



e3p

Phase I Geoenvironmental Site Assessment
Bryn Lane, Wrexham Industrial Estate

Reference: 14-892-R1-1
Date: August 2021



PHASE I GEOENVIRONMENTAL SITE ASSESSMENT

Bryn Lane
Grafters Ltd, Unit 6
Wrexham Industrial Estate
LL13 9UT

Prepared for:
Portal Construction N.W. Ltd



Report Ref: 14-892-R1-1
Date Issued: August 2021

Bryn Lane, Wrexham

Phase I Geoenvironmental Site Assessment

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EXECUTIVE SUMMARY

Site Address	Grafters Ltd, Unit 6, Bryn Lane, Wrexham Industrial Estate, Wrexham, LL13 9UT	
Grid Reference	E 339040, N 350150	
Site Area	2.38 Ha.	
Proposed Development	Pace Architecture is assisting their client in the proposed acquisition and future redevelopment of a parcel of land off Bryn Lane, Wrexham for a commercial end use.	
Current Site Use	The site comprises an irregular shaped parcel of land located to the east of Wrexham Industrial Park and is opposite Wrexham recycling centre. The site is currently unused. The site heavily vegetated around the boundaries with some woodland fenced off in the centre of the east and west boundary of the site. No structures have been identified on site. The site is accessible from the northern boundary just off Bryn Lane from an unnamed road that leads to Kingsmoor Industrial Estate. The site can also be accessed from the southeastern corner of the site by the same road that leads to Kingmoor Industrial Estate. There is possible site access from Bryn Lane directly, however it is currently blocked by fencing and concrete blocks. There are several drainage ditches and ponds within the site, with some of them not containing water. There is a slope of 2-3m to an area of crushed aggregate in the centre of the southern sector of the site where it appears the site has been cut from its original landform. There is an area crushed hardcore present within the centre of the site. Asphalt hardstanding is present within the southern sector of the site that leads to the possible site entrance from Bryn Lane.	
Site History	A review of the pertinent Ordnance Survey mapping suggests that the site comprised agricultural land with ponds and farm buildings present in the centre that extend to the south noted as Upper Bryn Farm and Byrn Mawr respectively in 1961. Circa 1972-1974 the area in the northeast of the site has been excavated to enlarge the pond with an embankment formed around the perimeter. Several of the buildings were associated with Upper Bryn Farm were later demolished in 1982, with all the buildings present on the site being fully demolished by 2006. No changes occur on-site from 2006 until circa 2021.	
Environmental Setting	Drift Geology	Glacial till – Devensian – Sand, Clay and Gravel
	Bedrock Geology	Salop Formation - MUDSTONE, SANDSTONE and CONGLOMERATE (majority of site). Eastern boundary – Kinnerton Sandstone Formation (SANDSTONE).
	Faults	No faults present
	Hydrogeology	The drift geology comprises a Secondary Undifferentiated Aquifer.



	Hydrogeology	The majority of the site has a secondary A bedrock aquifer within the bedrock with a principal bedrock aquifer along the eastern boundary of the site.
	Hydrology	A pond has been identified in the north east corner of the site and extends along the eastern boundary for several metres.
	Flood Risk	Surface water features have been identified on-site and provide a low to high risk of flooding according to Natural Resources Wales. The Envirocheck has stated that there is potential for groundwater flooding to occur at the surface.
Utility Locations	A formal drainage survey has not been completed; however, a manhole was noted in the northeast corner of the hardstanding. A site walkover has also identified potential services entering the site from Bryn Lane.	
Landfill Sites and Ground Gases	A licenced waste management facility is located 72m west of the site, under Waste Recycling Group Ltd. The site is listed to receive household waste.	
Radon	Less than 1% of homes are estimated to be at or above the Action Level)–no special precautions required.	
Coal Mining/Land Stability	The site is not located in coal reporting area.	
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction within influencing distance of the subject site.	
Initial Conceptual Site Model	Contaminant Sources ✿ Made Ground has a potential to be onsite, but not extensive (historical residential/farm buildings and infilled ponds) – Polycyclic aromatic hydrocarbons (PAH), heavy metals, asbestos containing material (ACM), ground gases. ✿ Historical agricultural use (spillages of fuel etc.) – PAHs, TPHs, Metals Pathways ✿ Direct contact and ingestion ✿ Vapour inhalation ✿ Dust inhalation Receptors ✿ Future site users (proposed commercial end-users and construction workers) ✿ Buildings (proposed commercial units) ✿ Drainage ditches and Underlying aquifer (A principal bedrock aquifer and a Secondary A bedrock aquifer)	
Recommendations	Intrusive investigation to confirm the conceptual site model on a site-wide basis.	



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DRAWING LIST

14-892-001 - Site Location Plan
14-892-002 - Proposed Development Plan
14-892-003 - Historical Features Plan
14-892-004 - Site Features Plan



1. INTRODUCTION

1.1. BACKGROUND

E3P Ltd has been commissioned by Pace Architecture who are assisting their client to undertake a Phase I Geoenvironmental Site Assessment at land to a parcel of land off Bryn Lane, Wrexham LL13 9UT.

This report is required to determine potential contaminated land liabilities and geotechnical constraints as part of a proposed site redevelopment

1.2. PROPOSED DEVELOPMENT

Pace Architecture who are assisting their client in the proposed acquisition and future redevelopment of a parcel of land for commercial end use with associated car parking and utility infrastructure. Currently there are four site layouts that are being considered.

A snapshot of the proposed development layouts is indicated in Figure 1.1.

FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT OPTIONS



1.3. OBJECTIVES

- ✦ The objectives of the geoenvironmental investigation are as follows:
- ✦ Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available in order to complete a desk study in line with Environment Agency (EA) document Model Procedures for the Management of Contaminated Land (Contaminated Land Report 11 (CLR11)).
- ✦ Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
- ✦ Assess the desk-study information and, where possible, provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
- ✦ Provide recommendations regarding future works required and undertake a preliminary pre-construction cost appraisal.

1.4. SOURCES OF INFORMATION

Background information was sought from the following sources:

- ✦ Envirocheck Search
- ✦ Historical mapping dated 1879 to 2021. A selection of historical maps are reproduced in Appendix V;
- ✦ On-line planning records held by Wrexham County Borough Council;
- ✦ Consultations with representatives of Wrexham County Borough Council;
- ✦ Magic Map Groundwater Vulnerability Map;
- ✦ Radon: Guidance on protective measures for new buildings (BRE Document BR 211, 2007);
- ✦ British Geological Survey Map;
- ✦ Groundsure IO database;
- ✦ <https://zeticauxo.com/downloads-and-resources/risk-maps/>; and,
- ✦ <https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en>

1.5. LIMITATIONS

The limitations of this report are presented in Appendix I.



1.6. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.



2. SITE SETTING

2.1. SITE DETAILS

Site Address	Grafters Ltd, Unit 6, Bryn Lane, Wrexham Industrial Estate, WREXHAM, LL13 9UT
National Grid Reference	E 339040, N 350150
Site Area	2.38 Ha.

All acronyms used within this report are defined in the Glossary presented in Appendix II.

A site location map is presented in Appendix III as Drawing 14-892-001.

2.2. CURRENT SITE USE

E3P has undertaken a site walkover of the entire site and a description of the key findings is summarised in Table 2.1.

