

CONTRACT NO. E13353/1

PRELIMINARY RISK ASSESSMENT REPORT
FOR A PROPOSED UNIT AT RIVERSIDE
INDUSTRIAL ESTATE, LITTLEHAMPTON

Prepared by
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BGS Borehole Records	Enclosure B	(5 pages)
Hydrology, Hydrogeology, Site Sensitivity & Flood Risk	Enclosure C	(6 pages)
Environmental Database	Enclosure D	(122 pages)
Historical Maps	Enclosure E	(8 pages)

Generic List of Acronyms and Abbreviations

µg/kg	micrograms per kilogram
µg/l	micrograms per litre
ACEC	aggressive chemical environment for concrete
ACM	asbestos containing material
AOD	above Ordnance datum
bgl	below ground level
BGS	British Geological Survey
BH	borehole
BTEX	benzene, toluene, ethylbenzene and xylene compounds
CBR	California bearing ratio
CH ₄	methane
CIRIA	Construction Industry Research and Information Association
CLR	Contaminated Land Report
CO	carbon monoxide
CO ₂	carbon dioxide
COMAH	control of major accident hazards
CPT	cone penetration test
CSM	conceptual site model
DEFRA	Department of Environment, Food and Rural Affairs
DoE	Department of Environment (now part of DEFRA)
DP	dynamic probe
DPSH	dynamic probe super heavy
DQRA	detailed quantitative risk assessment
DS	design sulphate class
DWS	drinking water standard
EA	Environment Agency
EHO	Environmental Health Officer
EQS	environmental quality standard
FRA	flood risk assessment
GAC	generic assessment criteria
GPR	ground penetrating radar
GPS	global positioning systems
GQRA	generic quantitative risk assessment
GW-TV	groundwater threshold value
ha	hectare
H ₂ S	hydrogen sulphide
HPA	Health Protection Agency (now PHE)
HSE	Health and Safety Executive
IPPC	Integrated Pollution Prevention and Control

LAPPC	Local Authority Pollution Prevention and Control
LNR	Local Nature Reserve
mb	millibar
MAGIC	Multi Agency Geographical Information for the Countryside
MCERTS	Monitoring Certification Scheme
mg/kg	milligrams per kilogram
mg/l	milligrams per litre
NIEA	Northern Ireland Environment Agency
NGR	National Grid Reference
O ₂	oxygen
OS	Ordnance Survey
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PFS	petrol filling station
PID	photo ionisation detector
PHE	Public Health England
PPE	personal protective equipment
PRA	preliminary risk assessment
SAC	Special Area of Conservation
S4UL	Suitable For Use Level
SEPA	Scottish Environment Protection Agency
SGV	soil guideline value
SOM	soil organic matter
SPA	Special Protection Area
SPT	standard penetration test
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SVOCs	semi-volatile organic compounds
TOC	total organic carbon
TP	trial pit
TPH	total petroleum hydrocarbons
TPO	Tree Preservation Order
UKAS	United Kingdom Accreditation Service
UXO	unexploded ordnance
UST	underground storage tank
VOCs	volatile organic compounds
WAC	Waste Acceptance Criteria
WFD	Water Framework Directive
WHO	World Health Organisation
WS	window sampling borehole

PRELIMINARY RISK ASSESSMENT REPORT FOR A PROPOSED UNIT AT RIVERSIDE INDUSTRIAL ESTATE, LITTLEHAMPTON

Executive Summary

Objective of Report	To carry out a preliminary risk assessment (PRA) in accordance with the risk assessment framework presented in CLR11, in order to assess whether the area is potentially contaminated or whether there are other potential geo-environmental liabilities.
Site Description	The site covers about 0.13 hectares and is occupied by a car park adjacent an industrial unit with an area of landscaping along the north-western boundary of the site.
Proposed Development	The existing car park is to be redeveloped to comprise a new industrial unit with a goods yard and a smaller car park.
Geology	BGS mapping indicates the site to be underlain by superficial Raised Marine Deposits (clay, silt, sand and gravel), over bedrock geology of Undifferentiated Chalk Formation. BGS boreholes located close to the site encountered about 2.2-3.5m of silty clay overlying weathered chalk.
Hydrology	The nearest surface water feature to the site is a drainage ditch located adjacent the northwest boundary which flows into the River Arun about 250m to the south.
Hydrogeology	The Raised Marine Deposits are classified as a Secondary A aquifer, whilst the underlying chalk is classified as a Principal Aquifer. Three licenced water abstractions are located within 1km of the site, however none of these are for public supply.
Major Ecological Receptors	None within 1km of the site.
Flood Risk	The site lies within a low risk area with respect to flooding from rivers and the sea and a very low risk area with respect to surface water flooding from rainfall.
Brief Site History	The site formed part of a field until the early 1970's when travelling cranes (associated with a pre-cast concrete works to the south), were located in its eastern section. By the early 1980's the Riverside Industrial Estate had been constructed and the site had taken its present day form as an area of hardstanding / car parking.
Mineral Extraction	The site is not located within a Coal Mining Area and the desk study research has not identified any evidence of mineral extraction in the site locality. It is therefore considered unlikely that subsidence due to mineral extraction could affect the proposed development.
Initial CSM	The contaminant–pathway–receptor linkage could potentially be completed for this site with respect to human health, the development end use and controlled waters as a result of on- and off-site sources of contamination.
Soil Gas	Made ground beneath the site (if present) and nearby historic landfilling are potential sources of soil gas and a gas monitoring regime is recommended. The site is located within an intermediate radon area (1-3% of homes affected); however, maps produced by the Building Research Establishment (BRE) indicate that no radon protective measures are considered necessary.
Preliminary Geotechnical Assessment	Proposed foundation loads are not known at the present time. However, given the reported presence of near surface soft and firm clay with a relatively high groundwater table, conventional shallow foundations may not be feasible. An intrusive investigation is recommended to provide quantifiable data for foundation design.
Summary of main risk items	A summary of the main risk items identified by the PRA is included in Section 9.0. This is not exhaustive and should be read in conjunction with the main text of the report.
Limitations	The limitations of this report are highlighted in Section 10.0.

1.0 INTRODUCTION

DTS RAEBURN Limited were commissioned by Pegasus Group on behalf of L&C Commercial Limited to carry out a preliminary risk assessment (PRA) at Riverside Industrial Estate, Littlehampton. It is understood that the existing car park is to be redeveloped to comprise a new industrial unit with a goods yard and smaller car park.

The principal objective of the PRA was to assess whether the land is potentially contaminated or whether there are other potential geo-environmental liabilities. These could include, but are not limited to, subsidence hazards due to shallow mining, the generation or migration of soil gas to beneath the site and other geotechnical abnormalities.

The PRA has been prepared in accordance with the risk assessment framework presented in CLR11 'Model Procedures for the Management of Land Contamination' (DEFRA and EA, 2004).

The environmental aspects of the PRA have been prepared utilising a risk-based approach and incorporating the accepted 'pollutant linkage' approach to contaminated land hazard identification (i.e. contaminant–pathway–receptor linkage). This approach is consistent with methodologies contained in both CLR11 and Part IIA of the Environmental Protection Act 1990. The latter was introduced by Section 57 of the Environment Act 1995, which came into force in England and Wales in April 2000.

The scope of the PRA included a desk study and site reconnaissance, which comprise the minimum information required for sites where contamination is either known or suspected. The PRA has also been designed to fulfil the objectives of a 'preliminary investigation' as defined by BS10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites – Code of Practice'.

The following information has been used to formulate the PRA report:

- ✦ Site walkover survey carried out on 11th June 2020
- ✦ Historical OS maps supplied by Landmark Information Group Limited
- ✦ Site specific BGS GeoIndex Report
- ✦ Environmental database information prepared by Landmark Information Group Limited
- ✦ Correspondence with Local Authorities and other Statutory Agencies

2.0 SITE AND SURROUNDING AREA

2.1 Site Location

The site is centred on NGR 501754, 102560 and plans showing the site location are included as Figures 1 and 2.

2.2 Site Description

A photographic record of the site walkover is presented as Plates 1 to 6. A plan showing the layout of the site and the immediate surrounding area, together with the orientations of the photographs, is included as Figure 3.

The site is roughly triangular in shape and covers an area of about 0.13 hectares. It is generally flat and largely occupied by a concrete surfaced car park used by the neighbouring industrial units. The surface of the concrete was in poor condition in some areas with evidence of repair work.

The eastern boundary of the site is formed by an industrial unit approximately 6m in height. The site is bounded to the north-west by an area of landscaping with a drainage ditch about 1m lower than the site (dry during the site walkover in June 2020). Beyond the drainage ditch there is an embankment within the landscaping that rises to Bridge Road, situated about 2-3m above the site level. A number of mature deciduous trees were observed within the landscaping (over 15m in height), and there were a few areas of fly tipping.

The north and northwest boundaries of the site are fenced off by a 2.3m high palisade fence and a 2.0m high chain-link fence respectively.

