those of potential groundwater contamination and lateral groundwater migration. The likelihood of the various pathways linking the contaminants to the receptors is presented in **Table 7.2** below:

Table 6.2 - Matrix of Contaminant Linkages

Source/ Contaminated Medium	Pathway	Receptor					
		A – Humans using the site pre-development completion	B – Humans living on the site post construction assuming clean garden	C – Surface water	D - Groundwater	E – Flora & Fauna Post Construction	F – Building & Services
Soil	Ingestion	P	P	-	-	U	-
	Dermal Contact/Direct Contact	P	P	-	-	U	P
	Inhalation	P	P	-	-	U	-
	Infrastructure/Drainage	P	U	P	P	U	P
	Groundwater	P	U	U	U	U	P
	Surface Water	P	U	P	P	U	P
Groundwater	Ingestion	P	U	-	-	U	-
	Inhalation	P	U	-	-	U	-
	Dermal Contact	P	U	-	-	U	-
	Groundwater	P	U	P	P	U	P
	Surface Water	P	U	P	P	U	P
Radon	Migration	-	U	-	-	-	-
Gas (CH ₄ CO ₂)	Migration	P	P	-	-	U	U
Key to significance of contaminant linkages S = Significant Pathway P = Possible Pathway U = Unlikely Pathway - = Not Applicable Only Significant and Possible contaminant linkages are taken forwards to the next part of the risk assessment.							

6.8 UNCERTAINTIES

The following uncertainties exist in the preliminary conceptual model:

- The presence of any features unrecorded by the historic maps.
- Any unrecorded geological features.
- Any unrecorded pollution events during the Site's history.

6.9 CONCEPTUAL SITE MODEL

In accordance with BS 10175, a schematic section has been developed for the site based on the previously presented data and contaminant linkage assessment:

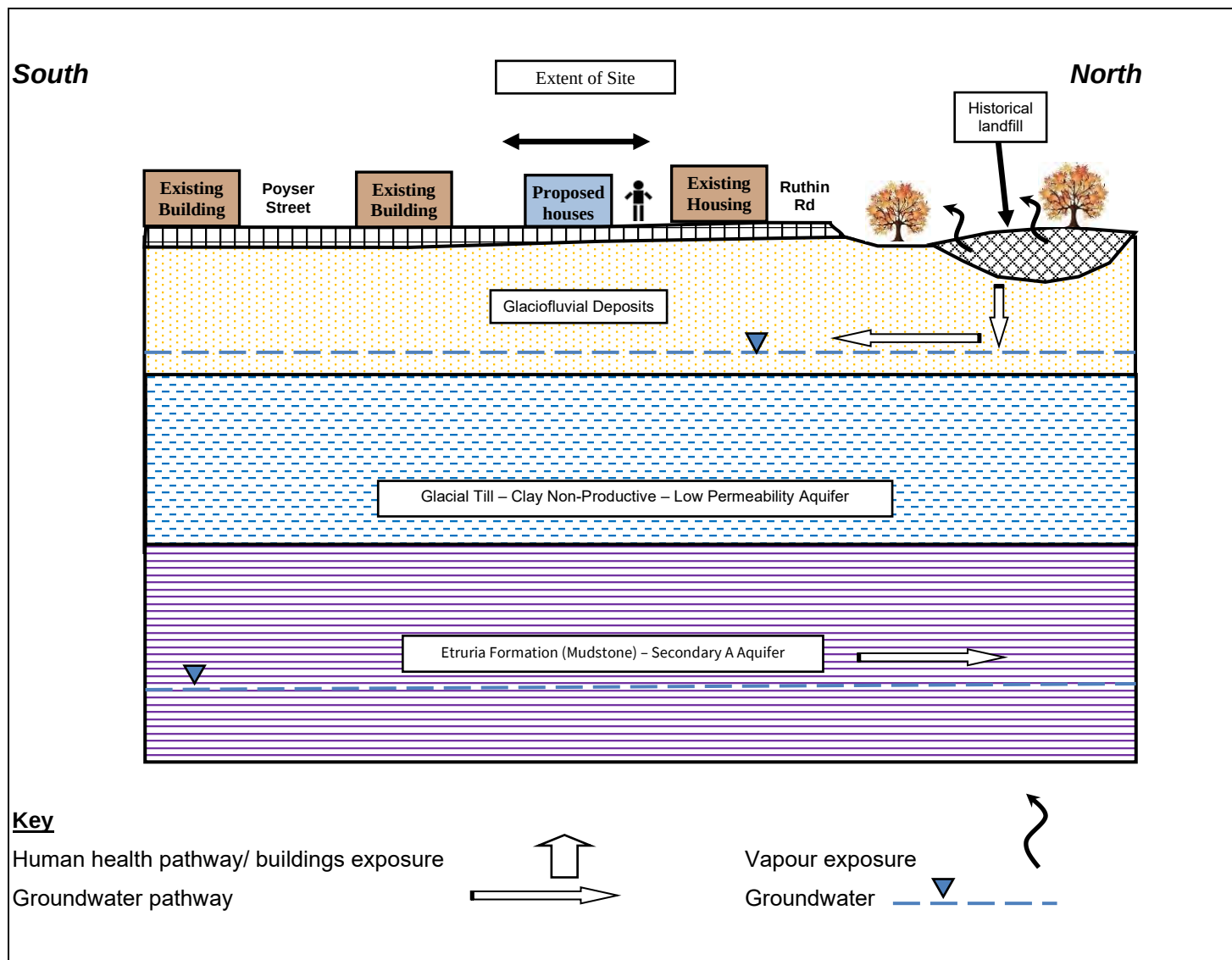


Figure 2: Preliminary Conceptual Ground Model – Schematic Section (not to scale)

The model shows the predicted geology and topography, the major on-site potential contamination sources, and vulnerable receptors.

The information presented above represents the preliminary conceptual ground model that may need to be revised based on information obtained as part of any future intrusive investigation. A number of sensitive receptors and potential pathways and sources (in association with a list of likely contaminants) have been identified.

The ground model and proposed end use described above should be considered broadly representative of the standard housing (with vegetable uptake) as defined in SR3 "Updated Technical Model to the CLEA Model" (SC050021/SR3, 2011) for the purpose of this report.

6.10 PRELIMINARY ASSESSMENT OF POTENTIAL POLLUTANT LINKAGES

The preliminary hazard assessment is based on current available guidance published by a number of sources and is summarised in Appendix A. A preliminary conceptual site model for this site has been established using the desk study information and has been used as a basis for the preliminary hazard assessment. The significant and possible potential pathways are only considered for the hazard assessment.

The preliminary hazard assessment is a qualitative assessment of the risks posed by each viable pollution link identified. The hazard assessment leads to a recommended subsequent activity that could be:

- Action Required (AR) in the short term to break existing contaminant-pathway-receptor (CPR) link;
- Site Investigation Required (SIR) with objectives for risk estimation, or
- No Action Required (NAR) at this stage.

6.11 PRELIMINARY ASSESSMENT OF POTENTIAL POLLUTANT LINKAGES

Table 6.3 - CSM Risk Assessment

Hazard Identification				Hazard Assessment			
Link	Contaminant	Pathway	Receptor	Probability	Consequence	Risk	Hazard Assessment
1	Contaminated soil/made ground/groundwater.	Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	A- Humans using the site during construction.	Low	Mild	Moderate (M)	SIR - Total soil concentration of relevant contaminants for contractors and designer's risk assessments.
2		Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	B- Humans using the site after development completion. No change of use.	Low	Mild	Low (L)	SIR- Total soil concentration of relevant contaminants for contractor's risk assessments.
3		Via service pipes	B- Humans using the site after construction. F- Building structures	Low	Medium	Mod/Low Risk (M/L)	SIR - Total soil concentration of relevant contaminants
4		Downward migration	D- Perched groundwater	Low	Medium	Mod/Low Risk (M/L)	SIR- Total soil concentration of relevant contaminants for contractor's risk assessments.
5		Downward migration	D – Secondary bedrock aquifer /water supply	Low	Medium	Medium/ Low	Potential Made Ground is in direct contact with bedrock aquifer - SIR
6	Gas – Made Ground/ organic soils & Hydrocarbon vapours	Inhalation	A & B- Humans using the site during construction and after development completion.	Low	Medium	Low to Moderate (M)	SIR to prove ground conditions and presence of any hydrocarbons impact

7 FIELDWORK

7.1 INTRODUCTION

The fieldwork was carried out on 6th June 2023. GroundSolve personnel were present to supervise all work, describe the ground encountered, and take samples. Fieldwork procedures were undertaken in accordance with the relevant sections of:

- British Drilling Association "Guidance for Safe Intrusive Activities on Contaminated or Potentially Contaminated Land" (2008);
- BS5930:2015 + A1:2020 "Code of Practice for Site Investigations;"
- BS10175:2011 + A2:2017 "Investigation of Potentially Contaminated Sites – Code of Practice."

The investigation included:

- 3 No. Machine excavated trial pits to maximum depth of 2.1mBGL,
- Sampling for chemical testing of soils,
- Description of the ground encountered in accordance with BS5930:2015 + A1:2020, Code of Practice for Site Investigations.

7.2 TRIAL PITS

Three trial pits were excavated using a tracked excavator, where access permitted, across the site to depths of between 1.8m (TP03) and 2.1mbgl (TP02).

The trial pit logs and photographs are presented in **Appendix D** and the locations shown in **Drawings**.

7.3 SAMPLES AND SAMPLE CONTAINERS

Soil samples for chemical analysis each comprised a pair of samples: a plastic tub for metals and inorganics and an amber glass jar for organics.

Soil samples were stored in cool boxes with ice packs and dispatched directly to the testing laboratory, for all phases of the investigation.

7.4 SOAKAWAY TESTS

One soil infiltration (soakaway) test was carried out in accordance with BRE Digest 365 (2016) in trial pit TP01. Due to the relatively slow infiltration rate and the pit collapsing only one test was possible. The results are presented in Appendix E and summarised below.

Table 7.1 - Summary of soakaway testing

Hole	Test No.1	Depth (m bgl)	Water Level at start of Test (m bgl)	Head at start of test (m)	Infiltration Rate m/s
TP01	Test 1	2.0	0.5	1.5	1.08×10^{-5}

The soakaway test was carried out within the clayey sandy fine to coarse gravel Made Ground.

The test carried out within TP01 failed to drain past 25% volume of head. For indicative purposes, an extrapolated infiltration rate has been calculated by estimating the time it would have taken to drain 25% volume of head.

It is recommended that the design of the surface water drainage takes into account the underlying Glacial Clay encountered within TP02 and TP03.

8 LABORATORY TESTING

8.1 CHEMICAL LABORATORY TESTING

Chemical samples were submitted to a UKAS accredited laboratory in accordance with ISO17025 and are also MCERTS accredited for soil analysis in accordance with the Environment Agency's scheme. The laboratory carries out Quality Assurance and Quality Control in accordance with BS ISO 17025 and participate in external laboratory comparison and quality control schemes. Details of the accreditation and the methods of analysis are provided on the relevant test reports.

The selection of samples for laboratory testing and analytes to be determined were made based on the preliminary CSM and relevant observations during the investigations. The sample selection rationale is as follows:

- To gain a good coverage across the Site of the various material types and strata encountered;
- To investigate the specific locations of previous potentially contaminative land uses as identified within the Phase 1 desk study and subsequent CSM;

The selected soil samples were tested for a range of typical contamination indicators including specific tests for contaminants suspected as being present from the desk study, CSM, and observations made on-site. Tests were also performed which were used to support the modelling of contaminant transport and impacts (e.g., TOC) and for waste classification purposes.

Each of the soil samples were analysed for the 'total' concentration of a suite of potential contaminants.

The results of the laboratory analysis are presented in **Appendix F**. The various suites of analysis for the soil are presented in **Table 8.1** below:

Table 8.1 - Suites of Analysis for Environmental Soil Samples

Determinand	Soil Suite 1	Soil Suite 2
Number of Samples	3	3
Index Tests		
Asbestos Screen / Quantification	✓	✓
pH	✓	✓
Metals		
As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn (all totals)	✓	✓
Inorganics		
Acid Soluble Sulphate	✓	✓
Cyanide - Total	✓	✓
Sulphate (2:1 extract on soil samples)	✓	✓
Organics		
Phenols - Total (monohydric)	✓	✓
Total Organic Carbon (TOC)	✓	✓
PAH (Speciated USEPA 16)	✓	✓
Speciated TPH (C5-C35)	✓	-
BTEX	✓	-

9 GROUND CONDITIONS

9.1 GENERAL

The site investigations have allowed the site-specific ground conditions to be described and this information was used to provide an improved conceptual ground model. The geology encountered during the site investigations was different to the existing publicly available British Geological Survey (BGS) mapping for the area. The site was understood to comprise Glaciofluvial deposits (sand and gravel), however Glacial Clay deposits have been encountered underlying the Made Ground. A summary of the general strata encountered across the site is given in the following sub sections.

9.2 TOPSOIL

Topsoil was encountered within TP02 and TP03 ranging in thickness from 0.2m to 0.4m. The topsoil generally comprises dark brown sandy slightly gravelly clay.

9.3 ANTHROPOGENIC MATERIALS

Made ground was encountered within TP01 and TP02 ranging between 1.9m and 1.0m respectively. The Made Ground typically comprises dark brown clayey sandy fine to coarse sub-angular gravel including ceramics, brick, glass, and sandstone.

9.4 GLACIAL CLAY

TP02 and TP03 encountered firm brown slightly sandy slightly gravelly Clay ranging between 1.0m proven to 2.1m and 0.40m proven 1.8m respectively.

10 GENERIC QUANTITATIVE RISK ASSESSMENT

10.1 ASSESSMENT FOR THE PROTECTION OF HUMAN HEALTH

The results of the soil analyses are presented below, where they have been compared to suitable generic assessment criteria (GACs), in order to allow a generic quantitative risk assessment (GQRA) to be carried out for the site and the proposed development.

The Category 4 Screening Levels (C4SLs) published by DEFRA (2014) have been adopted in the first instance, which have been published for six substances to date. Where a C4SL is unavailable, the "Suitable 4 Use Levels" (S4ULs) published by LQM/CIEH (2015) have been adopted.

These criteria have been derived using the CLEA model for a range of standard end-use scenarios and a range of soil organic matter (SOM) contents. It should be noted that the C4SL values are derived on the basis of a "low level of toxicological concern", while the S4UL values are based on a "tolerable" or "minimal" level of risk. As such, the S4ULs describe a lower level of risk than the C4SLs and are equivalent to the former Soil Guideline Values (SGVs, published by the Environment Agency) and the previous editions of the LQM/CIEH GAC values.

The GQRA is based on a soil with a Soil Organic Matter of 1.0%, for residential end use.

A full summary of the chemical test results is presented in **Appendix G**.

Metals

The results from TP02 and TP03 have recorded very low concentrations with no exceedances of the applicable GACs. TP01 recorded deep Made Ground proven to 1.9m. The results from TP01 at 0.25m and 0.5m taken from the Made Ground have recorded elevated concentrations of Lead and Mercury and exceed the GAC for residential landuse with plant uptake.

PAHs

The results from the PAH analysis are typically low, there were no exceedance of the applicable GACs.

Petroleum Hydrocarbons (PHC)

No hydrocarbon impacted material was encountered during the fieldwork. The results from the chemical analysis have shown no exceedance of the relevant GACs.

Asbestos

Asbestos can be present in soil as fragments of bulk Asbestos Containing Materials (ACMs) (e.g., asbestos cement sheeting) and also as discrete asbestos fibres within the soil matrix. This investigation has carried out assessments to determine whether both bulk fragments of asbestos and discrete fibres are present in the soil at the site. The asbestos assessment commenced on site with inspection of the Made Ground by our site staff for the presence of bulk ACMs. During the fieldwork no suspected ACMs were identified.

No ACMs were found in the laboratory asbestos analysis.

10.2 ASSESSMENT FOR THE PROTECTION OF CONTROLLED WATERS

The total concentrations detected within soil samples are predominantly relatively marginal in human health terms and do not indicate particularly high concentrations which would be indicative of a significant source of groundwater contamination. Overall, it is assessed that there is a low possibility of a contaminant linkage between and the underlying groundwater in the Secondary A/Undifferentiated Aquifer.

GroundSolve believes that the site does not pose a significant risk to Controlled Water because:

- The groundwaters at and in the vicinity of the site are not abstracted for human consumption;
- The concentrations of potential contaminants within the Made Ground does not represent a significant source and are unlikely to present a significant risk to controlled waters.
- Glacial clay has been proven to be present under the site, therefore limiting any potential lateral or vertical migration.

10.3 PERMANENT GROUND GASES

There is the potential that ground gases may migrate from the historical landfill / infilled gravel pits further to the north. The site and surrounding areas are potentially underlain by glaciofluvial deposits with moderate gas permeability. In view of this and further to discussions with the Local Authority, it was agreed that Characteristic Situation 2 gas protection measures in line with BS8485:2015+A1:2019 would be adopted as a precautionary measure.

The Site is located within an area where the radon risk is low, with the highest risk estimated 1-3% of properties are affected by radon; therefore, no radon protective measures are required.

Background information relating to the origin and production of landfill and ground gases are presented in **Appendix H**, together with current guidance on the assessment of ground gases.

Gas Remediation Strategy

The proposed development comprises residential buildings. Based on *BS8485:2015 + A1:2019 Table 3* the new building can be classed as a *Type A buildings (Private, residential)* and from Table 4 of this standard a Score of 3.5 points of protection will be required for Characteristic Situation 2 ground gas conditions.

The standard does not provide set requirements, but it provides a menu of different options which in combination can be used to provide an appropriate Score as set out in Table 4 of this standard. An example of appropriate protection measures are:

- Floor Slab:
 - Block and beam ground floor slab – Score 0, or

- Cast in situ ground-bearing floor slab (with only nominal mesh reinforcement) – Score 0.5; or
- Cast in situ monolithic reinforced ground-bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations (with only nominal mesh reinforcement)– Score 1.0;
- Passive sub floor dispersal layer
 - Very good performance– Score 2.5;
 - Good performance– Score 1.5;Media used to provide the dispersal layer are:
 - Clear void
 - Polystyrene void forming blanket.
 - Geocomposite void former blanket.
 - No-fines gravel layer with gas drains.
 - No-fines gravel layer.
- gas resistant membrane meeting all of the following criteria – Score 2.0:

The installation of the ground gas protection measures will require independent verification in accordance with CIRIA C735 and BS8485:2015+A1:2019; the verification of correct installation forms part of the overall system of mitigation in both of these guidance documents. All elements of the gas protections will require verification.

10.4 RISKS TO HUMAN HEALTH (CONSTRUCTION PHASE)

During the construction works there will be a risk to on-site workers and people occupying adjacent properties. Appropriate risk assessments should be carried out by the contractor to allow appropriate controls for the mitigation of risk to health of construction workers to be put in place. This risk can be controlled to within acceptable limits by:

- Method statement for site activities including control of dust generation;
- Having adequate site hygiene facilities allowing staff to keep a good level of personal hygiene;
- The method statement shall have a contingency plan which should be implemented if the presence of significantly elevated levels of lead is suspected in groundworks; and
- Only permitting smoking or eating on site in appropriate pre-designated areas.

As a minimum it is anticipated the works will be undertaken in accordance with BRE best practise guidance, and that the following measures will be introduced to assist with control of dust generation during the groundworks phase of the works:

- Access roads and any stockpiles created during groundworks should be regularly damped down with water;
- Vehicles used to transport materials/wastes and aggregates should be enclosed or tarpaulined;
- Vehicle movements and speed should be kept to a minimum within the site ;
- Dust generating equipment (e.g., mobile crushing and screening equipment) should be located to minimise potential nuisance impacts to receptors as far as practicable; and
- Minimising drop heights of all loading and unloading activities that involve the transfer of soils and demolition materials.

10.5 CONCEPTUAL SITE MODEL

The proposed development comprises two residential properties with associated hardstanding surfaces / parking facilities and rear private garden areas.

The conceptual site model has been updated since the Phase 1 Preliminary Risk Assessment, as the findings of the Phase 2 site investigation revealed the following general downward succession:

- Site surface; topsoil (TP03);
- Made Ground; typically, clayey sandy fine to coarse gravel including ceramics, brick, glass, and sandstone.
- Natural Deposits; comprises Firm brown sandy slightly sandy clay.

The Made Ground appears to be limited to the access road, parking areas and proposed building plots. The chemical testing has been shown that the Made Ground encountered within TP01 would be unsuitable for use in the proposed soft landscaped areas. It is understood that the surface materials (0.2m to 0.3m) are to be removed from site and replaced with granular fill and macadam surfacing. It is considered that no further works will be required within this area as there will be no pathway between the Made Ground and end users of the site.

No Made Ground was encountered in TP03. The review of the historical mapping indicates that the northern part of the site has remained relatively undeveloped and separate to the builder's yard to the south.

The chemical testing carried out within TP02 and TP03 have shown there is no risk from potential contaminants. It is concluded that the existing topsoil encountered in the proposed private gardens are suitable for the proposed development.

Whilst unexpected contamination is not anticipated, the proposed development could encounter previously unrecorded hotspots of contaminants. These will be assessed and mitigated in accordance with current good practice as detailed in **Appendix J**.

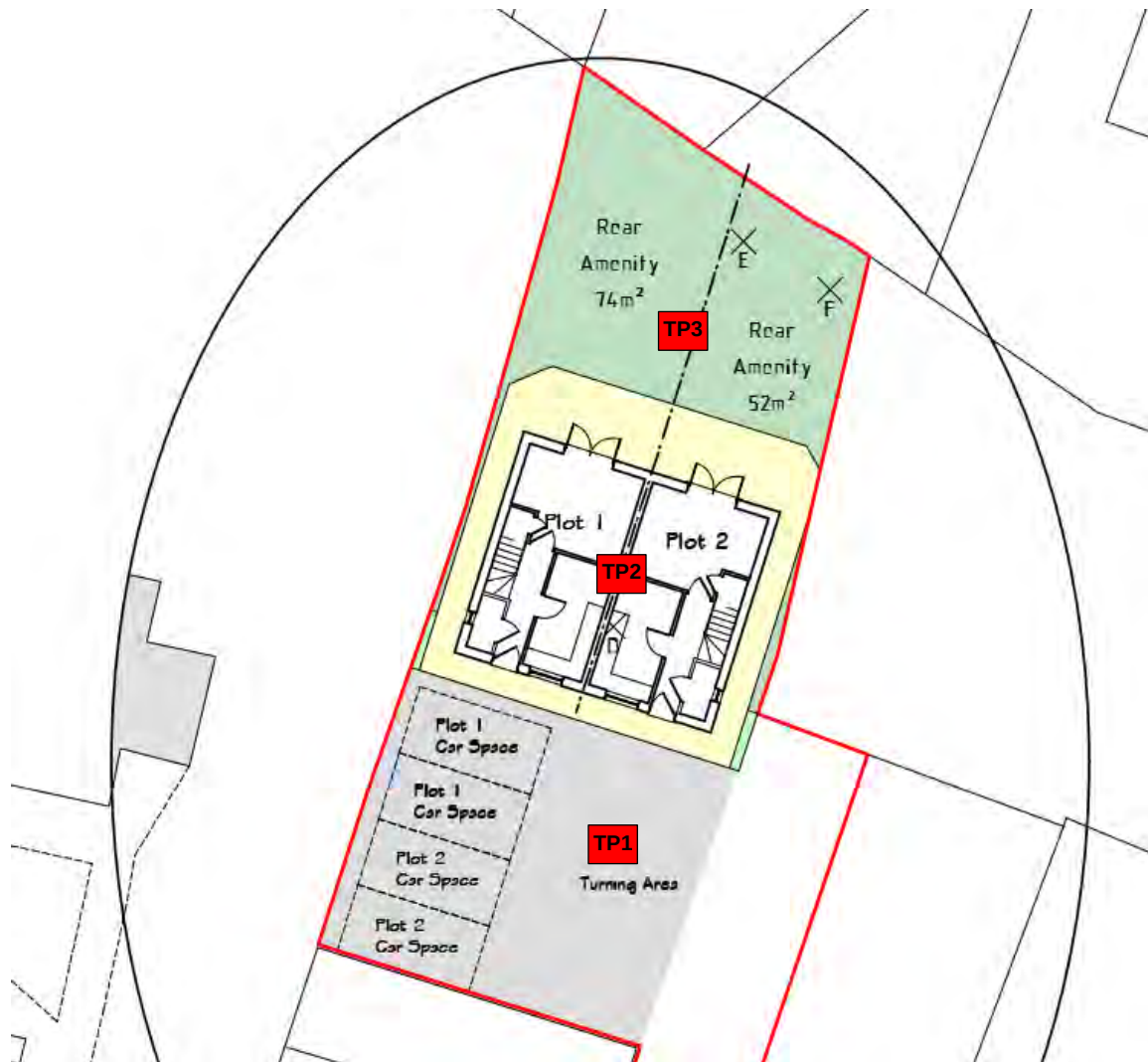


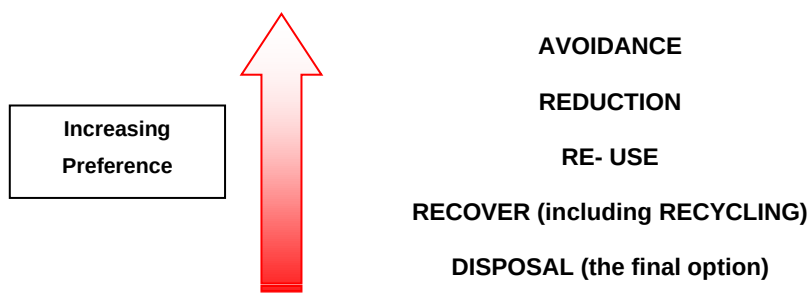
Figure 3 - Extract from Drawing F045/002_Site & Location Plan – Blue Print Architectural Services

Based on the Ground Gas Assessment, Ground gas (primarily methane and carbon dioxide) concentrations from historical landfills may present a potential risk to the proposed development. Due to the potential risks identified, it has been agreed with the local authority that Characteristic Situation 2 gas protection measures are adopted for the development in line with BS8485:2015+A1:2019. The installation of the ground gas protection measures will require independent verification in accordance with CIRIA C735.

11 WASTE ASSESSMENT

11.1 WASTE HIERARCHY

In accordance with government guidance, it is required that the production and disposal of waste is managed in accordance with the following hierarchy of preference:



11.2 WASTE CHARACTERISATION AND CLASSIFICATION

If there is a portion of excess soil this will then have to be sent to a suitable landfill site. A two-phase approach is required comprising:

- Waste Characterisation; and
- Waste Classification (Waste Acceptance Criteria).

Waste Characterisation

The results of the total concentrations from the chemical testing on soil samples have been assessed to determine whether or not they are hazardous in terms of waste classification. The results of this assessment indicate that none of the materials encountered during the investigation can be classified as hazardous.

Waste Classification

In order to determine whether soils can be sent to a licensed landfill for disposal further testing is required comprising landfill Waste Acceptance Criteria (WAC) analysis for both total concentrations for certain chemicals and for leachate analysis. No WAC testing was carried out as part of this investigation. WAC testing will have to be carried out to confirm the landfill waste classification and if any pre-treatment is required. This is best carried out once all material to be disposed of is stockpiled, and volumes can be accurately assessed.

Testing Frequency

There are also set requirements for the required sampling and testing frequencies for materials being sent for disposal at landfills. The required testing frequencies for each different waste type are summarised in **Table 11.1** below.

Table 11.1 Laboratory Sampling Testing Frequencies

Testing Level	Quantity of Waste	Number of Samples	
		Homogeneous	Heterogeneous & New Wastes
Level 1 Characterisation (Description, Total Concentrations & Leaching)	<100T	2	5
	<500T	3	8
	<1000T	5	14
	10,000 T	11	22
	Per additional 10,000T	+5 pro rata	+10 pro rata
Level 2 Compliance For Regularly Generated Wastes (Total Concentrations & Leaching)		1 per defined waste sub-population per year	3 per defined waste sub-population per year
Level 3 Verification Delivery document & visual check Chemical testing as per Level 2 suite		Visual – Each Load	Visual – Each Load
		1 per year per waste stream	3 per year per waste stream

12 CONCLUSIONS AND RECOMMENDATIONS

12.1 GROUND PROFILE

A preliminary risk assessment has been carried out based on the contaminant-pathway-receptor model as defined in Statutory Guidance to Part IIA of the Environment Protection Act, 1990, and in accordance with BS 10175: 2011 +A1 2013 “Investigation of Potentially Contaminated Sites – Code of Practice”. The characteristic ground conditions and elements of the surrounding environment and has been summarised and a risk assessment carried out.

The proposed development comprises a pair of semi-detached residential properties with associated car parking and garden areas.

The conceptual site model has been updated since the Phase 1 Preliminary Risk Assessment, as the findings of the Phase 2 site investigation revealed the following general downward succession:

- Site surface; topsoil (TP03);
- Made Ground; typically, clayey sandy fine to coarse gravel including ceramics, brick, glass, and sandstone.
- Natural Deposits; comprises Firm brown sandy slightly sandy clay.

12.2 ENVIRONMENTAL RISK ASSESSMENT

A preliminary risk assessment has been carried out based on the contaminant-pathway-receptor model as defined in Statutory Guidance to Part IIA of the Environment Protection Act, 1990, and in accordance with BS 10175:2011 + A2 2017 “Investigation of Potentially Contaminated Sites – Code of Practice”. In order to make a more detailed assessment of the potential hazards, a Phase 2 intrusive investigation was carried out to develop a more comprehensive conceptual ground model of the site. This detailed the characteristic ground conditions and elements of the surrounding environment and has assisted with identifying the potential contaminants of concern, the potential receptors of the contaminations and the pathways between them.

GroundSolve conclude that the risk from contaminants to the proposed development is considered low and will not require any remediation except for the potential risk from ground gases. Due to the potential risks identified, it has been agreed with the local authority that Characteristic Situation 2 gas protection measures are adopted for the development in line with BS8485:2015+A1:2019. The installation of the ground gas protection measures will require independent verification in accordance with CIRIA C735. As the site is within a low radon risk area, no radon protection will be required for the proposed development.

Whilst unexpected contamination is not anticipated, the proposed development could encounter previously unrecorded hotspots of contaminants. These will be assessed and mitigated in accordance with current good practice.

12.3 REGULATORY LIAISON

Any proposals to remediate or develop the site should be agreed with the relevant authorities (e.g., local authority environmental health officer, Environment Agency etc) to obtain Planning Permission prior to commencement of the works and should be agreed with the NHBC or similar, or with the local authority building control officer prior to commencement of the works. Where remediation works are required, a verification report should be submitted to the relevant authorities for approval in accordance with relevant Planning Conditions.

12.4 HEALTH AND SAFETY

As outlined within the HSE publication “Successful Health and Safety Management – HSG65” this report should inform your development of safe systems of work and information as an input into the safety management system. The contents of this report may be used to supplement the contents of the Health and Safety File as required under the Construction Design and Management (CDM) Regulations 2015. All risk control measures should be in accordance with the guidelines laid down within the Management of Health and Safety at Work Regulations 1999.

In accordance with the Construction Design and Management (CDM) Regulations 2015, GroundSolve has acted in the role of Principal Contractor and as Principal Designer for the works as described in this report. With issue of this report, GroundSolve has discharged and completed all contractual and legal requirements for these positions, and we have no further involvement with the project.

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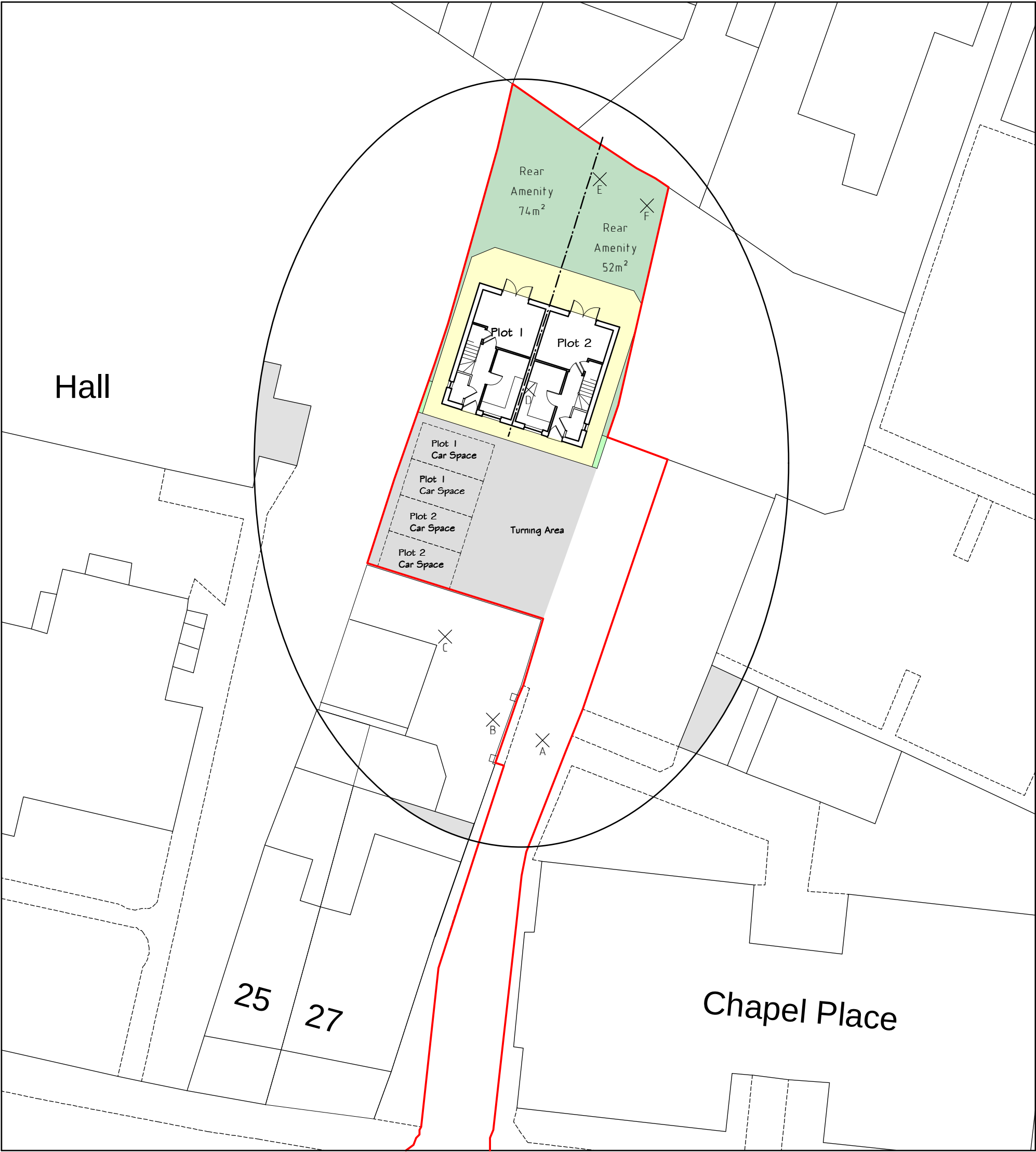
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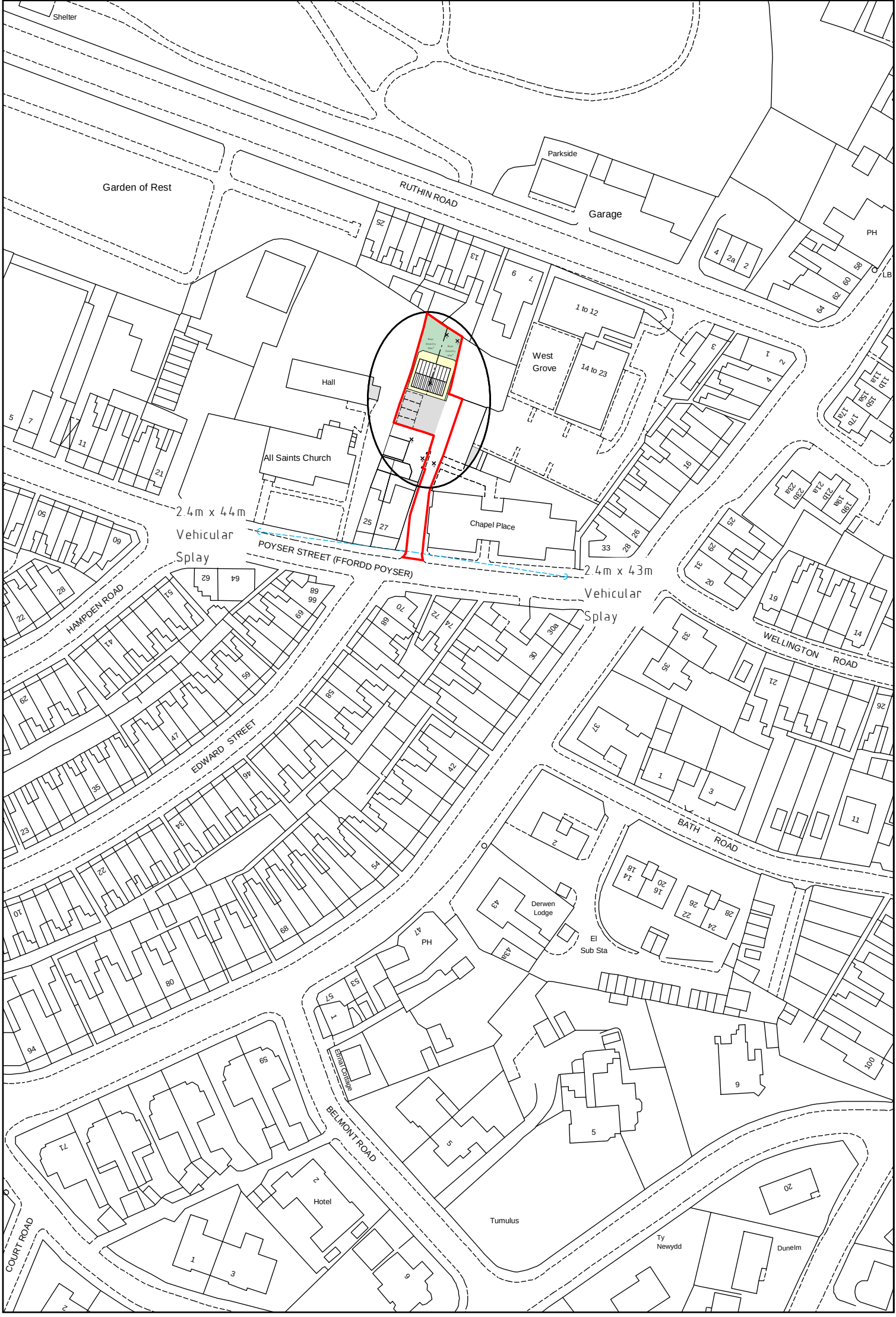
Coal Authority Interactive Map Viewer, <http://mapapps2.bgs.ac.uk/coalauthority/home.html>

BGS Geology of Britain Viewer <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

DRAWINGS



Site Plan 1:250

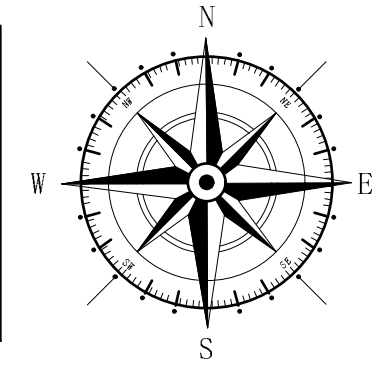


Location Plan 1:1250

Key	Level
A	10.000
B	10.050
C	9.983
D	10.083 (FFL)
E	10.219
F	9.943

Key

- Surrounding Buildings
- Proposed Site
- Land Owned by Client



Rev	Date	Detail	Initial

Project:
Proposed residential development at 27 Poyser Street, Wrexham, LL13 7RT.

Title: Proposed: Site & Location Plan	Scale: (A2) 1:250 & 1:1250
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Drawn By: S Hatherall	Date: August 2021
Drawing No: FO45/002	Sheet: 1 of 1

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APPENDIX A: ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY AND TERMINOLOGY

Environmental Risk Assessment Methodology & Terminology

LEGISLATION OVERVIEW

This report includes hazard identification and environmental risk assessment in line with the risk-based methods referred to in relevant UK legislation and guidance. Government environmental policy is based upon a “suitable for use approach,” which is relevant to both the current use of land and also to any proposed future use. The contaminated land regime is the statutory regime for remediation of contaminated land that causes an unacceptable level of risk and is set out in Part 2A of the Environmental Protection Act 1990 (“EPA 1990”). The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health, or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

“any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

a) Significant harm is being caused or there is a significant possibility of such harm being caused;

or

b) Pollution of controlled waters is being, or is likely to be, caused.”

In order to assist in establishing if there is a “significant possibility of significant harm” there must be a “contaminant linkage” for potential harm to exist. That means there must be a source(s) of contamination, sensitive receptors present and a connection or pathway between the two. This combination of contaminant-pathway-receptor is termed a “contaminant linkage or CPR linkage.”

Part IIA of The Environmental Protection Act 1990 is supported by a substantial quantity of guidance and other Regulations. Key implementing legislation of the Part 2A regime includes the Contaminated Land (England) Regulations 2006 (SI 2006/1380) as amended by the overarching legislation for the contaminated land regime, which implements the provisions of Part IIA of the Environmental Protection Act 1990 (as inserted by section 57 of the Environment Act 1995), came into force on 14th July 2000 together with recent amended regulations: Contaminated Land (England) (Amendment) Regulations 2012 (SI 2012/263). Revised Contaminated Land Statutory Guidance was published by DEFRA in April 2012. Part IIA defines the duties of Local Authorities in dealing with it. Part IIA places contaminated land responsibility as a part of planning and redevelopment process rather than Local Authority direct action except in situations of very high pollution risk.

In the planning process guidance is provided by National Planning Policy Framework (NPPF) of July 2018 which requires that a site which has been developed shall not be capable of being determined “contaminated land” under Part IIA. In practice, Planning Authorities require sites being developed to have a lower level of risk post development than the higher level of risk that is required in order to determine a site as being contaminated in accordance with Part IIA. This is to ensure that there is a suitable zone of safety below the level for Part IIA determination and prevent

recently developed sites becoming reclassified as contaminated land if there are future legislative or technical changes (e.g., a substance is subsequently found to be more toxic than previously assessed this increases its hazard).

The criteria for assessing concentrations of contaminants and hence determining whether a site represents a hazard are based on a range of techniques, models and guidance. Within this context it is relevant to note that Government objectives are:

- a) to identify and remove unacceptable risks to human health and the environment;
- b) to seek to bring damaged land back into beneficial use;
- c) to seek to ensure that the cost burdens faced by individuals, companies and society as a whole are proportionate, manageable and economically sustainable.

These three objectives underlie the "suitable for use" approach to risk management and remediation of contaminated land. The "suitable for use" approach focuses on the risks caused by land contamination. The approach recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land and a wide range of other factors, such as the underlying geology of the site. Risks therefore should be assessed on a site-by-site basis.

The "suitable for use" approach then consists of three elements:

- a) ensuring that land is suitable for its current use - in other words, identifying any land where contamination is causing unacceptable risks to human health and the environment, assessed on the basis of the current use and circumstances of the land, and returning such land to a condition where such risks no longer arise ("remediating" the land); the contaminated land regime provides the regulatory mechanisms to achieve this;
- b) ensuring that land is made suitable for any new use, as planning permission is given for that new use - in other words, assessing the potential risks from contamination, on the basis of the proposed future use and circumstances, before official permission is given for the development and, where necessary to avoid unacceptable risks to human health and the environment, remediating the land before the new use commences; this is the role of the town and country planning and building control regimes; and
- c) limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought - in other words, recognising that the risks from contaminated land can be satisfactorily assessed only in the context of specific uses of the land (whether current or proposed), and that any attempt to guess what might be needed at some time in the future for other uses is likely to result either in premature work (thereby running the risk of distorting social, economic and environmental priorities) or in unnecessary work (thereby wasting resources).

The mere presence of contaminants does not therefore necessarily warrant action, and consideration must be given to the scale of risk involved for the use that the site has and will have in the future.

OVERALL METHODOLOGY

The work presented in this report has been carried out in general accordance with recognised best practice as detailed in guidance documents such as in the EA online guidance: Land Contamination: Risk Management (LCRM) (Environment Agency, 2020), and BS10175:2011+A2 2017. Important aspects of the risk assessment process are transparency and justification. The particular rationale behind the risk assessments presented is given in this appendix.

The first stage of a two-staged investigation and assessment of a site is the Preliminary Investigation (BS 10175:2011), often referred to as the Phase 1 Study, comprising desk study and walk-over survey, which culminates in the Preliminary Risk Assessment. A preliminary conceptual site model (CSM) is developed which identifies potential geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them. From the geo-environmental perspective, the Hazard Identification process uses professional judgement to evaluate all the hazards in terms of potential contaminant linkages (of contaminant source-pathway-receptor). Potential contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and generic risk assessment.

The second stage is the Ground Investigation, Generic Risk Assessment and Geotechnical Interpretation. This represents the further assessment mentioned above. The scope of the Ground Investigation is based on the findings of the Preliminary Risk Assessment and is designed to reduce uncertainty in the geotechnical and geo-environmental hazard identification. The Ground Investigation comprises fieldwork, laboratory testing and usually also on-site monitoring. The Ground Investigation may include the Exploratory, Main and Supplementary Investigations described in BS 10175:2011+A2 2017. The results of the Ground Investigation reduces uncertainty in the geotechnical and geo-environmental risks. Depending on the findings more detailed investigations or assessments may be required.

PRELIMINARY RISK ASSESSMENT

Current practice recommends that the determination of potential liabilities that could arise from land contamination be carried out using the process of risk assessment, whereby “risk” is defined as:

- “(a) The probability, or frequency, or occurrence of a defined hazard; and
- (b) The magnitude (including the seriousness) of the consequences.”

The UK’s approach to the assessment of environmental risk is set out in by the Department of the Environment Transport and the Regions (2000) publication “A Guide to Risk Assessment and Risk Management for Environmental Protection” (also called Greenleaves II). This established an iterative, systematic staged process which comprises:

- a) Hazard identification;
- b) Hazard assessment;
- c) Risk estimation;
- d) Risk evaluation;
- e) Risk assessment;

At each stage during the development process, the above steps are repeated as more detailed information becomes available for the site.

For an environmental risk to be present, all three of the following elements must be present:

- Source/Contaminant: hazardous substance that has the potential to cause adverse impacts;
- Receptor: target that may be affected by contamination: examples include human occupants/users of site, water resources (rivers or groundwater), or structures;
- Pathway: a viable route whereby a hazardous substance may come into contact with the receptor.

The absence of one or more of each component (contaminant, pathway, receptor) would prevent a contaminant linkage being established and there would be no significant environmental risk.

The identification of potential contaminant linkages is based on a Conceptual Model of the site, which is subject to continual refinement as additional data becomes available. As part of a Preliminary Risk Assessment (Desk Study and site walk over) a Preliminary Conceptual Site Model (PCSM) is formed. Based on the PCSM, potential contaminant linkages can be assessed. If the PCSM and hazard assessment indicate that a contaminant linkage is not of significance then no further assessment or action is required for this linkage. For each significant and potential linkage, a risk assessment is carried out. The linkages which potentially pose significant risks may require a variety of responses ranging from immediate remedial action or risk management or, more commonly, further investigation and risk assessment. This next stage is termed a Phase II Main Site Investigation and should provide additional data to allow refinement of the Conceptual Site Model and assess the level of risk from each contaminant linkage.

Definition of Risk Assessment Terminology

CIRIA Report C552, Contaminated Land Risk Assessment A Guide to Good Practice, 2001 sets out a methodology for estimating risk. The methodology for risk evaluation is a qualitative method for interpreting the output for the risk estimation stage of the assessment. It involves the classification of the:

- Magnitude of the potential consequence (severity) of risk occurring.
- Magnitude of the probability (likelihood) of the risk occurring.

The classification of consequence and probability are set out in table B1 and B2 below:

Table B1 Classification of Consequence

Classification	Definition	Examples
Severe (Sv)	Short term (acute) risk to human health likely to result in “significant harm” as defined by the Environment protection Act 1990, Part IIA. Short term risk of pollution of controlled waters. Catastrophic damage to buildings / property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem	High concentrations of cyanide on the surface of an informal recreation area Major spillage of contaminants from site into controlled water. Explosion causing building collapse (can also equate to a short-term human health risk if buildings are occupied.)
Medium (Md)	Chronic damage to Human Health (“significant harm”). Pollution of controlled waters. A significant change in a particular ecosystem, organism forming part such ecosystem.	Concentrations of contaminants from site exceeding generic or site-specific screening criteria. Leaching of contaminants into a major or minor aquifer. Death of species within a designated nature reserve.
Mild (Mi)	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures, and services. Damage to sensitive buildings / structures / services or the environment.	Pollution of non-classified groundwater. Damage to building, rendering it unsafe to occupy (e.g., foundation damage resulting in instability)
Minor (Mr)	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by measures such as protective clothing etc). Easily repairable effects of damage to buildings, structures, and services.	The presence of contaminants at such concentrations that protective equipment is required during site work. The loss of plants in a landscaping scheme. Discolouration of concrete.

The classification of consequence does not take into account the probability of the consequence being realised. Therefore there may be more than one consequence for a particular pollutant linkage. Both a severe and medium classification can result in death. Severe relates to short term (acute) risk while medium relates to long term (chronic) risk. Mild relates to significant harm but to

less sensitive receptors. Minor classification relates to harm which is not significant but could have a financial cost.

Table B2 Classification of Probability

Classification	Definition
High likelihood (Hi)	There is a pollutant linkage and an event that either appears very likely in the short term and almost inevitable in the long term, or there is evidence at the receptor or harm or pollution.
Likely (Li)	There is a pollutant 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 (Lw)	There is a pollutant 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 short term.
Unlikely (Ul)	There is a pollutant linkage, but circumstances are such that it is improbable that an event would occur even in the very long term.

The classification gives a guide as to the severity and consequence of identified risk when compared with other risk presented on the site. It should be noted that if a risk is identified it cannot be classified as “no risk” but as “very low risk”. Differing stakeholders may have a different view on the acceptability of a risk.

Once the consequence and probability have been classified these can be compared using a matrix (**Table B3**) to identify an overall risk category. These categories and the actions required are categorised in **Table B4**.

Table B3 Risk Evaluation Matrix

		Consequence			
		Severe (Sv)	Medium (Md)	Mild (Mi)	Minor (Mr)
Probability	High likelihood (Hi)	Very High Risk (VH)	High Risk (H)	Moderate Risk (M)	Mod/Low Risk (M/L)
	Likely (Li)	High Risk (H)	Moderate Risk (M)	Mod/Low Risk (M/L)	Low Risk (L)
	Low likelihood (Lw)	Moderate Risk (M)	Mod/Low Risk (M/L)	Low Risk (L)	Very Low Risk (VL)
	Unlikely (Ul)	Mod/Low Risk (M/L)	Low Risk (L)	Very Low Risk (VL)	Very Low Risk (VL)

Table B4 Risk Categorisations

Very High Risk (VH)	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 are likely to be required.
High Risk (H)	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 (M)	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 (L)	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 (VL)	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.

GENERIC QIANTITATIVE RISK ASSESSMENT

In the following sections the current UK guidance on risks to the following receptors are discussed: human health, plant life and controlled waters

Human Health

The overall methodology for assessing the risk to human health from potential contaminants in soil is set out in the Environment Agency's guidance "Using Soil Guideline Values" SC050021/SGV Introduction, March 2009 and using the CLEA 1.06 model software (and CLEA 1.071 for nickel). The generic assessment criteria are in accordance with the following:

- Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil;
- Science Report SC050021/SR3: Updated technical background to the CLEA model;
- Science Report SC050021/SR4: CLEA Software (Version 1.071, 2014) & Handbook;
- Toxicological reports and SGV technical notes;
- Toxicological data published by LQM/CIEH (2009) and CL:AIRE/EIC/AGS (2009);
- DEFRA Development of Category 4 Screening Levels for assessment of land affected by contamination - SP1010 (December 2013);
- LQM/CIEH Suitable 4 Use Levels (S4ULs) for Human Health Risk Assessment; and,
- Toxicology review published by the European Food Safety Authority for nickel (2015).

In March 2014 six 'proposed' Category 4 Screening Levels (pC4SL) were issued by Defra. These screening values are considered to be within Category 4 as defined in the Contaminated Land Statutory Guidance and indicate safe levels for new developments passing through the planning system. The SGV for lead has been withdrawn, and the pC4SL for lead has been derived using current best practice. In January 2015 LQM/CIEH published S4ULs for 89 contaminants in accordance with the C4SL methodology.

Note that groundwater contamination may pose a risk to human health but that there are no relevant generic assessment criteria available for comparison. GroundSolve has derived our own assessment criteria for this.

Phytotoxic Risks

Generic assessment of phytotoxicity is by comparison with guideline values presented in the British Standard for Topsoil and the MAFF document "Code of Good agricultural practice for the protection of soil", October 1998. This is in accordance with LCRM's reference to DEFRA notice CLAN 4/04.

Controlled Waters

Risks to controlled waters (groundwater and surface waters) from contaminants are assessed in accordance with the EA documents "The Environment Agency's Approach to Groundwater Protection" (2017) and Remedial Targets Methodology (RTM, 2006). Pollutant inputs from

contaminated land sites are considered as passive inputs under the European Water Framework Directive (2000/60/EC) (WFD) and its daughter Directives, and as such are regulated under the Environment Agency's 'limit' pollution objective. Acceptable water quality targets (WQT) are defined for protection of human health (based on Drinking Water Standards (DWS)) and for protection of aquatic ecosystems (Environmental Quality Standards (EQS)). The risk posed to controlled waters from total soil concentrations cannot be directly assessed. The risk is assessed either by comparison of results of leachate tests carried out on soil samples, or from the direct testing of samples of groundwater to screening criteria. Leachate testing generally forms a conservative assessment and is not appropriate for organic contaminants.

CURRENT GUIDANCE ON INTERPRETATION OF CHEMICAL ANALYSIS OF SOILS

Contaminated land is defined under law through Part IIA of the Environmental Protection Act 1990, implemented through Section 57 of the Environment Act 1995. This supports a 'suitable for use' based approach to the risk assessment of potentially contaminated land. The site-specific risk assessment is based upon assessment of plausible contaminant linkages, referred to as the contaminant-pathway- receptor model, based upon the current or proposed use of the site.

Before undertaking a risk assessment, a conceptual site model is devised in order to identify the potential contaminants, pathways and receptors. The individual contaminants, pathways and receptors then need to be further investigated in order to refine the initial assessment and risk assessment undertaken.

In March 2002, the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency published the Contaminated Land Exposure Assessment (CLEA) Model and a series of related reports. These were designed to provide a scientifically based framework for the assessment of chronic risks to human health from contaminated land. These reports (CLR7-10) together with associated "SGV" documents were withdrawn and the following documents have been published as revised guidance to the CLEA assessment:

- Environment Agency : 2008: Using Soil Guideline Values SC050021/SGV Introduction, March 2008.
- Environment Agency : 2008: Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil.
- Environment Agency : 2008: Science Report SC050021/SR3: Updated technical background to the CLEA model.
- Environment Agency : 2008 : Compilation of Data for Priority Organic Contaminants for Derivation of Soil Guideline Values Science report SC050021/SR7
- Environment Agency : Science Report SC050021/SR4: CLEA Software (Version 1.071, 2015) & Handbook.
- DEFRA Development of Category 4 Screening Levels for assessment of land affected by contamination - SP1010 (December 2013).
- LQM/CIEH Suitable 4 Use Levels for Human Health Risk Assessment.

Additional guidance on statistical assessment replacing CLR 7 is partly provided in:

- CL:AIRE: 2009: Guidance on Comparing Data With a Critical Concentration

A different approach to the statistical appraisal of data is required depending on whether the assessment of risk is to assess whether land is Contaminated Land in accordance with regulations, or whether the assessment is to assess whether the site is suitable for new development in according with Planning guidance. This is discussed further in CL:AIRE: 2009 "Guidance on Comparing Data With a Critical Concentration".

The introduction of the Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) reassessed the CLEA Model and the derived SGVs (and associated GACs calculated using the model). This re-assessment concluded that the SGVs/GACs were conservative screening criteria for determining the suitability of soil with regard to the risk to human health under the planning regime and defined a new upper limit for planning purposes which is the boundary between the new Category 3 and 4. In March and September 2014 DEFRA issued guidance on these new Category 4 Screening Levels (C4SL) and these are discussed further below.

Soil Guideline Values

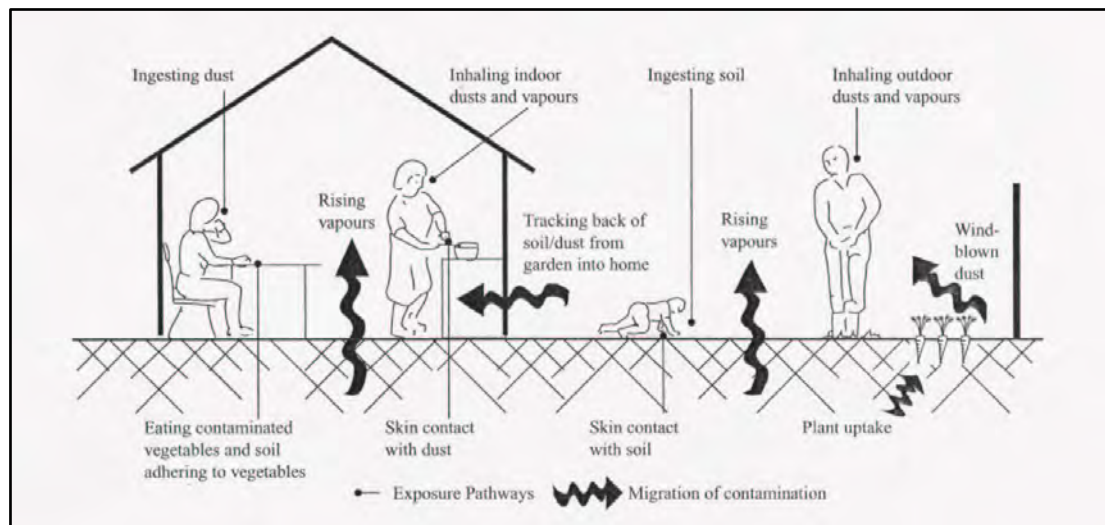
A program for the derivation of SGVs based on the above guidance is provided by the Environment Agency and is entitled “CLEA Software Version 1.06”. These reports, together with supporting toxicology reviews (“Tox” or Supplementary Information Reports) for individual substances (which will be gradually updated), Soil Guideline Value Reports and other guidance referred to in the above documents, provide guidance and the scientific basis for assessing the risk to human health from potential contaminants. Soil Guideline Value Reports (SGV Reports) have been published for a number of contaminants and these are published on the Environment Agency website. Eventually the reports will include SGVs for:

- heavy metals and other inorganic compounds: arsenic, cadmium, chromium, cyanide, lead (now withdrawn), mercury nickel (now withdrawn), and selenium;
- benzene, ethylbenzene, toluene, and xylenes;
- phenol;
- dioxins and dioxin-like polychlorinated biphenyls (PCBs);
- polycyclic aromatic hydrocarbons (PAHs) – 11 substances.

