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SITE INVESTIGATION REPORT

BARBER'S DROVE NORTH
CROWLAND
LINCOLNSHIRE

Report Reference C15122

On behalf of:-

**Burmor Construction
Burmor House
Sunderland Road
Northfields Industrial Estate
Market Deeping
PE6 8FD**

October 2020

BURMOR CONSTRUCTION

SITE INVESTIGATION REPORT

FOR

PROPOSED RESIDENTIAL DEVELOPMENT

AT

LAND OFF BARBER'S DROVE NORTH

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INTRODUCTION

The client, Burmor Construction, proposes to build a new residential development on vacant land north of Barber's Drove North, Crowland in Lincolnshire.

Ground Engineering Limited was commissioned by the client to carry out a site investigation to determine the nature and geotechnical properties of the underlying soils, and provide information for the design and construction of the foundations. A desk study checking past uses and a contamination assessment were also included within the scope of this report.

LOCATION, TOPOGRAPHY AND GEOLOGY OF THE SITE

The site of the proposed development is located to the north-east of the junction of Barber's Drove North with James Road, on the southern side of Crowland in Lincolnshire. The National Grid Reference for the centre of the site is TF 2427 0960 and its location is shown on plans following this report text.

The approximately 1.3 hectare, irregular shaped site is approximately 40m wide fronting Barber's Drove North, increasing to 70m wide behind houses fronting the road, and extends 200m north-east along the northern side of James Road. A drain is also present along the south-eastern boundary of the site with James Road. The central northern part of the site contained a small wooden stable and shed on a paving slab base, and the eastern part of the site was used as a paddock for a horse. The site is bounded by Barber's Drove North to the south-west, including No.17 Barber's Drove North; by an undeveloped parcel of land to the north-west; by a drain to the north-east; and by James Road to the south-east. Trees were present along the south-eastern boundary with James Road; along the north-western boundary of the site with the adjacent field; and in the garden of No.17 Barber's Drove North on the south-western margin.

The level site stands at an elevation of about 2mOD in an area of low-lying Fenland.

The geological maps for the area, sheet 158 at 1:50,000 scale, and Crowland sheet at 1:10,000 scale, show the site to be underlain by a thick succession of Barroway Drove Beds, more recently identified as Tidal Flat Deposits. These silt and fine sand soils are indicated to rest on the solid geology of the Oxford Clay Formation at depth. Previous work in the vicinity has found a Marine Sand beneath the surface layer of Tidal Flat Deposits.

HISTORY OF THE SITE

Research into the site history involved reference to historical Ordnance Survey (OS) maps, photographs and information obtained from the internet. The map extracts and photographs studied are presented in the desk study map section, Appendix 1, and are described below. Distances are approximate.

<i>OS Map Extract</i>	<i>Description</i>
1886-87 Lincolnshire Sheets 148SW & 153NW Scale 1:10,560 Figure A	The site is undeveloped within a large field on the north side of Barber's Drove. Drains are present around the margins of the field. The north-eastern boundary drain is named Greenbank Drain, which flows to the south-east. Green Bank, an earthworks (flood defence), is present north of Green Bank Drain. A row of houses named Grove Terrace is shown north of Green Bank. A corn mill is shown 150m west of the site. Crowland is to the north-north-west of the site.
1888 Lincolnshire Sheets 148.13, 148.14, 153.1 & 153.2 Scale 1:2500 Figure B	The site and immediate surrounding area appear unchanged.
1904 Lincolnshire Sheets 148.13, 148.14, 153.1 & 153.2 Scale 1:2500 Figure C	The site and immediate surrounding area appear generally unchanged. New buildings are shown adjacent a house 100m to the north of the site.
1950 Lincolnshire Sheets 148SW & 153NW Scale 1:10,560 Figure D	The site area appears unchanged. New houses are shown along Barber's Drove to the west and south of the site. New houses have also been built to the west and north of the site.
1975 Sheet TF2409 Scale 1:2500 Figure E	The site area remained undeveloped. A tree-lined drain is shown along the south-eastern boundary of the site, with a new road (James Road, A1073) beyond. The drain along the north-western boundary has been infilled. A new house fronting Barber's Drove is shown close to the west of the site, with another house and outbuildings also to the west. New housing has also been built on the southern side of Barber's Drove. Green Bank is not evident to the north of the site, and a new house 'Modar' and a pumping station are denoted in this area. A piggery is shown 90m south-east of the site; a glasshouse and a transport depot 90m to the north-west; and another pumping station 120m west of the

<i>OS Map Extract</i>	<i>Description</i>
	site.
1979 Sheets TF20NW & TF21SW Scale 1:10,560 Figure F	The site and immediate surrounding area appear generally unchanged. A works is denoted 125m south-west of the site, and allotment gardens 125m north-east of the site.
1989 Sheet TF2409 Scale 1:2500 Figure G	The site and immediate surrounding area appear generally unchanged. New roads and housing have been built 100m south-west of the site.
1995 Sheet TF2409 Scale 1:2500 Figure H	The site area appears unchanged. A new house has been built off-site adjacent the south-western boundary. A fire station has been built 30m north-east of the site. A larger building is shown at the works to the north-west of the site.
1999 GroundSure Aerial Photograph of Site (Page 12, Appendix 2)	The site comprises a sub-divided field with an outbuilding in the central northern part. Mature trees are evident along the south-eastern boundary with the road, and also along the north-western boundary with the adjacent field. Trees are also present on the farther side of the ditch to the north-east. New buildings are shown at the (former) piggery site to the south-east of the site, including the foundations for a new house on its northern side.
2003 Sheets TF2409NW & TF2409SW Scale 1:1250 Figure I	The site and immediate surrounding area appear unchanged.
2010 Sheets TF20NW & TF21SW Scale 1:10,000 Figure J	The site and immediate surrounding area appear unchanged.
2012-2018 GroundSure Aerial Photographs of Site (Pages 8-11, Appendix 2)	The site remained undeveloped apart from the small outbuilding. Two large new houses have been built to the west of the site fronting Barber's Drove, in an area that had been cleared of trees. A new road (A16) has been built to the south-east of the site (by 2012).
2020 Sheet TF2409 (BT) Scale 1:2500 Figure K	The site is shown sub-divided into three parts, with the outbuilding (stable) in the central northern area. The adjacent road has been renamed Barber's Drove North.
2020 Sheets TF20NW & TF21SW Scale 1:10,000 Figure L	The site and immediate surrounding area appear unchanged.

Summary of Historical Information

The Ordnance Survey map of 1886-7 showed that the site was undeveloped within a rural area to the south of Crowland. The site has remained undeveloped apart from an outbuilding first evident on the 1999 aerial photograph, which at the time of this investigation was being used as a stable for a horse.

The area around the site was initially fields to the south of Crowland. A new house had been built to the south-west of the site by 1975, by which time James Road (A1073) had been built bounding the site to the south-east. By the 1970s the area around the site had been partly developed which included a piggery to the south-east; a transport depot to the north-west, pumping stations to the north-east and south-west; and a works to the south-west.

SUMMARY OF ENVIRONMENTAL DATA

Appendix 2 contains information derived from Environmental Databases for a radius of up to 2,000m from the site. The information covers datasets held by Groundsure with contributors including the local authority, the Environment Agency (EA), British Geological Survey, Ordnance Survey and the Coal Authority and the results, within a radius of 250m, are summarised below:

1-2. Historical Industrial Sites	On-Site	0 - 250m
Potentially Contaminative Uses (1:10,000 mapping)	0	8
Historical Tank Database	0	0
Historical Energy Features Database	0	3
Historical Petrol & Fuel Site Database	0	0
Historical Garage & Motor Vehicle Repair Database	0	0
3. Landfill and Other Waste Sites	On-Site	0 - 250m
Landfill Sites	0	0
Historical Landfill and Other Waste Sites	0	0
Waste Exemptions	0	0
4. Current Land Use	On-Site	0 - 250m
Current Industrial Sites Data	0	3
Records of Petrol and Fuel Sites	0	0
Underground Electricity, High Pressure Oil and Gas Pipelines	0	0
Sites Determined as Contaminated Land under Part IIA EPA 1990	0	0
Records of COMAH and NIHHS Sites	0	0
Environmental permits/pollution incidents/registers	0	2
5-6. Hydrogeology and Hydrology	On-Site	0 - 250m
Productive strata within superficial geology beneath the site	No	
Productive strata within solid geology	No	
Groundwater Abstraction Licences	0	0
Surface Water Abstraction Licences	0	0
Potable Water Abstraction Licences	0	0
Source Protection Zones	0	0
Water Network Entries	0	41
Surface Water Features	1	14

7-9. Flooding					
Risk of flooding from rivers & the sea (RoFRaS) rating				Medium	
Historical flood events				1	0
Flood defences within 250m of site				No	
Any areas benefitting from flood defences within 250m of site				No	
Flood storage areas within 250m of site				No	
Environment Agency indicative Zone 2 floodplains within 50m of site				Yes	
Environment Agency indicative Zone 3 floodplains within 50m of site				Yes	
Surface water flooding on site				1 in 30 year (0.30m to 1.00m)	
Groundwater flooding on site				Negligible	
10-13. Designated Environmentally Sensitive Sites				On Site	0 - 250m
Environmentally sensitive sites				2	1
14-16. Geology					
Artificial Ground or Made Ground records				0	0
Superficial Ground and Drift Geology records beneath the site				Yes	
17. Natural Hazards (on site)					
Hazard	Negligible	Very Low	Low	Moderate	High
Shrinking or Swelling Clay	-	-	-	On-site	-
Running Sand	-	-	-	On-site	-
Compressible Ground	-	-	-	-	On-site
Collapsible Rocks	On-site	-	-	-	-
Landslides	-	On-site	-	-	-
Soluble rocks	On-site	-	-	-	-
18. Mining					
Surface ground workings				0	0
Underground workings				0	0
Non coal-mining areas within 50m of site				0	0
Mining cavities				0	0
Brine affected areas on study site				No	
19. Radon					
The property is not in a Radon Affected Area, as less than 1% of properties are above the action level. No Radon Protective Measures are required for new properties or extensions.					

Database Summary

No historical land uses are identified on the site. A depot is recognised 75m north of the site; a works 123m south-west; pumping station 128m west; an electricity sub-station 148m west; and corn mill 150m west of the site. No garages, petrol or fuel stations are recorded within 250m of the site. No historic landfills are recorded on, or within 250m of the site.

Recent industrial land uses around the site include Crowland Fire Station 32m north-east, and electricity sub-stations to the west and north. Two pollution incidents are

recorded 103m south-west of the site, for events which occurred in 2002, for atmospheric pollutants and effect⁶ which had minor impact on air.

Superficial Tidal Flat Deposits are shown beneath the site, which are classified by the EA as an 'Unproductive' stratum. The solid geology Oxford Clay Formation underlying the site is also classified by the EA as an 'Unproductive' stratum. There are no groundwater abstractions within 250m of the site. The site is not within a source protection zone.

The nearest surface water feature is a drain along the south-eastern boundary of the site along James Road. The site is within a Zone 2 and Zone 3 floodplain, and has a medium risk of flooding. The site flooded in 1947 from the River Welland. The site is within a nitrate vulnerable zone, and an SSSI impact zone, both environmentally sensitive areas.

There is a high hazard from compressible ground; a moderate hazard from shrinking and swelling clay and running sand; a very low hazard from landslides; and a negligible hazard from soluble rocks and collapsible rocks. The site is not in an area affected by mining.

The site is not in a radon affected area, and no radon protection measures are required for new properties on the site.

PRELIMINARY RISK ASSESSMENT

Potential sources of contamination present on or beneath the site would relate primarily to; the historical use of the site; the presence of contaminated soil; and the potential presence of hazardous or ground gas beneath the site.

In order to assess the risks associated with the presence of ground contamination the linkages between the sources and potential receptors to contamination need to be established and evaluated. This is in accordance with the Environmental Protection Act 1990, which provides a statutory definition of Contaminated Land. To fall within this definition it is necessary that, as a result of the condition of the land, substances may be present on or under the land such that;

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

There are three principal factors that are assessed whilst undertaking a qualitative risk assessment for any site. These are the presence of a contamination source, the existence of migration pathways and the presence of a sensitive target(s). It should be noted that it is necessary for each element of source, pathway and target to be present in order for exposure of a human or environmental receptor to occur.

UK Government guidance on the assessment of contaminated land, requires risk to human health and the environment to be reviewed using source i pathway i target relationships. If each of these elements is present, the linkage provides a potential risk to the identified targets.

Contaminants or ***potential pollutants*** identified as ***sources*** in relation to the identified previous uses are listed overleaf in Table 1.

Table 1: Identified Potential Contaminant Sources

<i>Contaminant Source</i>	<i>Comments</i>
Drainage/ Buildings	Effluent from existing field drains could provide a contaminant source. The outbuildings may include asbestos containing materials (ACM).
Soil Beneath Site	Contamination may be present within any made ground on the site.
Soil Gas	Potential soil gas generated from made ground or naturally deposited organic soils.
Ground Contamination Outside Site Boundary	Ground contamination migrating from adjoining sites.

A ***Pathway*** is defined as one or more routes through which a receptor is being, or could be, exposed to, or affected by, a given contaminant.

Potential ***Targets or Receptors*** fall within the categories of Human Health, Water Environment, Flora and Fauna, and Building Materials.

There are a number of possible pathways for the contaminants identified on the site to impact human and/or environmental receptors and these are summarised in Tables 2 and 3.

Table 2: Human Receptors and Pathways

<i>Human Receptor-Mechanism</i>	<i>Typical Exposure Pathway</i>
Human Inhalation	Breathing Dust and Fumes Breathing Gas emissions
Human Ingestion	Eating -contaminated soil, for example by small children -produce grown on contaminated soil Ingesting dust or soil on vegetables Drinking contaminated water
Human Contact	Direct skin contact with contamination Direct skin contact with contaminated liquids

Table 3: Water Receptors and Pathways

<i>Receptor-Water Environment</i>	<i>Typical Exposure Pathway</i>
Groundwater The superficial Tidal Flat Deposits and solid geology Oxford Clay are indicated to be 'Unproductive' strata. The site is not within a Source Protection Zone.	Surface infiltration of atmospheric waters into the soils beneath the site could wash or dissolve potential contaminants and migrate to underlying groundwater. Contamination leads to restriction/prevention of use as a resource, for example, drinking water, and can have secondary impacts on other resources, which depend on it.
Surface Water/Watercourses The nearest surface water feature is a drain immediately south-east of the site.	Surface infiltration of atmospheric waters into the soils beneath the site could wash or dissolve potential contaminants and laterally migrate. Contamination leads to a restriction/prevention of use: -as drinking water resource -for amenity use Effects on aquatic life.

Preliminary Conceptual Model

Assessment of the potential linkage between ground contamination sources, human and environmental receptors have been assessed based on the desk study research documented in the preceding sections of this report.

A generalised preliminary conceptual model is presented below in Table 4.

Table 4: Preliminary Conceptual Model Relative to Residential Development

Receptors	Pathway	Estimated Potential for Linkage with Contaminant Sources			
		Drainage/ Buildings	Soil Beneath Site	Soil Gas	Ground Contamination Outside Site Boundary
Human Health i ground or construction workers	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	Low likelihood/ Likely	Low likelihood	Low likelihood	Low likelihood
Human Health i end users	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	N/A	Low likelihood	Low likelihood	Low likelihood
Water Environment	Migration through ground into surface water or surrounding groundwater	Low likelihood	Low likelihood	Unlikely	Low likelihood
Flora	Vegetation on site growing on contaminated soil	Low likelihood	Low likelihood	Low likelihood	Unlikely
Building Materials	Contact with contaminated soil	Low likelihood	Low likelihood	Low likelihood	Low likelihood
Key to Table 4 Estimated Potential for Linkage with Contaminant Source		Definition			
High likelihood		There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.			
Likely		There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.			
Low likelihood		There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place, and is less likely in the shorter term.			
Unlikely		There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.			
N/A		Not Applicable.			

SITE WORK

The site work conducted on 6th August 2020 comprised eight machine excavated trial pits (TP1 to TP8). The positions are shown on the exploratory hole location plan following this report text.

Public utility service drawings were sourced and consulted prior to determining the exploratory hole positions. Prior to excavation, a service scan was made at each position using a CAT (Cable Avoidance Tool) to check for the absence of detectable buried services that may otherwise have been damaged by the investigation.

The exploratory hole records, presented following the plans, give the descriptions and depths of the various strata encountered, details of all samples taken, in-situ tests and the groundwater conditions observed during and on completion of excavation.

Machine Excavated Trial Pits

Trial pits TP1 to TP8 were excavated using a JCB 3CX to depths of between 2.05m and 3.40m. The exposed strata were sampled and recorded by a Geoenvironmental Engineer. Representative small, bulk and environmental jar samples of soil were taken at regular intervals throughout the depth of each trial pit.

An immediate assessment of the apparent shear strength of clay was made within the trial pits using a hand shear vane. The apparent cohesion results have been plotted against depth in Figure 1.

A Mackintosh Probe (MP) was used to provide an indication of the density of the soils at regular depth intervals within selected trial pits. The 25mm diameter solid cone point of the probe was screwed onto the rods and driven into the ground by repeated blows of a 4.5kg slide hammer with a fall of 0.30m. The depth penetrated for 100 blows was recorded and is presented on the trial pit records.

Soakaway tests were carried out within trial pits TP1 and TP2 in broad accordance with BRE Digest 365 (2016) in order to allow the assessment of the soil infiltration rate. The

general method of the test was to excavate the trial pits with vertical sides trimmed square to the base. The dimensions were accurately measured and recorded, and the pit was then filled with clean water. The rate of water dissipation from the pit was measured by recording the depth of water relative to a datum at frequent time intervals. After an initial 120 to 150 minute monitoring period the pits were refilled and the tests recorded for a further 240 minutes. The results are presented and follow the respective trial pit records.

On completion, the trial pits were emptied of water, backfilled with arisings and the surfaces reinstated.

LABORATORY WORK

The samples were inspected in the laboratory and assessments of the soil characteristics have been taken into account during preparation of the trial pit records. The soil descriptions have been made in accordance with BS5930:2015+A1:2020. The geotechnical test results, undertaken in accordance with BS1377:1990 & 2016, are presented following the exploratory hole records. The chemical test results follow the geotechnical test results.

The moisture content and index properties of selected soil samples were determined as a guide to soil classification and behaviour. The liquid limit was determined by a cone penetrometer.

The particle size distribution of selected samples of silt and sand were determined by sieve analysis. The particle size distribution passing the 63µm sieve was obtained by pipette sedimentation on selected samples. Results of these tests have been combined and are presented as particle size distribution curves at the end of this report.

California Bearing Ratio (CBR) tests were performed on selected recompacted near surface samples in accordance with Lincolnshire County Council's specification. The samples were recompacted using a 2.5kg rammer (BS light) or vibrating hammer, and the test consisted of jacking into the soil a cylindrical plunger with a cross sectional area of 1935mm². A force of 50N was applied initially to seat the plunger on the soil surface and then the plunger was made to penetrate the soil at a uniform rate of 1mm/min. Readings of force were taken at intervals of penetration of 0.25mm to a penetration not exceeding 7.50mm. The CBR value is the ratio of the force required to achieve 2.5mm or 5.0mm penetration to standard forces expressed as a percentage.

Selected samples of soil were analysed to determine the concentration of soluble sulphates. The pH values were also determined.

Chemical analysis of soil samples recovered from the exploratory holes was undertaken, by an independent laboratory, primarily for characterisation purposes. The samples were tested for a suite encompassing a wide range of potential contaminants outlined by the

Environment Agency (EA) and National House Building Council (NHBC) document R&D 66;
2008 'Guidance for the Safe Development of Housing on Land Affected by Contamination'

GROUND CONDITIONS

The ground conditions have been plotted as a soil profile in Figure 2. The ground conditions comprised a surface layer of made ground to between 0.20m and 0.80m depth, underlain by superficial Tidal Flat Deposits comprising sandy, silty clay, overlying very silty to silty Marine Sand at 0.50m to 1.30m depth. Groundwater was recorded between 2.05m and 3.40m depth during the investigation.

Made Ground

Made ground was generally encountered to between 0.20m and 0.40m depth, and locally to 0.80m depth in TP5 in the area of the stable. The made ground generally comprised stiff, dark brown, slightly gravelly, silty clay. The gravel fraction comprised angular to rounded flint, quartzite, quartz, and locally with occasional brick fragments.

In TP5 close to the stable, a 0.02m surface layer of sandy topsoil was underlain by a 0.13m thick layer of light brown, silty sand and gravel fill, with a gravel fraction of limestone. Beneath the sand and gravel fill, a firm, dark brown, slightly gravelly, silty clay with a gravel fraction of sub-angular and sub-rounded flint, quartzite, quartz, ash, coal and brick fragments.

Tidal Flat Deposits

Beneath the surface made ground at between 0.20m and 0.80m depth, firm, locally stiff (TP6, TP7 and TP8), orange brown, light brown and light grey, sandy, silty clay was encountered. These soils were considered to represent the anticipated superficial Tidal Flat Deposits, and were encountered to depths of between 0.50m (TP2 and TP3) and 1.30m (TP8).

Marine Sand

At depths of between 0.50m and 1.30m, light brown and orange brown, very silty sand was encountered, which became silty sand with depth, and was found to at least the base of

the trial pits at a maximum 3.40m depth. The sand fraction was generally fine grained, and these soils were considered to represent superficial Marine Sand.

Groundwater

Groundwater was recorded during excavation of the trial pits at between 2.05m (TP1) and 3.40m (TP8) depth. Groundwater was recorded at between 2.05m and 3.40m depth on completion of the trial pits.

Observations

Live roots were observed to a maximum depth of 1.80m in TP8.

Excavation Stability

The trial pit sides were generally unstable and collapsed below 0.90m to 2.70m depth.

Evidence of Contamination

The made ground encountered during this investigation was not noted to have olfactory or visual evidence of fuel contamination. The made ground contained occasional fragments of ash, coal and brick. No asbestos containing materials were noted in the soils during this investigation, or during testing.

COMMENTS ON THE GROUND CONDITIONS IN RELATION TO FOUNDATION DESIGN AND CONSTRUCTION

This investigation found made ground to depths of between 0.20m and 0.80m, covering superficial firm or stiff clay Tidal Flat Deposits, and in turn generally loose, initially very silty Marine Sand below 0.50m to 1.30m depth. Groundwater was met as shallow as 2.05m depth during the investigation. The superficial deposits (clay and sand) could offer support for lightly to modest loaded traditional foundations for the proposed housing development.

The clays of the Tidal Flat Deposit were generally firm or stiff, but were root affected and should not be used to support proposed houses. The proposed houses should not be supported on traditional foundations cast within the shallow clay soils unless the structures are lightly loaded and could tolerate significant total and differential consolidation movements. Slightly deepened foundations will be locally required on this site, due to the proximity of hedgerows and trees around the site boundaries, in order to penetrate the zones of root influence within the low to high volume change potential clays.

Foundations should extend through any firm and stiff, desiccated, root affected clays, into the underlying very silty to silty Marine Sand 0.50m to 1.30m below ground level, which offers modest support for traditional foundations.

Floor slabs could be ground bearing in areas where they are well away from the influence of trees, or where sand forms the sub-grade, although differential movements are likely to occur.

Traditional Shallow Foundations

Large scale processes of natural sedimentation allow a certain degree of confidence to be placed in the absence of important variation of the engineering properties of natural soils across sites. The made ground had variable bearing properties and was found to a maximum depth of 0.80m, and root affected clay Tidal Flat Deposits were encountered to between 0.50m to

1.30m depth. The made ground and root affected clay soils should both be avoided as bearing strata.

Samples of the near surface clay had modified plasticity indices of between 17% and 43%, and the silty clay is rated as having a low to high volume change potential based on NHBC Standards Chapter 4.2 'Building near trees' (2020). A minimum foundation depth of 1.00m in the naturally deposited clay soils beneath this site, where remote from trees, would be considered appropriate in order to penetrate the zone affected by seasonal moisture content and volume change. The 'firm and stiff crust' of the near surface clays was root affected, and it is recommended that foundations are extended into the underlying non-shrinkable silty sand soils.

The silty sand soils would be classed as non-shrinkable and where present could enable foundations to be cast at a minimum foundation depth of 0.60m.

In summary, foundations for the new buildings will need to be a minimum of 0.60m deep, and preferably extended through any clay soils into non-shrinkable silty sand soils encountered as deep as 1.30m below ground level.

In areas within the zones of root influence, anti-heave precautions such as void forming or compressible materials, should be incorporated alongside strip foundations within root affected clay soils.

The non-shrinkable, orange brown and brown, very silty fine sand, found beneath the surface clay soils at between 0.50m and 1.30m depth, offers a maximum safe bearing pressure of 80kN/m² for foundations up to 1.20m width, where present above the groundwater table. The above bearing pressure should ensure that settlement beneath such foundations would be within 25mm. Settlement within the underlying sand should occur as the loads are applied.

Structures founded within the Tidal Flat Deposits would have to tolerate potentially large total and differential settlements, which may be exaggerated where the foundations cross any natural variation different soil types. Differential settlements are likely to occur across individual building plots where foundations partially bear within the clay, due to variation in thickness and compressibility of the underlying soils. Further differential movements will occur if and where foundation pressures locally increase along foundation runs. Movements

could be further exacerbated by effects of desiccation, which could also locally generate upward heave movements. New foundations should incorporate reinforcement in order to minimise differential movements along or between them.

Excavations

The made ground together with the underlying soils should be easily removed within excavations for the proposed buildings. The sides of excavations within any silty fine sand are likely to be unstable and should not be relied upon to stand unsupported.

Excavations could be expected to encounter groundwater at depths between 2.05m and 3.40m, which is likely to reflect the water level in nearby drains. The groundwater levels may fluctuate seasonally and such inflows would locally be accompanied by 'running sand' conditions and resulting instability. Care should be taken not to excavate below the water table in the absence of suitable groundwater control and side support, such as dewatering via screened sumps or well points and interlocking sheeting. The clays, and silty sands are prone to softening, deterioration and loosening in the presence of water, with loss of their modest bearing properties. Care should be taken to keep the excavations dry.

Attention should be given where personnel are to enter deep excavations, when sides should either be safely battered back, or close side support provided, in order to comply with statutory safety requirements and prevent sidewall collapse.

Floor Slabs

Ground bearing floor slabs could be adopted for the new properties where they are beyond the zones of influence from trees, and the naturally deposited clay/silt and non-shrinkable silty sand soils are present at shallow depth.

Ground bearing floor slabs could be adopted for proposed buildings, even within influencing distance of neighbouring trees, if root infested clays are removed and replaced with suitable well-graded coarse-grained fill. Damaging differential heave movements could occur across such slabs, particularly where they cover any clay affected by recently severed tree roots.

Suspended floor slabs will be required to avoid the anticipated large total and differential consolidation settlements, any negative skin friction, together with any volume change movements within root affected clays, providing that the sub-floor gaps recommended in Table 7 of the NHBC Standards Chapter 4.2 (2020), are adopted.

Hardstanding

Naturally deposited, firm or stiff, silty clays or loose to medium dense, very silty fine sand was encountered at sub-grade level across this site.

Based on IAN 73/06, Table 5.1 recommends a design CBR value of 1% for silt, 2.5% for silty clay with a plasticity index of 40%, and 20% for a poorly graded sand.

Laboratory CBR tests yielded CBR values ranging between 0.3% and 17%. A design CBR value of 1.0% for the naturally deposited very silty sand, and 2.5% for silty clay should be adopted for hardstanding design on this site, although the pavement construction will need to be at least 450mm thick since the silty soils are considered to be potentially frost susceptible in accordance with Road Note 29, Appendix 1.

The sub-grade should be suitably compacted and inspected, with any topsoil, very soft, organic or desiccated clays, being removed and replaced with suitable well-graded coarse-grained fill. Care should be taken not to allow exposed silt/clay soils at sub-grade level to become exposed to inclement weather conditions, since they are prone to rapid softening and deterioration. A permeable geotextile should be incorporated in order to prevent both loss of any sub-base material into the sub-grade and migration of sub-grade soils into the overlying sub-base.

Drainage

The soakaway tests in TP1 and TP2 determined extrapolated soil infiltration rates (f) of between $1.78 \times 10^{-6} \text{m/s}$ and $7.06 \times 10^{-6} \text{m/s}$, for the orange brown, very silty to silty sand. These results rate the soils as having a 'good' to 'poor' drainage potential according to BS8004:1986 Figure 6.

Groundwater was met during excavation of the trial pits at depths of between 2.05m and 3.40m within silty sand soils of the Marine Sand. The soakaway drainage on this site may deteriorate over time as the chambers become blocked with silt. Provision should be made for regular cleaning. There would be no advantage in excavating soakaway chambers below the groundwater level, which reduces the effective volume of the soakaway.

Sulphate Conditions

Sulphate analysis of selected samples of soil yielded soluble sulphate concentrations within Design Sulphate Classes DS-1 and DS-2, of the BRE Special Digest 1, Table C1 (2001), presented in Appendix 3. The pH results of the samples ranged between 4.3 and 8.4 indicating acidic to alkaline conditions.

These results indicate an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-3z for buried concrete. This ACEC Class should be considered when specifying a Design Chemical Class (DC Class) for buried concrete on this site, as detailed in the above cited BRE document.

COMMENTS ON THE SOIL CHEMICAL TEST RESULTS

The results of the laboratory chemical testing on near surface soil samples have primarily been compared to soil screening values (SSVs) produced by Land Quality Management Limited (LQM) and the Chartered Institute for Environmental Health (CIEH) presented in their document 'The LQM/CIEH S4ULs for Human Health Risk Assessment: 2015 (Publication Number S4UL3608)'. The LQM/CIEH S4ULs are intended for use in assessing the potential risks posed to human health by contaminants in soil and are transparently-derived and cautious 'trigger values' above which further assessment of the risks or remedial action may be needed. The S4ULs (Suitable for Use Levels) have been derived, in accordance with UK legislation and Environment Agency policy, using a modified version of the Environment Agency CLEA 1.06 software.

Reference has also been given to ATRISKsoil soil screening values produced by Atkins Limited and provided under licence to Ground Engineering Limited. Atkins SSVs have been derived in line with the Environment Agency 2009 guidance using the CLEA 1.071 software. With the absence of a S4UL for cyanide the ATRISKsoil SSV has been used as the soil screening criteria within this report.

In 2014 the Department for Environment Food and Rural Affairs (DEFRA) published, in their document SP1010, Category 4 Screening Levels (C4SL) for several contaminants including lead. The C4SL represent screening levels below which the land could be considered suitable for a specified use and definitely not contaminated land in respect of those determinands. With the absence of S4UL for lead the C4SL has been used as the soil screening criteria within this report.

For each contaminant the adopted soil screening criteria have been calculated for the following land uses:

- Residential use with home grown produce
- Residential use without home grown produce
- Commercial and industrial usage

The intended purpose of the SSVs are as 'intervention values' in the regulatory framework for assessment of human health risks in relation to land use. These values are not binding standards, but are intended to inform judgements about the need for action to ensure that a new use of land does not pose any unacceptable risks to the health of the intended users.

Table 5 compares the test results for the made ground with the SSVs in relation to the specified uses. The number of test results, which exceed these values, are also provided.

Table 5: Comparison of Chemical Test Results with SSVs for Near Surface Soils

Determinand	Number of Samples	Min Value mg/kg	Max Value mg/kg	Number of Samples Exceeding SSV for			Measured 95 th Percentile mg/kg	Assessment Method	Soil Screening Criteria 2.5% SOM		
				Residential with home grown produce	Residential without home grown produce	Commercial/ Industrial			Residential with home grown produce mg/kg	Residential without home grown produce mg/kg	Commercial/ Industrial mg/kg
Organic Matter	9	5.5%	14%	-	-	-	-	-	-	-	-
Arsenic	9	21	25	0	0	0	23.90	S4UL	37	40	640
Cadmium	9	<0.2	0.3	0	0	0	0.23	S4UL	11	85	190
Chromium (III)	9	41	54	0	0	0	48.97	S4UL	910	910	8600
Chromium (VI)	9	<4.0	<4.0	0	0	0	<4.0	S4UL	6	6	33
Lead	9	48	83	0	0	0	69.22	C4SL	200	310	2330
Mercury	9	<0.3	1	0	0	0	0.93	S4UL	11	15	320
Selenium	9	<1	<1	0	0	0	<1	S4UL	250	430	12,000
Nickel	9	28	42	0	0	0	38.00	S4UL	130	180	980
Phenols	9	<1.0	1.5	0	0	0	1.29	S4UL	200	690	690
Benzo[a]pyrene	9	<0.05	0.73	0	0	0	0.27	S4UL	0.98	1.2	15
Copper	9	21	35	0	0	0	29.06	S4UL	2400	7100	68,000
Zinc	9	70	140	0	0	0	107.44	S4UL	3700	40,000	730,000
Free Cyanide	9	<1	<1	0	0	0	<1	ATRISK	34	34	34

Notes

S4UL and C4SL for metals were derived using 6% SOM. These values are not sensitive to SOM and would also be applicable for 1% SOM and 2.5% SOM.