2.3 Ecology/Invasive & Injurious Plant Species

Detailed ecological and arboricultural surveys were outside the scope of this report. However, no Japanese Knotweed or other injurious or invasive weeds were observed within or immediately adjacent to the site at the time of the reconnaissance.

2.4 Surrounding Area

The site is bounded to the east by an industrial unit, to the south by an access road and further car parking with industrial units beyond, and to the north and west by an area of landscaping with Bridge Road beyond. The site forms part of the Riverside Industrial Estate.

2.5 Proposed Development

Under the current development proposals (Figure 4), the existing car park is to be redeveloped to comprise a new industrial unit of about 500m² plan area with a goods yard and a car park with 16no. car parking spaces.

3.0 GEO-ENVIRONMENTAL SETTING

3.1 Topography

A topographical survey provided to DTS by Pegasus Group, shows that the site gently falls from north to south from about 2.8m AOD to about 2.55m AOD respectively.

3.2 Geological Setting

3.2.1 BGS Mapping

The geology of the site and surrounding area is shown by a BGS GeoIndex Report, which is included as Enclosure A. This indicates the site to be underlain by superficial Raised Marine Deposits (clay, silt, sand and gravel), overlying bedrock geology of Undifferentiated Chalk Formation.

3.2.2 BGS Borehole Records

The BGS database includes records of two boreholes drilled adjacent north of the site in 1968, prior to construction of Bridge Road. The full records are included as Enclosure B, together with a plan showing their locations.

The succession of strata encountered in the boreholes comprised:

- Topsoil over silty / sandy clay to about 2.2 – 3.5m bgl
- Weathered Chalk

Groundwater was encountered during drilling between about 1 and 2m bgl.

3.3 Hydrology, Hydrogeology and Site Sensitivity

Site sensitivity information provided by Landmark Information Group is discussed in the following sub-sections and presented in Enclosure C.

3.3.1 Hydrology

The nearest surface water feature to the site is a drainage ditch located adjacent the northwest boundary. This flows into the River Arun about 250m to the south.

3.3.2 Hydrogeology

The Raised Marine Deposits are classified as a Secondary A aquifer, whilst the underlying Chalk Formation is classified as a Principal Aquifer.

Reference to an environmental database (Enclosure D) indicates a number of licenced surface water abstractions located within 1km of the site, which are tabulated within Table 3.2. None of the abstractions are for public supply and the site is not located within 1km of a groundwater SPZ.

Table 3.2 Details of licenced groundwater abstractions

Distance and Direction from Site	Details
258m southeast	Single abstraction point (River Arun Estuary) – General Washing / Process Washing
335m south	River or stream reach (Ryebank Rife and Elmer Rife) – Spray Irrigation
383m south	River or stream reach (Ryebank Rife) – Spray Irrigation

3.3.3 Major Ecological Receptors

There are no major ecological receptors¹ within 1km of the site.

3.3.4 Flood Risk

The site is located within a low risk area with respect to flooding from rivers and the sea. This means that each year this area has a chance of flooding of between 0.1% and 1% and takes into account the effect of any flood defences in the area.

The site is located within a very low risk area with respect to surface water flooding from rainfall. This means that each year this area has a chance of flooding of less than 0.1%.

3.4 Summary

The site is considered sensitive with respect to controlled waters given the Secondary A and Principal aquifer status of the underlying superficial geology and bedrock respectively and the proximity of surface water features.

The site is not considered sensitive to major ecological receptors due to the absence of such features within 1km and is not considered to be at significant risk of flooding.

4.0 SITE HISTORY

The site history has been deduced primarily from a review of historical OS maps obtained from Landmark Information Group, supplemented by additional research where necessary.

¹ As listed in Table A of Annex 3, DEFRA Circular 01/2006: Environmental Protection Act 1990: Part 2A – Contaminated Land, September 2006.

4.1 Historical Maps and Plans

Table 4.1 summarises the previous uses of the site and surrounding area as identified in maps dated between 1876 and 2020. Copies of the maps referenced in the table are included in Enclosure E. Any identified uses of the site and the surrounding area that are considered potentially contaminative are shown in ***bold italics***. The distances and directions from the site stated in the table below are approximate.

Table 4.1 Review of Historical Maps

On-site	Surrounding area
1876 (1:2,500)	
The site is undeveloped and comprises part of a field.	The site is surrounded in all directions by fields and there is a <i>railway line</i> located 200m to the northeast.
1911 (1:2,500)	
No significant changes are apparent.	Loading stages and wharfs are identified on the northern bank of the River Arun 250m to the southeast.
1962 (1:10,000)	
No significant changes are apparent.	Bridge Road and associated <i>embankments</i> have been constructed adjacent north and west of the site.
1970 (1:2,500)	
No significant changes are apparent.	There is a <i>pre-cast concrete works</i> located 100m south, an <i>asphalt works</i> and <i>electricity substation</i> located 200m southeast, a <i>coal yard, tanks</i> and <i>hoppers</i> are identified 250m southeast by the river bank, and there is a <i>carriage shed</i> and <i>engineering works</i> located 200m northeast adjacent the railway.
1974 (1:2,500)	
A 'travelling crane' associated with the <i>pre-cast concrete works</i> is shown in the eastern section of the site.	The travelling crane extends outside the site boundary to the north-east and southwest. The <i>pre-cast concrete works</i> has been extended to the southern boundary of the site. An <i>industrial estate</i> is identified 250m to the northeast.
1984 (1:2,500)	
The travelling crane has been demolished and the site is now occupied by hardstanding associated with the Riverside <i>Industrial Estate</i> .	The concrete works to the south of the site has been demolished. The Riverside <i>Industrial Estate</i> has been developed to the south and east of the site. There is an <i>industrial unit</i> forming the eastern boundary of the site.
1991 (1:2,500)	
No significant changes are apparent.	Riverside <i>Industrial Estate</i> has been developed into its present day layout
2020 (1:10,000)	
No significant changes are apparent.	No significant changes are apparent.

Copies of other 1:2,500 and 1:10,000 scale maps dated between 1879 and 2006 have also been consulted but these do not reveal any further information regarding the site or its immediate environs and have therefore not been reproduced within this report.

4.2 Summary

The site formed part of a field until the early 1970's when a travelling crane (associated with a pre-cast concrete works to the south), were located in its eastern section. By 1984 the Riverside

Industrial Estate had been constructed and the site had taken its present-day form as an area of hardstanding with an industrial unit located adjacent the eastern boundary.

These findings have been taken into account in the preparation of an initial conceptual site model (CSM) which is presented in Section 7.0 of this report.

5.0 MINERAL EXTRACTION

Reference to the Coal Authority website indicates that the site is not located within a Coal Mining Area. In addition, neither the historical maps reviewed in Section 4.0 above or the environmental database information (Enclosure D) show any evidence of below ground mineral extraction in the site locality. It is therefore considered unlikely that subsidence due to mineral extraction could affect the proposed development.

6.0 ENVIRONMENTAL DATABASE INFORMATION

Enclosure D contains a database of environmental information prepared by Landmark Information Group Limited. The main points of note within this database are tabulated below. All distances stated are approximate and positional accuracy may be to within 100m in some cases.

Table 6.1 Summary of Environmental Database Information

	No. of entries		Details of notable database entries	
	0-250m	251-500m	Distance & Direction from site	Additional Information
Contaminated Land Register Entries and Notices	0	0	-	-
Discharge Consents	8	9	86-484m S, SE, E, NE 223m E 225m E 248m SE 357m SE	13no. unknown discharges to stream / river, estuary or controlled sea Sewage discharge to saline estuary Storm sewage overflow to stream / river Trade discharge process water to saline estuary Trade effluent discharge drainage to saline estuary
Integrated Pollution Prevention and Control (IPPC)	0	1	317m E	Waste landfilling excluding inert waste (greater than 10T per day with a capacity greater than 25,000T). Includes temporary storage, disposal and recovery of hazardous waste
Local Authority Pollution Prevention and Controls (LAPPC)	2	4	164m SW 223m SE 268m SE 322m NE 326m N 371m S	Respraying of road vehicles (revoked) Mineral drying and sandstone coating process Blending, packing, loading, using bulk cement (revoked) Aluminium and aluminium alloy processes Petrol filling station Waste oil burners (revoked)
Pollution Incidents to Controlled Waters	8	1	25-207m Various 266m NE	8no. discharge of oils and fuels to unknown surface water Discharge of industrial chemicals to unknown surface water <i>All incidents were classified as Category 3 (minor) and took place between 1992 and 1999. Unlikely to affect the site due to minor status and elapsed time.</i>
Historical Landfill Sites	1	2	250m SW	Included industrial, commercial and household waste

	No. of entries		Details of notable database entries	
	0-250m	251-500m	Distance & Direction from site	Additional Information
			331m SW 469m NW	(operational between 1946 and 1975) Included industrial waste (1981 only) No data supplied (Wick Farm) <i>Unlikely to affect the site due to distance.</i>
Licensed Waste Management Facilities	1	1	100m N 320m E	Both relate to clinical waste transfer stations
Registered Waste Transfer Sites	0	1	261m SE	Waste included asbestos, contaminated rubbish, demolition waste and treated timber (licensed lapsed in 1987)
Potentially Infilled Water	4	8	18-470m Various	All relate to unknown filled ground (pond, marsh, river, stream, dock etc.)
COMAH Sites	0	1	354m E	Understood to relate to Transco Plc., the records are no longer supplied under COMAH regulations
Planning Hazardous Substance Consents	0	1	358m E	Regional gas supply – liquified extremely flammable gas (including LPG) and natural gas
PFS sites	1	0	203m NW	Open

In addition to the operations detailed in Table 6.1, the database includes a large number of contemporary trade directory entries within the vicinity of the site, the majority of these are located within the Riverside Industrial Estate and other industrial areas to the east of the site. These include active and former industrial land uses such as sheet metal works, printers, vehicle repairs, garage services, electronic equipment manufacturers, tyre dealers, blacksmiths, glass fibre moulding, PFS sites, precision engineers, builder's merchants, concrete manufacturing and distribution, joinery manufacturers, waste disposal and recycling services.