In September 2015, CLEA was re-issued as ‘CLEA Version 1.071’. Currently, the software has been used to produce an in-house GAC for nickel, following with withdrawal of the SGV.

In addition, CIEH through LQM and the EIC have published generic assessment criteria (GACs) for a wide variety of other parameters including metals, hydrocarbons, chlorinated aliphatic compounds, PAHs and explosive substances for three standard land uses. These have been produced to supplement the Environment Agency guidance. These GACs will be replaced by SGVs when or if the Environment Agency publishes any more SGVs.

The CLEA model has been developed to calculate an estimated tolerable daily soil intake (TDSI) for site users given a set ‘default’ exposure pathways. Ten human exposure pathways are covered in the CLEA model as presented below:



- Ingestion:
 - ingestion of outdoor soil;
 - ingestion of indoor dust;
 - ingestion of home-grown vegetables;
 - ingestion of soil attached to home grown vegetables.
- Dermal Contact:
 - dermal contact with outdoor soil;
 - dermal contact with indoor dust.
- Inhalation:
 - inhalation of outdoor dust;
 - inhalation of indoor dust;
 - inhalation of outdoor soil vapour;
 - inhalation of indoor soil vapour.

It should be noted that there are other potential exposure pathways on some sites not included in the CLEA model e.g., certain organic compounds can pass through plastic water pipes into drinking water supply.

The presence and/or significance of each of the above exposure pathways are dependent on the type of land use being considered and the nature of the contaminant under scrutiny. Accordingly, the CLEA model considers for principle 'default' land use types and makes a series of 'default' assumptions with regard to human exposure frequency, duration and critical human target groups for each land use considered:

- residential land use;
- allotments;
- commercial and industrial land use.

The land use categories defined in the CLEA are detailed below.

Residential: This land use category assumes that people live in a variety of dwellings including terraced, detached and semi-detached houses up to two storeys high. The structure of buildings varies. Default parameters for building materials and building design are included in CLEA documents to calculate the relevant multi-layer diffusion coefficients for vapour intrusion and to model indoor vapour intrusion. The CLEA model assumes that regardless of the style of housing the residents will have access to either a private garden or community open space nearby, and that soil tracked into the home will form indoor dust. It allows for the ingestion pathways from home grown vegetables.

Allotments: The CLEA model incorporates an assessment of land provided by local authorities specifically for people to grow fruit and vegetables for their own consumption. Consumption of such fruit and vegetables present several exposure pathways; plants absorb contaminants mainly via water uptake through roots, the contaminants move to edible portions of plants via translocation and contaminated soil particles become trapped in the skin and between leaves. At present the model fails to account for exposure through the consumption of animals, and their products (e.g., eggs), which have been reared on contaminated land.

Commercial/Industrial: Although there are a wide variety of workplaces and work-related activities, the CLEA assessment of this land-use assumes that work occurs in a permanent, three-storey structure, where employees spend most time indoors, conducting office-based or light physical work. The model assumes employees sit outside during breaks for most of the year. Limitations in applying this land-use to different industries is detailed in EA publication “Updated technical background to the CLEA model” (2011). The generic model assumes that the site would not be covered by hard standing. Risk of exposure to contaminants would be clearly less where commercial land is essentially all buildings and hard standing.

Based on the assumptions of each land use and the associated applicable exposure pathways, a ‘Soil Guideline Value’ (SGV) may be calculated for each contaminant under consideration for a particular land use in order to determine whether certain contaminant soil concentrations pose a significant risk to human health. The primary purpose of the CLEA SGVs are as ‘trigger values’ – indicators to a risk assessor that soil concentrations below this level require no further assessment as it can be assumed that the soil is suitable for the proposed use. Where soil concentrations occur above the SGV then further assessment of the results is required. The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012 provides new clarity on the assessment of risk where soil concentrations exceed the SGV. The guidance introduces a four-stage classification system relating to concentration of contaminants and the assessed risk which indicates appropriate actions. Category 1 and 2 sites are classified as “Contaminated Land” as defined in Part IIA of The Environmental Protection Act (1990). Category 3 and 4 sites are not considered as “Contaminated Land” in accordance with the Act. This can be explained using the figure on the following page.

There are also difficulties in establishing soil concentrations of contaminants beyond which risks from exposure to these contaminants would be ‘unacceptable’ and that they would lead to “significant possibility of significant harm” as defined in Part IIA of The Environmental Protection Act (1990) and determine that the land is “contaminated.” This ultimately requires detailed ‘toxicological’ information of the health effects of individual contaminants and also a scientific judgement on what constitutes an ‘unacceptable’ risk. It is for local authorities or the

Environment Agency to determine whether a particular site is contaminated land, and it is for local Planning Authorities to determine whether land affected by contamination can be redeveloped.

Given the SGVs have been derived only for a limited number of contaminants and there was little prospect of further SGVs being published, two professional groupings have produced Generic Assessment Criteria (GACs) in accordance with the CLEA model for a large number of additional contaminants. These GACs were recognised in the new Contaminated Land Statutory Guidance (DEFRA, 2012) and have been produced as follows:

- *LQM/CIEH : 2009 Nathaniel CP, McCaffrey C, Ashmore MH, Cheng NPS GROUP, Gillett A, Ogden R & Scott D : 2009 . The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd edition). Land Quality Press, Nottingham.*
- *CL:AIRE/EIC/AGS: 2009 : Soil Generic Assessment Criteria (GAC) for Human Health Risk Assessment. Contaminated Land: Applications in Real Environments, Environment Industries Commission & Association of Geotechnical and Environmental Specialists. December 2009.*

Category 4 Screening Levels and LQM/CIEH Suitable 4 Use Levels

For new developments progressing through the planning regime, it is desirable that the soil concentrations are within Category 4 where there is a valid contaminant linkage. The upper boundary between Category 4 and 3 is not defined in the guidance. This boundary can also be better defined by carrying out a Detailed Quantified Risk Assessment (DQRA) and this is discussed later in this appendix.

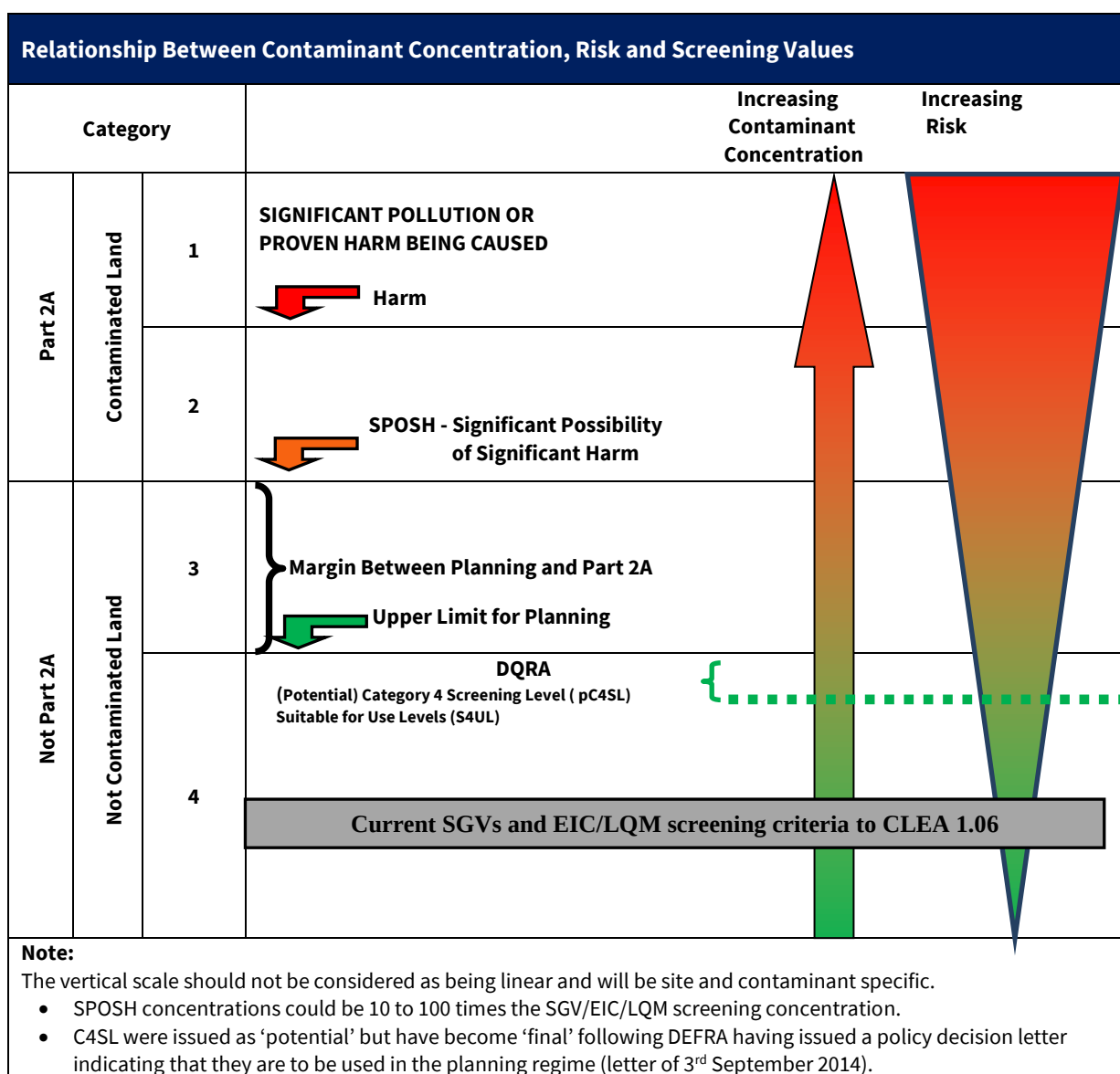
In December 2013 Defra issued the findings of a research project undertaken by CL:AIRE to set out the framework by which potential Category 4 Screening Levels (pC4SL) may be derived. The report was not designed to produce 'final' C4SL as the steering group producing the report believes that final C4SL should be set by a 'relevant authority' (e.g., Defra), the toxicological framework proposed has not been reviewed by the Committee on Toxicity and the document has yet to be subject to peer review.

In March 2014, appendices to the main Defra report were published detailing the derivation of pC4SL for 6 contaminants and other appendices regarding a review of the CIEH/CL:AIRE statistics guidance and sensitivity analysis. For each contaminant, a range of pC4SL have been produced relating to modifying toxicological parameters only, modifying exposure parameters only or by modifying both. It should be noted that the pC4SL produced for lead (the SGV was withdrawn in 2011) has undertaken a relatively large toxicological review in relation to modelling blood lead concentrations. pC4SL have been produced for:

- Arsenic;
- Benzene;
- Benzo(a)pyrene (as a surrogate marker for PAHs);
- Cadmium;
- Chromium (VI); and
- Lead

As previously discussed the values were initially published as 'potential' C4SL but have become 'final' following DEFRA having issued a policy decision letter indicating that they are to be used in the planning regime (letter of 3rd September 2014). It is considered that the pC4SL provide a

simple test for deciding whether land is suitable for use without any remediation. The pC4SL represent a new set of screening levels that are more pragmatic (but strongly precautionary) compared to the existing soil guideline values (SGVs and the other GACs calculate in accordance with the existing CLEA methodology). The pC4SL provide cautious estimates of contaminant concentrations in soil that are still considered to present an acceptable level of risk, within the context of Part 2A, by combining information on toxicology, exposure assessment and normal levels of exposure to these contaminants. pC4SL values should not be seen as ‘SPOH values.’ Exceeding a pC4SL means that further investigation is required, not that the land is necessarily contaminated. In January 2015, LQM published Suitable 4 Use Levels (S4ULs) for a further 89 contaminants using the Defra C4SL methodology. In a similar manner to the pC4SLs, no authoritative review has been undertaken although the approach and quality of the work undertaken is widely accepted as being of high quality.



Lead:

The SGV for lead was withdrawn in 2011 and is not used in this report. The pC4SL for lead provides a technically robust and conservative assessment tool using significantly updated toxicological modelling in line with current scientific understanding of lead toxicology.

Nickel

The SGV for nickel was withdrawn in 2015 and is not used in this report. In-house GACs for nickel have been produced using the updated toxicological review by the EFSA and the CLEA 1.071 software.

Public Open Space

The Defra report (December 2013) has also introduced exposure scenarios for two other commonly occurring land uses which require assessment (under the planning and Part 2A regimes) on a relatively frequent basis. These exposure scenarios are:

- Public Open Space – Space Near Residential Housing (POS_{resi}); and,
- Public Open Space – Public Park (POS_{park}).

Potential use of pC4SL relating to Public Open Space (POS) require care due to the significant variability in exposure characteristics. For example, POS may include:

- Children's play areas, public parks where children practise sport several times a week and teenagers only once a week;
- Grassed areas adjacent to residential properties which are rarely used;
- Dedicated sports grounds where exposure is only to players and groundworkers; and,
- Nature reserves or open ground with low level activity (for example, dog walking).

Within the Defra report (December 2013) the following exposure scenarios have been modelled as these are considered the most important for potential exposure for the critical receptor i.e., young children:

- Green open space close to housing, including tracking back of soil (POS_{resi}); and
- Park-type scenario where distance is considered sufficient to discount tracking back of soil (POS_{park}).

Detailed Quantified Risk Assessment (DQRA)

SGVs, GACs, pC4SL and S4ULs are based on a number of basic assumptions. There are two main options for developing Site Specific Assessment Criteria (SSAC) by adjusting the CLEA model so that they have greater relevance to the site:

- **Simple adjustment of the generic SGV / C4SL model.** Such adjustment is restricted to the choice of exposure routes selected for the generic land use, building type, soil type and soil organic matter content within the CLEA software.
- **Detailed adjustment.** It may be relevant to make greater modifications to the model due to the specific use of the land in question. This can include modification to any parameter value, including exposure assumptions, building parameters, and the choice and application of fate and transport models. This is equally relevant to site-specific modifications of existing generic land uses, the development of new land uses, and the inclusion of additional exposure pathways. Much of this can be undertaken using the CLEA software. Depending on the complexity of the detailed adjustments required, it may be necessary to use other tools either alone or in conjunction with the CLEA software. Both options should follow established protocols for DQRA and require sufficient justification and supporting information for the adjustments made. Detailed adjustments are likely to require substantially greater technical justification and supporting documentation, especially if modifications are based on information not contained within the SGV framework documents.

The two choices present the risk assessor with three options/decisions:

1. Use a published SGV/GAC/pC4SL/S4UL if it can be demonstrated that the assumptions inherent in the value are appropriate to the site in question. If they are not, proceed to either option 2 or 3 below.
2. Make simple site-specific adjustments to the generic exposure model used to derive the SSAC. Three examples of when this could be appropriate are:
 - a. High density residential development with no exposed contaminated soil at surface. It is appropriate in this case to consider the relevance of direct contact pathways and consumption of homegrown produce.
 - b. Soil type is significantly different (specifically when soil type is likely to be less protective e.g., made ground) to that assumed in the SGV/GAC/pC4SL/S4UL.
 - c. Soil organic matter content is significantly different to that assumed in the derivation of the SGV/GAC/pC4SL/S4UL.
3. If simple adjustments are not sufficient to reflect site conditions, undertake a DQRA. This may be undertaken using the CLEA software or by using an alternative risk assessment methodology that is relevant, appropriate, authoritative, and scientifically based. Changes to toxicological end points may also be considered, although this should only be undertaken by a toxicology expert. In the context of this guidance, simple adjustments of a generic land use scenario for soil type or SOM content for example are not considered sufficient to be classed as a DQRA.

DQRAs should be conducted with the agreement of the local authority (or the Environment Agency) since it is the authority that determines whether land is Contaminated Land or whether Planning Permission for a new development may be granted.

Representative Data

The type, quantity and quality of the available soil data influence the method chosen to obtain a site representative soil concentration that is compared with an SGV/GAC/pC4SL/S4UL in the screening process. The soil data should be representative of the exposure scenario being considered. This can include factors such as:

- Averaging area over which exposure occurs;
- Sample depth; and,
- Heterogeneity of soil.

where the ‘averaging area’ is defined as:

“That area (together with a consideration of depth) of soil to which a receptor is exposed or which otherwise contributes to the creation of hazardous conditions”.

Site investigations take discrete samples from a given area (and to a certain depth). It has to be assumed that these samples are to some degree representative of the contaminant concentration throughout that volume of soil. The critical soil volume (taking into account area and depth) which might be usefully compared with an SGV/GAC/pC4SL/S4UL is a site-specific decision, but a starting point is the generic land use scenarios used in the derivation of the SGV/GAC/pC4SL/S4UL. The critical soil volume depends on two factors:

- Contaminant distribution and vertical profile (bands of highly contaminated material or lateral hot spots should not necessarily be averaged out with more extensive cleaner areas of soil without justification)
- Contribution to average exposure underpinning the SGV. Direct contact exposure pathways depend on the adult or child coming into contact with near-surface soils and the area over which that exposure occurs is usually important (i.e., the averaging area). Vapour pathways are less dependent on surface area, for example vapour intrusion may result from a highly concentrated hot spot beneath a building leading to elevated average indoor air concentrations. For the three standard land uses for which SGVs are derived, relevant considerations are:
 - For the standard **residential or allotment land use**, the critical soil volume is the area of an individual garden, communal play area or working plot from the surface to a depth of between 0.50m and 1.00m. This is the ground over which children are most likely to come into contact with soil or from which vegetable and fruit produce will be harvested. In the case of volatile contaminants, it may also be appropriate to consider the volume of soil underneath the footprint of the building although vapour intrusion may be driven by a soil volume much smaller than this if the contaminant source is highly concentrated.
 - For the standard **commercial land use**, the critical soil volume has to be decided on a case-by- case basis due to the wide range of possible site layouts. However, for non-volatile contaminants, landscaped and recreational areas around the perimeter of office buildings are likely to be most important. For volatile contaminants, the footprint occupied by the building itself should also be considered.

- For **most exposure pathways**, the contamination is assumed to be at or within one metre of the surface.

The use of averaging areas must be justified on the basis of relevance to the exposure scenario. SGVs are relevant only when the exposure assumptions inherent in them are appropriate for the identified exposure averaging area. Further guidance on critical soil volumes and the consideration of averaging exposure areas can be found in:

- *Secondary model procedure for the development of appropriate soil sampling strategies for land contamination* (Environment Agency, 2000);
- *Guidance on comparing soil contamination data with a critical concentration* (CIEH/CL:AIRE, 2009); and
- *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Appendix I* (Defra December 2013, March 2014)

It is the mean soil concentration for the individual contaminant within an individual averaging area, which is compared to the SGV. However, as contaminant concentrations vary across a site, and sampling and analysis will introduce measurement errors, the comparison between measured mean concentration and the SGV must take this uncertainty into account.

There are two principal options available to obtain site representative soil concentrations from a site investigation dataset; statistical and non-statistical methods. Data objectives, quality and quantity are likely to determine which approach is most appropriate. If statistical methods such as those presented in CIEH/CL:AIRE (2011) are to be used, sufficient data need to be available or obtained. No one single statistical approach is applicable to all sites and circumstances. The wider range of robust statistical techniques developed by organisations including the US Environmental Protection Agency (USEPA) are also important tools. Risk assessors should choose an appropriate statistical approach on the basis of the specific site and the decision that is being made. For further guidance on the appropriate use of statistical approaches, refer to USEPA 2006 or good environmental monitoring statistics textbooks.

When statistical approaches are inappropriate (this will depend on the objectives of the site investigation), individual or composite samples should be compared directly to the SGV. Guidance on use of alternative data handling approaches such as the use of composite sampling can be found in documents such as:

- *Verification of remediation of land contamination* (Environment Agency, 2010);
- *Sampling and testing of wastes to meet landfill Waste Acceptance Criteria* (Environment Agency, 2005);
- *Guidance on choosing a sampling design for environmental data collection* (USEPA, 2002); and,
- *Soil Quality – Sampling, ISO 10381 series* (ISO, 2002–2007).

The statistical tests should not be used as arbiters for decisions under Part 2A. They are an additional, useful line of evidence to assist in decision-making. The implications of the basis for the derivation of the site representative soil concentration must be taken into account in any decision-making process and clearly documented.

Where the statistical tests are conducted in accordance with the method described in CL:AIRE 2009:

- For the Planning situation, it has to be demonstrated that the concentration of contaminants is low compared to the pC4SL/S4UL or SSAC. All of the test data should be below the screening criteria and no statistical analysis is required or if there are exceedances of the criteria then a statistical assessment is required. For the statistical assessment this decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is lower than the screening criteria.
- For the Part 2A scenario the regulator needs to determine whether the concentration of contaminants is greater than the SGV/GAC/pC4SL/S4UL or SSAC. This decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is higher than the SSAC. However, the regulator may proceed with determination if there is just a 51% probability, “on the balance of probabilities.”

If the screening levels are exceeded then more sophisticated quantitative risk assessment can be undertaken or remedial action may be taken to break the contaminant linkages. The benefits of undertaking a quantitative risk assessment must be weighed against the likelihood that it will bring about cost savings in the proposed remediation. Further information about the use of soil guideline values is provided in Environment Agency : 2008: Using Soil Guideline Values SC050021/SGV Introduction, March 2008.

GENERIC RISK ASSESSMENT CRITERIA FOR RISK TO PLANTS

Soil contaminants, if present at sufficient concentrations, can have an adverse effect on the plant population. Phytotoxic effects can be manifested by a variety of responses, such as growth inhibition, interference with plant processes, contaminant-induced nutrient deficiencies and chlorosis (yellowing of leaves). All chemicals are probably capable of causing phytotoxic effects. Thus, the phytotoxic potential of substances is dependent on the concentrations capable of having adverse effects on plants and the concentrations likely to be found at contaminated sites. Phytotoxicity is a difficult parameter to quantify given that experimental techniques vary widely, and variations exist in plant tolerances, soil effects and synergistic/antagonistic reactions between chemicals. Contaminants may be taken up and accumulated by plants through a range of mechanisms. The principal pathways are active and/or passive uptake through the plant root, adsorption to root surfaces and volatilisation from the soil surface followed by foliar uptake. After plant uptake, contaminants may be metabolised or excreted, or they may be bioaccumulated and this is highly species dependant. Many of the substances capable of adversely affecting vegetation exert this effect because of their water solubility, a characteristic that could result in their transport from contaminated sites into adjacent locations where the chemical may generate a phytotoxic response. This could be important if, for example, the adjacent site has important conservation status.

The concentration in soil at which substances become phytotoxic depend on a range of factors including plant type, soil type, pH, the form and availability of the contaminant and other vegetation stress factors that may be present (such as drought). Some plants (including some rare plants) will only grow in soils where there are relatively high concentrations which would be phytotoxic to other species. Whilst many contaminants may be phytotoxic, data are limited. Some heavy metals are essential as trace elements for plant growth but may become toxic at higher concentrations.

GroundSolve has carried out a review of a number of current and former guidance documents and other texts on phytotoxicity. It is not possible to produce a definitive list of phytotoxic substances on account of the variables mentioned above. However, a number of metals are repeatedly cited as commonly occurring priority pollutants. As a result, the following list is adopted by GroundSolve as indicators of the potential for phytotoxicity: As, Cr, Cu, Ni and Zn (note that Boron has been excluded from this list because the more modern studies do not assess this).

As the CLEA framework is a risk-based approach, applied to humans, an alternative strategy is required to assess the risk to plants from substances that are phytotoxic. Reference to published criteria and background concentrations can help put site data into context. Published assessment criteria for the protection of plant life from a number of countries are given in the following Table. The most authoritative source is the British Standard for topsoil, but this only lists three elements. LCRM states that the ICRL Guidance Note 70/90 can be used for initial screening criteria. This approach has been adopted by GroundSolve where BS3882 is lacking, but where an ICRL 70/90 criterion is lacking, the lowest criterion in Table below from, firstly UK, and, secondly, European and then other worldwide criteria. The adopted criteria are highlighted in the table 3.8. The MAFF value of 250 mg/kg has been chosen for As over the ICRL value of 50 mg/kg as MAFF explains the 50 is applicable to vegetables and human health, whereas 250 is applicable to the plants themselves.

Table B.5: Published Assessment Criteria for Phytotoxic Elements (mg/kg)							
Reference	As	CR (Total)	Cr (III)	Cr (VI)	Cu	Ni	Zn
British Standard for topsoil (BS3882:2007)	-	-	-	-	200 (pH >7) 135 (pH 6-7) 100 (pH 5.5-6.0)	110 (pH >7) 75 (pH 6-7) 60 (pH 5.5-6.0)	300 (pH >7) 200 (pH 6-7) 200 (pH 5.5-6.0)
MAFF Code of Good Agricultural Practice for the Protection of Soil (1998)	250	-	400 for sites containing sewage and sludge	-	500 (grass) but may fall to 250 for clover and sensitive species (at pH>6)	110 (pH>7) 75 (pH 6-7) 60 (pH 5.5-6.0)	1000 (clover & grass at pH 6), may fall to 300 for sensitive species (at pH 6-7)
ICRCL 59/83 (1987) now withdrawn for human health assessment	-	-	-	-	130	70	300
ICRCL 70/90 (1990) threshold trigger value	50	-	-	25 *	250	-	1000
Dutch ecotoxicological intervention value (Swartjes 1993 & 1994)	40	230	-	7	190	-	-
Australian Guideline B(1) (1999), Interim Urban Ecological Investigation Level (EIL). Soils not generally considered phytotoxic below these EILs.	20	-	400	1	100	60	200
New Zealand guidelines for timber treatment sites (1977), estimated based on Cu bioavailability *	-	-	-	-	500 - 1000 clay soils	-	-
New Zealand guidelines for timber treatment sites (1977), soil criteria for protection of plant life (residential/ agricultural setting)	10-20	-	600	25	130	-	-
Note: * Cr (VI) is only likely to be present in as a significant proportion of total Cr where pH >12 so this does not routinely need to be tested for regarding plant health.							

CURRENT GUIDANCE FOR CONTROLLED WATERS RISK ASSESSMENT

Summary of Regulatory Context

Government policy is based upon a “suitable for use approach,” which is relevant to both the current use of land and also to any proposed future use. When considering the current use of land, Part IIA of the Environment Protection Act 1990 ^[4] (EPA 1990) provides the regulatory regime, which was introduced by Section 57 of the Environment Act 1995 ^[5], which came into force in England on 1 April 2000. The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health, controlled waters or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

“any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

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

Part IIA provides a statutory definition of the pollution of controlled waters under Section 78A(9) as:

*“the entry into controlled waters of **any** poisonous, noxious or polluting matter or **any** solid waste matter”*

Part IIA is supported by a substantial quantity of guidance and other Regulations, especially for England, The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012. The document re-confirms the duties of Enforcing Authorities in dealing with contamination including the role of the Environment Agency which has powers under Part 7 of The Water Resources Act (1991) to take action to prevent or remedy the pollution of controlled waters, including circumstances where the pollution arises from contamination in the land.

Part IIA introduces the concept of a contaminant linkage; where for potential harm to exist, there must be a connection between the source of the hazard and the receptor via a pathway. Risk assessment in contaminated land is therefore directed towards identifying the contaminants, pathways and receptors that can provide contaminant linkages. This is known as the contaminant-pathway-receptor link (CPR or contaminant linkage).

Part IIA places contaminated land responsibility as a part of the planning and redevelopment process rather than Local Authority or Environment Agency taking direct action except in situations of very high pollution risk or where harm is occurring. In the planning process guidance is provided by National Planning Policy Framework (NPPF) of March 2012. This requires that a site which has been developed shall not be capable of being determined “contaminated land” under Part IIA. Therefore, appropriate risk-based investigation is required to identify the contaminant

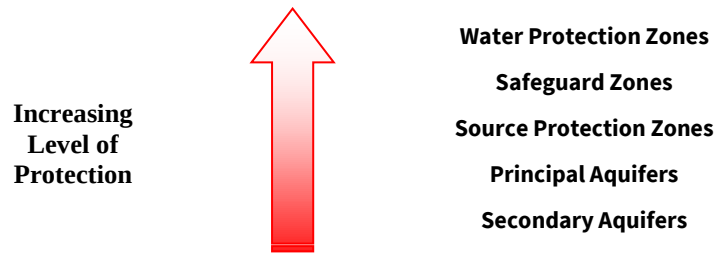
linkages that can then be assessed, and then mitigated using methods that can be readily agreed with the planners.

Environment Agency Guidance

Legislation and guidance surrounding the protection of controlled waters in the UK is numerous and can be complex. The Environment Agency's overall position on groundwater is "*To protect and manage groundwater resources for present and future generation in ways that are appropriate for the risks that we identify*" (The Environment Agency's Approach to Groundwater Protection, 2017). In brief, the core objectives of the existing legislation serve to enforce this position.

In 1992, the National Rivers Authority published their Policy and Practice for the Protection of Groundwater (PPPG), this document was influential as it provided a focus for key developments such as Source Protection Zones (SPZs) and Groundwater Vulnerability Maps. The Policy was then revised in 1998, since which there have been substantial changes in legislation, driven by Europe. Key European Directives relating to groundwater include the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC). Aspects of these directives are controlled by primary UK legislation such as the Water Resources Act 1991 as amended by the Water Act 2003. Further to legislative changes, gaps identified in the 1998 PPPG required addressing. These changes are reflected in the Environment Agency Policy document *The Environment Agency's Approach to Groundwater Protection* of March 2017.

The Environment Agency follows a tiered, risk-based approach to drinking water protection, and this should be taken into account when carrying out controlled waters risk assessment:



Tools available for Risk Assessment of Controlled Waters

In order for a developer of a potentially contaminated site to fulfil their obligations under the legislation, a site assessment would be required to be undertaken in order to identify any potential risks to controlled waters and to derive suitable clean-up criteria if necessary to ensure the protection of controlled waters. A number of tools are available for this purpose.

Three main stages apply to any risk assessment of controlled waters, these are:

- i. Risk Screening (devise Conceptual Site Model, making reference to groundwater vulnerability maps, site setting etc)
- ii. Generic Risk Assessment (using the EA Remedial Targets Methodology – Tier 1 - Comparison of groundwater data with relevant standards)
- iii. Detailed Quantitative Risk Assessment (Consideration of aquifer properties and site-specific parameters, using the EA Remedial Targets Methodology - Tiers 2 & 3)

The process is summarised below (Taken from the Environment Agency GP3 consultation document, 2006):

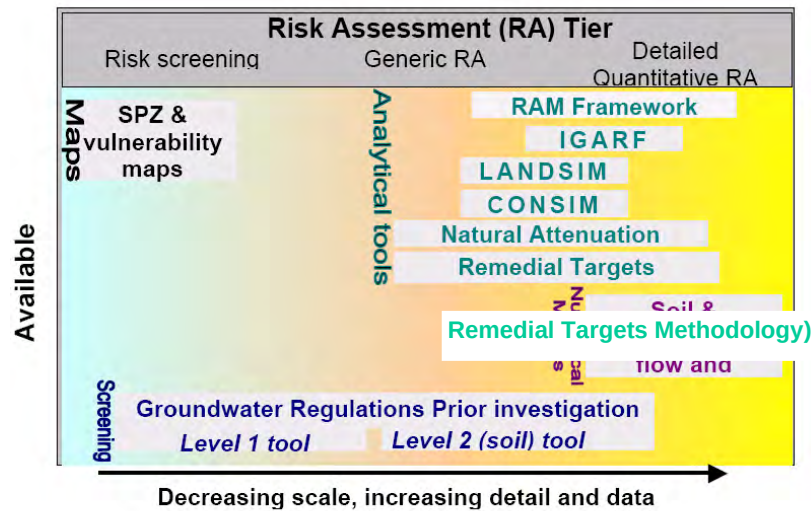


Figure 1-1 Environment Agency groundwater assessment tools, mapped against the different levels of risk assessment.

When assessing groundwater impact the Environment Agency advocate the application of their framework methodology “Remedial Targets Methodology – Hydrogeological Risk Assessment for Land Contamination” Environment Agency (2006). The methodology has four tiers of assessment:

Tier 1 utilises either a soil concentration (calculation of pore water concentrations based on partitioning calculations), leaching test or pore-water concentration of perched water as a source concentration input and these are contrasted directly to water quality standards. No dilution or attenuation is considered at Level 1.

Tier 2 (groundwater) considers dilution of the contaminant within the underlying receiving groundwater or surface water body. To determine a dilution, factor the infiltration rate of pore water and the discharge of groundwater beneath the source must be determined. Level 2 Assessment comprises a comparison between measured groundwater concentrations with to water quality standards.

Tier 3 considers natural attenuation in the form of dispersion, retardation and degradation of the contaminant. As the levels are progressed, the assessment becomes increasingly more detailed and less conservative as the data requirements are increased with each successive tier. The Environment Agency has released Excel Worksheets to carry out basic calculations using a conservative approach up to Tier 3. However, in this case the conceptual model is a simple one and assumes there is a simple migration of contaminants from the source zone into the aquifer receptor. Using these worksheets requires a sensitivity analysis showing how by varying each parameter, what effect it might have on the outcome of the assessment. Groundwater conceptual models are not always this simple.

Tier 4 is for more complex conceptual models where multiple sources, multiple pathways, multiple receptors and complex water balances can be assessed.

The Environment Agency developed a spreadsheet-based code to support the Remedial Target Methodology, and the code is capable of undertaking assessments for Tiers 1 to 3. Tier 4 assessment is not supported by the spreadsheet-based code.

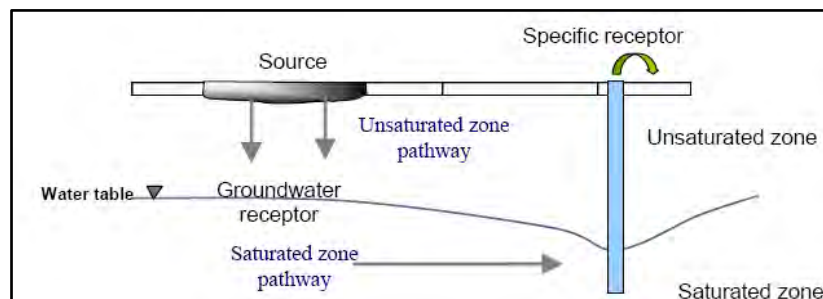
A more advanced code, ConSim 2, developed on behalf of the Environment Agency to support the Remedial Targets Methodology, allows for the introduction of additional geological horizons and is used mainly to determine the concentrations reaching a receptor and the timescales over which this may happen.

The codes assess only the dissolved phase contaminants. There are many further codes commercially available for use in controlled waters risk assessment, particularly for more complex situations, however, these should be used with caution and only once agreement has been obtained from the Environment Agency. All have the overall aim of the estimation of risk from contaminant linkages and the protection of controlled waters.

General notes on each stage of the controlled waters risk assessment process

Risk Screening

The understanding of the Conceptual Site Model (CSM) is the key to assessing any site. Using a robust CSM, potential pathways or receptors may be screened out from any further assessment at an early stage. For example, if the pathway through the unsaturated zone is blocked by the presence of a significant thickness of low permeability clay. A greater understanding of the CSM is achieved with each tier of risk assessment. An example of a basic Source-Pathway-Receptor concept is given below (taken from the Environment Agency GP3, 2006):



Generic Risk Assessment

When undertaking the Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Tier 1), comparison of chemical analytical results is made with screening criteria. Published values of screening criteria with which chemical test results can be compared are published in the following guidance:

There is a hierarchy of screening criteria which is as follows:

- Updated Recommendations on Environmental Technical Standards, River Basin Management (2015-21), April 2012 by the UK Technical Advisory Group on the Water Framework Directive;
- Environmental Quality Standards (EQS) for freshwaters based on The EC Dangerous Substances Directive (76/464/EEC and Daughter Directives);

- Surface Waters (Abstraction for Drinking Water)(Classification) Regulations (1996)
- Surface Waters (Fishlife) (Classification) Regulations (1997)
- UK Drinking Water Standards (DWS) (Water Supply (Water Quality) Regulations 2000);
- Dutch Ministry of Housing, Spatial Planning and Environment (2001) Intervention Values and Target Values – soil quality standards;
- World Health Organisation Guidelines for Drinking Water (2004)

Should the Level 1 or 2 assessments indicate threshold levels to be exceeded, then there are three alternative ways in which to proceed:

- To devise suitable remedial solutions;
- To carry out more investigation, sampling and analysis;
- To conduct a site-specific Detailed Quantitative Risk Assessment (DQRA) to whether or not the soil materials are suitable for their site-specific intended use or to devise a site-specific clean-up level.

Detailed Quantitative Risk Assessment (DQRA)

The decision to carry out a DQRA will be dependent on the extent and implications of the initial qualitative and generic assessment. The scope of any such assessment will be accurately defined by the outcomes of the former two stages. The CSM will be sufficiently refined by this stage that only certain contaminants of concern, certain pathways and certain receptors will require further assessment, the remainder having been screened out.

Additional site-specific data is normally required for this stage of assessment, as explained above, more processes that are capable of affecting contaminant concentrations are considered (such as dilution and attenuation).

Remediation criteria derived will therefore be specific to each site and will be based on a detailed assessment of the potential impact at the identified receptor or *compliance point*. A greater level of confidence can be placed on the predicted impact on the compliance point following a DQRA.

Definition of Controlled Waters

The term ‘controlled waters’ is defined in Section 104 of the Water Resources Act 1991 as:

“Territorial Waters...which extend seawards for three miles..., coastal waters..., inland freshwaters, waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and ground waters, that is to say, any waters contained in underground strata.”

Note that the definition of groundwater under the Water Resources Act 1991 includes all water within underground strata (including soil / pore water in the unsaturated zone). The definition of groundwater under the Groundwater Directive however is limited to water in the saturated zone. For the purposes of Part IIA of the Environmental Protection Act 1990, the Environment Agency

recommends that the groundwater within the saturated zone only is considered as the receptor (rather than soil / pore water).

Environment Agency's Aquifer Designations

The Environment Agency have classified different types of aquifers from which groundwater can be extracted. The aquifer designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey.

The maps are split into two different types of aquifer designation:

- **Superficial (Drift)** – permeable unconsolidated (loose) deposits.
- **Bedrock (Solid)** – solid permeable formations e.g., sandstone, chalk, limestone.

The aquifer designations displayed on the Environment Agency maps are as follows:

- **Principal Aquifers (formerly termed Major Aquifers)** – These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as a major aquifer.
- **Secondary Aquifers (formerly termed Minor Aquifers)** – These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:
 - **Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;
 - **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
 - **Secondary Undifferentiated** - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
- **Unproductive Strata (formerly termed Non-Aquifer)** – These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Hazardous and Non-Hazardous Substances

The Groundwater (England and Wales) Regulations 2009 control the disposal to the hydrogeological environment of potentially polluting substances which are divided into Hazardous Substances and Non-hazardous Contaminants (this roughly approximates to the former List 1 and List 2 substances).

Hazardous Substances are the most damaging and toxic and must be prevented from directly or indirectly entering the groundwater environment. Hazardous Substances include mineral oils and hydrocarbons, pesticides, biocides, herbicides, solvents and some metals. Discharge of Hazardous Substances to Controlled Waters must be prevented.

Non-hazardous Pollutants are any contaminants other than Hazardous Substances. Non-hazardous Pollutants are potentially toxic but are less harmful than Hazardous Substances, but their direct discharge to groundwater is generally not permitted and any indirect discharge to groundwater must be limited and be controlled by technical precautions in order to prevent pollution. Non-hazardous Pollutants include ammonia and nitrites, many metals and fluorides.

MANAGEMENT OF CONTAMINATED LAND

When risk assessment of the site has been completed and this indicates that remedial works are required, the main guidance in managing this process is set out in the DEFRA/EA online guidance LCRM (2020) “Land Contamination: Risk Management” The stages of managing remediation are as follows:

- (a) Options Appraisal and develop Remediation Strategy;
- (b) Develop Implementation Plan and Verification Plan;
- (c) Remediation, Verification and Monitoring.

The Remediation Strategy sets out the remediation targets, identifies technically feasible remedial solutions and presents an evaluation of the options so that these can be assessed enabling that the most suitable solution is adopted. An outline of the proposed remedial method should be presented. Agreement should be sought of the appropriate statutory bodies for the Remediation Strategy before proceeding to the next stage.

The Implementation Plan is a detailed method statement setting out how the remediation is to be carried out including stating how the site will be managed, welfare procedures, health and safety considerations together with practical measures such as details of temporary works, programme of works, waste management licences and regulatory consents required. Agreement should again be sought of the appropriate statutory bodies for this Plan.

The Verification Plan sets out the requirements for gathering data to demonstrate that the remediation has met the required remediation objectives and criteria. The Verification Plan presents the requirements for a wide range of issues including the level of supervision, sampling and testing regimes for treated materials, waste and imported materials, required monitoring works during and post remediation, how compliance with all licenses and consents will be checked etc. Agreement should again be sought of the appropriate statutory bodies for the Verification Plan. On completion of the remediation a Verification Report should be produced to provide a complete record of all remediation activities on-site and the data collected as required in the Verification Plan. The Verification Report should demonstrate that the remediation has met the remedial targets to show that the site is suitable for the proposed use.

GLOSSARY

TERMS		UNITS	
AST	Above Ground Storage Tank	m	Metres
BGS	British Geological Survey	km	Kilometres
BSI	British Standards Institute	%	Percent
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes	%v/v	Percent volume in air
CIEH	Chartered Institute of Environmental Health	mb	Milli Bars (atmospheric pressure)
CIRIA	Construction Industry Research Association	l/hr	Litres per hour
CLEA	Contaminated Land Exposure Assessment	ha	Hectare (10,000m ²)
CSM	Conceptual Site Model	µg/l	Micrograms per Litre (parts per billion)
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)	ppb	Parts Per Billion
DWS	Drinking Water Standard	mg/kg	Milligrams per kilogram (parts per million)
EA	Environment Agency	ppm	Parts Per Million
EQS	Environmental Quality Standard	mg/m ³	Milligram per metre cubed
GAC	General Assessment Criteria	Mg/m ³	Megagram per metre cubed
GL	Ground Level	µg/m ³	Microgram per metre cubed
GSV	Gas Screening Value	m bgl	Metres Below Ground Level
HCV	Health Criteria Value	m bcl	Metre Below Cover Level
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel)	mOD	Metres Above Ordnance Datum (sea level)
ND	Not Detected	kN/m ²	Kilo Newtons per metre squared
LMRL	Lower Method Reporting Limit	kPa	Kilo Pascal – same as kN/m ²
NR	Not Recorded	µm	Micro metre
OD	Ordnance Datum		
PAH	Poly Aromatic Hydrocarbon		
PCB	Poly-Chlorinated Biphenyl		
PID	Photo Ionisation Detector		
PCSM	Preliminary Conceptual Site Model		
SGV	Soil Guideline Value		
TPH (CWG)	Total Petroleum Hydrocarbon (Criteria Working Group)		
SPT	Standard Penetration Test		
SVOC	Semi Volatile Organic Compound		
UST	Underground Storage Tank		
VCCs	Vibro Concrete Columns	VSCs	Vibro Stone Columns
VOC	Volatile Organic Compound		

APPENDIX B: SITE PHOTOGRAPHS

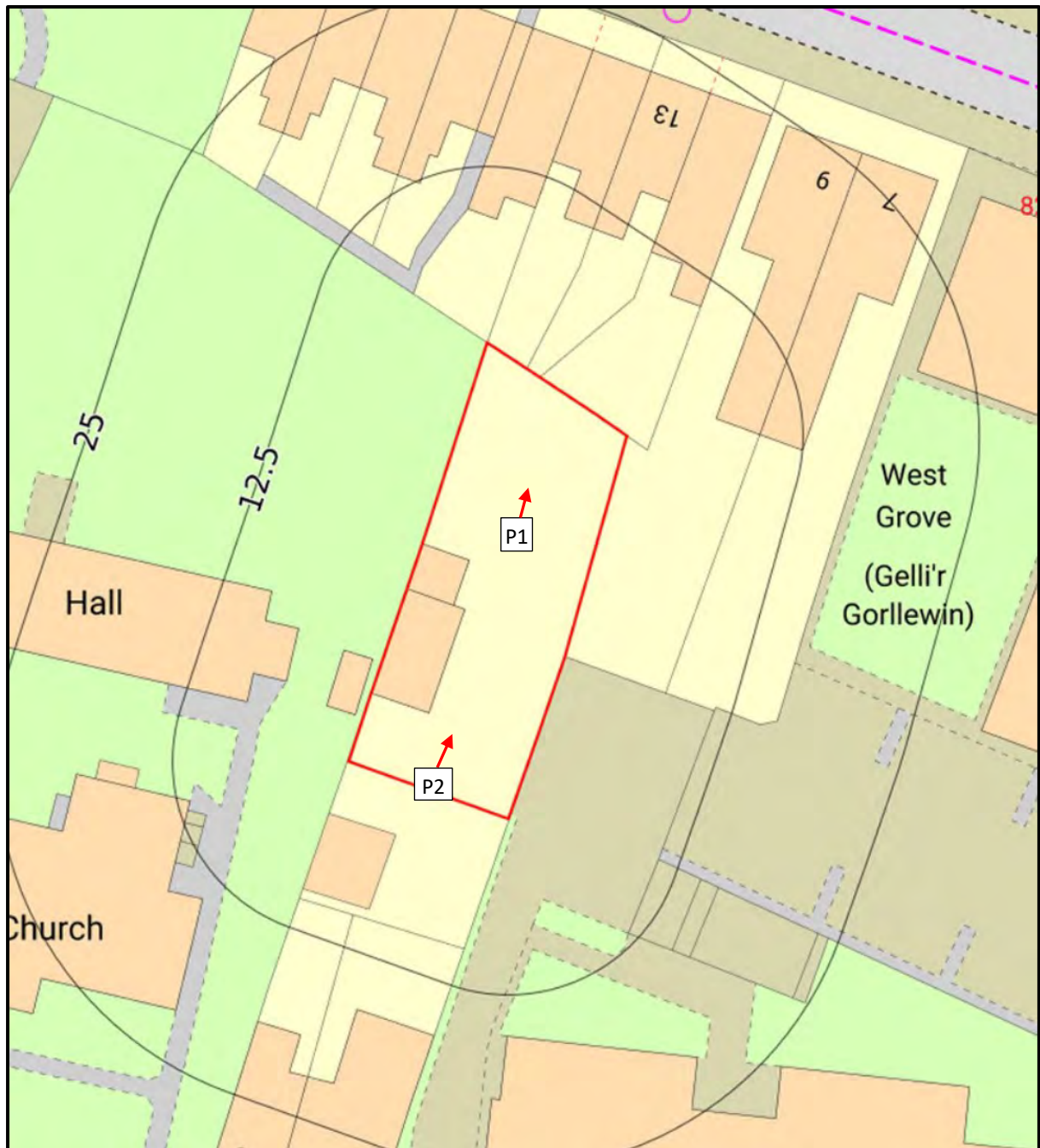




Photo 1 – Site entrance to the existing compound at the centre of the site



Photo 2 – Within the existing site compound facing north to the canal

APPENDIX C: GROUNDSURE REPORT

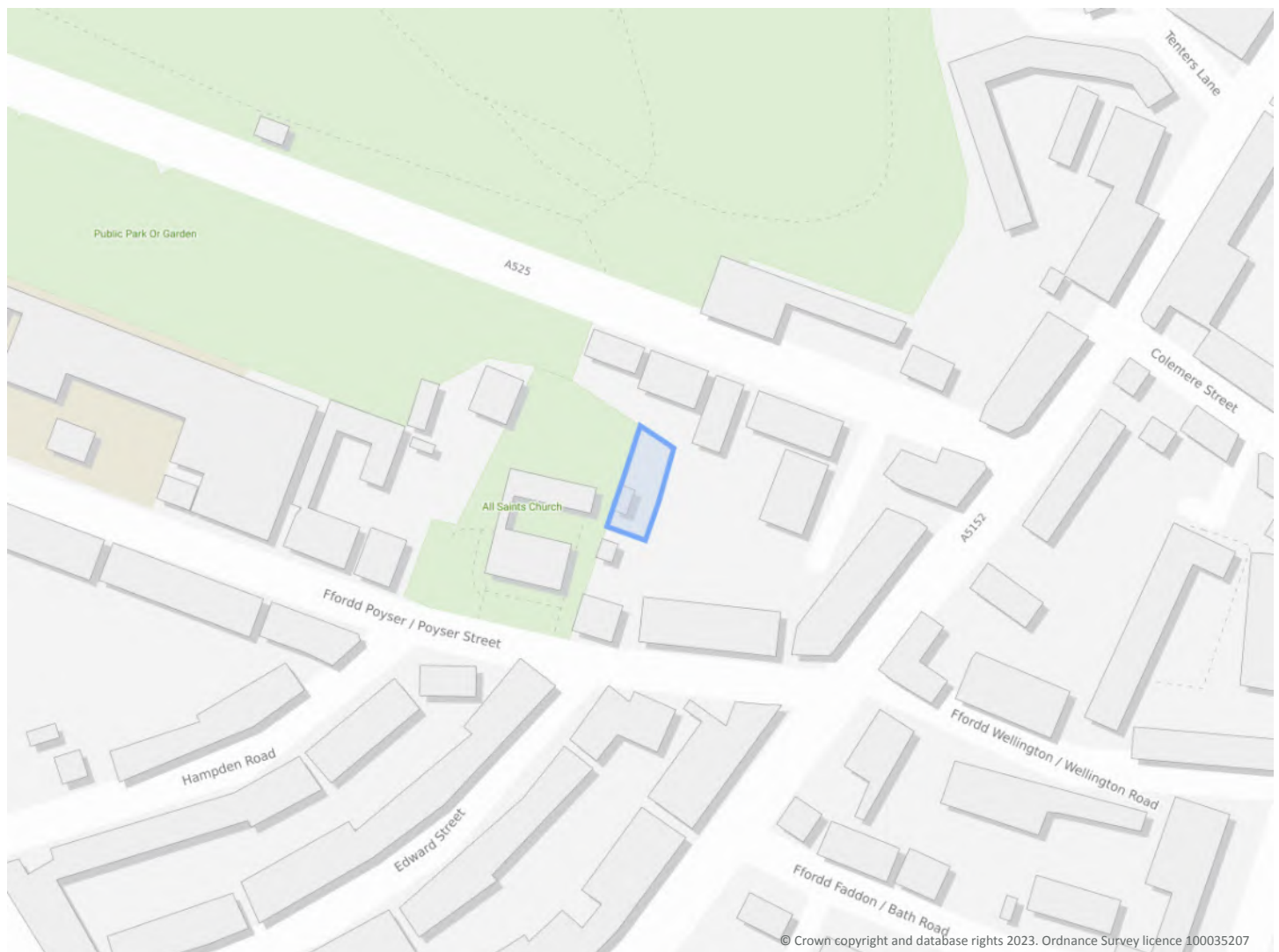
27, POYSER STREET, WREXHAM, LL13 7RT

Order Details

Date: 12/05/2023
Your ref: 2919_-_PO001251
Our Ref: GS-E5T-A2U-H5X-D80

Site Details

Location: 333118 349842
Area: 0.04 ha
Authority: [Wrexham - Wrexham County Borough Council](#) ↗



[Summary of findings](#)

[p. 2 >](#) [Aerial image](#)

[p. 8 >](#)

[OS MasterMap site plan](#)

[p.13 >](#) groundsure.com/insightuserguide ↗

Contact us with any questions at:

info@groundsure.com ↗

01273 257 755

Summary of findings

Page	Section	Past land use >	On site	0-50m	50-250m	250-500m	500-2000m
14 >	1.1 >	Historical industrial land uses >	0	5	5	98	-
19 >	1.2 >	Historical tanks >	0	1	7	16	-
20 >	1.3 >	Historical energy features >	0	0	4	11	-
21 >	1.4 >	Historical petrol stations >	0	0	0	0	-
21 >	1.5 >	Historical garages >	0	2	9	10	-
22 >	1.6 >	Historical military land >	0	0	0	0	-
Page	Section	Past land use - un-grouped >	On site	0-50m	50-250m	250-500m	500-2000m
23 >	2.1 >	Historical industrial land uses >	0	6	5	147	-
29 >	2.2 >	Historical tanks >	0	1	7	27	-
31 >	2.3 >	Historical energy features >	0	0	7	18	-
32 >	2.4 >	Historical petrol stations >	0	0	0	0	-
32 >	2.5 >	Historical garages >	0	5	18	21	-
Page	Section	Waste and landfill >	On site	0-50m	50-250m	250-500m	500-2000m
35 >	3.1 >	Active or recent landfill >	0	0	0	0	-
35 >	3.2 >	Historical landfill (BGS records) >	0	0	0	0	-
36 >	3.3 >	Historical landfill (LA/mapping records) >	0	0	2	0	-
36 >	3.4 >	Historical landfill (EA/NRW records) >	0	0	1	0	-
36 >	3.5 >	Historical waste sites >	0	0	0	2	-
37 >	3.6 >	Licensed waste sites >	0	0	0	0	-
37 >	3.7 >	Waste exemptions >	0	0	0	15	-
Page	Section	Current industrial land use >	On site	0-50m	50-250m	250-500m	500-2000m
40 >	4.1 >	Recent industrial land uses >	0	0	9	-	-
41 >	4.2 >	Current or recent petrol stations >	0	0	0	1	-
41 >	4.3 >	Electricity cables >	0	0	0	0	-
42 >	4.4 >	Gas pipelines >	0	0	0	0	-
42 >	4.5 >	Sites determined as Contaminated Land >	0	0	0	0	-



42 >	4.6 >	Control of Major Accident Hazards (COMAH) >	0	0	0	0	-
42 >	4.7 >	Regulated explosive sites >	0	0	0	0	-
42 >	4.8 >	Hazardous substance storage/usage >	0	0	0	0	-
43 >	4.9 >	Historical licensed industrial activities (IPC) >	0	0	0	0	-
43 >	4.10 >	Licensed industrial activities (Part A(1)) >	0	0	0	0	-
43 >	4.11 >	Licensed pollutant release (Part A(2)/B) >	0	0	0	0	-
43 >	4.12 >	Radioactive Substance Authorisations >	0	0	0	0	-
43 >	4.13 >	Licensed Discharges to controlled waters >	0	0	0	3	-
44 >	4.14 >	Pollutant release to surface waters (Red List) >	0	0	0	0	-
44 >	4.15 >	Pollutant release to public sewer >	0	0	0	0	-
44 >	4.16 >	List 1 Dangerous Substances >	0	0	0	0	-
45 >	4.17 >	List 2 Dangerous Substances >	0	0	0	0	-
45 >	4.18 >	Pollution Incidents (EA/NRW) >	0	0	0	1	-
45 >	4.19 >	Pollution inventory substances >	0	0	0	0	-
45 >	4.20 >	Pollution inventory waste transfers >	0	0	0	0	-
46 >	4.21 >	Pollution inventory radioactive waste >	0	0	0	0	-
Page	Section	Hydrogeology >	On site	0-50m	50-250m	250-500m	500-2000m
47 >	5.1 >	Superficial aquifer >	Identified (within 500m)				
49 >	5.2 >	Bedrock aquifer >	Identified (within 500m)				
51 >	5.3 >	Groundwater vulnerability >	Identified (within 50m)				
52 >	5.4 >	Groundwater vulnerability- soluble rock risk >	None (within 0m)				
52 >	5.5 >	Groundwater vulnerability- local information >	None (within 0m)				
53 >	5.6 >	Groundwater abstractions >	0	0	0	0	4
54 >	5.7 >	Surface water abstractions >	0	0	0	1	9
57 >	5.8 >	Potable abstractions >	0	0	0	0	2
57 >	5.9 >	Source Protection Zones >	0	0	0	0	-
58 >	5.10 >	Source Protection Zones (confined aquifer) >	0	0	0	0	-
Page	Section	Hydrology >	On site	0-50m	50-250m	250-500m	500-2000m
59 >	6.1 >	Water Network (OS MasterMap) >	0	0	0	-	-



59 >	6.2 >	Surface water features >	0	0	0	-	-
60 >	6.3 >	WFD Surface water body catchments >	1	-	-	-	-
60 >	6.4 >	WFD Surface water bodies >	0	0	0	-	-
60 >	6.5 >	WFD Groundwater bodies >	1	-	-	-	-
Page	Section	River and coastal flooding >	On site	0-50m	50-250m	250-500m	500-2000m
62 >	7.1 >	Risk of flooding from rivers and the sea >	None (within 50m)				
62 >	7.2 >	Historical Flood Events >	0	0	0	-	-
62 >	7.3 >	Flood Defences >	0	0	0	-	-
63 >	7.4 >	Areas Benefiting from Flood Defences >	0	0	0	-	-
63 >	7.5 >	Flood Storage Areas >	0	0	0	-	-
64 >	7.6 >	Flood Zone 2 >	None (within 50m)				
64 >	7.7 >	Flood Zone 3 >	None (within 50m)				
Page	Section	Surface water flooding >					
65 >	8.1 >	Surface water flooding >	1 in 30 year, 0.1m - 0.3m (within 50m)				
Page	Section	Groundwater flooding >					
67 >	9.1 >	Groundwater flooding >	Moderate (within 50m)				
Page	Section	Environmental designations >	On site	0-50m	50-250m	250-500m	500-2000m
68 >	10.1 >	Sites of Special Scientific Interest (SSSI) >	0	0	0	0	2
69 >	10.2 >	Conserved wetland sites (Ramsar sites) >	0	0	0	0	0
69 >	10.3 >	Special Areas of Conservation (SAC) >	0	0	0	0	0
69 >	10.4 >	Special Protection Areas (SPA) >	0	0	0	0	0
69 >	10.5 >	National Nature Reserves (NNR) >	0	0	0	0	0
70 >	10.6 >	Local Nature Reserves (LNR) >	0	0	0	0	0
70 >	10.7 >	Designated Ancient Woodland >	0	0	0	0	28
71 >	10.8 >	Biosphere Reserves >	0	0	0	0	0
71 >	10.9 >	Forest Parks >	0	0	0	0	0
72 >	10.10 >	Marine Conservation Zones >	0	0	0	0	0
72 >	10.11 >	Green Belt >	0	0	0	0	0
72 >	10.12 >	Proposed Ramsar sites >	0	0	0	0	0