LQM/CIEH S4ULs ©Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3608. All rights reserved

ATRISKsoil SSVs produced by Atkins Limited and provided under licence to Ground Engineering Limited.

Discussion of Soil Results

Levels of all elements and compounds in the samples tested were within the associated soil screening values for both residential end uses and for commercial/industrial end use.

Statistical analysis, using the mean value test, indicates that none of the US95 values exceeded the screening values for the most sensitive end uses of residential with home grown produce and residential without home grown produce, nor the screening values for a commercial or industrial usage.

The made ground encountered during this investigation was not noted to have olfactory or visual evidence of fuel contamination.

No asbestos containing materials (ACM) were observed within the made ground soils during site work or testing in the laboratory.

In conclusion, the near surface soils would be suitable for use in the proposed gardens and landscaped areas of the residential development, and also beneath buildings and areas of permanent hardstanding if geotechnically suitable.

UPDATED CONCEPTUAL MODEL

Assessment of the potential linkage between ground contamination sources, human and environmental receptors have been assessed based on the desk study research and the intrusive ground investigation documented in the preceding sections of this report.

A generalised conceptual model relative to the existing site and proposed residential use of the site is presented in Table 6 below.

Table 6: General Conceptual Model Relative to Future Residential Development

Receptors	Pathway	Estimated Potential for Linkage with Contaminant Sources			
		Drainage/ Buildings	Soil	Soil Gas	Off-Site Sources
Human Health i ground workers	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	Low/ Moderate	Low	Low	Very Low
Human Health i users of completed development	Ingestion and Inhalation of contaminated Soil, Dust and Vapour	N/A	Very Low	Low	Very Low
Water Environment	Migration through ground into surface water or groundwater	Low	Very Low	Very Low	Low
Flora	Vegetation on site growing on contaminated soil	Very Low	Very Low	Very Low	Very Low
Building Materials	Contact with contaminated soil	Very Low	Very Low	Very Low	Very Low

<u>Key to Table 6</u> Risk	Definition
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, or, there is evidence that severe harm to a designated receptor is currently happening. The risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) and remedial works may be necessary in the short term and likely over the long term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.
N/A	Not Applicable because the proposed development will remove the source.

COMMENTS ON GROUND CONTAMINATION IN RELATION TO PROPOSED DEVELOPMENT

Anticipated exposure scenarios relating to the existing site, the site history and proposed residential end use of the site, in the context of the conceptual model, are discussed as follows.

This investigation may not have revealed the full extent of contamination on the site and appropriate professional advice should be sought if subsequent site work reveals materials that may appear to be contaminated.

Contaminated Soil

On the basis of the ground investigation, the site is underlain by between 0.20m and 0.80m of made ground and topsoil. The chemical testing has identified no elevated concentrations in the soils tested in respect to the proposed gardens or soft landscaping in the residential development, and would be suitable beneath buildings or areas of permanent hardstanding. The absence of contaminants in the made ground indicates that there is a low risk of contaminants affecting groundworkers during any construction works, and there will be a very low risk of affecting future end users of the site.

The underlying naturally deposited soils encountered beneath the site would generally be considered suitable for retention and re-use within the development if required.

Existing Drainage

Redundant drain runs, where encountered, should be removed from beneath the site and precautions should ensure that any remaining effluent is directly disposed off-site. The integrity of existing drainage should be checked, and if they are to be retained any damaged sections should be replaced prior to development. The latter measures should minimise any future risk to human health and the water environment.

Buildings

The existing outbuildings within the site may have asbestos containing materials within them and an asbestos survey should be undertaken prior to demolition for the proposed redevelopment. Suitable precautions, in line with current best practice, should be put in place to protect workers from the effects of asbestos material, during the site clearance and redevelopment phases.

There is a very low risk of contamination affecting the existing and proposed structures, and their foundations.

Soil Gas

According to the environmental database there are no landfills recorded within 250m of the site. The site is generally underlain by a thin layer of made ground and topsoil, covering variable Tidal Flat Deposits and in turn Marine Sand at depth.

There is a low risk that hazardous gases would affect groundworkers during the construction phase and a low risk of hazardous gases affecting future users of the site.

Consideration should be given to gas monitoring within deep or confined spaces, particularly where thick made ground and organic soils are present, to ensure safety of personnel entering them, since carbon dioxide could accumulate within any excavations, service chambers or sub-structures.

The site is not in a radon affected area, and no radon protection measures are required for new properties on the site.

Human Health - Construction Workers

Based on the chemical test results, no special precautions would be required during the development of the site by workers who may come into contact with the soil during groundworks, providing standard precautions are adopted which should generally include the procedures given by the Health and Safety Executive (The Blue Book) HS(G)66.

For the protection of workers during groundworks the following is recommended:

a) Limit repeated or prolonged skin contact with soils by wearing gloves with sleeves rolled down.

b) Washing facilities should be made available to groundworkers, so as to minimise the potential for inadvertent ingestion of soil.

c) If any soils are revealed which are different to those encountered by this ground investigation, the advice of a specialist should be sought in view of classifying the material and ascertaining its risk to groundworkers.

d) Suitable precautions, in line with current best practice, should be put in place to protect workers from the effects of asbestos containing material, during the site clearance phase.

e) Consideration should be given to gas monitoring within deep or confined spaces, particularly where thick made ground and organic soils are present, to ensure safety of personnel entering them, since carbon dioxide could accumulate within any excavations, service chambers or sub-structures.

Human Health - Users of Completed Development

The results of the chemical analysis undertaken would indicate that the made ground and near surface soils should be considered suitable for re-use at the surface in any new garden, landscaped or planted areas.

The made ground could be considered for re-use beneath proposed buildings and permanent hardstanding, if suitable for engineering purposes, where it is unlikely to affect future users of the site, however these soils could affect buried services.

Any soil imported to site must be certified as "suitable for use".

Water Environment

The site is underlain by superficial Tidal Flat Deposits and solid geology Oxford Clay at depth, which are indicated by the EA to be 'Unproductive' strata. The Marine Sand beneath the site would be anticipated to be a 'Secondary (A) Aquifer'. The nearest surface water

feature is the drain along the south-eastern boundary of the site. The site does not lie within a source protection zone.

Groundwater was recorded as shallow as 2.05m below ground level during the investigation.

The risk to the water environment from soil contaminants is considered very low as it is unlikely that the proposed development and contaminants within the made ground soils would impact the quality of the water environment.

Effects on Building Materials and Buried Services

The sulphate requirements for buried concrete have been discussed in the previous section of this report.

The local water supply company should be consulted if new buried plastic water pipes are to be installed within the made ground soils on this site.

Off-Site Disposal of Soil Arisings

The results of chemical analysis provided to the rear of this report should be used within the information necessary for basic characterisation of the soil destined for landfill. The Environment Agency publication Hazardous Waste, Technical Guidance WM3 outlines the methodology for classifying wastes and should be referenced for guidance. The test results (total metals, hydrocarbons and cyanide) should be compared to the relevant thresholds to determine whether they fall into the primary categories of non-hazardous or hazardous waste and will help indicate the likely European Waste Catalogue (EWC) code which is determined by the waste type. The results of Waste Acceptance Criteria (WAC) leachate testing, on a sample from TP1 at 0.10m depth, should be used to check whether, if categorised as non-hazardous waste it could be disposed of at an inert waste landfill; or if categorised as hazardous waste whether it could qualify as stable non-reactive hazardous waste for disposal in non-hazardous landfill. Asbestos containing materials would be considered hazardous and should be appropriately disposed of.

It is expected that arisings of natural soils from the excavations across this site would fall into the inert category under the European Waste Catalogue description 'Soil and Stones', EWC code 17 05 04 with restrictions excluding topsoil and peat.

GROUND ENGINEERING LIMITED



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Senior Geo-Environmental Engineer



C. M. J. EBELING

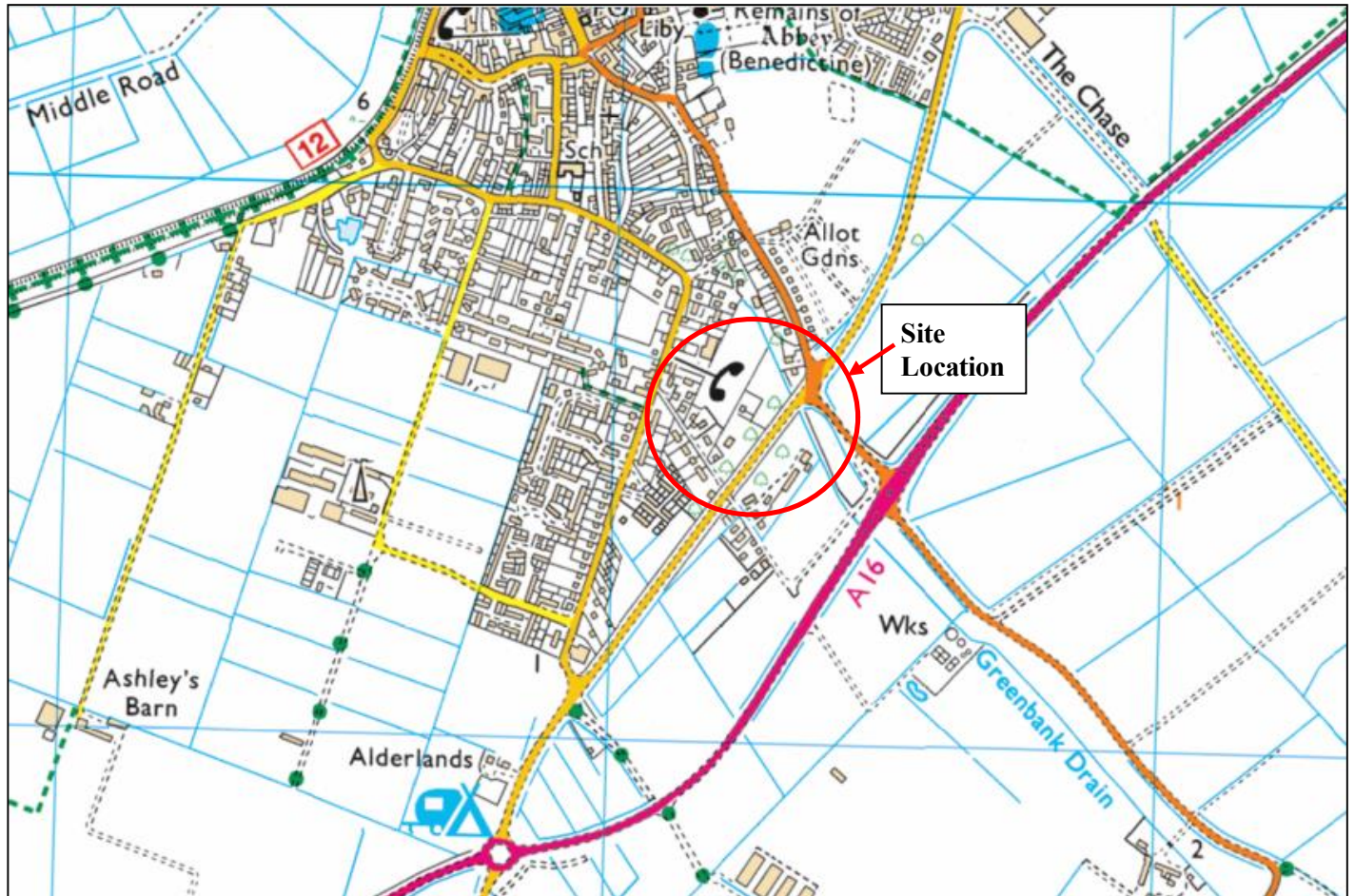
M.Sc.(Eng.), M.A.E.G.,

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Director

Site Location Plan

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Not To Scale



Project : Barber's Drove North, Crowland, Lincolnshire

Client : Burmor Construction

**GROUND
ENGINEERING
LIMITED**

Peterborough

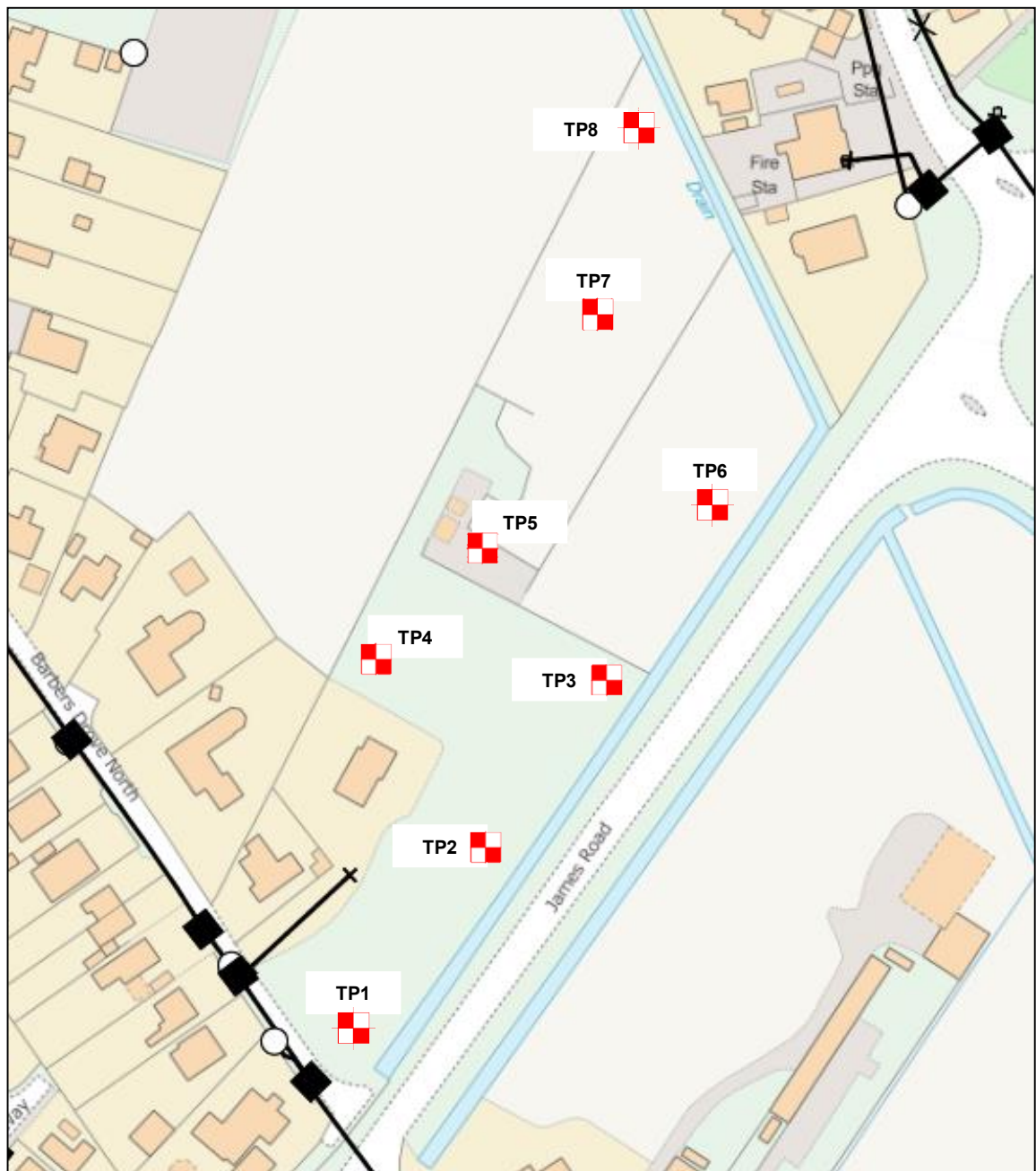
Tel : 01733 566566

Project No.

C15122

Exploratory Hole Location Plan

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Not To Scale



Project : Barber's Drove North, Crowland, Lincolnshire

Client : Burmor Construction

**GROUND
ENGINEERING
LIMITED**

Peterborough Tel : 01733 566566

**Project No.
C15122**

GROUND ENGINEERING LIMITED Tel: 01733-565566 www.groundengineering.co.uk			Site: BARBER'S DRIVE, CROWLAND		TRIAL PIT TP1			
Samples and in-situ Tests			Date: 06/08/20	Pit Size: 1.70m L x 0.60m W x 2.05m D.		Ground Level:		
Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m	
0.10	D1	(80)		MADE GROUND - Stiff, dark brown, slightly gravelly, silty CLAY. Gravel is sub-angular to rounded quartz, quartzite and flint.		0.30		
0.10	ES1			Firm, brown, orange brown and grey, sandy CLAY. (TIDAL FLAT DEPOSIT)				
0.10	V1							
0.40	D2	(42)						0.80
0.40	V2							
0.50-0.80	B1							
0.90	D3				Orange brown, very silty SAND. Sand is fine grained.			1.50
1.20	D4		(MARINE SAND)					
1.45	D5		Grey and orange brown, silty SAND. Sand is fine grained.					
1.60	D6			(MARINE SAND)		2.05		
2.05	D7			1 Pit completed at 2.05m depth				

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- Σ - Water Strike
- ↗ - Water Rise
- ✓c - Level on completion
- MP - Mackintosh Probe
- P() - Hand Penetrometer
- Cohesion () kPa
- V - Vane Shear Test
- Cohesion () kPa

REMARKS

1. Live roots observed to 1.45m depth
2. Pit sides unstable below 1.90m depth
3. Groundwater met at 2.05m depth
4. Water stood at 2.05m depth on completion

Project No
15122

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SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Barber's Drove, Crowland
Client: Burmor Construction

Project No: C15122
Sheet No: 1/2

Trial Pit: TP1
Depth: 2.05
Length: 1.70
Width: 0.60

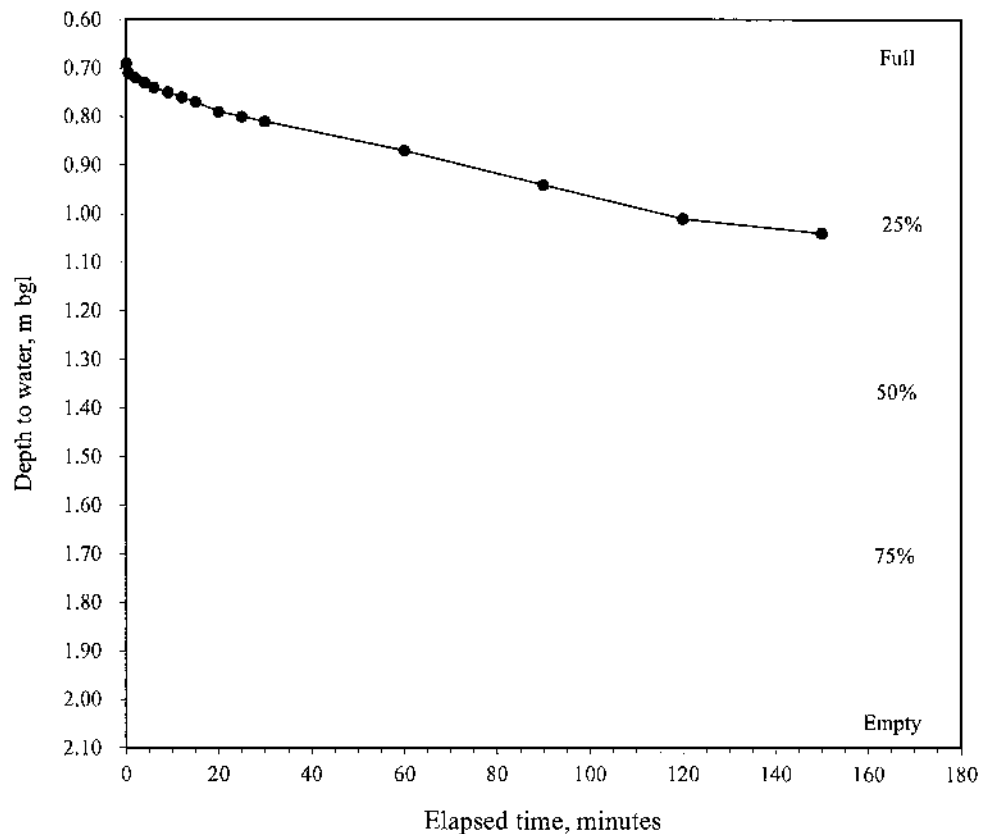
FIRST FILLING

Description of Stratum under test: Blue grey and orange brown mottled silty SAND.

Depth to water prior to test: 2.05 (Seepage)
(below ground level)

DEPTH TO WATER vs ELAPSED TIME

Elapsed Time min	Depth to Water m
0	0.69
1	0.71
2	0.72
4	0.73
6	0.74
9	0.75
12	0.76
15	0.77
20	0.79
25	0.80
30	0.81
60	0.87
90	0.94
120	1.01
150	1.04



$$f = (V75 - V25) / A50(T75 - T25)$$

V75-V25 = 0.694
A50 = 4.148
T75-T25 = 1570

Extrapolated Soil Infiltration Rate $f = \underline{1.78E-06} \text{ m/s}$

All dimensions given in metres

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Barber's Drove, Crowland
Client: Burmor Construction

Project No: C15122
Sheet No: 2/2

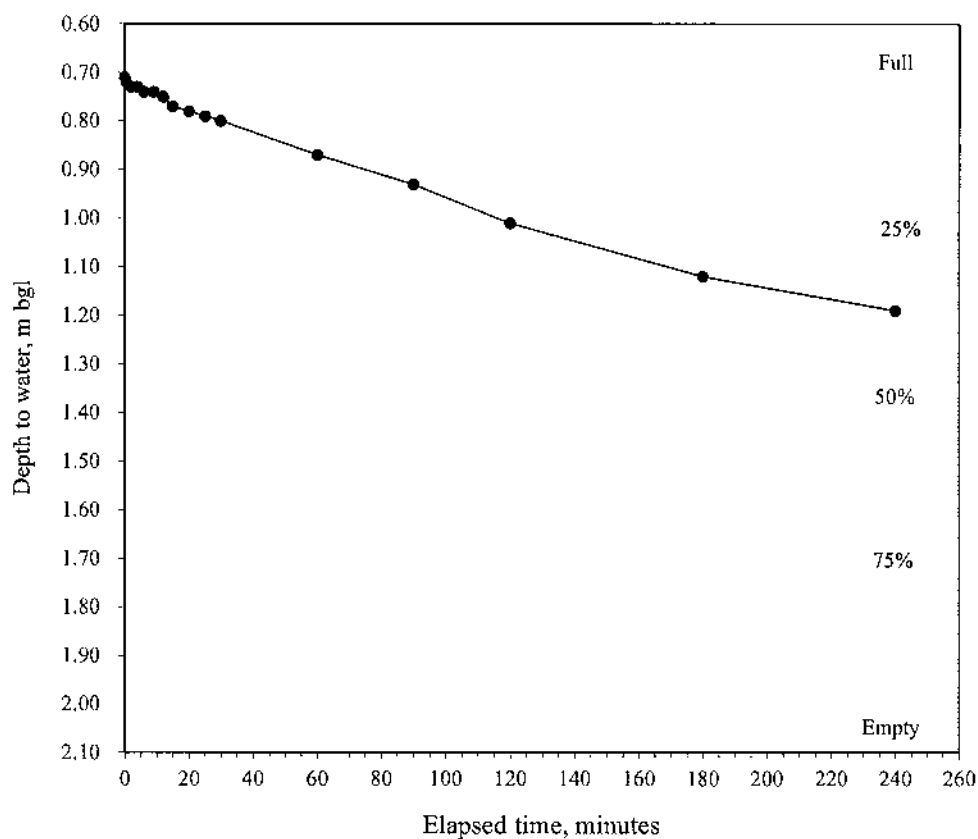
Trial Pit: TP1 SECOND FILLING
Depth: 2.05
Length: 1.70
Width: 0.60

Description of Stratum under test: Blue grey and orange brown mottled silty SAND.

Depth to water prior to test: Dry
(below ground level)

DEPTH TO WATER vs ELAPSED TIME

Elapsed Time min	Depth to Water m
0	0.71
1	0.72
2	0.73
4	0.73
6	0.74
9	0.74
12	0.75
15	0.77
20	0.78
25	0.79
30	0.80
60	0.87
90	0.93
120	1.01
180	1.12
240	1.19



$$f = (V75-V25)/A50(T75-T25)$$

$$V75-V25 = 0.683$$

$$A50 = 4.102$$

$$T75-T25 = 912$$

Extrapolated Soil Infiltration Rate $f = \underline{\underline{3.04E-06}} \text{ m/s}$

All dimensions given in metres

GROUND ENGINEERING			Site: BARBER'S DROVE, CROWLAND		TRIAL PIT TP2	
L I M I T E D			Date: 06/08/20	Pit Size: 1.70m L x 0.60m W x 2.45m D.	Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O. D. Level m
0.05	V1	(90)		MADE GROUND - Stiff, dark brown, slightly gravelly, silty, organic CLAY. Gravel is angular to sub-rounded quartz, quartzite and flint.		
0.15	D1					
0.15	ES1					
0.40	D2			Firm, grey, brown and dark brown, sandy, silty CLAY.		0.35
0.40	V2	(62)		(TIDAL FLAT DEPOSIT)		0.50
0.50-0.80	B1			Medium dense, light brown and orange brown, very silty SAND. Sand is fine grained.		
0.60	D3					
0.90-1.35	MP1	100				
1.20	D4			(MARINE SAND)		
1.60	D5			Grey and orange brown, silty SAND.		1.55
2.00	D6			(MARINE SAND)		
2.45	D7			Pit completed at 2.45m depth		2.45
KEY			REMARKS			
D - Disturbed Sample			1. Live roots observed to 1.20m depth			
B - Bulk Sample			2. Groundwater seepage at 2.45m depth			
U - Undisturbed Sample			3. Pit sides stable			
R - Root Sample			4. Water stood at 2.45m depth on completion			
W - Water Sample						
ES - Environmental Sample						
 Water Strike						
 Water Rise						
 Level on completion						
MP - Mackintosh Probe						
P() - Hand Penetrometer						
Cohesion () kPa						
V - Vane Shear Test						
Cohesion () kPa						
					Project No 15122	
					Scale 1:25	Page 1/1

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Barber's Drove, Crowland
Client: Burmor Construction

Project No: C15122
Sheet No: 1/2

Trial Pit: TP2
Depth: 2.45
Length: 1.70
Width: 0.60

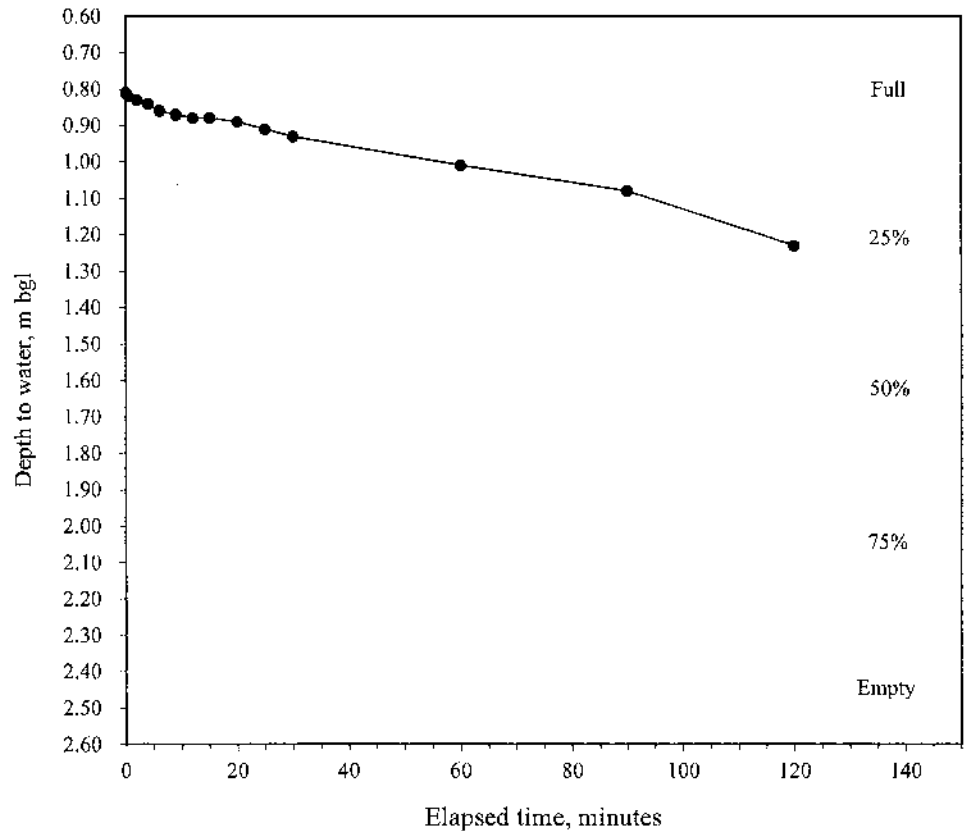
FIRST FILLING

Description of Stratum under test: Blue grey and orange brown mottled silty SAND.

Depth to water prior to test: 2.45 (Seepage)
(below ground level)

DEPTH TO WATER vs ELAPSED TIME

Elapsed Time min	Depth to Water m
0	0.81
1	0.82
2	0.83
4	0.84
6	0.86
9	0.87
12	0.88
15	0.88
20	0.89
25	0.91
30	0.93
60	1.01
90	1.08
120	1.23



$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 0.836$$

$$A50 = 4.792$$

$$T75 - T25 = 383$$

Extrapolated Soil Infiltration Rate $f = \underline{7.60E-06} \text{ m/s}$

All dimensions given in metres

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Barber's Drove, Crowland
Client: Burnor Construction

Project No: C15122
Sheet No: 2/2

Trial Pit: TP2
Depth: 2.45
Length: 1.70
Width: 0.60

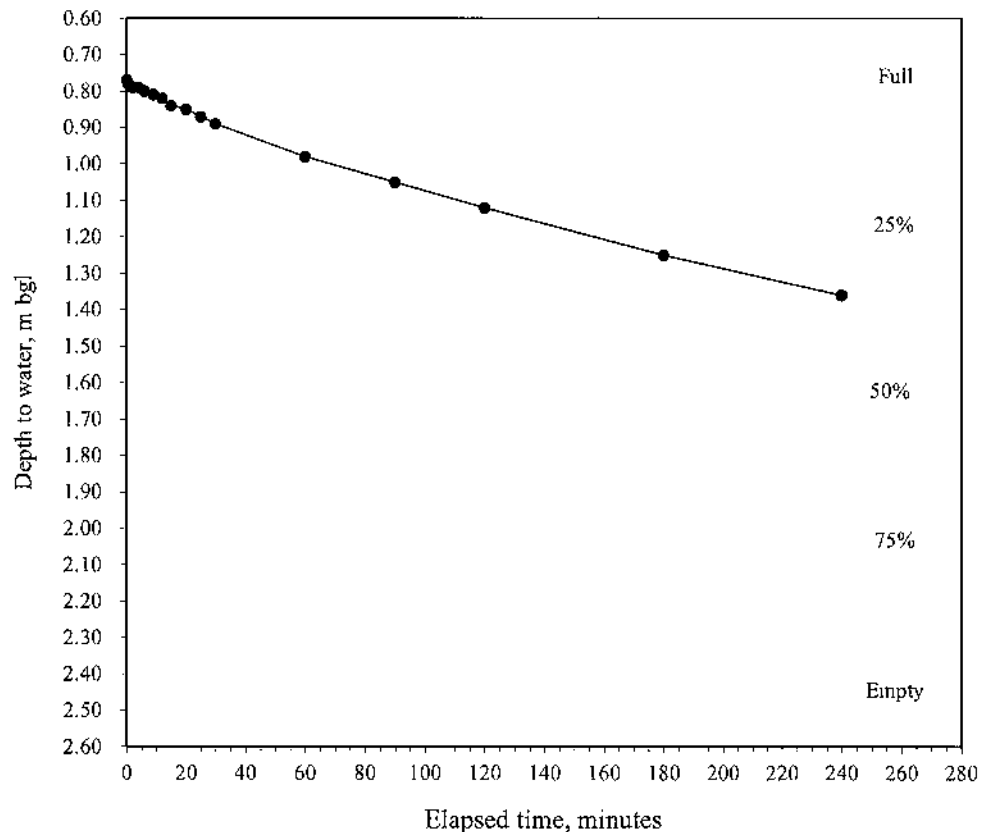
SECOND FILLING

Description of Stratum under test: Blue grey and orange brown mottled silty SAND.