The database indicates that the site is unlikely to be affected by authorised discharges or pollution incidents. However, a number of potentially contaminative land uses have been identified. The possibility of ground contamination having been caused at the site as a result of these activities is discussed further in Section 7.0 below.

7.0 INITIAL CONCEPTUAL SITE MODEL (CSM)

A qualitative risk assessment of the site was undertaken utilising the information obtained in the preceding desk study section of the report in order to facilitate the development of an initial CSM. This was based on a risk-based approach and incorporated the accepted contaminant–pathway–receptor linkage approach ('pollutant linkage') outlined in Part IIa of the Environmental Protection Act 1990. This approach also follows the risk assessment framework included in CLR11 (DEFRA and EA, 2004) in which three essential elements to any risk are considered:

- ✧ A **contaminant** – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters;
- ✧ A **receptor** – in simple terms, something that may be adversely affected by a contaminant;
- ✧ A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

A risk is created only where the above three elements are linked together, and must first be established for a contaminated land hazard to exist and before any other secondary considerations are given to the effects and the need/requirement for remediation.

Table 7.1 below summarises the potential contaminants, receptors and pathways identified. Contaminants arising from the current and historical uses of both the site and surrounding area have been considered. Ground contamination can only be considered as potential until proven and hence the assessment is qualitative. For the purpose of this assessment the contaminants have been separated according to whether they are likely to have originated from on-site or off-site sources. The potential contaminants arising from the identified sources have been determined from the relevant DoE Industry Profiles (where available) and are included in italics in the Table.

Table 7.1 Initial CSM

Potential Sources (Associated Contaminants)
On-site sources: - Potential made ground associated with historical site uses (dependant on nature and source of material, but may include <i>hydrocarbons, metals, cyanide, phenol, PAH, asbestos, soil gas</i>) - Previous use of eastern section for travelling cranes (former concrete works) (<i>hydrocarbons, asbestos</i>)
Off-site sources: - Various industrial uses within 500m of the site (<i>metals, petroleum hydrocarbons, PAH compounds, phenol, cyanide, sulphates, acids/alkalis, asbestos</i>). - Historic landfill within 250m of the site (<i>soil gas</i>)
Potential Receptors
- Humans: Construction workers, site users. - Development end use: Proposed development, services and utilities. - Controlled waters: - Groundwater: Secondary A and Principal aquifer status of the underlying superficial geology and bedrock respectively - Surface Water: Drainage ditch along northwest boundary, River Arun 250m south
Potential Pathways
- Humans: Ingestion, skin contact, inhalation of dust, indoor and outdoor air - Development end use: Contact - Controlled waters: - Groundwater: Leachate migration into pore water from soil contamination, free product flow (if present), dilution and dispersion into groundwater. - Surface Water: Surface run off / hydrogeological flow within groundwater.

The CSM summarises the identified potential sources of ground contamination, potential exposure/migratory pathways and potential receptors, and indicates that it is possible for the accepted contaminated land hazard identification convention (contaminant-pathway-receptor linkage) to be completed for this site with respect to human receptors, the development end use, and controlled waters as a result of both on-site and off-site sources of contamination. However, the primary responsibility for contamination occurring at the site from off-site sources would lie with the respective site owners/occupiers. A risk prioritisation is presented in Section 8.0 below.

8.0 PRELIMINARY RISK ASSESSMENT

8.1 Ground Contamination Risk Prioritisation

Tables 8.1 and 8.2 illustrate a risk prioritisation of the 'pollutant linkages' that may be present at the site as a result of potential contaminants arising from on- and off-site sources respectively.

The significance of each 'pollutant linkage' has been assessed as low, moderate or high based upon the following definitions:

- Low: No significant linkage exists and / or the potential for future impact is considered to be minimal.
- Moderate: The linkage exists, but there are insufficient field or laboratory data to confirm the link.
- High: The linkage exists and the availability of data indicates remedial action may be required to address potential liability issues.

The assessment relates the relevance of these linkages to the site under consideration and the proposed development scheme.

Table 8.1 Ground contamination assessment with respect to on-site sources

On-site Sources	Potential Contaminants	Pathway	Receptor	Risk Classification
Potential made ground	Hydrocarbons Metals Cyanide Phenol PAH Asbestos Soil gas	Direct contact with contaminated material, ingestion of soil, inhalation of air	<u>Human health:</u> Construction workers	Low to moderate
			<u>Human health:</u> Site end users	Low to moderate
		Direct contact	<u>Development end use</u>	Low to moderate
Former travelling cranes	Hydrocarbons Asbestos	Leachate migration into pore water from soil contamination, free product flow, dilution and dispersion into groundwater	<u>Groundwater:</u> Secondary A and Principal aquifer status of the underlying superficial geology and bedrock respectively	Low to moderate
		Hydrogeological flow within groundwater, surface water run-off	<u>Surface Water:</u> Adjacent drainage ditch and River Arun 250m south	Low to moderate

The assessment in Table 8.1 indicates that the risk to construction workers is considered low to moderate; however, in practice this should be mitigated by the adoption of safe working practices including the use of appropriate personal protective equipment (PPE).

The risk to future site occupiers and the development end use from ground contamination at the site is generally considered low on the basis of the available information but may raise to moderate with respect to soil gas and areas of soft landscaping. The risk to the controlled water receptors is also considered low to moderate on the basis of the available information.

Table 8.2 Ground contamination assessment with respect to off-site sources

Off-site Sources	Potential Contaminants	Pathway	Receptor	Risk Classification
Various industrial uses within 500m and historic landfill	Metals Hydrocarbons PAH Phenol Cyanide Sulphate Acids/alkalis Asbestos Soil gas	Direct contact with contaminated material, ingestion of soil, inhalation of air	Human health: Construction workers	Low to moderate
			Human health: Site end users	Low to moderate
		Direct contact	Development end use	Low to moderate
		Leachate migration into pore water from soil contamination, free product flow, dilution and dispersion into groundwater	Groundwater: Secondary A and Principal aquifer status of the underlying superficial geology and bedrock respectively	Low to moderate
		Hydrogeological flow within groundwater, surface water run-off	Surface Water: Nearby drainage ditch and River Arun 250m south	Low to moderate

The assessment in Table 8.2 indicates a low to moderate risk to construction workers, site end users and controlled waters from contamination caused by off-site activities. However, the responsibility for ground contamination occurring from off-site sources would lie with the respective site owners/occupiers.

8.2 Soil Gas

Any made ground beneath the site (associated with previous land uses) is a potential source of soil gas. Furthermore, historic landfill within 250m of the site accepted putrescible domestic waste and is therefore considered another potential source of soil gas. It is recommended that a gas monitoring regime should be incorporated into any future ground investigation to provide data for quantitative risk assessment.

PHE interactive Radon Maps indicate that the site is in the intermediate band of radon potential, with 1-3% of homes being affected by radon gas at concentrations above the Action Level. However, maps produced by the Building Research Establishment (BRE – BR211, 2015) indicate that no radon protective measures are considered necessary at the site location.

8.3 Preliminary Geotechnical Recommendations

Proposed foundation loads are not known at the present time. However, given the reported presence of near surface soft and firm clay with a relatively high groundwater table, conventional shallow foundations may not be feasible. An intrusive investigation is recommended to provide quantifiable data for foundation design (to summary!).

9.0 SUMMARY OF MAIN RISKS

Table 9.1 summarises the main risks to the proposed redevelopment at the site identified by the PRA as perceived by DTS Raeburn. A risk classification has not been included, as this would need to include a likely cost-benefit analysis, which is outside the scope of this report. The list of hazard/risks tabulated is not exhaustive and should be read in conjunction with the main text of the report.