72 >	10.13 >	Possible Special Areas of Conservation (pSAC) >	0	0	0	0	0
72 >	10.14 >	Potential Special Protection Areas (pSPA) >	0	0	0	0	0
73 >	10.15 >	Nitrate Sensitive Areas >	0	0	0	0	0
73 >	10.16 >	Nitrate Vulnerable Zones >	0	0	0	0	0
74 >	10.17 >	SSSI Impact Risk Zones >	1	-	-	-	-
75 >	10.18 >	SSSI Units >	0	0	0	0	0
Page	Section	Visual and cultural designations >	On site	0-50m	50-250m	250-500m	500-2000m
76 >	11.1 >	World Heritage Sites >	0	0	0	-	-
77 >	11.2 >	Area of Outstanding Natural Beauty >	0	0	0	-	-
77 >	11.3 >	National Parks >	0	0	0	-	-
77 >	11.4 >	Listed Buildings >	0	0	5	-	-
78 >	11.5 >	Conservation Areas >	0	1	1	-	-
78 >	11.6 >	Scheduled Ancient Monuments >	0	0	1	-	-
79 >	11.7 >	Registered Parks and Gardens >	0	0	0	-	-
Page	Section	Agricultural designations >	On site	0-50m	50-250m	250-500m	500-2000m
80 >	12.1 >	Agricultural Land Classification >	None (within 250m)				
80 >	12.2 >	Open Access Land >	0	0	0	-	-
80 >	12.3 >	Tree Felling Licences >	0	0	0	-	-
80 >	12.4 >	Environmental Stewardship Schemes >	0	0	0	-	-
81 >	12.5 >	Countryside Stewardship Schemes >	0	0	0	-	-
Page	Section	Habitat designations >	On site	0-50m	50-250m	250-500m	500-2000m
82 >	13.1 >	Priority Habitat Inventory >	0	0	0	-	-
82 >	13.2 >	Habitat Networks >	0	0	0	-	-
82 >	13.3 >	Open Mosaic Habitat >	0	0	0	-	-
82 >	13.4 >	Limestone Pavement Orders >	0	0	0	-	-
Page	Section	Geology 1:10,000 scale >	On site	0-50m	50-250m	250-500m	500-2000m
83 >	14.1 >	10k Availability >	Identified (within 500m)				
84 >	14.2 >	Artificial and made ground (10k) >	0	0	0	3	-
85 >	14.3 >	Superficial geology (10k) >	1	0	2	5	-

86 >	14.4 >	Landslip (10k) >	0	0	0	0	-
87 >	14.5 >	Bedrock geology (10k) >	1	0	2	1	-
88 >	14.6 >	Bedrock faults and other linear features (10k) >	0	0	1	1	-
Page	Section	Geology 1:50,000 scale >	On site	0-50m	50-250m	250-500m	500-2000m
89 >	15.1 >	50k Availability >	Identified (within 500m)				
90 >	15.2 >	Artificial and made ground (50k) >	0	0	0	2	-
91 >	15.3 >	Artificial ground permeability (50k) >	0	0	-	-	-
92 >	15.4 >	Superficial geology (50k) >	1	0	0	3	-
93 >	15.5 >	Superficial permeability (50k) >	Identified (within 50m)				
93 >	15.6 >	Landslip (50k) >	0	0	0	0	-
93 >	15.7 >	Landslip permeability (50k) >	None (within 50m)				
94 >	15.8 >	Bedrock geology (50k) >	1	0	1	0	-
95 >	15.9 >	Bedrock permeability (50k) >	Identified (within 50m)				
95 >	15.10 >	Bedrock faults and other linear features (50k) >	0	0	1	0	-
Page	Section	Boreholes >	On site	0-50m	50-250m	250-500m	500-2000m
96 >	16.1 >	BGS Boreholes >	0	0	5	-	-
Page	Section	Natural ground subsidence >					
98 >	17.1 >	Shrink swell clays >	Negligible (within 50m)				
99 >	17.2 >	Running sands >	Very low (within 50m)				
100 >	17.3 >	Compressible deposits >	Negligible (within 50m)				
101 >	17.4 >	Collapsible deposits >	Very low (within 50m)				
102 >	17.5 >	Landslides >	Very low (within 50m)				
103 >	17.6 >	Ground dissolution of soluble rocks >	Negligible (within 50m)				
Page	Section	Mining, ground workings and natural cavities >	On site	0-50m	50-250m	250-500m	500-2000m
105 >	18.1 >	Natural cavities >	0	0	0	0	-
106 >	18.2 >	BritPits >	0	0	0	0	-
106 >	18.3 >	Surface ground workings >	0	6	9	-	-
107 >	18.4 >	Underground workings >	0	0	0	0	0
107 >	18.5 >	Historical Mineral Planning Areas >	0	0	0	0	-



107 >	18.6 >	Non-coal mining >	1	0	1	0	2
108 >	18.7 >	Mining cavities >	0	0	0	0	0
108 >	18.8 >	JPB mining areas >	None (within 0m)				
108 >	18.9 >	Coal mining >	Identified (within 0m)				
108 >	18.10 >	Brine areas >	None (within 0m)				
109 >	18.11 >	Gypsum areas >	None (within 0m)				
109 >	18.12 >	Tin mining >	None (within 0m)				
109 >	18.13 >	Clay mining >	None (within 0m)				
Page	Section	Radon >					
110 >	19.1 >	Radon >	Between 1% and 3% (within 0m)				
Page	Section	Soil chemistry >	On site	0-50m	50-250m	250-500m	500-2000m
112 >	20.1 >	BGS Estimated Background Soil Chemistry >	1	0	-	-	-
112 >	20.2 >	BGS Estimated Urban Soil Chemistry >	0	0	-	-	-
112 >	20.3 >	BGS Measured Urban Soil Chemistry >	0	0	-	-	-
Page	Section	Railway infrastructure and projects >	On site	0-50m	50-250m	250-500m	500-2000m
113 >	21.1 >	Underground railways (London) >	0	0	0	-	-
113 >	21.2 >	Underground railways (Non-London) >	0	0	0	-	-
113 >	21.3 >	Railway tunnels >	0	0	0	-	-
113 >	21.4 >	Historical railway and tunnel features >	0	0	0	-	-
113 >	21.5 >	Royal Mail tunnels >	0	0	0	-	-
114 >	21.6 >	Historical railways >	0	0	0	-	-
114 >	21.7 >	Railways >	0	0	0	-	-
114 >	21.8 >	Crossrail 1 >	0	0	0	0	-
114 >	21.9 >	Crossrail 2 >	0	0	0	0	-
114 >	21.10 >	HS2 >	0	0	0	0	-

Recent aerial photograph



Capture Date: 10/04/2020

Site Area: 0.04ha



Recent site history - 2017 aerial photograph



Capture Date: 07/05/2017

Site Area: 0.04ha



Recent site history - 2009 aerial photograph



Capture Date: 01/06/2009

Site Area: 0.04ha



Recent site history - 2003 aerial photograph



Capture Date: 04/08/2003

Site Area: 0.04ha



Recent site history - 2000 aerial photograph

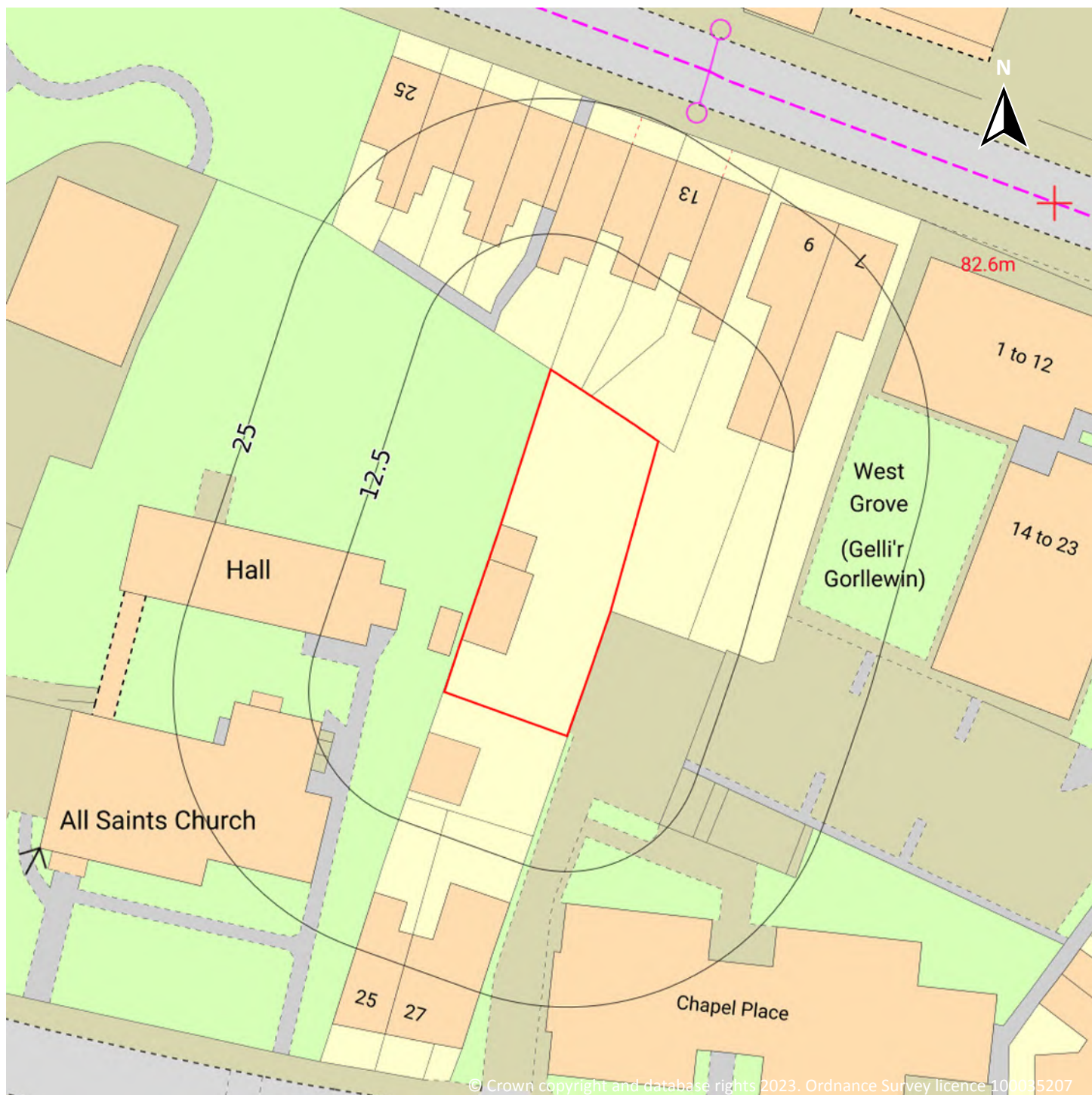


Capture Date: 04/09/2000

Site Area: 0.04ha



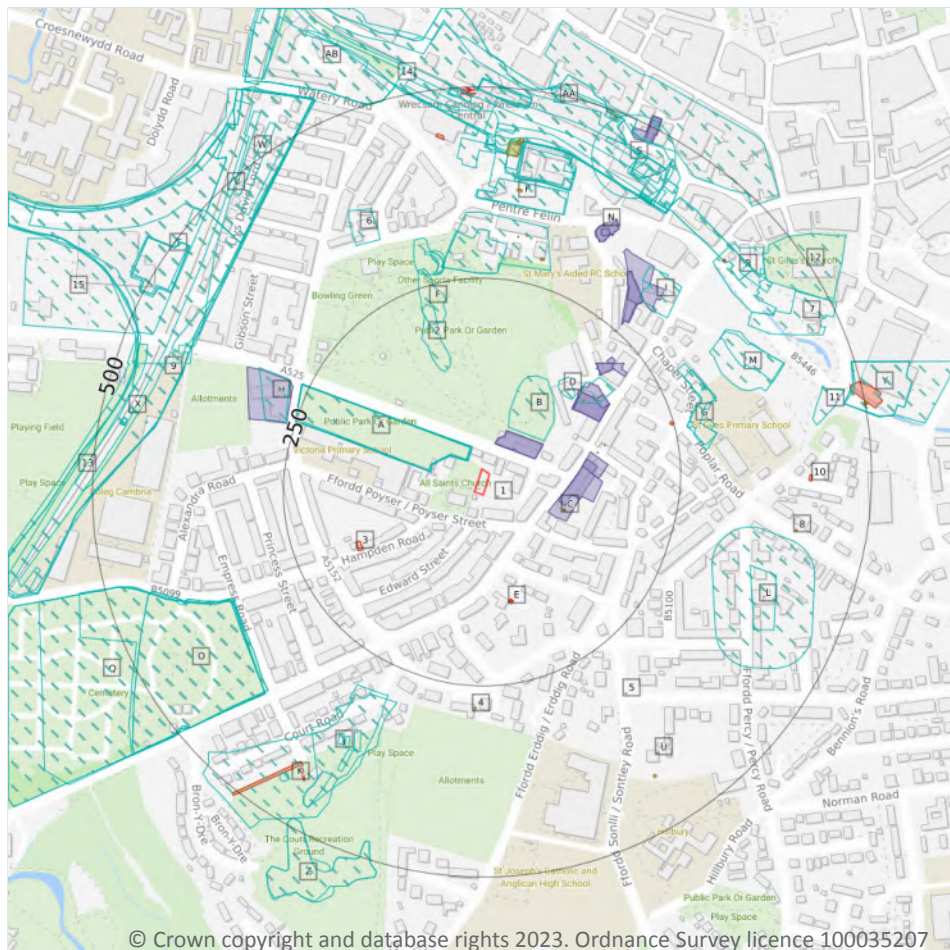
OS MasterMap site plan



Site Area: 0.04ha



1 Past land use



- Site Outline
- Search buffers in metres (m)
- Historical industrial land uses
- Historical tanks
- Historical energy features
- Historical garages

1.1 Historical industrial land uses

Records within 500m

108

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 1:10,560 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on [page 14](#) >

ID	Location	Land use	Dates present	Group ID
A	21m NW	Cemetery	1872	843658



ID	Location	Land use	Dates present	Group ID
A	21m NW	Disused Cemetery	1938 - 1949	977421
A	21m NW	Disused Cemetery	1898	991825
A	23m NW	Disused Cemetery	1910	915040
A	24m NW	Disused Cemetery	1938	915226
B	65m NE	Refuse Heap	1977	828252
2	136m N	Unspecified Pit	1898	838963
D	142m NE	Unspecified Heap	1964	802678
D	148m NE	Malthouse	1872	818898
F	200m N	Refuse Heap	1872	973036
F	256m N	Unspecified Depot	1974 - 1985	895588
F	256m N	Unspecified Depots	1989 - 1992	958859
F	261m N	Unspecified Ground Workings	1910	799087
F	261m N	Refuse Heap	1938	918132
H	262m W	Garage	1977	844086
F	263m N	Unspecified Heap	1938	802676
G	266m E	Malthouse	1872	818899
G	266m E	Brewery	1910 - 1938	869875
J	289m SW	Brick Works	1898	818669
K	294m S	Brick Field	1872	817819
I	302m NE	Malthouse	1872	818897
L	311m E	Unspecified Works	1964	829791
M	329m NE	Brewery	1938	970155
6	329m NW	Malthouse	1872	818896
O	345m SW	Cemetery	1898	976592
O	345m SW	Cemetery	1938	982556
J	346m SW	Brick Kilns	1872	827892
P	347m N	Unspecified Works	1974 - 1980	950666
Q	347m SW	Cemetery	1992	902283



ID	Location	Land use	Dates present	Group ID
Q	347m SW	Cemetery	1964 - 1977	977728
P	348m N	Unspecified Works	1964	944431
Q	349m SW	Cemetery	1949	895594
O	349m SW	Cemetery	1910 - 1938	859988
M	350m NE	Brewery	1872 - 1898	863045
J	359m SW	Brick Kilns	1872	827893
J	360m SW	Brick Kilns	1872	827891
L	361m E	Unspecified Commercial/Industrial	1977	796415
J	375m SW	Brick Kilns	1872	827894
P	382m N	Brewery	1938	898083
P	382m N	Brewery	1872 - 1898	913369
P	384m N	Brewery	1938 - 1949	905153
P	386m N	Unspecified Depot	1974 - 1980	922321
7	390m NE	Brewery	1872	822684
P	394m N	Unspecified Depot	1989 - 1992	848601
P	394m N	Brewery	1910	863489
R	397m NE	Breweries	1872	826799
S	400m NE	Railway Station	1985 - 1992	965064
T	406m W	Railway Sidings	1964 - 1989	913585
T	409m NW	Railway Sidings	1872 - 1898	920101
S	409m NE	Railway Building	1938	819237
S	410m NE	Railway Station	1910	934457
T	410m NW	Railway Sidings	1938 - 1949	946390
P	411m NE	Railway Sidings	1964	871251
P	411m NE	Railway Sidings	1938 - 1949	955462
P	411m NE	Railway Sidings	1974 - 1980	962798
9	412m W	Railway Sidings	1910	935215
P	412m NE	Railway Sidings	1910	880355



ID	Location	Land use	Dates present	Group ID
T	412m NW	Railway Sidings	1938	861177
P	412m NE	Railway Sidings	1898	958574
S	412m NE	Railway Buildings	1898	870617
S	412m NE	Railway Buildings	1938 - 1949	914273
R	413m NE	Railway Sidings	1989	865604
R	413m NE	Railway Sidings	1985	918046
S	414m NE	Railway Station	1964	976301
K	415m SW	Railway Sidings	1898	794470
V	415m NW	Railway Sidings	1992	893363
S	417m NE	Railway Building	1938	819236
R	421m NE	Railway Sidings	1898	960835
P	424m N	Unspecified Pit	1964	838962
11	429m E	Malthouse	1872	818900
S	433m NE	Railway Station	1938 - 1980	918185
W	433m NW	Goods Yard	1992	948709
W	433m NW	Goods Yard	1989	963675
W	433m NW	Goods Yard	1974 - 1985	987910
P	436m N	Unspecified Depot	1985	818104
S	436m NE	Railway Station	1898	915029
P	439m NE	Railway Sidings	1910	882628
R	441m NE	Railway Building	1938	819219
K	443m SW	Unspecified Tank	1938	823856
12	443m NE	Grave Yard	1872	817182
P	444m N	Railway Building	1910 - 1938	927170
X	458m W	Railway Building	1898	819247
13	462m W	Railway Sidings	1910	850891
X	464m W	Railway Building	1938 - 1949	870603
X	464m W	Junction Station	1938	811473



ID	Location	Land use	Dates present	Group ID
14	466m N	Railway Sidings	1910	982230
T	468m NW	Engine Shed	1938 - 1949	852841
T	469m NW	Engine Shed	1910 - 1938	907265
S	473m NE	Unspecified Commercial/Industrial	1989	796413
Y	473m E	Unspecified Commercial/Industrial	1977	796411
Y	473m E	Unspecified Works	1964	871252
T	473m NW	Engine Shed	1964 - 1980	954089
Y	473m E	Unspecified Works	1992	976240
P	475m N	Railway Building	1964	980783
P	476m N	Railway Building	1938	893288
P	476m N	Railway Building	1898 - 1949	878367
Z	478m S	Clay Pit	1898	827617
Z	478m S	Old Clay Pit	1910 - 1938	857410
P	480m N	Railway Buildings	1974 - 1980	930412
S	487m N	Railway Building	1964	855113
P	488m N	Railway Building	1938	819235
S	489m N	Railway Building	1938	915421
15	489m NW	Unspecified Depot	1964 - 1980	958817
AA	490m N	Railway Building	1938	819238
V	491m NW	Railway Building	1974 - 1989	908914
AB	499m N	Unspecified Mill	1938 - 1949	873543
AB	499m N	Unspecified Mill	1898	959707
AA	500m N	Railway Building	1938	819233

This data is sourced from Ordnance Survey / Groundsure.



1.2 Historical tanks

Records within 500m

24

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original ungrouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on [page 14 >](#)

ID	Location	Land use	Dates present	Group ID
1	18m SE	Tank or Trough	1874	120832
C	105m E	Unspecified Tank	1989	136219
C	105m E	Unspecified Tank	1982	122512
C	105m E	Unspecified Tank	1990	139974
C	106m E	Unspecified Tank	1996	130616
C	144m E	Tank or Trough	1874	120836
C	155m E	Tank or Trough	1874	120835
D	156m NE	Pump and Tank	1874	120587
4	278m S	Unspecified Tank	1912	109502
F	284m N	Unspecified Tank	1958 - 1999	131895
F	307m N	Tank or Trough	1874	120833
F	310m N	Tank or Trough	1874	120834
5	319m SE	Tank or Trough	1874	120837
N	359m NE	Pump and Tank	1874	120593
P	367m N	Unspecified Tank	1958 - 1988	144013
U	407m SE	Pump and Tank	1874	120588
8	407m E	Unspecified Tank	1912	109612
P	411m N	Unspecified Tank	1937	141189
P	428m N	Unspecified Tank	1912	142793
U	429m SE	Unspecified Tank	1899 - 1912	122502
P	431m N	Unspecified Tank	1958 - 1968	139500



ID	Location	Land use	Dates present	Group ID
S	491m N	Unspecified Tank	1912	109503
Y	499m E	Unspecified Tank	1958 - 1966	144733
Y	499m E	Unspecified Tank	1988	136727

This data is sourced from Ordnance Survey / Groundsure.

1.3 Historical energy features

Records within 500m

15

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original ungrouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on [page 14 >](#)

ID	Location	Land use	Dates present	Group ID
E	140m S	Electricity Substation	1971 - 1990	75882
E	142m S	Electricity Substation	1996	67632
3	163m SW	Electricity Substation	1990	60090
G	245m E	Electricity Substation	1996	60091
R	413m NE	Electricity Substation	1990	71728
R	413m NE	Electricity Substation	1990	79600
R	413m NE	Electricity Substation	1988	82655
R	414m NE	Electricity Substation	1996	76735
R	414m NE	Electricity Substation	1968	71165
R	414m NE	Electricity Substation	1958	82467
10	418m E	Electricity Substation	1988 - 1990	85306
K	420m SW	Electricity Substation	1988 - 1990	73000
P	434m N	Electricity Substation	1999	60085
Y	485m E	Electricity Works	1912	63445
S	494m N	Electricity Substation	1958 - 1996	80187



This data is sourced from Ordnance Survey / Groundsure.

1.4 Historical petrol stations

Records within 500m	0
----------------------------	----------

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original ungrouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

This data is sourced from Ordnance Survey / Groundsure.

1.5 Historical garages

Records within 500m	21
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Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original ungrouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on [page 14 >](#)

ID	Location	Land use	Dates present	Group ID
B	37m N	Garage	1996	22587
B	38m N	Garage	1971 - 1990	24585
C	88m SE	Garage	1982 - 1990	26513
C	96m E	Garage	1971	21878
C	122m E	Garage	1958	27534
D	138m NE	Garage	1982 - 1989	26215
D	138m NE	Garage	1958 - 1971	27493
D	139m NE	Garage	1958	21498
D	194m NE	Garage	1982 - 1990	27032
D	194m NE	Garage	1971 - 1996	27513
D	213m NE	Garage	1958 - 1988	26705
H	260m W	Garage	1963 - 1990	27358



ID	Location	Land use	Dates present	Group ID
I	262m NE	Garage	1958 - 1968	26942
I	266m NE	Garage	1988	21378
I	292m NE	Garage	1990 - 1999	27167
N	335m NE	Garage	1988	23323
N	335m NE	Garage	1958 - 1968	27120
N	343m NE	Garage	1958	22724
S	476m NE	Garage	1990 - 1999	25206
S	479m NE	Garage	1988	23685
S	480m NE	Garage	1958 - 1968	24780

This data is sourced from Ordnance Survey / Groundsure.

1.6 Historical military land

Records within 500m

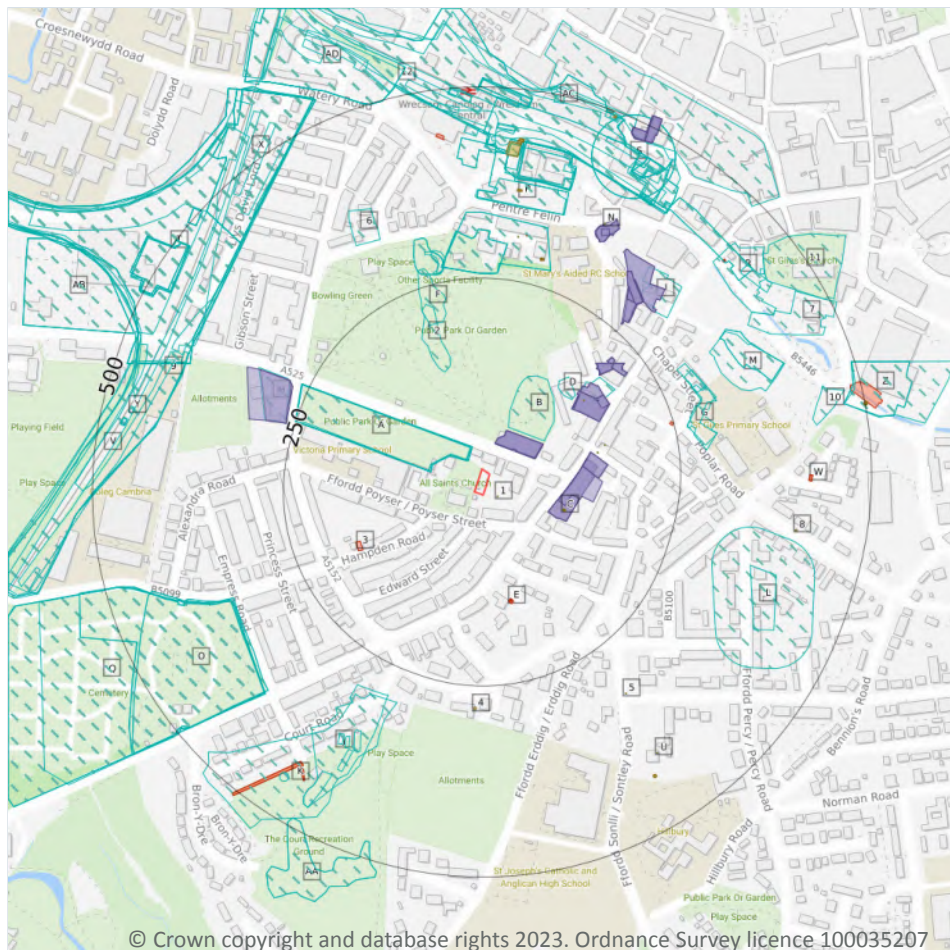
0

Areas of military land digitised from multiple sources including the National Archives, local records, MOD records and verified other sources, intelligently grouped into contiguous features.

This data is sourced from Ordnance Survey / Groundsure / other sources.



2 Past land use - un-grouped



- Site Outline
- Search buffers in metres (m)
- Historical industrial land uses
- Historical tanks
- Historical energy features
- Historical garages

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2.1 Historical industrial land uses

Records within 500m

158

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 10,560 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on [page 23](#) >

ID	Location	Land Use	Date	Group ID
A	21m NW	Disused Cemetery	1938	977421
A	21m NW	Disused Cemetery	1949	977421
A	21m NW	Disused Cemetery	1898	991825



ID	Location	Land Use	Date	Group ID
A	21m NW	Cemetery	1872	843658
A	23m NW	Disused Cemetery	1910	915040
A	24m NW	Disused Cemetery	1938	915226
B	65m NE	Refuse Heap	1977	828252
2	136m N	Unspecified Pit	1898	838963
D	142m NE	Unspecified Heap	1964	802678
D	148m NE	Malthouse	1872	818898
F	200m N	Refuse Heap	1872	973036
F	256m N	Unspecified Depot	1980	895588
F	256m N	Unspecified Depot	1974	895588
F	256m N	Unspecified Depot	1985	895588
F	256m N	Unspecified Depots	1989	958859
F	256m N	Unspecified Depots	1992	958859
F	261m N	Unspecified Ground Workings	1910	799087
F	261m N	Refuse Heap	1938	918132
F	261m N	Refuse Heap	1938	918132
H	262m W	Garage	1977	844086
F	263m N	Unspecified Heap	1938	802676
G	266m E	Malthouse	1872	818899
G	266m E	Brewery	1938	869875
G	281m NE	Brewery	1910	869875
J	289m SW	Brick Works	1898	818669
K	294m S	Brick Field	1872	817819
I	302m NE	Malthouse	1872	818897
L	311m E	Unspecified Works	1964	829791
M	329m NE	Brewery	1938	970155
6	329m NW	Malthouse	1872	818896
O	345m SW	Cemetery	1938	982556



ID	Location	Land Use	Date	Group ID
O	345m SW	Cemetery	1898	976592
J	346m SW	Brick Kilns	1872	827892
P	347m N	Unspecified Works	1980	950666
P	347m N	Unspecified Works	1974	950666
Q	347m SW	Cemetery	1992	902283
Q	347m SW	Cemetery	1977	977728
Q	347m SW	Cemetery	1964	977728
P	348m N	Unspecified Works	1964	944431
Q	349m SW	Cemetery	1949	895594
O	349m SW	Cemetery	1938	859988
O	349m SW	Cemetery	1910	859988
M	350m NE	Brewery	1898	863045
M	350m NE	Brewery	1872	863045
J	359m SW	Brick Kilns	1872	827893
J	360m SW	Brick Kilns	1872	827891
L	361m E	Unspecified Commercial/Industrial	1977	796415
J	375m SW	Brick Kilns	1872	827894
P	382m N	Brewery	1938	898083
P	382m N	Brewery	1898	913369
P	382m N	Brewery	1872	913369
P	384m N	Brewery	1938	905153
P	384m N	Brewery	1949	905153
P	386m N	Unspecified Depot	1980	922321
P	386m N	Unspecified Depot	1974	922321
7	390m NE	Brewery	1872	822684
P	394m N	Unspecified Depot	1989	848601
P	394m N	Unspecified Depot	1992	848601
P	394m N	Brewery	1910	863489



ID	Location	Land Use	Date	Group ID
R	397m NE	Breweries	1872	826799
S	400m NE	Railway Station	1989	965064
S	400m NE	Railway Station	1992	965064
S	400m NE	Railway Station	1985	965064
T	406m W	Railway Sidings	1989	913585
T	406m W	Railway Sidings	1980	913585
T	406m W	Railway Sidings	1974	913585
T	406m W	Railway Sidings	1985	913585
T	406m W	Railway Sidings	1964	913585
T	409m NW	Railway Sidings	1898	920101
S	409m NE	Railway Building	1938	819237
S	410m NE	Railway Station	1910	934457
T	410m NW	Railway Sidings	1938	946390
T	410m NW	Railway Sidings	1949	946390
P	411m NE	Railway Sidings	1964	871251
P	411m NE	Railway Sidings	1938	955462
P	411m NE	Railway Sidings	1980	962798
P	411m NE	Railway Sidings	1974	962798
V	412m W	Railway Sidings	1964	913585
9	412m W	Railway Sidings	1910	935215
P	412m NE	Railway Sidings	1910	880355
T	412m NW	Railway Sidings	1938	861177
P	412m NE	Railway Sidings	1938	955462
P	412m NE	Railway Sidings	1949	955462
P	412m NE	Railway Sidings	1898	958574
S	412m NE	Railway Buildings	1938	914273
S	412m NE	Railway Buildings	1949	914273
S	412m NE	Railway Buildings	1898	870617



ID	Location	Land Use	Date	Group ID
R	413m NE	Railway Sidings	1989	865604
R	413m NE	Railway Sidings	1985	918046
S	414m NE	Railway Station	1964	976301
K	415m SW	Railway Sidings	1898	794470
T	415m NW	Railway Sidings	1992	893363
S	417m NE	Railway Building	1938	819236
R	421m NE	Railway Sidings	1898	960835
P	424m N	Unspecified Pit	1964	838962
V	426m W	Railway Sidings	1977	913585
10	429m E	Malthouse	1872	818900
S	433m NE	Railway Station	1938	918185
X	433m NW	Goods Yard	1989	963675
X	433m NW	Goods Yard	1992	948709
X	433m NW	Goods Yard	1980	987910
X	433m NW	Goods Yard	1974	987910
X	433m NW	Goods Yard	1985	987910
S	435m NE	Railway Station	1980	918185
S	435m NE	Railway Station	1974	918185
P	436m N	Unspecified Depot	1985	818104
S	436m NE	Railway Station	1938	918185
S	436m NE	Railway Station	1949	918185
S	436m NE	Railway Station	1898	915029
P	439m NE	Railway Sidings	1910	882628
R	441m NE	Railway Building	1938	819219
K	443m SW	Unspecified Tank	1938	823856
11	443m NE	Grave Yard	1872	817182
P	444m N	Railway Building	1910	927170
P	445m N	Railway Building	1938	927170



ID	Location	Land Use	Date	Group ID
T	448m NW	Railway Sidings	1872	920101
Y	458m W	Railway Building	1898	819247
V	462m W	Railway Sidings	1910	850891
Y	464m W	Railway Building	1938	870603
Y	464m W	Railway Building	1949	870603
Y	464m W	Junction Station	1938	811473
12	466m N	Railway Sidings	1910	982230
T	468m NW	Engine Shed	1938	852841
T	468m NW	Engine Shed	1949	852841
T	469m NW	Engine Shed	1910	907265
T	470m NW	Engine Shed	1938	907265
S	473m NE	Unspecified Commercial/Industrial	1989	796413
Z	473m E	Unspecified Commercial/Industrial	1977	796411
Z	473m E	Unspecified Works	1964	871252
T	473m NW	Engine Shed	1980	954089
T	473m NW	Engine Shed	1974	954089
T	473m NW	Engine Shed	1964	954089
Z	473m E	Unspecified Works	1992	976240
P	475m N	Railway Building	1964	980783
P	476m N	Railway Building	1938	893288
P	476m N	Railway Building	1910	878367
P	477m N	Railway Building	1938	878367
P	477m N	Railway Building	1949	878367
P	477m N	Railway Building	1898	878367
AA	478m S	Old Clay Pit	1938	857410
AA	478m S	Clay Pit	1898	827617
P	480m N	Railway Buildings	1980	930412
P	480m N	Railway Buildings	1974	930412



ID	Location	Land Use	Date	Group ID
S	487m N	Railway Building	1964	855113
P	488m N	Railway Building	1938	819235
S	489m N	Railway Building	1938	915421
AB	489m NW	Unspecified Depot	1980	958817
AB	489m NW	Unspecified Depot	1974	958817
AB	489m NW	Unspecified Depot	1964	958817
AC	490m N	Railway Building	1938	819238
T	491m NW	Railway Building	1989	908914
T	491m NW	Railway Building	1980	908914
T	491m NW	Railway Building	1974	908914
T	491m NW	Railway Building	1985	908914
AD	499m N	Unspecified Mill	1938	873543
AD	499m N	Unspecified Mill	1949	873543
AD	499m N	Unspecified Mill	1898	959707
AC	500m N	Railway Building	1938	819233

This data is sourced from Ordnance Survey / Groundsure.

2.2 Historical tanks

Records within 500m

35

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on [page 23 >](#)

ID	Location	Land Use	Date	Group ID
1	18m SE	Tank or Trough	1874	120832
C	105m E	Unspecified Tank	1982	122512
C	105m E	Unspecified Tank	1989	136219
C	105m E	Unspecified Tank	1990	139974
C	106m E	Unspecified Tank	1996	130616



ID	Location	Land Use	Date	Group ID
C	144m E	Tank or Trough	1874	120836
C	155m E	Tank or Trough	1874	120835
D	156m NE	Pump and Tank	1874	120587
4	278m S	Unspecified Tank	1912	109502
F	284m N	Unspecified Tank	1990	131895
F	284m N	Unspecified Tank	1990	131895
F	284m N	Unspecified Tank	1988	131895
F	284m N	Unspecified Tank	1996	131895
F	284m N	Unspecified Tank	1999	131895
F	285m N	Unspecified Tank	1958	131895
F	307m N	Tank or Trough	1874	120833
F	310m N	Tank or Trough	1874	120834
5	319m SE	Tank or Trough	1874	120837
N	359m NE	Pump and Tank	1874	120593
P	367m N	Unspecified Tank	1958	144013
P	367m N	Unspecified Tank	1988	144013
U	407m SE	Pump and Tank	1874	120588
8	407m E	Unspecified Tank	1912	109612
P	411m N	Unspecified Tank	1937	141189
P	428m N	Unspecified Tank	1912	142793
U	429m SE	Unspecified Tank	1899	122502
U	429m SE	Unspecified Tank	1912	122502
P	431m N	Unspecified Tank	1958	139500
P	431m N	Unspecified Tank	1968	139500
P	432m N	Unspecified Tank	1958	139500
S	491m N	Unspecified Tank	1912	109503
Z	499m E	Unspecified Tank	1958	144733
Z	499m E	Unspecified Tank	1966	144733



ID	Location	Land Use	Date	Group ID
Z	499m E	Unspecified Tank	1988	136727
Z	499m E	Unspecified Tank	1958	144733

This data is sourced from Ordnance Survey / Groundsure.

2.3 Historical energy features

Records within 500m

25

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on [page 23 >](#)

ID	Location	Land Use	Date	Group ID
E	140m S	Electricity Substation	1982	75882
E	140m S	Electricity Substation	1989	75882
E	140m S	Electricity Substation	1990	75882
E	141m S	Electricity Substation	1971	75882
E	142m S	Electricity Substation	1996	67632
3	163m SW	Electricity Substation	1990	60090
G	245m E	Electricity Substation	1996	60091
R	413m NE	Electricity Substation	1990	79600
R	413m NE	Electricity Substation	1990	71728
R	413m NE	Electricity Substation	1988	82655
R	414m NE	Electricity Substation	1996	76735
R	414m NE	Electricity Substation	1968	71165
R	414m NE	Electricity Substation	1958	82467
W	418m E	Electricity Substation	1988	85306
W	418m E	Electricity Substation	1990	85306
K	420m SW	Electricity Substation	1988	73000
K	420m SW	Electricity Substation	1990	73000
P	434m N	Electricity Substation	1999	60085



ID	Location	Land Use	Date	Group ID
Z	485m E	Electricity Works	1912	63445
S	494m N	Electricity Substation	1996	80187
S	495m N	Electricity Substation	1990	80187
S	495m N	Electricity Substation	1990	80187
S	495m N	Electricity Substation	1988	80187
S	495m N	Electricity Substation	1958	80187
S	495m N	Electricity Substation	1968	80187

This data is sourced from Ordnance Survey / Groundsure.

2.4 Historical petrol stations

Records within 500m

0

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

This data is sourced from Ordnance Survey / Groundsure.

2.5 Historical garages

Records within 500m

44

Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on [page 23](#) >

ID	Location	Land Use	Date	Group ID
B	37m N	Garage	1996	22587
B	38m N	Garage	1971	24585
B	38m N	Garage	1982	24585
B	38m N	Garage	1989	24585
B	38m N	Garage	1990	24585
C	88m SE	Garage	1982	26513



ID	Location	Land Use	Date	Group ID
C	88m SE	Garage	1989	26513
C	88m SE	Garage	1990	26513
C	96m E	Garage	1971	21878
C	122m E	Garage	1958	27534
C	123m E	Garage	1958	27534
D	138m NE	Garage	1982	26215
D	138m NE	Garage	1989	26215
D	138m NE	Garage	1971	27493
D	138m NE	Garage	1958	27493
D	139m NE	Garage	1958	21498
D	194m NE	Garage	1982	27032
D	194m NE	Garage	1989	27032
D	194m NE	Garage	1990	27032
D	194m NE	Garage	1971	27513
D	195m NE	Garage	1996	27513
D	213m NE	Garage	1988	26705
D	214m NE	Garage	1958	26705
H	260m W	Garage	1963	27358
I	262m NE	Garage	1958	26942
I	262m NE	Garage	1968	26942
H	262m W	Garage	1990	27358
I	266m NE	Garage	1988	21378
I	292m NE	Garage	1996	27167
I	292m NE	Garage	1999	27167
I	294m NE	Garage	1990	27167
I	294m NE	Garage	1990	27167
N	335m NE	Garage	1988	23323
N	335m NE	Garage	1958	27120

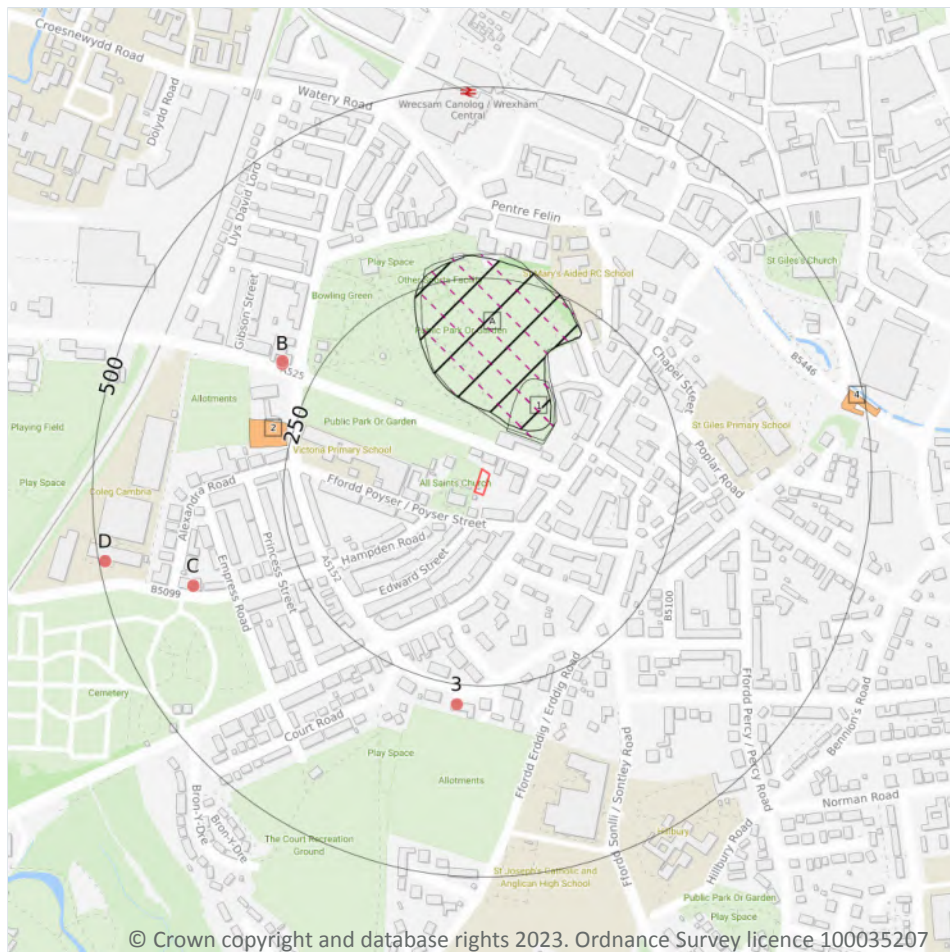


ID	Location	Land Use	Date	Group ID
N	335m NE	Garage	1958	27120
N	335m NE	Garage	1968	27120
N	343m NE	Garage	1958	22724
S	476m NE	Garage	1990	25206
S	476m NE	Garage	1990	25206
S	478m NE	Garage	1996	25206
S	478m NE	Garage	1999	25206
S	479m NE	Garage	1988	23685
S	480m NE	Garage	1958	24780
S	480m NE	Garage	1968	24780

This data is sourced from Ordnance Survey / Groundsure.



3 Waste and landfill



- Site Outline
- Search buffers in metres (m)
- Historical landfill (EA/NRW)
- Historical landfill (LA/OS)
- Historical waste sites
- Waste exemptions

3.1 Active or recent landfill

Records within 500m

0

Active or recently closed landfill sites under Environment Agency/Natural Resources Wales regulation.

This data is sourced from the Environment Agency and Natural Resources Wales.

3.2 Historical landfill (BGS records)

Records within 500m

0

Landfill sites identified on a survey carried out on behalf of the DoE in 1973. These sites may have been closed or operational at this time.

This data is sourced from the British Geological Survey.



3.3 Historical landfill (LA/mapping records)

Records within 500m

2

Landfill sites identified from Local Authority records and high detail historical mapping.

Features are displayed on the Waste and landfill map on [page 35 >](#)

ID	Location	Site address	Source	Data type
1	60m NE	Refuse Tip	1971 mapping	Polygon
A	63m NE	Parciau	Wrexham Council	Polygon

This data is sourced from the Ordnance Survey/Groundsure and Local Authority records.

3.4 Historical landfill (EA/NRW records)

Records within 500m

1

Known historical (closed) landfill sites (e.g. sites where there is no PPC permit or waste management licence currently in force). This includes sites that existed before the waste licensing regime and sites that have been licensed in the past but where a licence has been revoked, ceased to exist or surrendered and a certificate of completion has been issued.

Features are displayed on the Waste and landfill map on [page 35 >](#)

ID	Location	Details		
A	67m NE	Site Address: Parciau, Wrexham, Clwyd Licence Holder Address: -	Waste Licence: - Site Reference: - Waste Type: Inert, Industrial, Commercial, Household Environmental Permitting Regulations (Waste) Reference: - Licence Issue: - Licence Surrender: -	Operator: Wrexham Borough Council Licence Holder: Wrexham Borough Council First Recorded 01/01/1969 Last Recorded: 31/12/1972

This data is sourced from the Environment Agency and Natural Resources Wales.

3.5 Historical waste sites

Records within 500m

2

Waste site records derived from Local Authority planning records and high detail historical mapping.

Features are displayed on the Waste and landfill map on [page 35 >](#)



ID	Location	Address	Further Details	Date
2	252m W	Site Address: N/A	Type of Site: Amenity Site Planning application reference: N/A Description: N/A Data source: Historic Mapping Data Type: Polygon	1990
4	469m E	Site Address: N/A	Type of Site: Refuse Destructor Planning application reference: N/A Description: N/A Data source: Historic Mapping Data Type: Polygon	1912

This data is sourced from Ordnance Survey/Groundsure and Local Authority records.

3.6 Licensed waste sites

Records within 500m	0
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Active or recently closed waste sites under Environment Agency/Natural Resources Wales regulation.

This data is sourced from the Environment Agency and Natural Resources Wales.

3.7 Waste exemptions

Records within 500m	15
----------------------------	-----------

Activities involving the storage, treatment, use or disposal of waste that are exempt from needing a permit. Exemptions have specific limits and conditions that must be adhered to.

Features are displayed on the Waste and landfill map on [page 35 >](#)

ID	Location	Site	Reference	Category	Sub-Category	Description
3	277m S	Partnerships in Care, Fairholme Partnerships in Care, 1-3 Fairy Road, Wreccsam, Wrexham, LL137PR	NRW- WME022371	Treating waste exemption	Not on a farm	Sorting and de-naturing of controlled drugs for disposal
B	296m NW	Speedy Asset Services Limited, Park View Car Sales, Ruthin Road, Wrexham, Wreccsam, LL13 7TT	NRW- WME042257	Storing waste exemption	Not on a farm	Storage of waste in secure containers



ID	Location	Site	Reference	Category	Sub-Category	Description
B	296m NW	Speedy Asset Services Limited, Park View Car Sales, Ruthin Road, Wrexham, Wreccsam, LL13 7TT	NRW-WME042257	Storing waste exemption	Not on a farm	Storage of waste in a secure place
B	297m NW	Speedy Asset Services Limited, Speedy Hire, Park View Garage, Ruthin Road, Wrexham, Wreccsam, LL137TT	NRW-WME026905	Treating waste exemption	Not on a farm	Preparatory treatments (baling, sorting, shredding etc)
B	297m NW	Speedy Asset Services Limited, Speedy Hire, Park View Garage, Ruthin Road, Wrexham, Wreccsam, LL137TT	NRW-WME026905	Treating waste exemption	Not on a farm	Sorting mixed waste
C	389m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL137UG	NRW-WME022190	Using waste exemption	Not on a farm	Use of mulch
C	389m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL137UG	NRW-WME022190	Using waste exemption	Not on a farm	Spreading waste on non-agricultural land to confer benefit
C	389m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL137UG	NRW-WME022190	Treating waste exemption	Not on a farm	Treatment of waste wood and waste plant matter by chipping, shredding, cutting or pulverising
C	389m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL137UG	NRW-WME022190	Using waste exemption	Not on a farm	Use of waste for a specified purpose
C	389m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL137UG	NRW-WME022190	Using waste exemption	Not on a farm	Spreading of plant matter to confer benefit
D	492m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL13 7UG	NRW-WME049784	Using waste exemption	Not on a farm	Spreading waste on non-agricultural land to confer benefit

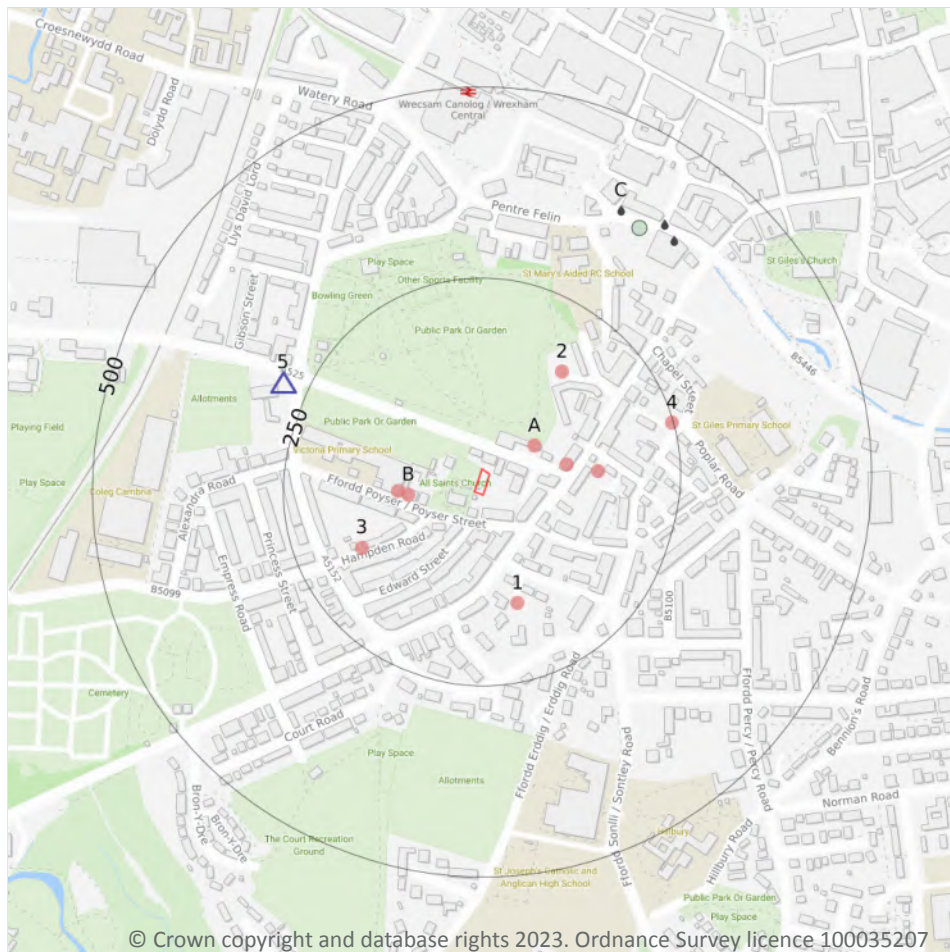


ID	Location	Site	Reference	Category	Sub-Category	Description
D	492m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL13 7UG	NRW-WME049784	Treating waste exemption	Not on a farm	Treatment of waste wood and waste plant matter by chipping, shredding, cutting or pulverising
D	492m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL13 7UG	NRW-WME049784	Using waste exemption	Not on a farm	Spreading of plant matter to confer benefit
D	492m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL13 7UG	NRW-WME049784	Using waste exemption	Not on a farm	Use of waste for a specified purpose
D	492m W	Coleg Cambria, Coleg Cambria Bersham Road, Bersham Road, Wrexham, Wrexham, LL13 7UG	NRW-WME049784	Using waste exemption	Not on a farm	Use of mulch

This data is sourced from the Environment Agency and Natural Resources Wales.



4 Current industrial land use



- Site Outline
- Search buffers in metres (m)
- Recent industrial land uses
- Current or recent petrol stations
- Licensed Discharges to controlled waters
- Pollution Incidents (EA/NRW)

4.1 Recent industrial land uses

Records within 250m

9

Current potentially contaminative industrial sites.

Features are displayed on the Current industrial land use map on [page 40](#) >

ID	Location	Company	Address	Activity	Category
A	69m NE	Belle Vue Garage	Ruthin Road, Wrexham, Clwyd, LL13 7NU	Vehicle Repair, Testing and Servicing	Repair and Servicing
B	87m W	J Browse Motorcycles	11, Poyser Street, Wrexham, Clwyd, LL13 7RP	Vehicle Components	Industrial Products
B	101m W	Owens Motorcycles	7, Poyser Street, Wrexham, Clwyd, LL13 7RP	New Vehicles	Motoring



ID	Location	Company	Address	Activity	Category
A	102m E	Price Brothers & Sons Upholstery Ltd	Upholsterers and Curtains 62, Pen y Bryn, Wrexham, Clwyd, LL13 7HY	Furniture	Consumer Products
A	142m E	National Tyres and Autocare	Pen-y-Bryn, Ruabon Road, Wrexham, Clwyd, LL13 7HU	Vehicle Repair, Testing and Servicing	Repair and Servicing
1	149m S	Electricity Sub Station	Clwyd, LL13	Electrical Features	Infrastructure and Facilities
2	164m NE	Electricity Sub Station	Clwyd, LL13	Electrical Features	Infrastructure and Facilities
3	165m SW	Electricity Sub Station	Clwyd, LL13	Electrical Features	Infrastructure and Facilities
4	248m E	Electricity Sub Station	Clwyd, LL13	Electrical Features	Infrastructure and Facilities

This data is sourced from Ordnance Survey.

4.2 Current or recent petrol stations

Records within 500m

1

Open, closed, under development and obsolete petrol stations.

Features are displayed on the Current industrial land use map on [page 40](#) >

ID	Location	Company	Address	LPG	Status
5	284m NW	TOTAL	Ruthin Road, Victoria Road, Wrexham, Wrexham, LL13 7TT	Not Applicable	Obsolete

This data is sourced from Experian.

4.3 Electricity cables

Records within 500m

0

High voltage underground electricity transmission cables.

This data is sourced from National Grid.



4.4 Gas pipelines

Records within 500m

0

High pressure underground gas transmission pipelines.

This data is sourced from National Grid.

4.5 Sites determined as Contaminated Land

Records within 500m

0

Contaminated Land Register of sites designated under Part 2a of the Environmental Protection Act 1990.

This data is sourced from Local Authority records.

4.6 Control of Major Accident Hazards (COMAH)

Records within 500m

0

Control of Major Accident Hazards (COMAH) sites. This data includes upper and lower tier sites, and includes a historical archive of COMAH sites and Notification of Installations Handling Hazardous Substances (NIHHS) records.

This data is sourced from the Health and Safety Executive.

4.7 Regulated explosive sites

Records within 500m

0

Sites registered and licensed by the Health and Safety Executive under the Manufacture and Storage of Explosives Regulations 2005 (MSER). The last update to this data was in April 2011.

This data is sourced from the Health and Safety Executive.

4.8 Hazardous substance storage/usage

Records within 500m

0

Consents granted for a site to hold certain quantities of hazardous substances at or above defined limits in accordance with the Planning (Hazardous Substances) Regulations 2015.

This data is sourced from Local Authority records.



4.9 Historical licensed industrial activities (IPC)

Records within 500m**0**

Integrated Pollution Control (IPC) records of substance releases to air, land and water. This data represents a historical archive as the IPC regime has been superseded.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.10 Licensed industrial activities (Part A(1))

Records within 500m**0**

Records of Part A(1) installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.11 Licensed pollutant release (Part A(2)/B)

Records within 500m**0**

Records of Part A(2) and Part B installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

This data is sourced from Local Authority records.

4.12 Radioactive Substance Authorisations

Records within 500m**0**

Records of the storage, use, accumulation and disposal of radioactive substances regulated under the Radioactive Substances Act 1993.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.13 Licensed Discharges to controlled waters

Records within 500m**3**

Discharges of treated or untreated effluent to controlled waters under the Water Resources Act 1991.

Features are displayed on the Current industrial land use map on [page 40](#) >

ID	Location	Address	Details	
C	384m NE	WREXHAM BROOK STREET - SSO	Effluent Type: UNSPECIFIED Permit Number: CM0174701 Permit Version: 1 Receiving Water: GWENFRO	Status: CONSENT EXPIRED - TIME LIMIT Issue date: 20/10/1989 Effective Date: 20/10/1989 Revocation Date: 16/03/1998
C	389m NE	O/S TOP RANK CLUB BROOK ST WREXHAM, O/S TOP RANK CLUB BROOK ST WREXH, WREXHAM	Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY Permit Number: CG0355301 Permit Version: 1 Receiving Water: TRIBUTARY OF THE RIVER CLYWEDO	Status: Effective Issue date: 21/07/1994 Effective Date: 21/07/1994 Revocation Date: -
C	399m NE	CSO O/S TOP RANK CLUB BROOK ST WREXHAM, Taurus Business Centre, 1 Vicarage Hill, Wrexham, LL13 7HN	Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY Permit Number: CG0355301 Permit Version: 0 Receiving Water: RIVER GWENFRO	Status: Effective Issue date: 11/10/2019 Effective Date: 11/10/2019 Revocation Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

4.14 Pollutant release to surface waters (Red List)

Records within 500m	0
----------------------------	----------

Discharges of specified substances under the Environmental Protection (Prescribed Processes and Substances) Regulations 1991.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.15 Pollutant release to public sewer

Records within 500m	0
----------------------------	----------

Discharges of Special Category Effluents to the public sewer.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.16 List 1 Dangerous Substances

Records within 500m	0
----------------------------	----------

Discharges of substances identified on List I of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

This data is sourced from the Environment Agency and Natural Resources Wales.



4.17 List 2 Dangerous Substances

Records within 500m

0

Discharges of substances identified on List II of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.18 Pollution Incidents (EA/NRW)

Records within 500m

1

Records of substantiated pollution incidents. Since 2006 this data has only included category 1 (major) and 2 (significant) pollution incidents.

Features are displayed on the Current industrial land use map on [page 40 >](#)

ID	Location	Details	
C	376m NE	Incident Date: 08/03/2010 Incident Identification: 759614 Pollutant: Specific Waste Materials Pollutant Description: Asbestos	Water Impact: Category 4 (No Impact) Land Impact: Category 2 (Significant) Air Impact: Category 2 (Significant)

This data is sourced from the Environment Agency and Natural Resources Wales.

4.19 Pollution inventory substances

Records within 500m

0

The pollution inventory (substances) includes reporting on annual emissions of certain regulated substances to air, controlled waters and land. A reporting threshold for each substance is also included. Where emissions fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

4.20 Pollution inventory waste transfers

Records within 500m

0

The pollution inventory (waste transfers) includes reporting on annual transfers and recovery/disposal of controlled wastes from a site. A reporting threshold for each waste type is also included. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.