TABLE 2.1 SITE DESCRIPTION

Occupancy/Use	The subject site is an irregular shaped parcel of land located to the east of Wrexham Industrial Park and is currently an unused parcel of land.	
Surface Cover (%)	Buildings	0%
	Hardstand	15%
	Soft Cover	85%
Structures	There are no structures present on site. On the north-eastern boundary, there is a structure used as gated access to the industrial park.	
Access	Vehicle access off Bryn Lane via a private road leading to Kingmoor Park along the northern boundary of the site. There is another point of access along the south east corner of the site from the road leading to Kingmoor Park.	
Slope	Imagery from google maps has identified a slope of 2-3m from the grassed area in the north to the area of hardstanding in the south. The site has a gentle slope on the grassed western boundary roughly 2-3m. Along the eastern boundary, there is a steep embankment from the drainage ditch.	
Retaining Structures	No structures identified.	
Vegetation/Ecology	Scrub vegetation including bullrushes and brambles are present on the site around the area of hardstanding in the south of the site. The remaining area of the site has heath and rough grassland with trees along the boundary. During the site walkover, very thick vegetation was identified at the bottom of the steep embankment on the eastern boundary. In the centre of the grassed area in the north of the site deep tyre tracks, indicate boggy ground when wet. Fenced areas of woodland were identified in the centre of the eastern and western boundary. Dead and distress vegetation was identified during the site walkover located across the site.	
Hazardous Material Storage	No above-ground storage tanks (ASTs) or underground storage tanks (USTs) were observed at the site during the preliminary site walkover. Due to the previously developed nature of the site, there is a possibility that hazardous materials storage will have occurred on the site.	



Asbestos-Containing Material (ACM)	No evidence of ACM was noted across the majority of the site during the site walkover. Due to the previously developed nature of the site, there is a possibility that asbestos materials will be present on site.
Polychlorinated Biphenyls (PCBs)	There is no equipment identified that may contain PCBs within the site boundary; however, there is an electric substation and a transformer to the south of the site. It should be noted that historical mapping suggests the substation was constructed after the ban of PCBs in 1981 therefore, is deemed to be a low risk.
Waste Storage	The site walkover has identified waste storage on the southern boundary of the site.
Drainage	A formal drainage survey has not been completed; however, a review of online imagery shows several drainage ditches on the site that flow into the River Dee.

2.3. SURROUNDING AREA

The surrounding area land uses are summarised in Table 2.2.

TABLE 2.2 SURROUNDING LAND USES

DIRECTION	LAND USE
North	Grassland
East	Commercial Units - X P O Logistics
South	Commercial Units with a car park
West	Commercial Units - Wrexham Recycling Centre



3. SITE HISTORY

3.1. ON-SITE HISTORICAL DEVELOPMENT

A review of historical mapping and historical aerial imagery pertinent to the site is summarised in Table 3.1. In addition, historical site features are presented on Drawing No 14-892-003 in Appendix III.

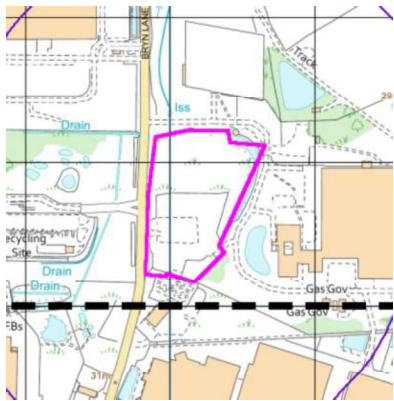
TABLE 3.1 HISTORICAL DEVELOPMENT

MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1873 1:2,500	The site is predominantly agricultural land with a pond located along the eastern boundary and one located to the south of the site. Unspecified structures are located in the south of the site.	
1899 1:2,500	Two pumps are recorded on the southern boundary of the site with close proximity to the buildings present.	
1961 1:2,500	Several more buildings have been developed in the site noted as Upper Bryn Farm, that extends from the centre and to the south of the site farm buildings are noted as Bryn Mawr and Park Farm. The pond in the south of the site is no longer recorded.	



MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1972-1974 1:2,500	A pond is present in the north-eastern corner of the site and extends along the eastern boundary. The area in the northeast of the site has been excavated to create the pond with an embankment formed around the perimeter. A drain is recorded in the northwest of the site. New roadways have been built around the site.	
1982 1:2,500	The farm buildings associated with Upper Bryn Farm have been demolished, with only a few buildings remain in the south of the site.	
2006 1:10,000	The remaining buildings in the south of site have been demolished.	



MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
2006 1:10,000	No significant changes to site.	

3.2. OFF-SITE HISTORICAL DEVELOPMENT

A review of potentially contaminative uses identified on historical Ordnance Survey maps within a 250 m radius of the site is summarised in Table 3.2.

TABLE 3.2 SURROUNDING HISTORICAL DEVELOPMENT

SURROUNDING FEATURE	DISTANCE	DATES	DIRECTION
Pond Then: no longer recorded	60 m	Pre 1873–Pre 1972 Pre 1972–Present	South-West
Well Then: no longer recorded	100m	Pre 1911– Pre 1972 Pre 1972–Present	South
Tank	120m	Pre 1972-Present	South-West
Electrical Substation	250m	Pre 1972-Present	East
Water control station	250m	Pre 1972-Present	East
Gas control station	250m	Pre 1972-Present	East
Electrical Substation	250m	Pre 1982–Present	East
Depot Then: no longer recorded	250m	Pre 1970- Pre 1979 Pre 1979-Present	South-West
Ponds/Pits Then: no longer recorded	0-250m	Pre 1879 – Pre 1881 Pre 1881 - Present	All directions
Ponds/Pits Then: no longer recorded	0-250m	Pre 1881 – Pre 1889 Pre 1889 – Present	All directions
Ponds/Pits Then: no longer recorded	0-250m	Pre 1889 – Pre1992 Pre 1992 – Present	All directions
Ponds	0-250m	Pre 1992 - Present	North

3.3. PLANNING HISTORY

E3P has undertaken a review of online planning records held by Wrexham County Borough Council and no environmentally pertinent information has been obtained for the site.



3.4. ANECDOTAL INFORMATION

Online searches have not returned any pertinent information on the site.

3.5. PREVIOUS REPORTS

E3P have not been provided with any previous reports for the subject site.



4. ENVIRONMENTAL SETTING

4.1. GEOLOGY AND HYDROGEOLOGY

The British Geological Survey (BGS) map (Sheet 121) for the site, (1:50,000, Solid and Drift editions) and online records indicate the site is underlain by the geological sequence presented in Table 4.1.

TABLE 4.1 SUMMARY OF UNDERLYING GEOLOGY

GEOLOGICAL UNIT	CLASSIFICATION	DESCRIPTION	AQUIFER CLASSIFICATION
Drift	Glacial Till	SAND, CLAY and GRAVEL	Secondary undifferentiated
Solid – whole site	Salop Formation - Warwickshire Group	MUDSTONE, SANDSTONE and CONGLOMERATE.	Secondary A aquifer
Solid – eastern boundary	Kinnerton Sandstone Formation - Sandstone.	SANDSTONE	Principal aquifer

Based on the local topography, the location of surface watercourses and the presence of several drainage ditches and streams within the site boundary, it is considered likely that shallow groundwater, if present, will flow in a northerly direction, following the topographical gradient towards the River Dee north east.

TABLE 4.2 SUMMARY OF BGS BOREHOLE RECORDS

LOCATION	DEPTH	MADE GROUND	DRIFT	SOLID
140 m NW (SJ35SE195)	2.6 m	0 m	SAND, CLAY and GRAVEL > 2.6 m	Not encountered
150 m S (SJ34NE168)	24.3m	0m	CLAY	Not encountered
160 m SW (SJ34NE203)	2.5m	0m	CLAY and GRAVEL	Not encountered
150 m S (SJ34NE170)	23m	0m	CLAY and GRAVEL	Not encountered

The Envirocheck report indicates that the site is not located within a groundwater source protection zone. Furthermore, there are no groundwater/potable abstractions within 1 km of the site.

4.2. NATURAL LANDFORM AND GEOMORPHOLOGY

Based on the initial geological assessment, a review of available topographic data and pertinent mapping, E3P has undertaken a preliminary geomorphological assessment of the landform and its possible mechanism for formation.

A drainage ditch flows in a south westerly direction to the south of the subject site at a lower elevation surrounding the hardstanding. It would appear that the current site level plateau will have been formed by the placement and upfilling of material prior to the construction of the historical development.



4.3. GEOTECHNICAL DATA

Geotechnical data presented within a commercially available environmental database is summarised in Table 4.3.