Depth to water prior to test: Dry
(below ground level)

DEPTH TO WATER vs ELAPSED TIME

Elapsed Time min	Depth to Water m
0	0.77
1	0.78
2	0.79
4	0.79
6	0.80
9	0.81
12	0.82
15	0.84
20	0.85
25	0.87
30	0.89
60	0.98
90	1.05
120	1.12
180	1.25
240	1.36



$$f = (V75-V25)/A50(T75-T25)$$

$$V75-V25 = 0.857$$

$$A50 = 4.884$$

$$T75-T25 = 560$$

Extrapolated Soil Infiltration Rate $f = \underline{5.22E-06} \text{ m/s}$

All dimensions given in metres

GROUND ENGINEERING LIMITED Tel: 01733-666666 www.groundengineering.co.uk			Site: BARBER'S DROVE, CROWLAND		TRIAL PIT TP3		
Samples and in-situ Tests			Date: 06/08/20	Pit Size: 1.70m L x 0.60m W x 3.10m D.		Ground Level:	
Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
0.05	D1			MADE GROUND - Stiff, dark brown, slightly gravelly, silty, organic CLAY. Gravel is angular to sub-rounded quartz, quartzite and flint.			
0.05	ES1					0.35	
0.40	D2			Firm, grey, brown and dark brown, sandy, silty CLAY.		0.50	
0.50-0.80	B1			(TIDAL FLAT DEPOSIT)			
0.60	D3			Loose, light brown and orange brown, very silty SAND. Sand is fine grained.			
0.75-1.42	MP1	100					
1.00	D4			(MARINE SAND)			
1.40	D5					1.55	
1.60	D6			Brown, orange brown and grey, very silty SAND. Sand is fine grained.			
				(MARINE SAND)		2.10	
2.15	D7		1 V	Grey, silty SAND.			
2.50	D8			(MARINE SAND)			
3.10	D9		2 c	Pit completed at 3.10m depth		3.10	

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- 1
V Water Strike
- 2
c Water Rise
- 2
c Level on completion
- MP - Mackintosh Probe
- P() - Hand Penetrometer Cohesion () kPa
- V - Vane Shear Test Cohesion () kPa

REMARKS

- Live roots observed to 1.20m depth
- Pit sides unstable and collapsed below 1.50m depth
- Groundwater met at 2.30m depth
- Water stood at 3.10m depth on completion

Project No
15122

Scale 1:25 Page 1/1

L I M I T E D
Tel: 01733-566566
www.groundengineering.co.uk

Date: 06/08/20

Pit Size: 1.70m L x 0.60m W x 2.70m D.

TRIAL PIT
TP4

Ground
Level:

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample ES - Environmental Sample ∇ - Water Strike ∇ - Water Rise ∇c - Level on completion MP - Mackintosh Probe P () - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa	REMARKS 1. Live roots observed to 1.00m depth 2. Pit sides unstable below 1.20m depth 3. Groundwater met at 2.20m depth 4. Water stood at 2.70m depth on completion	Project No 15122	
		Scale 1:25	Page 1/1

GROUND ENGINEERING L I M I T E D Tel: 01733-566566 www.groundengineering.co.uk			Site: BARBER'S DROVE, CROWLAND		TRIAL PIT TP5	
Date: 06/08/20			Pit Size: 1.70m L x 0.60m W x 2.90m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O. D. Level m
0.10 0.10 0.30 0.30 0.30 0.50-0.80	D1 ES1 D2 ES2 V1 B1	(50)		MADE GROUND - Sandy TOPSOIL. MADE GROUND - Light brown, silty SAND AND GRAVEL. Gravel is sub-angular to rounded limestone. MADE GROUND - Firm, dark brown, slightly gravelly, silty, organic CLAY. Gravel is sub-angular and sub-rounded quartz, quartzite, flint, coal, ash and brick fragments.		0.02 0.15 0.80
0.85 0.90	V2 D3	(47)		Firm, grey and brown, sandy, silty CLAY. (TIDAL FLAT DEPOSIT)		1.10
1.20 1.50	D4 D5			Grey, light brown and orange brown, very silty SAND. Sand is fine grained.		2.50
2.00	D6			(MARINE SAND)		2.90
2.90	D7		$\frac{1}{\nabla}$ ∇c Pit completed at 2.90m depth			

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ∇ Water Strike
- ∇c Water Rise
- ∇c Level on completion
- MP - Mackintosh Probe
- P() - Hand Penetrometer Cohesion () kPa
- V - Vane Shear Test Cohesion () kPa

REMARKS

1. Live roots observed to 1.40m depth
2. Groundwater met at 2.80m depth
3. Pit sides unstable below 1.40m depth
4. Water stood at 2.90m depth

Project No
15122

Scale
1:25

Page
1/1

GROUND ENGINEERING LIMITED Tel: 01733-666666 www.groundengineering.co.uk			Site: BARBER'S DROVE, CROWLAND		TRIAL PIT TP6		
			Date: 06/08/20	Pit Size: 1.70m L x 0.60m W x 3.00m D.	Ground Level:		
Samples and in-situ Tests			(Date)	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result	Water				
0.10 0.10 0.10	D1 ES1 V1	(92)		MADE GROUND - Stiff, dark brown, very gravelly, silty CLAY. Gravel is sub-angular and sub-rounded flint, quartz, quartzite and brick fragments.		0.30	
0.35 0.40 0.50-0.75	D2 V2 B1	(120)		Stiff, grey and orange brown, silty CLAY. (TIDAL FLAT DEPOSIT)		0.75	
0.80 0.90	D3 V3	(56)		Firm, brown, orange brown and grey, slightly sandy, silty CLAY. (TIDAL FLAT DEPOSIT)		1.20	
1.20 1.50	D4 D5			Grey, light brown and orange brown, slightly clayey, very silty SAND. Sand is fine and medium grained. (MARINE SAND)		1.90	
2.00 2.50	D6 D7			Grey, silty SAND. (MARINE SAND)		3.00	
3.00	D8			Pit completed at 3.00m depth			

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample ES - Environmental Sample Water Strike Water Rise Level on completion MP - Mackintosh Probe P() - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa	REMARKS 1. Live roots observed to 1.20m depth 2. Groundwater met at 3.00m depth 3. Pit sides unstable below 0.90m depth 4. Water stood at 3.00m depth on completion	Project No 15122	
		Scale 1:25	Page 1/1

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: BARBER'S DROVE, CROWLAND		TRIAL PIT TP7		
Samples and In-situ Tests			Date: 06/08/20	Pit Size: 1.70m L x 0.60m W x 3.00m D.		Ground Level:	
Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
0.10	D1	(140) (116)		MADE GROUND - Stiff, dark brown, slightly gravelly, silty CLAY. Gravel is sub-angular and sub-rounded quartz, quartzite, flint and brick fragments.		0.20	
0.10	ES1			Stiff, grey and orange brown, silty CLAY. (TIDAL FLAT DEPOSIT)		0.55	
0.10	V1					0.75	
0.30	V2					2.00	
0.35	D2	Light grey, brown and orange brown, very silty SAND. Sand is fine and medium grained. (MARINE SAND)					
0.60	D3						
0.85-1.45	MP1				100		
1.20	D4	(MARINE SAND)					
2.05	D5			Grey, silty SAND.			
2.50	D6				(MARINE SAND)		
3.00	D7	Pit completed at 3.00m depth					
				3.00			
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							</

GROUND ENGINEERING L I M I T E D Tel: 01733-566566 www.groundengineering.co.uk			Site: BARBER'S DROVE, CROWLAND		TRIAL PIT TP8	
			Date: 06/08/20	Pit Size: 1.70m L x 0.60m W x 3.40m D.		Ground Level:
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O.D. Level m
0.10	V1	(114)		MADE GROUND - Stiff, dark brown, slightly gravelly, silty CLAY. Gravel is sub-angular and sub-rounded quartz, quartzite and flint.		0.30
0.20	D1					
0.20	ES1					
0.40	D2			Stiff, grey, brown and orange brown, slightly sandy, silty CLAY.		0.70
0.40	V2	(86)		(TIDAL FLAT DEPOSIT)		
0.80	D3			Firm, brown and grey, slightly sandy, silty CLAY.		1.30
0.80	V3	(49)		(TIDAL FLAT DEPOSIT)		
1.40	D4			Grey and light brown, very silty SAND.		2.30
1.80	D5			(MARINE SAND)		
2.40	D6			Brown and orange brown, silty SAND. Sand is fine grained.		3.40
2.70	D7			...Becoming grey below 2.65m depth.		
3.40	D8			(MARINE SAND)		
			1 Pit completed at 3.40m depth			
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample ES - Environmental Sample Water Strike Water Rise Level on completion MP - Mackintosh Probe P{ } - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 1.80m depth 2. Groundwater met at 3.40m depth 3. Pit sides unstable below 2.70m depth 4. Water stood at 3.40m depth on completion			
						Project No 15122
						Scale 1:25
						Page 1/1

LABORATORY TEST RESULTS

CONTRACT BARBER'S DRIVE, CROWLAND

Trial-pit	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphates (SO ₄)				C.B.R.		Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m ³	Dry Mg/m ³	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Total % Dry Wt.	Aqueous Extract mg/l	Water mg/l	pH	Top %	Base %	
TP1	B1	0.50 – 0.80	45	24	21	31	1.87	1.44										0.9	0.9	SOIL CLASSIFICATION = CI 0% retained on 425µm sieve 0% retained on 20mm sieve
	D4	1.20											938			7.7				
TP2	B1	0.50 – 0.80				28	1.87	1.47										0.3	0.3	0% retained on 20mm sieve
	D3	0.60											148			8.2				
TP3	D4	1.00															8.1		SOIL CLASSIFICATION = CI 0% retained on 425µm sieve	
	D3	0.60											321			4.3				
TP5	D3	0.90	39	22	17	31													SOIL CLASSIFICATION = CI 0% retained on 425µm sieve	
	D5	1.50											181			8.0				
TP6	B1	0.50 – 0.75				27	1.71	1.34									17	17	0% retained on 20mm sieve	
	D3	0.80	46	23	23	21														
	D4	1.20	48	23	25	28													SOIL CLASSIFICATION = CI 0% retained on 425µm sieve	

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

C.B.R. - CALIFORNIA BEARING RATIO

15122

LABORATORY TEST RESULTS

CONTRACT BARBER'S DROVE, CROWLAND

Trial- pit	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphates (SO ₄)				C.B.R.		Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m ³	Dry Mg/m ³	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Total % Dry Wt.	Soil Aqueous Extract mg/l	Water mg/l	pH	Top %	Base %	
TP7	D4	1.20	72	29	43	34								140			8.4			SOIL CLASSIFICATION = CV 0% retained on 425µm sieve
TP8	D3	0.80																		
	D4	1.40												189			8.3			

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water: Soil
C.B.R. - CALIFORNIA BEARING RATIO

15122



8180

GROUND ENGINEERING

Newark Road Peterborough
t: 01733 566566
e: admin@groundengineering.co.uk

TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4

Wet Sieving Method and Sedimentation by Pipette

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Contact: Simon Weatherley

Site Name: Barbers Drove
Site Address: Crowland

Certificate Number: PL7138-1/2/710-2

Client Reference: C15122

Lab Job Number: PL7138-1

Date Sampled: Unknown

Date Received: 10.08.2020

Date Tested: 20.08.2020

Certificate of Sampling: N/A

Sampling Certificate No.: N/A

Sampled By: Client

TEST RESULTS

Laboratory Reference: PL7138-1/2

Client Reference: D3

Pre-treatment for organic material:

No

Sample Description: Brown slightly clayey SILT/SAND.

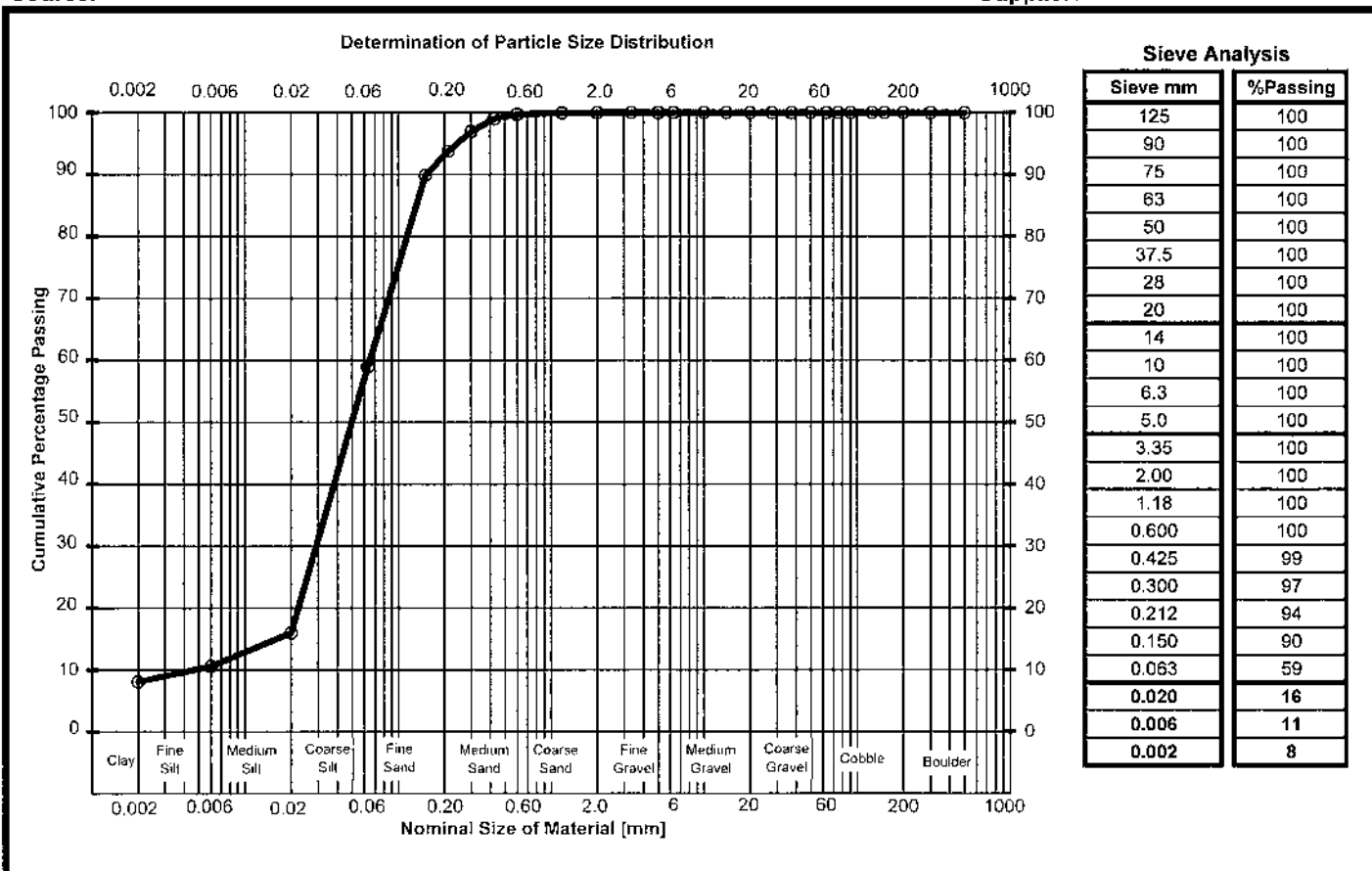
Material Specification: Not Required

Depth: 0.90m

Location: TP1

Source:

Supplier:



Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

Approved Signatory: M. Hartnup - Laboratory Manager

Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 10.09.2020 Page 1 of 1

Form Number: GELab/C/709-2 Version 54

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Registration Number: 6929574
Reg Office: Ground Engineering Ltd
Newark Rd, Peterborough PE1 5UA



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GROUND ENGINEERING

NEWARK ROAD, PETERBOROUGH, PETERBOROUGH, PETERBOROUGH

TEST CERTIFICATE

Newark Road Peterborough

t: 01733 566566

e: admin@groundengineering.co.uk

Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4

Wet Sieving Method and Sedimentation by Pipette

Client: Ground Engineering Ltd

Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7138-1/4/710-2

Client Reference: C15122

Lab Job Number: PL7138-1

Date Sampled: Unknown

Date Received: 10.08.2020

Date Tested: 20.08.2020

Contact: Simon Weatherley

Certificate of Sampling: N/A

Sampling Certificate No.: N/A

Site Name: Barbers Drove

Site Address: Crowland

Sampled By: Client

TEST RESULTS

Laboratory Reference: PL7138-1/4

Pre-treatment for
organic material:

No

Client Reference: B1

Sample Description: Brown orange-brown grey slightly clayey SILT/SAND with occasional roots less than 4mm in diameter.

Material Specification: Not Required

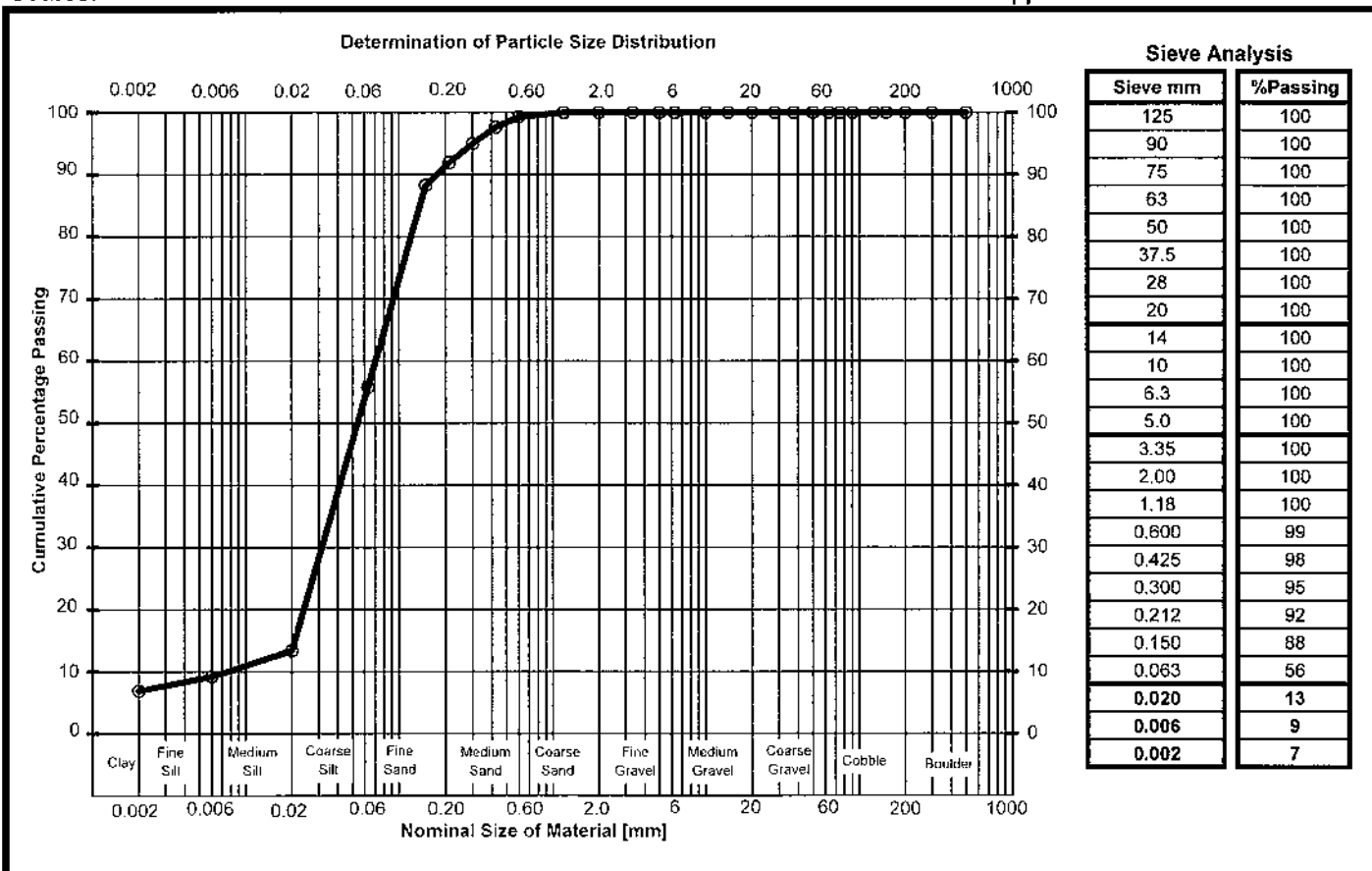
Location: TP2

Depth Top: 0.50m

Depth Base: 0.80m

Source:

Supplier:



Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

Approved Signatory: M. Hartnup - Laboratory Manager

Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 10.09.2020

Page 1 of 1

Form Number: GELab/C/709-2 Version 54

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Reg Office: Ground Engineering Ltd
Newark Rd, Peterborough PE1 5UA



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GROUND ENGINEERINGNewark Road Peterborough
t: 01733 566566
e: admin@groundengineering.co.uk**TEST CERTIFICATE****Determination of Particle Size Distribution**

Tested in Accordance with BS 1377-2: 1990: Clause 9.2

Wet Sieving Method

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7138-1/7/710-2

Client Reference: C15122

Lab Job Number: PL7138-1

Date Sampled: Unknown

Date Received: 10.08.2020

Date Tested: 20.08.2020

Contact: Simon Weatherley

Certificate of Sampling: N/A

Sampling Certificate No.: N/A

Sampled By: Client

Site Name: Barbers Drove
Site Address: Crowland**TEST RESULTS**

Laboratory Reference: PL7138-1/7

Client Reference: D6

Pre-treatment for
organic material:

N/A

Sample Description: Brown orange-brown dark-grey slightly clayey SILT/SAND.

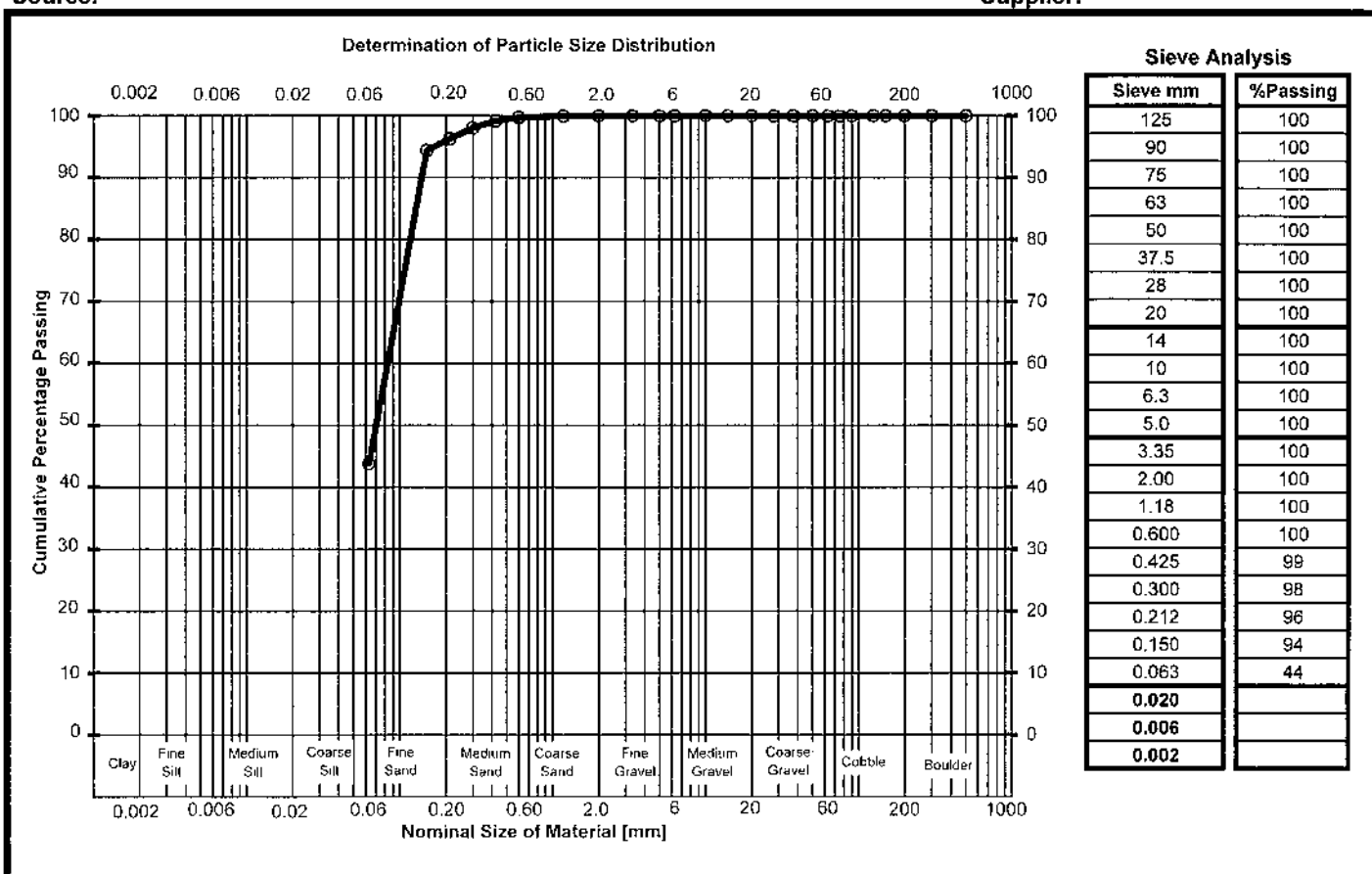
Material Specification: Not Required

Depth: 1.60m

Location: TP3

Source:

Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 10.09.2020 Page 1 of 1

Form Number: GELab/C/709-2 Version 54

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Newark Rd, Peterborough PE1 5UA



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GROUND ENGINEERING

Peterborough

TEST CERTIFICATE

Newark Road Peterborough

t: 01733 566566

e: admin@groundengineering.co.uk

Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2

Wet Sieving Method

Client: Ground Engineering Ltd

Client Address: Newark Road

Peterborough

PE1 5UA

Contact: Simon Weatherley

Site Name: Barbers Drove

Site Address: Crowland

Certificate Number: PL7138-1/9/710-2

Client Reference: C15122

Lab Job Number: PL7138-1

Date Sampled: Unknown

Date Received: 10.08.2020

Date Tested: 20.08.2020

Certificate of Sampling: N/A

Sampling Certificate No.: N/A

Sampled By: Client

TEST RESULTS

Laboratory Reference: PL7138-1/9

Client Reference: D4

Pre-treatment for
organic material:

N/A

Sample Description: Brown orange-brown slightly clayey silty SAND.

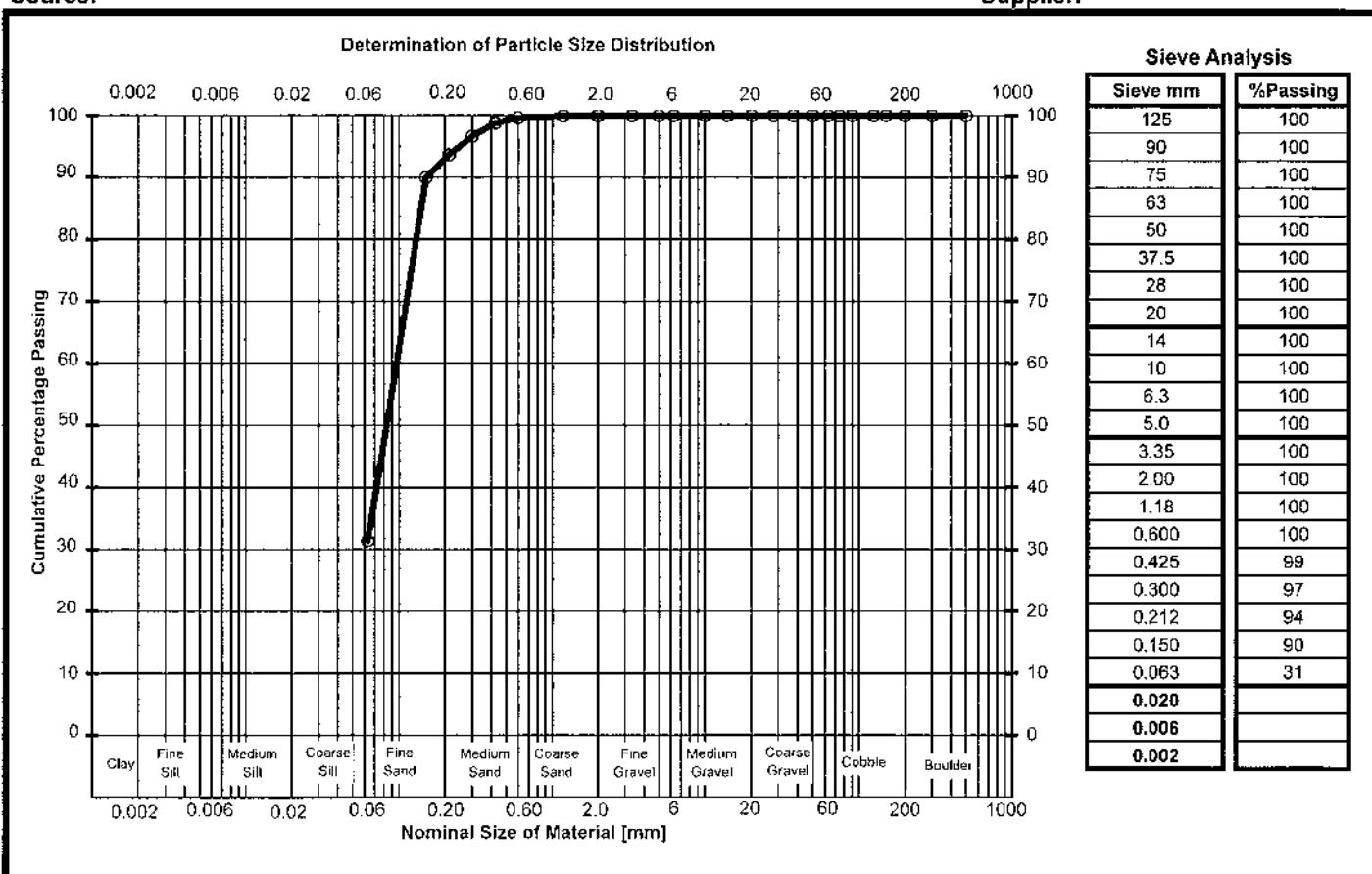
Material Specification: Not Required

Depth: 0.80m

Location: TP4

Source:

Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 10.09.2020

Page 1 of 1

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GROUND ENGINEERING

NEWARK ROAD, PETERBOROUGH, PE1 5UA

TEST CERTIFICATENewark Road Peterborough
t: 01733 566566

e: admin@groundengineering.co.uk

Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2

Wet Sieving Method

Client: Ground Engineering Ltd

Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7138-1/11/710-2

Client Reference: C15122

Lab Job Number: PL7138-1

Date Sampled: Unknown

Date Received: 10.08.2020

Date Tested: 20.08.2020

Contact: Simon Weatherley

Certificate of Sampling: N/A

Site Name: Barbers Drove

Sampling Certificate No.: N/A

Site Address: Crowland

Sampled By: Client

TEST RESULTS

Laboratory Reference: PL7138-1/11

Pre-treatment for
organic material:

N/A

Client Reference: D4

Sample Description: Brown slightly clayey silty SAND.