4.21 Pollution inventory radioactive waste

Records within 500m

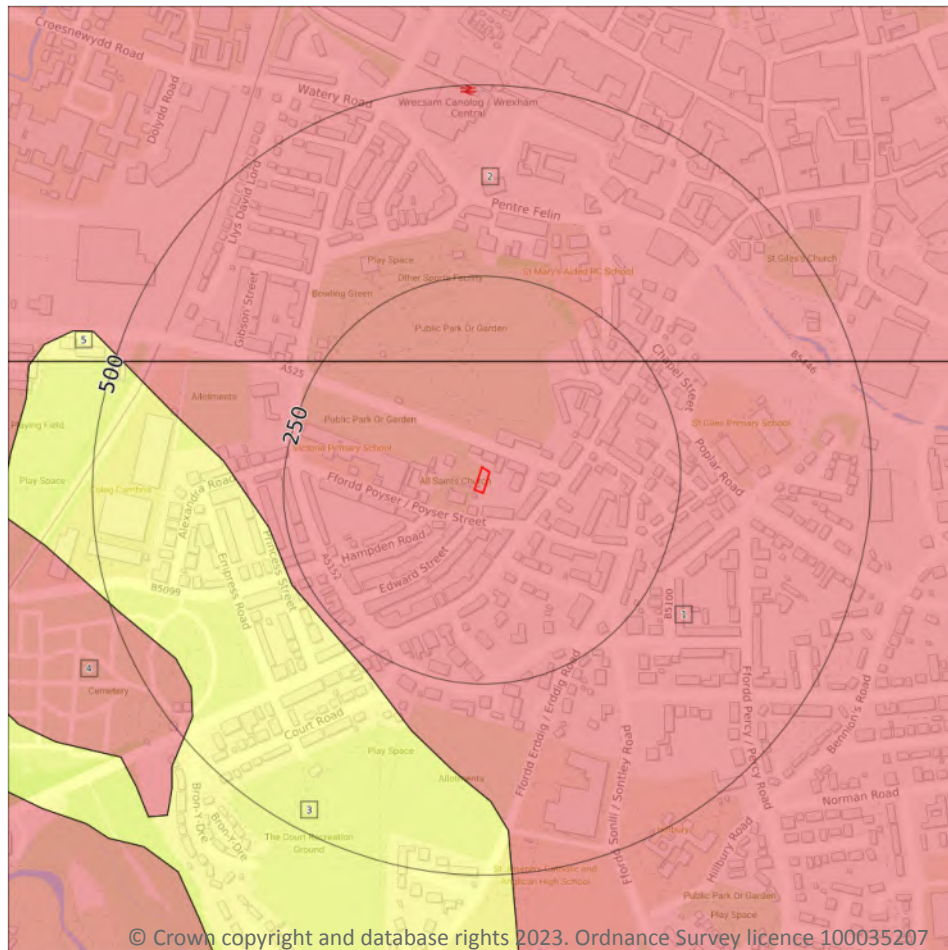
0

The pollution inventory (radioactive wastes) includes reporting on annual releases of radioactive substances from a site, including the means of release. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.



5 Hydrogeology - Superficial aquifer



- Site Outline
- Search buffers in metres (m)
- Principal
 - Secondary A
 - Secondary B
 - Secondary Undifferentiated
 - Unproductive
 - Unknown

5.1 Superficial aquifer

Records within 500m

5

Aquifer status of groundwater held within superficial geology.

Features are displayed on the Hydrogeology map on [page 47 >](#)

ID	Location	Designation	Description
1	On site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	139m N	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

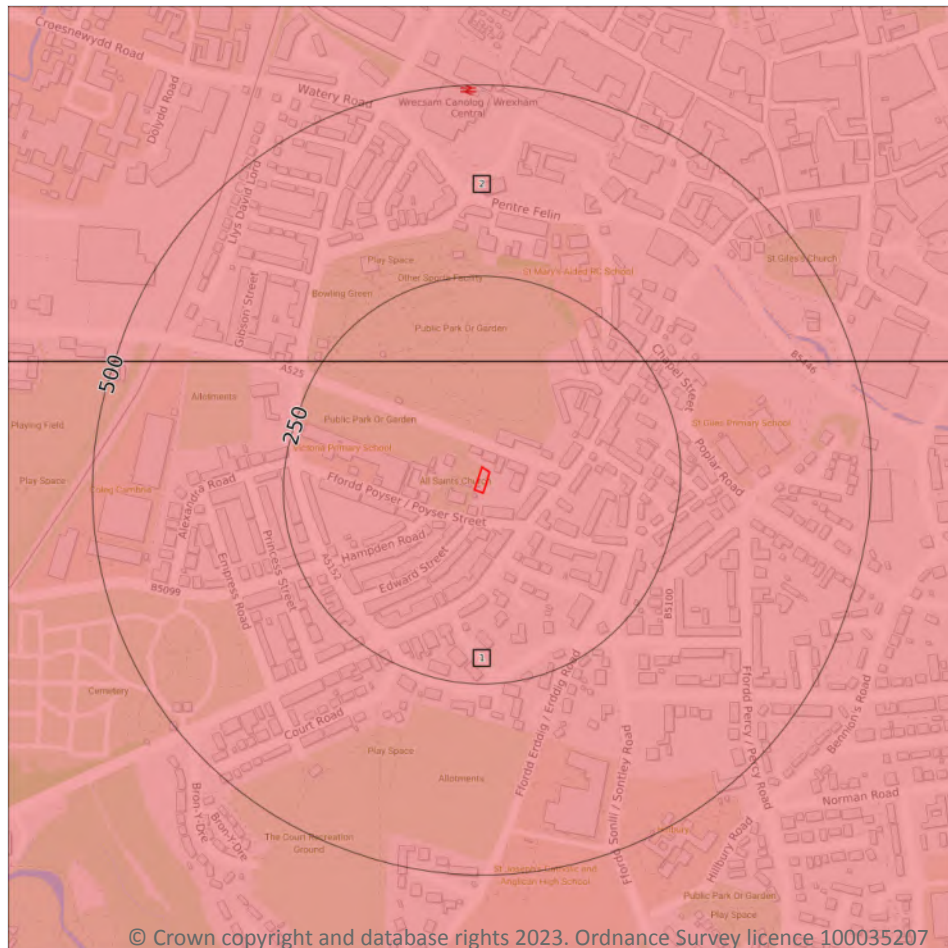


ID	Location	Designation	Description
3	262m SW	Secondary Undifferentiated	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
4	449m SW	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
5	490m W	Secondary Undifferentiated	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.



Bedrock aquifer



- Site Outline
- Search buffers in metres (m)
- Principal
 - Secondary A
 - Secondary B
 - Secondary Undifferentiated
 - Unproductive

5.2 Bedrock aquifer

Records within 500m

2

Aquifer status of groundwater held within bedrock geology.

Features are displayed on the Bedrock aquifer map on [page 49](#) >

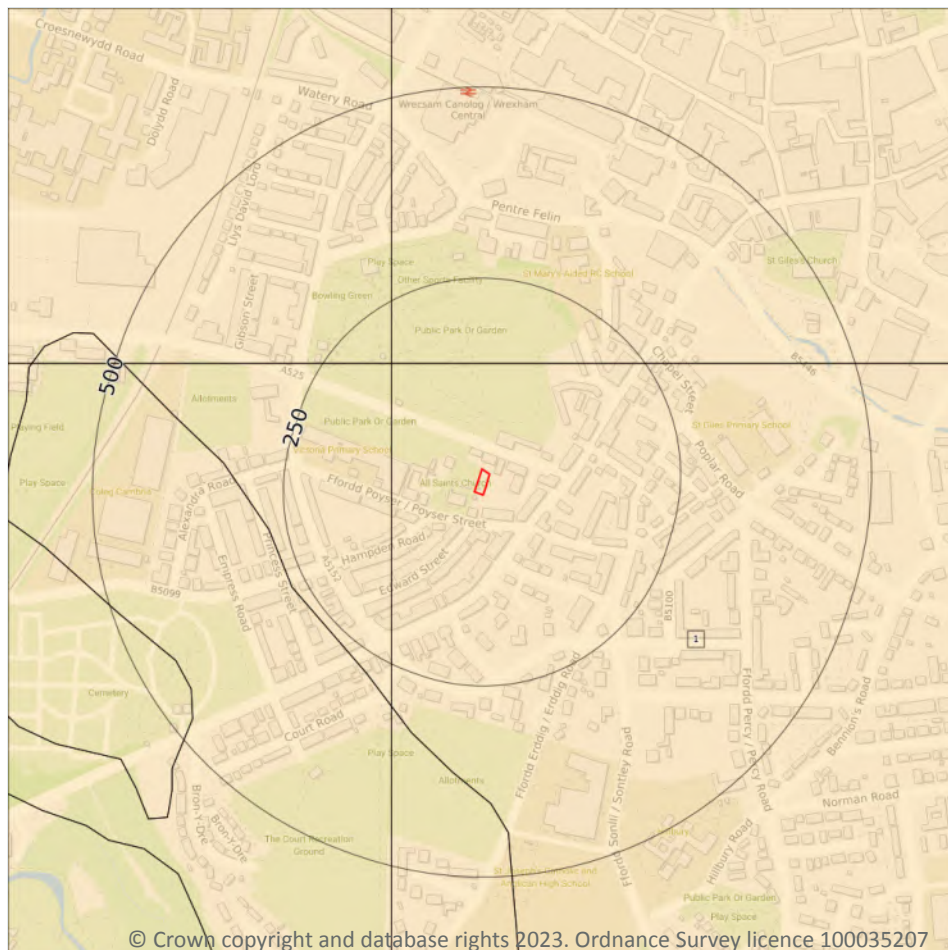
ID	Location	Designation	Description
1	On site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	139m N	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers



This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.



Groundwater vulnerability



5.3 Groundwater vulnerability

Records within 50m

1

An assessment of the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a one kilometre square grid. Groundwater vulnerability is described as High, Medium or Low as follows:

- High - Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
- Medium - Intermediate between high and low vulnerability.
- Low - Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

Features are displayed on the Groundwater vulnerability map on [page 51](#) >

ID	Location	Summary	Soil / surface	Superficial geology	Bedrock geology
1	On site	Summary Classification: Secondary superficial aquifer - High Vulnerability Combined classification: Productive Bedrock Aquifer, Productive Superficial Aquifer	Leaching class: High Infiltration value: >70% Dilution value: 300- 550mm/year	Vulnerability: High Aquifer type: Secondary Thickness: >10m Patchiness value: >90% Recharge potential: High	Vulnerability: Low Aquifer type: Secondary Flow mechanism: Well connected fractures

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

5.4 Groundwater vulnerability- soluble rock risk

Records on site

0

This dataset identifies areas where solution features that enable rapid movement of a pollutant may be present within a 1km grid square.

This data is sourced from the British Geological Survey and the Environment Agency.

5.5 Groundwater vulnerability- local information

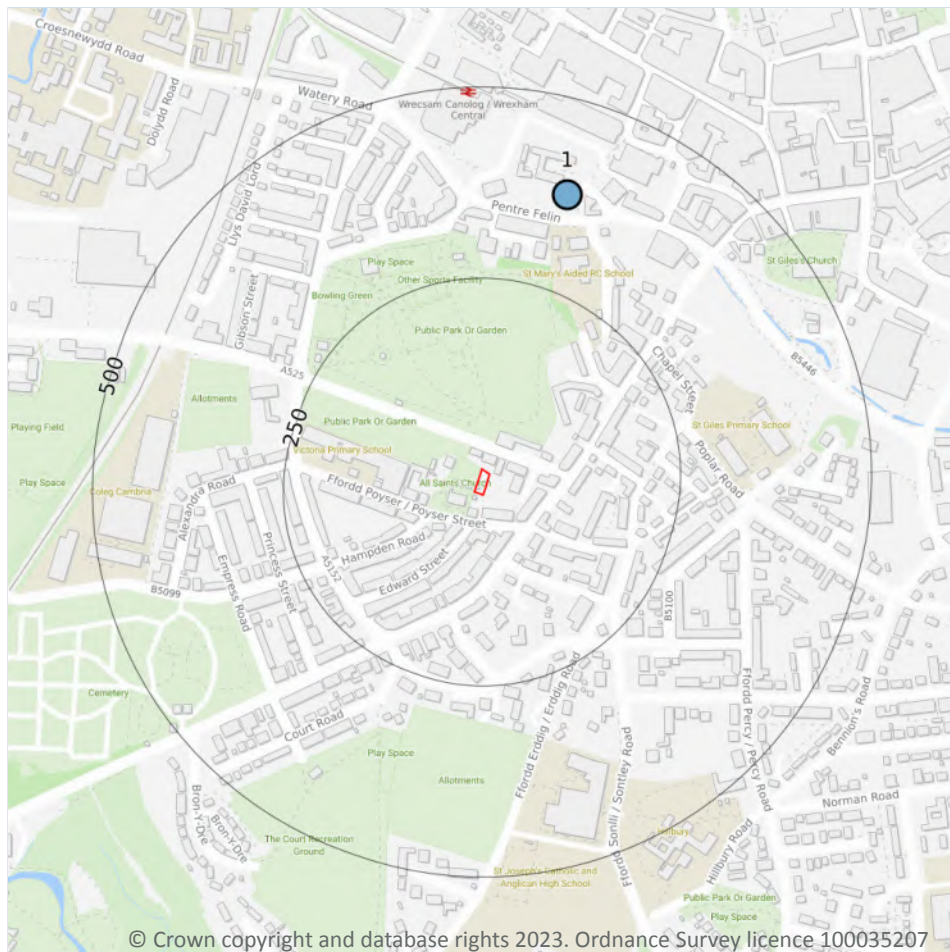
Records on site

0

This dataset identifies areas where additional local information affecting vulnerability is held by the Environment Agency. Further information can be obtained by contacting the Environment Agency local Area groundwater team through the Environment Agency National Customer Call Centre on 03798 506 506 or by email on enquiries@environment-agency.gov.uk ↗.

This data is sourced from the British Geological Survey and the Environment Agency.

Abstractions and Source Protection Zones



- Site Outline
- Search buffers in metres (m)
- Source Protection Zone 1
Inner catchment
- Source Protection Zone 2
Outer catchment
- Source Protection Zone 3
Total catchment
- Source Protection Zone 4
Zone of Special Interest
- Source Protection Zone 1c
Inner catchment - confined aquifer
- Source Protection Zone 2c
Outer catchment - confined aquifer
- Source Protection Zone 3c
Total catchment - confined aquifer
- Drinking water abstraction licences
Polygon features
- Drinking water abstraction licences
Linear features
- Groundwater abstraction licence (point)
- Groundwater abstraction licence (area)
- Groundwater abstraction licence (linear)
- Surface Water Abstractions (point)
- Surface Water Abstractions (area)
- Surface Water Abstractions (linear)

5.6 Groundwater abstractions

Records within 2000m

4

Licensed groundwater abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, between two points (line data) or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on [page 53](#) >



ID	Location	Details	
-	964m NW	Status: Historical Licence No: 24/67/7/0012 Details: Process water Direct Source: EAW Groundwater Point: WELL NO.2 Data Type: Point Name: Carlsberg Tetley Brewing Ltd. Easting: 332610 Northing: 350681	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 25/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 04/05/1970 Version End Date: -
-	979m NW	Status: Historical Licence No: 24/67/7/0012 Details: Process water Direct Source: EAW Groundwater Point: WELL NO.3 Data Type: Point Name: Carlsberg Tetley Brewing Ltd. Easting: 332630 Northing: 350710	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 25/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 04/05/1970 Version End Date: -
-	1054m NW	Status: Historical Licence No: 24/67/7/0012 Details: Process water Direct Source: EAW Groundwater Point: WELL NO.1 Data Type: Point Name: Carlsberg Tetley Brewing Ltd. Easting: 332600 Northing: 350780	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 25/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 04/05/1970 Version End Date: -
-	1662m NE	Status: Historical Licence No: WA/067/0007/0017 Details: Dewatering - Very Low Direct Source: Salop Formation (Warwickshire Group) Point: - Data Type: Poly4 Name: - Easting: 334642 Northing: 350626	Annual Volume (m ³): 27030 Max Daily Volume (m ³): 159.12 Original Application No: - Original Start Date: Dec 16 2020 12:00AM Expiry Date: Mar 31 2021 12:00AM Issue No: - Version Start Date: - Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

5.7 Surface water abstractions

Records within 2000m

10

Licensed surface water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on [page 53 >](#)



ID	Location	Details	
1	375m N	Status: Historical Licence No: 24/67/7/0147 Details: Effluent/Slurry Dilution Direct Source: EAW Surface Water Point: RIVER GWENFRO Data Type: Point Name: Wrexham County Borough Easting: 333230 Northing: 350220	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 24/02/1967 Expiry Date: - Issue No: 100 Version Start Date: 24/02/1967 Version End Date: -
-	852m NW	Status: Historical Licence No: 24/67/7/0135 Details: Spray Irrigation - Direct Direct Source: EAW Surface Water Point: RIVER GWENFRO Data Type: Point Name: Rees Easting: 332350 Northing: 350230	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 24/02/1967 Expiry Date: - Issue No: 100 Version Start Date: 28/01/1983 Version End Date: -
-	991m W	Status: Historical Licence No: 24/67/7/0135 Details: Spray Irrigation - Direct Direct Source: EAW Surface Water Point: TRIBUTARY OF RIVER GWENFRO Data Type: Line Name: Morris Easting: 331800 Northing: 350100	Annual Volume (m ³): 4546 Max Daily Volume (m ³): 511.434 Original Application No: - Original Start Date: 24/02/1967 Expiry Date: - Issue No: 101 Version Start Date: 13/06/2003 Version End Date: -
-	1316m S	Status: Historical Licence No: 24/67/7/0202 Details: Water Wheels not used for Power - Very Low Direct Source: - Point: - Data Type: Point Name: - Easting: 333340 Northing: 348530	Annual Volume (m ³): 14400 Max Daily Volume (m ³): 216 Original Application No: - Original Start Date: Aug 7 1989 12:00AM Expiry Date: - Issue No: - Version Start Date: - Version End Date: -
-	1316m S	Status: Historical Licence No: 24/67/7/0202 Details: Water Wheels Not Used For Power Direct Source: EAW Surface Water Point: AFON CLYWEDOG Data Type: Point Name: Wrexham Maelor Borough Council (Rhostyllen) Easting: 333340 Northing: 348530	Annual Volume (m ³): 14400 Max Daily Volume (m ³): 144 Original Application No: - Original Start Date: 07/08/1989 Expiry Date: - Issue No: 100 Version Start Date: 07/08/1989 Version End Date: -



ID	Location	Details	
-	1337m S	Status: Historical Licence No: 24/67/7/0169 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household Direct Source: EAW Surface Water Point: SPRING Data Type: Point Name: The National Trust Easting: 333400 Northing: 348520	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 14/06/1968 Expiry Date: - Issue No: 100 Version Start Date: 06/05/1977 Version End Date: -
-	1371m W	Status: Historical Licence No: 24/67/7/0135 Details: Spray Irrigation - Direct Direct Source: EAW Surface Water Point: TRIBUTARY OF RIVER GWENFRO Data Type: Line Name: Morris Easting: 331100 Northing: 350060	Annual Volume (m ³): 4546 Max Daily Volume (m ³): 511.434 Original Application No: - Original Start Date: 24/02/1967 Expiry Date: - Issue No: 101 Version Start Date: 13/06/2003 Version End Date: -
-	1782m S	Status: Historical Licence No: 24/67/7/0169 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household Direct Source: EAW Surface Water Point: SPRING Data Type: Point Name: The National Trust Easting: 332440 Northing: 348180	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 14/06/1968 Expiry Date: - Issue No: 100 Version Start Date: 06/05/1977 Version End Date: -
-	1827m NW	Status: Historical Licence No: 24/67/7/0135 Details: Spray Irrigation - Direct Direct Source: EAW Surface Water Point: RIVER GWENFRO Data Type: Line Name: Morris Easting: 331190 Northing: 350560	Annual Volume (m ³): 4546 Max Daily Volume (m ³): 511.434 Original Application No: - Original Start Date: 24/02/1967 Expiry Date: - Issue No: 101 Version Start Date: 13/06/2003 Version End Date: -
-	1827m NW	Status: Active Licence No: 24/67/7/0135 Details: Spray Irrigation - Direct - High Direct Source: - Point: - Data Type: Line Name: - Easting: 331190 Northing: 350560	Annual Volume (m ³): 4546 Max Daily Volume (m ³): 981.96 Original Application No: - Original Start Date: 13/06/2003 Expiry Date: - Issue No: - Version Start Date: - Version End Date: -



This data is sourced from the Environment Agency and Natural Resources Wales.

5.8 Potable abstractions

Records within 2000m

2

Licensed potable water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on [page 53](#) >

ID	Location	Details	
-	1337m S	Status: Historical Licence No: 24/67/7/0169 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household Direct Source: EAW Surface Water Point: SPRING Data Type: Point Name: The National Trust Easting: 333400 Northing: 348520	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 14/06/1968 Expiry Date: - Issue No: 100 Version Start Date: 06/05/1977 Version End Date: -
-	1782m S	Status: Historical Licence No: 24/67/7/0169 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household Direct Source: EAW Surface Water Point: SPRING Data Type: Point Name: The National Trust Easting: 332440 Northing: 348180	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 14/06/1968 Expiry Date: - Issue No: 100 Version Start Date: 06/05/1977 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

5.9 Source Protection Zones

Records within 500m

0

Source Protection Zones define the sensitivity of an area around a potable abstraction site to contamination.

This data is sourced from the Environment Agency and Natural Resources Wales.



5.10 Source Protection Zones (confined aquifer)

Records within 500m

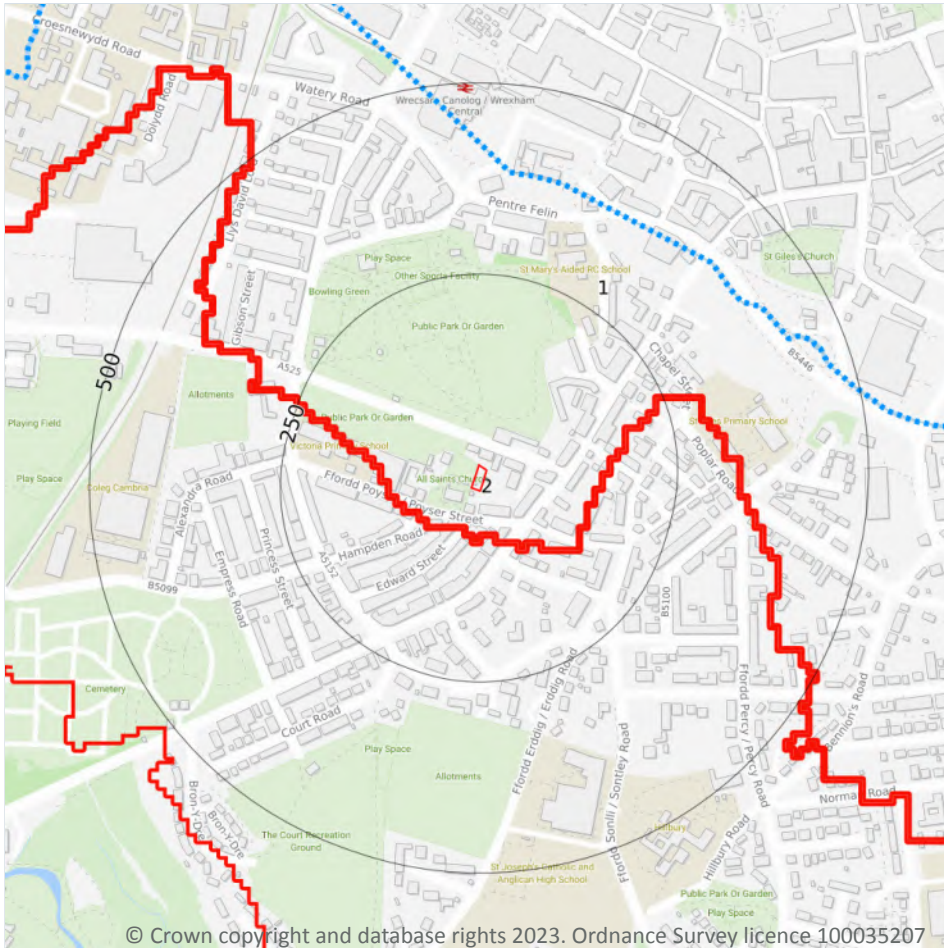
0

Source Protection Zones in the confined aquifer define the sensitivity around a deep groundwater abstraction to contamination. A confined aquifer would normally be protected from contamination by overlying geology and is only considered a sensitive resource if deep excavation/drilling is taking place.

This data is sourced from the Environment Agency and Natural Resources Wales.



6 Hydrology



- Site Outline
- Search buffers in metres (m)
- Water Network (OS MasterMap)
- Surface water features (wider than 5m)
- Surface water features (narrower than 5m)
- ⋯ WFD River, canal and surface water transfer water bodies
- WFD Lake water bodies
- WFD Transitional and coastal water bodies
- WFD Surface water body catchments boundaries
- WFD Groundwater body boundaries

6.1 Water Network (OS MasterMap)

Records within 250m

0

Detailed water network of Great Britain showing the flow and precise central course of every river, stream, lake and canal.

This data is sourced from the Ordnance Survey.

6.2 Surface water features

Records within 250m

0

Covering rivers, streams and lakes (some overlap with OS MasterMap Water Network data in previous section) but additionally covers smaller features such as ponds. Rivers and streams narrower than 5m are represented as a single line. Lakes, ponds and rivers or streams wider than 5m are represented as polygons.



This data is sourced from the Ordnance Survey.

6.3 WFD Surface water body catchments

Records on site

1

The Water Framework Directive is an EU-led framework for the protection of inland surface waters, estuaries, coastal waters and groundwater through river basin-level management planning. In terms of surface water, these basins are broken down into smaller units known as management, operational and water body catchments.

Features are displayed on the Hydrology map on [page 59 >](#)

ID	Location	Type	Water body catchment	Water body ID	Operational catchment	Management catchment
1	On site	River WB catchment	Gwenfro	GB111067051730	Clywedog - Dee	Dee

This data is sourced from the Environment Agency and Natural Resources Wales.

6.4 WFD Surface water bodies

Records identified

1

Surface water bodies under the Directive may be rivers, lakes, estuary or coastal. To achieve the purpose of the Directive, environmental objectives have been set and are reported on for each water body. The progress towards delivery of the objectives is then reported on by the relevant competent authorities at the end of each six-year cycle. The river water body directly associated with the catchment listed in the previous section is detailed below, along with any lake, canal, coastal or artificial water body within 250m of the site.

Features are displayed on the Hydrology map on [page 59 >](#)

ID	Location	Type	Name	Water body ID	Overall rating	Chemical rating	Ecological rating	Year
5	377m NE	River	Gwenfro	GB111067051730	Moderate	Fail	Good	2016

This data is sourced from the Environment Agency and Natural Resources Wales.

6.5 WFD Groundwater bodies

Records on site

1

Groundwater bodies are also covered by the Directive and the same regime of objectives and reporting detailed in the previous section is in place.

Features are displayed on the Hydrology map on [page 59 >](#)



ID	Location	Name	Water body ID	Overall rating	Chemical rating	Quantitative	Year
2	On site	Dee Carboniferous Coal Measures	GB41102G204800	Poor	Poor	Good	2017

This data is sourced from the Environment Agency and Natural Resources Wales.



7 River and coastal flooding

7.1 Risk of flooding from rivers and the sea

Records within 50m

0

The chance of flooding from rivers and/or the sea in any given year, based on cells of 50m within the Risk of Flooding from Rivers and Sea (RoFRaS)/Flood Risk Assessment Wales (FRAW) models. Each cell is allocated one of four flood risk categories, taking into account flood defences and their condition. The risk categories for RoFRaS for rivers and the sea and FRAW for rivers are; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 100 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 100 chance) or High (greater than or equal to 1 in 30 chance). The risk categories for FRAW for the sea are; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 200 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 200 chance) or High (greater than or equal to 1 in 30 chance).

This data is sourced from the Environment Agency and Natural Resources Wales.

7.2 Historical Flood Events

Records within 250m

0

Records of historic flooding from rivers, the sea, groundwater and surface water. Records began in 1946 when predecessor bodies started collecting detailed information about flooding incidents, although limited details may be included on flooding incidents prior to this date. Takes into account the presence of defences, structures, and other infrastructure where they existed at the time of flooding, and includes flood extents that may have been affected by overtopping, breaches or blockages.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.3 Flood Defences

Records within 250m

0

Records of flood defences owned, managed or inspected by the Environment Agency and Natural Resources Wales. Flood defences can be structures, buildings or parts of buildings. Typically these are earth banks, stone and concrete walls, or sheet-piling that is used to prevent or control the extent of flooding.

This data is sourced from the Environment Agency and Natural Resources Wales.



7.4 Areas Benefiting from Flood Defences

Records within 250m

0

Areas that would benefit from the presence of flood defences in a 1 in 100 (1%) chance of flooding each year from rivers or 1 in 200 (0.5%) chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.5 Flood Storage Areas

Records within 250m

0

Areas that act as a balancing reservoir, storage basin or balancing pond to attenuate an incoming flood peak to a flow level that can be accepted by the downstream channel or to delay the timing of a flood peak so that its volume is discharged over a longer period.

This data is sourced from the Environment Agency and Natural Resources Wales.



River and coastal flooding - Flood Zones

7.6 Flood Zone 2

Records within 50m

0

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land between Flood Zone 3 (see next section) and the extent of the flooding from rivers or the sea with a 1 in 1000 (0.1%) chance of flooding each year.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.7 Flood Zone 3

Records within 50m

0

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land with a 1 in 100 (1%) or greater chance of flooding each year from rivers or a 1 in 200 (0.5%) or greater chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.



8 Surface water flooding



— Site Outline

Search buffers in metres (m)

1 in 1000 return period

- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 250 return period

- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 100 return period

- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 30 return period

- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

8.1 Surface water flooding

Highest risk on site

Negligible

Highest risk within 50m

1 in 30 year, 0.1m - 0.3m

Ambiental Risk Analytics surface water (pluvial) FloodMap identifies areas likely to flood as a result of extreme rainfall events, i.e. land naturally vulnerable to surface water ponding or flooding. This data set was produced by simulating 1 in 30 year, 1 in 100 year, 1 in 250 year and 1 in 1,000 year rainfall events. Modern urban drainage systems are typically built to cope with rainfall events between 1 in 20 and 1 in 30 years, though some older ones may flood in a 1 in 5 year rainfall event.

Features are displayed on the Surface water flooding map on [page 65 >](#)

The data shown on the map and in the table above shows the highest likelihood of flood events happening at the site. Lower likelihood events may have greater flood depths and hence a greater potential impact on a site.



The table below shows the maximum flood depths for a range of return periods for the site.

Return period	Maximum modelled depth
1 in 1000 year	Between 0.1m and 0.3m
1 in 250 year	Between 0.1m and 0.3m
1 in 100 year	Negligible
1 in 30 year	Negligible

This data is sourced from Ambiantal Risk Analytics.



9 Groundwater flooding



— Site Outline
Search buffers in metres (m)

- High
- Moderate - High
- Moderate
- Low
- Negligible

9.1 Groundwater flooding

Highest risk on site

Moderate

Highest risk within 50m

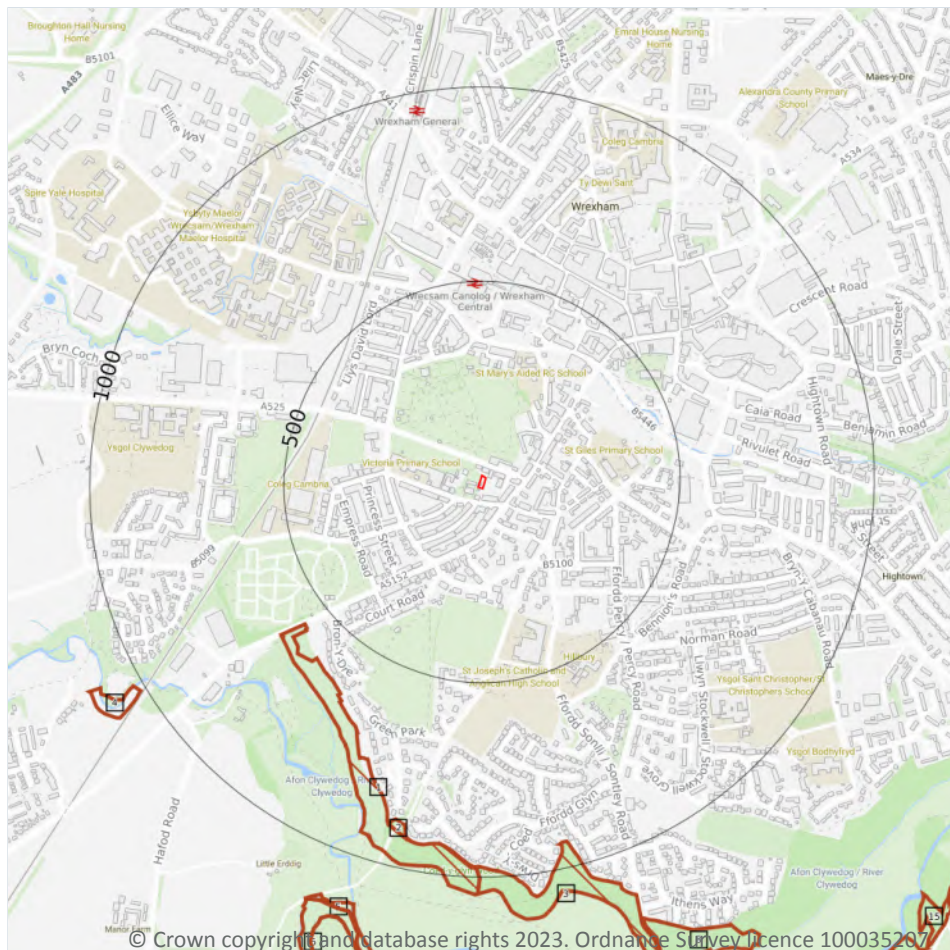
Moderate

Groundwater flooding is caused by unusually high groundwater levels. It occurs when the water table rises above the ground surface or within underground structures such as basements or cellars. Groundwater flooding tends to exhibit a longer duration than surface water flooding, possibly lasting for weeks or months, and as a result it can cause significant damage to property. This risk assessment is based on a 1 in 100 year return period and a 5m Digital Terrain Model (DTM).

Features are displayed on the Groundwater flooding map on [page 67](#) >

This data is sourced from Ambiantal Risk Analytics.

10 Environmental designations



- Site Outline
- Search buffers in metres (m)
- ▢ Sites of Special Scientific Interest (SSSI)
- ▢ Designated Ancient Woodland

10.1 Sites of Special Scientific Interest (SSSI)

Records within 2000m

2

Sites providing statutory protection for the best examples of UK flora, fauna, or geological or physiographical features. Originally notified under the National Parks and Access to the Countryside Act 1949, SSSIs were re-notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs were introduced by the Countryside and Rights of Way Act 2000 (in England and Wales) and (in Scotland) by the Nature Conservation (Scotland) Act 2004 and the Wildlife and Natural Environment (Scotland) Act 2010.

Features are displayed on the Environmental designations map on [page 68](#) >

ID	Location	Name	Data source
-	1572m NW	Gatewen Marsh	Natural Resources Wales



ID	Location	Name	Data source
-	1701m SE	Sontley Marsh	Natural Resources Wales

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.2 Conserved wetland sites (Ramsar sites)

Records within 2000m	0
-----------------------------	----------

Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. They cover all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities. These sites cover a broad definition of wetland; marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, and even some marine areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.3 Special Areas of Conservation (SAC)

Records within 2000m	0
-----------------------------	----------

Areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.4 Special Protection Areas (SPA)

Records within 2000m	0
-----------------------------	----------

Sites classified by the UK Government under the EC Birds Directive, SPAs are areas of the most important habitat for rare (listed on Annex I to the Directive) and migratory birds within the European Union.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.5 National Nature Reserves (NNR)

Records within 2000m	0
-----------------------------	----------

Sites containing examples of some of the most important natural and semi-natural terrestrial and coastal ecosystems in Great Britain. They are managed to conserve their habitats, provide special opportunities for scientific study or to provide public recreation compatible with natural heritage interests.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.6 Local Nature Reserves (LNR)

Records within 2000m**0**

Sites managed for nature conservation, and to provide opportunities for research and education, or simply enjoying and having contact with nature. They are declared by local authorities under the National Parks and Access to the Countryside Act 1949 after consultation with the relevant statutory nature conservation agency.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.7 Designated Ancient Woodland

Records within 2000m**28**

Ancient woodlands are classified as areas which have been wooded continuously since at least 1600 AD. This includes semi-natural woodland and plantations on ancient woodland sites. 'Wooded continuously' does not mean there is or has previously been continuous tree cover across the whole site, and not all trees within the woodland have to be old.

Features are displayed on the Environmental designations map on [page 68](#) >

ID	Location	Name	Woodland Type
1	569m SW	Unknown	Ancient Semi Natural Woodland
2	879m S	Unknown	Ancient Semi Natural Woodland
3	926m S	Unknown	Restored Ancient Woodland Site
4	1015m SW	Unknown	Ancient Semi Natural Woodland
5	1119m S	Unknown	Ancient Semi Natural Woodland
6	1139m S	Unknown	Restored Ancient Woodland Site
7	1165m S	Unknown	Restored Ancient Woodland Site
8	1180m S	Unknown	Ancient Semi Natural Woodland
9	1182m S	Unknown	Ancient Semi Natural Woodland
-	1272m S	Unknown	Ancient Semi Natural Woodland
-	1279m S	Unknown	Ancient Semi Natural Woodland
-	1391m SE	Unknown	Ancient Semi Natural Woodland
-	1421m SW	Unknown	Ancient Semi Natural Woodland
-	1518m SE	Unknown	Ancient Semi Natural Woodland
15	1541m SE	Unknown	Ancient Semi Natural Woodland
-	1544m W	Unknown	Restored Ancient Woodland Site



ID	Location	Name	Woodland Type
18	1575m SE	Unknown	Ancient Semi Natural Woodland
19	1585m SE	Unknown	Ancient Semi Natural Woodland
-	1604m S	Unknown	Ancient Semi Natural Woodland
-	1734m S	Unknown	Ancient Semi Natural Woodland
-	1786m S	Unknown	Restored Ancient Woodland Site
-	1791m S	Unknown	Restored Ancient Woodland Site
-	1797m SW	Unknown	Ancient Semi Natural Woodland
-	1819m S	Unknown	Restored Ancient Woodland Site
-	1826m S	Unknown	Restored Ancient Woodland Site
-	1833m SE	Unknown	Ancient Semi Natural Woodland
-	1886m S	Unknown	Ancient Semi Natural Woodland
-	1988m SW	Unknown	Ancient Semi Natural Woodland

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.8 Biosphere Reserves

Records within 2000m

0

Biosphere Reserves are internationally recognised by UNESCO as sites of excellence to balance conservation and socioeconomic development between nature and people. They are recognised under the Man and the Biosphere (MAB) Programme with the aim of promoting sustainable development founded on the work of the local community.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.9 Forest Parks

Records within 2000m

0

These are areas managed by the Forestry Commission designated on the basis of recreational, conservation or scenic interest.

This data is sourced from the Forestry Commission.



10.10 Marine Conservation Zones

Records within 2000m

0

A type of marine nature reserve in UK waters established under the Marine and Coastal Access Act (2009). They are designated with the aim to protect nationally important, rare or threatened habitats and species.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.11 Green Belt

Records within 2000m

0

Areas designated to prevent urban sprawl by keeping land permanently open.

This data is sourced from the Ministry of Housing, Communities and Local Government.

10.12 Proposed Ramsar sites

Records within 2000m

0

Ramsar sites are areas listed as a Wetland of International Importance under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention) 1971. The sites here supplied have a status of 'Proposed' having been identified for potential adoption under the framework.

This data is sourced from Natural England.

10.13 Possible Special Areas of Conservation (pSAC)

Records within 2000m

0

Special Areas of Conservation are areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive. Those sites supplied here are those with a status of 'Possible' having been identified for potential adoption under the framework.

This data is sourced from Natural England and Natural Resources Wales.

10.14 Potential Special Protection Areas (pSPA)

Records within 2000m

0

Special Protection Areas (SPAs) are areas designated (or 'classified') under the European Union Wild Birds Directive for the protection of nationally and internationally important populations of wild birds. Those sites supplied here are those with a status of 'Potential' having been identified for potential adoption under the framework.

This data is sourced from Natural England.



10.15 Nitrate Sensitive Areas

Records within 2000m

0

Areas where nitrate concentrations in drinking water sources exceeded or was at risk of exceeding the limit of 50 mg/l set by the 1980 EC Drinking Water Directive. Voluntary agricultural measures as a means of reducing the levels of nitrate were introduced by DEFRA as MAFF, with payments being made to farmers who complied. The scheme was started as a pilot in 1990 in ten areas, later implemented within 32 areas. The scheme was closed to further new entrants in 1998, although existing agreements continued for their full term. All Nitrate Sensitive Areas fell within the areas designated as Nitrate Vulnerable Zones (NVZs) in 1996 under the EC Nitrate Directive (91/676/EEC).

This data is sourced from Natural England.

10.16 Nitrate Vulnerable Zones

Records within 2000m

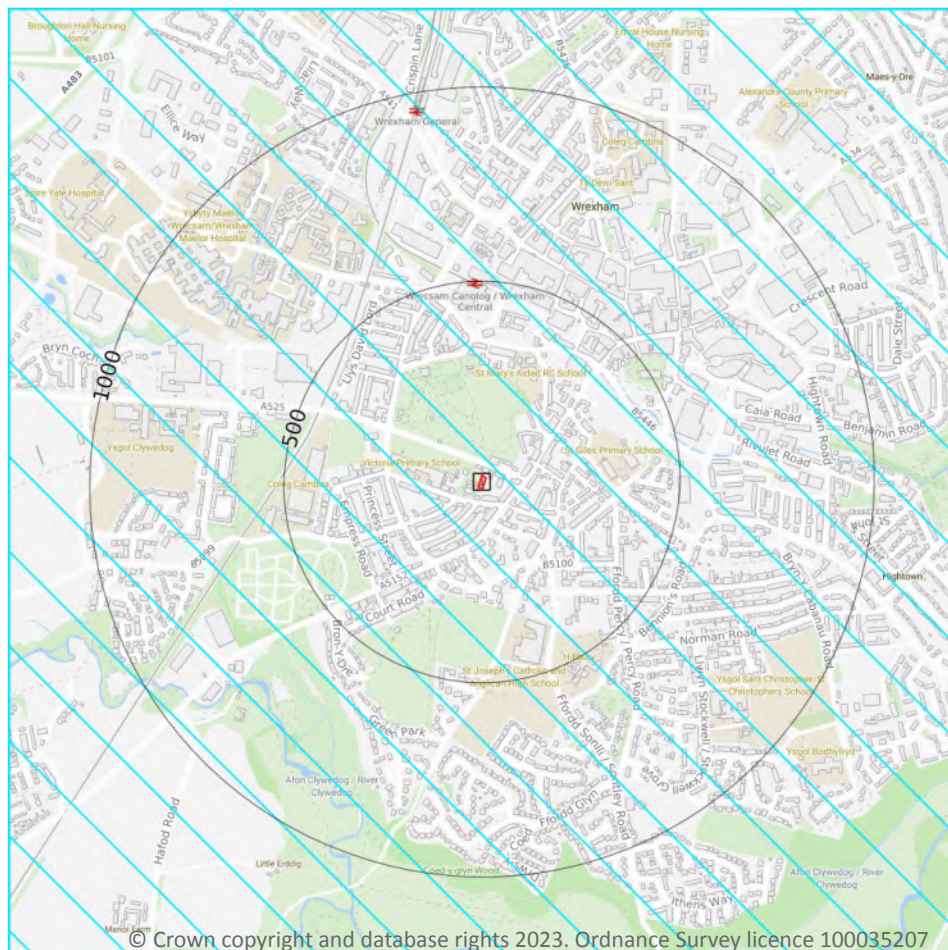
0

Areas at risk from agricultural nitrate pollution designated under the EC Nitrate Directive (91/676/EEC). These are areas of land that drain into waters polluted by nitrates. Farmers operating within these areas have to follow mandatory rules to tackle nitrate loss from agriculture.

This data is sourced from Natural England and Natural Resources Wales.



SSSI Impact Zones and Units



- Site Outline
- Search buffers in metres (m)
- SSSI Impact Risk Zones
- SSSI Units
- Not recorded
- Favourable
- Unfavourable - Recovering
- Unfavourable - No change
- Unfavourable - Declining
- Partially destroyed
- Destroyed

10.17 SSSI Impact Risk Zones

Records on site

1

Developed to allow rapid initial assessment of the potential risks to SSSIs posed by development proposals. They define zones around each SSSI which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts.

Features are displayed on the SSSI Impact Zones and Units map on [page 74 >](#)

ID	Location	Type of developments requiring consultation
1	On site	Air pollution - Livestock & poultry units with floorspace > 500m², slurry lagoons & digestate stores > 4000m². Combustion - General combustion processes >50mw energy input. incl: energy from waste incineration, other incineration, landfill gas generation plant, pyrolysis/gasification, anaerobic digestion, sewage treatment works, other incineration/ combustion.



This data is sourced from Natural England.

10.18 SSSI Units

Records within 2000m

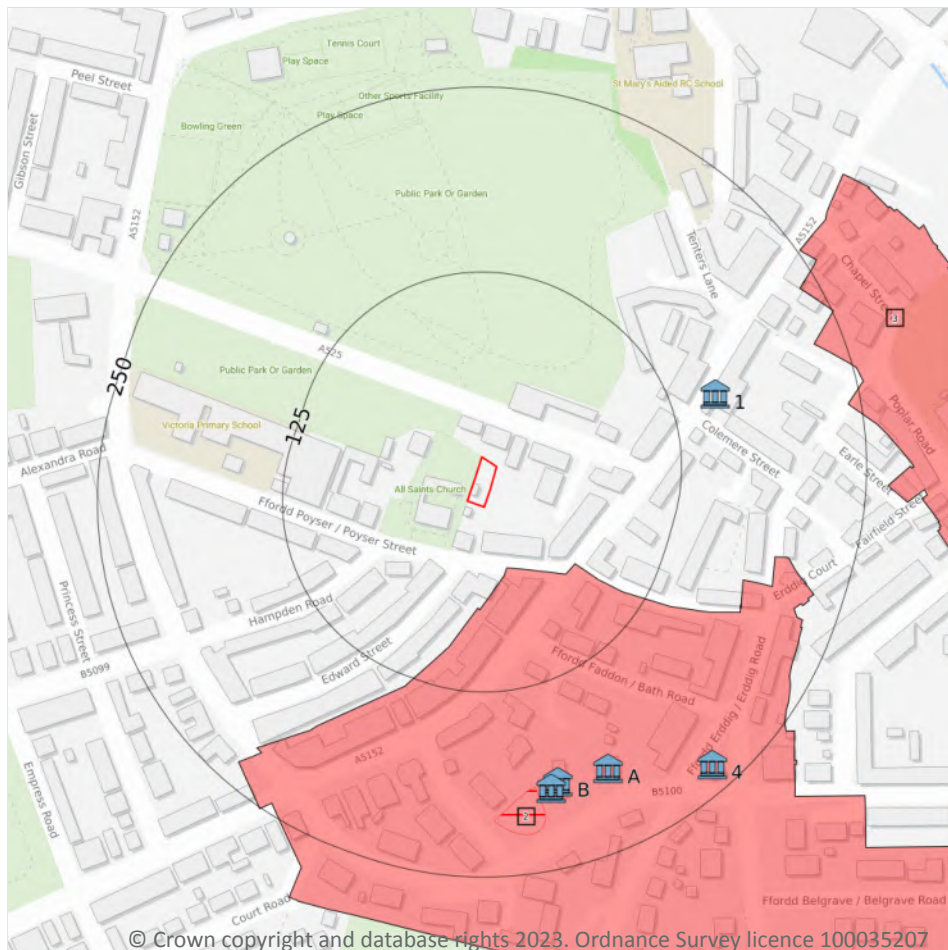
0

Divisions of SSSIs used to record management and condition details. Units are the smallest areas for which Natural England gives a condition assessment, however, the size of units varies greatly depending on the types of management and the conservation interest.

This data is sourced from Natural England and Natural Resources Wales.



11 Visual and cultural designations



- Site Outline
- Search buffers in metres (m)
- Listed buildings
- Conservation areas
- Conservation areas - no data
- National Parks
- Areas of Outstanding Natural Beauty
- Registered parks and gardens
- Scheduled Monuments
- World Heritage Sites

11.1 World Heritage Sites

Records within 250m

0

Sites designated for their globally important cultural or natural interest requiring appropriate management and protection measures. World Heritage Sites are designated to meet the UK's commitments under the World Heritage Convention.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.2 Area of Outstanding Natural Beauty

Records within 250m

0

Areas of Outstanding Natural Beauty (AONB) are conservation areas, chosen because they represent 18% of the finest countryside. Each AONB has been designated for special attention because of the quality of their flora, fauna, historical and cultural associations, and/or scenic views. The National Parks and Access to the Countryside Act of 1949 created AONBs and the Countryside and Rights of Way Act, 2000 added further regulation and protection. There are likely to be restrictions to some developments within these areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

11.3 National Parks

Records within 250m

0

In England and Wales, the purpose of National Parks is to conserve and enhance landscapes within the countryside whilst promoting public enjoyment of them and having regard for the social and economic well-being of those living within them. In Scotland National Parks have the additional purpose of promoting the sustainable use of the natural resources of the area and the sustainable social and economic development of its communities. The National Parks and Access to the Countryside Act 1949 established the National Park designation in England and Wales, and The National Parks (Scotland) Act 2000 in Scotland.

This data is sourced from Natural England, Natural Resources Wales and the Scottish Government.

11.4 Listed Buildings

Records within 250m

5

Buildings listed for their special architectural or historical interest. Building control in the form of 'listed building consent' is required in order to make any changes to that building which might affect its special interest. Listed buildings are graded to indicate their relative importance, however building controls apply to all buildings equally, irrespective of their grade, and apply to the interior and exterior of the building in its entirety, together with any curtilage structures.

Features are displayed on the Visual and cultural designations map on [page 76 >](#)

ID	Location	Name	Grade	Reference Number	Listed date
1	156m E	The Bowling Green Public House, At the top of Pen y Bryn, at its junction with Colemere Street.	II	1799	31/01/1994
B	192m S	7,Fairy Road,Wrexham,CLWYD,LL13 7PT, Situated on north side of Fairy Road, adjacent to its junction with Belmont Road.	II	16480	31/01/1994
B	195m S	5,Fairy Road,Wrexham,CLWYD,LL13 7PT, Situated on north side of Fairy Road, adjacent to its junction with Belmont Road.	II	1780	31/01/1994



ID	Location	Name	Grade	Reference Number	Listed date
A	196m SE	NO.9 FAIRY ROAD (N SIDE), CLWYD, Set back from the road in gardens, adjacent to Nos 5-7, and near the corner with Erddig Road.	II	1781	31/01/1994
4	232m SE	Stafford House, Situated in its own grounds on an 'island' site ringed by Fairy Road, Sontley Road and Erddig Road.	II	1782	31/01/1994

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.5 Conservation Areas

Records within 250m

2

Local planning authorities are obliged to designate as conservation areas any parts of their own area that are of special architectural or historic interest, the character and appearance of which it is desirable to preserve or enhance. Designation of a conservation area gives broader protection than the listing of individual buildings. All the features within the area, listed or otherwise, are recognised as part of its character. Conservation area designation is the means of recognising the importance of all factors and of ensuring that planning decisions address the quality of the landscape in its broadest sense.

Features are displayed on the Visual and cultural designations map on [page 76 >](#)

ID	Location	Name	District	Date of designation
A	44m S	Fairy Road	WREXHAM	1975-08-29
3	230m NE	Salisbury Park	WREXHAM	1996-11-11

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.6 Scheduled Ancient Monuments

Records within 250m

1

A scheduled monument is an historic building or site that is included in the Schedule of Monuments kept by the Secretary of State for Digital, Culture, Media and Sport. The regime is set out in the Ancient Monuments and Archaeological Areas Act 1979. The Schedule of Monuments has c.20,000 entries and includes sites such as Roman remains, burial mounds, castles, bridges, earthworks, the remains of deserted villages and industrial sites. Monuments are not graded, but all are, by definition, considered to be of national importance.

Features are displayed on the Visual and cultural designations map on [page 76 >](#)

ID	Location	Ancient monument name	Reference number
2	192m S	Fairy Oak Round Barrow	3726

This data is sourced from Historic England, Cadw and Historic Environment Scotland.



11.7 Registered Parks and Gardens

Records within 250m

0

Parks and gardens assessed to be of particular interest and of special historic interest. The emphasis being on 'designed' landscapes, rather than on planting or botanical importance. Registration is a 'material consideration' in the planning process, meaning that planning authorities must consider the impact of any proposed development on the special character of the landscape.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.



12 Agricultural designations

12.1 Agricultural Land Classification

Records within 250m

0

Classification of the quality of agricultural land taking into consideration multiple factors including climate, physical geography and soil properties. It should be noted that the categories for the grading of agricultural land are not consistent across England, Wales and Scotland.

This data is sourced from Natural Resources Wales.

12.2 Open Access Land

Records within 250m

0

The Countryside and Rights of Way Act 2000 (CROW Act) gives a public right of access to land without having to use paths. Access land includes mountains, moors, heaths and downs that are privately owned. It also includes common land registered with the local council and some land around the England Coast Path. Generally permitted activities on access land are walking, running, watching wildlife and climbing.

This data is sourced from Natural England and Natural Resources Wales.

12.3 Tree Felling Licences

Records within 250m

0

Felling Licence Application (FLA) areas approved by Forestry Commission England. Anyone wishing to fell trees must ensure that a licence or permission under a grant scheme has been issued by the Forestry Commission before any felling is carried out or that one of the exceptions apply.

This data is sourced from the Forestry Commission.

12.4 Environmental Stewardship Schemes

Records within 250m

0

Environmental Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment. The schemes identified may be historical schemes that have now expired, or may still be active.

This data is sourced from Natural England.



12.5 Countryside Stewardship Schemes

Records within 250m

0

Countryside Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment. Main objectives are to improve the farmed environment for wildlife and to reduce diffuse water pollution.

This data is sourced from Natural England.



13 Habitat designations

13.1 Priority Habitat Inventory

Records within 250m

0

Habitats of principal importance as named under Natural Environment and Rural Communities Act (2006) Section 41.

This data is sourced from Natural England.

13.2 Habitat Networks

Records within 250m

0

Habitat networks for 18 priority habitat networks (based primarily, but not exclusively, on the priority habitat inventory) and areas suitable for the expansion of networks through restoration and habitat creation.

This data is sourced from Natural England.

13.3 Open Mosaic Habitat

Records within 250m

0

Sites verified as Open Mosaic Habitat. Mosaic habitats are brownfield sites that are identified under the UK Biodiversity Action Plan as a priority habitat due to the habitat variation within a single site, supporting an array of invertebrates.

This data is sourced from Natural England.

13.4 Limestone Pavement Orders

Records within 250m

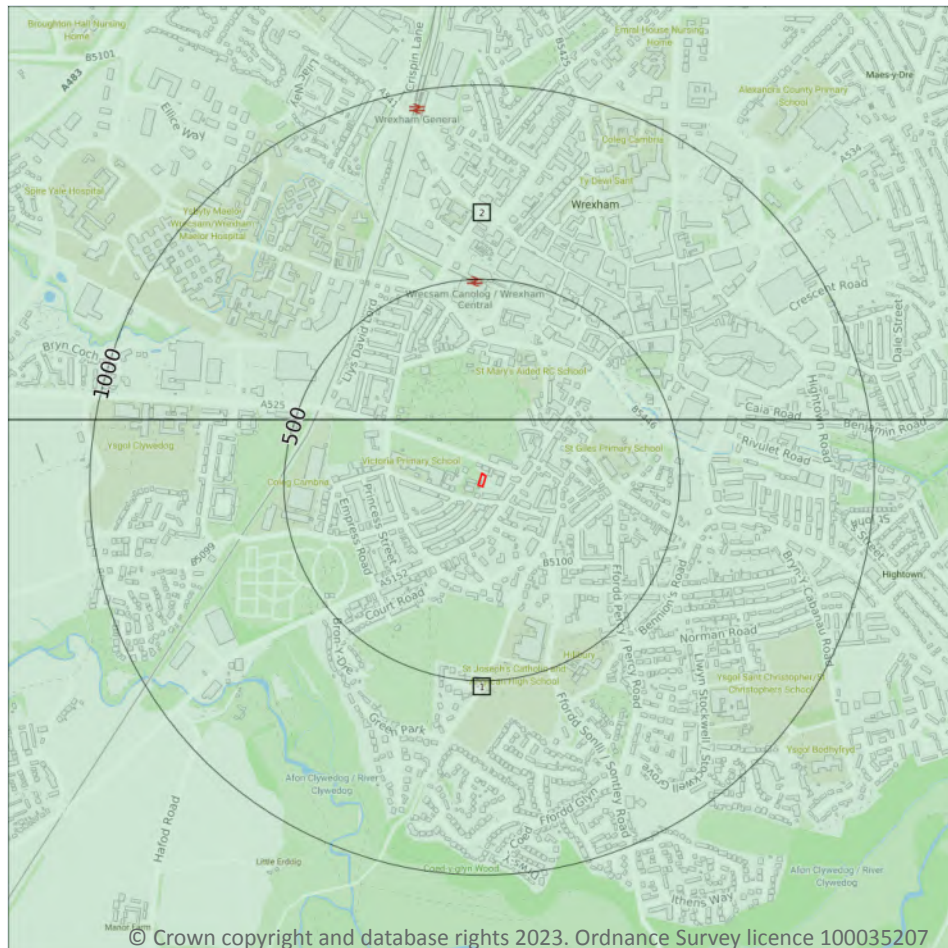
0

Limestone pavements are outcrops of limestone where the surface has been worn away by natural means over millennia. These rocks have the appearance of paving blocks, hence their name. Not only do they have geological interest, they also provide valuable habitats for wildlife. These habitats are threatened due to their removal for use in gardens and water features. Many limestone pavements have been designated as SSSIs which affords them some protection. In addition, Section 34 of the Wildlife and Countryside Act 1981 gave them additional protection via the creation of Limestone Pavement Orders, which made it a criminal offence to remove any part of the outcrop. The associated Limestone Pavement Priority Habitat is part of the UK Biodiversity Action Plan priority habitat in England.

This data is sourced from Natural England.



14 Geology 1:10,000 scale - Availability



— Site Outline
Search buffers in metres (m)

- Full coverage
- Partial coverage
- No coverage

14.1 10k Availability

Records within 500m

2

An indication on the coverage of 1:10,000 scale geology data for the site, the most detailed dataset provided by the British Geological Survey. Either 'Full', 'Partial' or 'No coverage' for each geological theme.