TABLE 4.3 SUMMARY OF GEOTECHNICAL DATA

HAZARD	DESIGNATION
Shrink-Swell Clay	Very low risk
Landslides	Very low to low risk
Ground Dissolution	No hazard
Compressible Ground	No hazard
Collapsible Deposits	Very low risk
Running Sand	Very low risk

4.4. COAL MINING

The site is not in a coal reporting area therefore no further assessment is required.

4.5. BRINE WORKINGS

The site is not situated in an area affected by brine pumping / extraction or rock salt mining.

4.6. RADON RISK POTENTIAL

The Envirocheck report indicates the site is situated in an area where less than 1% of homes are above the "Action Level" and that the BGS reports that full radon protective measures are not necessary in the construction of new dwellings or extensions.

4.7. PRELIMINARY GEOTECHNICAL ASSESSMENT

Based on the desk-study information, the following geotechnical assessment has been made:

- Given the previously developed nature of the site, it is likely there will be Made Ground fill deposits and obstructions.
- A number of historically infilled ponds are present within the site boundary, which are potential sources of alluvial deposits, silts and possible organic peat deposits in addition to potential depths of Made Ground. Investigation will be required in order to assess these and undertake in-situ geotechnical testing to determine the likely foundation solution for plots in these areas.

4.8. HYDROLOGY

Following a review of the historical and present-day mapping, a significant number of drainage ditches and ponds are located in close proximity to the site.

Surface water features within 250 m of the subject site are summarised in Table 4.4.

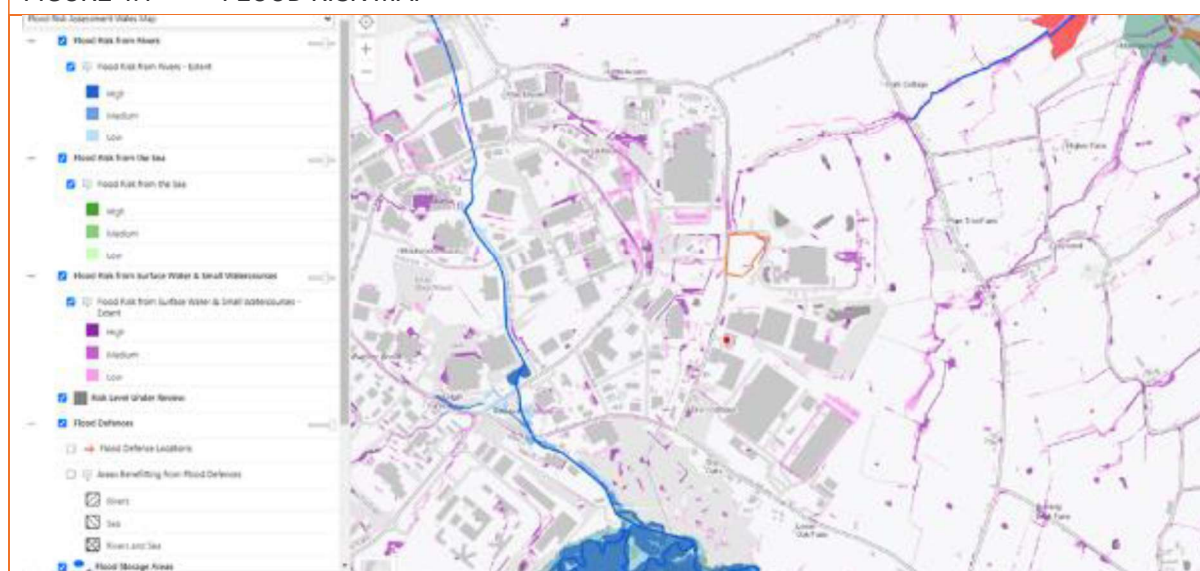


TABLE 4.4 SURFACE WATER FEATURES

SURFACE WATER FEATURE	QUALITY	DISTANCE (m)	DIRECTION
Drainage Ditch	Unknown	0 m	South
Pond	Unknown	0 m	North
Pond	Unknown	60 m	South East
Drainage Ditch	Unknown	5 m	North
Pond	Unknown	80 m	North East
Drainage Ditch	Unknown	40 m	West

The site is predominantly located within a currently defined "Flood Risk Zone 1"; defined as land assessed as having less than 1 in 1,000 annual probability of river or sea flooding (< 0.1%), and as such is considered to be unaffected by river flooding. In addition, the Envirocheck report states there is a limited potential for groundwater flooding to occur at the site. The Natural Resource Wales Flood Risk Map for the site is presented as Figure 4.1.

FIGURE 4.1 FLOOD RISK MAP



Source - <https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en>

4.9. INDUSTRIAL LAND USES

There are six entries in the Trade Directory within a 250 m radius of the site, however they are all inactive. There is also a fuel station entry 181 m southwest of the site named Certas Energy Wrexham Hgv, not used for retail.

4.10. SENSITIVE LAND USES

There are not any environmentally sensitive land uses that have been identified within close proximity to the site.



4.11. SITE SENSITIVITY ASSESSMENT

The site is assessed to be located within a “**Moderate**” sensitivity setting as discussed within Table 4.5.

TABLE 4.5 SITE SENSITIVITY ASSESSMENT

SENSITIVITY PROFILE	DISCUSSION	RATING
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not located in a Groundwater Protection Zone or Drinking Water Safeguard Zone.	Low
Distance to the Closest Groundwater Abstraction Point	The site is not located in an area where there is potable water extracted.	Low
Aquifer Classification in Superficial Drift Deposits	Superficial- Secondary Aquifer – Undifferentiated	Low
Aquifer Classification in Bedrock	The site is mainly underlain with Salop Formation bedrock (Mudstone, Sandstone and Conglomerate) which is classified as a Secondary A Aquifer; however along the eastern boundary a principal bedrock aquifer has been identified possibly entering the site in the south east corner within Kinnerton Sandstone Formation (Sandstone) bedrock.	High
Is the Site Underlain by Low-Permeability Drift to Depths in Excess of 10 m?	The underlying superficial deposits are likely to comprise gravelly and silty clay soils to depths in excess of 5 m which may reduce the potential for mobile phase contaminants to migrate towards the bedrock aquifer or adjacent watercourses	Low
Is the Site Located Within 50 m of a Surface Watercourse?	There are several surface watercourses on the site. There is a pond located 64 m west of the site	High
Sensitive Land Uses	No sensitive land uses have identified.	Low
OVERALL SITE ENVIRONMENTAL SENSITIVITY		Moderate



5. CONSULTATIONS

5.1. LANDFILL SITES AND WASTE TREATMENT SITES

There is a Licensed Waste Management Facility 72 m from the western boundary. This license is held by Waste Recycling Group Ltd and was last modified on the 8th of March 2011 and is thought to still be active, listed as receiving household waste.

5.2. REGULATORY DATABASE

The information summarised in Table 5.1 has been obtained from a commercially available environmental database. The summary table only includes records from within 250 m of the subject site and not otherwise detailed in the report.