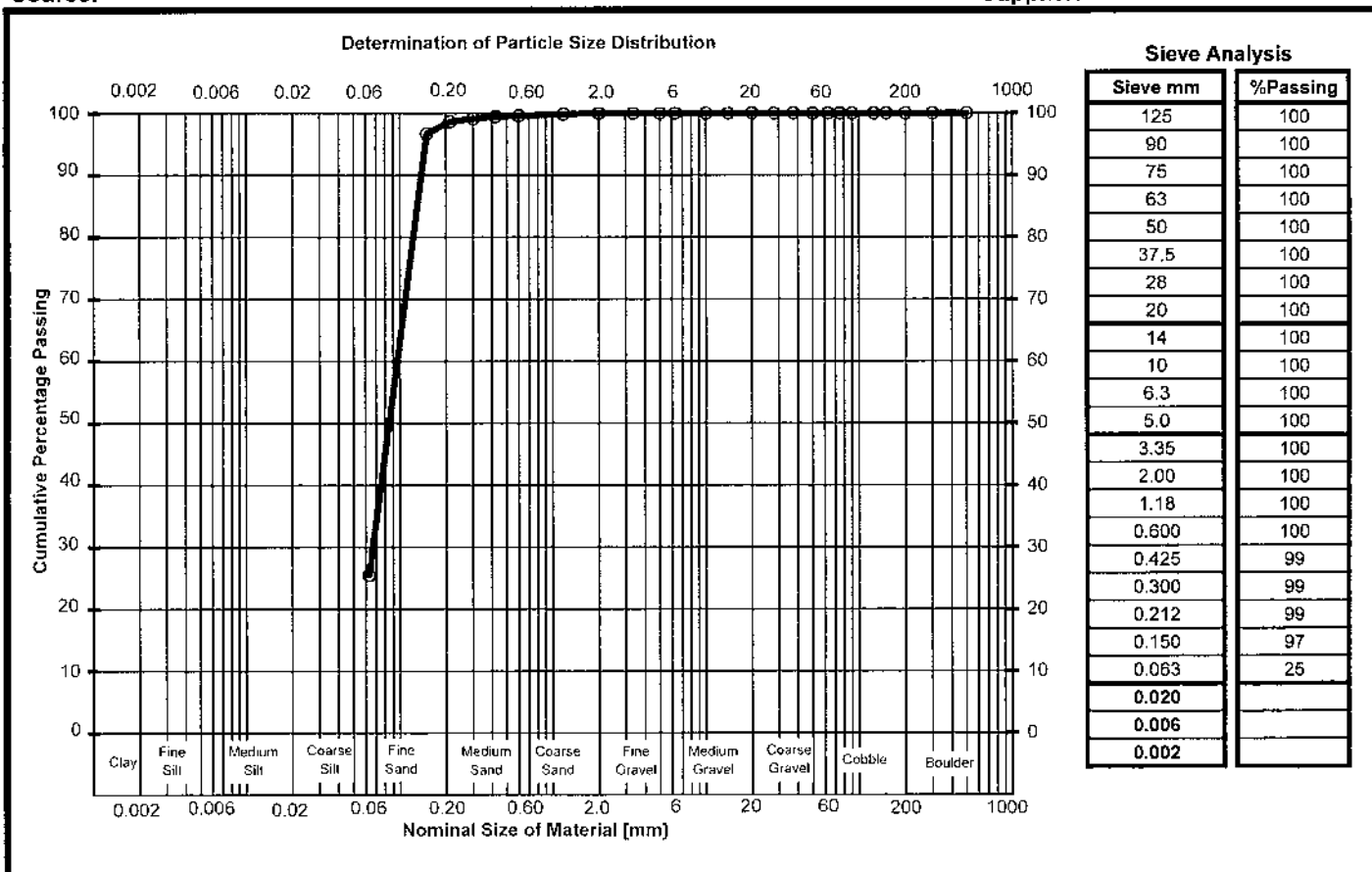
Material Specification: Not Required

Depth: 1.20m

Location: TP5

Source:

Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 10.09.2020 Page 1 of 1

Form Number: GELab/C/709-2 Version 54

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GROUND ENGINEERING

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TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Wet Sieving Method and Sedimentation by Pipette

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7138-1/16/710-2

Client Reference: C15122

Lab Job Number: PL7138-1

Date Sampled: Unknown

Date Received: 10.08.2020

Date Tested: 20.08.2020

Certificate of Sampling: N/A

Sampling Certificate No.: N/A

Sampled By: Client

Contact: Simon Weatherley

Site Name: Barbers Drove
Site Address: Crowland

TEST RESULTS

Laboratory Reference: PL7138-1/16

Client Reference: D5

Pre-treatment for
organic material: No

Sample Description: Brown grey clayey SILT/SAND with occasional root traces plus roots less than 2mm in diameter.

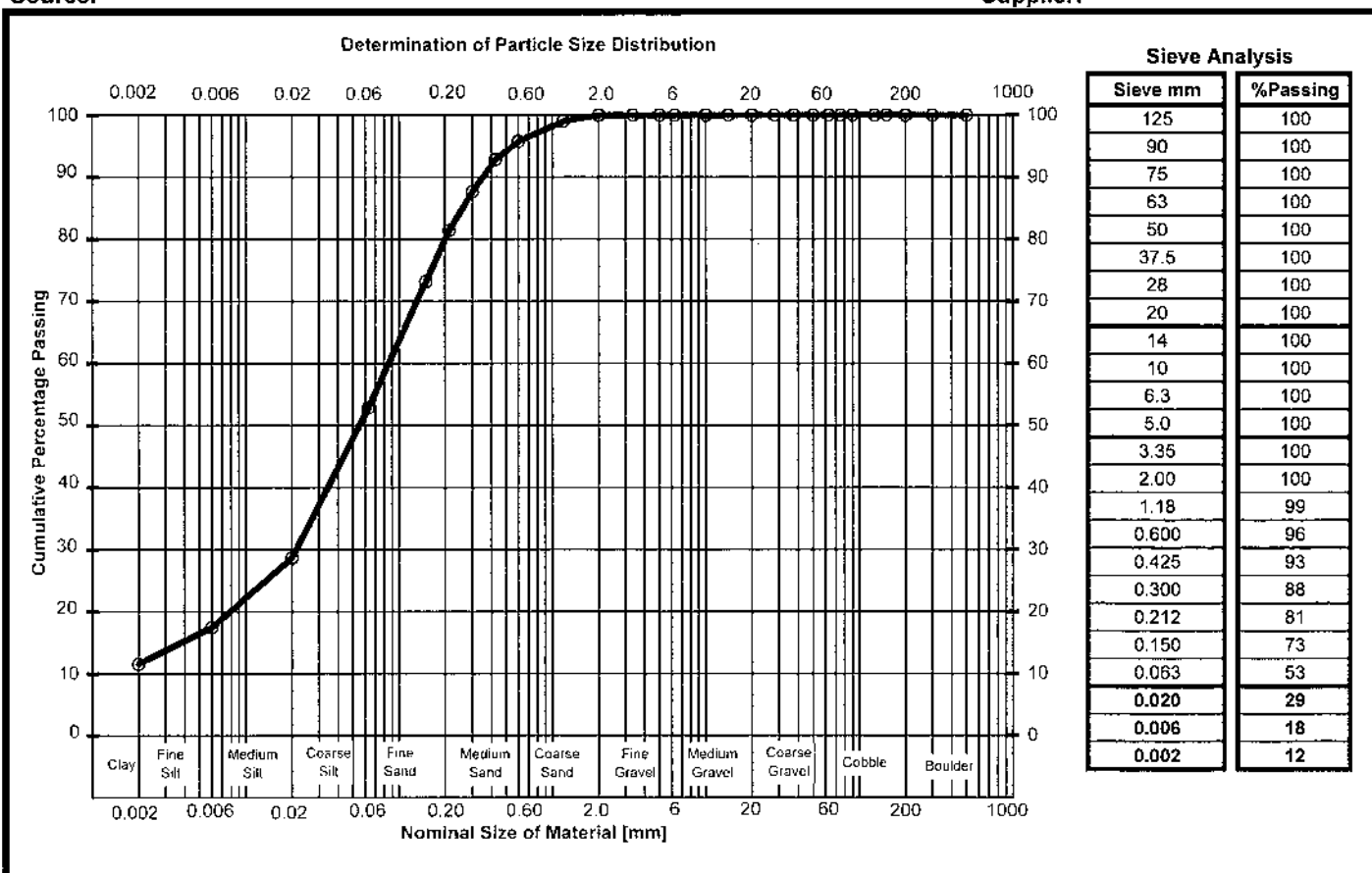
Material Specification: Not Required

Depth: 1.50m

Location: TP6

Source:

Supplier:



Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

Approved Signatory: M. Harinup - Laboratory Manager

Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 10.09.2020 Page 1 of 1

Form Number: GELab/C/709-2 Version 54

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8180

Newark Road Peterborough
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TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS 1377-2: 1990: Clause 9.2 & 9.4
Wet Sieving Method and Sedimentation by Pipette

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7138-1/17/710-2
Client Reference: C15122
Lab Job Number: PL7138-1
Date Sampled: Unknown
Date Received: 10.08.2020
Date Tested: 20.08.2020
Certificate of Sampling: N/A
Sampling Certificate No.: N/A
Sampled By: Client

Contact: Simon Weatherley

Site Name: Barbers Drove
Site Address: Crowland

TEST RESULTS

Laboratory Reference: PL7138-1/17
Client Reference: D3

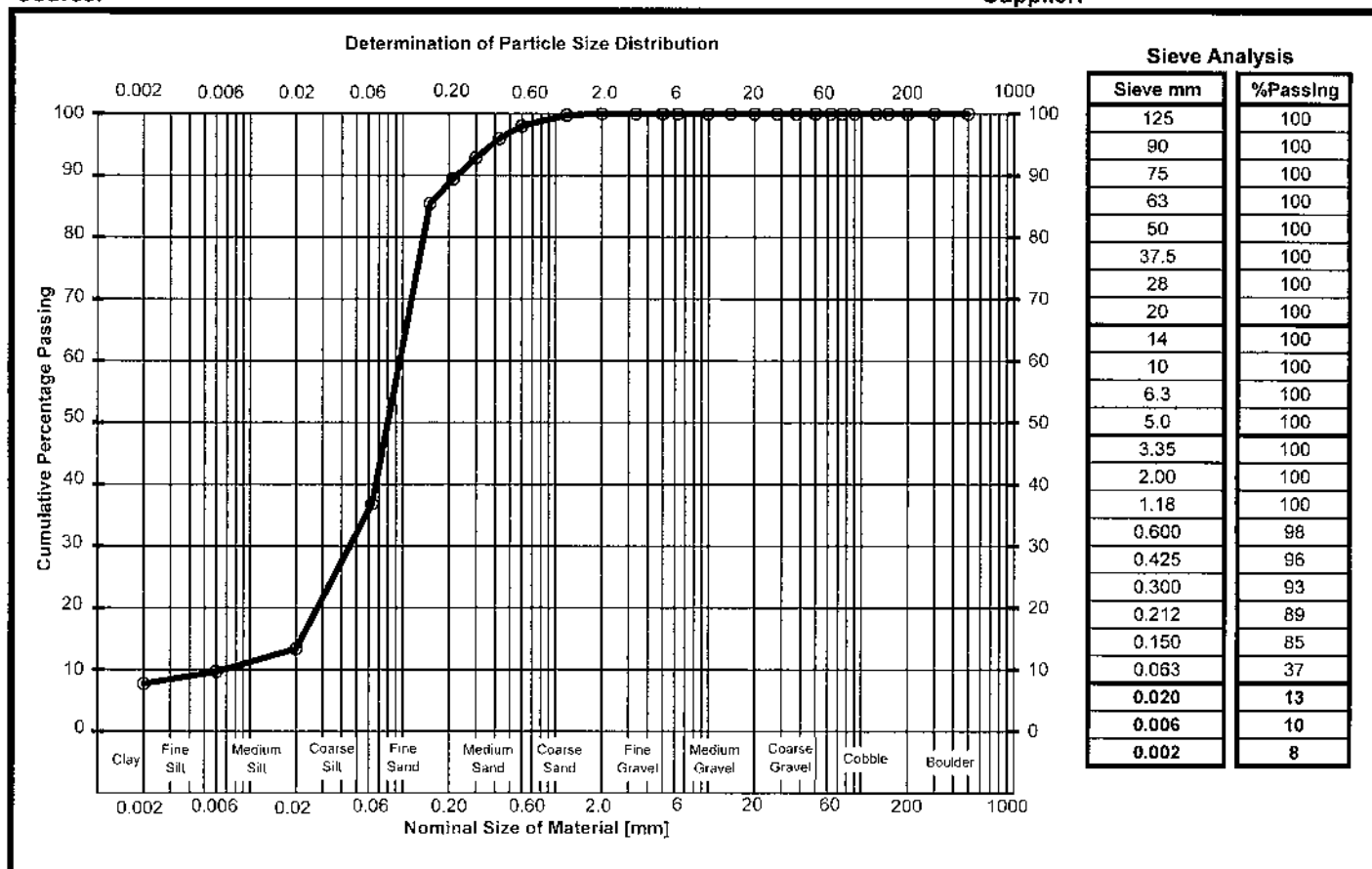
Pre-treatment for organic material: No

Sample Description: Brown slightly clayey SILT/SAND.

Material Specification: Not Required
Location: TP7
Source:

Depth: 0.60m

Supplier:



Comments: Data relevant to material below 63 microns is outside the current scope of UKAS accreditation

Approved Signatory: M. Hartnup - Laboratory Manager

Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 10.09.2020 Page 1 of 1
Form Number: GELab/C/709-2 Version 54

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Registration Number: 6929574
Reg Office: Ground Engineering Ltd
Newark Rd, Peterborough PE1 5UA



8180

GROUND ENGINEERING

L I M I T E D

TEST CERTIFICATE

Newark Road Peterborough
t: 01733 566566
e: admin@groundengineering.co.uk

Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Wet Sieving Method

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7138-1/21/710-2
Client Reference: C15122
Lab Job Number: PL7138-1
Date Sampled: Unknown
Date Received: 10.08.2020
Date Tested: 20.08.2020
Certificate of Sampling: N/A
Sampling Certificate No.: N/A
Sampled By: Client

Contact: Simon Weatherley

Site Name: Barbers Drove
Site Address: Crowland

TEST RESULTS

Laboratory Reference: PL7138-1/21
Client Reference: D6

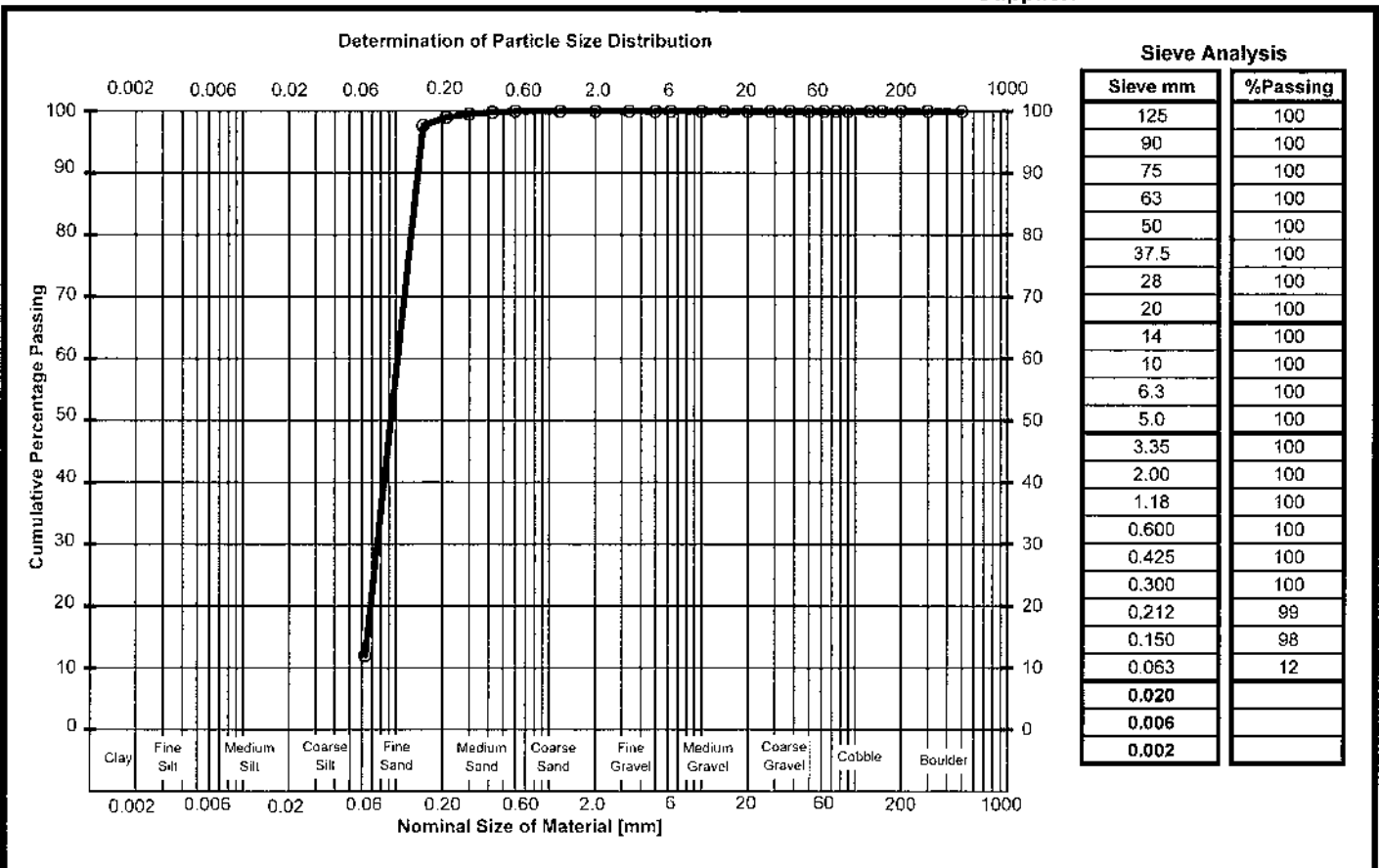
Pre-treatment for organic material: N/A

Sample Description: Brown orange-brown clayey silty SAND.

Material Specification: Not Required
Location: TP8
Source:

Depth: 2.40m

Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 10.09.2020 Page 1 of 1
Form Number: GELab/C/709-2 Version 54

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Registered in England & Wales
Registration Number: 6929574
Reg Office: Ground Engineering Ltd
Newark Rd, Peterborough PE1 5UA



Simon Weatherley
Ground Engineering Limited
Newark Road
Peterborough
PE1 5UA



i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: simon@groundengineering.co.uk

Analytical Report Number : 20-23912

Project / Site name:	Barber's Drove, Crowland	Samples received on:	10/08/2020
Your job number:	SW-C15122	Samples instructed on/ Analysis started on:	10/08/2020
Your order number:		Analysis completed by:	17/08/2020
Report Issue Number:	1	Report issued on:	17/08/2020
Samples Analysed:	9 soil samples		

Signed:

Rachel Bradley
Deputy Quality Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 20-23912

Project / Site name: Barber's Drove, Crowland

Lab Sample Number	1588059	1588060	1588061	1588062	1588063
Sample Reference	TP2	TP3	TP4	TP4	TP5
Sample Number	D1	D1	D1	D2	D2
Depth (m)	0.15	0.05	0.20	0.45	0.30
Date Sampled	06/08/2020	06/08/2020	06/08/2020	06/08/2020	06/08/2020
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	20	20	15	20	24
Total mass of sample received	kg	0.001	NONE	0.4	0.42	0.38	0.39	0.39

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.5	6.2	5.6	5.2	6.2
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	2	1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	160	160	140	93	100
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivale	g/l	0.00125	MCERTS	0.078	0.079	0.068	0.046	0.051
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivale	mg/l	1.25	MCERTS	78.3	78.9	67.9	46.3	50.7
Organic Matter	%	0.1	MCERTS	11	11	12	14	12

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	1.2	1.1	1.1	1.5	1.3
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.28	< 0.05	0.3
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.35	< 0.05	0.38
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	23	23	22	21	23
Boron (water soluble)	mg/kg	0.2	MCERTS	1.7	1.8	2	1	1.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.3	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (III)	mg/kg	1	NONE	42	43	45	40	40
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	42	44	45	41	42
Copper (aqua regia extractable)	mg/kg	1	MCERTS	24	21	26	25	27
Lead (aqua regia extractable)	mg/kg	1	MCERTS	59	53	61	55	67
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.8	0.8	1	1	1
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	29	28	35	31	35
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	76	70	81	71	90

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 20-23912

Project / Site name: Barber's Drove, Crowland

Lab Sample Number	1588064	1588065	1588066	1588067
Sample Reference	TP5	TP6	TP7	TP8
Sample Number	B1	D1	D1	D1
Depth (m)	0.50-0.80	0.10	0.10	0.20
Date Sampled	06/08/2020	06/08/2020	06/08/2020	06/08/2020
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	25	16	18	21
Total mass of sample received	kg	0.001	NONE	0.43	0.39	0.42	0.42

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.4	7.5	6.4	7.6
Total Cyanide	mg/kg	1	MCERTS	2	< 1	< 1	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	130	38	62	69
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivale	g/l	0.00125	MCERTS	0.067	0.019	0.031	0.035
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivale	mg/l	1.25	MCERTS	66.7	19.1	31	34.7
Organic Matter	%	0.1	MCERTS	13	6.1	6.6	5.5

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	1.4	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.33	0.29	< 0.05	1.1
Pyrene	mg/kg	0.05	MCERTS	0.43	0.33	< 0.05	1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.43
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.52
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.82
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.53
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.73
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.48
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.59

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	6.22
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	23	25	23	25
Boron (water soluble)	mg/kg	0.2	MCERTS	1.4	3.8	2	2.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (III)	mg/kg	1	NONE	39	51	51	54
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	41	51	52	54
Copper (aqua regia extractable)	mg/kg	1	MCERTS	27	30	24	35
Lead (aqua regia extractable)	mg/kg	1	MCERTS	76	65	48	83
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.9	0.6	0.6	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	34	40	42	40
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	87	120	100	140

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 20-23912

Project / Site name: Barber's Drove, Crowland

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1588059	TP2	D1	0.15	Brown clay and loam with gravel and vegetation.
1588060	TP3	D1	0.05	Brown clay and loam with gravel and vegetation.
1588061	TP4	D1	0.2	Brown clay and loam with gravel and vegetation.
1588062	TP4	D2	0.45	Brown loam and clay with gravel and vegetation.
1588063	TP5	D2	0.3	Brown clay and loam with gravel and vegetation.
1588064	TP5	B1	0.50-0.80	Brown clay and loam with gravel and vegetation.
1588065	TP6	D1	0.1	Brown clay and loam with gravel and vegetation.
1588066	TP7	D1	0.1	Brown clay and loam with gravel and vegetation.
1588067	TP8	D1	0.2	Brown clay and loam with gravel and vegetation.



Analytical Report Number : 20-23912

Project / Site name: Barber's Drove, Crowland

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



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Analytical Report Number : 20-23977

Project / Site name:	Barber's Drove, Crowland	Samples received on:	10/08/2020
Your job number:	SW-C15122	Samples instructed on/ Analysis started on:	10/08/2020
Your order number:		Analysis completed by:	17/08/2020
Report Issue Number:	1	Report issued on:	17/08/2020
Samples Analysed:	10:1 WAC sample		

Signed: *A. Czerwińska*

Agnieszka Czerwińska
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

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Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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Waste Acceptance Criteria Analytical Results							
Report No:	20-23977						
	Client: GROUNDENG						
Location	Barber's Drove, Crowland						
Lab Reference (Sample Number)	1588419 / 1588420						
Sampling Date	06/08/2020						
Sample ID	TP1 D1						
Depth (m)	0.10						
Solid Waste Analysis				Limits			
TOC (%)**	7.3			3%	5%	6%	
Loss on Ignition (%) **	-			--	--	10%	
BTEX (µg/kg) **	< 10			6000	--	--	
Sum of PCBs (mg/kg) **	< 0.007			1	--	--	
Mineral Oil (mg/kg)	< 10			500	--	--	
Total PAH (WAC-17) (mg/kg)	2.67			100	--	--	
pH (units)**	-			--	>6	--	
Acid Neutralisation Capacity (mol / kg)	-			--	To be evaluated	To be evaluated	
Eluate Analysis				Limit values for compliance leaching test			
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1		10:1	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)			
	mg/l		mg/kg				
Arsenic *	0.0012		< 0.0110	0.5	2	25	
Barium *	0.0149		0.122	20	100	300	
Cadmium *	< 0.0001		< 0.0008	0.04	1	5	
Chromium *	0.0044		0.036	0.5	10	70	
Copper *	0.023		0.19	2	50	100	
Mercury *	< 0.0005		< 0.0050	0.01	0.2	2	
Molybdenum *	0.0015		0.0126	0.5	10	30	
Nickel *	0.017		0.14	0.4	10	40	
Lead *	0.0067		0.055	0.5	10	50	
Antimony *	< 0.0017		< 0.017	0.06	0.7	5	
Selenium *	< 0.0040		< 0.040	0.1	0.5	7	
Zinc *	0.011		0.093	4	50	200	
Chloride *	3.1		25	800	15000	25000	
Fluoride	0.45		3.7	10	150	500	
Sulphate *	8.7		71	1000	20000	50000	
TDS*	30		240	4000	60000	100000	
Phenol Index (Monohydric Phenols) *	< 0.010		< 0.10	1	-	-	
DOC	31.2		256	500	800	1000	
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.80						
Dry Matter (%)	81						
Moisture (%)	19						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.

*= UKAS accredited (liquid eluate analysis only)

Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.



Analytical Report Number : 20-23977
Project / Site name: Barber's Drove, Crowland

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1588419	TP1	D1	0.1	Brown loam and clay with gravel and vegetation.



Analytical Report Number : 20-23977

Project / Site name: Barber's Drove, Crowland

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270. MCERTS accredited except Coronene.	L064-PL	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Total BTEX in soil (Poland)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073-PL	W	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	ISO 17025
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



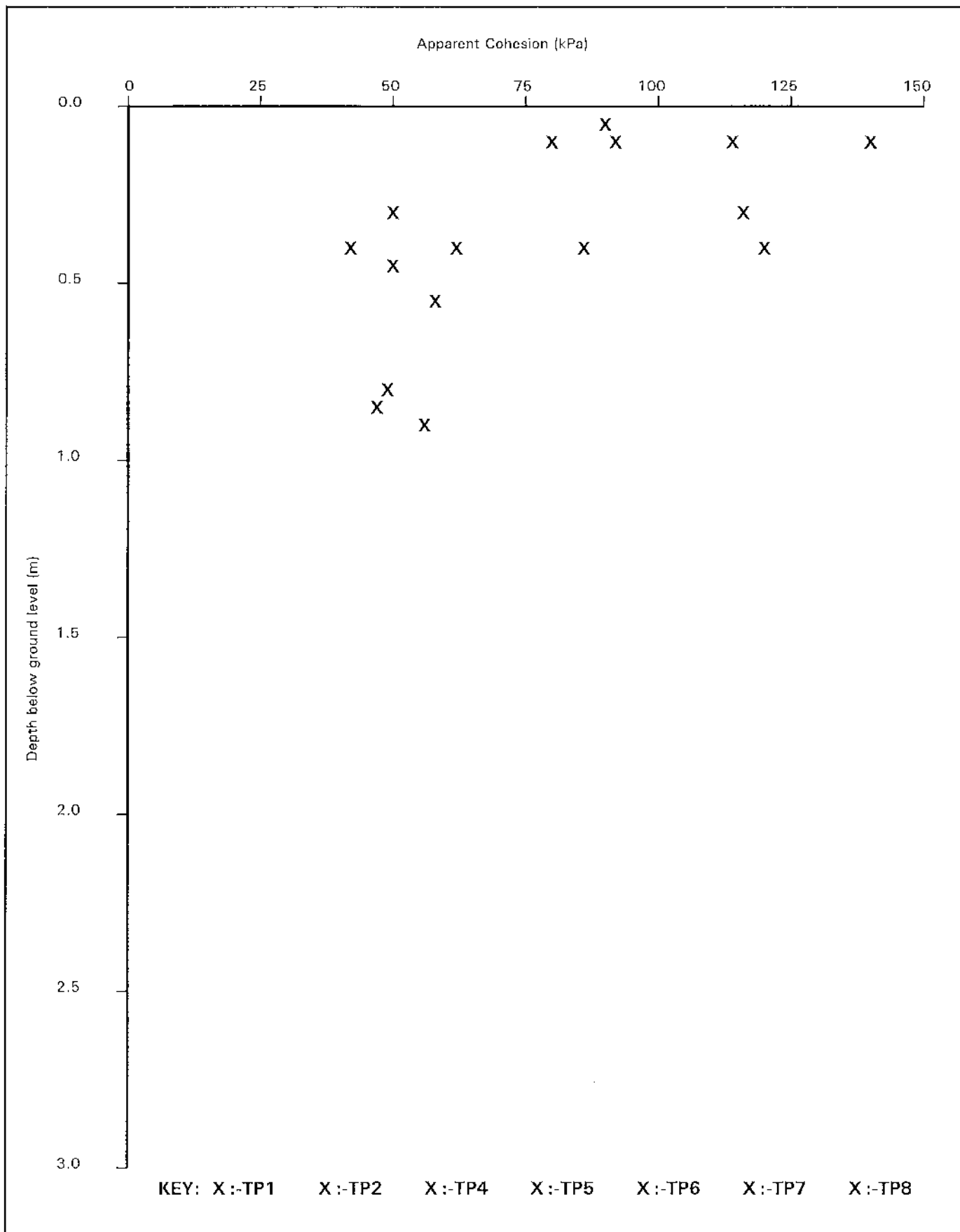
Sample Deviation Report



Analytical Report Number : 20-23977

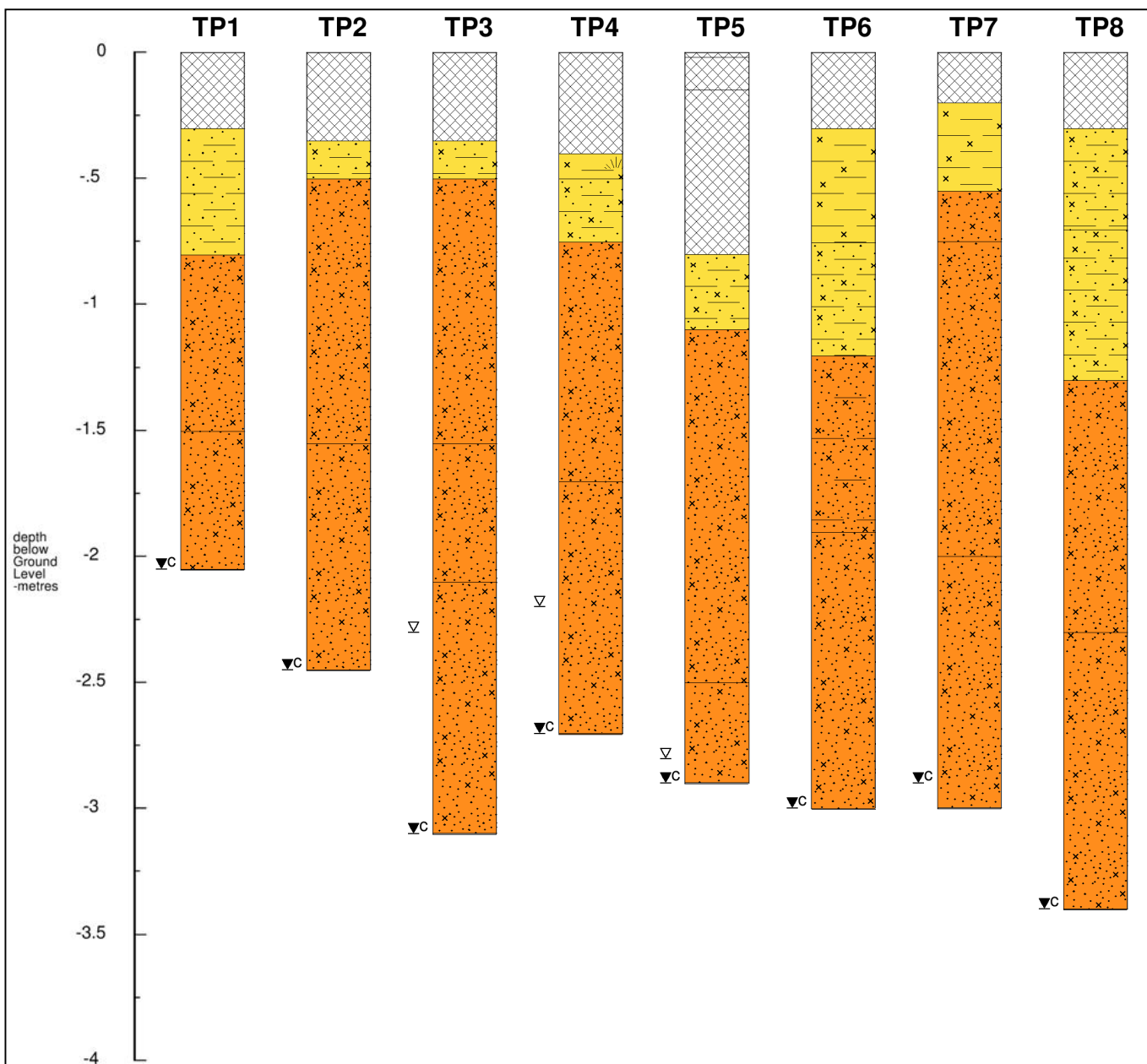
Project / Site name: Barber's Drove, Crowland

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
TP1	D1	S	1588419	b	BTEX in soil (Monoaromatics)	L073B-PL	b
TP1	D1	S	1588419	b	Total BTEX in soil (Poland)	L073-PL	b



Apparent Cohesion (kPa) vs Depth below ground level (m).