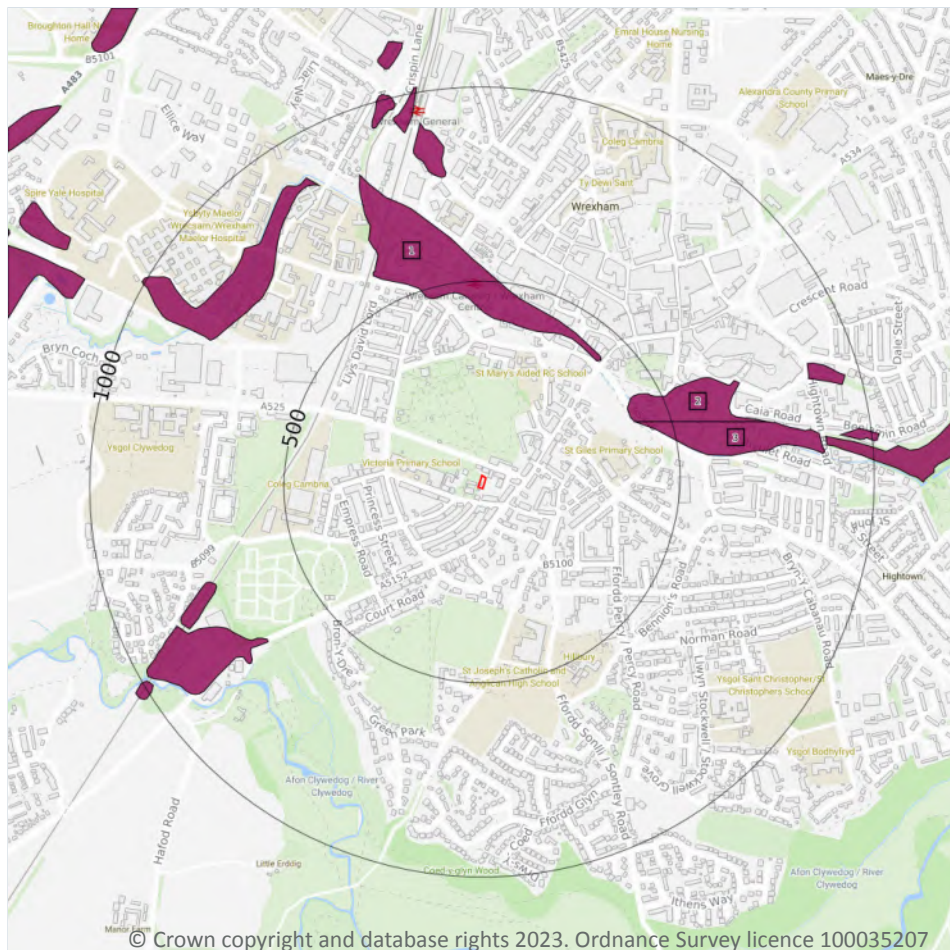
Features are displayed on the Geology 1:10,000 scale - Availability map on [page 83](#) >

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	On site	Full	Full	Full	Full	SJ34NW
2	139m N	Full	Full	Full	Full	SJ35SW

This data is sourced from the British Geological Survey.



Geology 1:10,000 scale - Artificial and made ground



— Site Outline
Search buffers in metres (m)

- Reclaimed ground
- Made ground
- Worked ground
- Infilled ground
- Disturbed ground
- Landscaped ground

14.2 Artificial and made ground (10k)

Records within 500m

3

Details of made, worked, infilled, disturbed and landscaped ground at 1:10,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

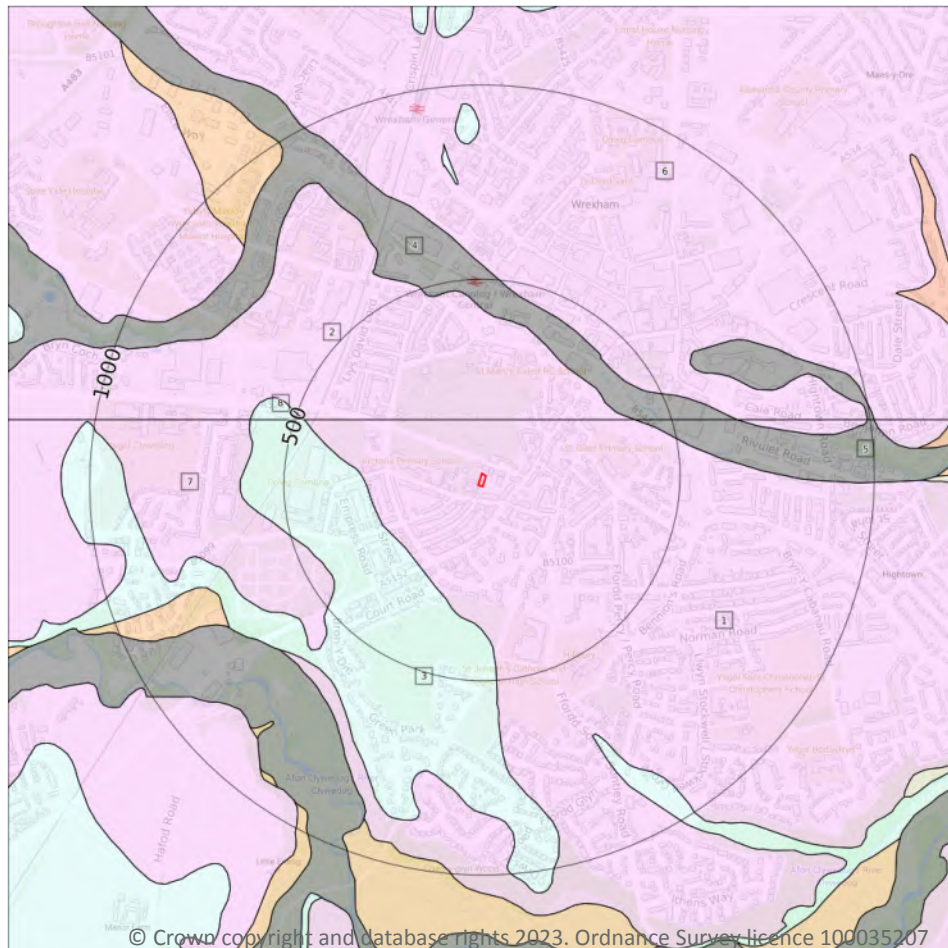
Features are displayed on the Geology 1:10,000 scale - Artificial and made ground map on [page 84](#) >

ID	Location	LEX Code	Description	Rock description
1	395m N	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
2	404m NE	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
3	410m E	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit

This data is sourced from the British Geological Survey.



Geology 1:10,000 scale - Superficial



Site Outline

Search buffers in metres (m)

Landslip (10k)

Superficial geology (10k)
Please see table for more details.

14.3 Superficial geology (10k)

Records within 500m

8

Superficial geological deposits at 1:10,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

Features are displayed on the Geology 1:10,000 scale - Superficial map on [page 85 >](#)

ID	Location	LEX Code	Description	Rock description
1	On site	GFDU-XSV	Glaciofluvial Deposits - Sand And Gravel	Sand And Gravel
2	139m N	GFDU-XSV	Glaciofluvial Deposits - Sand And Gravel	Sand And Gravel
3	248m SW	TILL-DMTN	Till - Diamicton	Diamicton
4	349m NE	ALV-C	Alluvium - Clay (unlithified Deposits Coding Scheme)	Clay



ID	Location	LEX Code	Description	Rock description
5	410m E	ALV-C	Alluvium - Clay (unlithified Deposits Coding Scheme)	Clay
6	423m NE	GFDU-XSV	Glaciofluvial Deposits - Sand And Gravel	Sand And Gravel
7	442m SW	GFDU-XSV	Glaciofluvial Deposits - Sand And Gravel	Sand And Gravel
8	478m W	TILL-DMTN	Till - Diamicton	Diamicton

This data is sourced from the British Geological Survey.

14.4 Landslip (10k)

Records within 500m

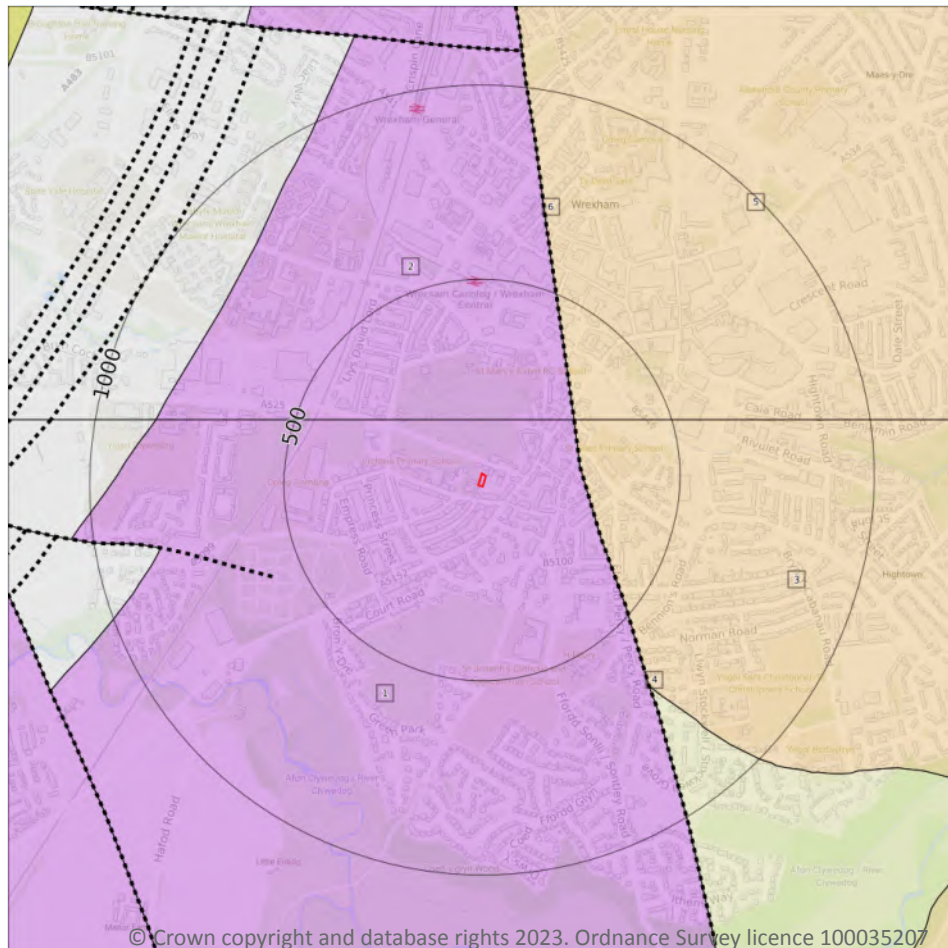
0

Mass movement deposits on BGS geological maps at 1:10,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.



Geology 1:10,000 scale - Bedrock



— Site Outline

Search buffers in metres (m)

.... Bedrock faults and other linear features (10k)

Bedrock geology (10k)
Please see table for more details.

14.5 Bedrock geology (10k)

Records within 500m

4

Bedrock geology at 1:10,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:10,000 scale - Bedrock map on [page 87](#) >

ID	Location	LEX Code	Description	Rock age
1	On site	ETM-MDST	Etruria Formation - Mudstone	Westphalian Age
2	139m N	ETM-MDST	Etruria Formation - Mudstone	Westphalian Age
3	244m E	SAL-MDSC	Salop Formation - Mudstone, Sandstone And Conglomerate	Cisuralian Epoch - Westphalian D Sub-age



ID	Location	LEX Code	Description	Rock age
5	270m NE	SAL-MDSC	Salop Formation - Mudstone, Sandstone And Conglomerate	Cisuralian Epoch - Westphalian D Sub-age

This data is sourced from the British Geological Survey.

14.6 Bedrock faults and other linear features (10k)

Records within 500m

2

Linear features at the ground or bedrock surface at 1:10,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

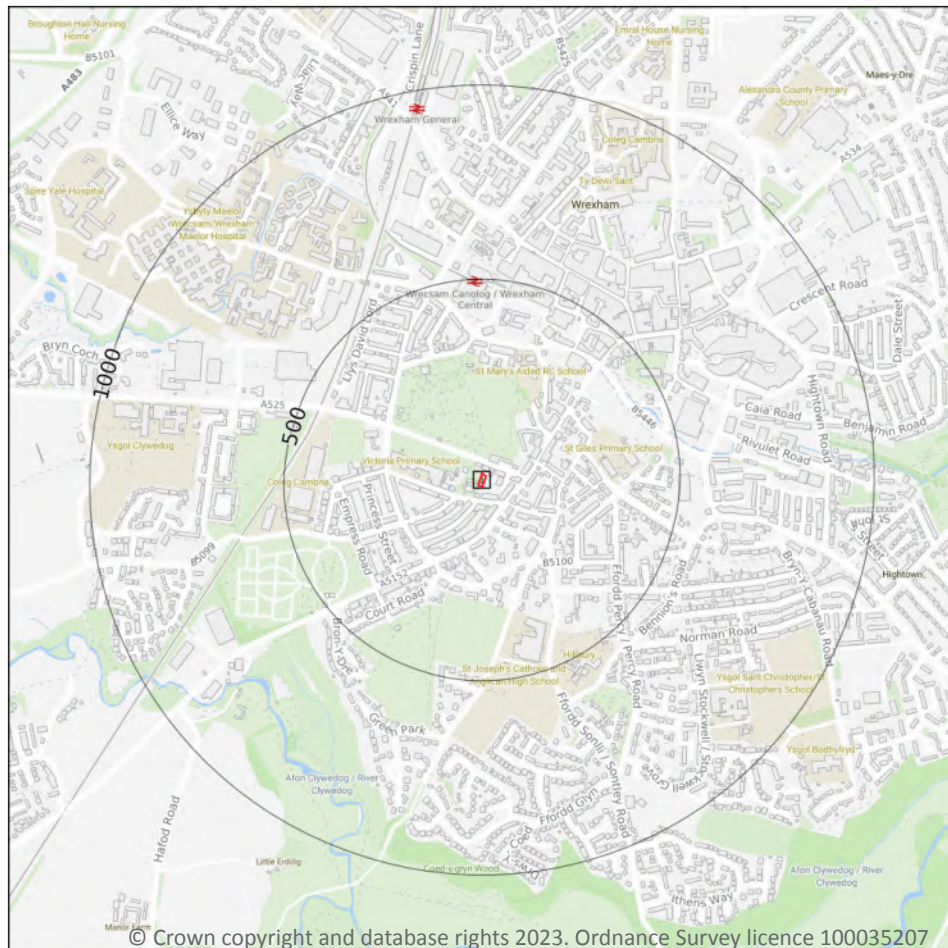
Features are displayed on the Geology 1:10,000 scale - Bedrock map on [page 87](#) >

ID	Location	Category	Description
4	244m E	FAULT	Normal fault, inferred
6	270m NE	FAULT	Normal fault, inferred

This data is sourced from the British Geological Survey.



15 Geology 1:50,000 scale - Availability



— Site Outline
Search buffers in metres (m)

□ Geological map tile

15.1 50k Availability

Records within 500m

1

An indication on the coverage of 1:50,000 scale geology data for the site. Either 'Full' or 'No coverage' for each geological theme. Where 50k data is not available, this area has been filled in with 625k scale data.

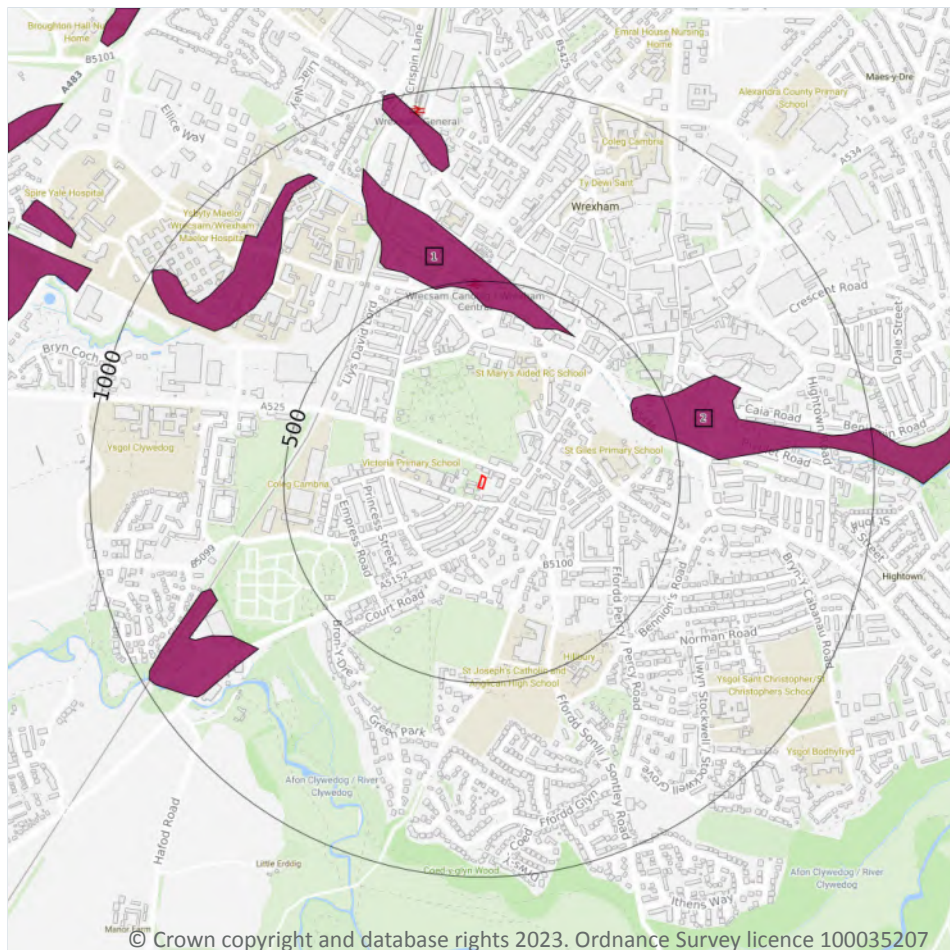
Features are displayed on the Geology 1:50,000 scale - Availability map on [page 89](#) >

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	On site	Full	Full	Full	Full	EW121_wrexham_v4

This data is sourced from the British Geological Survey.



Geology 1:50,000 scale - Artificial and made ground



- Site Outline
- Search buffers in metres (m)
- Made ground
 - Worked ground
 - Infilled ground
 - Disturbed ground
 - Landscaped ground

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15.2 Artificial and made ground (50k)

Records within 500m

2

Details of made, worked, infilled, disturbed and landscaped ground at 1:50,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

Features are displayed on the Geology 1:50,000 scale - Artificial and made ground map on [page 90](#) >

ID	Location	LEX Code	Description	Rock description
1	402m N	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
2	408m E	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

This data is sourced from the British Geological Survey.



15.3 Artificial ground permeability (50k)

Records within 50m

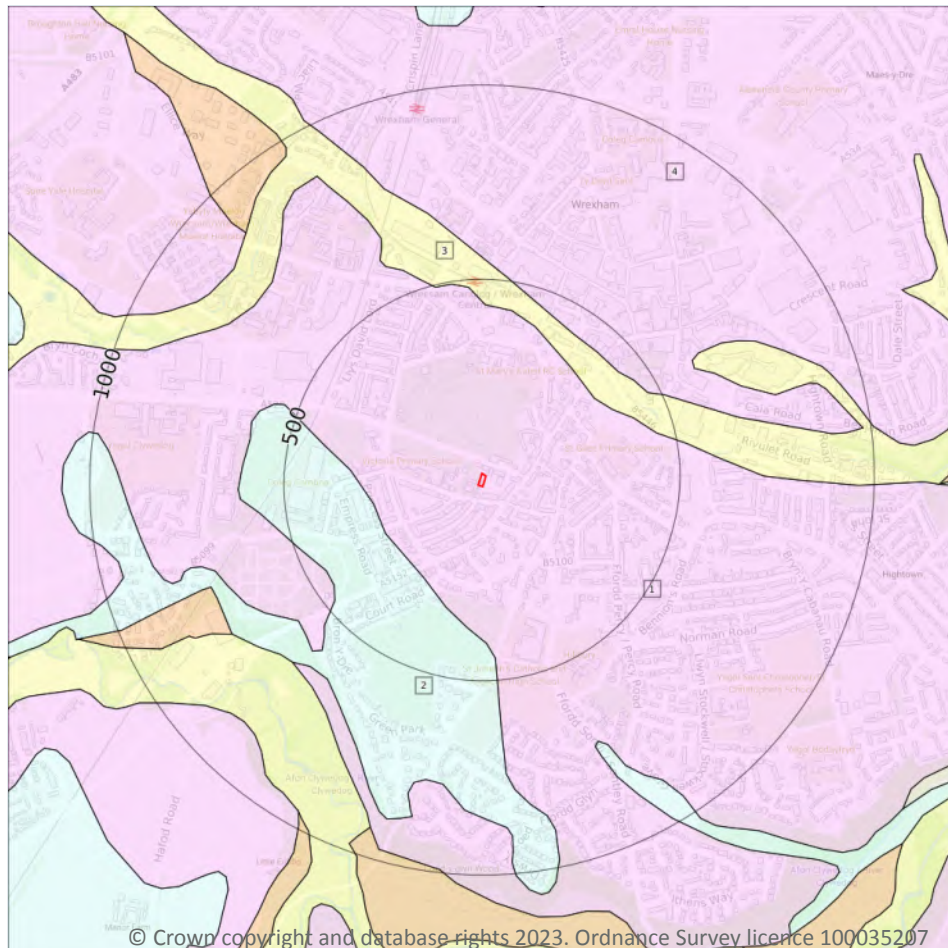
0

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any artificial deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.



Geology 1:50,000 scale - Superficial



Site Outline

Search buffers in metres (m)

Landslip (50k)

Superficial geology (50k)
Please see table for more details.

15.4 Superficial geology (50k)

Records within 500m

4

Superficial geological deposits at 1:50,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

Features are displayed on the Geology 1:50,000 scale - Superficial map on [page 92](#) >

ID	Location	LEX Code	Description	Rock description
1	On site	GFSDDD-XSV	GLACIOFLUVIAL SHEET DEPOSITS, DEVENSIAN	SAND AND GRAVEL
2	262m SW	TILLD-DMTN	TILL, DEVENSIAN	DIAMICTON
3	344m NE	ALV-XCZSV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL
4	428m NE	GFSDDD-XSV	GLACIOFLUVIAL SHEET DEPOSITS, DEVENSIAN	SAND AND GRAVEL



This data is sourced from the British Geological Survey.

15.5 Superficial permeability (50k)

Records within 50m

1

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any superficial deposits (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	Intergranular	Very High	High

This data is sourced from the British Geological Survey.

15.6 Landslip (50k)

Records within 500m

0

Mass movement deposits on BGS geological maps at 1:50,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.

15.7 Landslip permeability (50k)

Records within 50m

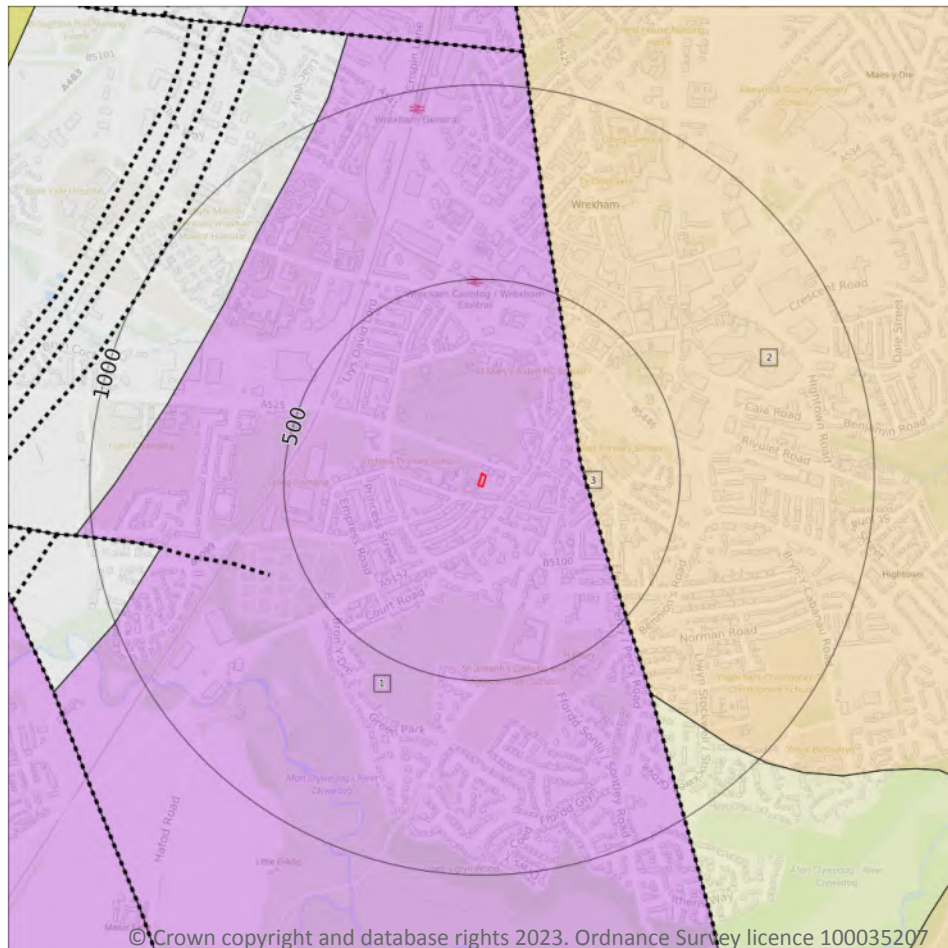
0

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any landslip deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.



Geology 1:50,000 scale - Bedrock



Site Outline

Search buffers in metres (m)

..... Bedrock faults and other linear features (50k)

Bedrock geology (50k)
Please see table for more details.

15.8 Bedrock geology (50k)

Records within 500m

2

Bedrock geology at 1:50,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:50,000 scale - Bedrock map on [page 94](#) >

ID	Location	LEX Code	Description	Rock age
1	On site	ETM-MDST	ETRURIA FORMATION - MUDSTONE	WESTPHALIAN
2	246m E	SAL-MDSC	SALOP FORMATION - MUDSTONE, SANDSTONE AND CONGLOMERATE	WESTPHALIAN

This data is sourced from the British Geological Survey.



15.9 Bedrock permeability (50k)

Records within 50m

1

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of bedrock (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	Fracture	Low	Low

This data is sourced from the British Geological Survey.

15.10 Bedrock faults and other linear features (50k)

Records within 500m

1

Linear features at the ground or bedrock surface at 1:50,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

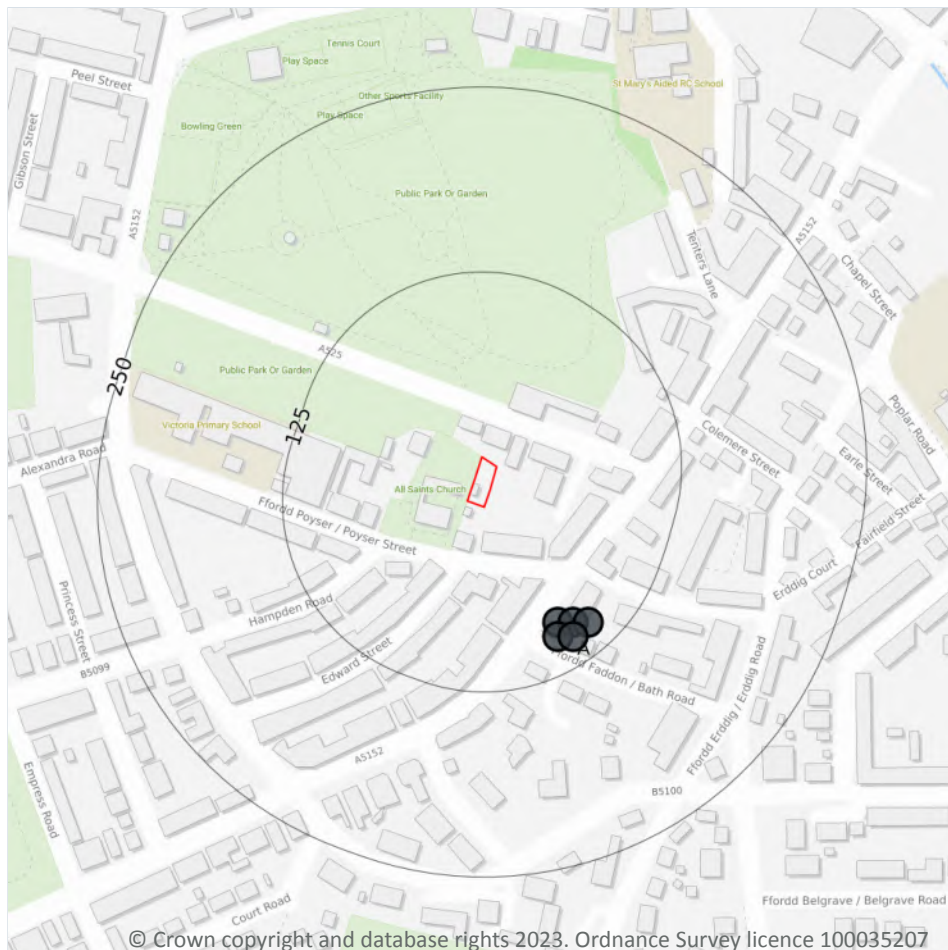
Features are displayed on the Geology 1:50,000 scale - Bedrock map on [page 94 >](#)

ID	Location	Category	Description
3	246m E	FAULT	Fault, inferred, displacement unknown

This data is sourced from the British Geological Survey.



16 Boreholes



— Site Outline
Search buffers in metres (m)

- Confidential
- 0 - 10m
- 10 - 30m
- 30m+
- Unknown

16.1 BGS Boreholes

Records within 250m

5

The Single Onshore Boreholes Index (SOBI); an index of over one million records of boreholes, shafts and wells from all forms of drilling and site investigation work held by the British Geological Survey. Covering onshore and nearshore boreholes dating back to at least 1790 and ranging from one to several thousand metres deep.

Features are displayed on the Boreholes map on [page 96](#) >

ID	Location	Grid reference	Name	Length	Confidential	Web link
A	92m SE	333170 349750	YALE LODGE RUABON ROAD WREXHAM WS5	-	Y	N/A
A	98m SE	333180 349750	YALE LODGE RUABON ROAD WREXHAM WS4	-	Y	N/A
A	101m SE	333170 349740	YALE LODGE RUABON ROAD WREXHAM WS2	-	Y	N/A



ID	Location	Grid reference	Name	Length	Confidential	Web link
A	105m SE	333190 349750	YALE LODGE RUABON ROAD WREXHAM WS3	-	Y	N/A
A	106m SE	333180 349740	YALE LODGE RUABON ROAD WREXHAM WS1	-	Y	N/A

This data is sourced from the British Geological Survey.



17 Natural ground subsidence - Shrink swell clays



- Site Outline
- Search buffers in metres (m)
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.1 Shrink swell clays

Records within 50m

1

The potential hazard presented by soils that absorb water when wet (making them swell), and lose water as they dry (making them shrink). This shrink-swell behaviour is controlled by the type and amount of clay in the soil, and by seasonal changes in the soil moisture content (related to rainfall and local drainage).

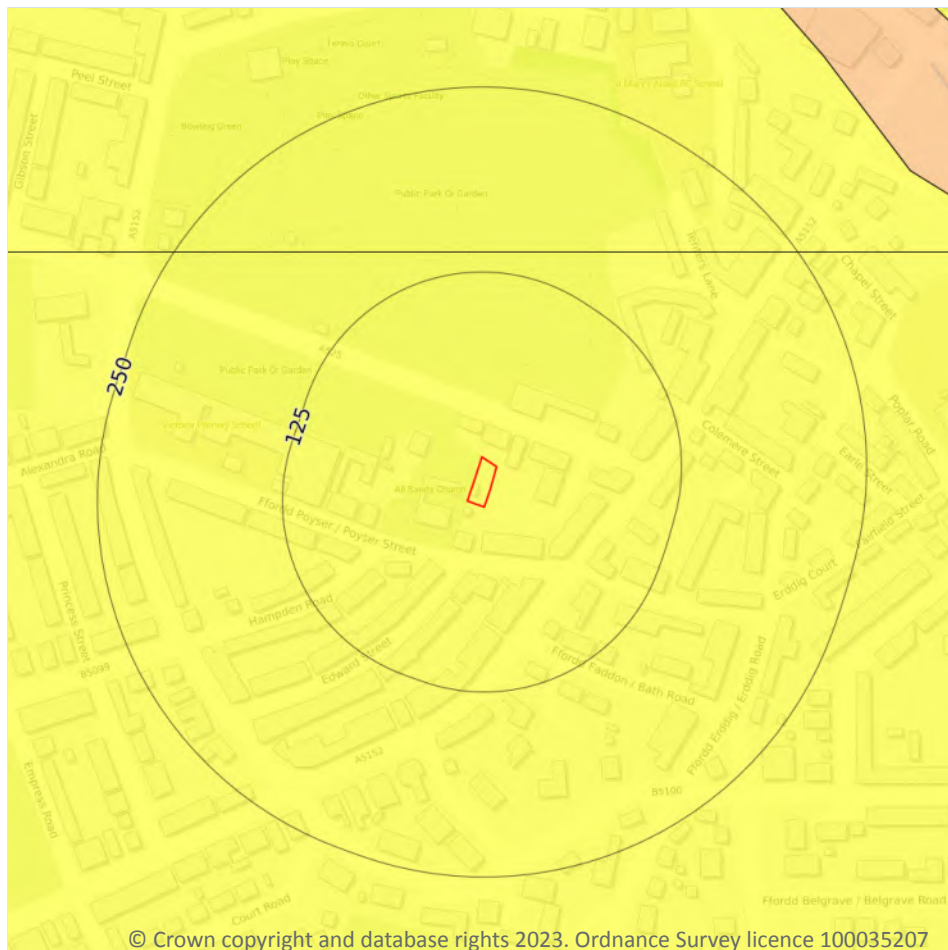
Features are displayed on the Natural ground subsidence - Shrink swell clays map on [page 98](#) >

Location	Hazard rating	Details
On site	Negligible	Ground conditions predominantly non-plastic.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Running sands



- Site Outline
- Search buffers in metres (m)
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.2 Running sands

Records within 50m

1

The potential hazard presented by rocks that can contain loosely-packed sandy layers that can become fluidised by water flowing through them. Such sands can 'run', removing support from overlying buildings and causing potential damage.

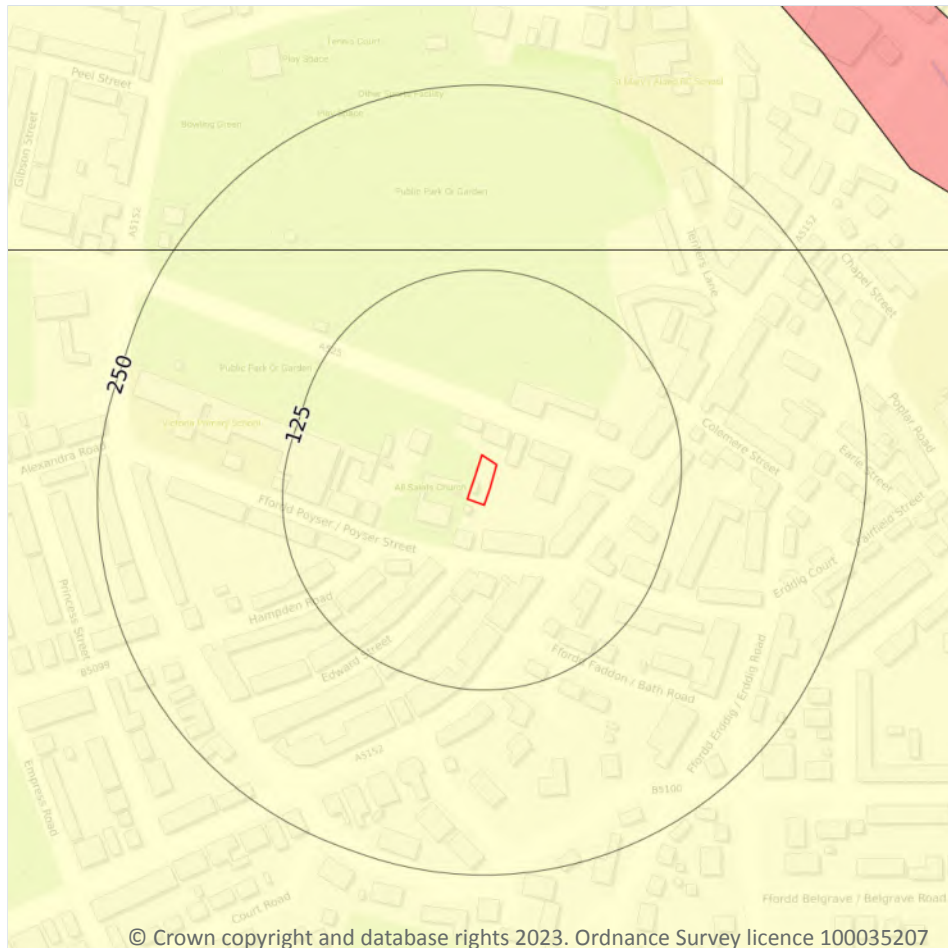
Features are displayed on the Natural ground subsidence - Running sands map on [page 99 >](#)

Location	Hazard rating	Details
On site	Very low	Running sand conditions are unlikely. No identified constraints on land use due to running conditions unless water table rises rapidly.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Compressible deposits



- Site Outline
- Search buffers in metres (m)
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.3 Compressible deposits

Records within 50m

1

The potential hazard presented by types of ground that may contain layers of very soft materials like clay or peat and may compress if loaded by overlying structures, or if the groundwater level changes, potentially resulting in depression of the ground and disturbance of foundations.

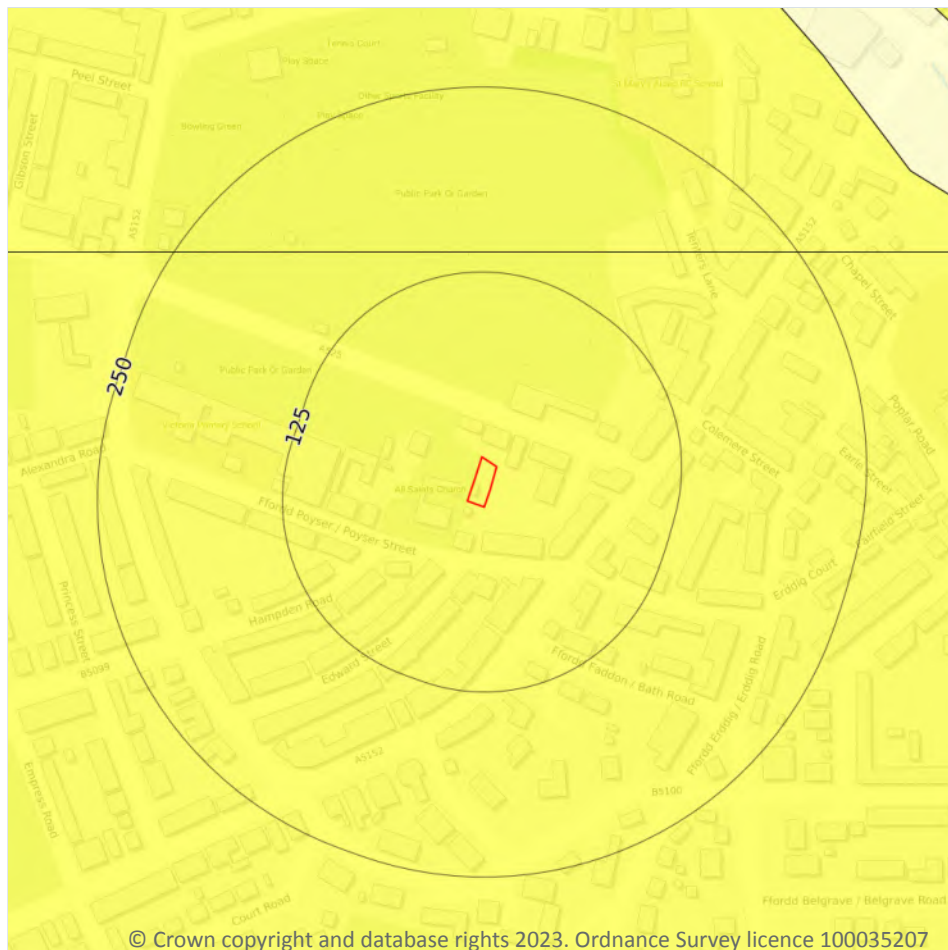
Features are displayed on the Natural ground subsidence - Compressible deposits map on [page 100](#) >

Location	Hazard rating	Details
On site	Negligible	Compressible strata are not thought to occur.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Collapsible deposits



- Site Outline
- Search buffers in metres (m)
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.4 Collapsible deposits

Records within 50m

1

The potential hazard presented by natural deposits that could collapse when a load (such as a building) is placed on them or they become saturated with water.

Features are displayed on the Natural ground subsidence - Collapsible deposits map on [page 101](#) >

Location	Hazard rating	Details
On site	Very low	Deposits with potential to collapse when loaded and saturated are unlikely to be present.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Landslides



- Site Outline
- Search buffers in metres (m)
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.5 Landslides

Records within 50m

1

The potential for landsliding (slope instability) to be a hazard assessed using 1:50,000 scale digital maps of superficial and bedrock deposits, combined with information from the BGS National Landslide Database and scientific and engineering reports.

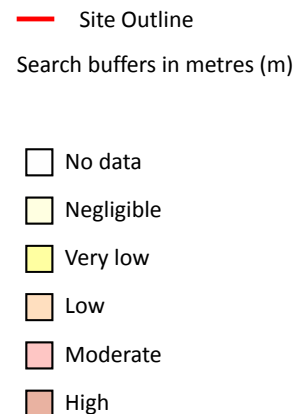
Features are displayed on the Natural ground subsidence - Landslides map on [page 102 >](#)

Location	Hazard rating	Details
On site	Very low	Slope instability problems are not likely to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Ground dissolution of soluble rocks



17.6 Ground dissolution of soluble rocks

Records within 50m

1

The potential hazard presented by ground dissolution, which occurs when water passing through soluble rocks produces underground cavities and cave systems. These cavities reduce support to the ground above and can cause localised collapse of the overlying rocks and deposits.

Features are displayed on the Natural ground subsidence - Ground dissolution of soluble rocks map on [page 103](#) >

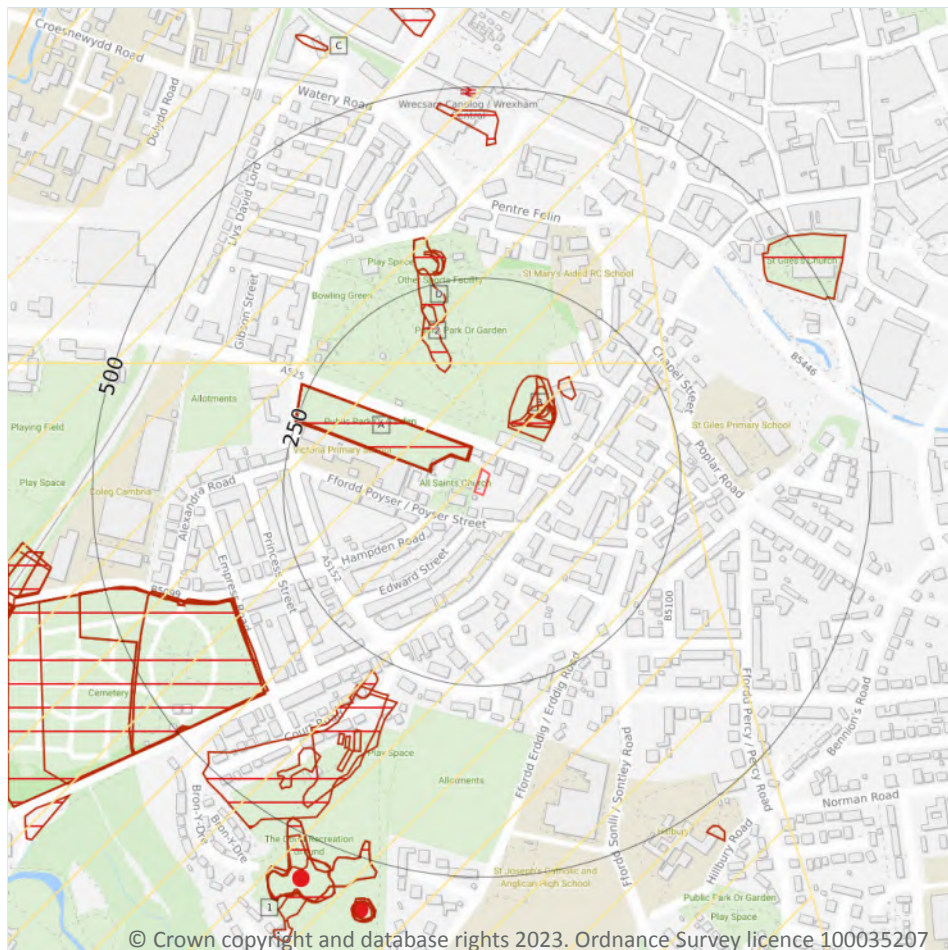
Location	Hazard rating	Details
On site	Negligible	Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present.



This data is sourced from the British Geological Survey.



18 Mining, ground workings and natural cavities



- Site Outline
- Search buffers in metres (m)
- Natural cavities (Area)
- Natural cavities (Point)
- BritPits
- Surface ground workings
- Underground workings
- Historical Mineral Planning Areas
- Mining Cavities
- Non Coal Mining
 - Sporadic underground mining of restricted extent possible
 - Localised small scale underground mining possible
 - Small scale mining possible
 - Underground mining known or likely within or in close proximity
 - Underground mining known within or in very close proximity

18.1 Natural cavities

Records within 500m

0

Industry recognised national database of natural cavities. Sinkholes and caves are formed by the dissolution of soluble rock, such as chalk and limestone, gulls and fissures by cambering. Ground instability can result from movement of loose material contained within these cavities, often triggered by water.

This data is sourced from Stantec UK Ltd.

18.2 BritPits

Records within 500m

0

BritPits (an abbreviation of British Pits) is a database maintained by the British Geological Survey of currently active and closed surface and underground mineral workings. Details of major mineral handling sites, such as wharfs and rail depots are also held in the database.

This data is sourced from the British Geological Survey.

18.3 Surface ground workings

Records within 250m

15

Historical land uses identified from Ordnance Survey mapping that involved ground excavation at the surface. These features may or may not have been subsequently backfilled.

Features are displayed on the Mining, ground workings and natural cavities map on [page 105 >](#)

ID	Location	Land Use	Year of mapping	Mapping scale
A	21m NW	Disused Cemetery	1938	1:10560
A	21m NW	Disused Cemetery	1949	1:10560
A	21m NW	Disused Cemetery	1898	1:10560
A	21m NW	Cemetery	1872	1:10560
A	23m NW	Disused Cemetery	1910	1:10560
A	24m NW	Disused Cemetery	1938	1:10560
B	65m NE	Refuse Heap	1977	1:10000
B	69m NE	Pond	1938	1:10560
B	80m NE	Pond	1872	1:10560
B	82m NE	Pond	1898	1:10560
B	95m NE	Pond	1949	1:10560
B	100m NE	Pond	1964	1:10560
2	136m N	Unspecified Pit	1898	1:10560
B	142m NE	Unspecified Heap	1964	1:10560
D	200m N	Refuse Heap	1872	1:10560

This data is sourced from Ordnance Survey/Groundsure.



18.4 Underground workings

Records within 1000m

0

Historical land uses identified from Ordnance Survey mapping that indicate the presence of underground workings e.g. mine shafts.

This is data is sourced from Ordnance Survey/Groundsure.

18.5 Historical Mineral Planning Areas

Records within 500m

0

Boundaries of mineral planning permissions for England and Wales. This data was collated between the 1940s (and retrospectively to the 1930s) and the mid 1980s. The data includes permitted, withdrawn and refused permissions.

This data is sourced from the British Geological Survey.

18.6 Non-coal mining

Records within 1000m

4

The potential for historical non-coal mining to have affected an area. The assessment is drawn from expert knowledge and literature in addition to the digital geological map of Britain. Mineral commodities may be divided into seven general categories - vein minerals, chalk, oil shale, building stone, bedded ores, evaporites and 'other' commodities (including ball clay, jet, black marble, graphite and chert).

Features are displayed on the Mining, ground workings and natural cavities map on [page 105 >](#)

ID	Location	Name	Commodity	Class	Likelihood
1	On site	Not available	Vein Mineral	A	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered
C	139m N	Not available	Vein Mineral	A	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered
9	793m NW	Not available	Iron Ore (Bedded)	B	Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered
-	833m W	Not available	Iron Ore (Bedded)	B	Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered



This data is sourced from the British Geological Survey.

18.7 Mining cavities

Records within 1000m

0

Industry recognised national database of mining cavities. Degraded mines may result in hazardous subsidence (crown holes). Climatic conditions and water escape can also trigger subsidence over mine entrances and workings.

This data is sourced from Stantec UK Ltd.

18.8 JPB mining areas

Records on site

0

Areas which could be affected by former coal and other mining. This data includes some mine plans unavailable to the Coal Authority.

This data is sourced from Johnson Poole and Bloomer.

18.9 Coal mining

Records on site

1

Areas which could be affected by past, current or future coal mining.

Location	Details
On site	The site is located within a coal mining area as defined by the Coal Authority. A Consultants Coal Mining Report is recommended to further assess coal mining issues at the site. This can be ordered directly through Groundsure or your preferred search provider.

This data is sourced from the Coal Authority.

18.10 Brine areas

Records on site

0

The Cheshire Brine Compensation District indicates areas that may be affected by salt and brine extraction in Cheshire and where compensation would be available where damage from this mining has occurred. Damage from salt and brine mining can still occur outside this district, but no compensation will be available.

This data is sourced from the Cheshire Brine Subsidence Compensation Board.



18.11 Gypsum areas

Records on site	0
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Generalised areas that may be affected by gypsum extraction.

This data is sourced from British Gypsum.

18.12 Tin mining

Records on site	0
-----------------	---

Generalised areas that may be affected by historical tin mining.

This data is sourced from Groundsure.

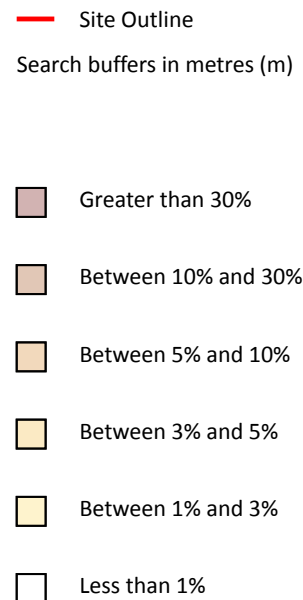
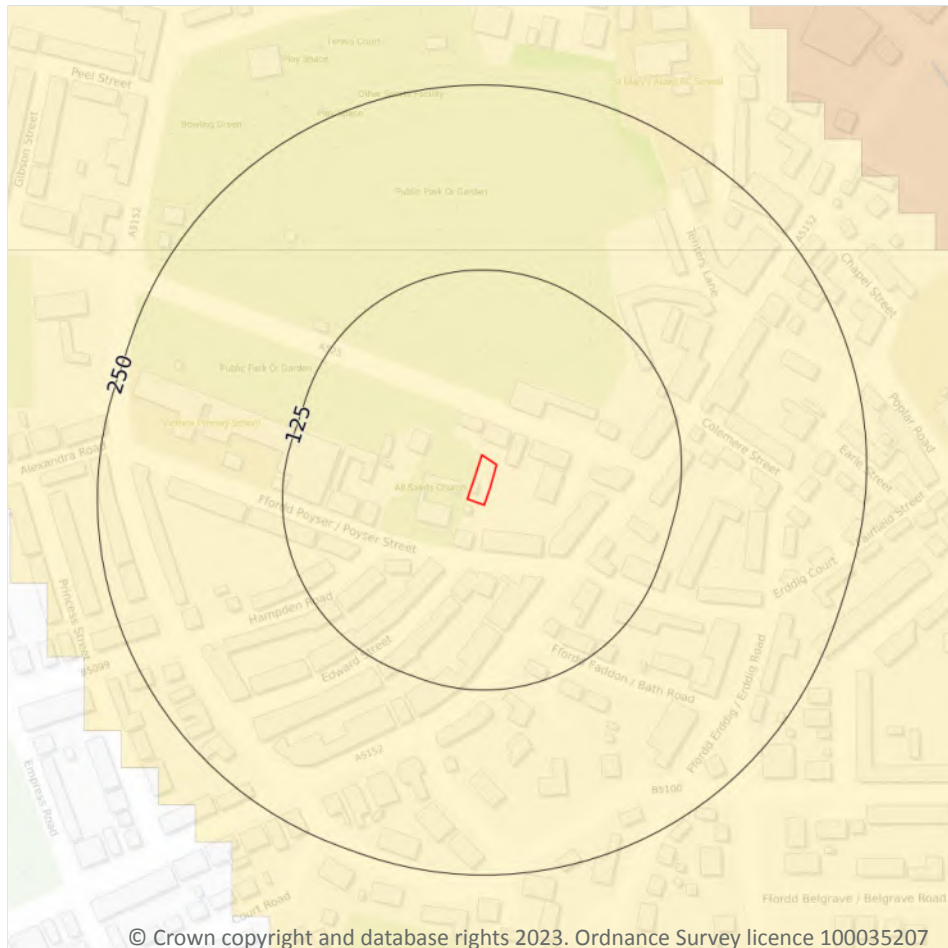
18.13 Clay mining

Records on site	0
-----------------	---

Generalised areas that may be affected by kaolin and ball clay extraction.

This data is sourced from the Kaolin and Ball Clay Association (UK).

19 Radon



19.1 Radon

Records on site

1

The Radon Potential data classifies areas based on their likelihood of a property having a radon level at or above the Action Level in Great Britain. The dataset is intended for use at 1:50,000 scale and was derived from both geological assessments and indoor radon measurements (more than 560,000 records). A minimum 50m buffer should be considered when searching the maps, as the smallest detectable feature at this scale is 50m. The findings of this section should supersede any estimations derived from the Indicative Atlas of Radon in Great Britain (1:100,000 scale).

Features are displayed on the Radon map on [page 110](#) >

Location	Estimated properties affected	Radon Protection Measures required
On site	Between 1% and 3%	None



This data is sourced from the British Geological Survey and UK Health Security Agency.



20 Soil chemistry

20.1 BGS Estimated Background Soil Chemistry

Records within 50m**1**

The estimated values provide the likely background concentration of the potentially harmful elements Arsenic, Cadmium, Chromium, Lead and Nickel in topsoil. The values are estimated primarily from rural topsoil data collected at a sample density of approximately 1 per 2 km². In areas where rural soil samples are not available, estimation is based on stream sediment data collected from small streams at a sampling density of 1 per 2.5 km²; this is the case for most of Scotland, Wales and southern England. The stream sediment data are converted to soil-equivalent concentrations prior to the estimation.

Location	Arsenic	Bioaccessible Arsenic	Lead	Bioaccessible Lead	Cadmium	Chromium	Nickel
On site	15 mg/kg	No data	100 - 200 mg/kg	60 - 120 mg/kg	1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg

This data is sourced from the British Geological Survey.

20.2 BGS Estimated Urban Soil Chemistry

Records within 50m**0**

Estimated topsoil chemistry of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc and bioaccessible Arsenic and Lead in 23 urban centres across Great Britain. These estimates are derived from interpolation of the measured urban topsoil data referred to above and provide information across each city between the measured sample locations (4 per km²).

This data is sourced from the British Geological Survey.

20.3 BGS Measured Urban Soil Chemistry

Records within 50m**0**

The locations and measured total concentrations (mg/kg) of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc in urban topsoil samples from 23 urban centres across Great Britain. These are collected at a sample density of 4 per km².

This data is sourced from the British Geological Survey.



21 Railway infrastructure and projects

21.1 Underground railways (London)

Records within 250m**0**

Details of all active London Underground lines, including approximate tunnel roof depth and operational hours.

This data is sourced from publicly available information by Groundsure.

21.2 Underground railways (Non-London)

Records within 250m**0**

Details of the Merseyrail system, the Tyne and Wear Metro and the Glasgow Subway. Not all parts of all systems are located underground. The data contains location information only and does not include a depth assessment.

This data is sourced from publicly available information by Groundsure.

21.3 Railway tunnels

Records within 250m**0**

Railway tunnels taken from contemporary Ordnance Survey mapping.

This data is sourced from the Ordnance Survey.

21.4 Historical railway and tunnel features

Records within 250m**0**

Railways and tunnels digitised from historical Ordnance Survey mapping as scales of 1:1,250, 1:2,500, 1:10,000 and 1:10,560.

This data is sourced from Ordnance Survey/Groundsure.

21.5 Royal Mail tunnels

Records within 250m**0**

The Post Office Railway, otherwise known as the Mail Rail, is an underground railway running through Central London from Paddington Head District Sorting Office to Whitechapel Eastern Head Sorting Office. The line is 10.5km long. The data includes details of the full extent of the tunnels, the depth of the tunnel, and the depth to track level.



This data is sourced from Groundsure/the Postal Museum.

21.6 Historical railways

Records within 250m

0

Former railway lines, including dismantled lines, abandoned lines, disused lines, historic railways and razed lines.

This data is sourced from OpenStreetMap.

21.7 Railways

Records within 250m

0

Currently existing railway lines, including standard railways, narrow gauge, funicular, trams and light railways.

This data is sourced from Ordnance Survey and OpenStreetMap.

21.8 Crossrail 1

Records within 500m

0

The Crossrail railway project links 41 stations over 100 kilometres from Reading and Heathrow in the west, through underground sections in central London, to Shenfield and Abbey Wood in the east.

This data is sourced from publicly available information by Groundsure.

21.9 Crossrail 2

Records within 500m

0

Crossrail 2 is a proposed railway linking the national rail networks in Surrey and Hertfordshire via an underground tunnel through London.

This data is sourced from publicly available information by Groundsure.

21.10 HS2

Records within 500m

0

HS2 is a proposed high speed rail network running from London to Manchester and Leeds via Birmingham. Main civils construction on Phase 1 (London to Birmingham) of the project began in 2019, and it is currently anticipated that this phase will be fully operational by 2026. Construction on Phase 2a (Birmingham to Crewe) is anticipated to commence in 2021, with the service fully operational by 2027. Construction on Phase 2b (Crewe to Manchester and Birmingham to Leeds) is scheduled to begin in 2023 and be operational by 2033.

This data is sourced from HS2 Ltd.



Data providers

Groundsure works with respected data providers to bring you the most relevant and accurate information. To find out who they are and their areas of expertise see <https://www.groundsure.com/sources-reference> ↗.