TABLE 5.1 SUMMARY OF ENVIRONMENTAL DATA

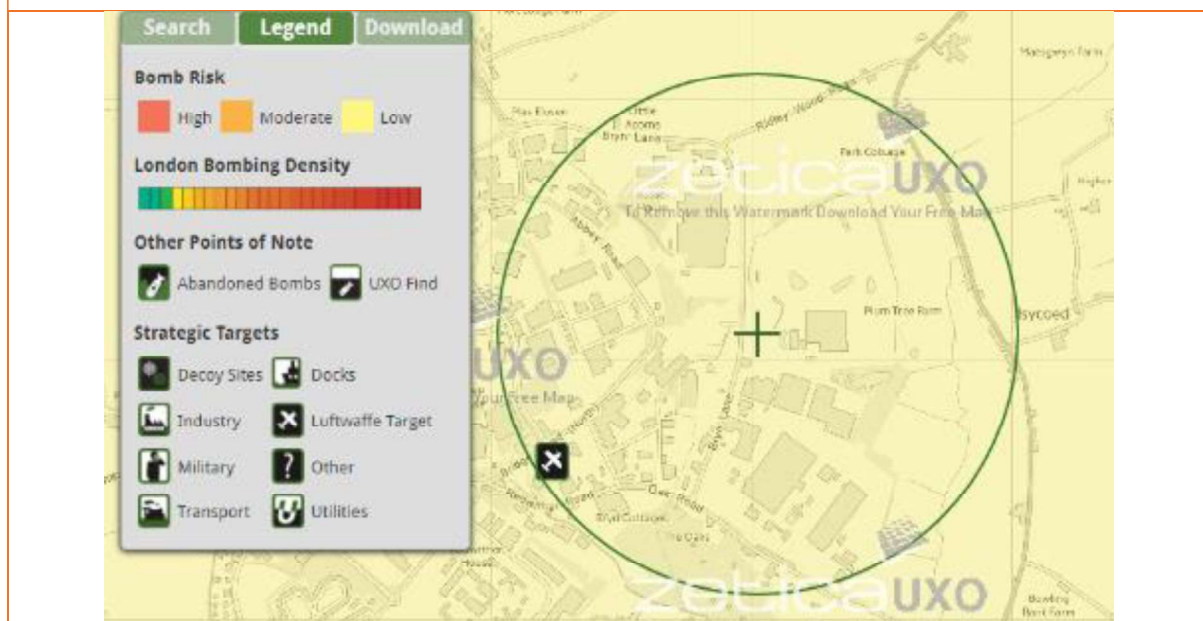
RECORD	ENTRIES WITHIN 250 m	DETAILS
Contaminated Land Register Entries and Notices	0	None Identified
Authorised Industrial Processes (IPC/IPPC/LAPPC)	0	None Identified
Fuel Stations Entries	1	181m south west of the site Certas Energy Wrexham Hgv. Bryn Lane, Wrexham Industrial Estate, Wrexham, Wrexham, LL13 9UT. Non-Retail.
Licensed Radioactive Substances	0	None Identified
Enforcements, Prohibitions or Prosecutions	0	None Identified
Discharge Consents	6	One licence belongs to Wrexham County Borough discharging sewage-final/treated effluent - not water company into a freshwater stream/river. Two licenses belong to CPL Petroleum discharging site drainage into freshwater stream/ river. The remaining three licenses have been revoked.
Pollution Incidents	0	None Identified
Consents Issued Under the Planning (Hazardous Substances) Act 1990	0	None Identified
Control of Major Accident Hazard (COMAH) Sites	0	None Identified

5.1. UNEXPLODED ORDNANCE

The regional unexploded bomb risk map from Zetica (2014) indicates that the site is in an area at low risk from possible unexploded ordnance (UXO) resulting from the Second World War. The Zetia UXO Risk Map is presented as Figure 5.1.



FIGURE 5.1 ZETICA UXO RISK MAP



Source - <https://zeticauxo.com/downloads-and-resources/risk-maps/>



5.2. INITIAL CONCEPTUAL SITE MODEL

In accordance with EA LCRM (2019) and BSI 10175 (Code of Practice for Investigation of Potentially Contaminated Land), E3P has developed an initial conceptual site model (CSM) to identify potential contamination sources, migration pathways and receptors within the study area. This is summarised within Table 5.2.

ON-SITE SOURCES OF CONTAMINATION

The following potential on-site sources of contamination have been identified:

-  Infilled ponds- Heavy metals, PAHs and ground gas.
-  Made Ground- Heavy metals, PAHs and ground gas.
-  Asbestos from former farm buildings likely contained within the made ground.

OFF-SITE SOURCES OF CONTAMINATION

The following potential off-site sources of contamination have been identified:

-  To the west of the site there is a licensed waste management facility, with a license to remove household waste, with no landfilling occurring on site.
-  To the east there is a factory with associated electrical substation, water control station and gas control station, however they are too far to have any impact on the site.



5.3. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 5.2 has been prepared for the site.

TABLE 5.2 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy Metals, non-volatile PAH (Made Ground)	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors.	Likely	High	LOW
Discussion: Heavy metals and PAH are considered likely due to Made Ground from historical development on the site as a farm. This may pose a short-term risk to construction workers, who may come into contact with impacted soils during earthworks. All construction works must be undertaken using the appropriate Personal Protective Equipment (PPE) to remove this potential risk.						
Recommendation: Intrusive investigation required to confirm the conceptual site model.						
PL3	ACM in Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Likely	High	LOW
Assessment: ACM is considered a possibility due to the age of the buildings that were present on the site that were later demolished and the presence of made ground. This may pose a risk to on-site and off-site future users who may come into contact with fibres. These risks can be mitigated through the development of a detailed enabling works strategy following guidance and protocol specified within the Control of Asbestos Regulations (2012) and industry best practice as detailed in C18A733 (Asbestos in Soil and Made Ground: A guide to understanding risk).						
Recommendation: Intrusive investigation required to confirm the conceptual site model. Construction works completed with PPE and provision of welfare.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Volatile Contaminants such as hydrocarbons, solvents (Made Ground)	Inhalation of vapours. Migration through permeable strata and preferential pathways.	Future site users. Off-site receptors.	Low Likelihood	Low	To be determined
Assessment: Low probability as significant sources of volatile contamination not identified, however the presence of made ground may provide a source. Leakages/spillages of volatile contamination are not considered possible due to the nature of farm processes.						
Recommendation: Intrusive investigation required.						
PL4	Methane, carbon dioxide (potentially infilled features on and within 250 m of the site)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Likely	Moderate	To be determined
Assessment: Likely due to the presence of infilled ponds within the site boundary. Infilled features are likely to contain unknown made ground characteristics. Glacial till will likely restrict migration of any ground gas into shallow foundations which may reduce the risk to end users.						
Recommendation: Gas monitoring required to determine gas risk.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL5	Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds (Made Ground)	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (Principal bedrock aquifer and Secondary A aquifer). Surface water Drainage Ditches.	Low Likelihood	Low	To be determined
Assessment: Low likely probability as significant sources of mobile contamination identified is not anticipated. Leakages/spillages are considered unlikely of mobile contamination are considered possible. Glacial till across the site may reduce downward migration into the underlying bedrock aquifer. No evidence of spills recorded within 250 m of the site.						
Recommendation: Sampling of groundwater and surface water required. Intrusive investigation required to confirm the conceptual site model.						
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Likely	Moderate/Low	Low
Assessment: Likely probability due to presence of Made Ground on site. Elevated sulphates may increase the chance of a sulphate attack and foundations.						
Recommendation: Intrusive investigation required to confirm the conceptual site model.						
PL7	Organic contaminants such as hydrocarbons (Made Ground)	Ingestion of tainted water supply.	Future site users. Water pipes.	Low Likelihood	Moderate	To be determined
Assessment: Low likelihood probability as significant contamination not anticipated at pipeline depth across the west of the site (0.75–1.35 m).						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
Recommendation: Intrusive investigation required.						

Main exposure pathways:

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation, PL4 = Vapour/Gas Inhalation; PL5 = Vertical / Lateral Migration; PL6 = Corrosion of concrete; PL7=Tainting of water supply



6. CONCLUSIONS AND RECOMMENDATIONS

6.1. SITE SUMMARY

Current Site Use	The subject site is an irregular shaped parcel of land located to the east of Wrexham industrial park and is currently unused parcel of land.
Historical Site Use	A review of the pertinent Ordnance Survey mapping suggests that the site comprised of agricultural land with ponds and farms buildings present in the centre that extend to the south noted as Upper Bryn Farm and Byrn Mawr respectively in 1961. Circa 1972-1974 the area in the north east of the site has been excavated to enlarge the pond with an embankment formed around the perimeter Several of the buildings were associated with Upper Bryn Farm were later demolished in 1982, with all the buildings present on the site being fully demolished by 2006. No changes occur on-site from 2006 until circa 2021.