Table 9.1 **Summary of main identified risks**

Hazard/Risk	Cause	Possible Impact/ Consequence	Recommendations
Potential soil and groundwater contamination	Former use of travelling cranes in east of the site and potential made ground	Possible impact on human health if disturbed and possible need for remediation. Cost and programming implications.	Intrusive investigation recommended.
Soil gas/vapours	Release of gas from potential made ground beneath the site and nearby historic landfill	Possible need for gas protection measures. Cost and programming implications.	Gas monitoring recommended.
Geotechnical considerations	Relatively poor ground conditions	Possible need for piled foundations. Cost and programming implications	Intrusive investigation recommended.

10.0 LIMITATIONS AND USE OF THIS REPORT

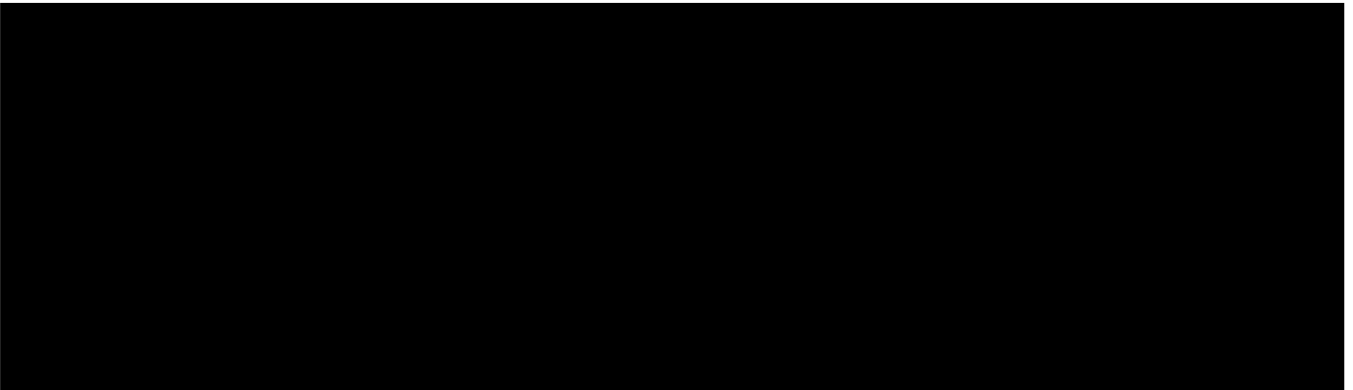
IMPORTANT: This section should be read before reliance is placed on any of the opinions, advice, recommendations and conclusions contained in this report.

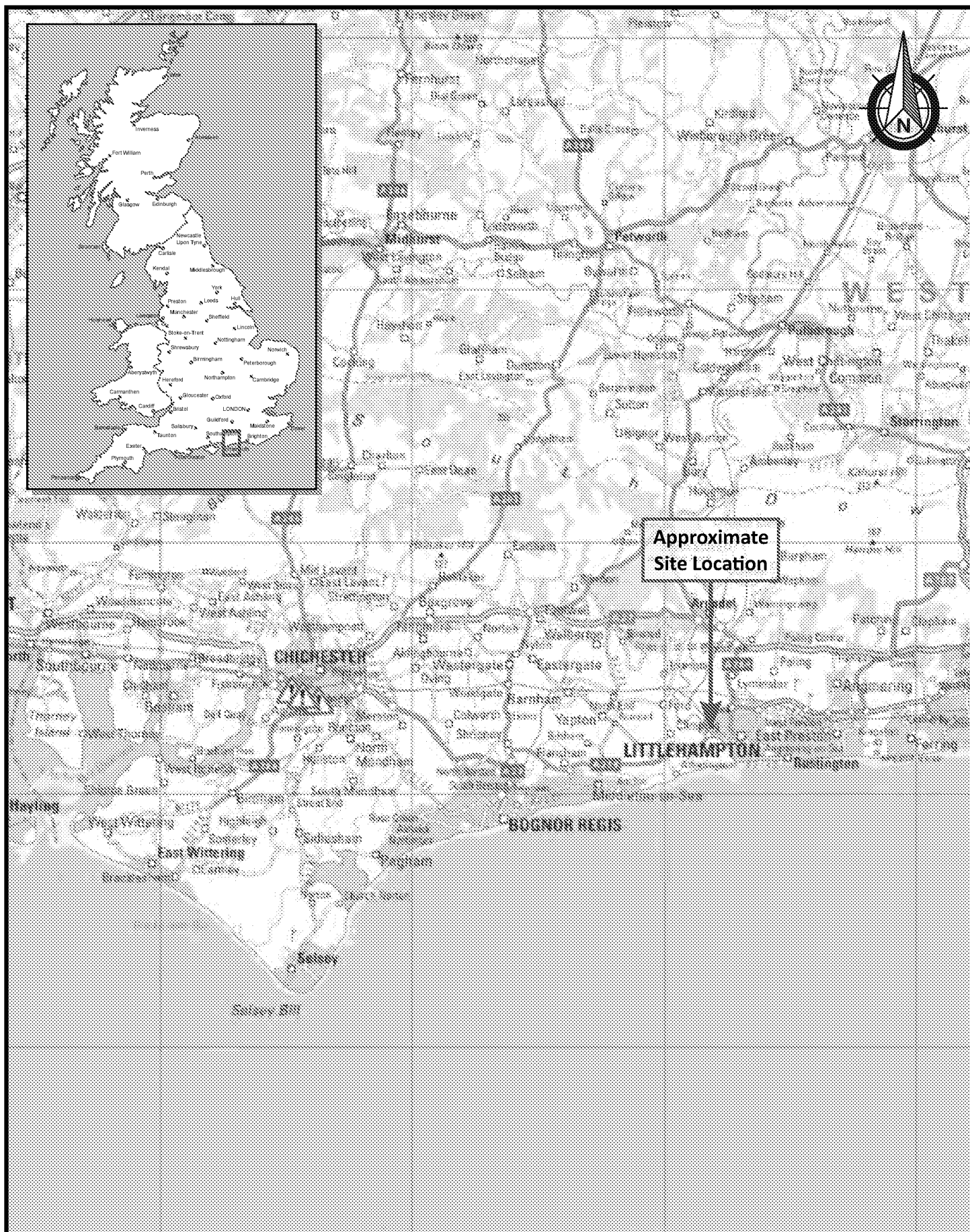
- a) This report has been prepared at the request of L&C Commercial Limited ('the Client') pursuant to their appointment of DTS Raeburn Limited in connection with the PRA;
- b) Except for L&C Commercial Limited, no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions contained in this report;
- c) All work carried out in preparing this report has used, and is based upon DTS Raeburn's professional knowledge and understanding of the current (June 2020) relevant standards, codes, technology and legislation. Changes in the above may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. Following delivery of this report, DTS Raeburn will have no obligation to advise the Clients of any such changes or of their effects. It may therefore be necessary to review the opinions, advice, recommendations and conclusions of this report following future changes to legislation;
- d) Some of the information referenced and included in the report has been provided by third parties and whilst DTS Raeburn has no reason to doubt the accuracy, these items have not been verified. DTS Raeburn accepts no responsibility for errors within third party materials referenced and presented in this report;
- e) The content of this report represents the professional opinion of experienced geotechnical and environmental specialists/consultants. DTS Raeburn does not provide associated legal advice and appropriate legal advice should be sought if required;
- f) The lack of evidence of the presence of hazardous materials, voids or obstructive features at the subject property does not guarantee the absence of such materials, rather it indicates only that none was found as a result of the services provided.