SITE		BARBER'S DROVE, CROWLAND	
CLIENT		BURMOR CONSTRUCTION	Contract Number 15122
GROUND ENGINEERING L I M I T E D		Tel: 01733-566566 www.groundengineering.co.uk	Date 01/10/20 Figure 1



KEY TO LEGENDS

	MADE GROUND
	TIDAL FLAT DEPOSIT
	MARINE SAND
∇	Groundwater Encountered
▼	Groundwater Rise
▼C	Level on Completion
c▼w	Level Casing Withdrawn
▼s	Standpipe Level

Project : Barber's Drove, Crowland

Client : Burmor Construction

**GROUND
ENGINEERING
LIMITED**

Tel : 01733 566566

Soil Profile

Fig No. 2

Project No

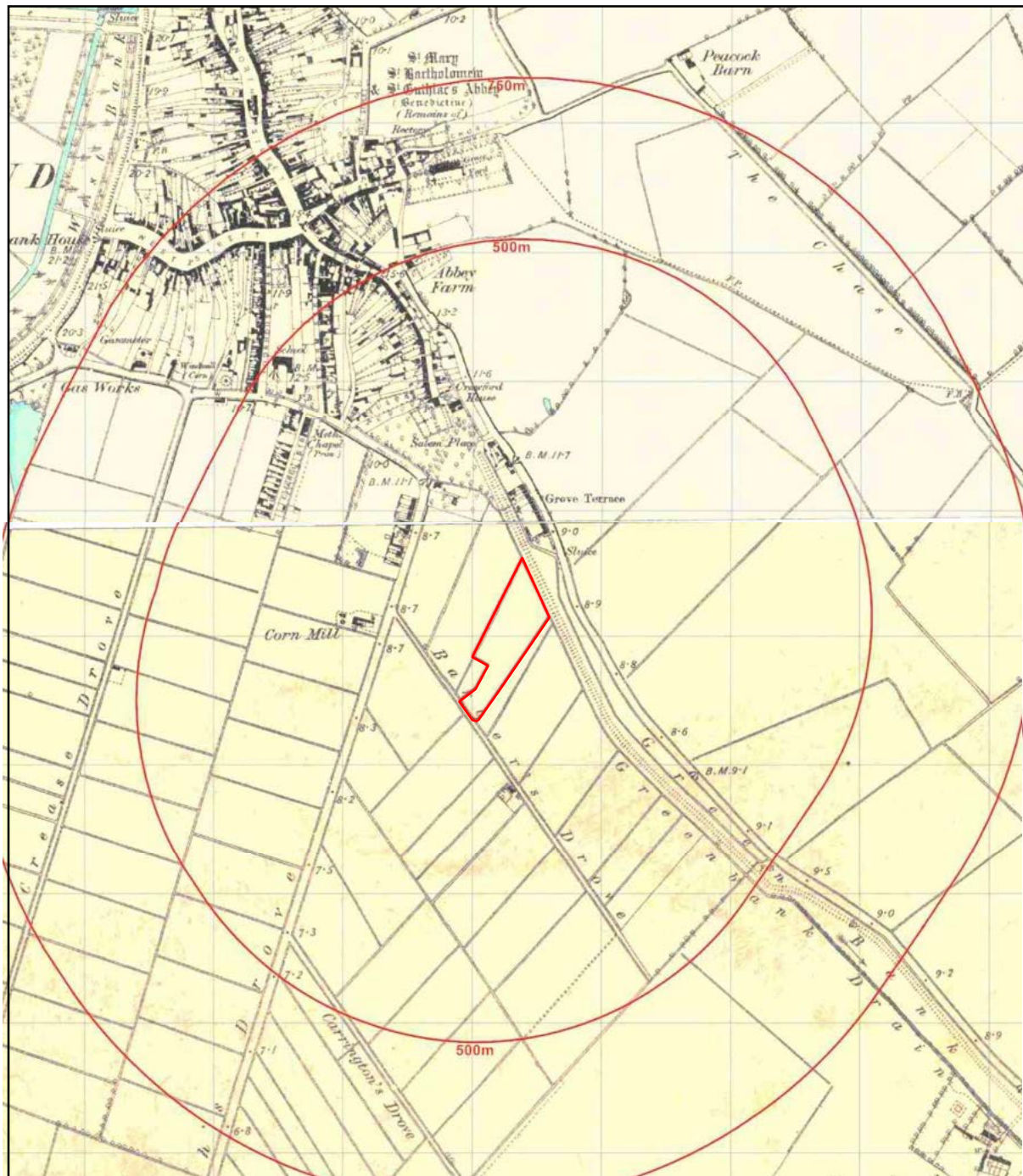
C15122

**Vertical Scale
1:25**

APPENDIX 1

HISTORICAL MAP EXTRACTS

Figure A

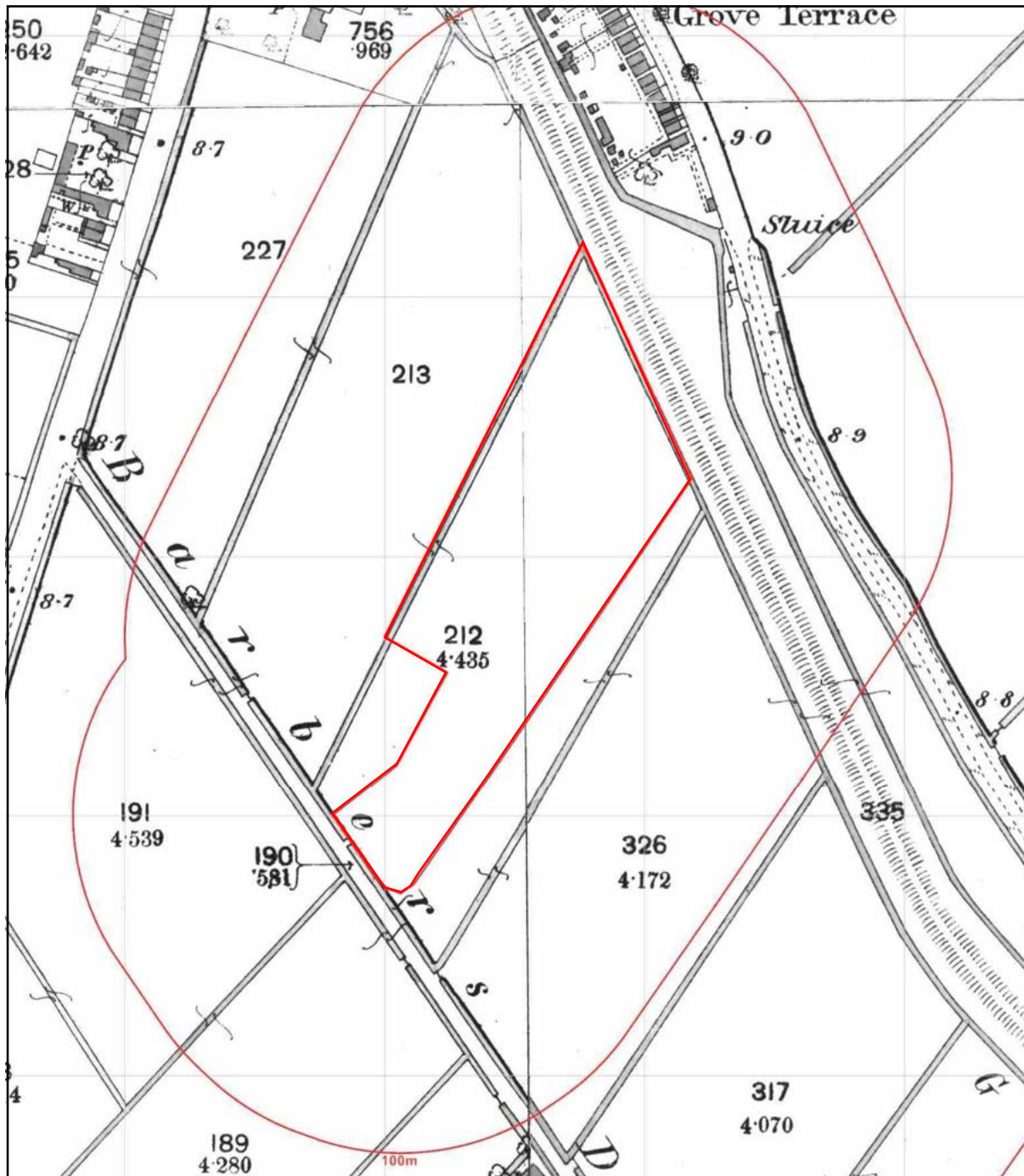


Peterborough Tel : 01733 566566

Site History

Figure B

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Client : Burmor Construction

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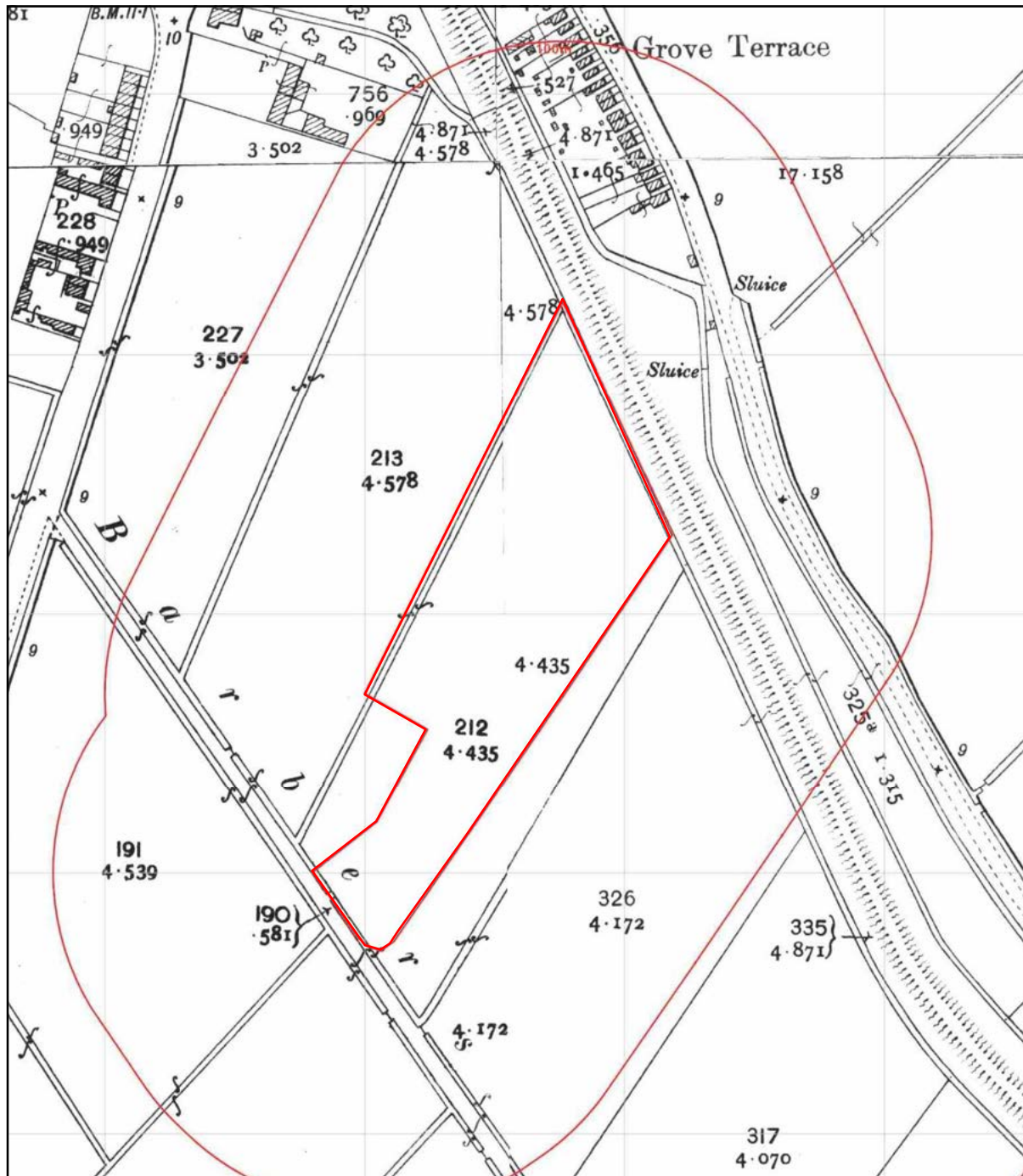
Project No.

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Site History

Figure C

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Client : Burmor Construction

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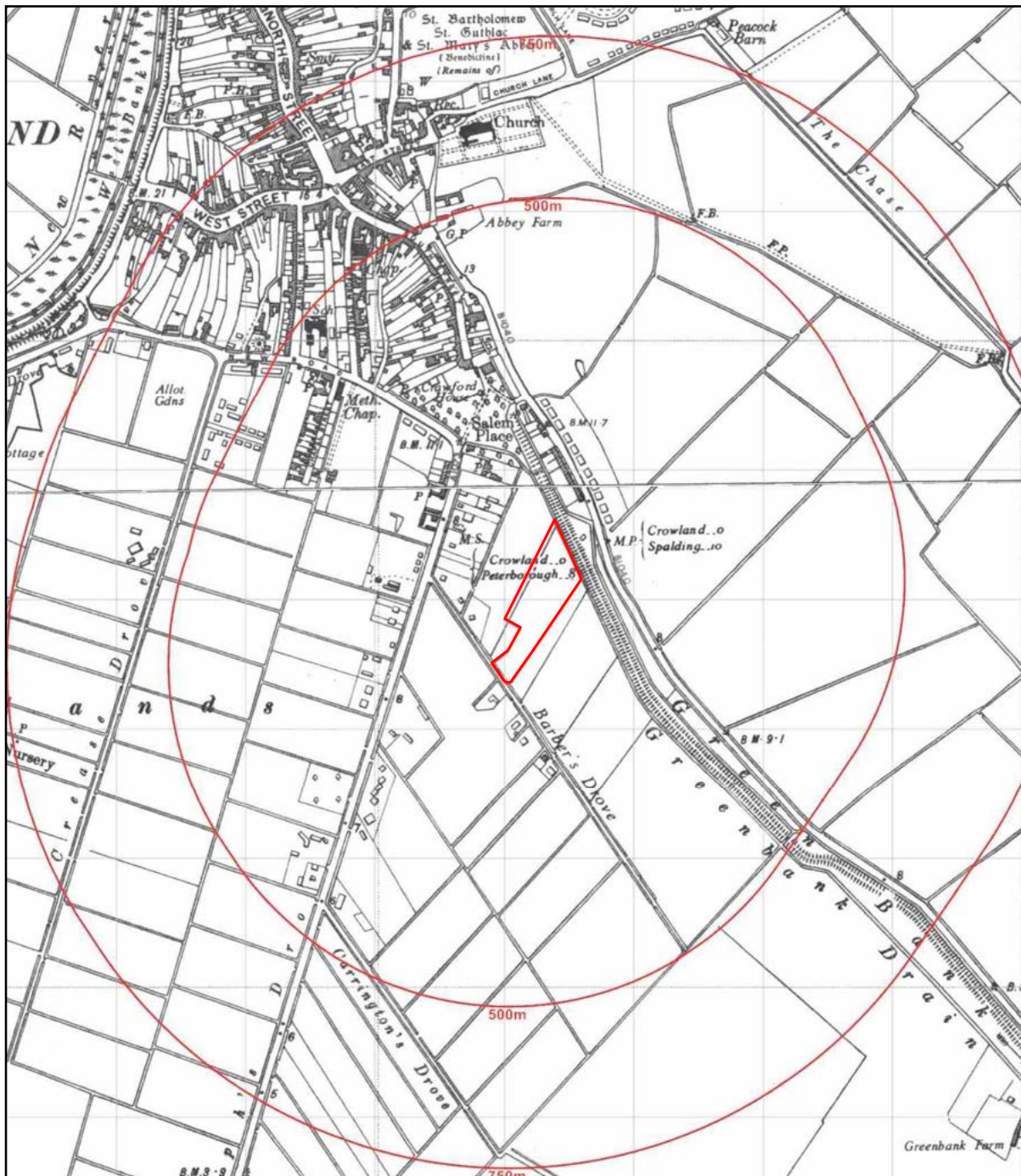
Project No.

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Site History

Figure D

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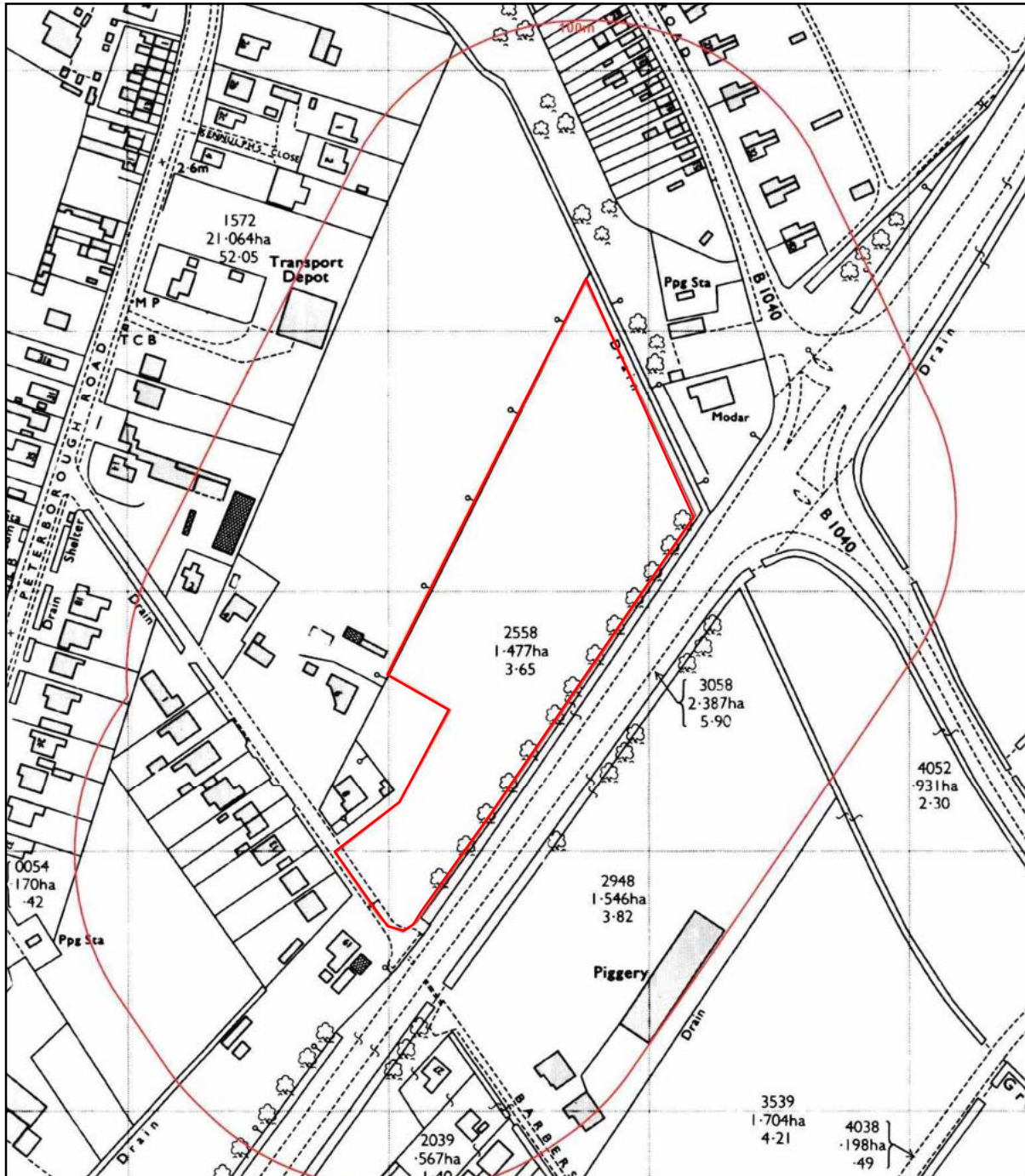
Project No.

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Site History

Figure E

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Client : Burmor Construction

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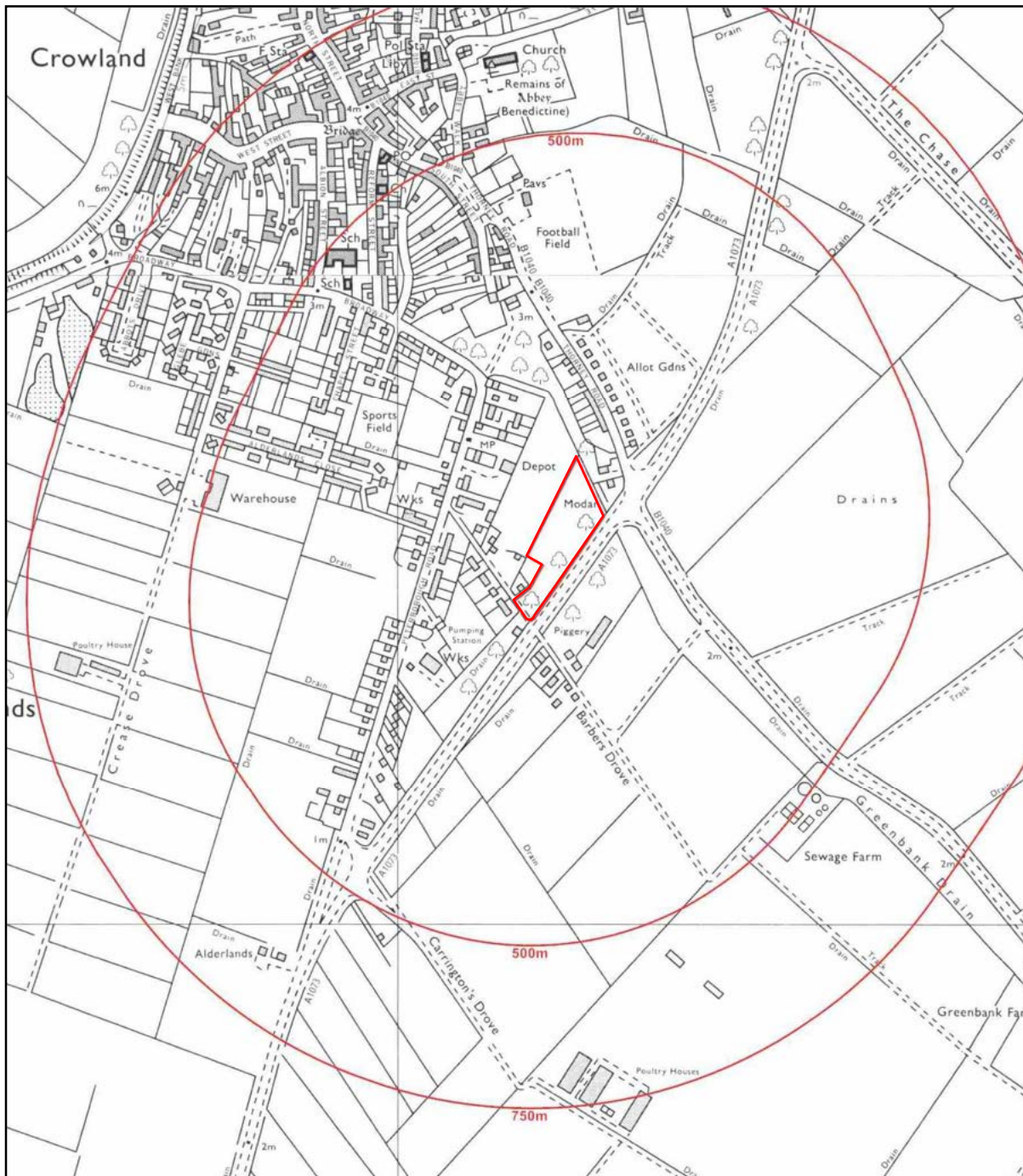
Project No.

C15122

Site History

Figure F

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Client : Burmor Construction

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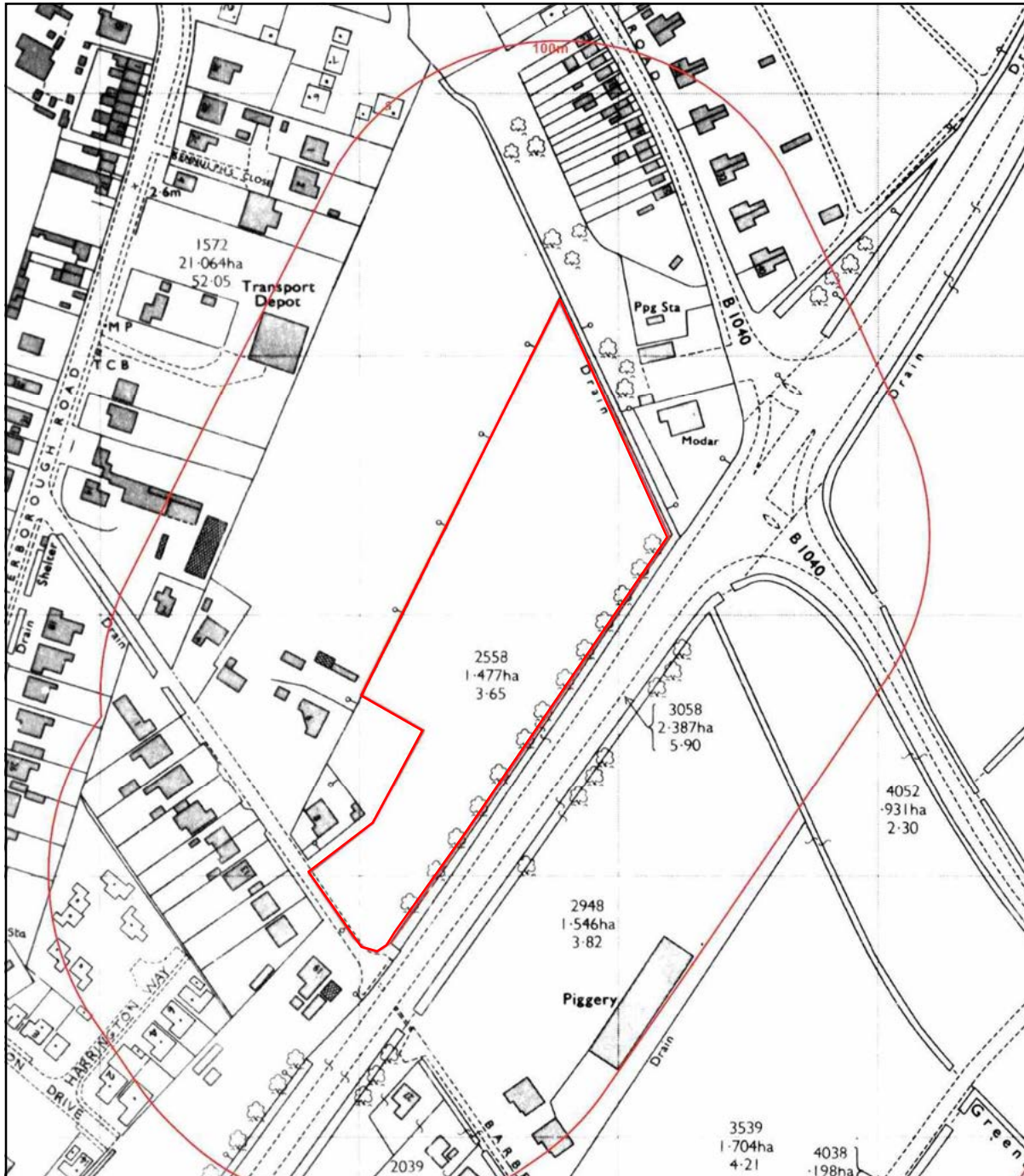
Project No.

C15122

Site History

Figure G

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Project : Barber's Drove, Crowland

Client : Burmor Construction

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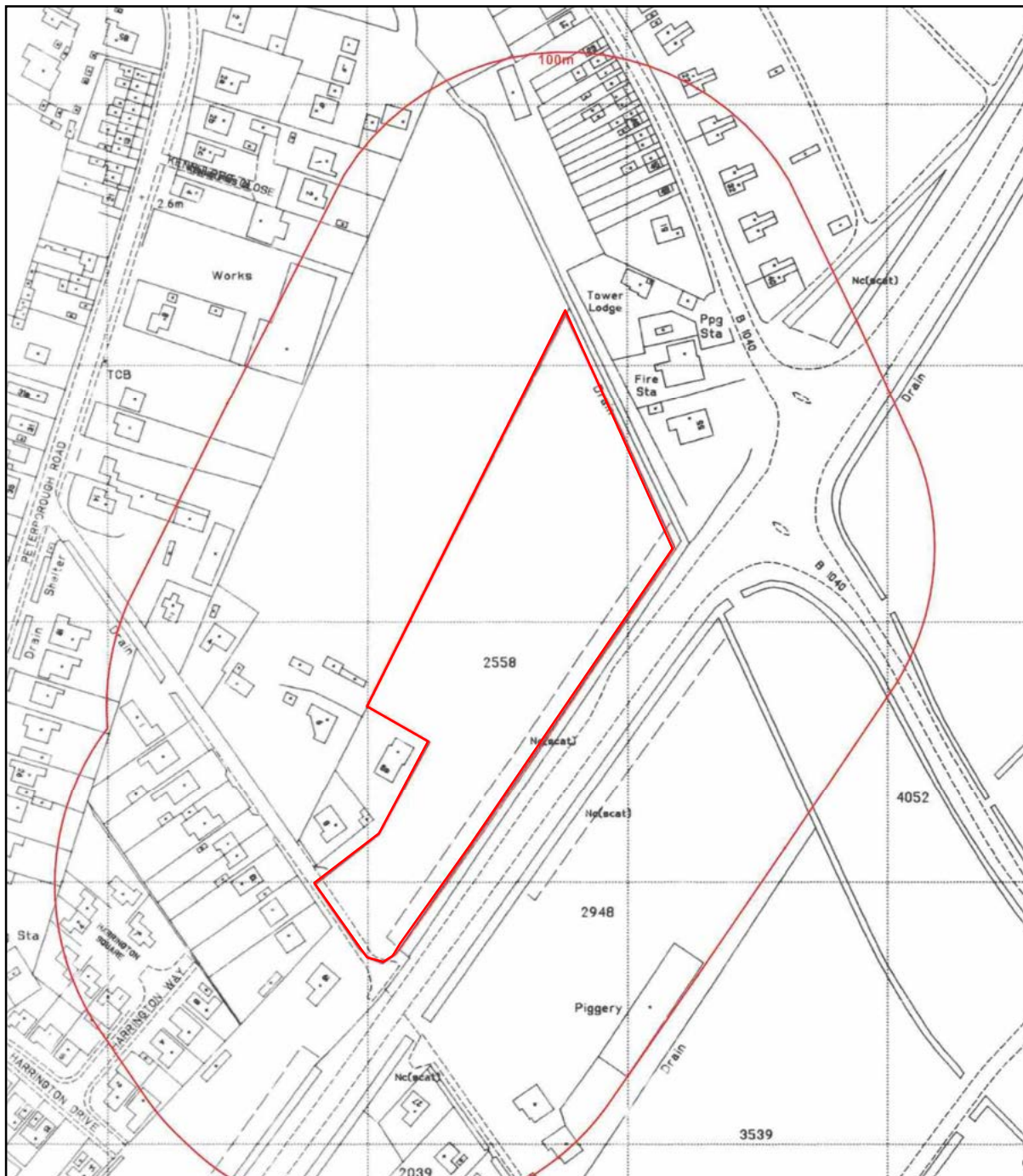
Project No.