6.2. CONTAMINATED LAND ASSESSMENT

Human Health	Made Ground may be present in the infilled pond recorded on-site and around the hardstanding due to the historic buildings previously on the site. The made ground provides a risk of containing heavy metals, PAHs and asbestos.
Controlled Waters	There are several drainage ditches on the site that flow into the River Dee. The site is underlain by a principal and secondary A bedrock aquifer but these may be afforded protection by overlying Glacial Till.
Ground Gas	The made ground present on-site from previous development, infilled ponds and the Waste Management Facility 72 m west of the site also being present on the site there is a likelihood of ground gas.
Potable Water	Off-site infilled ponds are only considered to be a low-potential source of ground gas due to the likely presence of low-permeability drift deposits.



6.3. GEOTECHNICAL ASSESSMENT

Geological	Significant thicknesses of cohesive drift deposits are anticipated.
Civil and Structural	Historical development relict farm building structures. Imagery from google maps has identified a slope of 2-3m from the grassed area in the north to the area of hardstanding in the south. The site has a gentle slope on the grassed western boundary roughly 2-3m. Along the eastern boundary, there is a steep embankment from the drainage ditch. A manhole is present in the centre of the site in the north-eastern corner of the hardstanding which indicates the presence of utility infrastructure which may require diverting. There are several surface drainage ditches within the site which are thought to eventually flow into the River Dee.
Abnormal Foundations	Where Made Ground is found at greater depth any future foundations may require a specialist engineered solution. This is likely in the south of the site where former development has taken place.

END OF REPORT



APPENDIX I

LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



APPENDIX II

GLOSSARY

TERMS

ACM	Asbestos-containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Above-ground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
CA	Coal Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate-phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi-volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibro-concrete column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme



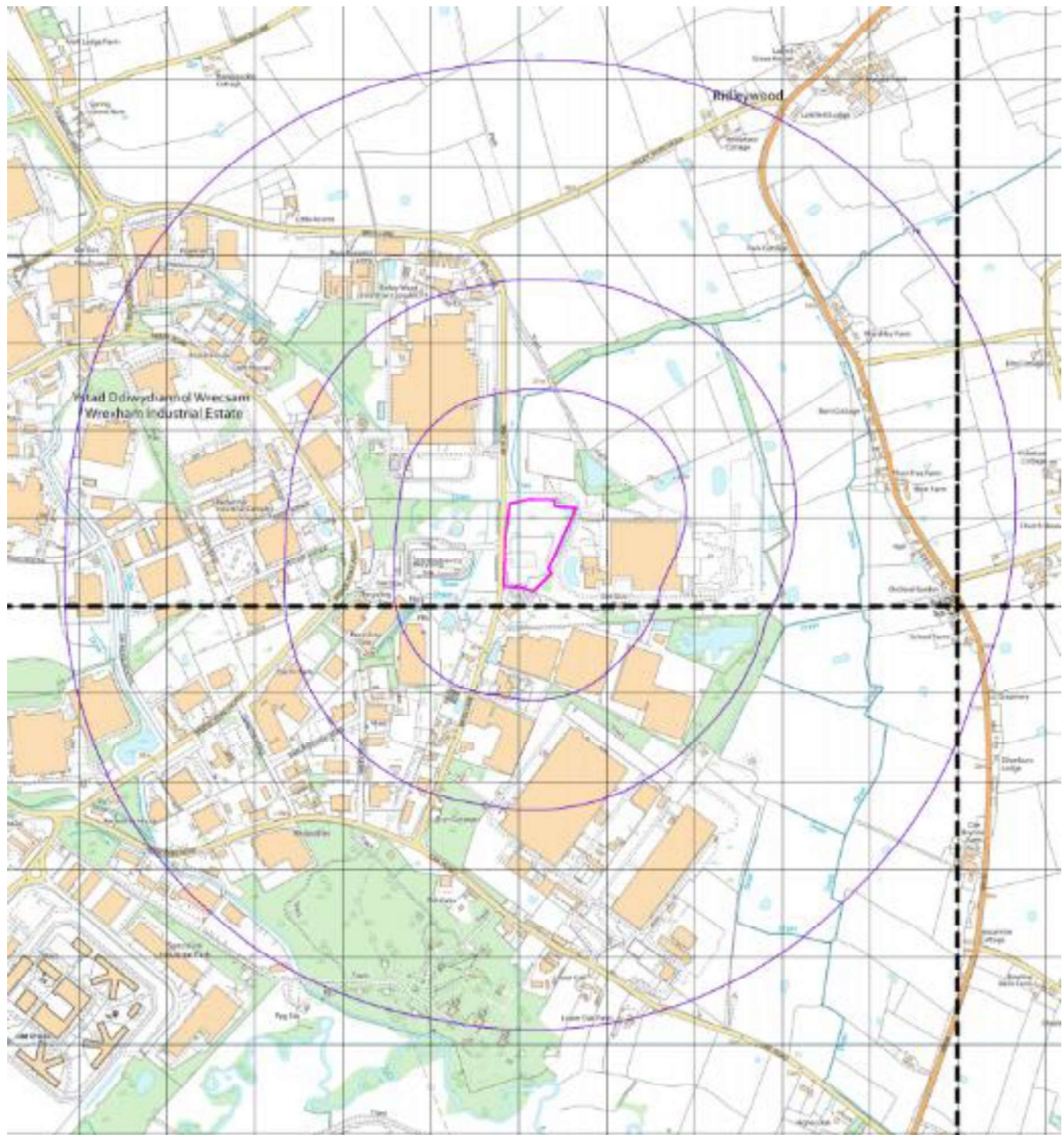
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection