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Site Details:

27, POYSER STREET,
WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1873

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1873
Revised N/A
Edition 1873
Copyright N/A
Levelled N/A

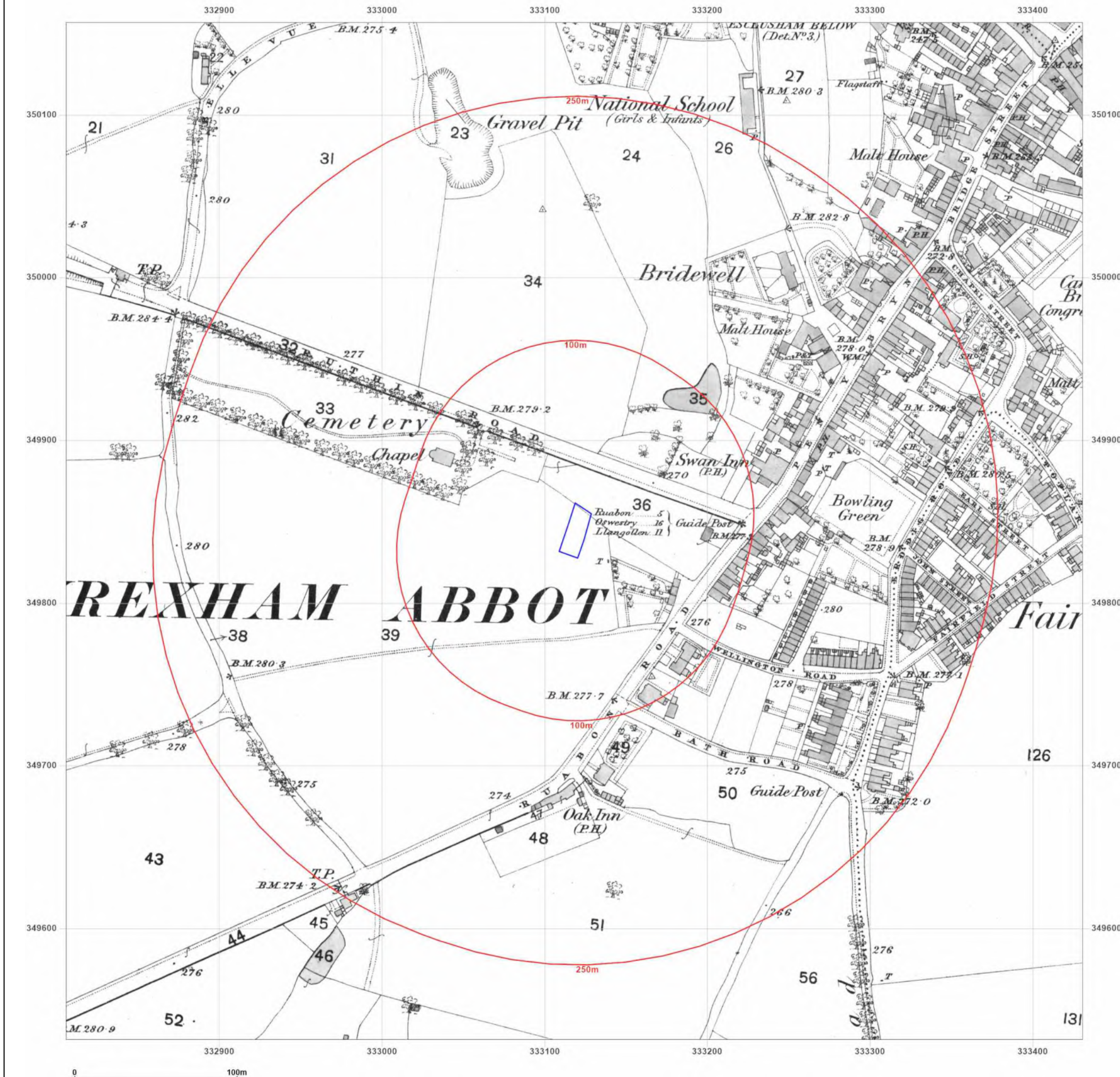


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Site Details:

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WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series Town Plan

Map date: 1874

Scale: 1:500

Printed at: 1:1,000



Surveyed 1874
Revised N/A
Edition N/A
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Surveyed 1874
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1874
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Edition N/A
Copyright N/A
Levelled N/A

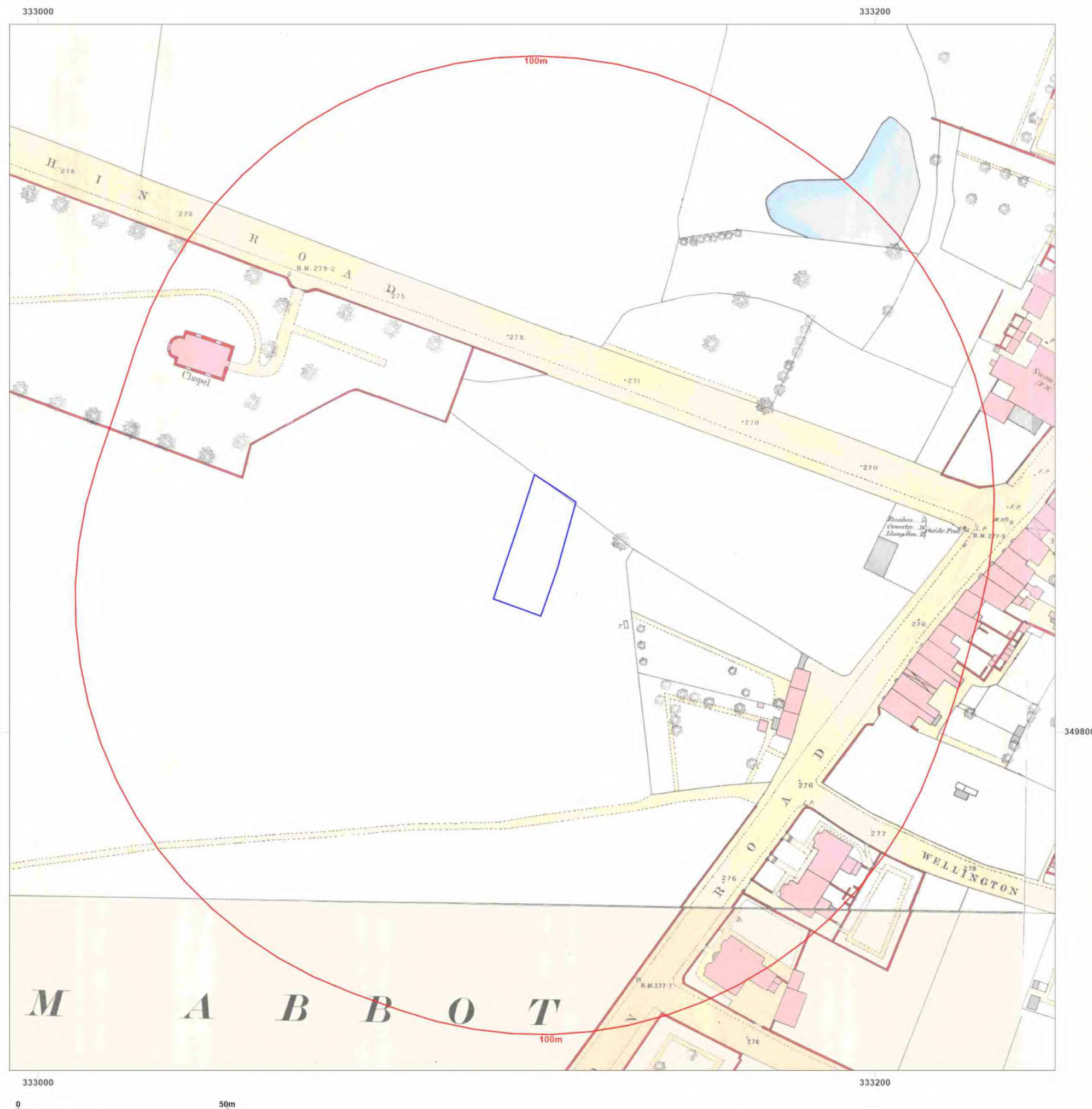


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1899

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1899
Revised 1899
Edition N/A
Copyright N/A
Levelled N/A

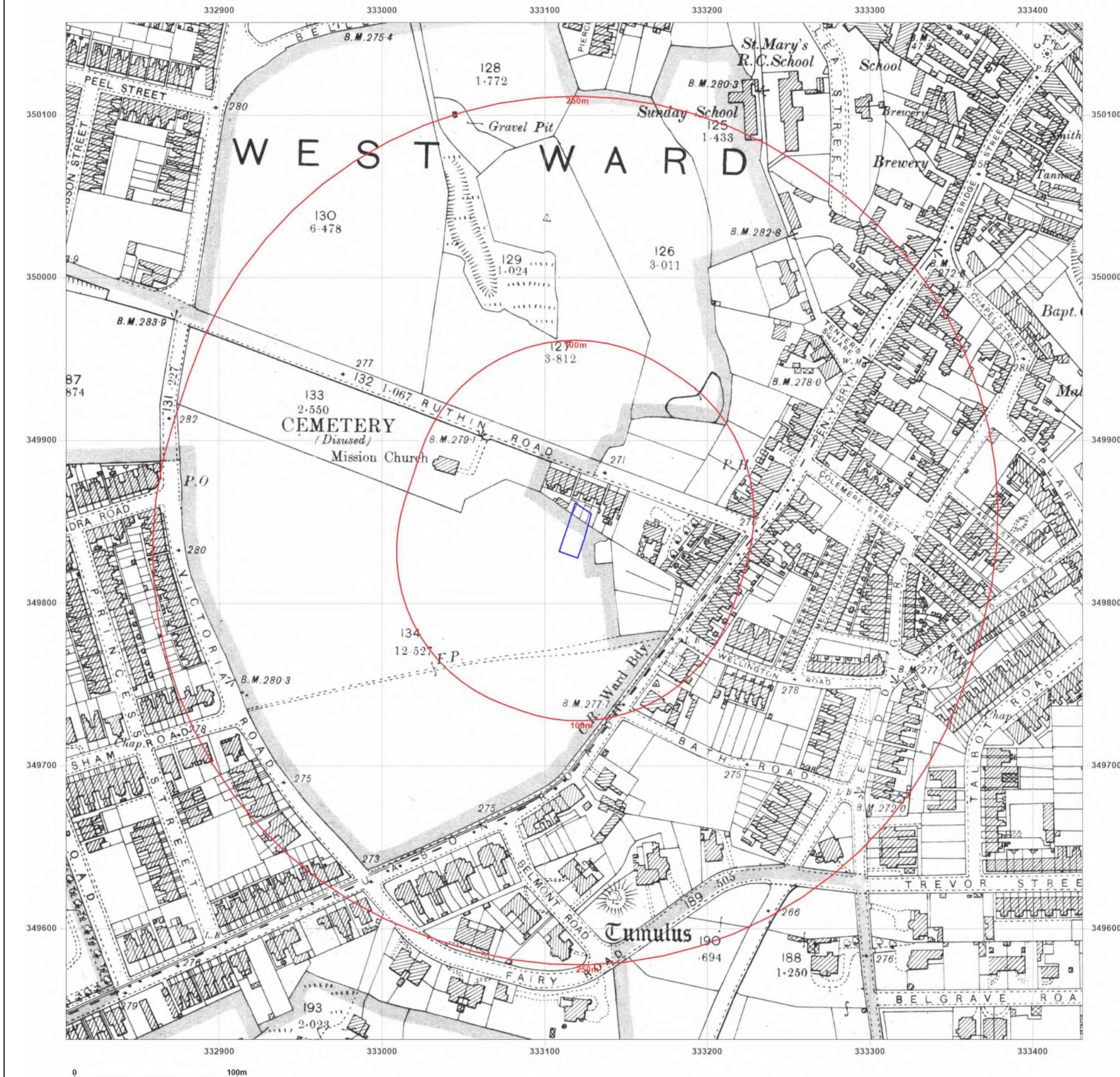


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1912

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1912
Revised 1912
Edition N/A
Copyright N/A
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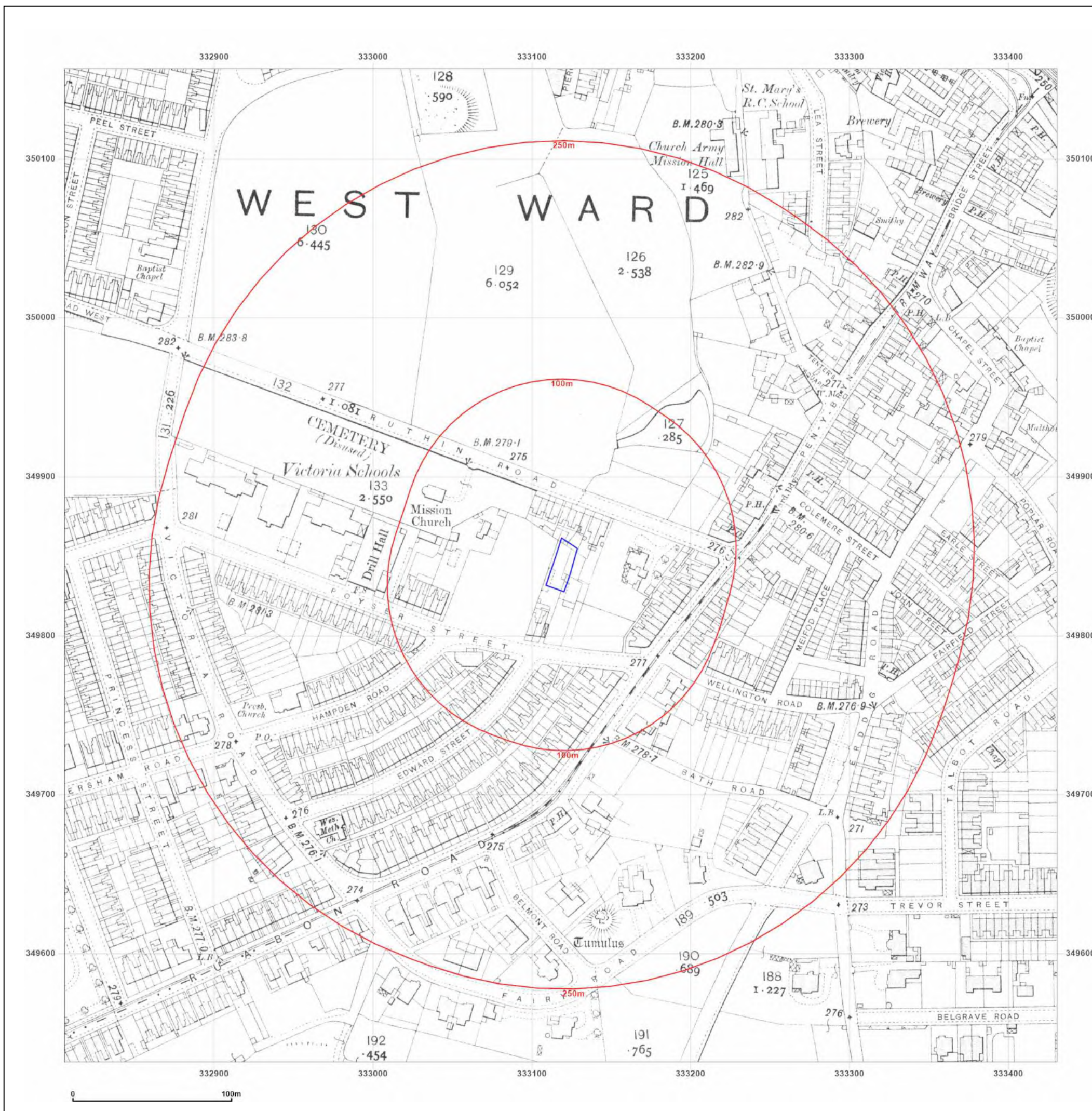


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1937

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1937
Revised 1937
Edition N/A
Copyright N/A
Levelled N/A

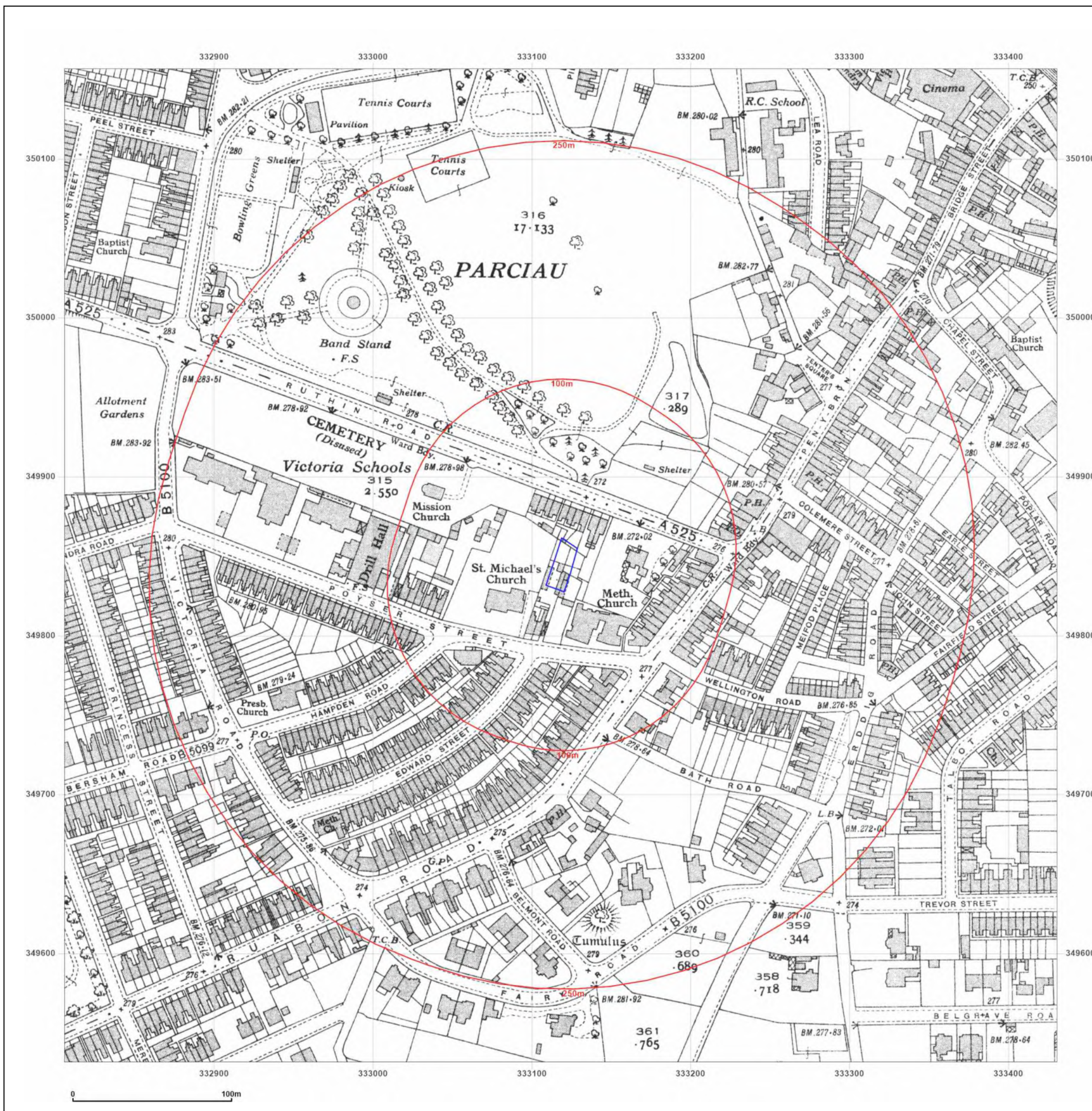


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1957-1958

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1957
Revised 1957
Edition N/A
Copyright N/A
Levelled 1950

Surveyed 1958
Revised 1958
Edition N/A
Copyright N/A
Levelled 1950

Surveyed 1957
Revised 1957
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1958
Revised 1958
Edition N/A
Copyright N/A
Levelled 1950

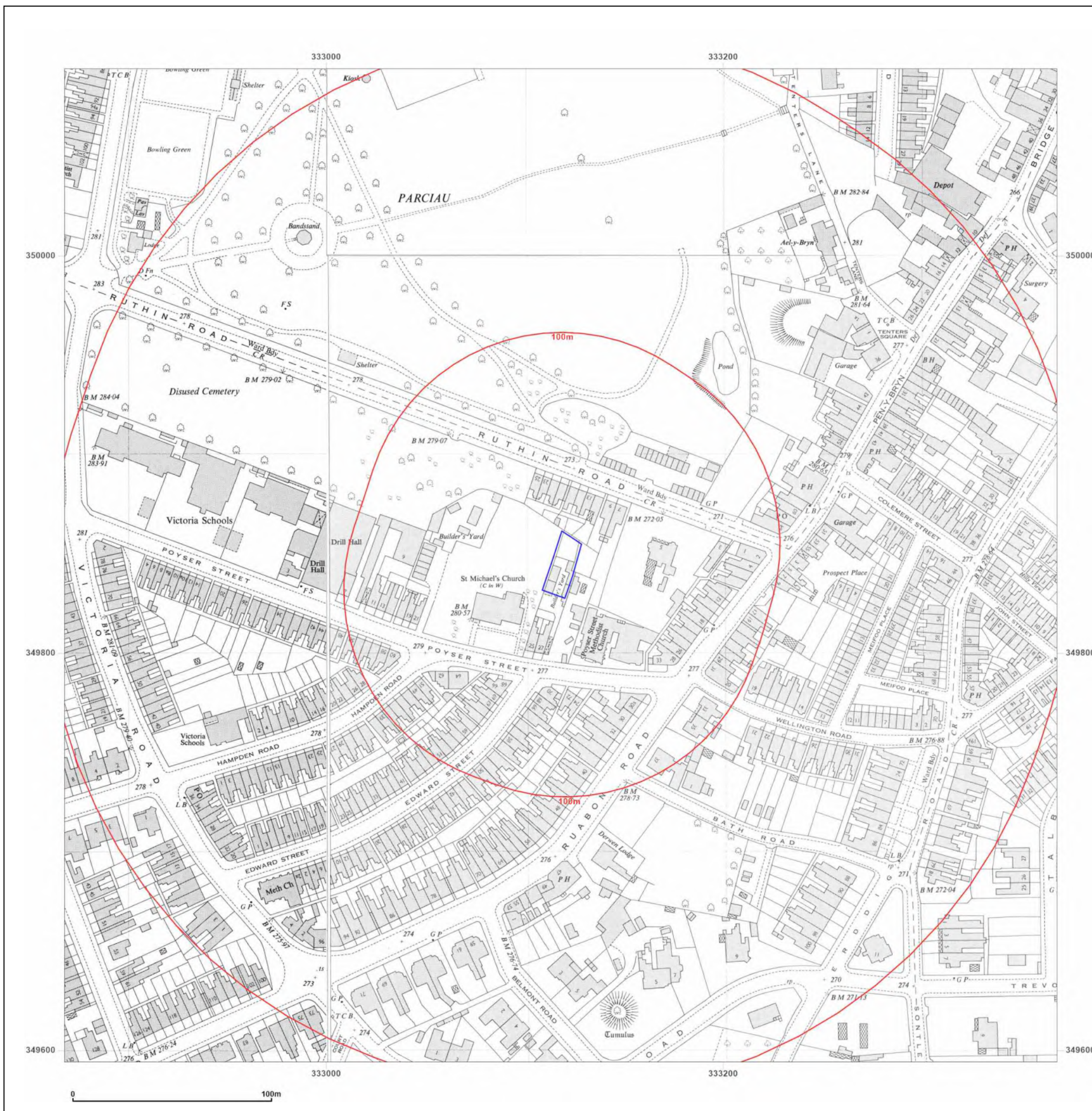


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1960

Scale: 1:2,500

Printed at: 1:2,500



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Surveyed 1958
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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1963

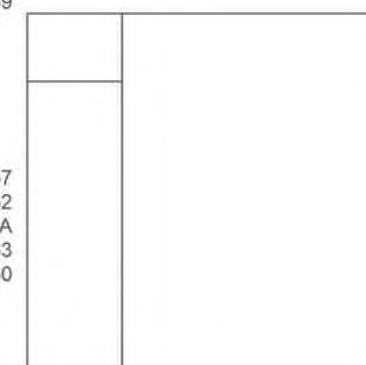
Scale: 1:1,250

Printed at: 1:2,000



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Edition N/A
Copyright 1963
Levelled 1959

Surveyed 1957
Revised 1962
Edition N/A
Copyright 1963
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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1963

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1957
Revised 1962
Edition N/A
Copyright 1963
Levelled 1960

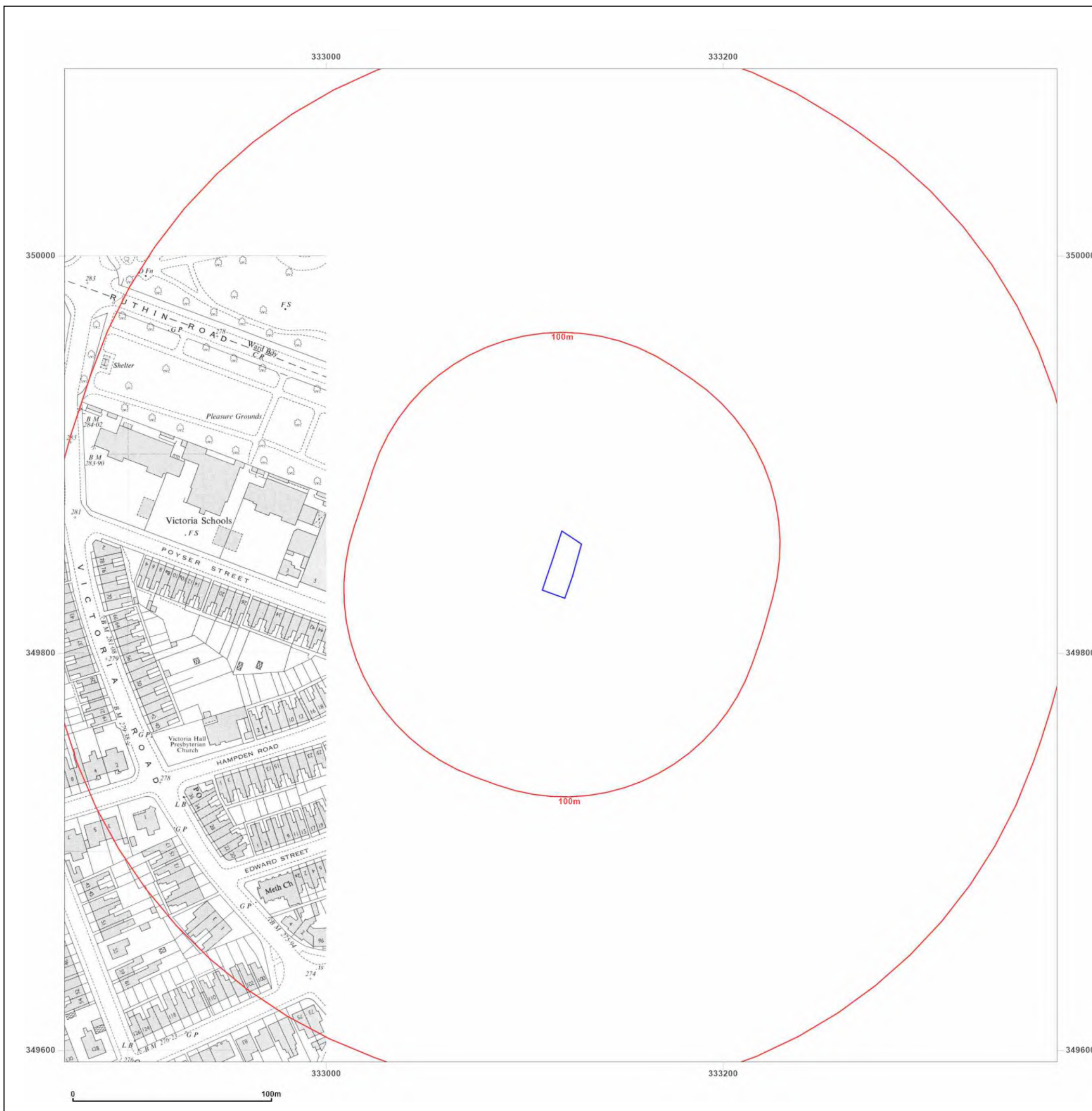


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1963-1968

Scale: 1:1,250

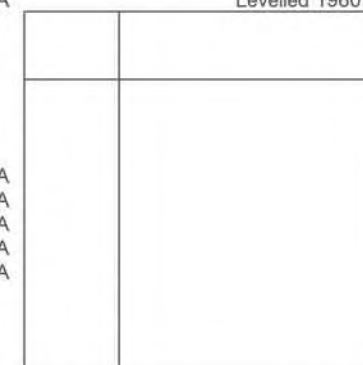
Printed at: 1:2,000



Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1958
Revised 1968
Edition N/A
Copyright 1968
Levelled 1960

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

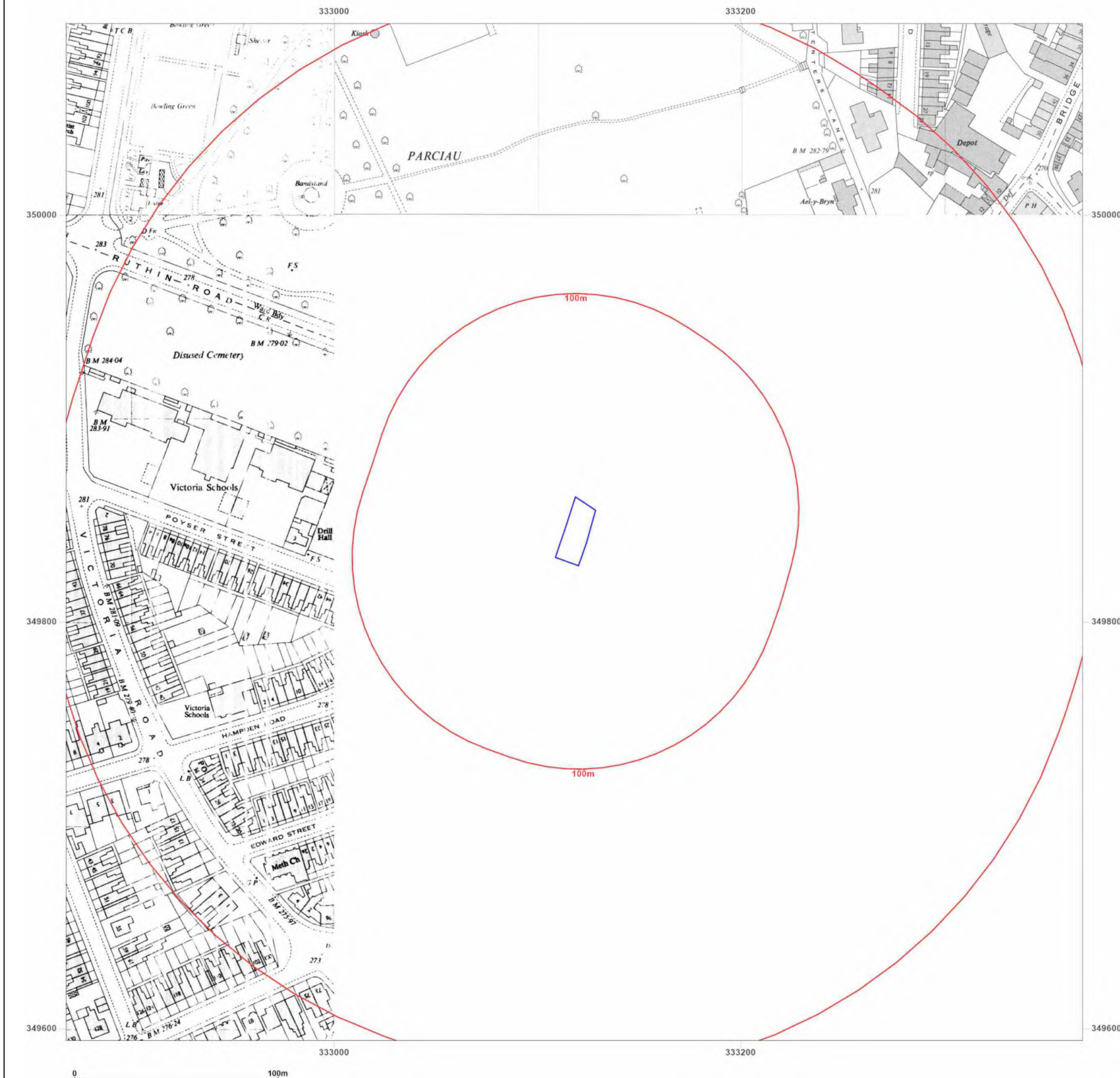


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1970-1975

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1957
Revised 1969
Edition N/A
Copyright 1970
Levelled 1959

Surveyed 1958
Revised 1975
Edition N/A
Copyright 1975
Levelled 1959

Surveyed 1958
Revised 1971
Edition N/A
Copyright 1971
Levelled 1960

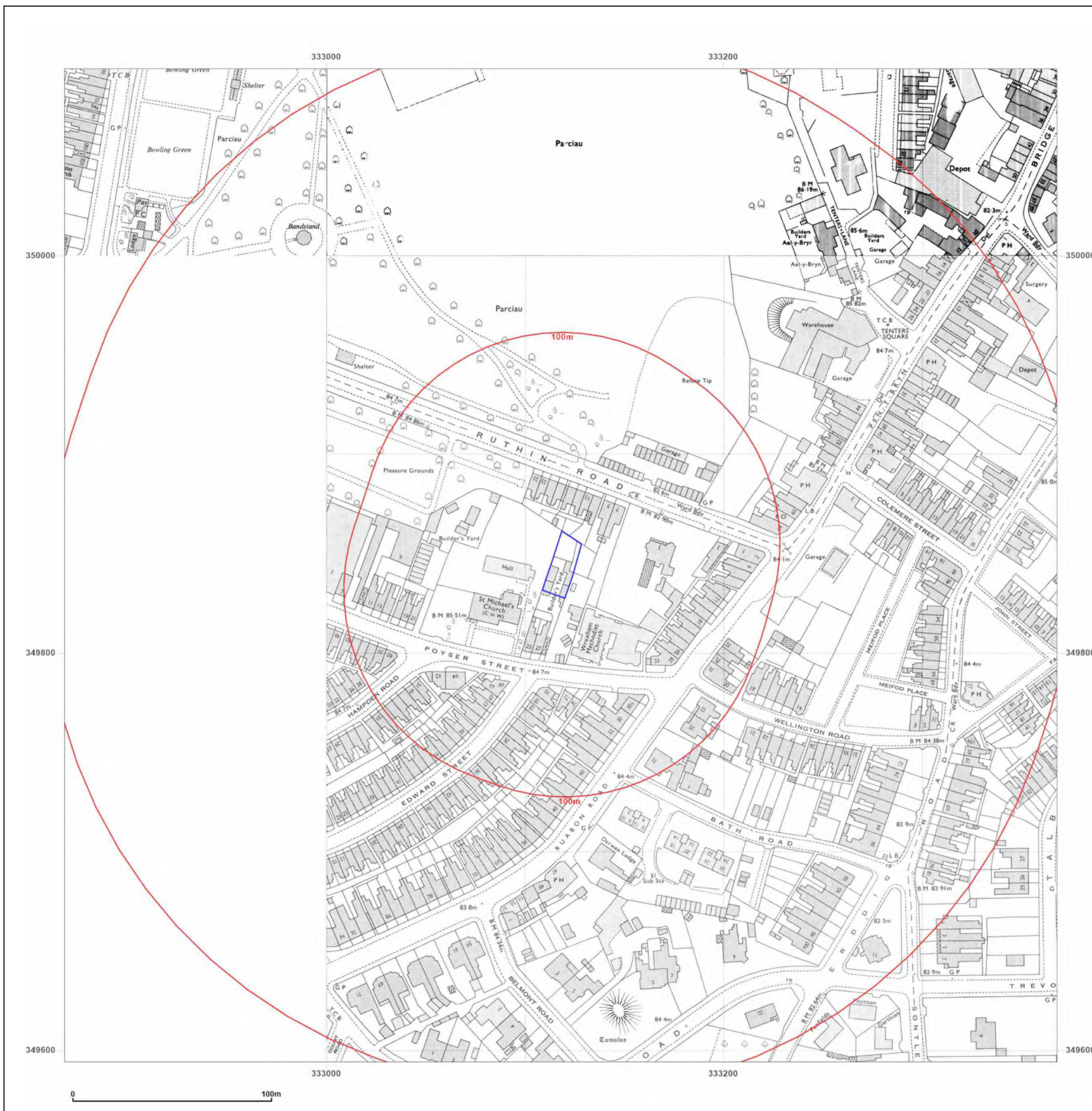


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

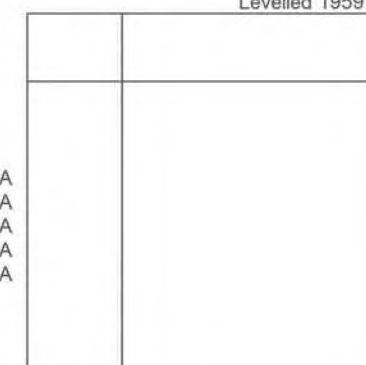
Map date: 1975-1977

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1958
Revised 1975
Edition N/A
Copyright 1975
Levelled 1959



Surveyed N/A
Revised N/A
Edition N/A
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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1982

Scale: 1:1,250

Printed at: 1:2,000



Surveyed N/A
Revised N/A
Edition N/A
Copyright 1982
Levelled 1960

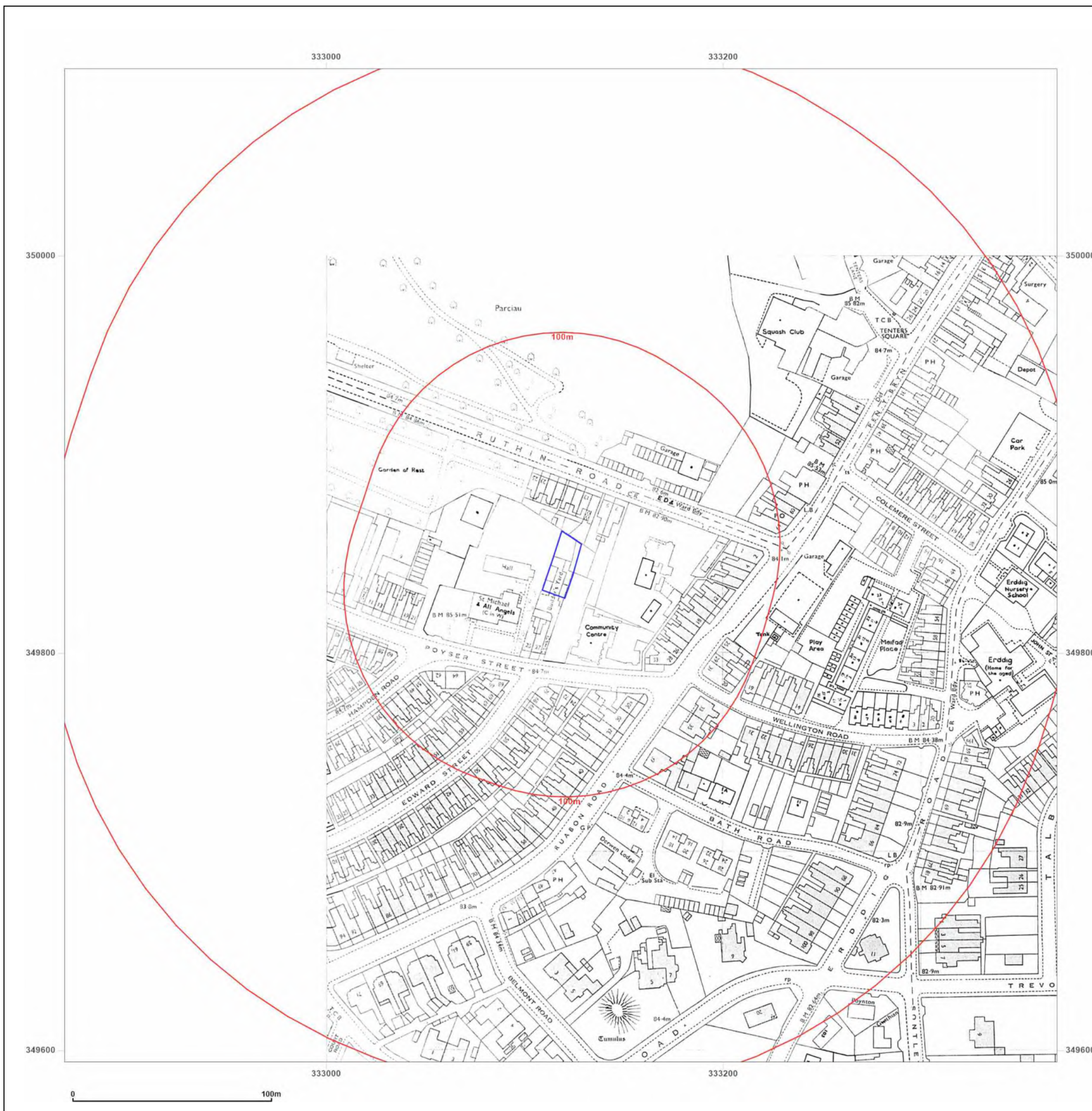


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1988-1990

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1959
Revised 1989
Edition N/A
Copyright 1989
Levelled 1959

Surveyed 1959
Revised 1988
Edition N/A
Copyright 1988
Levelled 1959

Surveyed 1960
Revised 1990
Edition N/A
Copyright 1990
Levelled 1960

Surveyed 1960
Revised 1989
Edition N/A
Copyright 1989
Levelled 1960

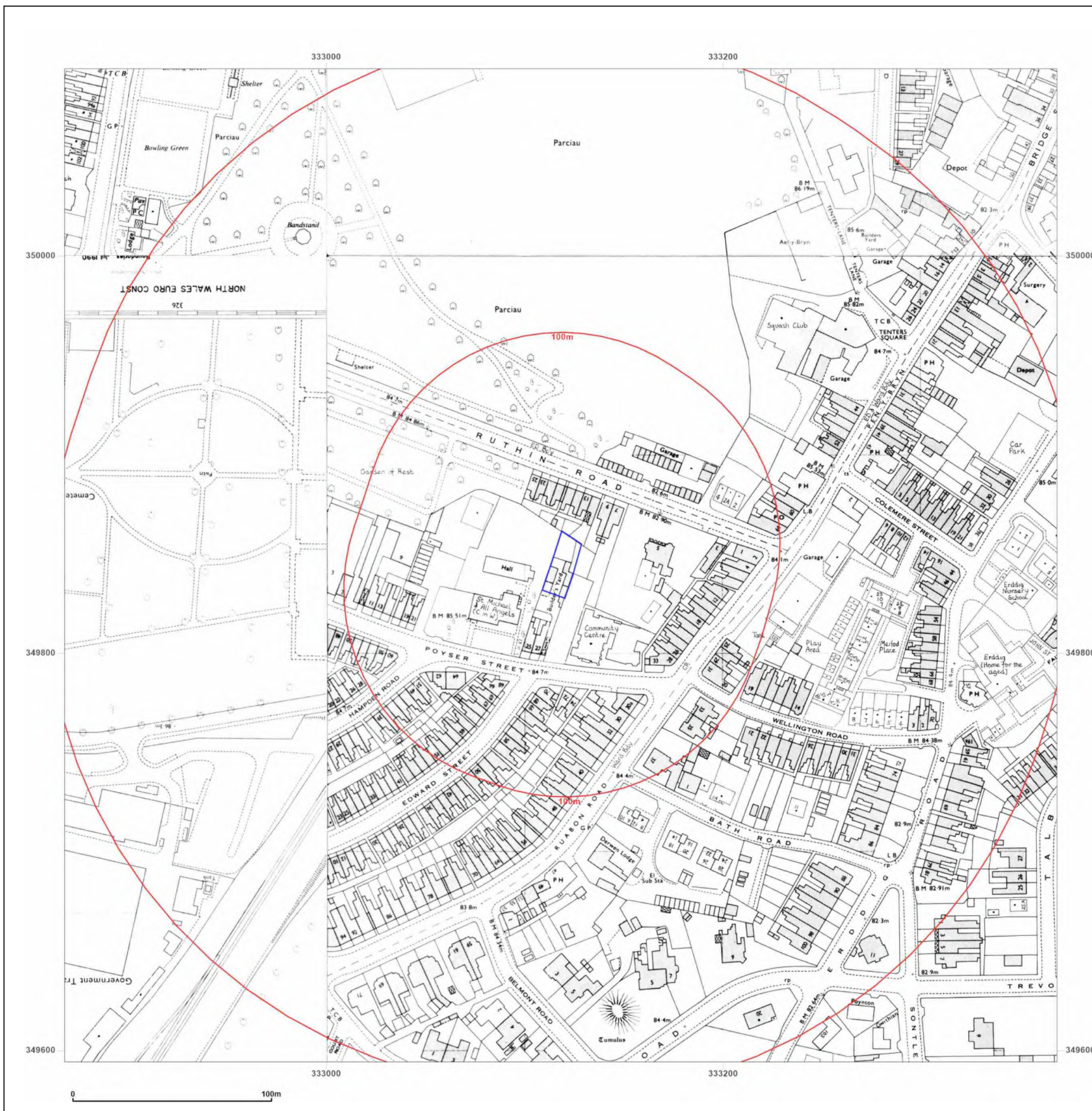


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1989-1992

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1959
Revised 1989
Edition N/A
Copyright 1989
Levelled 1959

Surveyed 1959
Revised 1990
Edition N/A
Copyright 1990
Levelled 1959

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

Surveyed 1960
Revised 1990
Edition N/A
Copyright 1990
Levelled 1960

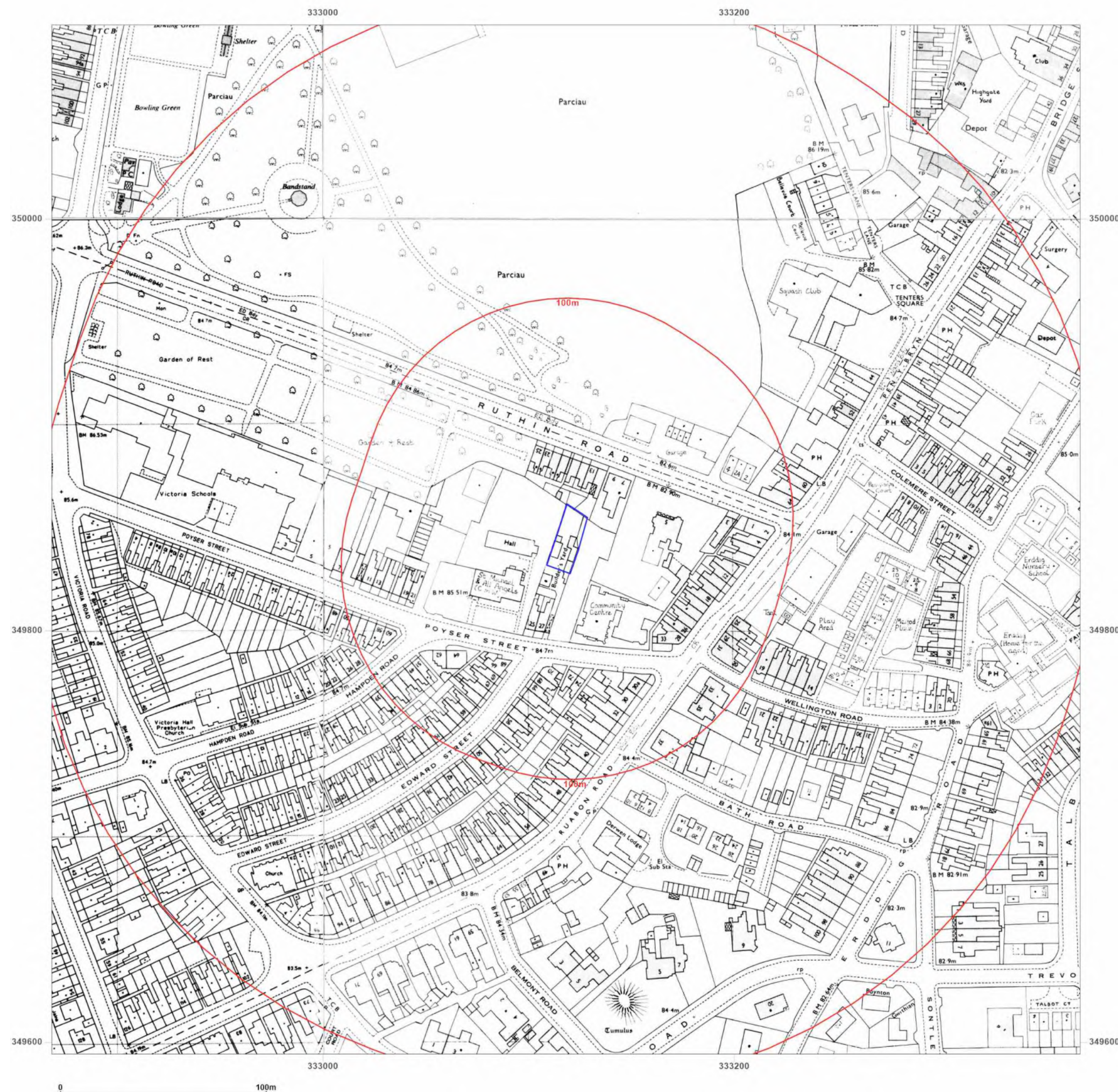


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1990-1992

Scale: 1:1,250

Printed at: 1:2,000



Surveyed N/A
Revised 1990
Edition N/A
Copyright 1989
Levelled 1959

Surveyed 1959
Revised 1990
Edition N/A
Copyright 1990
Levelled 1959

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

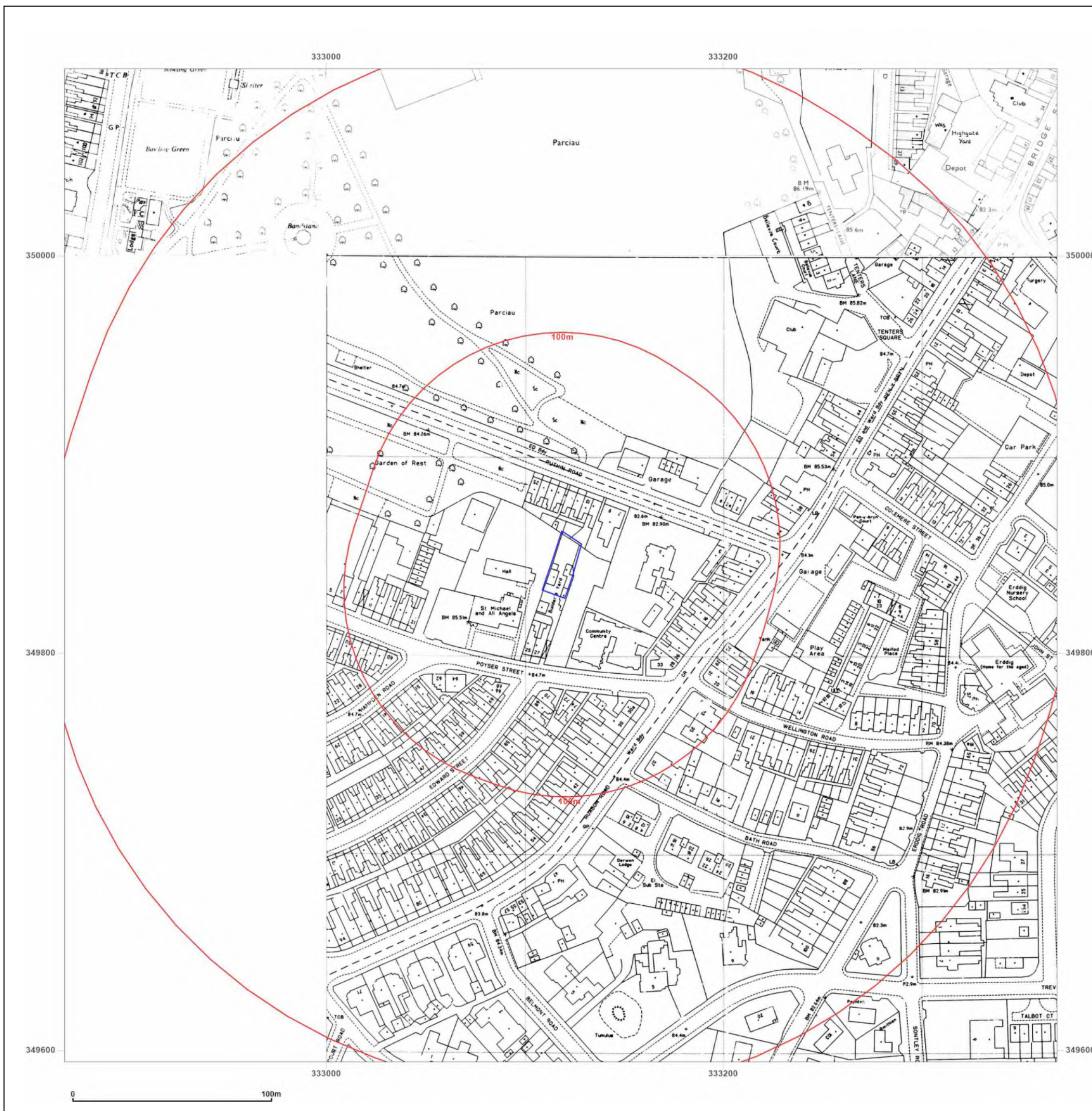


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: LandLine

Map date: 2003

Scale: 1:1,250

Printed at: 1:1,250



2003



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Site Details:

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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1872

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1872
Revised 1872
Edition N/A
Copyright N/A
Levelled N/A

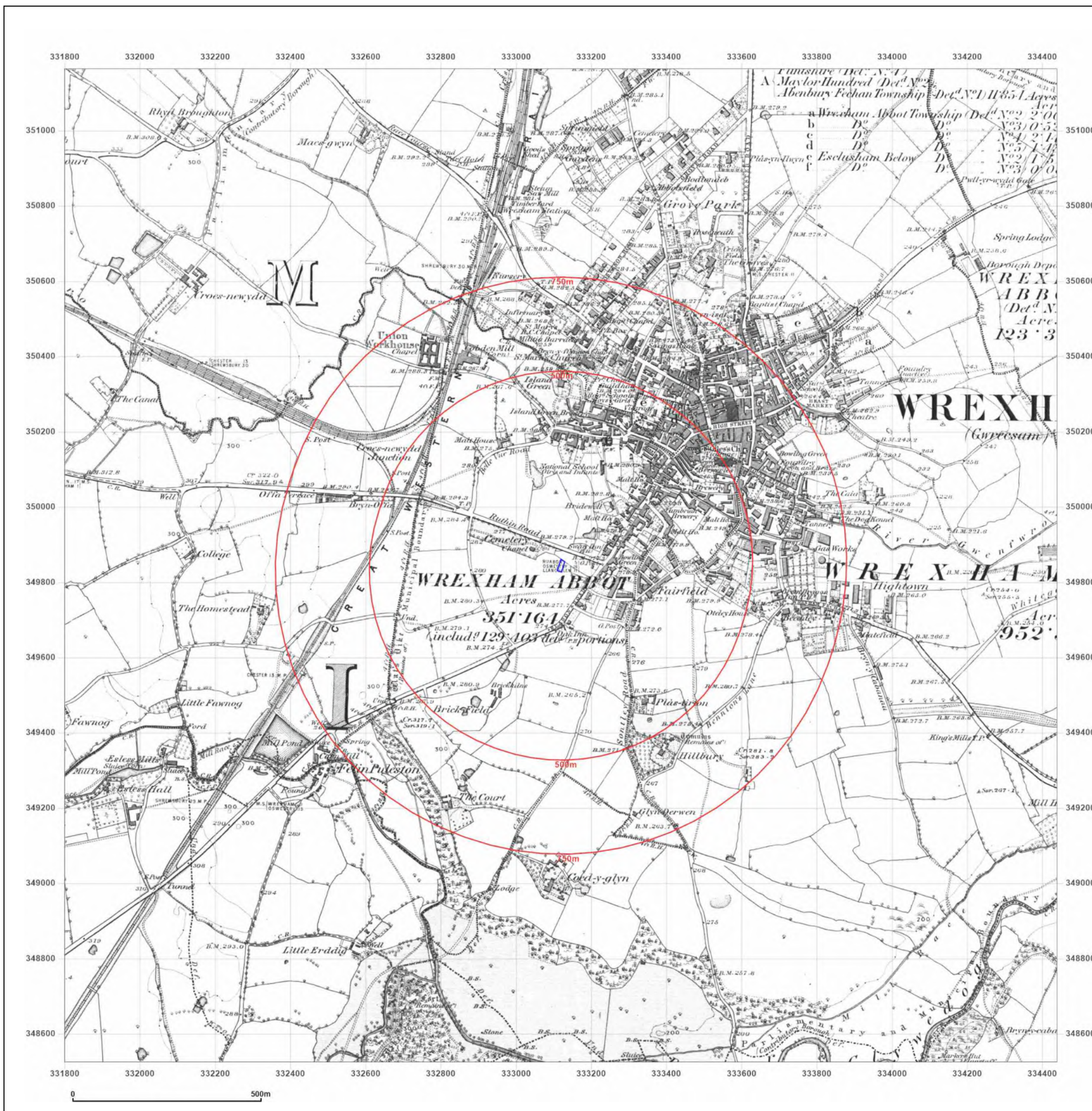


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1898

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1877
Revised 1898
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1871
Revised 1898
Edition N/A
Copyright N/A
Levelled N/A