C15122

Site History

Figure H

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Client : Burmor Construction

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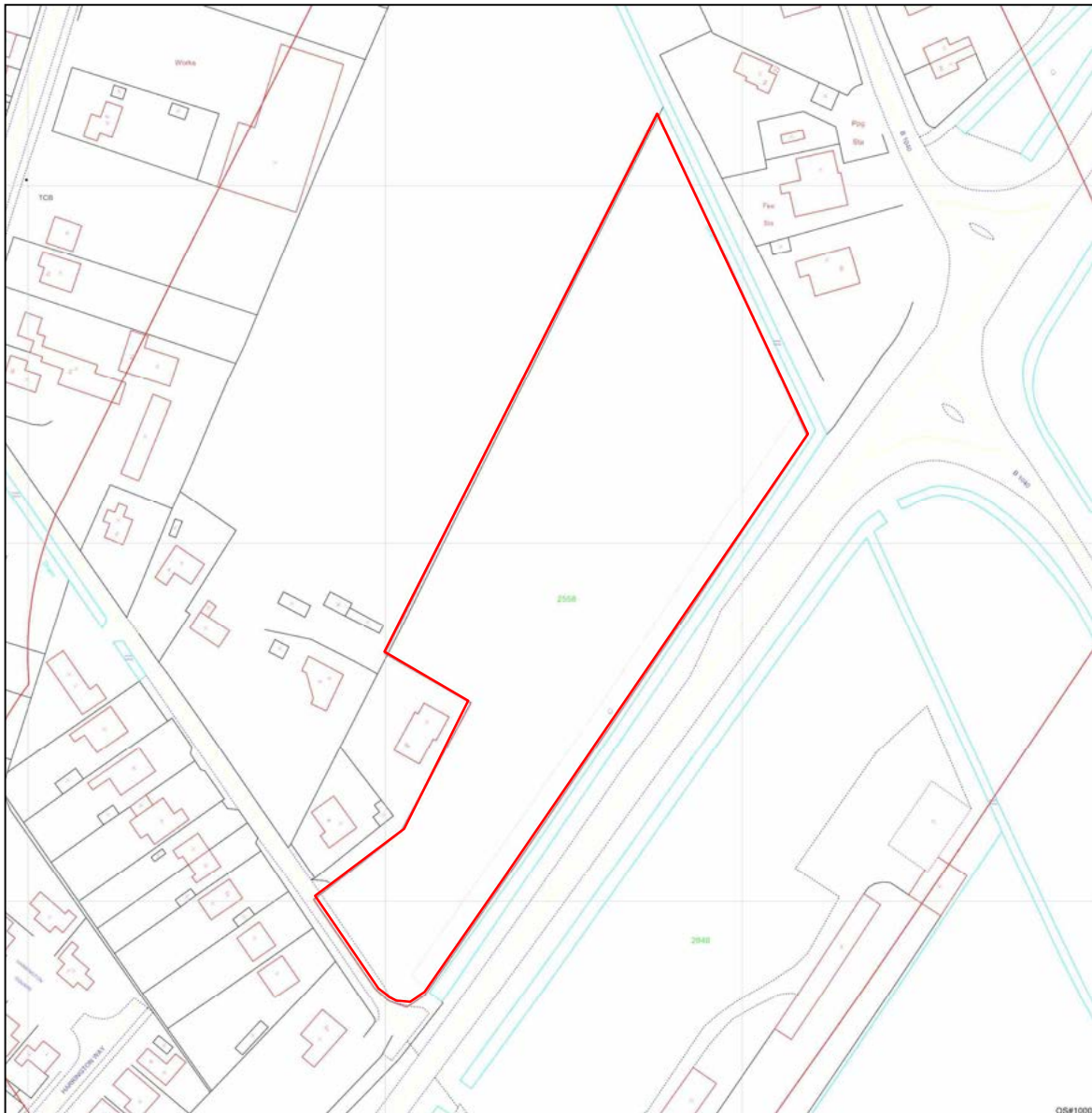
Project No.

C15122

Site History

Figure I

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Project : Barber's Drove, Crowland

Client : Burmor Construction

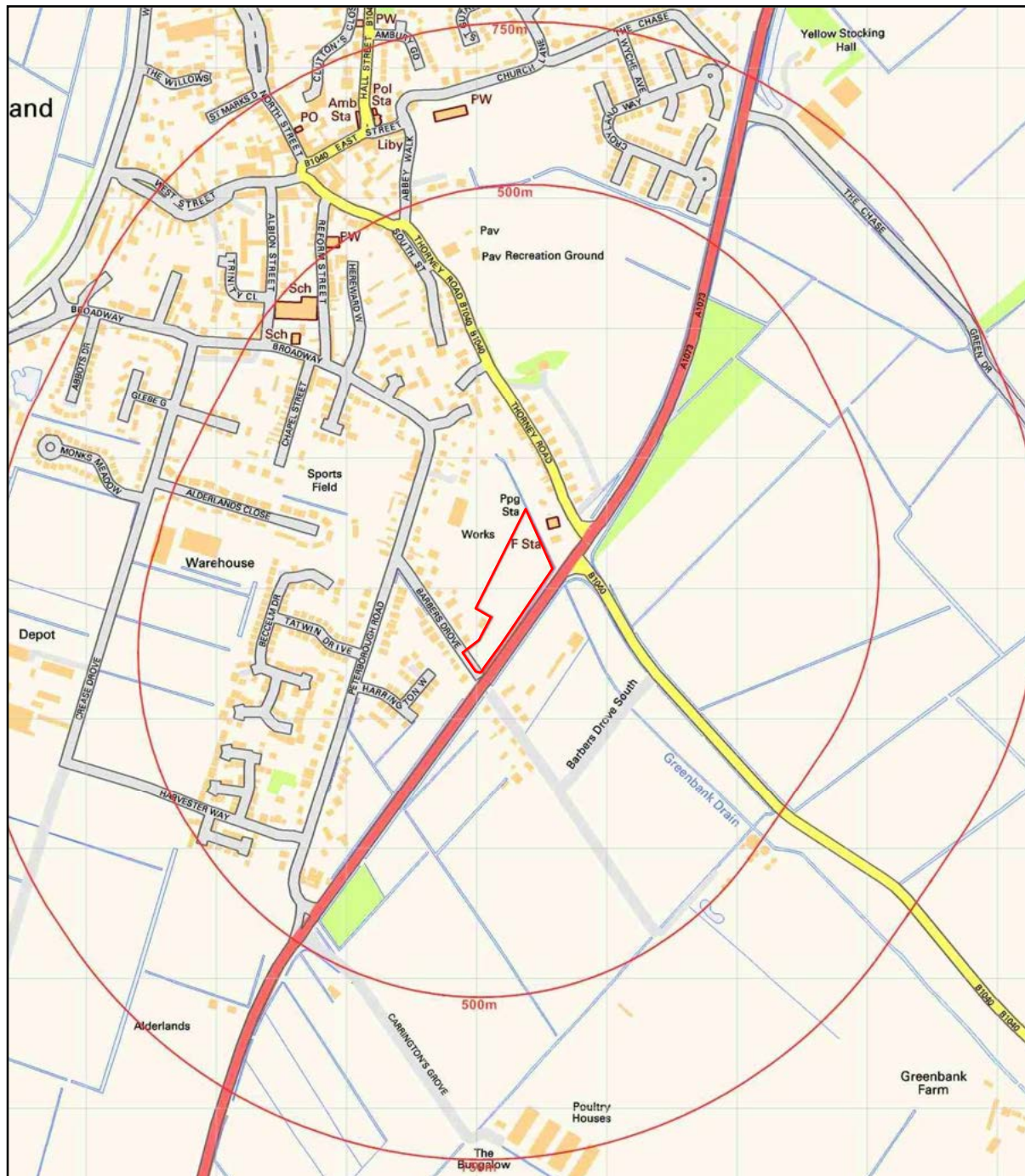
**GROUND
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Peterborough Tel : 01733 566566

Project No.

C15122

Figure J

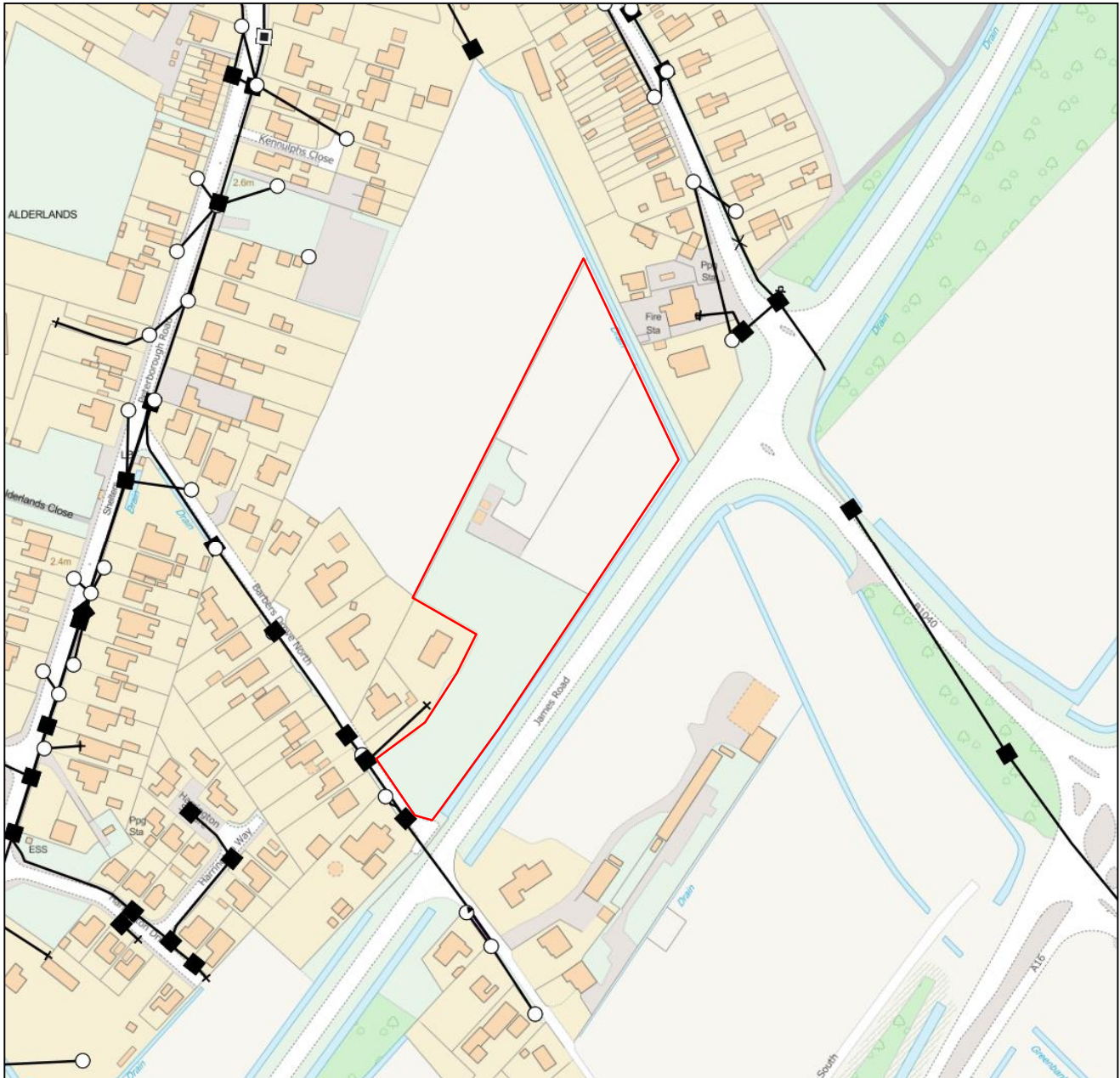


Peterborough Tel : 01733 566566

Site History

Figure K

Reproduced from the 2020 edition Ordnance Survey sheet TF2409 (BT plan) not to scale with the permission of the Controller of Her Majesty's Stationery Office, © Crown Copyright. All rights reserved. Licence number AL100005523



Project : Barber's Drove, Crowland

Client : Burmor Construction

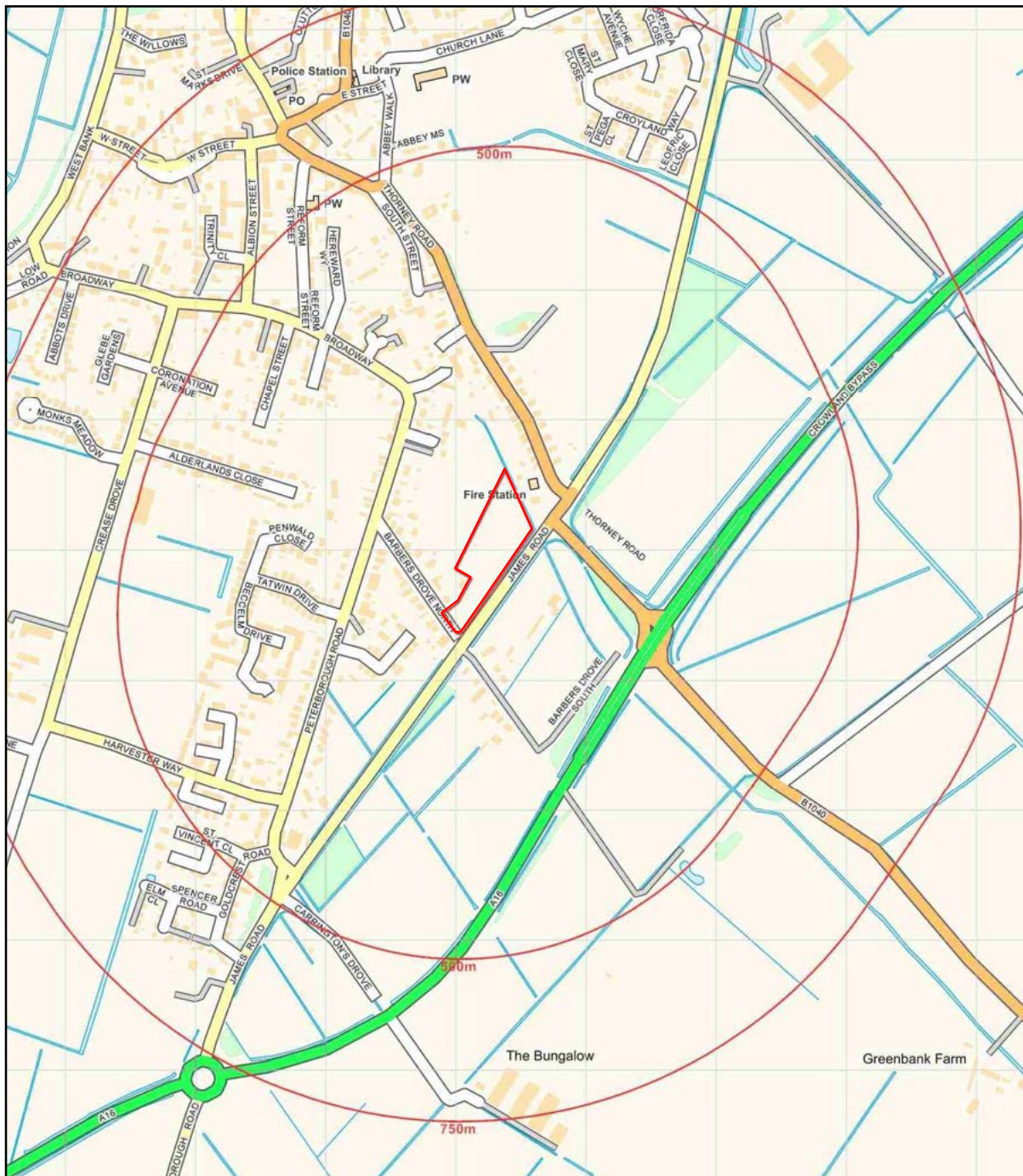
**GROUND
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LIMITED**

Peterborough Tel : 01733 566566

Project No.

C15122

Figure L



C15122

APPENDIX 2

ENVIRONMENTAL DATABASE SEARCH

BARBERS DROVE NORTH, CROWLAND, PETERBOROUGH, PE6 0BE

Order Details

Date: 03/08/2020
Your ref: swc15122
Our Ref: GS-6934878
Client: Ground Engineering Limited

Site Details

Location: 524246 309582
Area: 1.3 ha
Authority: [South Holland District Council](#)



Summary of findings

p. 2 **Aerial image**

p. 8

OS MasterMap site plan

p.13 groundsure.com/insightuserguide

Summary of findings

Page	Section	Past land use	On site	0-50m	50-250m	250-500m	500-2000m
14	1.1	<u>Historical industrial land uses</u>	0	0	8	3	-
15	1.2	<u>Historical tanks</u>	0	0	0	5	-
16	1.3	<u>Historical energy features</u>	0	0	3	2	-
16	1.4	Historical petrol stations	0	0	0	0	-
16	1.5	<u>Historical garages</u>	0	0	0	5	-
17	1.6	Historical military land	0	0	0	0	-
Page	Section	Past land use - un-grouped	On site	0-50m	50-250m	250-500m	500-2000m
18	2.1	<u>Historical industrial land uses</u>	0	0	10	3	-
19	2.2	<u>Historical tanks</u>	0	0	0	7	-
20	2.3	<u>Historical energy features</u>	0	0	4	4	-
20	2.4	Historical petrol stations	0	0	0	0	-
20	2.5	<u>Historical garages</u>	0	0	0	8	-
Page	Section	Waste and landfill	On site	0-50m	50-250m	250-500m	500-2000m
22	3.1	Active or recent landfill	0	0	0	0	-
22	3.2	Historical landfill (BGS records)	0	0	0	0	-
23	3.3	Historical landfill (LA/mapping records)	0	0	0	0	-
23	3.4	Historical landfill (EA/NRW records)	0	0	0	0	-
23	3.5	Historical waste sites	0	0	0	0	-
23	3.6	Licensed waste sites	0	0	0	0	-
23	3.7	<u>Waste exemptions</u>	0	0	0	5	-
Page	Section	Current industrial land use	On site	0-50m	50-250m	250-500m	500-2000m
25	4.1	<u>Recent industrial land uses</u>	0	1	2	-	-
26	4.2	<u>Current or recent petrol stations</u>	0	0	0	2	-
26	4.3	Electricity cables	0	0	0	0	-
26	4.4	Gas pipelines	0	0	0	0	-
26	4.5	Sites determined as Contaminated Land	0	0	0	0	-



27	4.6	Control of Major Accident Hazards (COMAH)	0	0	0	0	-
27	4.7	Regulated explosive sites	0	0	0	0	-
27	4.8	Hazardous substance storage/usage	0	0	0	0	-
27	4.9	Historical licensed industrial activities (IPC)	0	0	0	0	-
27	4.10	Licensed industrial activities (Part A(1))	0	0	0	0	-
28	4.11	<u>Licensed pollutant release (Part A(2)/B)</u>	0	0	0	1	-
28	4.12	Radioactive Substance Authorisations	0	0	0	0	-
28	4.13	<u>Licensed Discharges to controlled waters</u>	0	0	0	5	-
29	4.14	Pollutant release to surface waters (Red List)	0	0	0	0	-
29	4.15	Pollutant release to public sewer	0	0	0	0	-
29	4.16	List 1 Dangerous Substances	0	0	0	0	-
30	4.17	List 2 Dangerous Substances	0	0	0	0	-
30	4.18	<u>Pollution Incidents (EA/NRW)</u>	0	0	2	1	-
30	4.19	Pollution inventory substances	0	0	0	0	-
31	4.20	Pollution inventory waste transfers	0	0	0	0	-
31	4.21	Pollution inventory radioactive waste	0	0	0	0	-
Page	Section	Hydrogeology	On site	0-50m	50-250m	250-500m	500-2000m
32	5.1	<u>Superficial aquifer</u>	Identified (within 500m)				
34	5.2	<u>Bedrock aquifer</u>	Identified (within 500m)				
35	5.3	<u>Groundwater vulnerability</u>	Identified (within 50m)				
36	5.4	Groundwater vulnerability- soluble rock risk	None (within 0m)				
36	5.5	Groundwater vulnerability- local information	None (within 0m)				
37	5.6	<u>Groundwater abstractions</u>	0	0	0	0	1
38	5.7	<u>Surface water abstractions</u>	0	0	0	1	25
43	5.8	Potable abstractions	0	0	0	0	0
44	5.9	Source Protection Zones	0	0	0	0	-
44	5.10	Source Protection Zones (confined aquifer)	0	0	0	0	-
Page	Section	Hydrology	On site	0-50m	50-250m	250-500m	500-2000m
45	6.1	<u>Water Network (OS MasterMap)</u>	0	10	31	-	-



49	6.2	<u>Surface water features</u>	1	4	10	-	-
49	6.3	<u>WFD Surface water body catchments</u>	1	-	-	-	-
49	6.4	<u>WFD Surface water bodies</u>	0	0	0	-	-
50	6.5	WFD Groundwater bodies	0	-	-	-	-
Page	Section	River and coastal flooding	On site	0-50m	50-250m	250-500m	500-2000m
51	7.1	<u>Risk of Flooding from Rivers and Sea (RoFRaS)</u>	Medium (within 50m)				
52	7.2	<u>Historical Flood Events</u>	1	0	0	-	-
52	7.3	Flood Defences	0	0	0	-	-
52	7.4	Areas Benefiting from Flood Defences	0	0	0	-	-
53	7.5	Flood Storage Areas	0	0	0	-	-
54	7.6	<u>Flood Zone 2</u>	Identified (within 50m)				
55	7.7	<u>Flood Zone 3</u>	Identified (within 50m)				
Page	Section	Surface water flooding					
56	8.1	<u>Surface water flooding</u>	1 in 30 year, 0.3m - 1.0m (within 50m)				
Page	Section	Groundwater flooding					
58	9.1	<u>Groundwater flooding</u>	Negligible (within 50m)				
Page	Section	Environmental designations	On site	0-50m	50-250m	250-500m	500-2000m
59	10.1	Sites of Special Scientific Interest (SSSI)	0	0	0	0	0
59	10.2	Conserved wetland sites (Ramsar sites)	0	0	0	0	0
59	10.3	Special Areas of Conservation (SAC)	0	0	0	0	0
59	10.4	Special Protection Areas (SPA)	0	0	0	0	0
60	10.5	National Nature Reserves (NNR)	0	0	0	0	0
60	10.6	Local Nature Reserves (LNR)	0	0	0	0	0
60	10.7	Designated Ancient Woodland	0	0	0	0	0
60	10.8	Biosphere Reserves	0	0	0	0	0
61	10.9	Forest Parks	0	0	0	0	0
61	10.10	Marine Conservation Zones	0	0	0	0	0
61	10.11	Green Belt	0	0	0	0	0
61	10.12	Proposed Ramsar sites	0	0	0	0	0



61	10.13	Possible Special Areas of Conservation (pSAC)	0	0	0	0	0
62	10.14	Potential Special Protection Areas (pSPA)	0	0	0	0	0
62	10.15	Nitrate Sensitive Areas	0	0	0	0	0
62	10.16	<u>Nitrate Vulnerable Zones</u>	1	0	1	0	1
63	10.17	<u>SSSI Impact Risk Zones</u>	1	-	-	-	-
64	10.18	SSSI Units	0	0	0	0	0
Page	Section	Visual and cultural designations	On site	0-50m	50-250m	250-500m	500-2000m
65	11.1	World Heritage Sites	0	0	0	-	-
66	11.2	Area of Outstanding Natural Beauty	0	0	0	-	-
66	11.3	National Parks	0	0	0	-	-
66	11.4	Listed Buildings	0	0	0	-	-
66	11.5	<u>Conservation Areas</u>	0	0	1	-	-
67	11.6	Scheduled Ancient Monuments	0	0	0	-	-
67	11.7	Registered Parks and Gardens	0	0	0	-	-
Page	Section	Agricultural designations	On site	0-50m	50-250m	250-500m	500-2000m
68	12.1	<u>Agricultural Land Classification</u>	Grade 2 (within 250m)				
69	12.2	Open Access Land	0	0	0	-	-
69	12.3	<u>Tree Felling Licences</u>	0	0	1	-	-
69	12.4	Environmental Stewardship Schemes	0	0	0	-	-
70	12.5	Countryside Stewardship Schemes	0	0	0	-	-
Page	Section	Habitat designations	On site	0-50m	50-250m	250-500m	500-2000m
71	13.1	<u>Priority Habitat Inventory</u>	0	0	1	-	-
72	13.2	Habitat Networks	0	0	0	-	-
72	13.3	Open Mosaic Habitat	0	0	0	-	-
72	13.4	Limestone Pavement Orders	0	0	0	-	-
Page	Section	Geology 1:10,000 scale	On site	0-50m	50-250m	250-500m	500-2000m
73	14.1	<u>10k Availability</u>	Identified (within 500m)				
74	14.2	Artificial and made ground (10k)	0	0	0	0	-
75	14.3	<u>Superficial geology (10k)</u>	1	1	2	2	-

76	14.4	Landslip (10k)	0	0	0	0	-
77	14.5	<u>Bedrock geology (10k)</u>	1	0	0	1	-
78	14.6	Bedrock faults and other linear features (10k)	0	0	0	0	-
Page	Section	Geology 1:50,000 scale	On site	0-50m	50-250m	250-500m	500-2000m
79	15.1	<u>50k Availability</u>	Identified (within 500m)				
80	15.2	Artificial and made ground (50k)	0	0	0	0	-
80	15.3	Artificial ground permeability (50k)	0	0	-	-	-
81	15.4	<u>Superficial geology (50k)</u>	1	1	1	0	-
82	15.5	<u>Superficial permeability (50k)</u>	Identified (within 50m)				
82	15.6	Landslip (50k)	0	0	0	0	-
82	15.7	Landslip permeability (50k)	None (within 50m)				
83	15.8	<u>Bedrock geology (50k)</u>	1	0	0	0	-
84	15.9	<u>Bedrock permeability (50k)</u>	Identified (within 50m)				
84	15.10	Bedrock faults and other linear features (50k)	0	0	0	0	-
Page	Section	Boreholes	On site	0-50m	50-250m	250-500m	500-2000m
85	16.1	<u>BGS Boreholes</u>	0	9	6	-	-
Page	Section	Natural ground subsidence					
87	17.1	<u>Shrink swell clays</u>	Moderate (within 50m)				
88	17.2	<u>Running sands</u>	Moderate (within 50m)				
90	17.3	<u>Compressible deposits</u>	High (within 50m)				
92	17.4	<u>Collapsible deposits</u>	Negligible (within 50m)				
93	17.5	<u>Landslides</u>	Very low (within 50m)				
94	17.6	<u>Ground dissolution of soluble rocks</u>	Negligible (within 50m)				
Page	Section	Mining, ground workings and natural cavities	On site	0-50m	50-250m	250-500m	500-2000m
95	18.1	Natural cavities	0	0	0	0	-
95	18.2	BritPits	0	0	0	0	-
95	18.3	Surface ground workings	0	0	0	-	-
95	18.4	Underground workings	0	0	0	0	0
96	18.5	Historical Mineral Planning Areas	0	0	0	0	-



96	18.6	Non-coal mining	0	0	0	0	0
96	18.7	Mining cavities	0	0	0	0	0
96	18.8	JPB mining areas	None (within 0m)				
96	18.9	Coal mining	None (within 0m)				
97	18.10	Brine areas	None (within 0m)				
97	18.11	Gypsum areas	None (within 0m)				
97	18.12	Tin mining	None (within 0m)				
97	18.13	Clay mining	None (within 0m)				
Page	Section	Radon					
98	19.1	Radon	Less than 1% (within 0m)				
Page	Section	Soil chemistry	On site	0-50m	50-250m	250-500m	500-2000m
99	20.1	BGS Estimated Background Soil Chemistry	2	2	-	-	-
99	20.2	BGS Estimated Urban Soil Chemistry	0	0	-	-	-
100	20.3	BGS Measured Urban Soil Chemistry	0	0	-	-	-
Page	Section	Railway infrastructure and projects	On site	0-50m	50-250m	250-500m	500-2000m
101	21.1	Underground railways (London)	0	0	0	-	-
101	21.2	Underground railways (Non-London)	0	0	0	-	-
101	21.3	Railway tunnels	0	0	0	-	-
101	21.4	Historical railway and tunnel features	0	0	0	-	-
101	21.5	Royal Mail tunnels	0	0	0	-	-
102	21.6	Historical railways	0	0	0	-	-
102	21.7	Railways	0	0	0	-	-
102	21.8	Crossrail 1	0	0	0	0	-
102	21.9	Crossrail 2	0	0	0	0	-
102	21.10	HS2	0	0	0	0	-



Recent aerial photograph



Aerial photography supplied by Getmapping PLC. © Copyright Getmapping PLC 2020. All Rights Reserved.

Capture Date: 20/04/2018

Site Area: 1.3ha



Recent site history - 2017 aerial photograph



Aerial photography supplied by Getmapping PLC. © Copyright Getmapping PLC 2020. All Rights Reserved.

Capture Date: 25/04/2017

Site Area: 1.3ha



Recent site history - 2014 aerial photograph



Capture Date: 06/06/2014

Site Area: 1.3ha



Recent site history - 2012 aerial photograph



Capture Date: 23/07/2012

Site Area: 1.3ha



Recent site history - 1999 aerial photograph

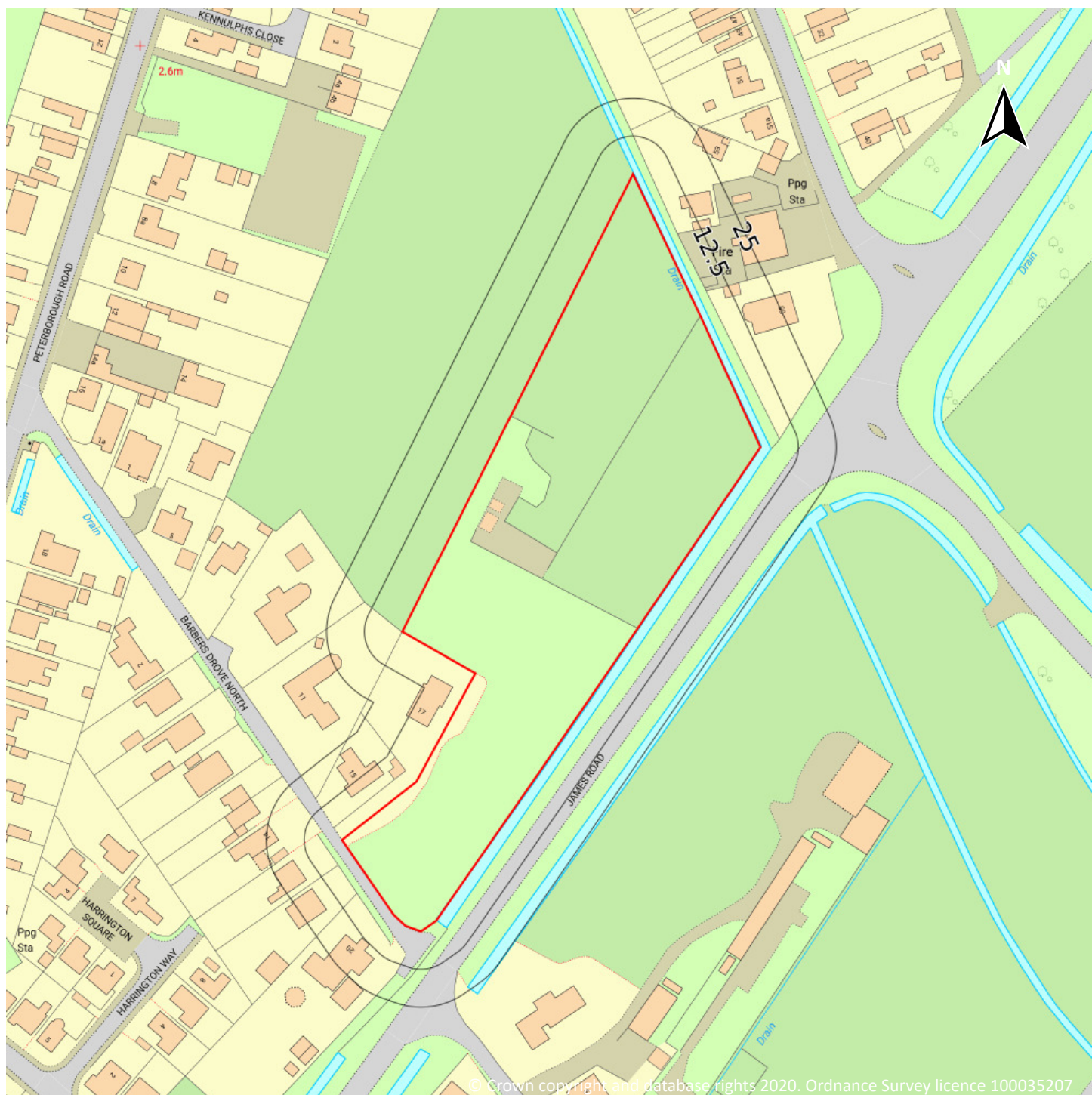


Capture Date: 18/06/1999

Site Area: 1.3ha



OS MasterMap site plan



Site Area: 1.3ha



1 Past land use



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

1.1 Historical industrial land uses

Records within 500m

11

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

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
1	75m NW	Unspecified Depot	1976	2005873



ID	Location	Land use	Dates present	Group ID
2	123m SW	Unspecified Works	1976	2005209
3	128m W	Pumping Station	1976	2004876
A	149m W	Windmill	1900 - 1901	2015336
A	150m W	Corn Mill	1886	2005776
A	150m W	Unspecified Windmill	1900	2031886
A	152m NW	Unspecified Works	1976	2005210
A	203m W	Unspecified Tank	1886	2004272
5	335m W	Unspecified Warehouse	1976	2012036
D	467m SE	Sewage Farm	1976	2005011
D	480m SE	Unspecified Tanks	1976	2009062

This data is sourced from Ordnance Survey / Groundsure.