DTS RAEBURN Ltd

E13353/1 – July 2020

References





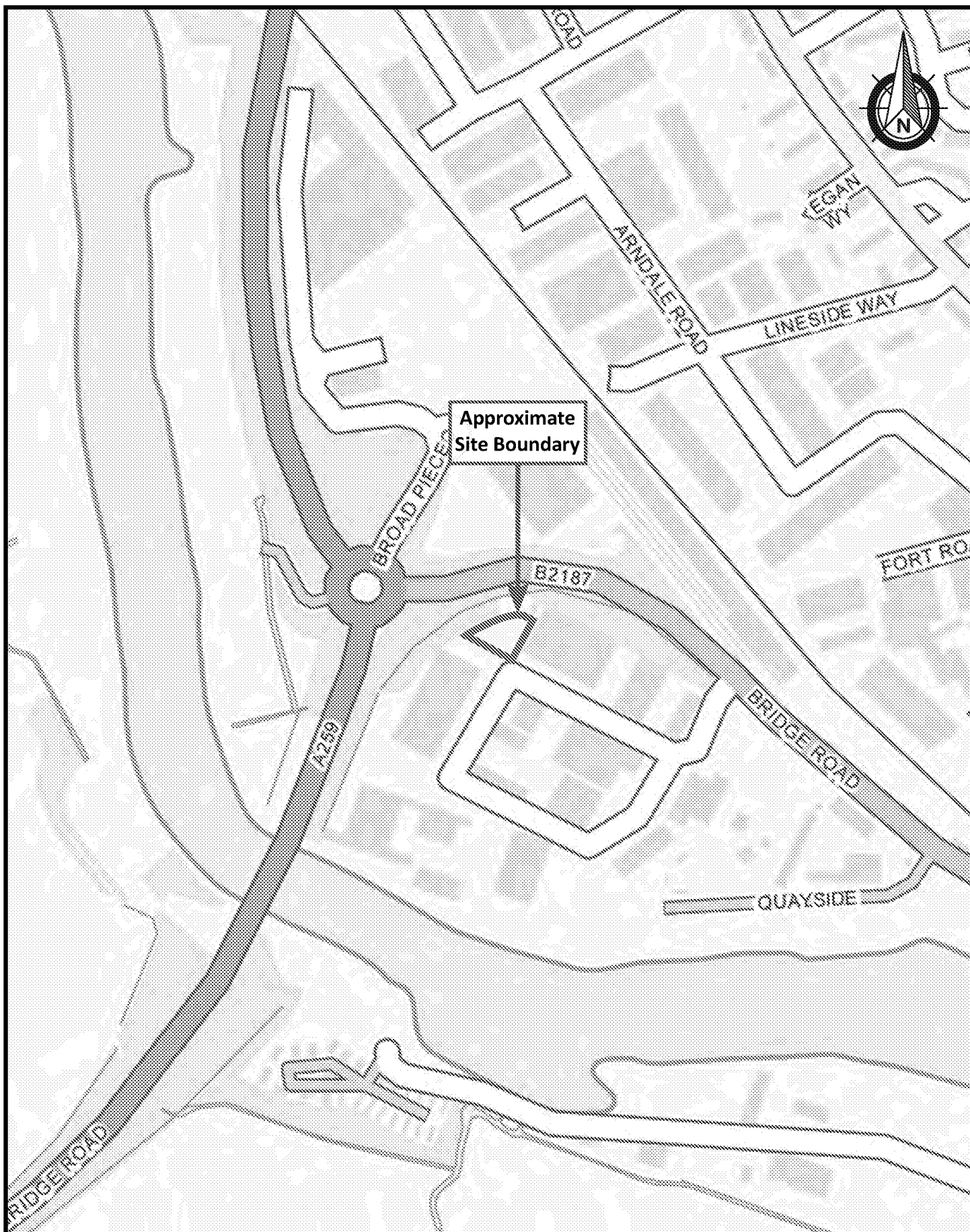
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 GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

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 Telephone: +44(0)121 344 5885 Facsimile: +44(0)121 344 5888

FIGURE 1

Site Location Plan
 1:200,000

E13353/1: Littlehampton
 Prepared for: Pegasus Planning Group Limited



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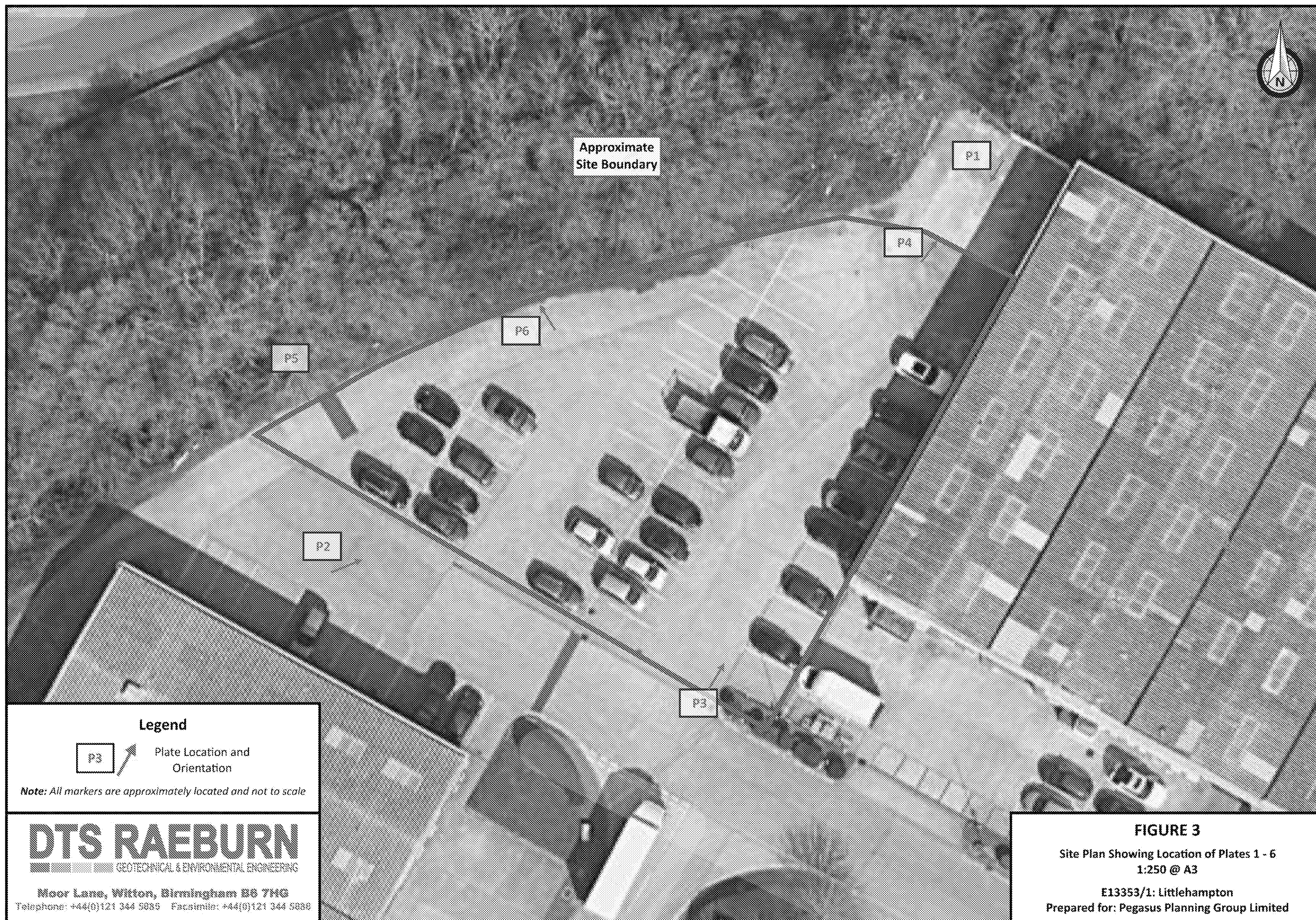
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FIGURE 2

Site Location Plan
1:2,500

E13353/1: Littlehampton

Prepared for: Pegasus Planning Group Limited





Approximate
Site Boundary

Proposed
Development

Unit area - 5,070sqft / 471sqm

Goods Yard

16 no. car parking spaces

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FIGURE 4

Proposed Development Scheme

1:200 @ A3

E13353/1: Littlehampton

Prepared for: Pegasus Planning Group Limited

eded)