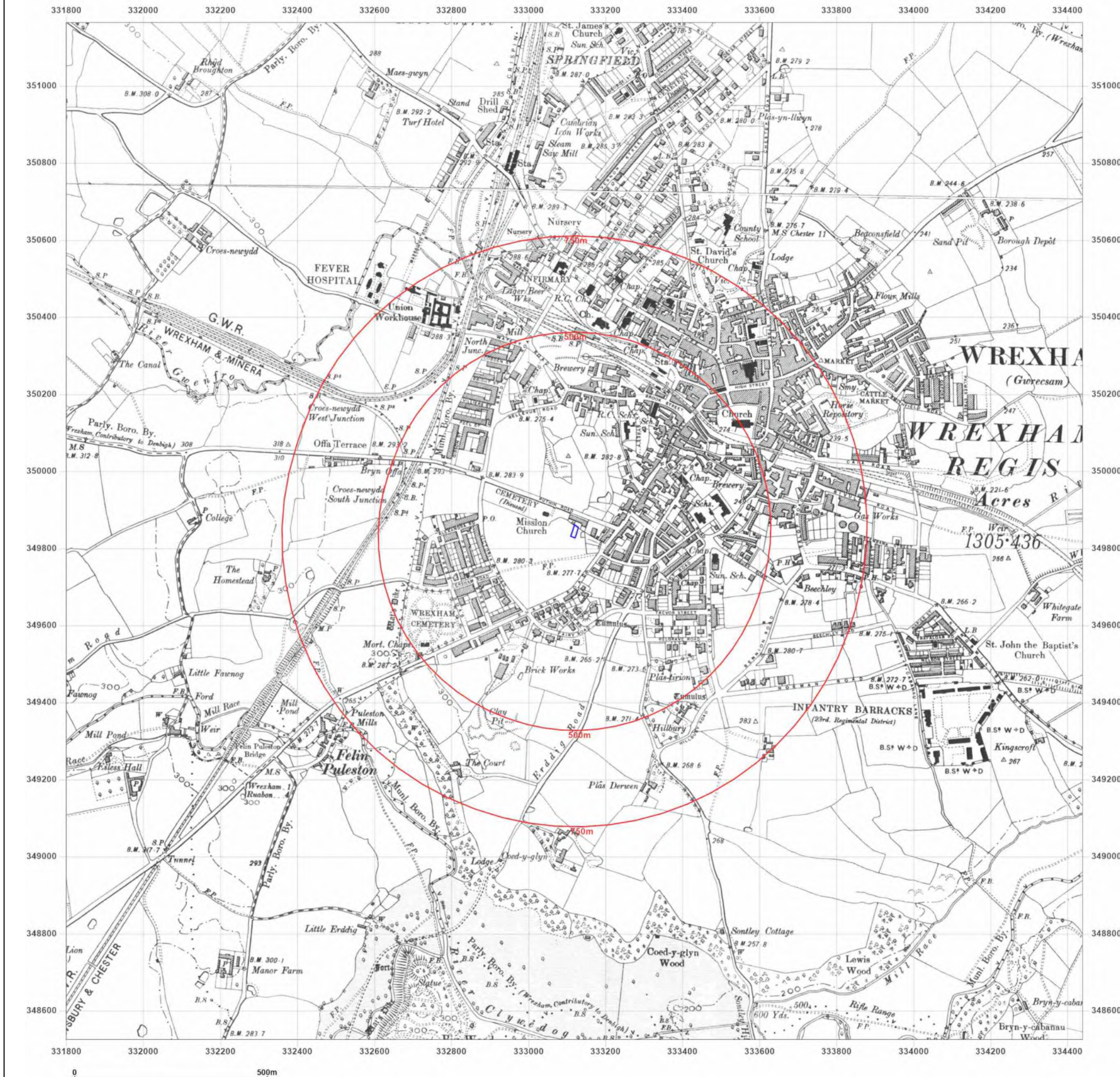


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1909-1910

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1871
Revised 1909
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1871
Revised 1910
Edition N/A
Copyright N/A
Levelled N/A

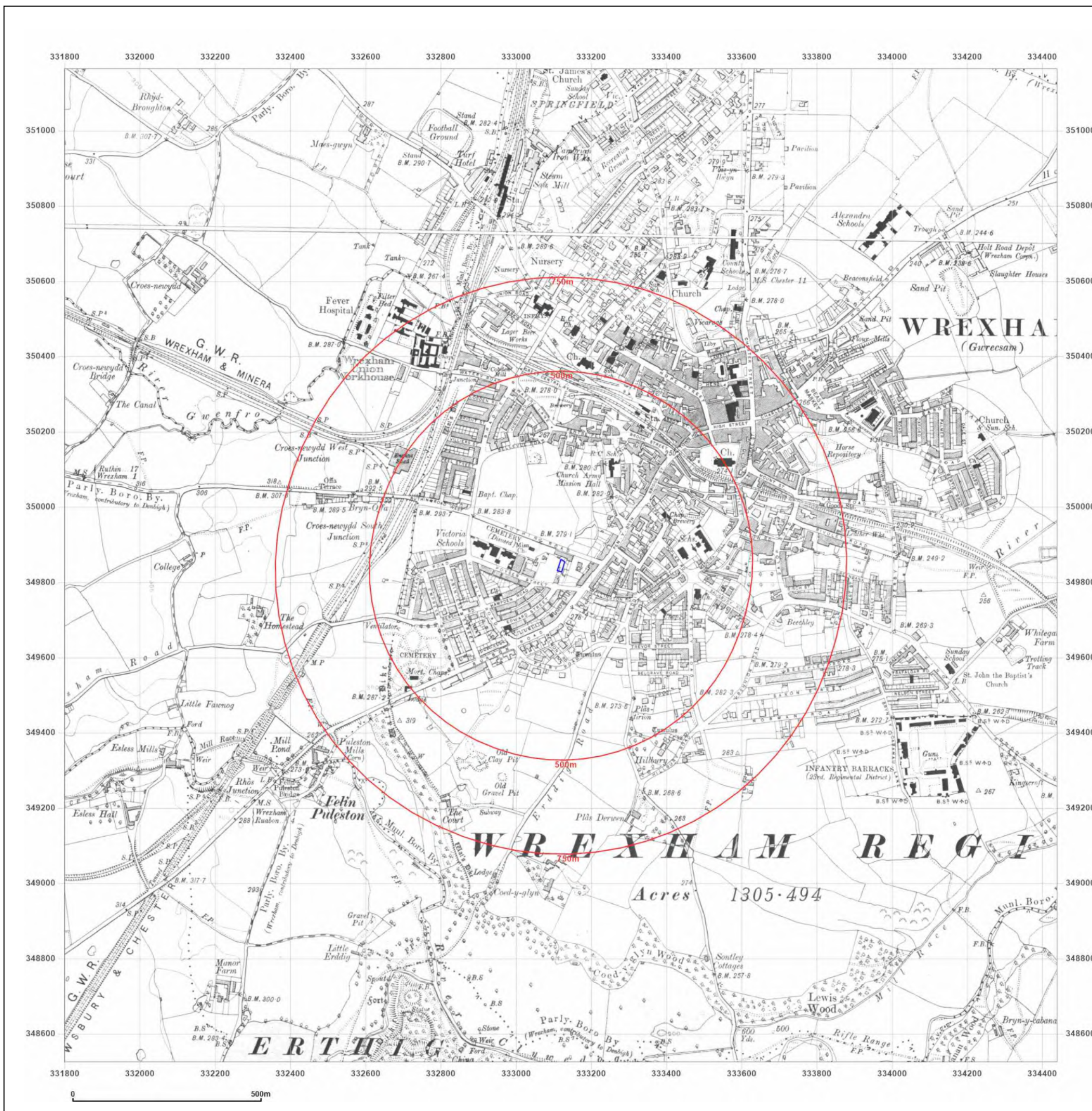


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1938

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1871
Revised 1938
Edition 1938
Copyright N/A
Levelled N/A

Surveyed 1871
Revised 1938
Edition 1938
Copyright N/A
Levelled N/A

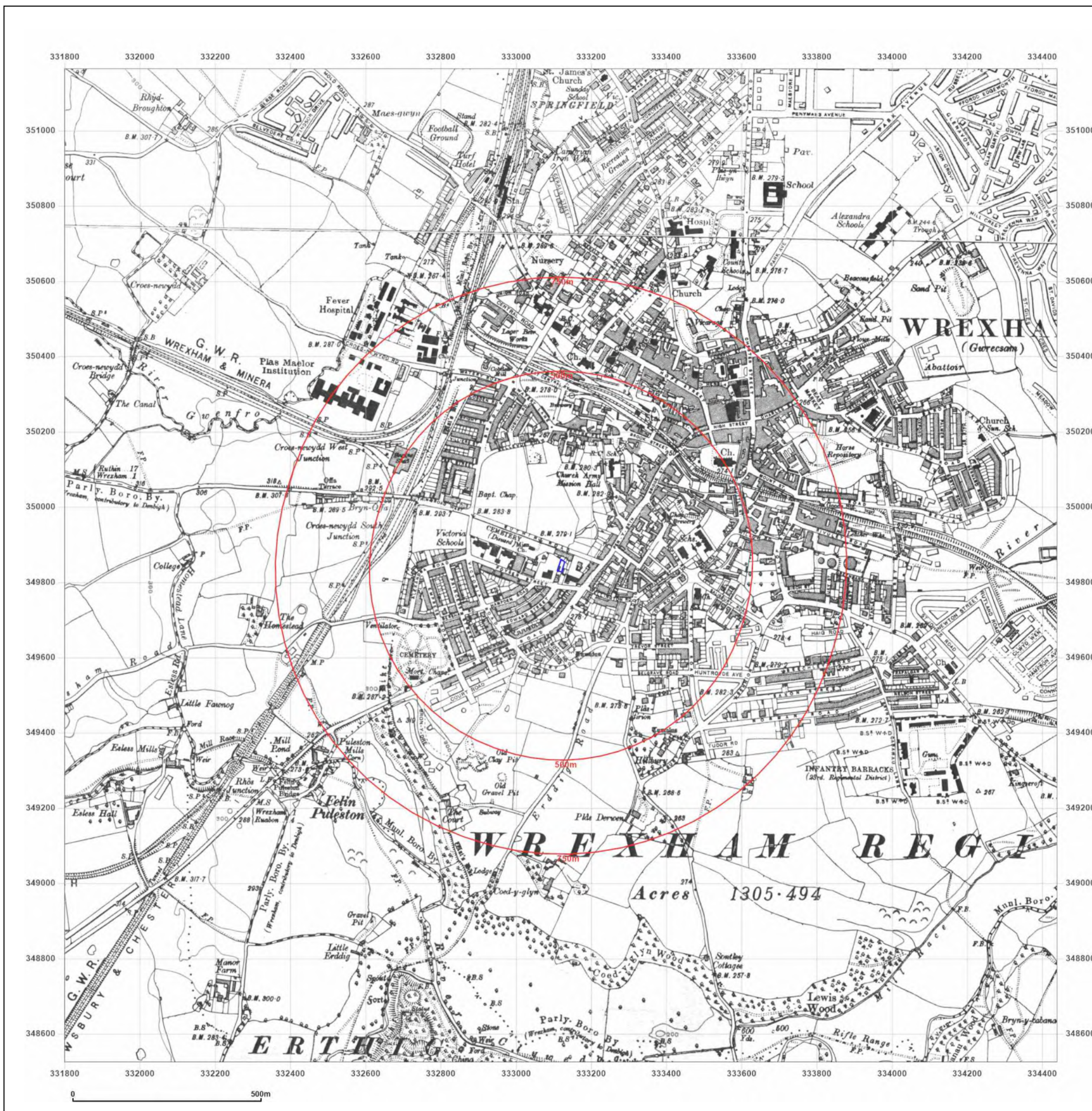


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1938

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1871
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1871
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

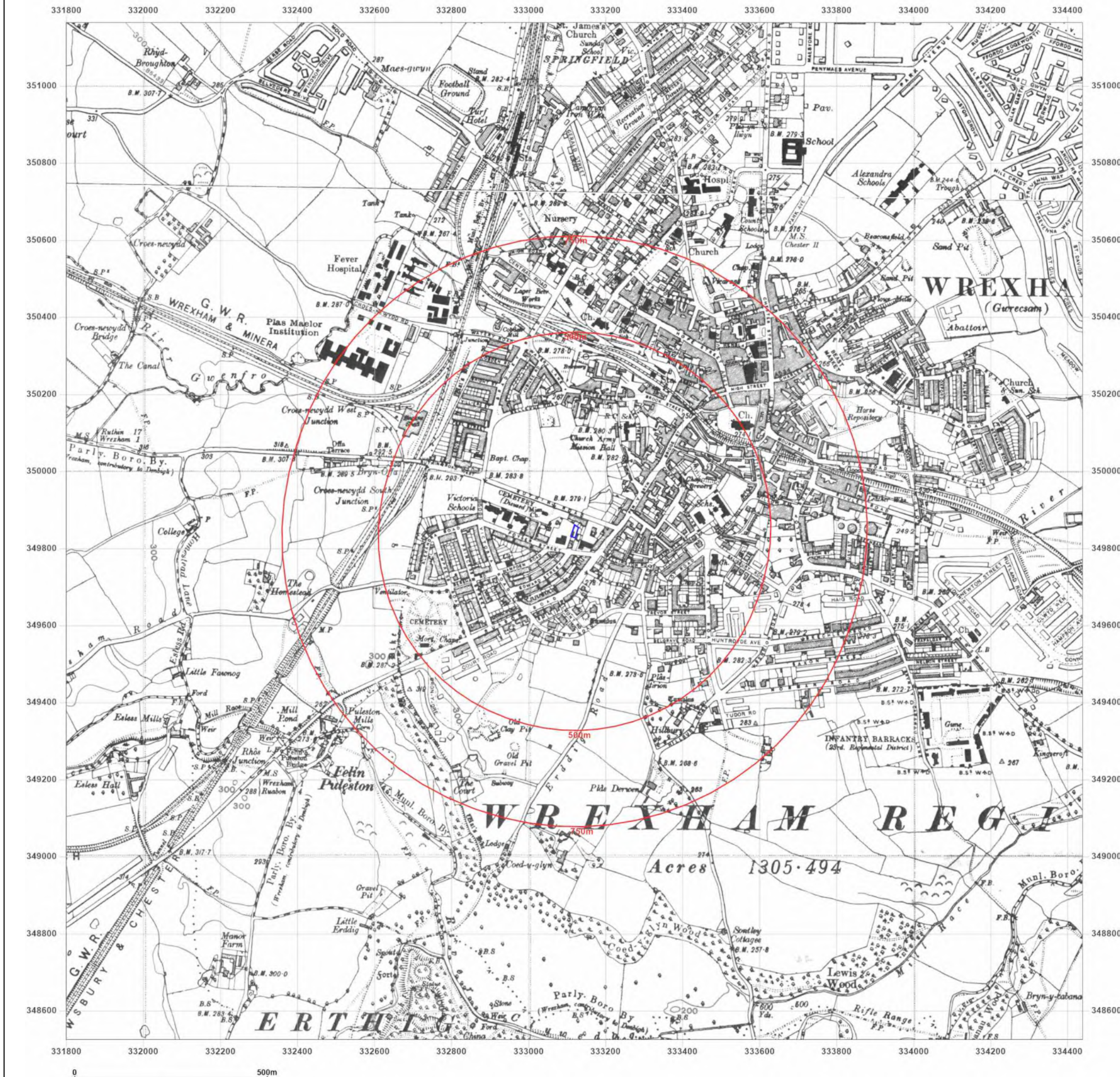


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WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: County Series

Map date: 1949

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1871
Revised 1949
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1871
Revised 1949
Edition N/A
Copyright N/A
Levelled N/A

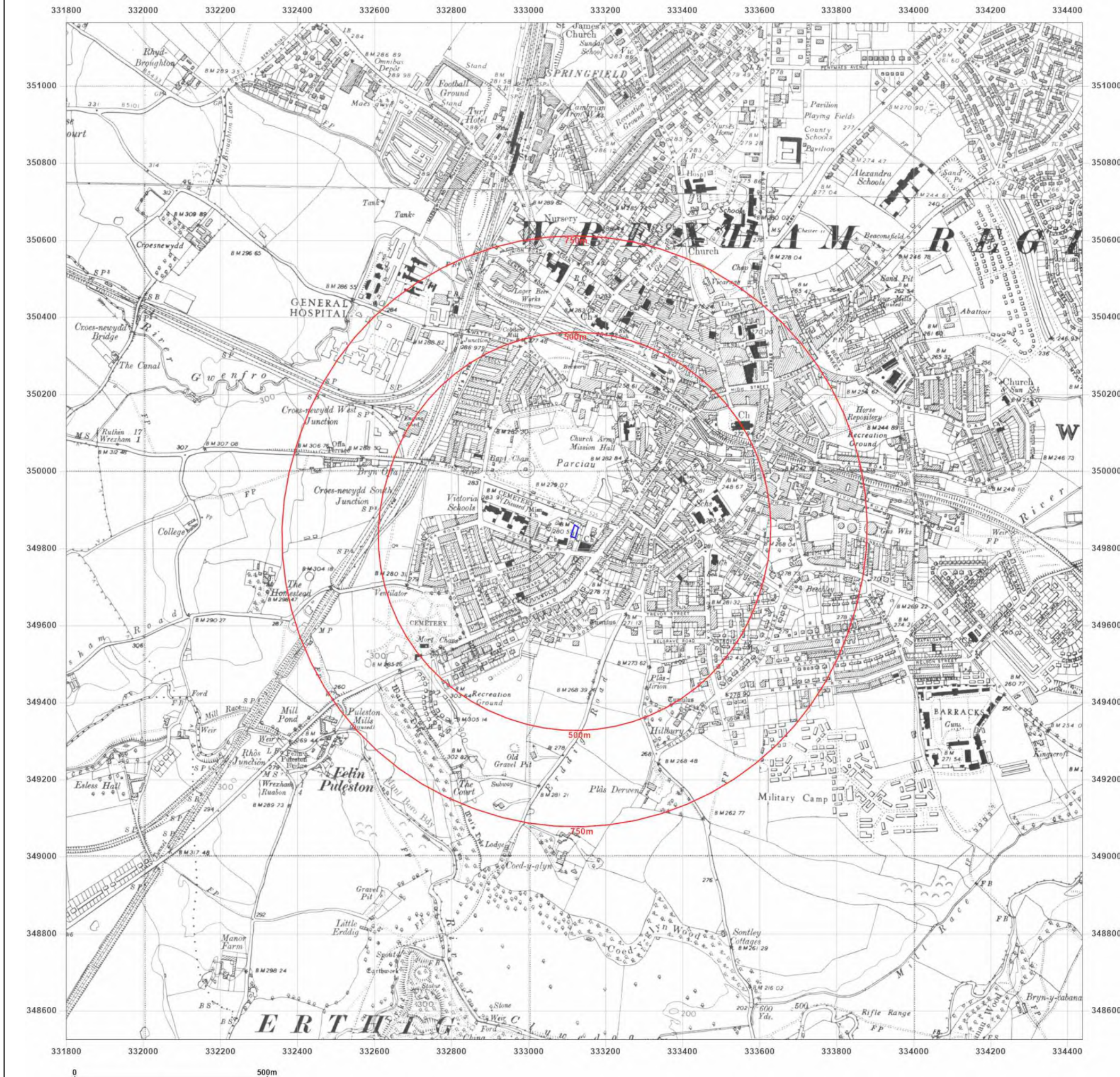


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Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: Provisional

Map date: 1964

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1964
Revised 1964
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1964
Revised 1964
Edition N/A
Copyright N/A
Levelled N/A

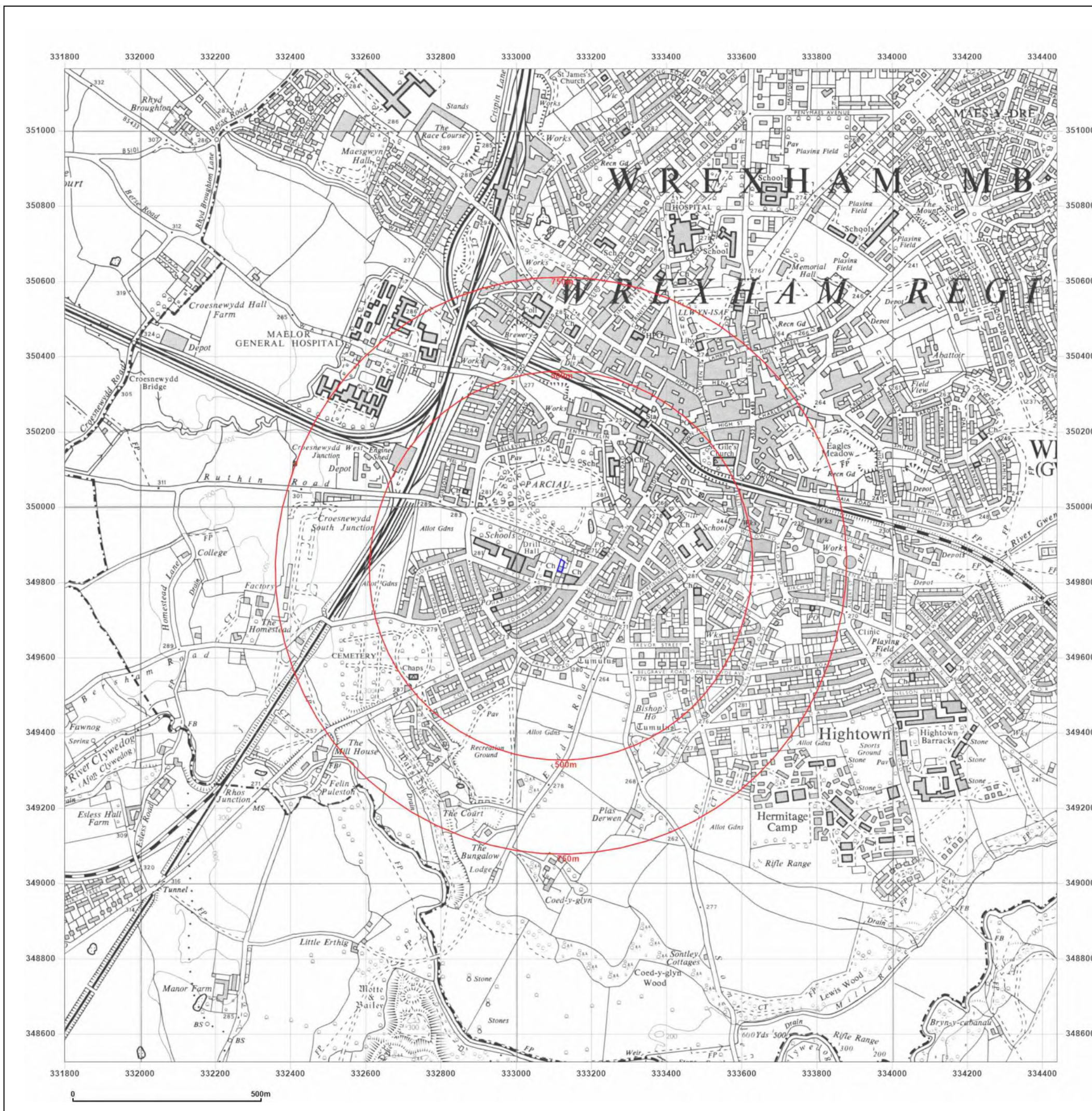


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Site Details:

27, POYSER STREET,
WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1974-1979

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1972
Revised 1974
Edition N/A
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Levelled 1969

Surveyed 1975
Revised 1979
Edition N/A
Copyright 1979
Levelled 1977

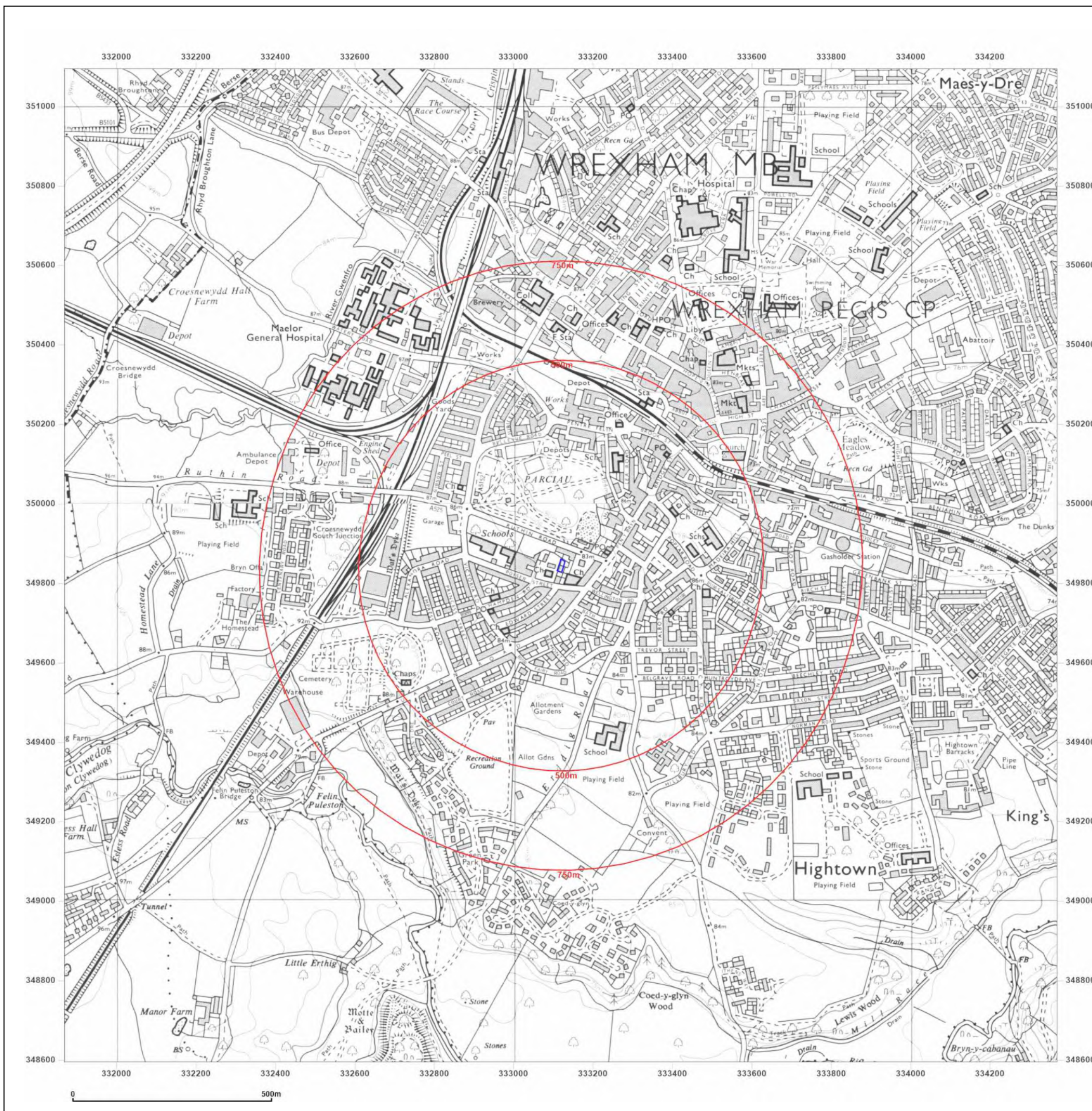


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Site Details:

27, POYSER STREET,
WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1980

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1980
Revised 1980
Edition N/A
Copyright N/A
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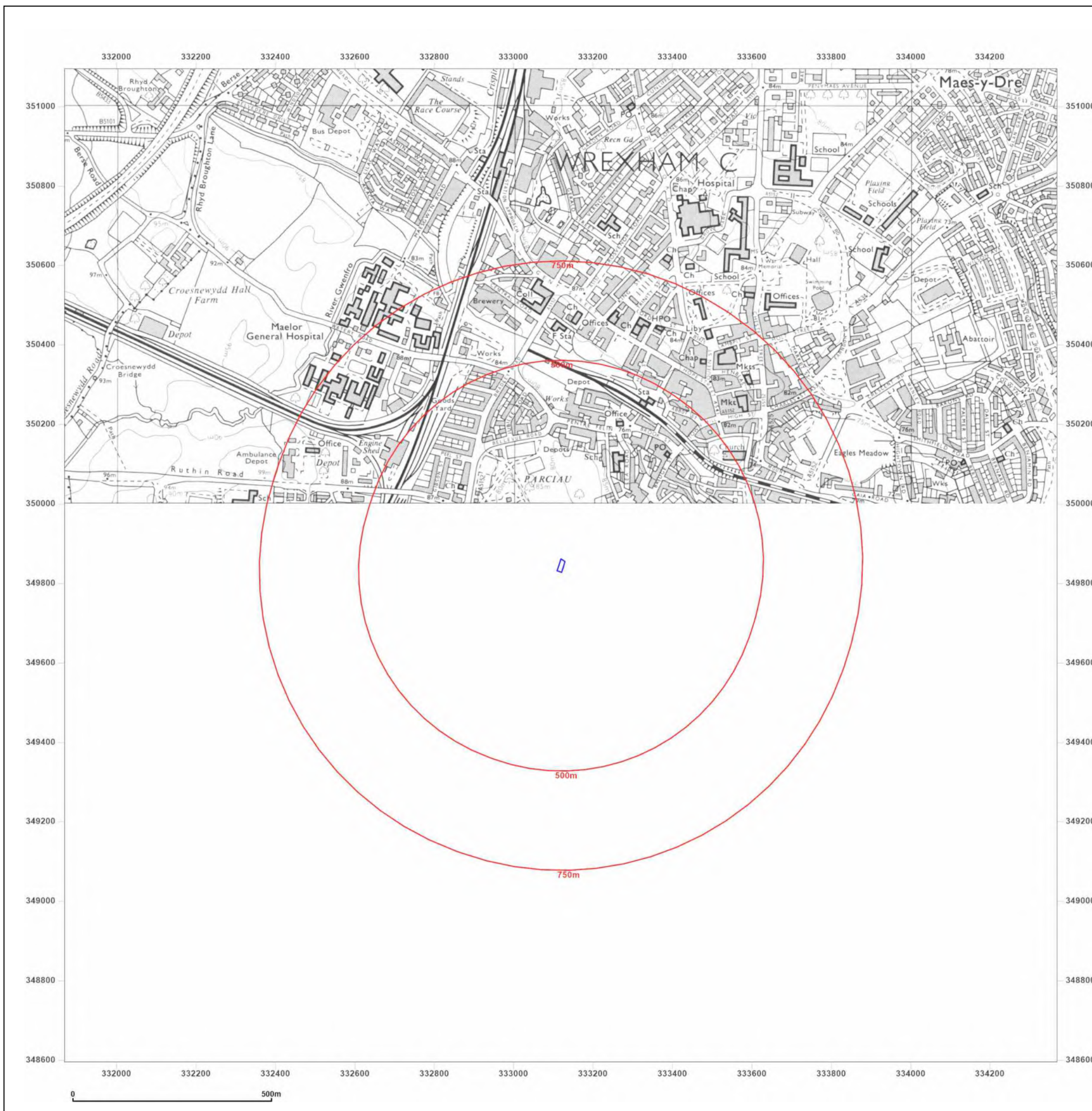


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Site Details:

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WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1985

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1985
Revised 1985
Edition N/A
Copyright N/A
Levelled N/A

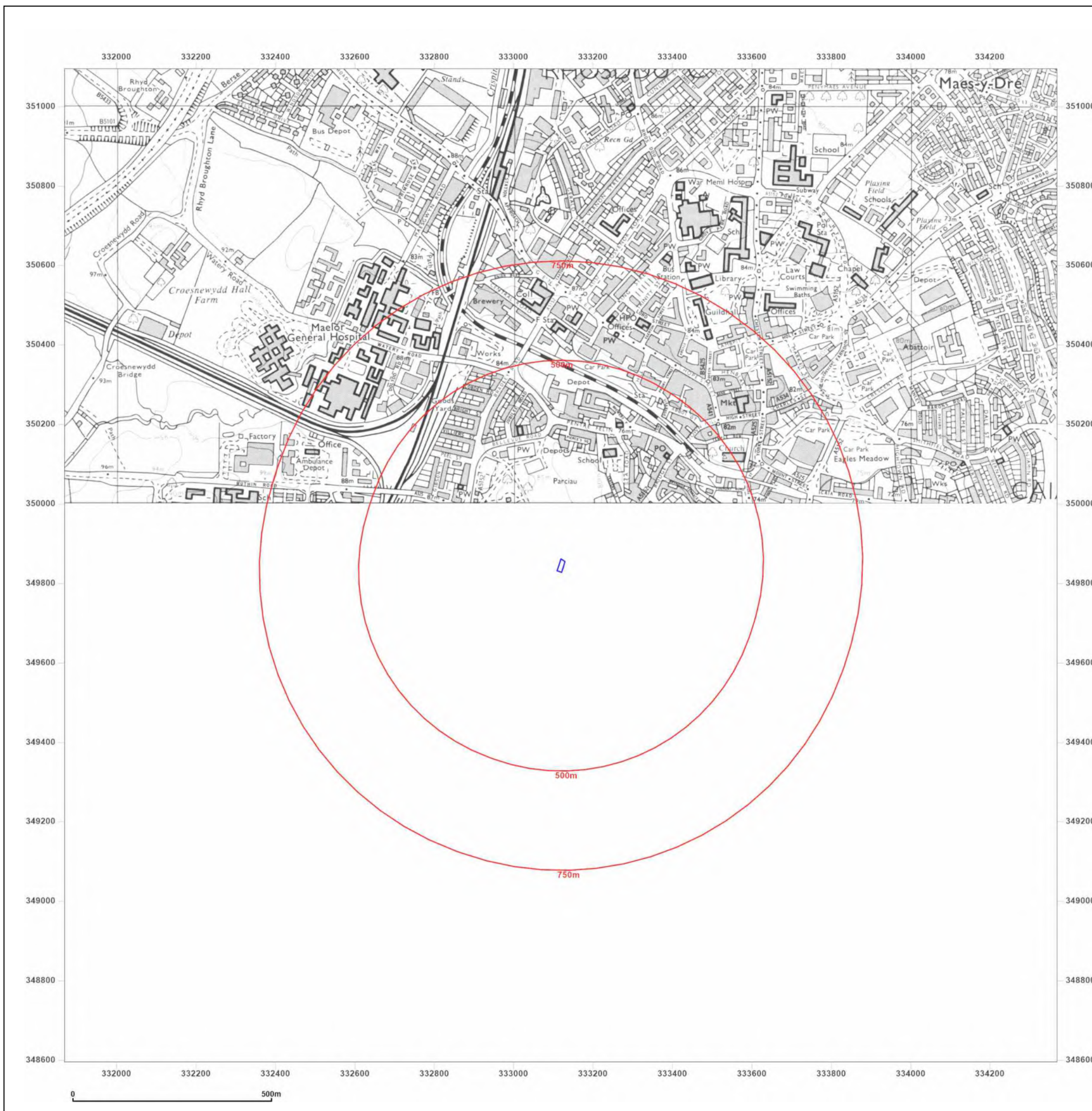


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Site Details:

27, POYSER STREET,
WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1989-1992

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1985
Revised 1989
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1987
Revised 1992
Edition N/A
Copyright N/A
Levelled N/A

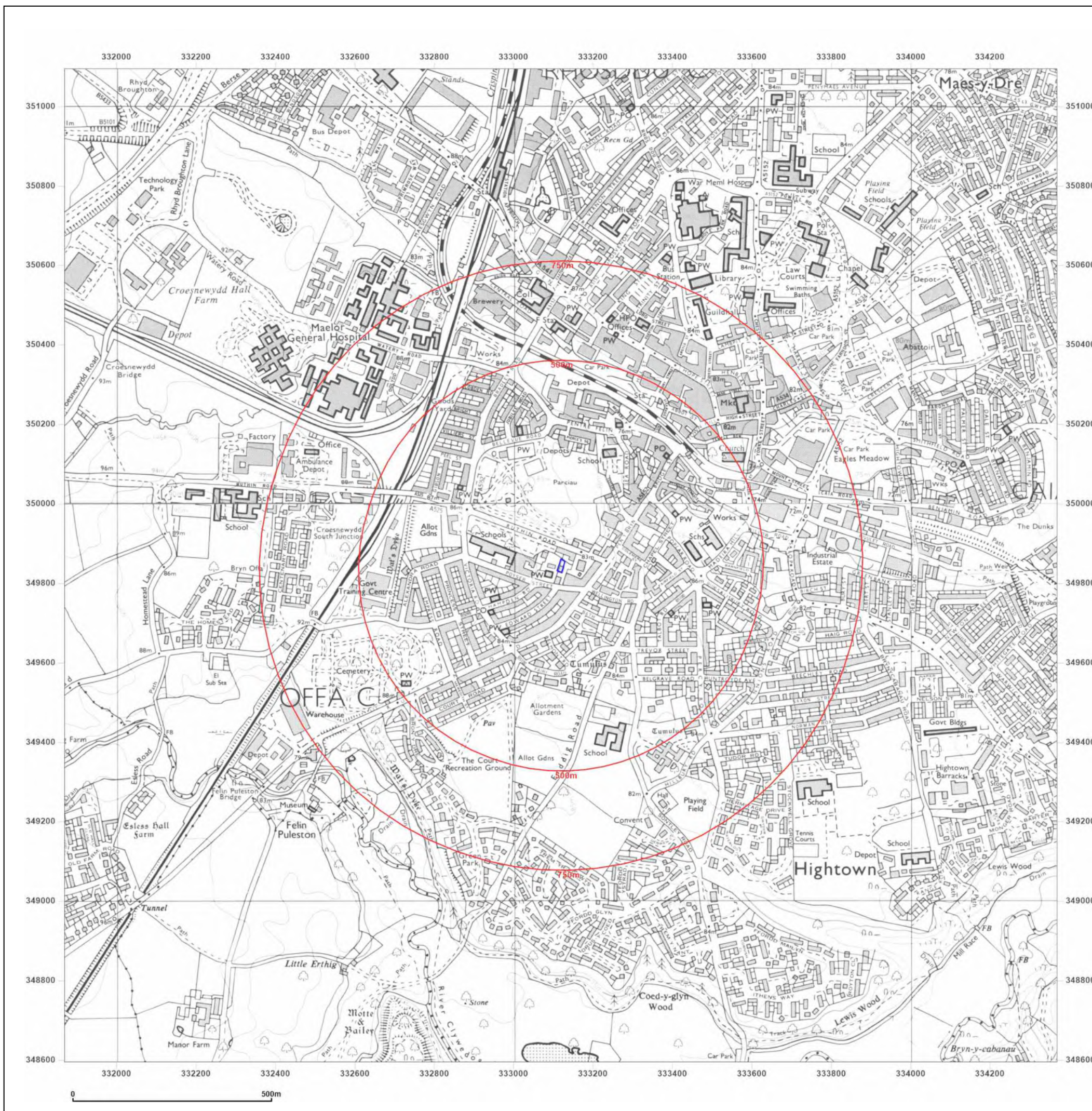


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Production date: 12 May 2023

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Site Details:

27, POYSER STREET,
WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 1992

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1990
Revised 1992
Edition N/A
Copyright N/A
Levelled N/A

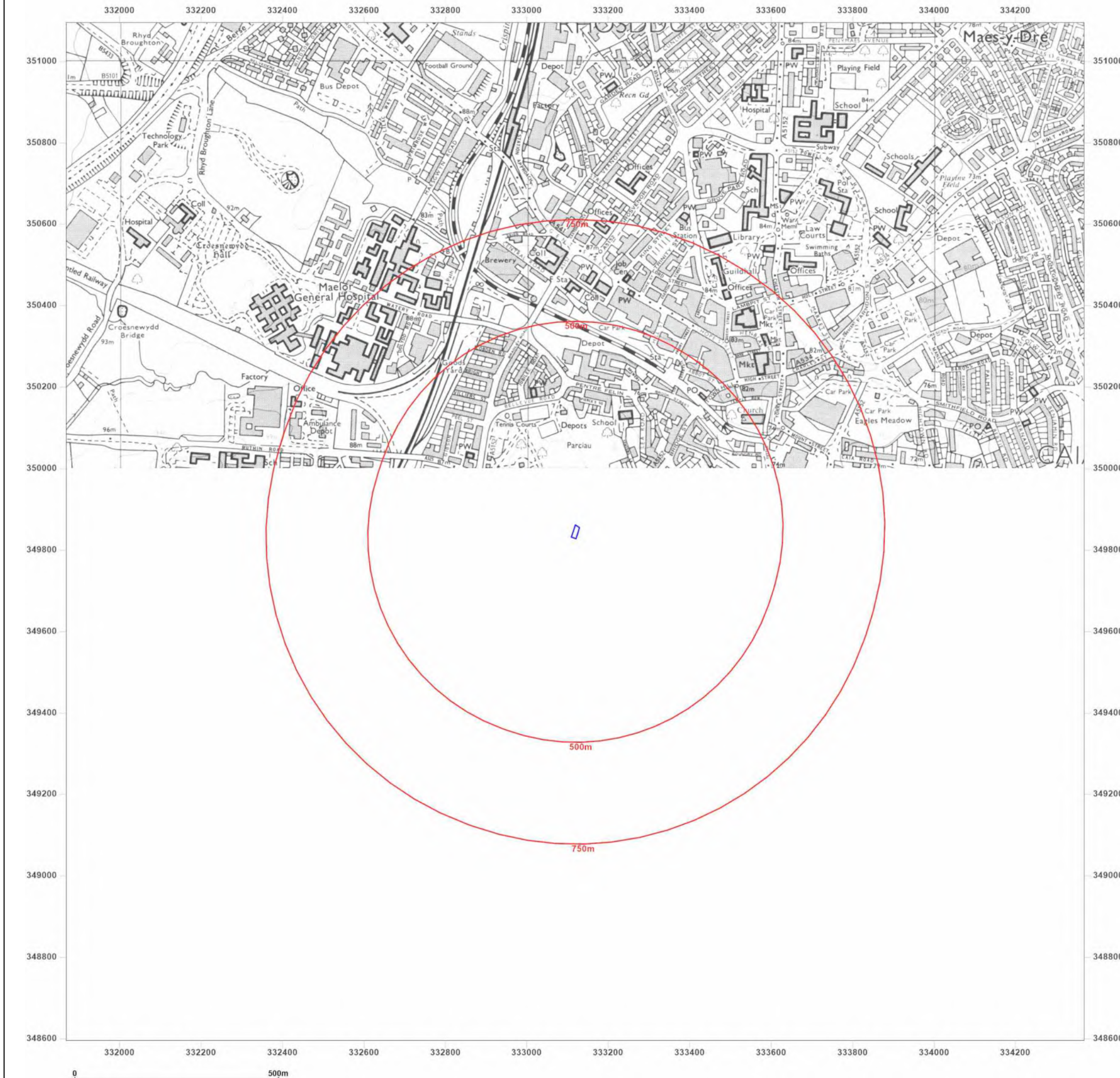


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Site Details:

27, POYSER STREET,
WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 2001

Scale: 1:10,000

Printed at: 1:10,000



2001

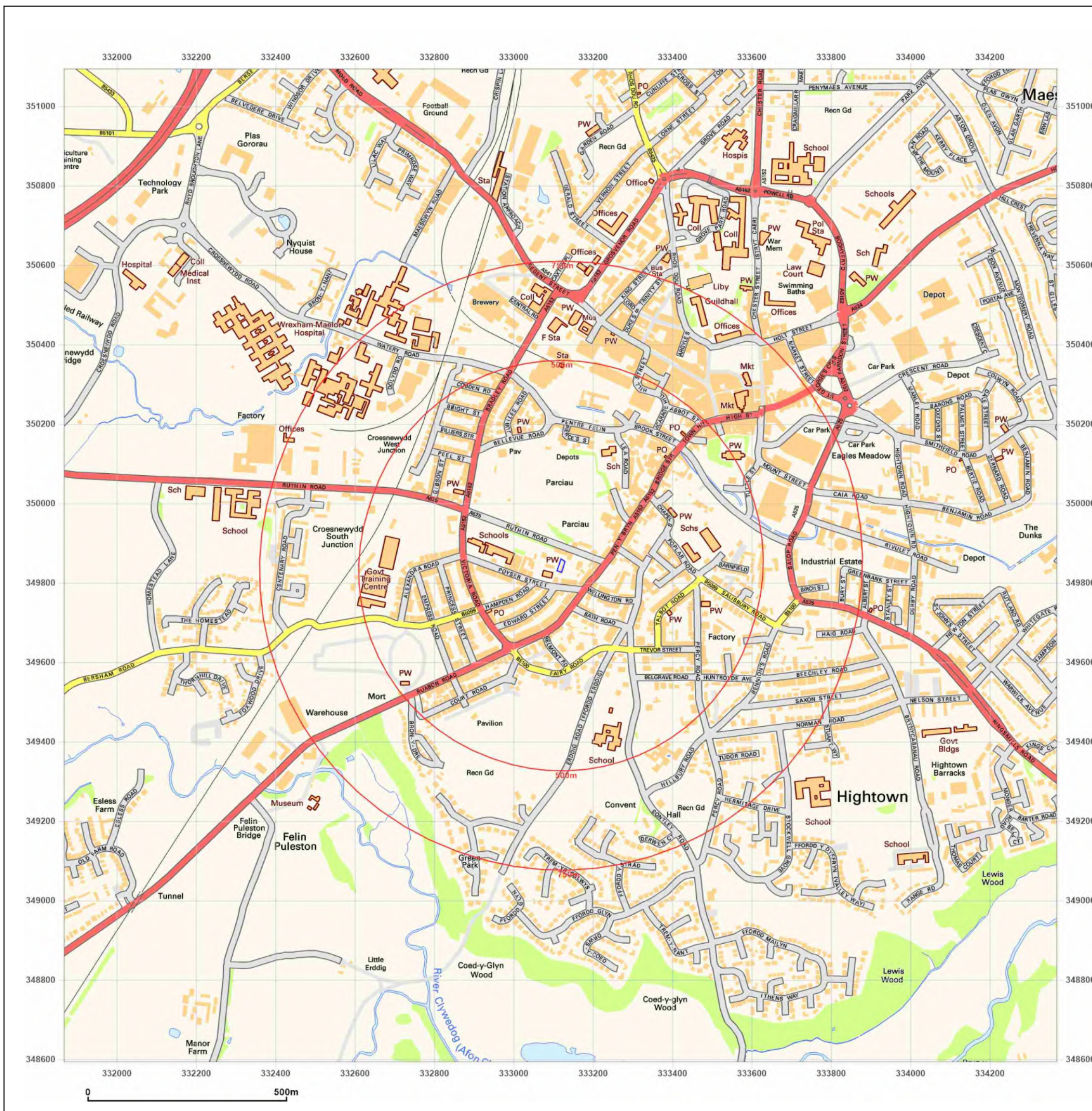


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Production date: 12 May 2023

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Site Details:

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WREXHAM, LL13 7RT

Client Ref: 2919_-_PO001251
Report Ref: GS-H1N-2QT-K3Z-XAQ
Grid Ref: 333118, 349844

Map Name: National Grid

Map date: 2023

Scale: 1:10,000

Printed at: 1:10,000



2023

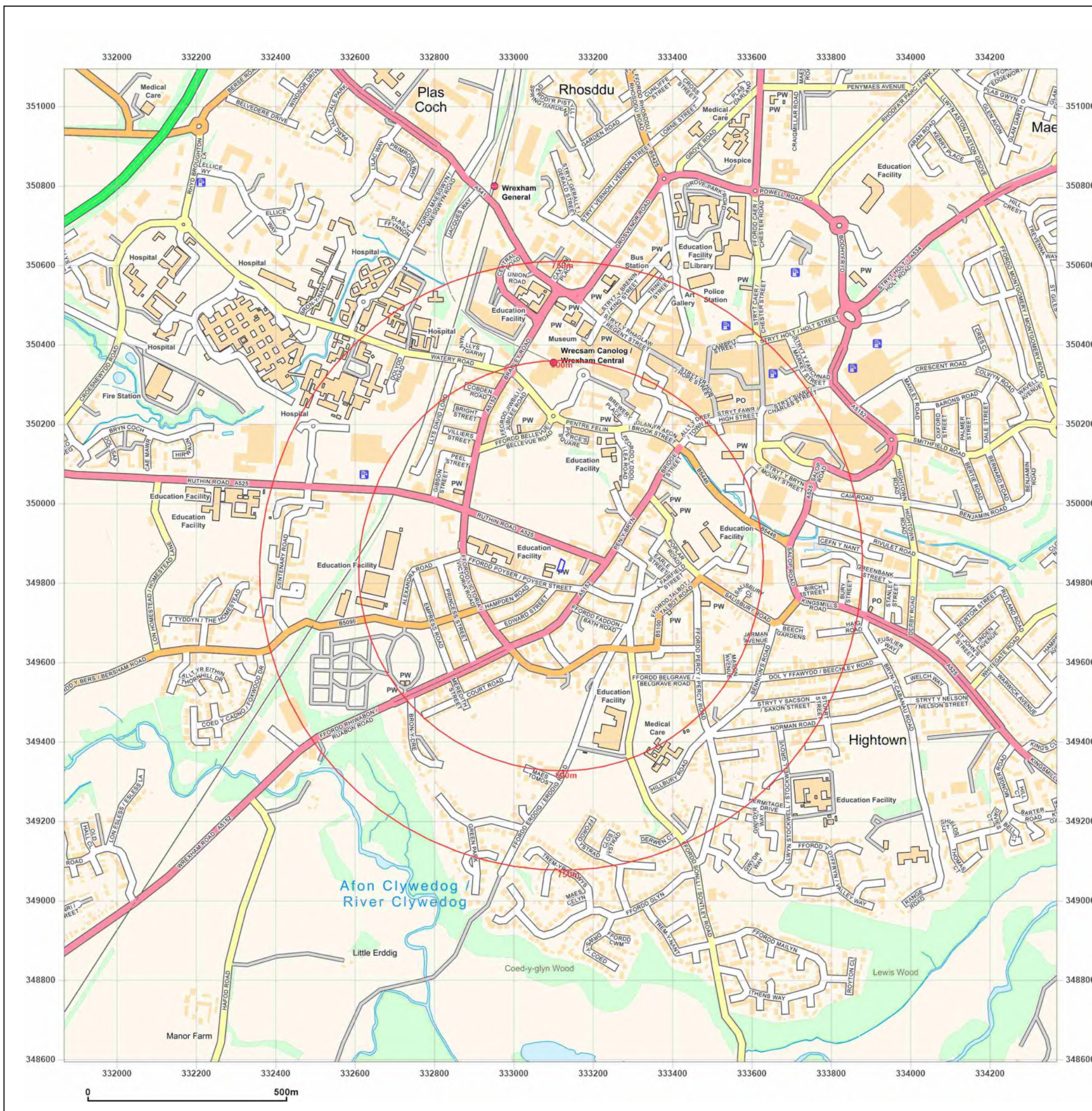


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APPENDIX D: EXPLORATORY HOLE RECORDS

GroundSolve Ltd
Unit 1 Well House Barns
Chester Road
Bretton
CH4 0DH

TP01

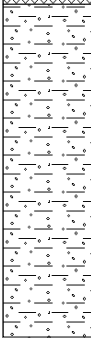
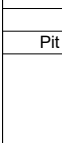
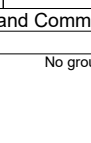


No Groundwater encountered.
Blue pipe used as part of Soakaway Test

TP01 – SPOIL



Project Name: 27 Poyser Street		Client: Mr T Fletcher		Date: 06/06/2023	
Location: Wrexham		Contractor: Supplied by client		Co-ords: E333120.37 N349843.11	
Project No. : 2919		Crew Name: TF		Equipment: 3Ton Tracked Excavator	
Location Number TP02	Location Type TP	Level	Logged By RP	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.25	ES		0.30			Dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium angular of brick and sandstone	1
		0.50	ES					Dark brown clayey slightly sandy angular to subrounded fine to coarse GRAVEL of brick, terracotta, glass and sandstone	
		0.75	B						
		1.00	D		1.00			Firm brown slightly sandy gravelly CLAY. Gravel is fine to medium subangular to surrounded of sandstone	
		1.00	ES						
		1.25	B						
		1.50	D		2.10				2
								End of Borehole at 2.100m	
									3
									4
									5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
1.50	0.50	Stable		No groundwater encountered			
Remarks							GroundSolve Ltd Unit 1 Well House Barns Chester Road Bretton CH4 0DH

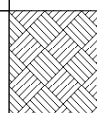
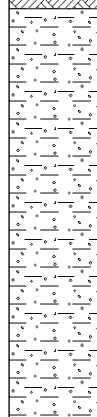
TP02



TP02 - SPOIL



Project Name: 27 Poyser Street		Client: Mr T Fletcher		Date: 06/06/2023	
Location: Wrexham		Contractor: Supplied by client		Co-ords: E333119.85 N349857.83	
Project No. : 2919		Crew Name: TF		Equipment: 3Ton Tracked Excavator	
Location Number TP03	Location Type TP	Level	Logged By RP	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		0.25	ES		0.40			Dark brown sandy slightly gravelly CLAY. Gravel is angular to surrounded fine to medium of sandstone	1		
		0.50 0.50	D ES					Firm brown slightly sandy gravelly CLAY. Gravel is fine to medium subangular to surrounded of sandstone and siltstone			
		1.00 1.00	D ES		1.80						
		1.50 1.50	B D								
End of Borehole at 1.800m								2			
									3		
									4		
									5		

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
1.50	0.50	Stable		No groundwater encountered			

Remarks						GroundSolve Ltd Unit 1 Well House Barns Chester Road Bretton CH4 0DH	
---------	--	--	--	--	--	--	--

TP03



TP03 - SPOIL

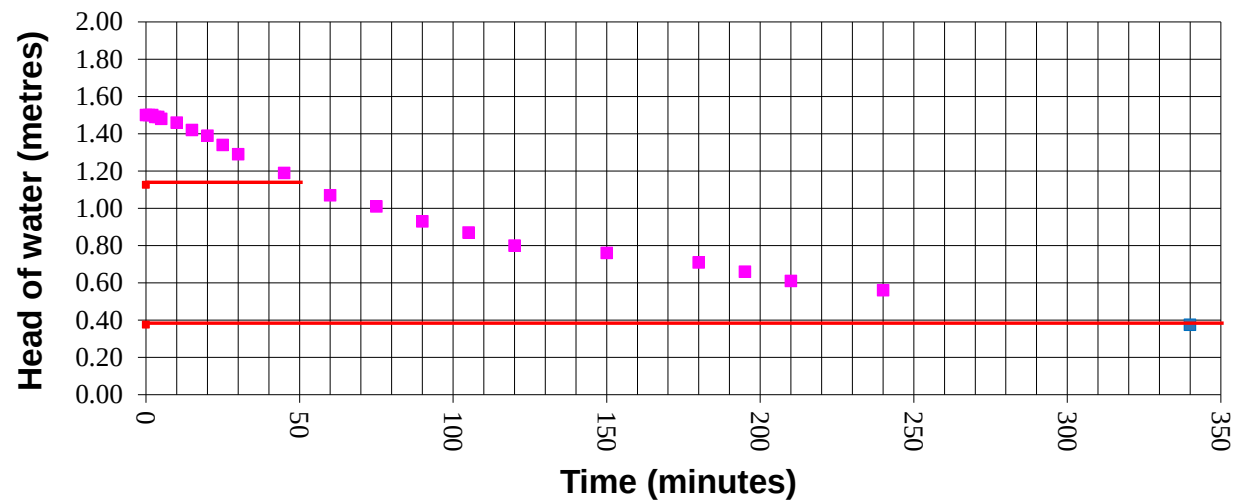


APPENDIX E: SOAKAWAY TEST RESULTS

Time (Mins)	Depth of Water	Head of Water
0	0.50	1.50
1	0.50	1.50
2	0.50	1.50
3	0.51	1.49
4	0.51	1.49
5	0.52	1.48
10	0.54	1.46
15	0.58	1.42
20	0.61	1.39
25	0.66	1.34
30	0.71	1.29
45	0.81	1.19
60	0.93	1.07
75	0.99	1.01
90	1.07	0.93
105	1.13	0.87
120	1.20	0.80
150	1.24	0.76
180	1.29	0.71
195	1.34	0.66
210	1.39	0.61
240	1.44	0.56
340	1.63	0.38

Extrapolated

GSL2919 - 27 Poyser Street, Wrexham
TP01 Test 1
06/06/23



Depth	Length	Width	Head at 75% Vol	Head at 25% Vol	Water depth(t=0)	Effective Area	Vp75-Vp25	Adjustment Factor *	t75	t25	Infiltration
(m)	(m)	(m)	(m)	(m)	(m)	Ap50 m2	Volume of water m3		(mins)	(mins)	rate m/s
2.00	1.50	0.75	1.125	0.38	1.50	4.500	0.844	1.00	50	340	1.078E-05

* with gravel filter adjustment factor = 0.30, with no filter = 1.0

Note: The test failed to reach the 25% head, therefore the t25 was extrapolated using previous data

APPENDIX F: LABORATORY CHEMICAL TEST RESULTS



Certificate of Analysis

Certificate Number 23-13335

Issued: 19-Jun-23

Client GroundSolve Limited
Unit 1
Well House Barns
Bretton
Flintshire
FAO Adam Fenwick
CH4 0DH

Our Reference 23-13335

Client Reference 2919

Order No (not supplied)

Contract Title 2919 - Poyser Street, Wrexham

Description 6 Soil samples.