1.2 Historical tanks

Records within 500m

5

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

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
D	476m SE	Tanks	1989	339367
D	477m SE	Tanks	1989	340554
D	478m SE	Tanks	1995	341398
D	482m SE	Tanks	1989 - 1995	341882
D	491m SE	Settlement Tanks	1989 - 1995	341594

This data is sourced from Ordnance Survey / Groundsure.



1.3 Historical energy features

Records within 500m

5

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

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
A	148m W	Electricity Substation	1995	220776
A	171m W	Electricity Substation	1989	220772
4	199m N	Electricity Substation	1989 - 1995	222546
6	429m SW	Electricity Substation	1996 - 1997	222329
7	497m NW	Electricity Substation	1973	220771

This data is sourced from Ordnance Survey / Groundsure.

1.4 Historical petrol stations

Records within 500m

0

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

This data is sourced from Ordnance Survey / Groundsure.

1.5 Historical garages

Records within 500m

5

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

Features are displayed on the Past land use map on **page 14**



ID	Location	Land use	Dates present	Group ID
B	378m SW	Garage	1965	68437
B	380m SW	Garage	1997	68838
B	381m SW	Garage	1996	68126
C	412m NW	Garage	1965	68108
C	418m NW	Garage	1996 - 1997	68807

This data is sourced from Ordnance Survey / Groundsure.

1.6 Historical military land

Records within 500m

0

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

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



2 Past land use - un-grouped



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

2.1 Historical industrial land uses

Records within 500m

13

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

Features are displayed on the Past land use - un-grouped map on **page 18**

ID	Location	Land Use	Date	Group ID
1	75m NW	Unspecified Depot	1976	2005873
2	123m SW	Unspecified Works	1976	2005209
3	128m W	Pumping Station	1976	2004876

ID	Location	Land Use	Date	Group ID
A	149m W	Windmill	1901	2015336
A	150m W	Windmill	1900	2015336
A	150m W	Corn Mill	1886	2005776
A	150m W	Unspecified Windmill	1900	2031886
A	150m W	Unspecified Windmill	1900	2031886
A	152m NW	Unspecified Works	1976	2005210
A	203m W	Unspecified Tank	1886	2004272
4	335m W	Unspecified Warehouse	1976	2012036
F	467m SE	Sewage Farm	1976	2005011
F	480m SE	Unspecified Tanks	1976	2009062

This data is sourced from Ordnance Survey / Groundsure.

2.2 Historical tanks

Records within 500m

7

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

Features are displayed on the Past land use - un-grouped map on **page 18**

ID	Location	Land Use	Date	Group ID
F	476m SE	Tanks	1989	339367
F	477m SE	Tanks	1989	340554
F	478m SE	Tanks	1995	341398
F	482m SE	Tanks	1989	341882
F	482m SE	Tanks	1995	341882
F	491m SE	Settlement Tanks	1989	341594
F	492m SE	Settlement Tanks	1995	341594

This data is sourced from Ordnance Survey / Groundsure.



2.3 Historical energy features

Records within 500m

8

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

Features are displayed on the Past land use - un-grouped map on **page 18**

ID	Location	Land Use	Date	Group ID
A	148m W	Electricity Substation	1995	220776
A	171m W	Electricity Substation	1989	220772
B	199m N	Electricity Substation	1989	222546
B	200m N	Electricity Substation	1995	222546
E	429m SW	Electricity Substation	1997	222329
E	429m SW	Electricity Substation	1997	222329
E	429m SW	Electricity Substation	1996	222329
5	497m NW	Electricity Substation	1973	220771

This data is sourced from Ordnance Survey / Groundsure.

2.4 Historical petrol stations

Records within 500m

0

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

This data is sourced from Ordnance Survey / Groundsure.

2.5 Historical garages

Records within 500m

8

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

Features are displayed on the Past land use - un-grouped map on **page 18**



ID	Location	Land Use	Date	Group ID
C	378m SW	Garage	1965	68437
C	380m SW	Garage	1997	68838
C	380m SW	Garage	1997	68838
C	381m SW	Garage	1996	68126
D	412m NW	Garage	1965	68108
D	418m NW	Garage	1997	68807
D	418m NW	Garage	1997	68807
D	418m NW	Garage	1996	68807

This data is sourced from Ordnance Survey / Groundsure.



3 Waste and landfill



- Site Outline
- Search buffers in metres (m)
- Waste exemptions

3.1 Active or recent landfill

Records within 500m

0

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

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

3.2 Historical landfill (BGS records)

Records within 500m

0

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

This data is sourced from the British Geological Survey.



3.3 Historical landfill (LA/mapping records)

Records within 500m**0**

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

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

3.4 Historical landfill (EA/NRW records)

Records within 500m**0**

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

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

3.5 Historical waste sites

Records within 500m**0**

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

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

3.6 Licensed waste sites

Records within 500m**0**

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

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

3.7 Waste exemptions

Records within 500m**5**

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

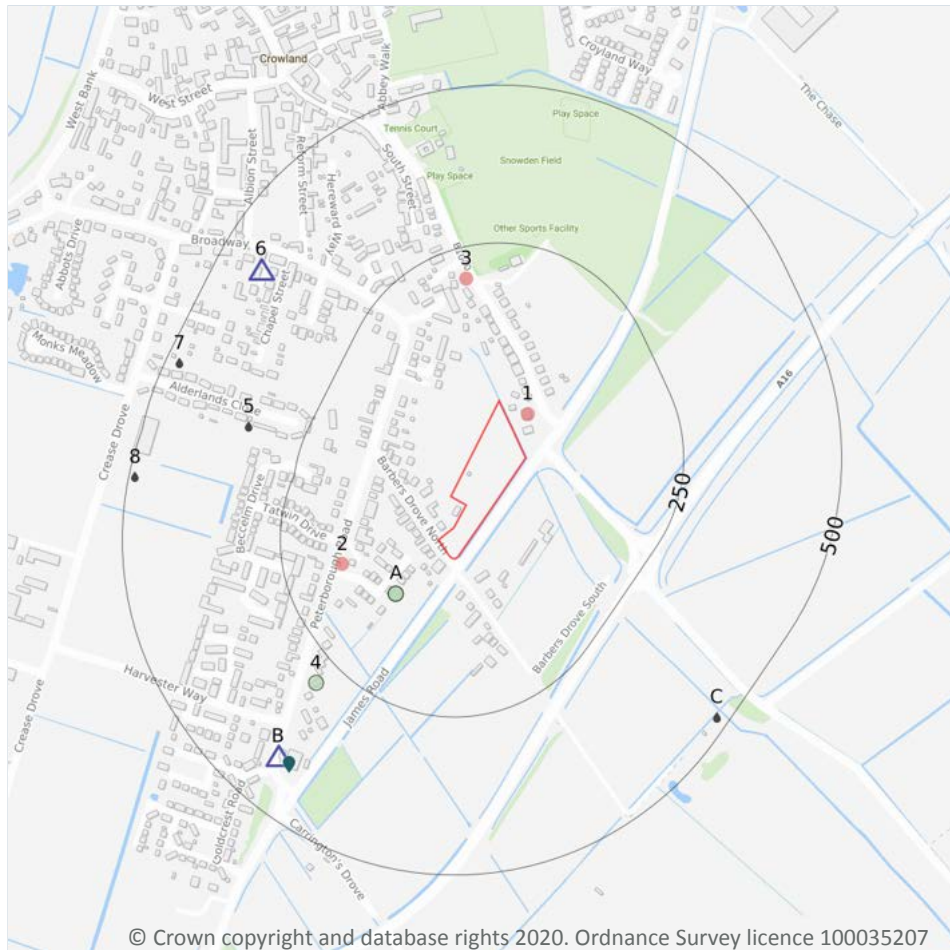
Features are displayed on the Waste and landfill map on **page 22**

ID	Location	Site	Reference	Category	Sub-Category	Description
A	410m N	crowland health centre Thorney Road Peterborough Lincolnshire PE6 0AL	EPR/QF0801TF /A001	Treating waste exemption	Non- Agricultural Waste Only	Sorting and de-naturing of controlled drugs for disposal
A	415m N	THORNEY ROAD, CROWLAND, PETERBOROUGH, PE6 0AL	WEX134776	Storing waste exemption	Not on a farm	Storage of waste in a secure place
A	415m N	THORNEY ROAD, CROWLAND, PETERBOROUGH, PE6 0AL	WEX134783	Treating waste exemption	Not on a farm	Sorting and de-naturing of controlled drugs for disposal
1	453m SW	81 Peterborough Road PETERBOROUGH PE6 0BB	EPR/TF0802TV /A001	Using waste exemption	Non- Agricultural Waste Only	Use of waste in construction
2	480m NW	Crowland South View Community Primary School Reform Street Crowland PE6 0AN	EPR/PH0379P Q/A001	Treating waste exemption	Non- Agricultural Waste Only	Crushing waste fluorescent tubes

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



4 Current industrial land use



- Site Outline
- Search buffers in metres (m)
- Recent industrial land uses
- △ Current or recent petrol stations
- Licensed pollutant release (Part A(2)/B)
- Licensed Discharges to controlled waters
- Pollution Incidents (EA/NRW)

4.1 Recent industrial land uses

Records within 250m

3

Current potentially contaminative industrial sites.

Features are displayed on the Current industrial land use map on **page 25**

ID	Location	Company	Address	Activity	Category
1	32m NE	Crowland Fire Station	Fire Station, Thorney Road, Crowland, Peterborough, Lincolnshire, PE6 0AL	Fire Brigade Stations	Central and Local Government
2	157m W	Electricity Sub Station	Lincolnshire, PE6	Electrical Features	Infrastructure and Facilities
3	201m N	Electricity Sub Station	Lincolnshire, PE6	Electrical Features	Infrastructure and Facilities



This data is sourced from Ordnance Survey.

4.2 Current or recent petrol stations

Records within 500m

2

Open, closed, under development and obsolete petrol stations.

Features are displayed on the Current industrial land use map on **page 25**

ID	Location	Company	Address	LPG	Status
B	417m SW	TOTAL	64, Peterborough Road, Crowland, Lincolnshire, PE6 0BA	Not Applicable	Obsolete
6	431m NW	OBSOLETE	59, Broadway, Crowland, Lincolnshire, PE6 0BH	Not Applicable	Obsolete

This data is sourced from Experian.

4.3 Electricity cables

Records within 500m

0

High voltage underground electricity transmission cables.

This data is sourced from National Grid.

4.4 Gas pipelines

Records within 500m

0

High pressure underground gas transmission pipelines.

This data is sourced from National Grid.

4.5 Sites determined as Contaminated Land

Records within 500m

0

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

This data is sourced from Local Authority records.



4.6 Control of Major Accident Hazards (COMAH)

Records within 500m**0**

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

This data is sourced from the Health and Safety Executive.

4.7 Regulated explosive sites

Records within 500m**0**

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

This data is sourced from the Health and Safety Executive.

4.8 Hazardous substance storage/usage

Records within 500m**0**

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

This data is sourced from Local Authority records.

4.9 Historical licensed industrial activities (IPC)

Records within 500m**0**

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

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

4.10 Licensed industrial activities (Part A(1))

Records within 500m**0**

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

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

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

Records within 500m

1

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

Features are displayed on the Current industrial land use map on **page 25**

ID	Location	Address	Details	
B	416m SW	Crowland Service Station, 64 Peterborough Road, Crowland, Peterborough, Cambs, PE6 0BA	Process: Unloading of Petrol into Storage at Service Stations Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified

This data is sourced from Local Authority records.

4.12 Radioactive Substance Authorisations

Records within 500m

0

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

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

4.13 Licensed Discharges to controlled waters

Records within 500m

5

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

Features are displayed on the Current industrial land use map on **page 25**

ID	Location	Address	Details	
5	338m W	CREASE DROVE, CROWLAND, PETERBOROUGH	Effluent Type: TRADE DISCHARGES - UNSPECIFIED Permit Number: PR5NF447 Permit Version: 1 Receiving Water: Unknown Trib	Status: PRE NRA LEGISLATION WHERE ISSUE DATE 01-SEP-89 (HISTORIC ONLY) Issue date: 12/12/1968 Effective Date: 12/12/1968 Revocation Date: 26/02/1992
7	478m NW	PREMISES AT CREASE DROVE, CROWLAND	Effluent Type: UNSPECIFIED Permit Number: PR5LF3154 Permit Version: 1 Receiving Water: Land	Status: PRE NRA LEGISLATION WHERE ISSUE DATE 01-SEP-89 (HISTORIC ONLY) Issue date: 03/12/1971 Effective Date: 03/12/1971 Revocation Date: 01/10/1996

ID	Location	Address	Details	
C	480m SE	CROWLAND STW, CROWLAND, PETERBOROUGH	Effluent Type: SEWAGE DISCHARGES - STW STORM OVERFLOW/STORM TANK - WATER COMPANY Permit Number: AW5NF79A Permit Version: 2 Receiving Water: Green Bank Drn,New S. Eau Rive	Status: VARIED BY APPLICATION - (WRA 91 SCHED 10 - AS AMENDED BY ENV ACT 1995) Issue date: 04/09/2003 Effective Date: 04/09/2003 Revocation Date: 31/03/2009
C	480m SE	CROWLAND STW, CROWLAND, PETERBOROUGH	Effluent Type: SEWAGE DISCHARGES - STW STORM OVERFLOW/STORM TANK - WATER COMPANY Permit Number: AW5NF79A Permit Version: 3 Receiving Water: Green Bank Drn,New S. Eau Rive	Status: VARIED BY APPLICATION - (WRA 91 SCHED 10 - AS AMENDED BY ENV ACT 1995) Issue date: 14/10/2008 Effective Date: 01/04/2009 Revocation Date: -
8	490m W	RES. DEV. TATWIN DRIVE, CROWLAND	Effluent Type: MISCELLANEOUS DISCHARGES - SURFACE WATER Permit Number: PR5NF5156 Permit Version: 1 Receiving Water: Fen drain	Status: PRE NRA LEGISLATION WHERE ISSUE DATE 01-SEP-89 (HISTORIC ONLY) Issue date: 21/05/1986 Effective Date: 21/05/1986 Revocation Date: 11/02/1992

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

4.14 Pollutant release to surface waters (Red List)

Records within 500m

0

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

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

4.15 Pollutant release to public sewer

Records within 500m

0

Discharges of Special Category Effluents to the public sewer.

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

4.16 List 1 Dangerous Substances

Records within 500m

0

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

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



4.17 List 2 Dangerous Substances

Records within 500m

0

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

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

4.18 Pollution Incidents (EA/NRW)

Records within 500m

3

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

Features are displayed on the Current industrial land use map on **page 25**

ID	Location	Details	
A	103m SW	Incident Date: 11/09/2002 Incident Identification: 107152 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Other Atmospheric Pollutant or Effect	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)
A	103m SW	Incident Date: 13/02/2002 Incident Identification: 58119 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Landfill Odour	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)
4	291m SW	Incident Date: 06/06/2002 Incident Identification: 83160 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Effects on Humans	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)

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

4.19 Pollution inventory substances

Records within 500m

0

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

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

4.20 Pollution inventory waste transfers

Records within 500m

0

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

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

4.21 Pollution inventory radioactive waste

Records within 500m

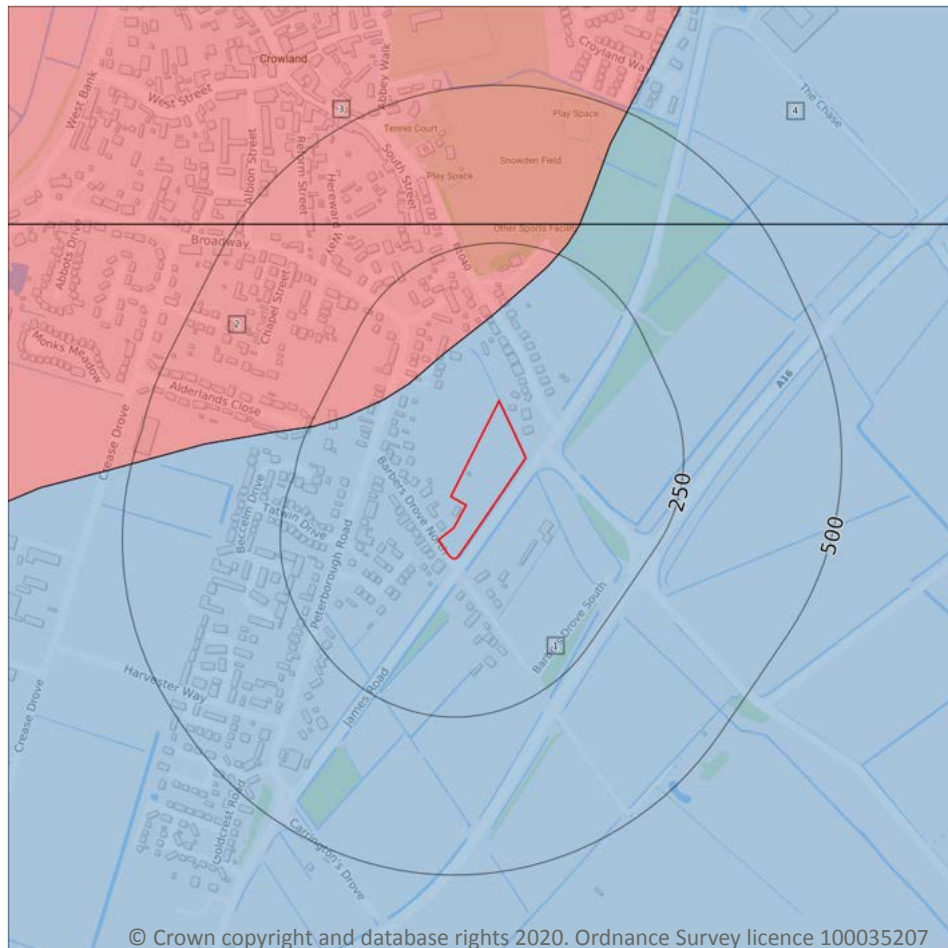
0

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

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



5 Hydrogeology - Superficial aquifer



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

5.1 Superficial aquifer

Records within 500m

4

Aquifer status of groundwater held within superficial geology.

Features are displayed on the Hydrogeology map on **page 32**

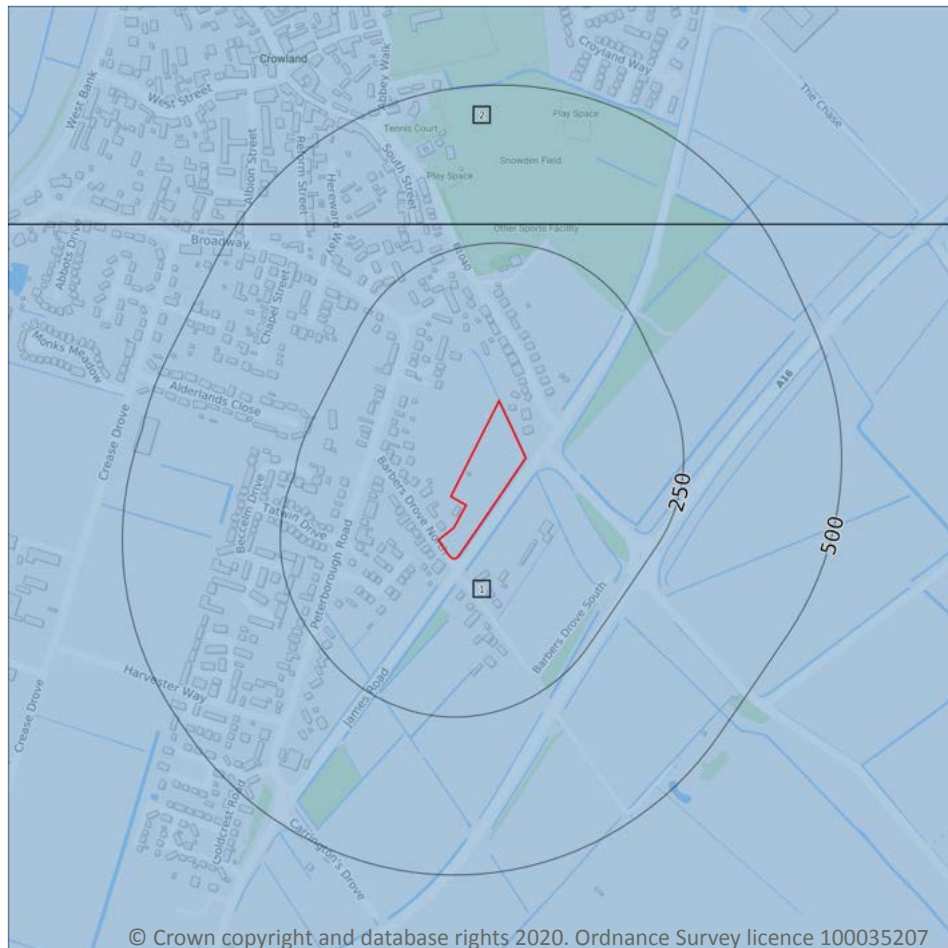
ID	Location	Designation	Description
1	On site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
2	113m NW	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

ID	Location	Designation	Description
3	280m N	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
4	308m NE	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

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



Bedrock aquifer



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

5.2 Bedrock aquifer

Records within 500m

2

Aquifer status of groundwater held within bedrock geology.

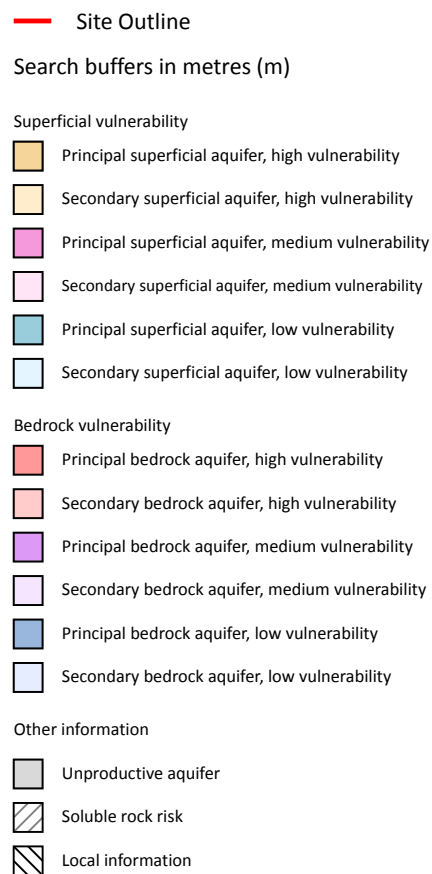
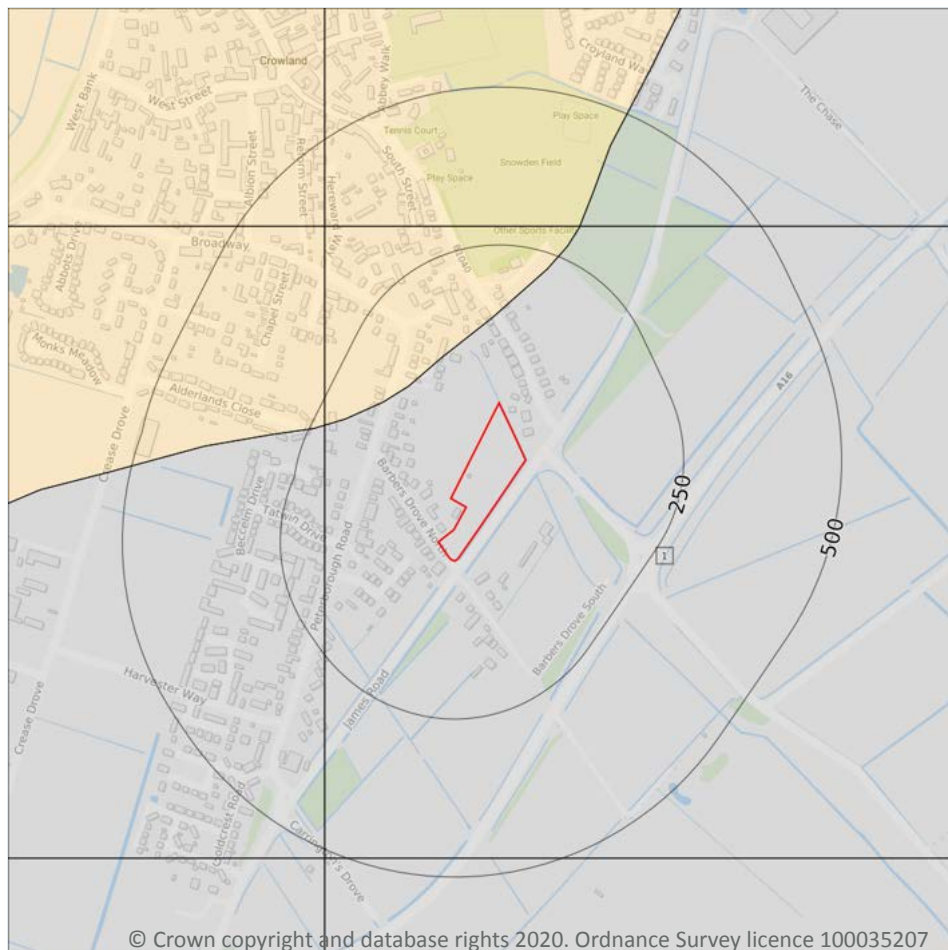
Features are displayed on the Bedrock aquifer map on **page 34**

ID	Location	Designation	Description
1	On site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
2	280m N	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

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



Groundwater vulnerability



5.3 Groundwater vulnerability

Records within 50m

1

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

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

Features are displayed on the Groundwater vulnerability map on **page 35**

ID	Location	Summary	Soil / surface	Superficial geology	Bedrock geology
1	On site	Summary Classification: Unproductive aquifer (may have productive aquifer beneath) Combined classification: Unproductive Bedrock Aquifer, Unproductive Superficial Aquifer	Leaching class: Intermediate Infiltration value: >70% Dilution value: <300mm/year	Vulnerability: Unproductive Aquifer type: Unproductive Thickness: 3-10m Patchiness value: >90% Recharge potential: Low	Vulnerability: Unproductive Aquifer type: Unproductive Flow mechanism: Well connected fractures

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

5.4 Groundwater vulnerability- soluble rock risk

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

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

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

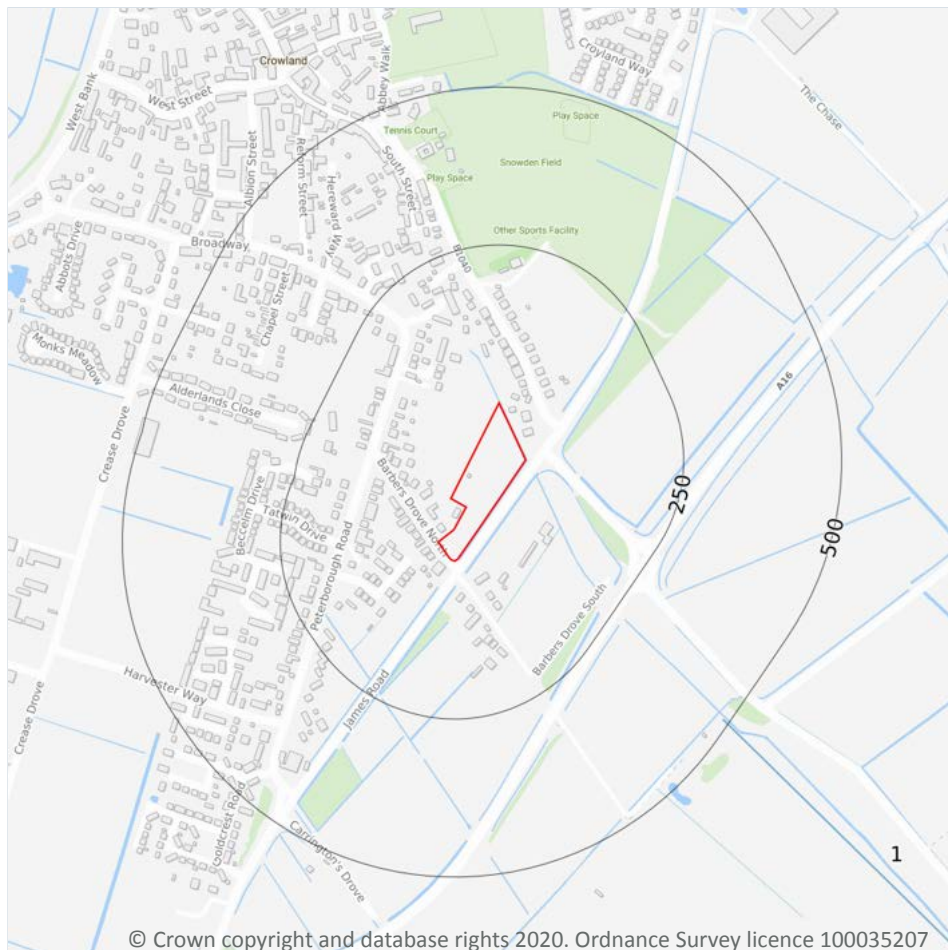
5.5 Groundwater vulnerability- local information

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

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

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

Abstractions and Source Protection Zones



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

5.6 Groundwater abstractions

Records within 2000m

1

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

Features are displayed on the Abstractions and Source Protection Zones map on **page 37**

ID	Location	Details	
-	980m N	Status: Historical Licence No: 5/32/11/*G/0024 Details: General Farming & Domestic Direct Source: GROUND WATER SOURCE OF SUPPLY Point: WELL AT 38 POSTLAND ROAD Data Type: Point Name: SMEDLEY Easting: 524300 Northing: 310700	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 01/03/1966 Expiry Date: - Issue No: 100 Version Start Date: 01/03/1966 Version End Date: -

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

5.7 Surface water abstractions

Records within 2000m

26

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

Features are displayed on the Abstractions and Source Protection Zones map on **page 37**

ID	Location	Details	
1	488m SE	Status: Active Licence No: 5/32/11/*S/0112 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: GREEN BANK DRAIN, CROWLAND Data Type: Line Name: BOOR Easting: 524630 Northing: 309220	Annual Volume (m ³): 15,000 Max Daily Volume (m ³): 2,000 Original Application No: - Original Start Date: 01/06/1986 Expiry Date: - Issue No: 101 Version Start Date: 30/09/2002 Version End Date: -
-	966m S	Status: Active Licence No: 5/32/11/*S/0112 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: FIELD DRAINS, CROWLAND Data Type: Line Name: BOOR Easting: 524530 Northing: 308560	Annual Volume (m ³): 15,000 Max Daily Volume (m ³): 2,000 Original Application No: - Original Start Date: 01/06/1986 Expiry Date: - Issue No: 101 Version Start Date: 30/09/2002 Version End Date: -



ID	Location	Details	
-	1042m NW	Status: Active Licence No: 5/31/14/*S/0254 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: NEW RIVER - CROWLAND Data Type: Line Name: F G TANSLEY & SON Easting: 523250 Northing: 310000	Annual Volume (m ³): 22,000 Max Daily Volume (m ³): 4,000 Original Application No: - Original Start Date: 01/07/2001 Expiry Date: - Issue No: 1 Version Start Date: 01/07/2001 Version End Date: -
-	1088m NW	Status: Historical Licence No: 5/31/14/*S/0178B Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: NEW RIVER AT CROWLAND Data Type: Line Name: F ADAMS & SON Easting: 523200 Northing: 310000	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 01/12/1984 Expiry Date: - Issue No: 100 Version Start Date: 01/11/1993 Version End Date: -
-	1368m SE	Status: Historical Licence No: 5/32/11/*S/0144 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: NEW SOUTH EAU DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 525264 Northing: 308599	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -
-	1368m SE	Status: Historical Licence No: 5/32/11/*S/0144 Details: Transfer Between Sources (Pre Water Act 2003) Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: NEW SOUTH EAU DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 525264 Northing: 308599	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -
-	1368m SE	Status: Active Licence No: 5/32/11/*S/0144/R01 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: NEW SOUTH EAU DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 525264 Northing: 308599	Annual Volume (m ³): 55,000 Max Daily Volume (m ³): 3,000 Original Application No: - Original Start Date: 01/11/2017 Expiry Date: 31/03/2029 Issue No: 1 Version Start Date: 01/11/2017 Version End Date: -