APPENDIX III

DRAWINGS

DRAWING 14-892-001 – SITE LOCATION PLAN





APPENDIX IV

PHOTOGRAPHS

PLATE 1 SOUTH OF THE SITE – 2-3 m LOWER IN ELEVATION



PLATE 2 DRAINAGE DITCH ALONG THE EASTERN BOUNDARY

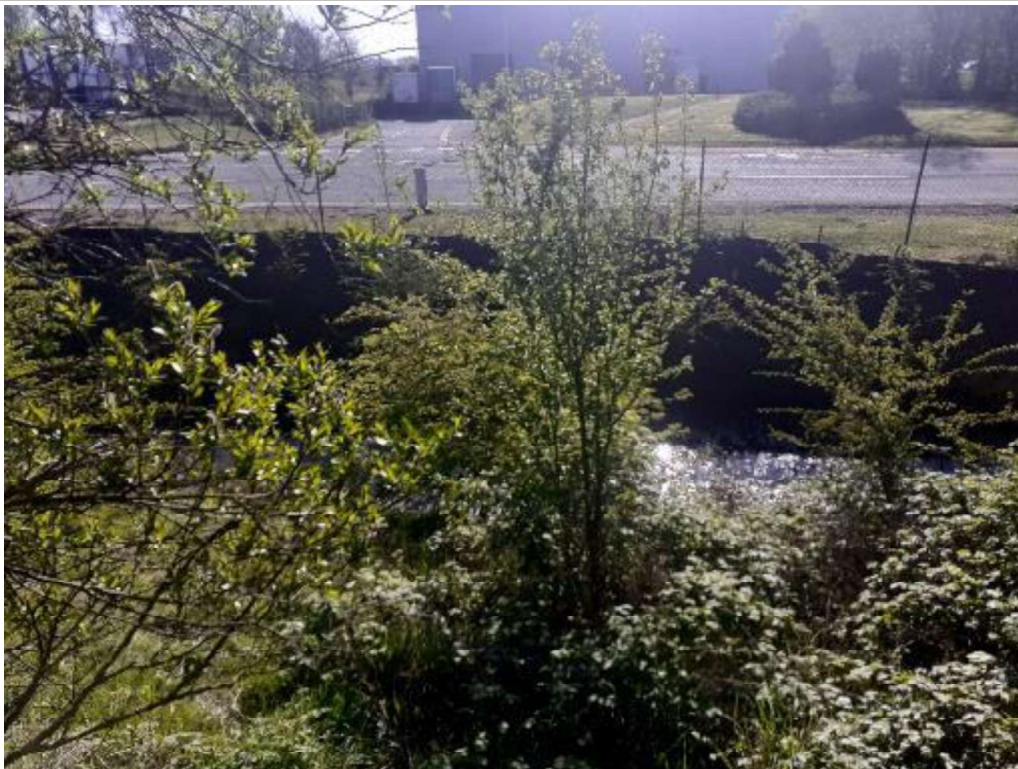


PLATE 3 VIEW OF THE SITE FACING SOUTH



PLATE 4

MANHOLE IN THE NORTH EAST CORNER OF THE HARDSTANDING



PLATE 5 VIEW OF THE SITE FACING NORTH



PLATE 6 POSSIBLE ACCESS TO SITE FROM BRYN LANE



APPENDIX V

HISTORICAL MAPS

Mapping Type	Scale	Date	Page
Denbighshire	1:2,500	1873	2
Denbighshire	1:2,500	1899	3
Denbighshire	1:2,500	1911	4
Denbighshire	1:2,500	1961	5
Ordinance Survey Plan	1:2,500	1972 - 1974	6
Ordinance Survey Plan	1:2,500	1982 - 1990	7
Additional SLMs	1:2,500	1987 - 1990	8
Additional SLMs	1:2,500	1989	9
Additional SLMs	1:2,500	1990	10
Ordinance Survey Plan	1:2,500	1992	11
Large-Scale National Grid Data	1:2,500	1992	12
Large-Scale National Grid Data	1:2,500	1993 - 1994	13
Large-Scale National Grid Data	1:2,500	1994	14
Large-Scale National Grid Data	1:2,500	1995	15
Historical Aerial Photography	1:2,500	2000	16

Quarry		Gravel Pit		Sand Pit	
Clay Pit		Single		Refuse Heap	
Sloping Masonry					Flat Rock

Order Number: 277102068_1_1
Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040.350150

One Details
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WREXHAM. LL13 9UT



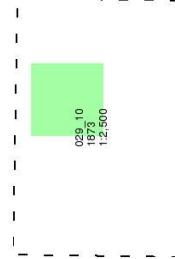
Denbighshire

Published 1873

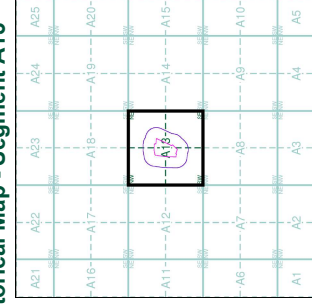
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The historical maps shown were reproduced from maps predominantly held at the time adopted for England, Wales and Scotland in the 1840s. In 1854 the Ordnance Survey began producing maps for Wales and Scotland, and in 1861 the 2,500 scale maps were adopted for mapping to be the illustrated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938 all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number: 277102068_1_1
Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

Site Details

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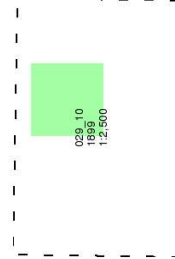
Denbighshire

Published 1899

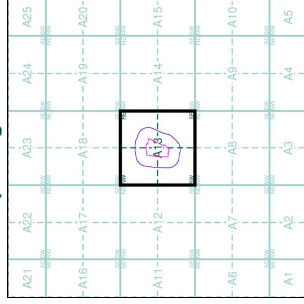
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the time adopted for England, Wales and Scotland in the 1840s. In 1854 the Ordnance Survey began mapping the area of Denbighshire and in 1861 it covered the whole of Wales. The maps were compiled by the Ordnance Survey of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938 all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number: 277102068_1_1
Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

Site Details

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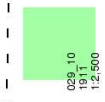
Denbighshire

Published 1911

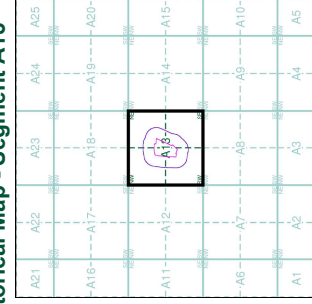
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The historical maps shown were reproduced from maps predominantly held at the time adopted for England, Wales and Scotland in the 1840s. In 1854 the Ordnance Survey began producing maps for Wales and in 1861 it began the 2500 scale maps which were used to create the Ordnance Survey map of Britain. The published date given below is often some years later than the surveyed date. Before 1938 all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13

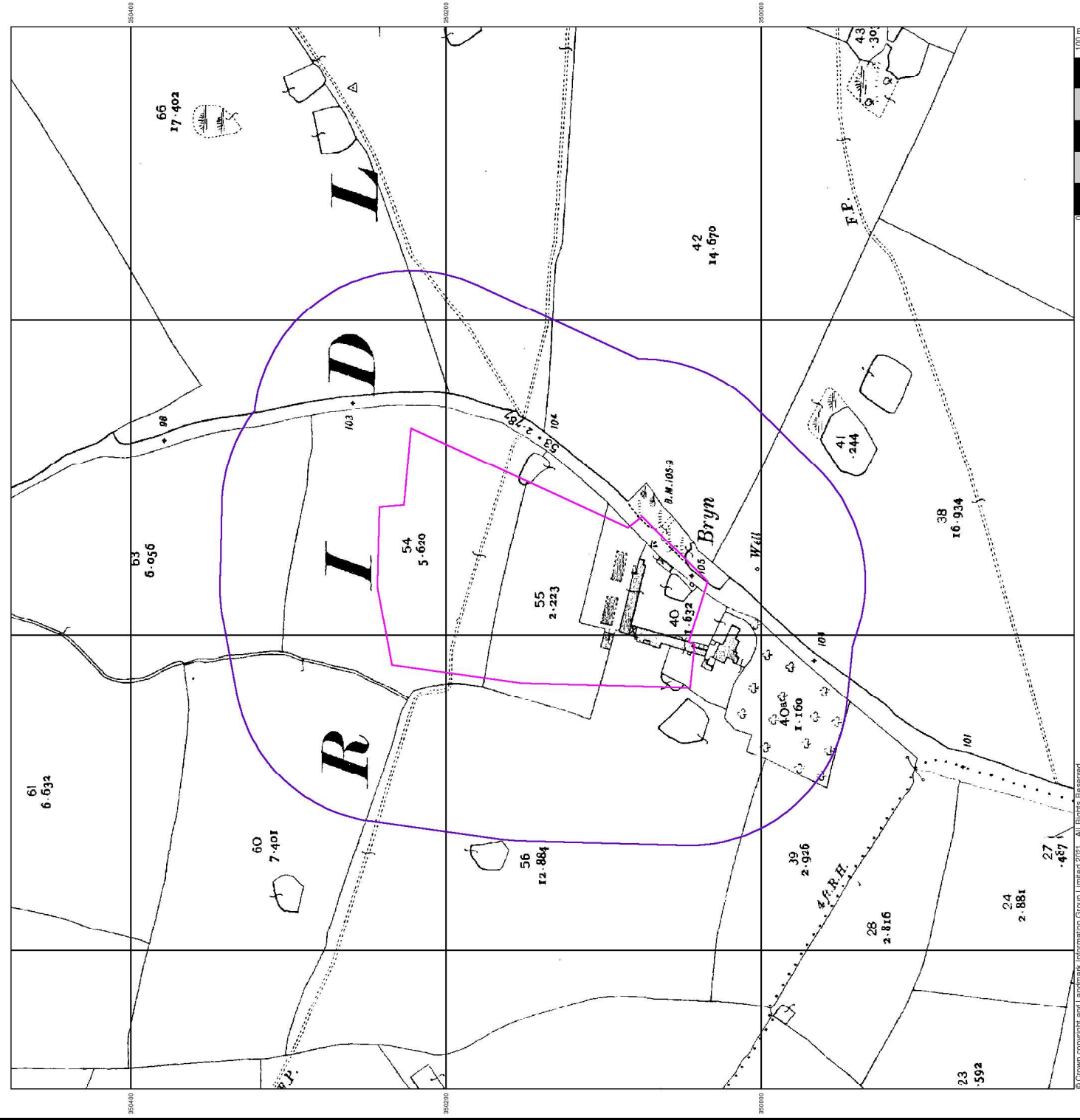


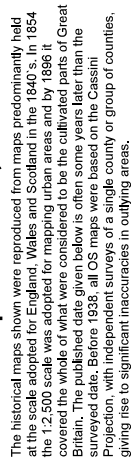
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Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

Site Details

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[illegible]

A 5x5 grid of points labeled A1 through A25. A central point A13 is highlighted with a thick black square and a purple circle. The grid is labeled with A21, A22, A23, A24, A25 on the top and A1, A2, A3, A4, A5 on the bottom. The left side is labeled with A16, A17, A18, A19, A20 and the right side with A11, A12, A13, A14, A15.