Plate 1: View south across car park



Plate 2: View north east to neighboring unit



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Plates 1 & 2

Photographic Record of Site Reconnaissance

E13353/1: Littlehampton

Prepared for: Pegasus Planning Group Limited

Plate 3:
View north along eastern boundary



Plate 4:
Poor condition surface concrete



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Plates 3 & 4

Photographic Record of Site Reconnaissance

E13353/1: Littlehampton
Prepared for: Pegasus Planning Group Limited

Plate 5: Drainage ditch along north western boundary



Plate 6: Vegetation along north western boundary



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Plates 5 & 6

Photographic Record of Site Reconnaissance

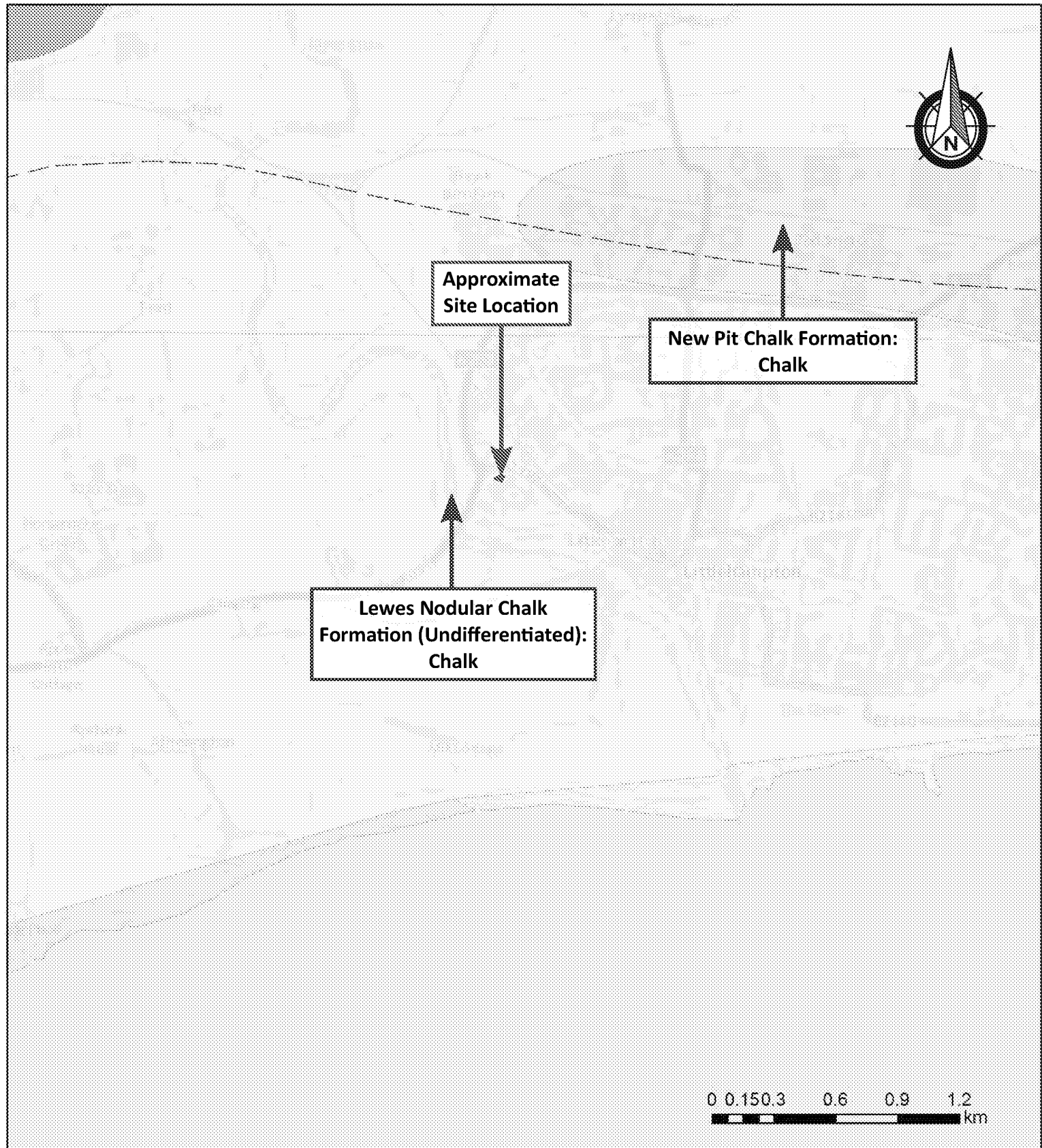
E13353/1: Littlehampton

Prepared for: Pegasus Planning Group Limited

ENCLOSURE A

**BGS Geoindex Report
(4 pages)**

Bedrock Geology



Map Key

Bedrock geology 1:50,000 scale

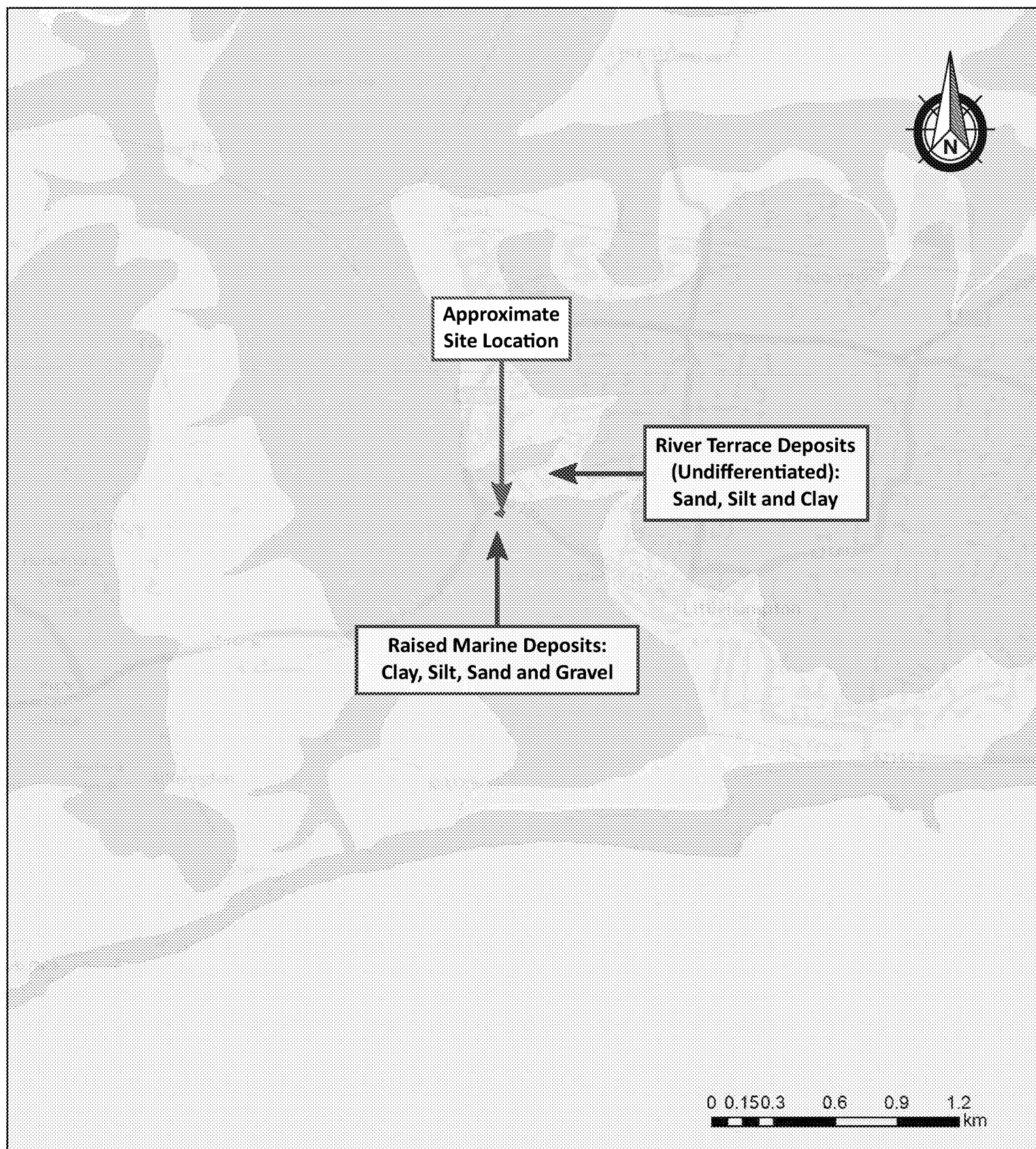
-  LONDON CLAY FORMATION - CLAY, SILT AND SAND
-  SPETISBURY CHALK MEMBER - CHALK
-  LEWES NODULAR CHALK FORMATION, SEAFORD CHALK FORMATION, NEWHAVEN CHALK FORMATION, CULVER CHALK FORMATION AND PORTSDOWN CHALK FORMATION (UNDIFFERENTIATED) - CHALK
-  TARRANT CHALK MEMBER - CHALK
-  NEW PIT CHALK FORMATION - CHALK
-  LEWES NODULAR CHALK FORMATION - CHALK
-  PORTSDOWN CHALK FORMATION - CHALK
-  LAMBETH GROUP - CLAY, SILT AND SAND
-  NEWHAVEN CHALK FORMATION - CHALK

Linear features 1:50,000 scale

-  Fold_Anticline
-  Fold_Syncline

Superficial Deposits

GEOINDEX
ONSHORE



Contains OS data © Crown Copyright and database right 2019

GeoIndex Onshore Data Sources: NERC, Natural England, English Heritage and Ordnance Survey

Map Key

Superficial deposits 1:50,000 scale

-  ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
-  BLOWN SAND - SAND
-  RAISED MARINE DEPOSITS - CLAY, SILT, SAND AND GRAVEL
-  HEAD - CLAY, SILT, SAND AND GRAVEL
-  RIVER TERRACE DEPOSITS (UNDIFFERENTIATED) - SAND, SILT AND CLAY
-  RAISED BEACH DEPOSITS, 1 - SAND AND GRAVEL
-  BEACH AND TIDAL FLAT DEPOSITS (UNDIFFERENTIATED) - CLAY, SILT, SAND AND GRAVEL

ENCLOSURE B

**BGS Borehole Records
(5 pages)**





**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 569740 : BGS Reference: TQ00SW16

British National Grid (27700) : 501770,102590

[Report an issue with this borehole](#)

<<

< Prev

Page 1 of 1

Next >

>>

GROUND EXPLORATIONS LTD.

BOREHOLE NO. 19

TQ00SW/16

Contract Name LITTLEHAMPTON.

Report No. 4412/SJB.

Client West Sussex County Council,

Site Address

Address County Surveyor's Department,

Littlehampton,

County Hall,

West Sussex.

Chichester, Sussex.

0177 0259

Standing Water Level 6' 0"

Method of Boring Shell/auger.

Water Struck 7' 0"

Diameter 6 ins.

Ground Level 8.53

Start 19.6.68. Finish 19.6.68.