Date Received 06-Jun-23

Date Started 06-Jun-23

Date Completed 19-Jun-23

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager



2139

Summary of Chemical Analysis

Soil Samples

Our Ref 23-13335

Client Ref 2919

Contract Title 2919 - Poyser Street, Wrexham

Lab No	2182160	2182161	2182162	2182163	2182164	2182165
Sample ID	TP01	TP01	TP02	TP02	TP03	TP03
Depth	0.25	0.50	0.25	0.50	0.25	0.50
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	25/05/2023	25/05/2023	25/05/2023	25/05/2023	25/05/2023	25/05/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	23	32	12	11	18	10
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.6	0.6	0.7	0.9	0.7	0.5
Cadmium	DETSC 2301#	0.1	mg/kg	1.3	1.7	0.4	0.3	0.4	0.3
Chromium	DETSC 2301#	0.15	mg/kg	140	77	14	13	17	16
Chromium III	DETSC 2301*	0.15	mg/kg	140	77	14	13	17	16
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	500	320	31	27	33	21
Lead	DETSC 2301#	0.3	mg/kg	300	1000	62	67	170	82
Mercury	DETSC 2325#	0.05	mg/kg	1.3	7.2	0.28	0.22	0.16	0.11
Nickel	DETSC 2301#	1	mg/kg	43	59	24	22	22	20
Selenium	DETSC 2301#	0.5	mg/kg	0.9	0.8	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	390	440	96	78	170	76
Inorganics									
pH	DETSC 2008#		pH	8.7	8.1	7.9	7.6	8.0	7.7
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.3	0.7	0.2	0.2	0.4	0.4
Organic matter	DETSC 2002#	0.1	%	3.2	4.0	2.6	3.4	0.7	1.5
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	100	32	17	13	< 10	10
Sulphide	DETSC 2024*	10	mg/kg	28	47	20	< 10	39	< 10
Sulphur (free)	DETSC 3049#	0.75	mg/kg	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01		< 0.01		< 0.01	
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01		< 0.01		< 0.01	
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01		< 0.01		< 0.01	
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5		< 1.5		< 1.5	
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2		< 1.2		< 1.2	
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5		< 1.5		< 1.5	
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4		< 3.4		< 3.4	
Aliphatic C35-C40	DETSC 3072*	3.4	mg/kg	< 3.4		< 3.4		< 3.4	
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10		< 10		< 10	
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01		< 0.01		< 0.01	
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01		< 0.01		< 0.01	
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01		< 0.01		< 0.01	
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9		< 0.9		< 0.9	
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5		< 0.5		< 0.5	
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6		< 0.6		< 0.6	
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4		< 1.4		< 1.4	
Aromatic C35-C40	DETSC 3072*	1.4	mg/kg	< 1.4		< 1.4		< 1.4	
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10		< 10		< 10	
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10		< 10		< 10	
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01		< 0.01		< 0.01	
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01		< 0.01		< 0.01	

Summary of Chemical Analysis

Soil Samples

Our Ref 23-13335

Client Ref 2919

Contract Title 2919 - Poyser Street, Wrexham

Lab No	2182160	2182161	2182162	2182163	2182164	2182165
Sample ID	TP01	TP01	TP02	TP02	TP03	TP03
Depth	0.25	0.50	0.25	0.50	0.25	0.50
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	25/05/2023	25/05/2023	25/05/2023	25/05/2023	25/05/2023	25/05/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01		< 0.01		< 0.01	
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01		< 0.01		< 0.01	
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	0.03	0.04	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.75	0.91	< 0.03	< 0.03	0.21	0.21
Anthracene	DETSC 3303	0.03	mg/kg	0.08	0.13	< 0.03	< 0.03	0.04	0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	1.1	1.3	0.04	0.04	0.36	0.33
Pyrene	DETSC 3303#	0.03	mg/kg	0.98	1.1	0.04	0.04	0.34	0.31
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.23	0.28	< 0.03	< 0.03	0.14	0.13
Chrysene	DETSC 3303	0.03	mg/kg	0.44	0.57	< 0.03	0.03	0.19	0.19
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.34	0.44	0.03	< 0.03	0.16	0.16
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.13	0.18	< 0.03	< 0.03	0.06	0.05
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.19	0.28	< 0.03	< 0.03	0.10	0.11
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.12	0.15	< 0.03	< 0.03	0.06	0.06
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	0.04	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.14	0.18	< 0.03	< 0.03	0.07	0.07
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	4.5	5.6	< 0.10	< 0.10	1.7	1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.8	0.7	0.8	0.7	0.8	0.5

Summary of Asbestos Analysis

Soil Samples

Our Ref 23-13335

Client Ref 2919

Contract Title 2919 - Poyser Street, Wrexham

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2182160	TP01 0.25	SOIL	NAD	none	D Wilkinson
2182161	TP01 0.50	SOIL	NAD	none	D Wilkinson
2182162	TP02 0.25	SOIL	NAD	none	D Wilkinson
2182163	TP02 0.50	SOIL	NAD	none	D Wilkinson
2182164	TP03 0.25	SOIL	NAD	none	D Wilkinson
2182165	TP03 0.50	SOIL	NAD	none	D Wilkinson

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 23-13335
 Client Ref 2919
 Contract 2919 - Poyser Street, Wrexham

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2182160	TP01 0.25 SOIL	25/05/23	GJ 250ml, GJ 60ml x2	Sulphur (free) (7 days), pH + Conductivity (7 days)	
2182161	TP01 0.50 SOIL	25/05/23	GJ 250ml, GJ 60ml x2, PT 1L	Sulphur (free) (7 days), pH + Conductivity (7 days)	
2182162	TP02 0.25 SOIL	25/05/23	GJ 250ml, GJ 60ml x2	Sulphur (free) (7 days), pH + Conductivity (7 days)	
2182163	TP02 0.50 SOIL	25/05/23	GJ 250ml, GJ 60ml x2, PT 1L	Sulphur (free) (7 days), pH + Conductivity (7 days)	
2182164	TP03 0.25 SOIL	25/05/23	GJ 250ml, GJ 60ml	Sulphur (free) (7 days), pH + Conductivity (7 days)	
2182165	TP03 0.50 SOIL	25/05/23	GJ 250ml, GJ 60ml, PT 1L	Sulphur (free) (7 days), pH + Conductivity (7 days)	

Key: G-Glass J-Jar P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

APPENDIX G: SUMMARY OF CHEMICAL TEST RESULTS

Residential with gardens (1% SOM)

	TP01	TP01	TP02	TP02	TP03	TP03							
	0.25	0.50	0.25	0.50	0.25	0.50	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Count	Adopted Guideline (mg/kg)	Source	Exceedance s
Metals & Non-Metals													
Arsenic	23	32	12	11	18	10	10	32	17.67	6	37	C4SL	0
Boron, water soluble	0.6	0.6	0.7	0.9	0.7	0.5	0.5	0.9	0.67	6	290	S4UL	0
Cadmium	1.3	1.7	0.4	0.3	0.4	0.3	0.3	1.7	0.73	6	22	C4SL	0
Chromium III	140	77	14	13	17	16	13	140	46.17	6	910	S4UL	0
Chromium, Hexavalent	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	1	6	21	C4SL	0
Copper	500	320	31	27	33	21	21	500	155.33	6	2400	S4UL	0
Lead	300	1000	62	67	170	82	62	1000	280.17	6	200	C4SL	2
Mercury	1.3	7.2	0.28	0.22	0.16	0.11	0.11	7.2	1.55	6	1.2	S4UL	2
Nickel	43	59	24	22	22	20	20	59	31.67	6	130	S4UL	0
Phenol - Monohydric	0.8	0.7	0.8	0.7	0.8	0.5	0.5	0.8	0.72	6	120	S4UL	0
Selenium	0.9	0.8	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.9	0.62	6	250	S4UL	0
Zinc	390	440	96	78	170	76	76	440	208.33	6	3700	S4UL	0

	TP01	TP01	TP02	TP02	TP03	TP03							
	0.25	0.50	0.25	0.50	0.25	0.50	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Count	Adopted Guideline (mg/kg)	Source	Exceedance s
Petroleum Hydrocarbons													
Benzene	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	0.87	C4SL	0
Toluene	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	130	S4UL	0
Ethylbenzene	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	47	S4UL	0
xylene	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	-	S4UL	3
Aliphatic C5-C6	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	42	S4UL	0
Aliphatic C6-C8	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	100	S4UL	0
Aliphatic C8-C10	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	27	S4UL	0
Aliphatic >EC10-EC12	< 1.5	-	< 1.5	-	< 1.5	-	< 1.5	< 1.5	1.5	3	130	S4UL	0
Aliphatic >EC12-EC16	< 1.2	-	< 1.2	-	< 1.2	-	< 1.2	< 1.2	1.2	3	1100	S4UL	0
Aliphatic >EC16-EC35	< 3.4	-	< 3.4	-	< 3.4	-	< 3.4	< 3.4	3.4	3	65000	S4UL	0
Aliphatic >EC35-EC40	< 3.4	-	< 3.4	-	< 3.4	-	< 3.4	< 3.4	3.4	3	65000	S4UL	0
Aromatic C5-C7	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	70	S4UL	0
Aromatic C7-C8	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	130	S4UL	0
Aromatic C8-C10	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	< 0.01	0.01	3	34	S4UL	0
Aromatic >EC10-EC12	< 0.9	-	< 0.9	-	< 0.9	-	< 0.9	< 0.9	0.9	3	74	S4UL	0
Aromatic >EC12-EC16	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	< 0.5	0.5	3	140	S4UL	0
Aromatic >EC16-EC21	< 0.6	-	< 0.6	-	< 0.6	-	< 0.6	< 0.6	0.6	3	260	S4UL	0
Aromatic >EC21-EC35	< 1.4	-	< 1.4	-	< 1.4	-	< 1.4	< 1.4	1.4	3	1100	S4UL	0
Aromatic >EC35-EC40	< 1.4	-	< 1.4	-	< 1.4	-	< 1.4	< 1.4	1.4	3	1100	S4UL	0

	TP01	TP01	TP02	TP02	TP03	TP03							
	0.25	0.50	0.25	0.50	0.25	0.50	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Count	Adopted Guideline (mg/kg)	Source	Exceedance s
Polyaromatic Hydrocarbons (PAH)													
Acenaphthene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.03	6	210	S4UL	0
Acenaphthylene	< 0.03	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.03	6	170	S4UL	0
Anthracene	0.08	0.13	< 0.03	< 0.03	0.04	0.03	< 0.03	0.13	0.06	6	2400	S4UL	0
Benzo(a)anthracene	0.23	0.28	< 0.03	< 0.03	0.14	0.13	< 0.03	0.28	0.14	6	7.2	S4UL	0
Benzo(a)pyrene	0.19	0.28	< 0.03	< 0.03	0.1	0.11	< 0.03	0.28	0.12	6	5	C4SL	0
Benzo(b)fluoranthene	0.34	0.44	0.03	< 0.03	0.16	0.16	< 0.03	0.44	0.19	6	2.6	S4UL	0
Benzo(g,h,i)perylene	0.14	0.18	< 0.03	< 0.03	0.07	0.07	< 0.03	0.18	0.09	6	320	S4UL	0
Benzo(k)fluoranthene	0.13	0.18	< 0.03	< 0.03	0.06	0.05	< 0.03	0.18	0.08	6	77	S4UL	0
Chrysene	0.44	0.57	< 0.03	0.03	0.19	0.19	< 0.03	0.57	0.24	6	15	S4UL	0
Dibenzo(a,h)anthracene	< 0.03	0.04	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.04	0.03	6	0.24	S4UL	0
Fluoranthene	1.1	1.3	0.04	0.04	0.36	0.33	0.04	1.3	0.53	6	280	S4UL	0
Fluorene	0.03	0.04	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.04	0.03	6	170	S4UL	0
Indeno(1,2,3-c,d)pyrene	0.12	0.15	< 0.03	< 0.03	0.06	0.06	< 0.03	0.15	0.08	6	27	S4UL	0
Naphthalene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.03	6	2.3	S4UL	0
Phenanthrene	0.75	0.91	< 0.03	< 0.03	0.21	0.21	< 0.03	0.91	0.36	6	95	S4UL	0
Pyrene	0.98	1.1	0.04	0.04	0.34	0.31	0.04	1.1	0.47	6	620	S4UL	0

	TP01	TP01	TP02	TP02	TP03	TP03							
	0.25	0.50	0.25	0.50	0.25	0.50	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Count	Adopted Guideline (mg/kg)	Source	Exceedance s
Other Contaminants / Testing													
Organic Matter	3.2	4	2.6	3.4	0.7	1.5	0.7	4	2.57	6	-	-	-
pH	8.7	8.1	7.9	7.6	8	7.7	7.6	8.7	8	6	-	-	-
Sulphide	28	47	20	< 10	39	< 10	< 10	47	25.67	6	-	-	-
Cyanide, Total	0.3	0.7	0.2	0.2	0.4	0.4	0.2	0.7	0.37	6	-	-	-
Sulphur (free)	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	0.75	6	-	-	-
Sulphate Aqueous Extract as SO4	100	32	17	13	< 10	10	< 10	100	30.33	6	-	-	-

APPENDIX H: CURRENT GUIDANCE FOR GROUND GAS RISK ASSESSMENT

Current Guidance for Ground Gas Risk Assessment

Origin of Ground and Landfill Gases

When carrying out a ground gas risk assessment for permanent ground gases (e.g., methane and carbon dioxide), the origin or source of the gases is important as potential risks will vary depending on the source. This Appendix relates to the risk of the two main ground gases of concern: methane and carbon dioxide and does not apply to other ground gases (e.g., radon or vapours from hydrocarbon spills). Methane and carbon dioxide are major constituents of landfill gas but can also occur from a variety of anthropogenic and natural sources, as summarised in Table G1 below:

Table G1. Potential Sources of Ground Gases		
Gas	Source	Comments
Landfill Gas	Anaerobic decomposition of degradable waste within landfill sites. Typically, 60% methane and 40% carbon dioxide during methanogenic phase.	Composition varies over time, particularly in early stages. Contains a range of minor constituents (particularly carbon monoxide and hydrogen sulphide).
Landfill Associated Gases	- Anaerobic degradation of leachate external to the site; - Degassing of dissolved gases in groundwater; - Evolution of gases following interaction between leachate and groundwater	Can result in secondary (external) production of methane or carbon dioxide.
Made Ground	Anaerobic degradation of organic components	Very variable depending on source
Sewer Gas, Cess Pits	Anaerobic degradation of organic components of sewage producing methane and carbon dioxide.	Often characterised by hydrogen sulphide odour.
Mains Gas	Leakage from underground pipework or storage tanks. Mainly methane but often contains higher alkanes.	An odouriser is added to permit detection of leaks. Typically, 90% CH ₄ , but 1 to 27% C ₂ -C ₄ alkanes, May also contain other trace gases e.g., CO, helium and CO ₂ (from degradation of CH ₄ in the ground).
Other Anthropogenic Sources	- Degradation of leaked or spilled hydrocarbons or other industrial chemicals; - Anaerobic degradation of organic contaminants in groundwaters (e.g., silage liquor); - Reactions between monitoring well construction components and environment; - Burial grounds/cemeteries.	Hydrocarbon spillages often have an 'oily' odour. Fuel spillages common – Petrol or Diesel and can contain a wide range of VOC's. Can degrade to produce methane / carbon dioxide.
Alluvium / Marsh / Peat Gas	Anaerobic microbial degradation of organic material (usually waterlogged vegetation / peat). Often associated with the presence of alluvial deposits or dredgings.	
Geogenic Gas	Natural seepages of carbon dioxide and hydrocarbon gases derived from geologic sources such as coal seams and deep oil / gas source formations. Can be present in solution in groundwaters.	Methane most common but can contain carbon dioxide and higher alkanes.
Mine Gases	Various types. Most common is "fire damp" with high methane, produced by the desorption of gas trapped in coal. "Black damp" (Stythe gas) with high carbon dioxide and denser than air. "White damp" is high in carbon monoxide.	Methane most common. Can contain higher alkanes, carbon dioxide and carbon monoxide. Often low in oxygen.
Natural Shallow Ground Gas	Various types - high carbon dioxide formed by subsurface aerobic activity leading to depleted oxygen and elevated carbon dioxide; - chemical degradation of rocks (e.g., carbonates) producing carbon dioxide; - carbon dioxide production in root zone of soils by plants.	Gases can be emitted from ground under falling barometric pressure conditions.

This Appendix concentrates on the assessment of risk from methane and carbon dioxide. This Appendix does not provide guidance for the assessment of risk when other gases are present due to 'Other Sources' from the above table (particularly organic compounds such as BTEX and VOC's or for the risk from radon or hydrogen sulphide).

To determine the origin of the gas a range of factors must be considered together, including;

1. Proximity of likely sources;
2. Ground conditions (geology, hydrogeology, anthropogenic pathways etc);
3. Properties of gases present including:
 - a. Chemical composition;
 - b. Physical properties;
 - c. Ratios of components e.g., methane : carbon dioxide.
4. Timeframe of activities such as infilling periods, capping works, installation of gas control systems etc.

Identification of the originating source may be problematic given that there may be more than one source present and trace gas analysis may be required. Identification of the sources of the gases encountered during monitoring is usually carried out through a process of eliminating the most unlikely potential sources (given the site setting) and selecting those which are the more likely candidates.

Hazards Associated with Presence of Ground Gases

Methane gas is combustible and potentially explosive. When the concentration of methane in air is between the limits of 5.0%v/v and 15.0%v/v an explosive mixture is formed. The Lower Explosive Limit (LEL) of methane is 5.0%v/v, which is equivalent to 100% LEL. The 15.0%v/v limit is known as the Upper Explosive Limit (UEL), but concentrations above this level cannot be assumed to represent safe concentrations. Further, the LEL and UEL will vary (up and down) depending upon the proportion of other gases (including oxygen). However, the fact that methane is a colourless, odourless gas means that there is no simple indicator of the presence of the gas until such a time as explosive limits are reached, and an incident occurs. Methane is lighter than air and has a low toxicity. However, at high concentrations it can result in asphyxiation due to oxygen displacement.

Carbon dioxide is a colourless, odourless gas, which, although non-flammable, is both toxic and an asphyxiant. As carbon dioxide is denser than air, it will collect in low points and depressions. The UK Health & Safety Executive (HSE) has published information relating to concentrations of carbon dioxide that humans may be exposed to, which uses concentrations contained in the Control of Substances Hazardous to Health Regulations 2002 (as amended). These are the Long-Term Occupational Exposure Limit (LTOEL, 8-hour period) and the Short-Term Occupational Exposure Limit (STOEL, 15-minute period), which are 0.5% and 1.5% carbon dioxide, respectively.

Parameters Influencing the Rate of Ground Gas Production

Figure G2 is taken from EA guidance document LFTGN 03 illustrates typical ground gas generation curves from biodegradable materials:

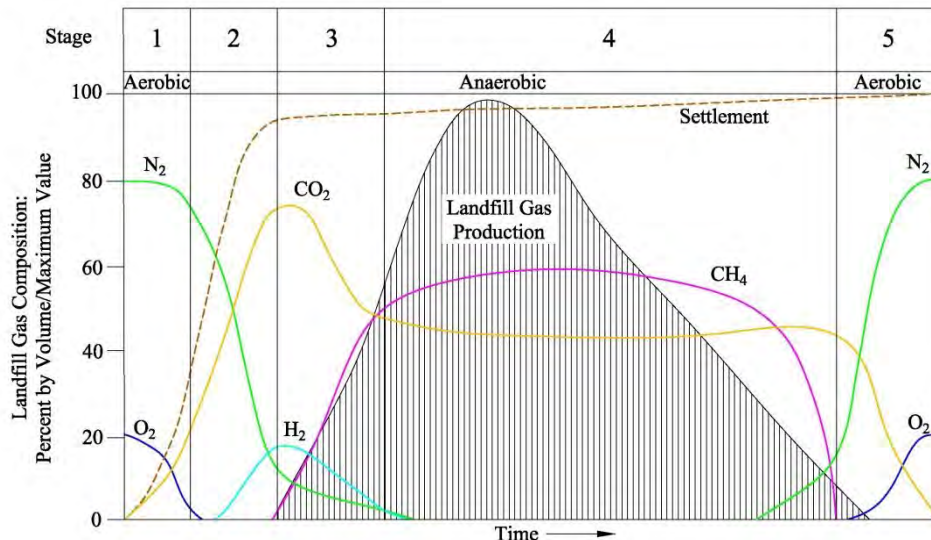


Figure G2. Idealised Representation of Landfill Gas Generation.

The production of methane and carbon dioxide at a landfill site may be expected to be considerable and ongoing. Concentrations of methane will eventually decrease, followed by concentrations of carbon dioxide, but the duration and rate of gas production can vary markedly between sites. Five distinct phases of gas production occur during the process which are, in order of event (as marked on Figure G2), as follows:

1. An aerobic phase involving oxygen depletion and temperature increase through aerobic respiration;
2. The establishment of anaerobic conditions and the evolution of carbon dioxide and hydrogen through acidogenic activity;
3. Commencement of methanogenic activity; the establishment of populations of methanogenic bacteria;
4. A phase of stable methanogenic activity, which may go on for many tens of years;
5. A phase of decreasing methanogenic activity, representing depletion of the organic material and a return to aerobic conditions.

The time scale for the return to the normal ground gas concentrations will be highly variable, depending upon the types and quantities of materials present. In addition, the optimum parameters influencing the rate of decomposition and ground gas production within the ground at a site are as follows:

- High water content with adequate rainfall and water infiltration to provide moisture content between approximately 20 to 26%;

- Conditions that either are or are very close to anaerobic;
- High proportion of biodegradable materials;
- A pH between 6.5 and 8.5, ideally verging slightly on the acidic between pH 6 to 7;
- Temperature between 25°C and 55°C;
- The ratio of the biochemical and chemical oxygen demands (BOD:COD);
- High permeability;
- Small particle size, as finer subsurface materials possess a greater surface area to provide a growing 'face' for the micro-organisms but high fines levels reduces permeability and reduces decomposition rate.

For this reason, it is vital that sources of methane and carbon dioxide are identified prior to the commencement of any work on a construction site, and that the ground gas regime is characterised at the worst temporal conditions a site may experience. From this, a risk assessment is carried out to identify the risk at the site from ground gases so that suitable protection measures can be designed and incorporated into a development to prevent a dangerous build-up of gas occurring.

Factors Influencing the Migration and Behaviour of Ground Gases

There are many factors that influence the migration of ground gases which can affect the risk from a gassing source:

- driving force – pressure differential along a pathway, diffusion and dissolved in solution;
- meteorological conditions – short term and seasonal conditions including atmospheric pressure changes (e.g., rapidly falling pressure causes gas to expand increasing emission rates), rainfall, frozen ground and thawing, temperature;
- geological and groundwater conditions – these can have the over-riding influence on the direction/pathways and quantity of migrating gas;
- anthropogenic influences – man-made pathways include mine shafts, service runs/drains, foundation piles, underground voids/pits/basements, foundation/building design/construction

Guidance Documents

Currently in the UK, there are no statutory threshold limits for hazardous gases in the ground as site specific variables mean that standard threshold values cannot be applied. The published guidance relating to development of sites where methane and carbon dioxide are present has been produced in response to building projects on or close to landfill sites, as both gases are principal constituents of landfill gas. Much of the historic guidance that has been produced on gas risk assessment focused on landfill sites and as a result there has previously been a lack of clarity when relating the process to gas conditions on non-landfill sites.

Statutory guidance regarding methane in the ground has previously taken a limiting concentration of 1.0 % by volume methane (equal to 20% of the lower explosive limit of methane in air) above which necessary actions will be appropriate. For carbon dioxide the limiting recommended trigger was 1.5 % by volume (the Long-Term Exposure Limit for carbon dioxide). Above these concentrations the Building Regulations Approved Document C (1992) stated that consideration should be given to whether actions may be appropriate, whilst more specific solutions would be likely to be necessary at concentrations greater than 5% by volume of carbon dioxide (Building Regulations Approved Document C, 1992). However, the latest fully revised version of Approved Document C (DoE, 2004) no longer endorses this approach and instead requires the use of a risk-based approach in interpreting the findings of a gas monitoring survey. Further, the latest EA documentation on landfill gas (LFTGN 03, 2004) continues to sanction the use of a risk-based approach through a structured approach to the assessment of ground gases and links with the risk assessment process outlined within CLR 11 for soil contaminants.

With the above in mind, recent guidance has been produced in 2006 and 2007 with the aim of providing up to date advice in relation to residential and commercial development. The guidance does not address issues associated with gas derived from landfills, for this refer to “*Guidance on the Management of Landfill Gas*” (Environment Agency 2004) for an overview.

Recent guidance relevant to gas assessments for residential and commercial development includes;

- **Wilson *et al.* (CIRIA C665, December 2007) “Assessing Risks Posed by Hazardous Ground Gases for Buildings.”**

This document provides up to date advice on all aspects of ground gas risk assessment such as investigation, monitoring programmes, data collection and interpretation. The guidance presents separate methodologies for the characterisation of:

- **All development types except low rise housing with gardens and for Low Rise Buildings without a 150mm void** (Situation A) (Table 8.5 CIRIA C665)
 - and;
 - **Low rise housing with gardens with a 150mm ventilated sub-floor void** (Situation B) (Table 8.7 CIRIA C665)
- (See below for further explanation of the methods of characterisation)

- **Boyle and Witherington (NHBC / RSK Group, Report 10627-R01(04) January 2007) “Guidance on the Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present.”**

This document presents the “Traffic Lights System” detailed below and is relevant only for low rise properties (e.g., bungalows and town houses) that have a ventilated sub-floor void (i.e., Situation B as described in CIRIA C665).

- **Wilson and Card (CIEH, expected 2011) “Ground Gas Handbook for Designers and Regulators”**

This document is expected to provide practical guidance on ground gas assessments and the design and evaluation of protection measures.

- **British Standard (BS 8485+A1, January 2019) “Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings”**

This document provides an overview of gas characterisation and assessment. The Standard is intended to be used by designers of gas protection measures and regulators involved in the assessment of design solutions. The Standard provides a framework in line with CLR11 allowing designers to judge the adequacy of ground gas and related site investigation data. The document provides an approach to determine appropriate ground gas parameters that can be used to identify a range of possible construction solutions mitigating against the presence of ground gas on a development site.

Each of these documents continues to highlight the importance of, and give further guidance towards, carrying out a tiered risk-based decision-making process in accord with government policy on dealing with contamination from historic or natural sources and highlight the importance of the Conceptual Model in site characterisation. These documents also stress the importance that the assessor should be confident that the ground gas monitoring results are representative of the likely worse case ground gas regime on a site and that the data collected from the site is sufficient. With this in mind, CIRIA C665 sets out ideal monitoring periods as below.

Idealised Frequency and Period of Monitoring (after Table 5.5a and 5.5b, CIRIA C665)						
		Generation Potential of Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	4/1	6/2	6/3	12/6	12/12
	Moderate (Flats)	6/2	6/3	9/6	12/12	24/24
	High (Residential with Gardens)	6/3	9/6	12/6	24/12	24/24
Notes 1. First number is the number of readings and the second is the minimum period in months (e.g., 6/2 – six sets of readings over two months). 2. At least two sets of readings must be at low (preferably under 1,000 mb) and falling pressure. 3. High sensitivity end use on high or very high hazard site will not normally be acceptable unless the source is treated to reduce gassing potential.						

Before the latest guidance, good practice for site characterisation had been based upon the method proposed by Wilson and Card (1999). CIRIA C665 (2007) effectively supersedes Wilson and Card (1999) and includes a modified version of the Wilson and Card method (Tables 8.5, 8.6 and Box 8.1). Gas concentrations and flow rates for either methane and/or carbon dioxide measured at a site to ‘Characteristic Situations.’ Appropriate protection measures are selected from Table 8.6 (if using modified Wilson & Card method) and from Box 8.4 from CIRIA C665 (if using the NHBC traffic lights method). Throughout the risk assessment process, strong regard must be given to the nature of the gassing source, the flow rates and the estimated surface emissions. Note that certain protection measures are stated in CIRIA Report 149 that are now considered wholly inappropriate to certain developments and consequently should not be used without modification. Throughout the process, it is important to remember that these tables are not

intended to be used as a definitive design tool and have been prepared to show the typical scope of measures for gas control.

Both the NHBC (2007) and CIRIA (2007) guidance documents and BS 8485+A1 (2019) propose that both ground gas concentrations and flow rates are used to calculate the limiting gas well gas volume flow rates for methane and carbon dioxide, based on the ground gas conditions monitored for during the worse-case temporal conditions. This limiting gas well volume flow rate is termed the Gas Screening Value (GSV, note that this was termed borehole gas volume flow), and is calculated as follows:

$$\text{GSV (l/hr)} = \frac{[\text{gas well gas concentration (\%v/v)}] \times [\text{gas well flow rate (l/hr)}]}{100}$$

These GSVs are then compared to generic 'Traffic Lights' contained within the NHBC guidance, which present typical maximum gas concentrations and limiting GSV's, for 'Situation B Development' (Low rise housing with gardens).

Table 8.7 NHBC Traffic light system for 150 mm void				
Traffic Light	Methane ¹		Carbon Dioxide ²	
	Typical max concentration ³ (% by volume)	Gas Screening Value ^{2,4} (litres/hour)	Typical max concentration ³ (% by volume)	Gas Screening Value ^{2,4} (litres/hour)
Green	1	0.13	5	0.78
Amber 1	5	0.63	10	1.6
Amber 2	20	1.60	30	3.10
Red				
Notes: 1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated; 2. Borehole Gas Volume Flow Rate, in litres per hour as defined in Wilson and Card (1999), is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered; 3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so; 4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.				

Box 8.4 of CIRIA C665 Gas protection measures for low-rise housing development based upon allocated NHBC Traffic light (Boyle and Witherington, 2007)	
Traffic Light Classification	Protection Measures Required
Green	Negligible gas regime identified, and gas protection measures are not considered necessary.
Amber 1	Low to intermediate gas regime identified, which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.
Amber 2	Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Membranes should always be fitted by a specialist Contractor. As with Amber 1, ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. Certification that these passive protection measures have been installed correctly should be provided.
Red	High gas regime identified. It is considered that standard residential housing would not normally be acceptable without a further Gas Risk Assessment and/or possible remedial mitigation measures to reduce and/or remove the source of gas.

For a 'Situation A Development' (All development except low rise housing with gardens), the GSV value is used to derive the appropriate Characteristic Situation from Table 8.5 of CIRIA C665 (below):

Table 8.5 from CIRIA C665 Modified Wilson and Card Classification					
Characteristic Situation (CIRIA R149)	Comparable Partners in Technology gas Regime (see Box 8.2)	Risk Classification	Gas Screening Value (CH ₄ or CO ₂) (l/hr) ¹	Additional Factors	Typical Source of Generation
1	A	Very low risk	<0.07	Typically, methane ≤ 1% and/or carbon dioxide ≤ 5%. Otherwise consider increase to Situation 2	Natural soils with low organic content "Typical" made ground
2	B	Low risk	<0.7	Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3	Natural soil, high peat/organic content. "Typical" made ground
3	C	Moderate risk	<3.5		Old landfill, inert waste, mine working flooded
4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mine working susceptible to flooding, completed landfill (WMP 26B criteria)
5	E	High risk	<70		Mine working unflooded inactive with shallow workings near surface
6	F	Very high risk	>70		Recent landfill site

It was intended in CIRIA C665 that the characteristic situation allocated to the development from the table above would then be used in Table 8.6 of CIRIA C665 in order to determine the level of gas protection the development requires. However, BS8485:2015 superseded this document and a different set of mitigation standards were put forward.

The recommended minimum gas protection score (points) be selected based on the building type (Table 3 which defines four building types) and the ground gas Characteristic Situation as detailed in Table 4 of BS8485:2015+A1:2019 (see below).

The first step in the decision-making process is to obtain the level of gas protection necessary in the range 0 to 7.5 from Table 4. Then a combination of structural barriers (Table 5) ventilation protection measures (Table 6) and/or gas resistant membranes (Table 8) should be chosen to meet that requirement. The level of gas protection necessary should take into account the characteristic gas situation and a number of other factors. The whole decision-making process should be made transparent, where all parties can see the approach being taken, can understand the various steps and decisions made and be confident that a risk-assessed solution has been designed and installed commensurate with the construction and site constraints.

Where the gas Characteristic Situation is 4 or more (and for NHBC Red situations according to CIRIA C665), the site requires a comprehensive risk assessment to confirm the scope of protection measures. These are higher risk sites and reliance on Table 4 alone is not sufficient.

BS8485:2015+A1:2019 Table 3 Building Types				
	Type A	Type B	Type C	Type D
Ownership	Private	Private or commercial/ public, possible multiple	Commercial / public	Commercial / industrial
Control (change of use, structural alterations, ventilation)	None	Some but not all	Full	Full
Room sizes	Small	Small / medium	Small to large	Large industrial / retail park style

BS8485:2015+A1:2019 Table 4 Gas Protection Score by CS and Type of Building				
CS	Required Gas Protection			
	High risk	Medium risk	Low risk	
	Type A	Type B	Type C	Type D
1	0	0	0	0
2	3.5	3.5	2.5	1.5
3	4.5	4	3	2.5
4	6.5 ^(A)	5.5 ^(A)	4.5	3.5
5	^(B)	6 ^(A)	5.5	4.5
6	^(B)	^(B)	^(B)	6
a)	Residential building should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g., high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g., in institutional and/or fully serviced contractual situations.			
b)	The gas hazard is too high for this empirical method to be used to define the gas protection measures			
^{NOTE 3} The NHBC has published guidance for use on residential developments, which utilise an alternative classification (“traffic light”) system. This guidance typically applies to Type A buildings utilising beam and block floor constructions with clear void ventilation. The design choice variables are limited to decisions relating to the membrane specification and verification recommendations (see Table 7). Designers utilising this system would therefore need to refer to NHBC to assess compliance for specific recommendations [see 8485:2015 for further on this note] ^{NOTE 4} The method of selecting the combination of these types of protection is given in section 7.2 of BS8485:2015. Once type of measures has been decided, the detailed design and specification of the measures should be undertaken (section 7.3)				

Section 7.2 defines the order of selecting protective measures. The first choice is provided by structural barriers as defined in Table 5.

BS8485+A1:2019 Table 5 Gas protection scores for structural barriers		
PROTECTION ELEMENT/SYSTEM	SCORE	COMMENTS
Floor and substructure design		
Floor slabs		
Block and beam floor slab	0	<i>General – score conditional that breaches of slab are sealed</i>
Cast in situ ground-bearing floor slab (with only nominal mesh reinforcement)	0.5	
Cast in situ monolithic reinforced ground-bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations (with only nominal mesh reinforcement)	1 or 1.5	<i>To achieve 1.5, raft or suspended slab to be well reinforced to prevent cracking and minimal penetrations</i>
Basement floor and walls to BS 8102:2009, Grade 2 waterproofing – See notes in BS8485:2015+A1:2019	2	
Basement floor and walls to BS 8102:2009, Grade 3 waterproofing – See notes in BS8485:2015+A1:2019	2.5	<i>Conditional that waterproofing is not based on geosynthetic clay liner</i>

Ventilation methods are detailed in Table 6, and points can only be gained from using one of the five types:

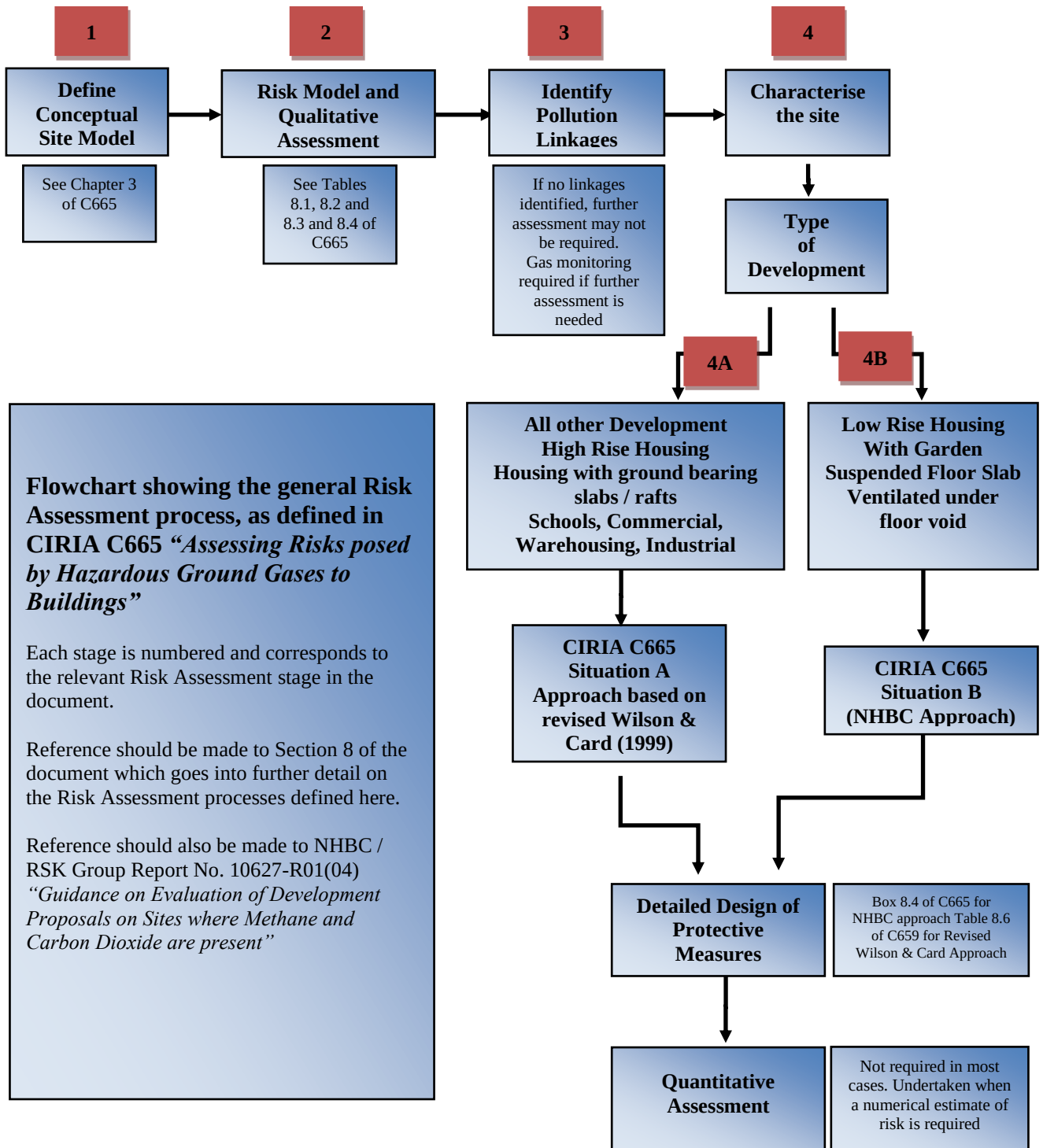
BS8485:2015+A1:2019 Table 6 Gas Protection Scores for Ventilation Protection Measures		
PROTECTION ELEMENT/SYSTEM	SCORE	COMMENTS
a) Pressure relief pathway (usually formed by low fines gravel or with a thin geocomposite blanket with strips terminating in a gravel trench external to the building)	0.5	<i>Whenever possible, a pressure pathway relief pathway (as a minimum) should be installed in all gas protection measures systems. If a layer has a low permeability and/or is not terminating in a venting trench (or similar), then the score is zero.</i>
b) Passive sub floor dispersal layer		
Very good performance	2.5	<i>Performance criteria shown in Fig B.6 and B.7 of BS 8484:2015.[See Annex B]</i>
Good performance	1.5	
Media used to provide the dispersal layer are:		
• Clear void • Polystyrene void forming blanket • Geocomposite void former blanket • No-fines gravel layer with gas drains • No-fines gravel layer		
c) Active dispersal layer, usually comprising fans with active abstraction (suction) from a subfloor dilution layer, with roof level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers	1.5 to 2.5	<i>This system relies on continued serviceability of the pumps; therefore, alarm and response systems should be in place. [See Annex B].</i>
d) Active positive pressurisation by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket	1.5 to 2.5	<i>This system relies on continued operation of the pumps; therefore, alarm and response systems should be in place. [See Annex B].</i>
e) Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft)	4	<i>Assumes car park is vented , designed to Building Regulations 2000, Approved Document F.</i>

Membrane methods are detailed in Table 7.

BS8485:2015+A1:2019 Table 7 Gas protection score for gas resistant membrane		
PROTECTION ELEMENT/SYSTEM	SCORE	COMMENTS
Gas resistant membrane meeting all of the following criteria: • Sufficiently impervious to gases with a methane gas transmission rate $<40.0 \text{ ml/day/m}^2/\text{atm}$ (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method) • Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • Sufficiently strong to withstand in-service stresses (e.g., settlement if placed below a floor slab); • Sufficiently strong to withstand the installation process and following trades until covered (e.g., penetration from steel fibres in fibre reinforced concrete, dropping tools etc); and to withstand in-service stresses (e.g., settlement if placed below a floor slab) • capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • verified in accordance with CIRIA C735	2	<i>The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation, and the integrity of joints.</i> <i>If a membrane is installed that does not meet the criteria, then the score is zero.</i>
See notes in BS8485:2015+A1:2019 regarding membrane requirements		

For a site which is impacted by migratory gases from an off source, the development may be protected by imposing pathway intervention methods, which if successfully validated, could also remove the need for further analysis. It is essential that the gas regime in these circumstances has been fully characterised and that the only source impacting the site is located off site and that the pathway is clearly defined and its interception equally proven before construction commences. Pathway intervention methods may include vertical membrane installations, venting trenches, rows of stone columns, activated trenches and various proprietary systems. These systems are particularly relevant to domestic housing where there is limited scope for foundation type solutions.

Following the choice of protection measures, detailed design should be entered into [Section 8 of BS 8485:2015+A1:2019].



APPENDIX I: SUMMARY OF GUIDANCE FOR CLASSIFICATION OF SOIL AS A WASTE MATERIAL

Guidance for Classification of Soil for Off Site Disposal at a Landfill Site

Many site developments create a portion of excess soils and Made Ground which if not re-usable, are required to be disposed off-site at a suitably licensed landfill site. The regulations and associated guidance published by the Environment Agency is relatively complex and lengthy. This guidance provides a summary of the following documents which should be referred to when assessing soil (and common constituents found within Made Ground on remediation sites) for off-site disposal:

- Guidance for Waste destined for disposal in landfills: Interpretation of the Waste Acceptance Requirements of the Landfill (England and Wales) Regulations 2002 (as amended) (EA, 2004);
- Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance Procedures (EA, April 2005);
- WM3 - Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Wastes (EA, May 2015);
- European Regulation No 1272/2008 on Classification, Labelling and Packaging of substances 2015 (CLP 2015);
- Guidance on Waste Destined for Disposal in Landfill (EA, June 2006);
- Treatment of Non-hazardous wastes for Landfill (EA, February 2007).

It is important to distinguish between the waste classification system and the designation of materials as “suitable for use” on site. A material may be retained on site for an appropriate end use if that end-use is clearly designated and that a site-specific risk assessment ensures that it does not pose a risk to human health or controlled waters. However, if this material is excavated and sent for disposal, the material is then subject to waste management regulations and the two systems cannot be directly correlated. It is therefore important to note that classifying a material as hazardous (should it be excavated and become a waste) does not necessarily indicate that it might not be suitable to be kept on site for re-use. Separate guidance in the form of a Code of Practice (CL:AIRE Version 2, 2011) has been developed jointly between the development industry and the Environment Agency to provide best practice when assessing whether materials are wastes or not, and for determining when waste can cease to be waste for a particular use.

In accordance with the current waste regulations (or Landfill Directive, as they are more commonly known), from 30th October 2007 all waste materials produced from construction sites have to be pre-treated prior to disposal. Pre-treatment includes waste minimisation, recovery (e.g., separation of demolition waste to be used as hardcore) and separation of materials into different waste categories (e.g., separate inert waste from hazardous waste etc). Mixing of different waste types shall be avoided and intentional mixing of inert materials with hazardous waste to ‘dilute it’ and hence change its waste classification, is illegal.

The current waste regulations (based on the EU landfill directive) introduced a two-tier classification system for waste materials, defining them as either being hazardous or non-hazardous. Landfills are licensed to take wastes based on a three-tier classification system with the non-hazardous waste divided into two sub-categories:

- Non-Hazardous - inert;
- Non-Hazardous - non-hazardous;
- Hazardous.

Waste materials are categorised with a six-figure numeric code in the European Waste Catalogue. Commonly found construction and demolition wastes including excavated soil from contaminated sites and Made Ground with their waste codes are summarised below (this is not a comprehensive list):

Waste Code	What is it?	Likely Waste Category–		
		Inert Waste	Non-Hazardous	Hazardous Waste
17 01 01 Concrete	Concrete, possibly with reinforcement (from Construction & Demolition)	✓		
17 01 02 Bricks		✓		
17 01 06* Mixtures of concrete, bricks, tiles & ceramics containing dangerous substances	These are not normally considered hazardous but if they are contaminated (e.g., by asbestos) then could be hazardous – see comment above			✓
17 01 07 Mixtures of concrete, bricks, tiles & ceramics other than those in 17 01 06	This is mixed inerts c.f. 17 09 04	✓		
17 05 03* soils and stones containing dangerous substances				✓
17 05 04 soils and stones other than those mentioned in 17 05 03	Soil and stones only (excluding top soil, peat, soil and stones from contaminated sites)	✓		
17 06 05* Construction materials containing asbestos	e.g., corrugated asbestos sheeting			✓
17 08 02 Gypsum-based construction materials other than those mentioned in 17 08 01	Plaster & plasterboard (although specific disposal requirements are required for high sulphate waste – see EA guidance ‘Understanding the Landfill Directive’ version 1.0 March 2010.		✓	
17 09 01* Construction & demolition wastes containing mercury				✓
17 09 02* Construction & demolition wastes containing PCBs	Waste with more than 50 mg/kg of PCB’s are hazardous			✓

Waste Code	What is it?	Likely Waste Category–		
		Inert Waste	Non-Hazardous	Hazardous Waste
17 09 03* Other mixed construction & demolition wastes containing dangerous substances	Broad range of potentially (see notes below – if asterix the waste is hazardous) hazardous wastes			✓
17 09 04 Mixed construction & demolition wastes other than those mentioned in 17 09 01, 17 09 02 & 17 09 03	Mixed inerts with soil, tarmac, cables, vegetation, plaster, etc. (this waste can only be considered inert if it passes the waste acceptance criteria identified in the regulations).	✓	✓	

Note: all wastes with an asterix code are hazardous regardless of whether they are mirror or absolute entries in the EWC list the decision to with regard to composition must come before applying the code for mirror entries.

Some materials are classified as Inert Waste based in its origin (e.g., 17 01 01 Concrete, or glass) without any requirement for laboratory chemical analysis.

However, most soils will require laboratory testing to confirm whether they are classified as Hazardous Waste. The protocol for assessing these materials and the appropriate threshold values is complicated and are set out in the Environment Agency’s “Technical Guidance WM3 Hazardous Waste – Interpretation of the Definition and Classification of Hazardous Waste” (2015). If the test results for the waste indicates that it is not hazardous then further analysis of the waste is required to determine whether it is Inert Waste. If the waste does not meet the criteria for either Hazardous or Inert, then it is by default classified as Non-hazardous Waste.

As an alternative location to landfills for off-site disposal of inert and non-hazardous waste, there are a number of sites which have Waste Permit Exemptions that can accept certain categories of inert and non-hazardous wastes. Additionally, some quarries can accept certain types of wastes to be used for quarry restoration material. For both alternatives to disposal at landfill sites the material still requires chemical testing as these sites have site specific acceptance criteria for wastes. It should also be noted that these types of sites do not incur landfill tax which in the 2018/19 tax year is £2.80 for inactive waste (inert and some types of non-hazardous waste) and £88.95/Tonne for active waste (some types of non-hazardous waste and hazardous waste. Note that the Inland Revenue uses a different classification scheme for waste for tax purposes to the European Waste Classification scheme.

Waste Categorisation

The process of determining the category of wastes is a three-stage process:

- Stage 1 – is the waste either Hazardous or Inert by definition without the requirement for chemical analysis (if it is then Stages 2 and 3 are not required);
- Stage 2 - Waste characterisation;
- Stage 3 - WAC classification.

Waste characterisation determines if a waste is hazardous or not. Excavated soil is characterised using a system based on the contaminants present and their hazardous properties. The system uses total concentrations of the contaminants. Thresholds (as a percentage of the waste) have been set for the various hazardous properties.

Fourteen hazardous properties together with other scenarios where material could cause a hazard have been defined:

- Hazardous properties: explosive, oxidising, highly flammable/flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, toxic for reproduction, mutagenic and ecotoxic;
- Substances which can release toxic/very toxic gases in contact with water, acid or air;
- Substances which, after disposal, can yield another substance, e.g., a leachate, which possesses any of the above hazardous properties.

Some of the hazardous properties are sub-divided e.g., there are three categories of carcinogenic, mutagenic and toxic for reproduction substances. The hazardous properties were originally defined in the European Hazardous Waste Directive 91/689/EC. Should a waste contain a contaminant with one or more of the listed hazardous properties at a concentration equal to or above the threshold value for the particular property, then the waste is hazardous. The hazardous properties of a wide range of chemicals are sourced from CLP 2015.

There are many reasons why waste soil is classified as being hazardous, but the majority of reasons can be divided into the following four groups:

- Hydrocarbons – this is probably the most common reason for the hazardous classification of soils. For most soils hydrocarbon analysis will be required for both Polycyclic Aromatic Hydrocarbons (PAH) and speciated Petroleum Hydrocarbons (PHCs) but depending on the site's history other groups of organic contaminants may also be included in any analysis suite for soil samples;
- Metals – Particularly sites from former metal processing or mining sites and also some types of ash have metal concentrations that are sufficiently high to characterise materials requiring disposal as hazardous waste.
- Asbestos;
- Anions – e.g., sulphate in plasterboard (there are special disposal requirements for high sulphate waste and specific WAC requirements); it is possible that sulphate salts of metals and semi-metals could make the waste hazardous – the sulphate concentration could possibly be significant under H12, H13 and H14.

The characterisation of wastes with significant metal concentrations involves some processing of the analysis data. The chemical analysis results for inorganic substances are generally reported as total concentrations e.g., total lead, total arsenic, total sulphate etc. However, CLP 2015 deals with the hazardous properties of actual compounds e.g., lead sulphate, arsenic pentoxide, nickel carbonate. Therefore, the total metal results have to be converted into assessed chemical analysis results for the compound most likely to be present in the soil samples. For example, if the sample contains high total lead concentrations and high sulphate concentrations, then the lead is likely to be present

in the soil as lead sulphate. The most likely compounds can often be determined from a desk study or previous site uses. If the site has been derelict for a number of years, consideration should be given as to whether water soluble compounds should or should not be chosen, as rainfall could have removed them from the soil (this does not apply if the soil has been taken from below under a concrete slab etc). Chemical knowledge and common sense needs to be used in choosing a suitable compound.

If no data is available, then a worst-case scenario has to be assumed and the most hazardous compound likely to be present has to be chosen. For example, metal chromates (lead chromate, nickel chromate) are often the most hazardous compounds formed by many metals, but if the chromium concentrations in the soil are low, chromates are unlikely to be present. It should also be noted that for many of the hazard categories, the cumulative hazard from different compounds is added (e.g., add the concentrations of the copper, lead and zinc compounds together to assess the Hazard Category H14 Ecotoxicity).

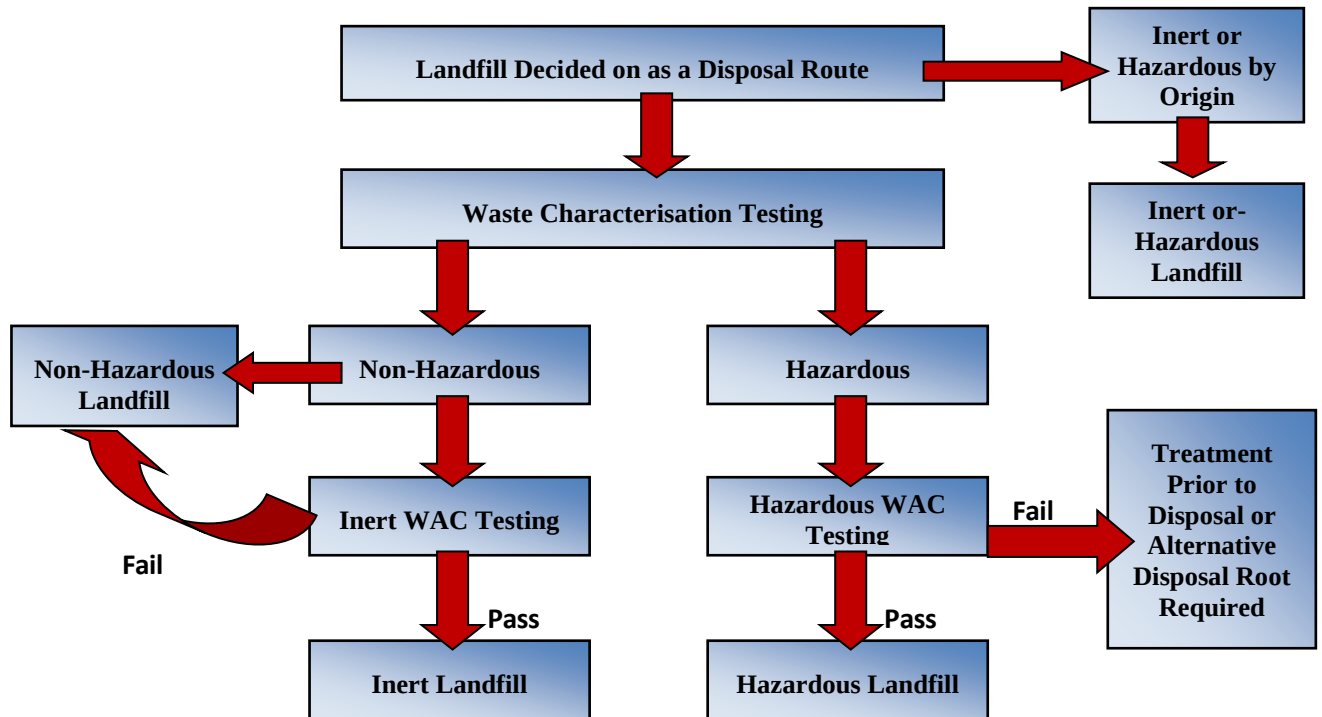
If the results of the above assessment determine that the waste is hazardous, it must then be analysed for the Waste Acceptance Criteria (WAC) analysis contained within appropriate Environmental Permitting Regulations (this comprises mainly leachate but also analysis for TOC and Loss on ignition). WAC limit values have been set for the listed determinands. If any of the determinands exceed their limit value, the waste must be pre-treated to reduce concentrations to below the limit values before the waste may be disposed of at a landfill site licensed to take hazardous waste.

For waste classified as not being hazardous, then there are two options available. Currently, waste correctly characterised as not being hazardous may be disposed of without WAC testing to a non-hazardous landfill. Alternatively, WAC testing for Inert Waste can be carried out (this is similar to the list for hazardous waste with the addition of PAH's, BTEX and Mineral Oil). If the results pass the Inert WAC criteria it can be disposed of at an Inert Waste Landfill. If any of the WAC test results exceed the Inert WAC criteria the waste has to be disposed at a non- hazardous landfill. There are WAC limits for non-hazardous waste set for pH and TOC. If these two criteria are not met then the waste must be pre-treated to so that it meets the criteria before it can be disposed.

If materials fail the WAC criteria it may be possible to pre-treat the waste on-site or be taken to a soil treatment centre for pre-treatment to reduce the soil's hazardous properties (e.g., by bioremediation of hydrocarbons).

It should be noted that in order to dispose of Hazardous Waste, the site must register as a producer of Hazardous Waste with the Environment Agency. When disposing of waste materials to landfill sites the appropriate Duty of Care Waste Transfer procedures must be followed.

Landfilled Waste Decision Tree



Landfill Tax

It should be noted that HM Revenue and Customs (HMRC) classify wastes for tax purposes using a different scheme to the threefold landfill EU Landfill Directive scheme (i.e., the hazardous, non-hazardous and inert). HMRC have a two-fold system for landfill tax. The Standard Landfill Tax is currently £88.95/T and applies to all wastes unless they qualify for the reduced rate of landfill tax of £2.80/T. The wastes that qualify for the reduced rate of Landfill Tax are set out in The Landfill Tax (Qualifying Material) Order 2011 with supplementary information on the interpretation of these regulations in HMRS "Notice LFT1 – A General Guide to Landfill Tax" (May 2012) and HMRC Briefing Notes 15/12 and 18/12.

APPENDIX J: UNFORESEEN GROUND CONTAMINATION

Unforeseen Ground Contamination

There is the potential for areas of previously unexpected contamination to be present, as is the case with any “brownfield” site. Any significant quantities of asbestos, significant ashy soils, unusual, brightly coloured or significantly oily or odorous material should be considered in this category. If unexpected contamination is found the following procedures should be adhered to:

1. All site works at the position of the suspected contamination will cease.
2. A suitably trained geo-environmental specialist should assess the visual and olfactory observations of the condition of the ground and the extent of contamination, and the Client and the Local Authority should be informed of the discovery. Should the contamination be likely to affect controlled waters the Environment Agency shall also be informed.
3. The suspected contaminated material will be investigated and tested appropriately in accordance with the assessed risks. The investigation works will be carried out in the presence of a suitably qualified geo-environmental engineer. The investigation works shall commence to recover samples for testing and, using visual and olfactory observations of the condition of the ground, delineate the area over which contaminated materials are present.
4. The unexpected, contaminated material will either be left in situ or be stockpiled whilst testing is carried out and suitable assessments completed to determine whether the material can be re-used on site or requires to be disposed as appropriate.
5. Where the material is left in situ awaiting results it will be reburied or covered with plastic sheeting.
6. Where the potentially contaminated material is to be temporarily stockpiled it will either be placed either on a prepared surface of clayey Alluvium, or on 2000-gauge Visqueen sheeting (or other impermeable surface) and covered to prevent dust and odour emissions.
7. Any areas where unexpected visual or olfactory ground contamination will be surveyed, a photographic record kept, and testing results incorporated into the Verification Report.
8. A photographic recorded will be made of relevant observations.
9. The testing suite will be determined by the independent geo-environmental specialist on the basis of visual and olfactory observations.
10. Test results will be compared against current assessment criteria suitable for the future use of the area of the site affected.
11. The results of the investigation and testing of any suspect unexpected contamination will be used to determine the relevant actions. After consultation with the Local Authority and if necessary the Environment Agency, materials should either be:
 - re-used in areas where test results indicate that it meets compliance targets so it can be reused without treatment; or
 - treatment of material on site to meet compliance targets so it can be reused; or

- removal from site to a treatment centre or to a suitably licensed landfill or permitted treatment facility.

12. Verification Report will be produced for the work.

Asbestos

Asbestos cement products and asbestos fibres have not been encountered in the soils at the site but based on the age of the Made Ground material containing asbestos could be expected to be encountered. If non-notifiable asbestos (e.g., chrysotile asbestos cement board) is encountered in excavations then it will be dealt with in accordance with the Control of Asbestos Regulations 2012 (CAR 2012) and the HSE's ACoP for asbestos (2013). Finding non-notifiable asbestos is a very common occurrence on brownfield sites and is a relatively low risk activity and can be dealt with as a matter of routine. Therefore, it is not proposed that the Council will be notified but an appropriate record will be kept of confirmatory testing and disposal. This will be included in remediation verification reports.

If suspect notifiable asbestos is encountered then the Council and the HSE will be notified. An appropriate action plan will be agreed with the Council and the HSE in accordance with CAR 2012. The action plan will include the preparation of the Risk Assessment and Plan of Work in accordance with CAR and other statutory requirements including:

- Site mobilisation;
- Excavation methodology;
- Handling, movement and storage on-site of excavation arisings;
- Any processing of excavation arisings containing ACMs;
- Movement and placement of arisings to final destination;
- Placing of cover system over soils with and ACMs remaining on-site;
- Off-site disposal of ACMs;
- Licences;
- PPE & RPE; and,
- Dust and fibre monitoring.

Potential mitigation measures that would be required include:

- Ensuring works are carried out by suitably trained and experienced personnel with working with asbestos;
- Site investigation and risk assessment;
- Removal or treatment of asbestos hotspots;
- Use of PPE and RPE by construction workers; and,

- Compliance monitoring.

Unexpected Tanks

No buried underground fuel storage tanks have been encountered during the site investigation works; however, there remains a low risk that tanks are present on-site. Should an underground tank be encountered, operations should cease in the area. Additionally, there may be pipework associated with these tanks which could have oily residues. The following procedures are to be adhered to if tanks and pipework are identified:

1. All site works at the position of the tanks/pipework should stop.
2. A description of the tank should be made by the geo-environmental engineer including; condition and surround, along with visual and olfactory observations should any contents in the tank be apparent. A photographic record will also be made of relevant observations.
3. The tank's position and depth should be determined and marked on a plan of the site.
4. The independent geo-environmental engineer will inform Client and the Local Authority.
5. During the presence of the independent geo-environmental engineer, investigation works should be undertaken to obtain samples of any liquid or sludge contents and to establish dimensions of the tank.
6. Testing will be determined on the basis of visual and olfactory observations by independent geo-environmental engineer.
7. Test results will be compared against current assessment criteria and proposals for disposal of any contents determined in agreement with the appropriate Regulatory Parties.
8. Emptying the tank and disposal of contents to a suitable licenced disposal facility.
9. Degassing and removal of the tank by a suitably qualified contractor will be required, and a Naked Flame Certificate should be provided.
10. Once the tank has been emptied in accordance with the above proposals, it is to be removed for disposal to a licensed waste management facility. Copies of the relevant waste consignment notes are to be kept and included in the Verification Report.
11. Excavation and remediation of any contaminated soils around the tank will be carried out.
12. Samples of the base and sides of the resultant hole will be sampled and supervised by the independent geo-environmental engineer to confirm whether risks to human health or controlled waters.