Site Details
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Ordnance Survey Plan

Published 1972 - 1974

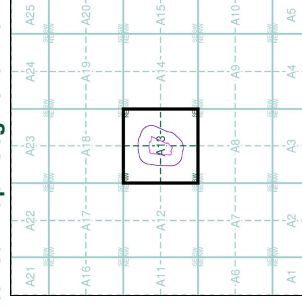
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The historical maps shown were reproduced from maps predominantly held at the time adopted for England, Wales and Scotland in the 1840s. In 1854 the OS adopted the Cassini projection for mapping in Great Britain. In 1861 it created the single sheet system of mapping to be the standard for Great Britain. The published date given below is often some years later than the surveyed date. Before 1938 all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

SJ3850	SJ3950
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12,500	12,500
SJ3849	SJ3949
1972	1972
12,500	12,500

Historical Map - Segment A13



Order Details

Order Number: 277102068_1_1
Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

Site Details

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Additional SIMs

Published 1982 - 1990

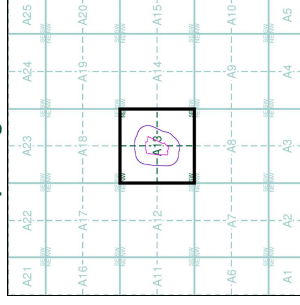
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in 1982. The main editions are an aerial photograph from 1947 to 1984, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SJ3850	SJ3950
1982	1990
12,500	12,500
SJ3849	SJ3849
1988	1988
12,500	12,500

Historical Map - Segment A13



Order Details

Order Number: 277102068_1_1
Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

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Additional SIMs

Published 1987 - 1990

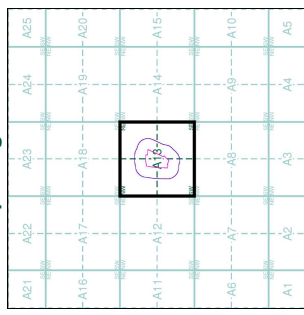
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions of the series. The first data was from 1947 to 1984, and contains detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

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1:2,500	
SJ3849	1988
1:2,500	
SJ3849	1990
1:2,500	

Historical Map - Segment A13



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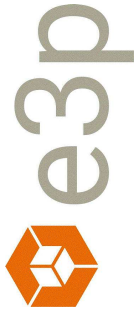
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National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

Site Details

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Additional SIMs

Published 1989

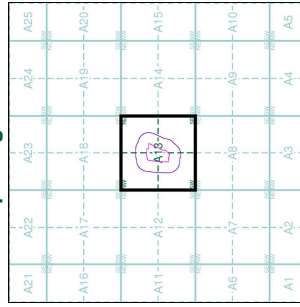
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The SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in 1989. The main editions are the 'A' series, first published in 1947 to 1984, and contain detailed information on buildings, roads, and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

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Historical Map - Segment A13



Order Details

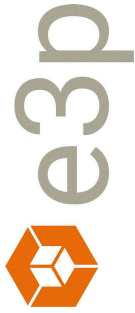
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Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

Site Details

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Additional SIMs

Published 1990

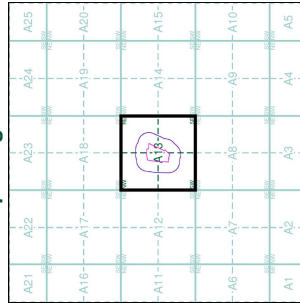
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The SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in 1990. The main editions are the 1:25,000 scale maps, first published in 1947 to 1994, and contain detailed information on buildings, roads, and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

---	---
SJ08850	1990
1:2,500	---
---	---
SJ08449	1990
1:2,500	---
---	---

Historical Map - Segment A13



Order Details

Order Number: 277102068_1_1
Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

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Ordnance Survey Plan

Published 1992

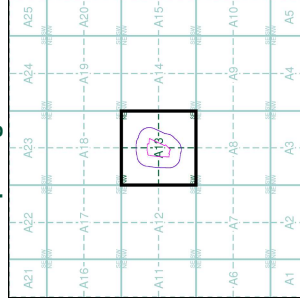
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the Ordnance Survey, which were adopted for England, Wales and Scotland in the 1840s. In 1854 the 2,500 scale maps were reissued and reprojected to the datum of 1936. It is noted that the published date given below is often many years later than the surveyed date. Before 1938 all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

SJ3850	1992	12,500
SJ3950	1992	12,500
SJ3849	1992	12,500
SJ3949	1992	12,500

Historical Map - Segment A13



Order Details

Order Number: 277102068_1_1
Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

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Published 1992

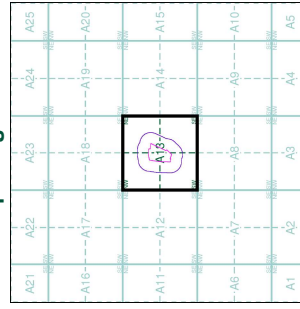
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'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SJ3850	SJ3950
1992	1992
12,500	12,500
SJ3849	SJ3949
1992	1992
12,500	12,500

Historical Map - Segment A13



Order Details

Order Details

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National Grid Reference:	339040, 350150
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Search Buffer (m):	100