Remarks

JARS		CORES		BULK	
2552	1' 6"	2553	3' 6"		
2554	7' 0"				
2555	9' 0"				
2556	Water				
Description				Thickness	Depth
Topsoil				1' 0"	1' 0"
Brown sandy clay and flints } ? BRILLACORTH				2' 0"	3' 0"
Firm brown chalky clay } COOMBE DEPOSIT				4' 6"	7' 6"
Weathered chalk				2' 6"	10' 0"

Notes 1. Descriptions are in accordance with B.S. Code of Practice C.P. 2001
Clients are requested to compare with samples submitted.
2. Core samples are nominally 4 ins. diameter and 18 ins. long.
Depths shown are to top of sample.



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 569751 : BGS Reference: TQ00SW27

British National Grid (27700) : 501700,102590

[Report an issue with this borehole](#)

<<

< Prev

Page 1 of 1

Next >

>>

GROUND EXPLORATIONS LTD.

BOREHOLE NO. 19B

TQ 00 SW/27

Contract Name LITTLEHAMPTON II

Report No. 4617/SJB/g

01700259

Client West Sussex County Council,

Site Address

Address County Surveyors Dept.,

Littlehampton,

County Hall,

Sussex.

Chichester.

Standing Water Level 3'0"

Method of Boring Shell/auger

Water Struck 2'0", 13'0", 20'0"

Diameter

6 ins.

Ground Level

5.58

Start 12. 2.69.

Finish 12. 2.69.

Remarks

JARS			CORES		BULK	
6524 2'0"			6525 3'6"			
6526 7'0"			6527 8'6"			
6528 12'0"						
6529 15'0"						
6530 20'0"						
6531 Water						
Description				Thickness	Depth	
Brown Silty clay				10' 0"	10' 0"	
Soft blue silty clay				3' 0"	13' 0"	
Chalk and Flints				7' 0"	20' 0"	

TOTALS	20' 0"	20' 0"

- Notes
1. Descriptions are in accordance with B.S. Code of Practice C.P. 2001
Clients are requested to compare with samples submitted.
 2. Core samples are nominally 4 ins. diameter and 18 ins. long.
Depths shown are to top of sample.

ENCLOSURE C

**Hydrology, Hydrogeology, Site Sensitivity
& Flood Risk Maps
(6 pages)**

DTS RAEBURN

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

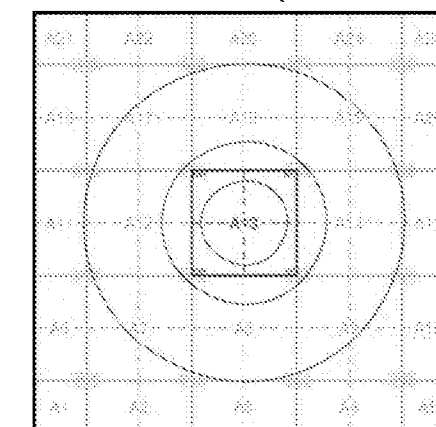
OS Water Network Data

- | | |
|----------------|---------------------------|
| — Canal | — Drain |
| — Reservoir | — Other |
| — Foreshore | — Lake |
| — Marsh | — Transfer |
| — Tidal River | — Lock Or Flight Of Locks |
| — Inland River | — Sea |

Contours (height in meters)

- | | | |
|------------------|-------------------|-------------------------|
| Standard Contour | — 100 — 110 — 120 | — MLW — Mean Low Water |
| Master Contour | — 100 — 110 — 120 | — MHW — Mean High Water |
| Spot Height | — 100 — 110 — 120 | |

OS Water Network Map - Slice A



Order Details

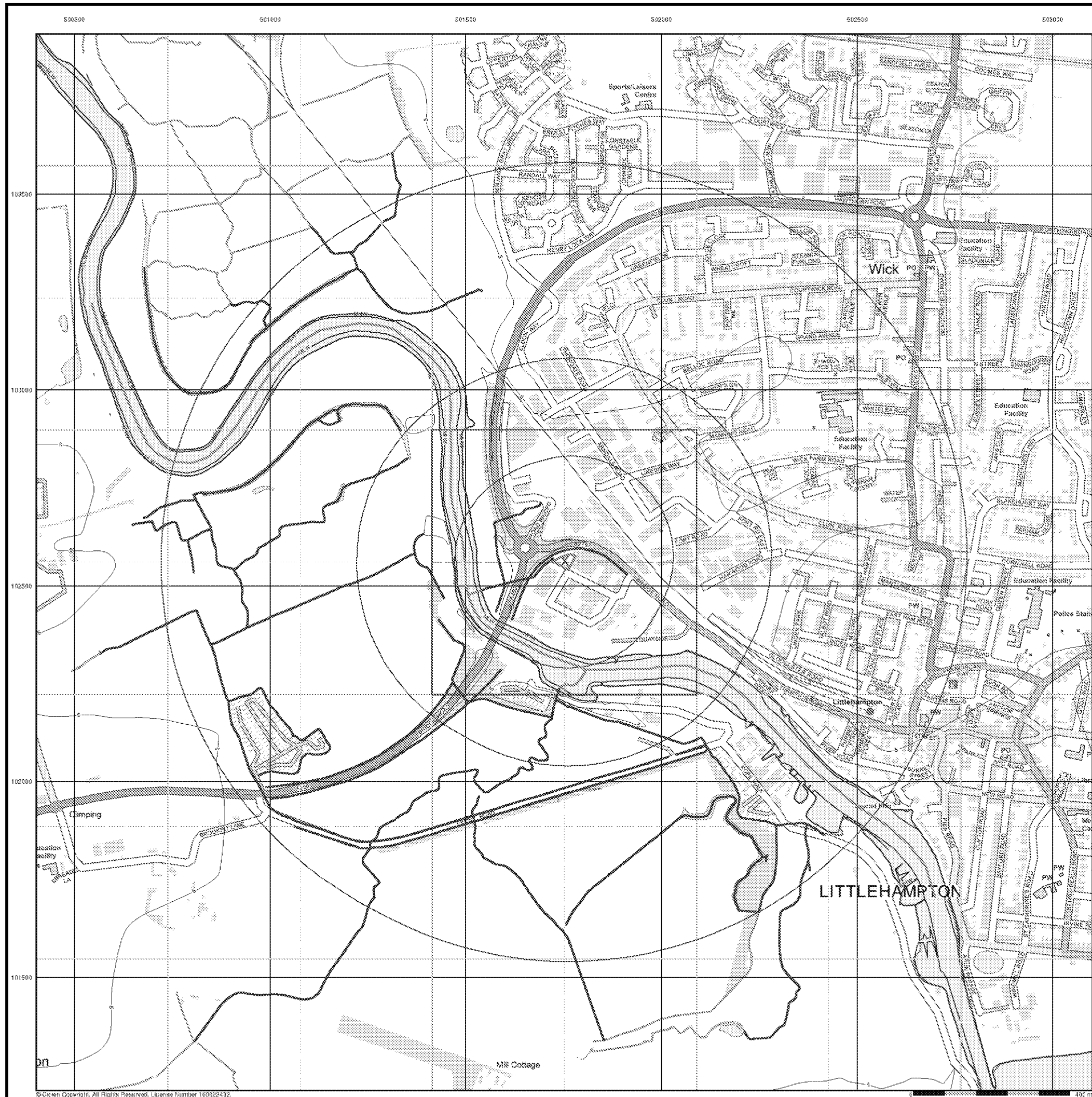
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 Slice: A
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 Search Buffer (m): 1000

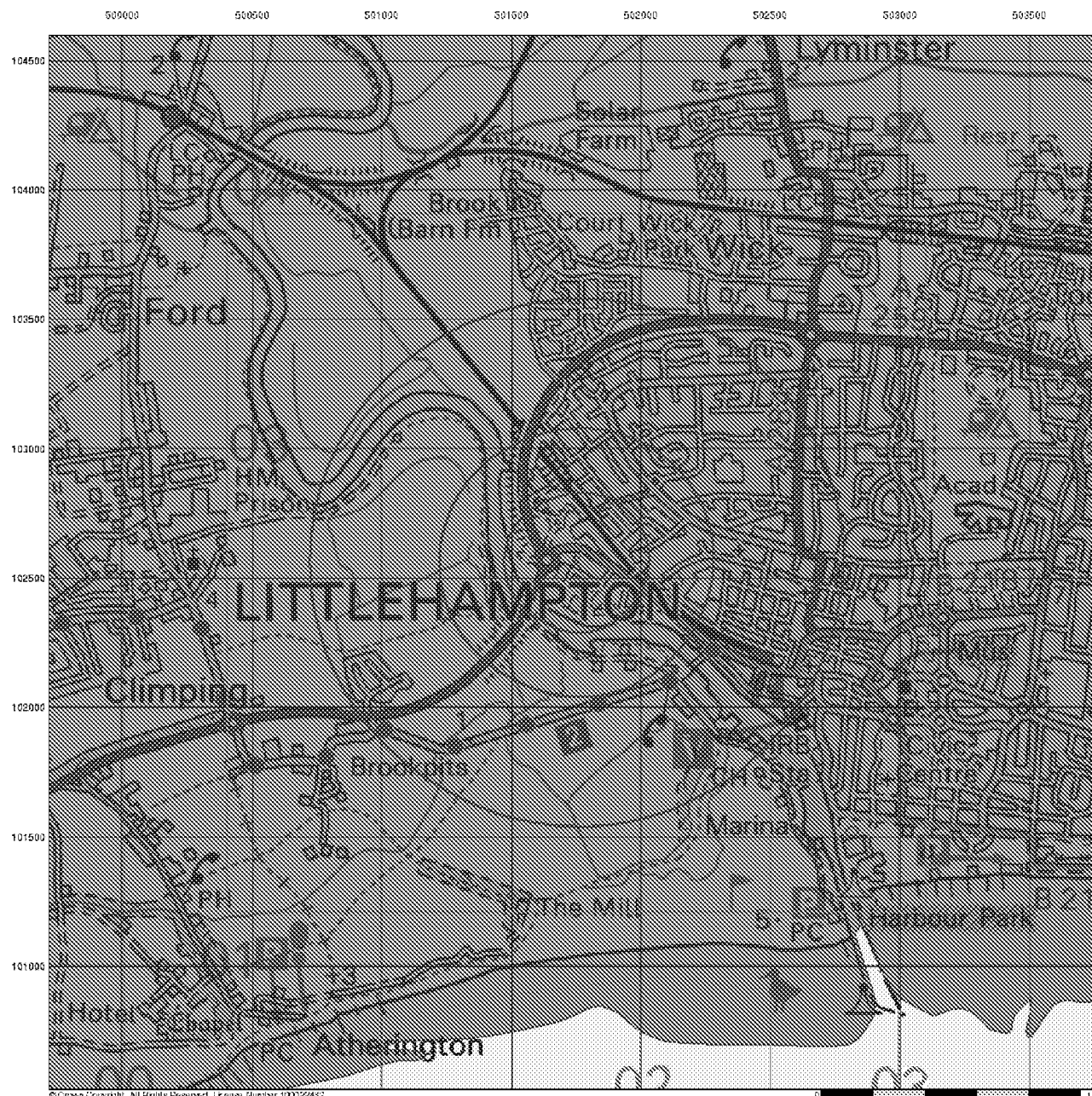
Site Details

Tyre Factory, Unit D3-D4, Riverside Industrial Estate, Bridge Road, LITTLEHAMPTON, BN17 5DF

Landmark
 INFORMATION GROUP

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





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GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

Bedrock Aquifer Designation

General

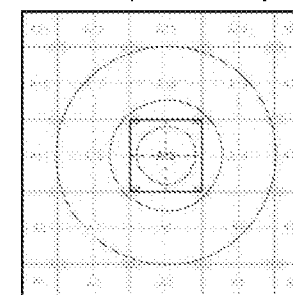
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



Order Details

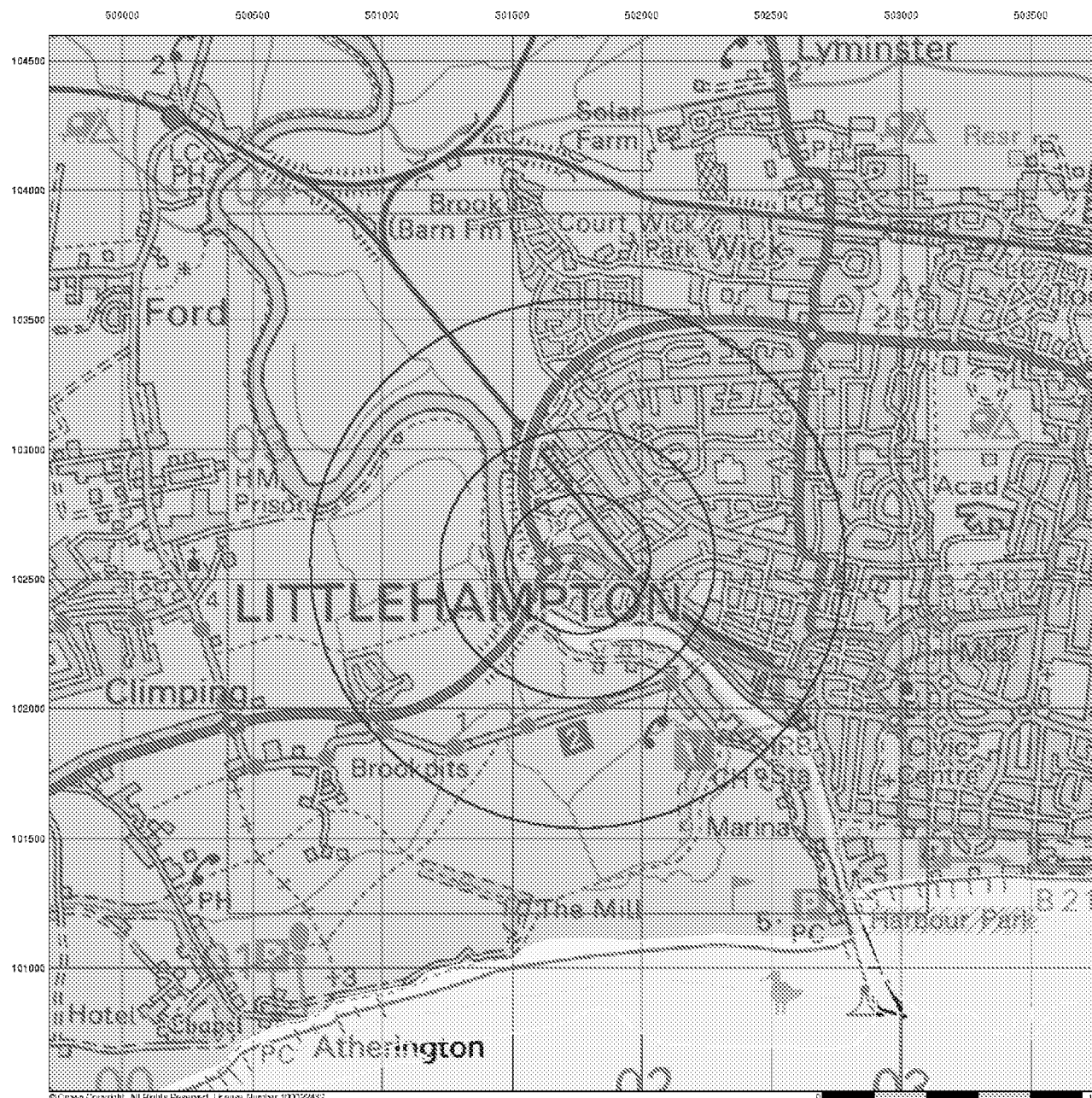
Order Number: 243894618_1_1
 Customer Ref: E13353/1
 National Grid Reference: 501750, 102560
 Slice: A
 Site Area (Ha): 0.13
 Search Buffer (m): 1000

Site Details

Tyre Factory, Unit D3-D4, Riverside Industrial Estate, Bridge Road,
 LITTLEHAMPTON, BN17 5DF

Landmark
 INFORMATION GROUP

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 Fax: 01444 544 5551
 Web: www.environment.co.uk



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Superficial Aquifer Designation

General

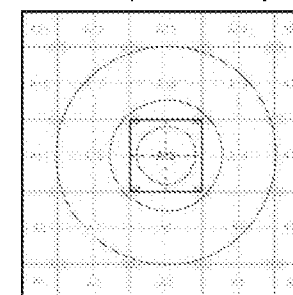
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 243894618_1_1
 Customer Ref: E13353/1
 National Grid Reference: 501750, 102560
 Slice: A
 Site Area (Ha): 0.13
 Search Buffer (m): 1000

Site Details

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Source Protection Zones

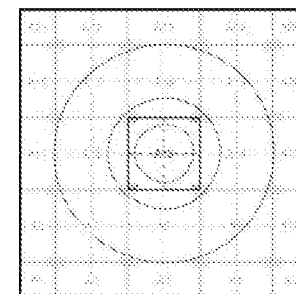
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 243894618_1_1
 Customer Ref: E13353/1
 National Grid Reference: 501750, 102560
 Slice: A
 Site Area (Ha): 0.13
 Search Buffer (m): 1000

Site Details

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Sensitive Land Uses

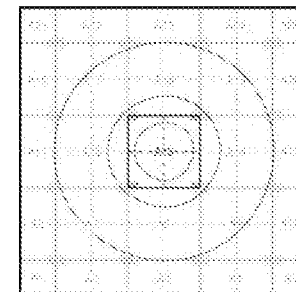
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Sensitive Land Uses

- Ancient Woodlands
- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area
- World Heritage Sites

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 243894618_1
 Customer Ref: E13353/1
 National Grid Reference: 501750, 102560
 Slice: A
 Site Area (Ha): 0.13
 Search Buffer (m): 1000

Site Details

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