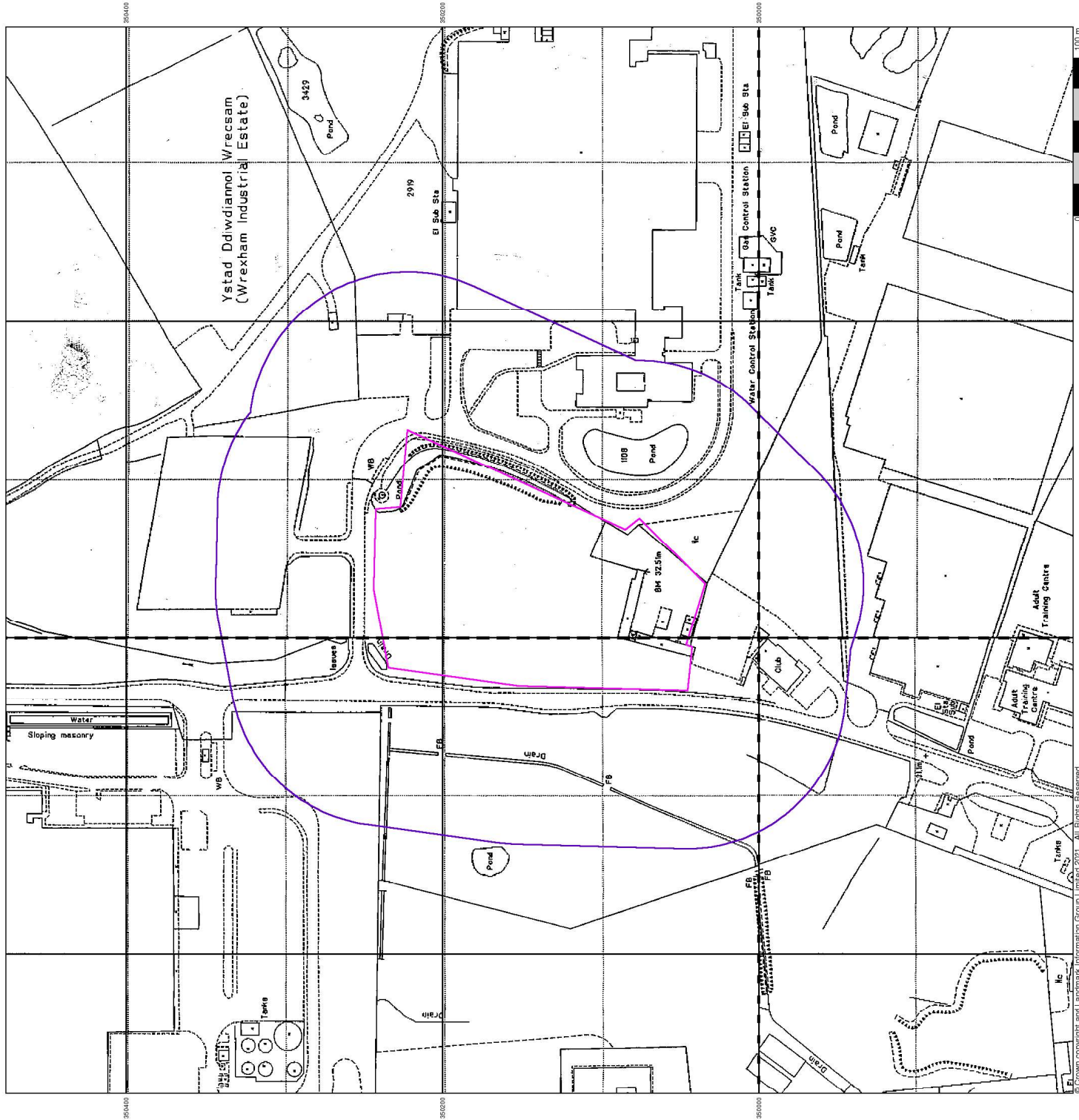
Site Details

Site Details
Graffers Ltd, Unit 6, Bryn Lane, Wrexham Industrial Estate,
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Published 1993 - 1994

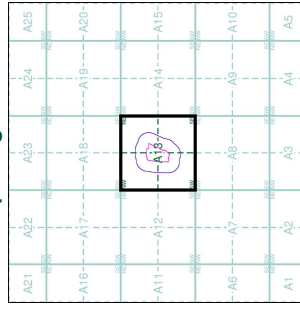
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'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SJ3850	1993	1:2.500
SJ3849	1994	1:2.500

Historical Map - Segment A13



Order Details

Order Details:
Order Number: 277102068_1_1
Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150

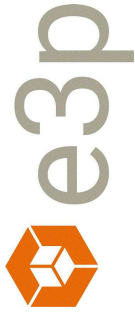
National Grid Reference:	3390
Slice:	A
Site Area (Ha):	2.38
Search Buffer (m):	100

Site Details

Site Details
Graffers Ltd, Unit 6, Bryn Lane, Wrexham Industrial Estate,
WREXHAM, LL13 9UT

Landmark®
INFORMATION GROUP

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



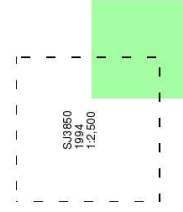
Large-Scale National Grid Data

Published 1994

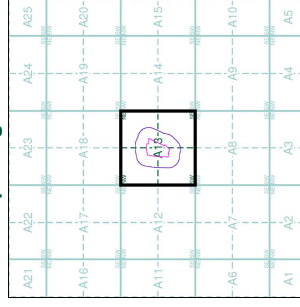
Source map scale - 1:2,500

Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the forerunners of digital mapping and so provide detailed information on the land and its features but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

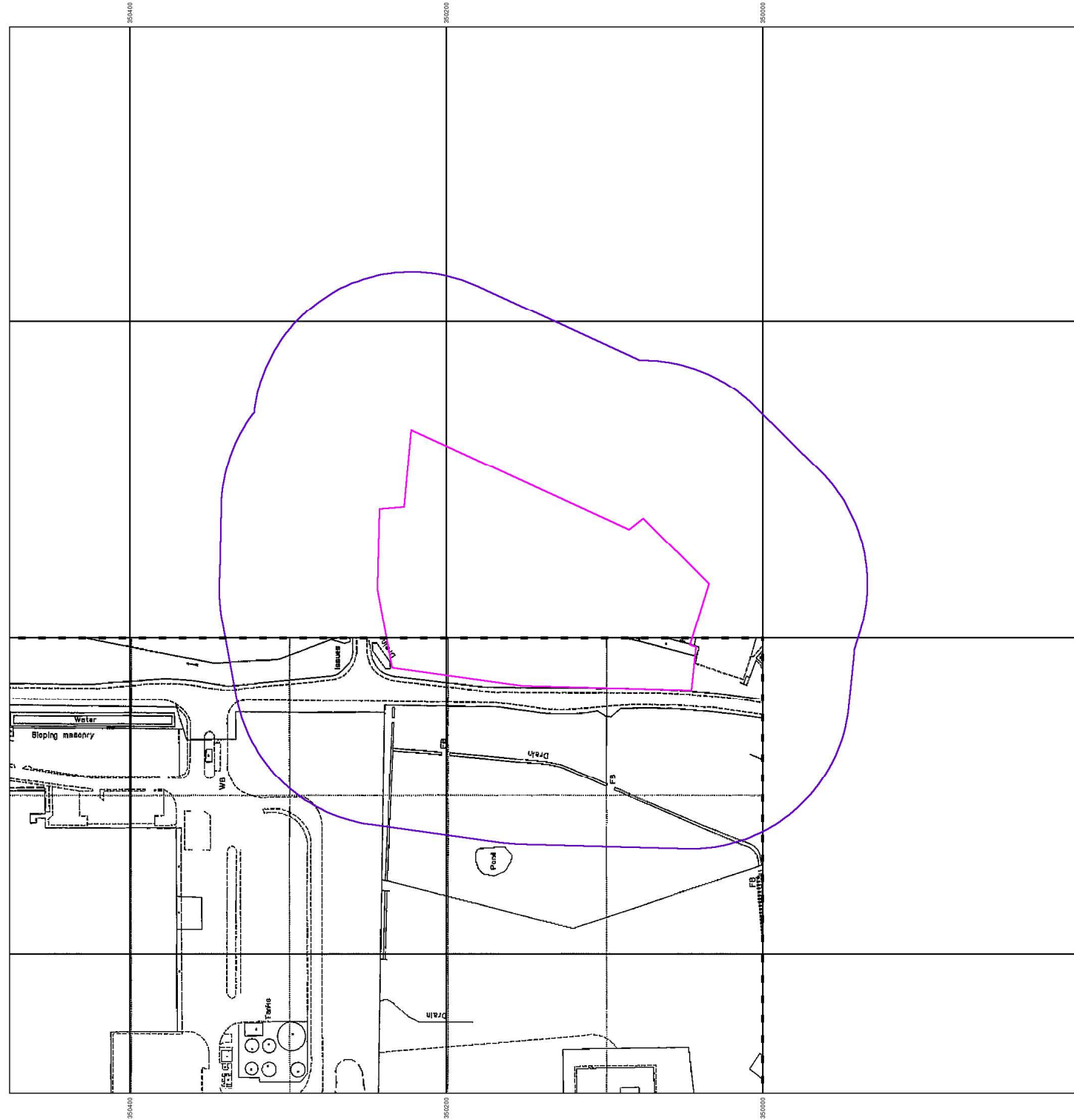
Order Number: 277102068_1_1
Customer Ref: 14892 Bryn Lane
National Grid Reference: 339040, 350150
Slice: A
Site Area (Ha): 2.38
Search Buffer (m): 100

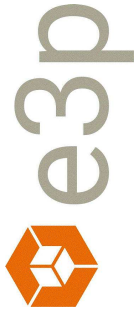
Site Details

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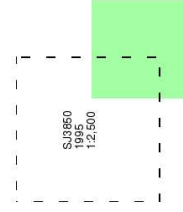
Large-Scale National Grid Data

Published 1995

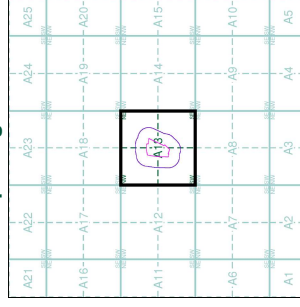
Source map scale - 1:2,500

Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the first units of digital mapping and so provide detailed information on the land and its features, but tend to show topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

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