ID	Location	Details	
-	1368m SE	Status: Active Licence No: 5/32/11/*S/0144/R01 Details: Transfer Between Sources (Pre Water Act 2003) Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: NEW SOUTH EAU DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 525264 Northing: 308599	Annual Volume (m ³): 55,000 Max Daily Volume (m ³): 3,000 Original Application No: - Original Start Date: 01/11/2017 Expiry Date: 31/03/2029 Issue No: 1 Version Start Date: 01/11/2017 Version End Date: -
-	1373m SE	Status: Active Licence No: 5/32/11/*S/0112 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN, CROWLAND Data Type: Line Name: BOOR Easting: 525250 Northing: 308570	Annual Volume (m ³): 15,000 Max Daily Volume (m ³): 2,000 Original Application No: - Original Start Date: 01/06/1986 Expiry Date: - Issue No: 101 Version Start Date: 30/09/2002 Version End Date: -
-	1379m SE	Status: Historical Licence No: 5/32/11/*S/0144 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: NEW SOUTH EAU DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 525270 Northing: 308590	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -
-	1379m SE	Status: Historical Licence No: 5/32/11/*S/0144 Details: Transfer Between Sources (Pre Water Act 2003) Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: NEW SOUTH EAU DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 525270 Northing: 308590	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -
-	1396m SE	Status: Historical Licence No: 5/32/11/*S/0144 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 523927 Northing: 307228	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -



ID	Location	Details	
-	1396m SE	Status: Historical Licence No: 5/32/11/*S/0144 Details: Transfer Between Sources (Pre Water Act 2003) Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 523927 Northing: 307228	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -
-	1396m SE	Status: Active Licence No: 5/32/11/*S/0144/R01 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 523927 Northing: 307228	Annual Volume (m ³): 55,000 Max Daily Volume (m ³): 3,000 Original Application No: - Original Start Date: 01/11/2017 Expiry Date: 31/03/2029 Issue No: 1 Version Start Date: 01/11/2017 Version End Date: -
-	1396m SE	Status: Active Licence No: 5/32/11/*S/0144/R01 Details: Transfer Between Sources (Pre Water Act 2003) Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 523927 Northing: 307228	Annual Volume (m ³): 55,000 Max Daily Volume (m ³): 3,000 Original Application No: - Original Start Date: 01/11/2017 Expiry Date: 31/03/2029 Issue No: 1 Version Start Date: 01/11/2017 Version End Date: -
-	1400m SE	Status: Historical Licence No: 5/32/11/*S/0144 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 523900 Northing: 307210	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -
-	1400m SE	Status: Historical Licence No: 5/32/11/*S/0144 Details: Transfer Between Sources (Pre Water Act 2003) Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Line Name: N WOODROFFE & SONS Easting: 523900 Northing: 307210	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -



ID	Location	Details	
-	1641m NW	Status: Active Licence No: 5/31/14/*S/0254 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: RIVER WELLAND - CROWLAND Data Type: Line Name: F G TANSLEY & SON Easting: 522930 Northing: 310660	Annual Volume (m ³): 22,000 Max Daily Volume (m ³): 4,000 Original Application No: - Original Start Date: 01/07/2001 Expiry Date: - Issue No: 1 Version Start Date: 01/07/2001 Version End Date: -
-	1689m NW	Status: Historical Licence No: 5/31/14/*S/0178B Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: RIVER WELLAND AT CROWLAND Data Type: Line Name: F ADAMS & SON Easting: 522900 Northing: 310700	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 01/12/1984 Expiry Date: - Issue No: 100 Version Start Date: 01/11/1993 Version End Date: -
-	1768m S	Status: Active Licence No: 5/32/11/*S/0144/R01 Details: Spray Irrigation - Storage Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Point Name: N WOODROFFE & SONS Easting: 524391 Northing: 307711	Annual Volume (m ³): 55,000 Max Daily Volume (m ³): 3,000 Original Application No: - Original Start Date: 01/11/2017 Expiry Date: 31/03/2029 Issue No: 1 Version Start Date: 01/11/2017 Version End Date: -
-	1769m S	Status: Historical Licence No: 5/32/11/*S/0144 Details: Spray Irrigation - Storage Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Point Name: N WOODROFFE & SONS Easting: 524391 Northing: 307710	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -
-	1770m S	Status: Historical Licence No: 5/32/11/*S/0144 Details: Transfer between sources Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Point Name: N WOODROFFE & SONS Easting: 524400 Northing: 307710	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 01/09/1997 Expiry Date: 31-Oct-17 Issue No: 100 Version Start Date: 01/06/1998 Version End Date: -



ID	Location	Details	
-	1770m S	Status: Historical Licence No: 5/32/11/*S/0144 Details: Spray Irrigation - Storage Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: HUNDREDS DRAIN AT THORNEY Data Type: Point Name: N WOODROFFE & SONS Easting: 524400 Northing: 307710	Annual Volume (m ³): 55000 Max Daily Volume (m ³): 3000 Original Application No: - Original Start Date: 23/09/1997 Expiry Date: 31/10/2017 Issue No: 102 Version Start Date: 16/07/2008 Version End Date: -
-	1815m SE	Status: Active Licence No: 5/32/11/*S/0112 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: GREEN BANK DRAIN, CROWLAND Data Type: Point Name: BOOR Easting: 525570 Northing: 308270	Annual Volume (m ³): 15,000 Max Daily Volume (m ³): 2,000 Original Application No: - Original Start Date: 01/06/1986 Expiry Date: - Issue No: 101 Version Start Date: 30/09/2002 Version End Date: -
-	1827m NW	Status: Active Licence No: 5/31/14/*S/0160 Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: COMMON DRAIN, CROWLAND Data Type: Line Name: WHEAT Easting: 521919 Northing: 312031	Annual Volume (m ³): 30,000 Max Daily Volume (m ³): 2,000 Original Application No: - Original Start Date: 01/09/1983 Expiry Date: - Issue No: 101 Version Start Date: 18/10/2013 Version End Date: -
-	1968m NW	Status: Historical Licence No: 5/31/14/*S/0178A Details: Spray Irrigation - Direct Direct Source: SURFACE WATER SOURCE OF SUPPLY Point: COMMON DRAIN CROWLAND Data Type: Line Name: F ADAMS & SON Easting: 522700 Northing: 310900	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 01/12/1984 Expiry Date: - Issue No: 100 Version Start Date: 01/12/1992 Version End Date: -

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

5.8 Potable abstractions

Records within 2000m

0

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

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



5.9 Source Protection Zones

Records within 500m

0

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

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

5.10 Source Protection Zones (confined aquifer)

Records within 500m

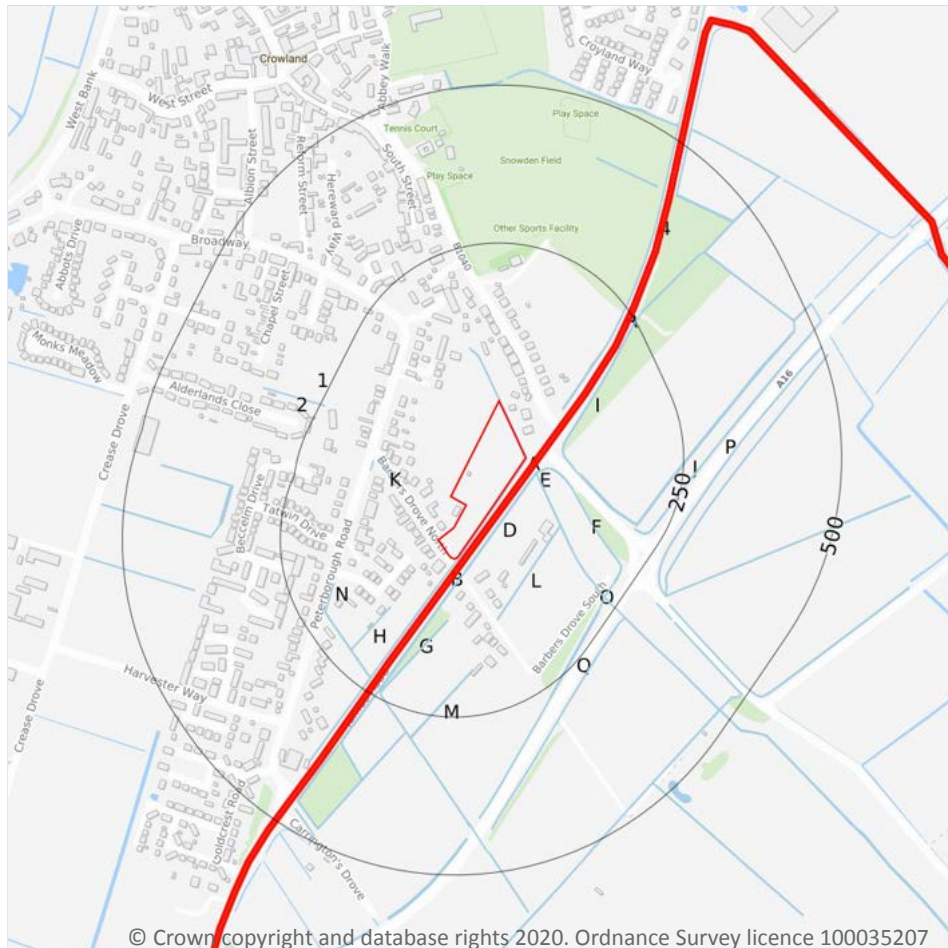
0

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

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



6 Hydrology



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

6.1 Water Network (OS MasterMap)

Records within 250m

41

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

Features are displayed on the Hydrology map on **page 45**

ID	Location	Type of water feature	Ground level	Permanence	Name
A	On site	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-

ID	Location	Type of water feature	Ground level	Permanence	Name
B	2m SE	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
D	23m SE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
B	25m SE	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
E	27m SE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
E	27m SE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
E	28m SE	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
F	31m SE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
G	40m S	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
G	47m SW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
I	59m E	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
E	82m E	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
I	85m NE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
K	90m W	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-



ID	Location	Type of water feature	Ground level	Permanence	Name
J	91m E	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
G	97m S	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
L	105m SE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
F	107m SE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
H	123m SW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
K	133m W	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
M	178m S	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
N	178m SW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
N	185m SW	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
N	191m SW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
O	203m SE	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
P	205m SE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
H	215m SW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-



ID	Location	Type of water feature	Ground level	Permanence	Name
O	216m SE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
O	226m SE	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
O	226m SE	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
O	226m SE	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
M	227m SW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
Q	232m SE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
R	237m NE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
M	238m SW	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
M	238m SW	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-
2	242m NW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
M	243m SW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
4	243m NE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
M	245m SW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-



ID	Location	Type of water feature	Ground level	Permanence	Name
R	249m NE	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	-

This data is sourced from the Ordnance Survey.

6.2 Surface water features

Records within 250m	15
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Covering rivers, streams and lakes (some overlap with OS MasterMap Water Network data in previous section) but additionally covers smaller features such as ponds. Rivers and streams narrower than 5m are represented as a single line. Lakes, ponds and rivers or streams wider than 5m are represented as polygons.

Features are displayed on the Hydrology map on **page 45**

This data is sourced from the Ordnance Survey.

6.3 WFD Surface water body catchments

Records on site	1
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The Water Framework Directive is an EU-led framework for the protection of inland surface waters, estuaries, coastal waters and groundwater through river basin-level management planning. In terms of surface water, these basins are broken down into smaller units known as management, operational and water body catchments.

Features are displayed on the Hydrology map on **page 45**

ID	Location	Type	Water body catchment	Water body ID	Operational catchment	Management catchment
1	On site	River WB catchment	Welland - conf Greatford Cut to tidal	GB205031050685	Lower Welland	Welland

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

6.4 WFD Surface water bodies

Records identified	1
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Surface water bodies under the Directive may be rivers, lakes, estuary or coastal. To achieve the purpose of the Directive, environmental objectives have been set and are reported on for each water body. The progress towards delivery of the objectives is then reported on by the relevant competent authorities at the end of each six-year cycle. The river water body directly associated with the catchment listed in the previous section is detailed below, along with any lake, canal, coastal or artificial water body within 250m of the site. Click on the

water body ID in the table to visit the EA Catchment Explorer to find out more about each water body listed. Features are displayed on the Hydrology map on **page 45**

ID	Location	Type	Name	Water body ID	Overall rating	Chemical rating	Ecological rating	Year
-	1610m NW	River	Welland - conf Greatford Cut to tidal	GB205031050685	Moderate	Good	Moderate	2016

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

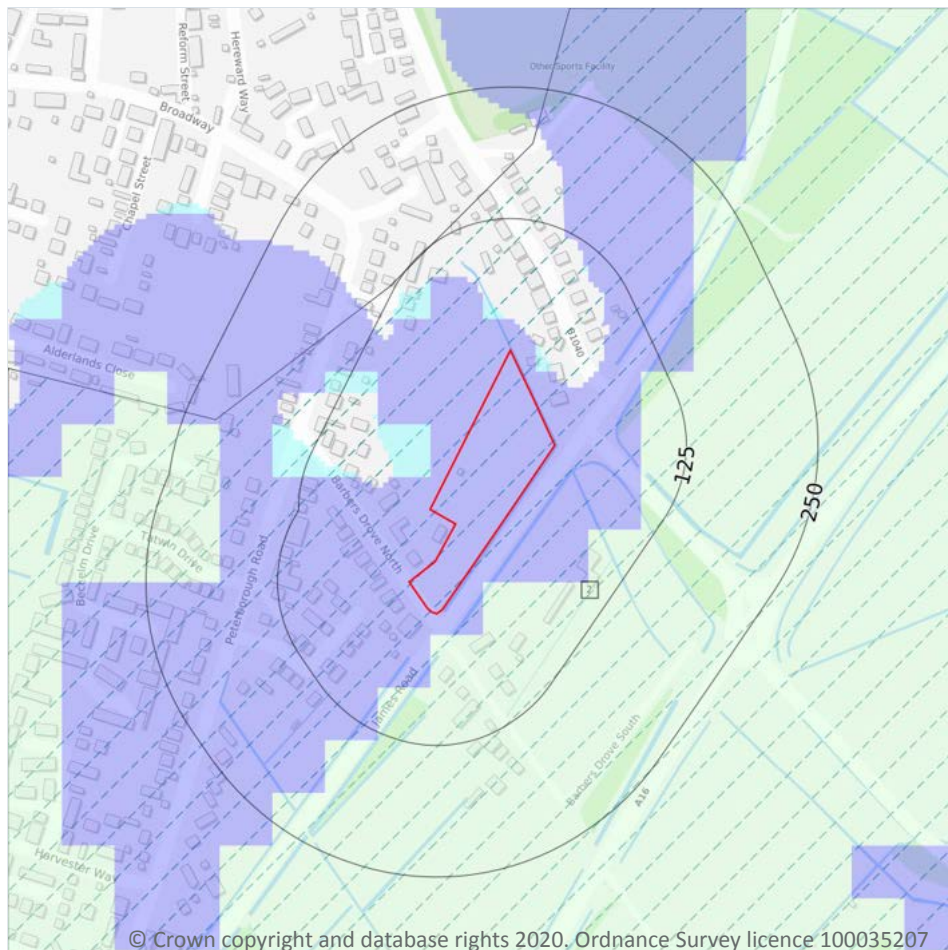
6.5 WFD Groundwater bodies

Records on site	0
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Groundwater bodies are also covered by the Directive and the same regime of objectives and reporting detailed in the previous section is in place. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each groundwater body listed.

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

7 River and coastal flooding



- Site Outline
- Search buffers in metres (m)
- Environment Agency river and coastal flooding:
 - High
 - Medium
 - Low
 - Very Low
- Historical Flood Events
- Areas Used for Flood Storage
- Areas Benefiting from Flood Defences
- Flood Defences

7.1 Risk of Flooding from Rivers and Sea (RoFRaS)

Records within 50m

5

The chance of flooding from rivers and/or the sea in any given year, based on cells of 50m. Each cell is allocated one of four flood risk categories, taking into account flood defences and their condition; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 100 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 100 chance) or High (greater than or equal to 1 in 30 chance).

Features are displayed on the River and coastal flooding map on **page 51**

Distance	RoFRaS flood risk
On site	Medium
0 - 50m	Medium



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

7.2 Historical Flood Events

Records within 250m

1

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

Features are displayed on the River and coastal flooding map on **page 51**

ID	Location	Event name	Date of flood	Flood source	Flood cause	Type of flood
2	On site	March 1947 On The River Welland Near Cowbit	1947-03-16 1947-03-18	Main river	Other	Fluvial

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

7.3 Flood Defences

Records within 250m

0

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

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

7.4 Areas Benefiting from Flood Defences

Records within 250m

0

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

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

7.5 Flood Storage Areas

Records within 250m

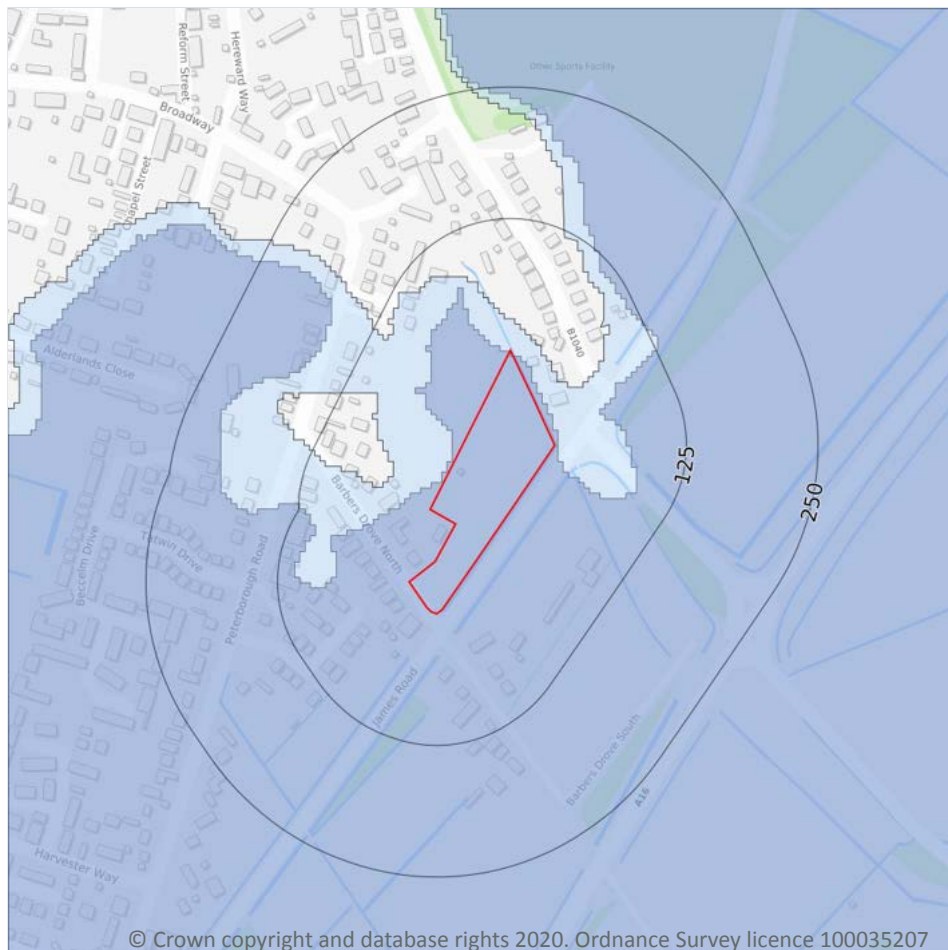
0

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

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



River and coastal flooding - Flood Zones



- Site Outline
- Search buffers in metres (m)
- Flood zone 2
- Flood zone 3

7.6 Flood Zone 2

Records within 50m

1

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

Features are displayed on the River and coastal flooding map on **page 51**

Location	Type
On site	Zone 2 - (Fluvial /Tidal Models)

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

7.7 Flood Zone 3

Records within 50m

1

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

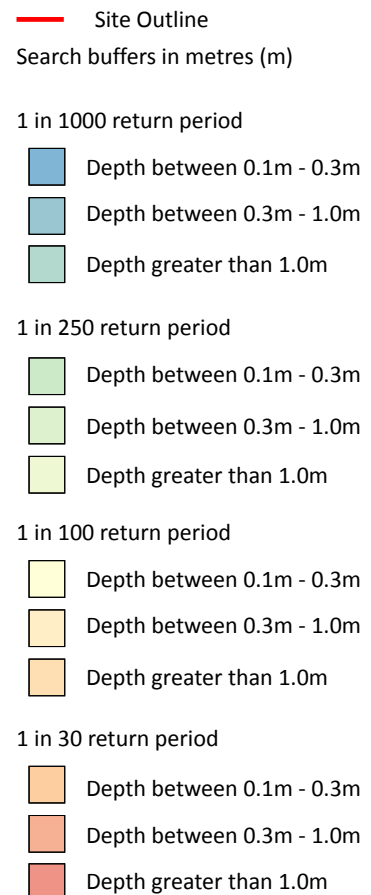
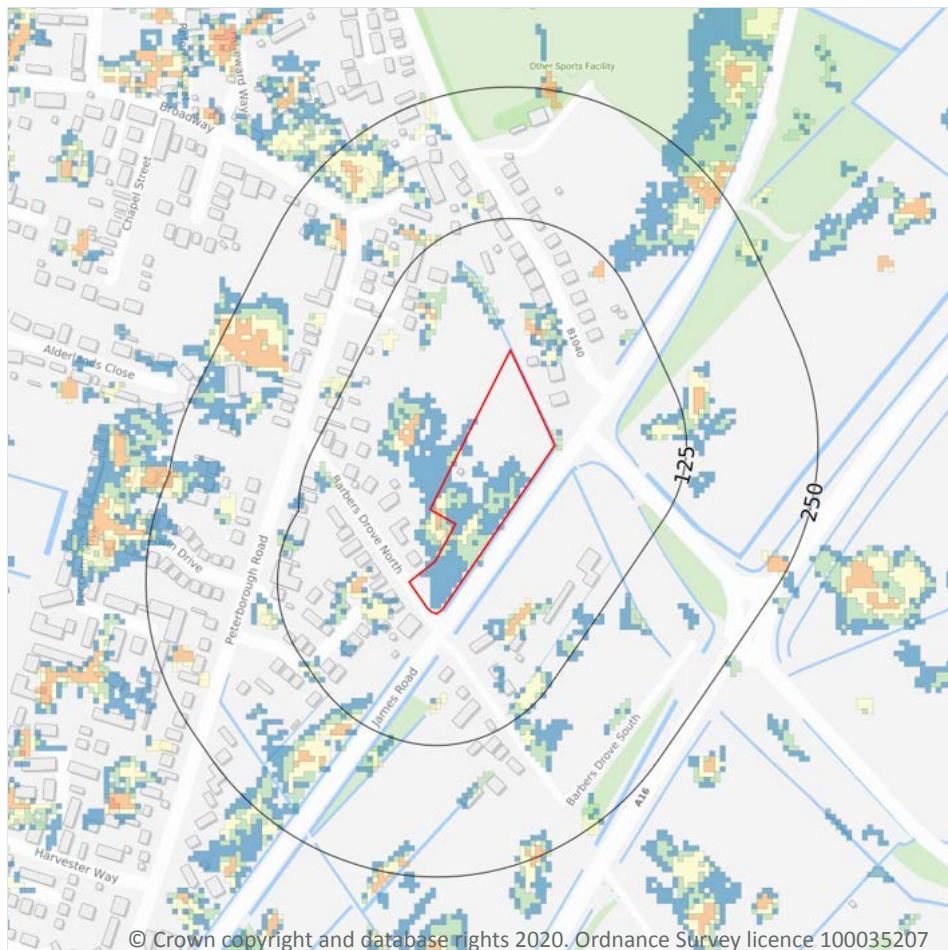
Features are displayed on the River and coastal flooding map on **page 51**

Location	Type
On site	Zone 3 - (Fluvial Models)

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



8 Surface water flooding



8.1 Surface water flooding

Highest risk on site

1 in 30 year, 0.1m - 0.3m

Highest risk within 50m

1 in 30 year, 0.3m - 1.0m

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

Features are displayed on the Surface water flooding map on **page 56**

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

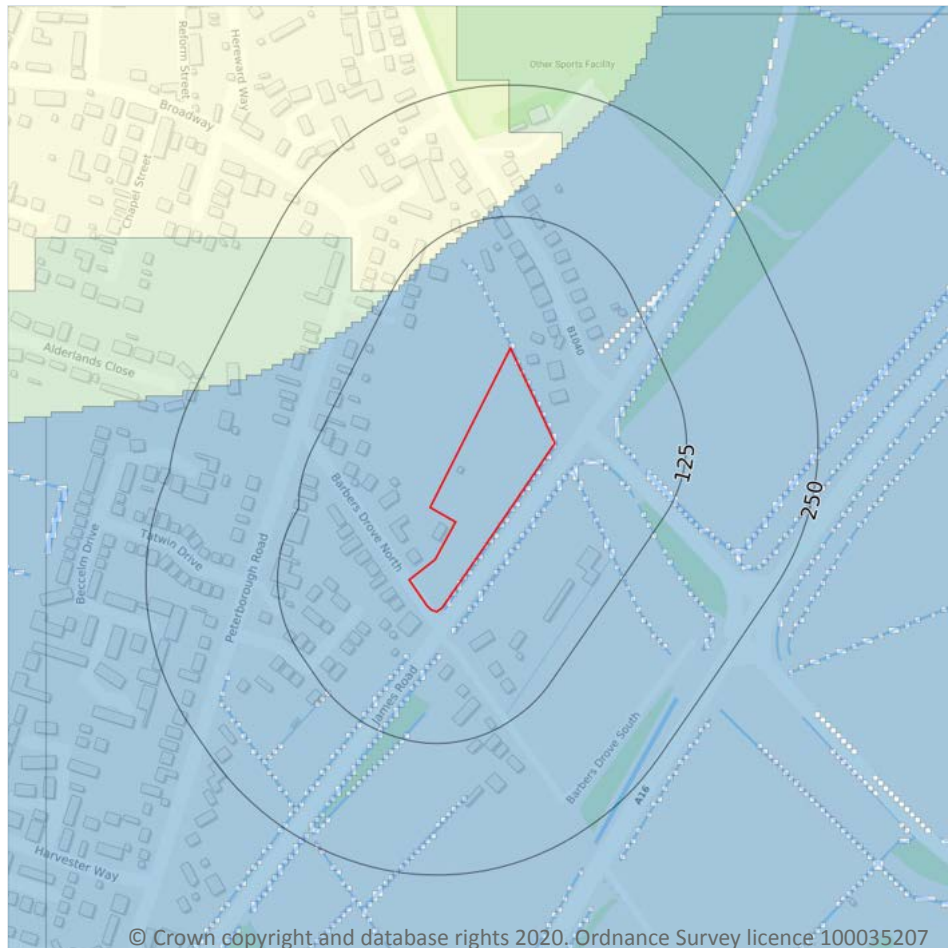
The table below shows the maximum flood depths for a range of return periods for the site.

Return period	Maximum modelled depth
1 in 1000 year	Between 0.3m and 1.0m
1 in 250 year	Between 0.3m and 1.0m
1 in 100 year	Between 0.1m and 0.3m
1 in 30 year	Between 0.1m and 0.3m

This data is sourced from Ambiantal Risk Analytics.



9 Groundwater flooding



— Site Outline
Search buffers in metres (m)

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

9.1 Groundwater flooding

Highest risk on site

Negligible

Highest risk within 50m

Negligible

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

Features are displayed on the Groundwater flooding map on **page 58**

This data is sourced from Ambiantal Risk Analytics.

10 Environmental designations

10.1 Sites of Special Scientific Interest (SSSI)

Records within 2000m

0

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

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

10.2 Conserved wetland sites (Ramsar sites)

Records within 2000m

0

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

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

10.3 Special Areas of Conservation (SAC)

Records within 2000m

0

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

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

10.4 Special Protection Areas (SPA)

Records within 2000m

0

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

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



10.5 National Nature Reserves (NNR)

Records within 2000m

0

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

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

10.6 Local Nature Reserves (LNR)

Records within 2000m

0

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

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

10.7 Designated Ancient Woodland

Records within 2000m

0

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

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

10.8 Biosphere Reserves

Records within 2000m

0

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

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

10.9 Forest Parks

Records within 2000m

0

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

This data is sourced from the Forestry Commission.

10.10 Marine Conservation Zones

Records within 2000m

0

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

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

10.11 Green Belt

Records within 2000m

0

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

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

10.12 Proposed Ramsar sites

Records within 2000m

0

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

This data is sourced from Natural England.

10.13 Possible Special Areas of Conservation (pSAC)

Records within 2000m

0

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

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



10.14 Potential Special Protection Areas (pSPA)

Records within 2000m

0

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

This data is sourced from Natural England.

10.15 Nitrate Sensitive Areas

Records within 2000m

0

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

This data is sourced from Natural England.

10.16 Nitrate Vulnerable Zones

Records within 2000m

3

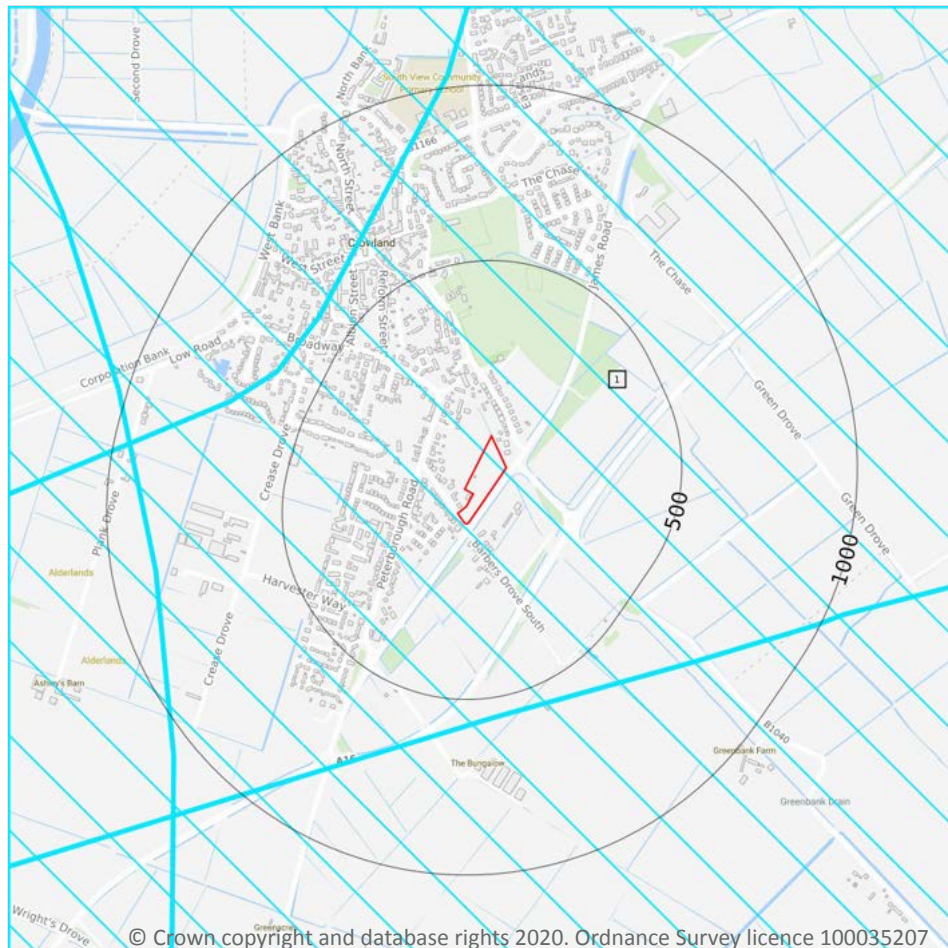
Areas at risk from agricultural nitrate pollution designated under the EC Nitrate Directive (91/676/EEC). These are areas of land that drain into waters polluted by nitrates. Farmers operating within these areas have to follow mandatory rules to tackle nitrate loss from agriculture.

Location	Name	Type	NVZ ID	Status
On site	River Welland NVZ	Surface Water	S832	Existing
88m W	River Welland NVZ	Surface Water	S832	Existing
1647m NW	Vernatt's Drain NVZ	Surface Water	S379	Existing

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



SSSI Impact Zones and Units



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

10.17 SSSI Impact Risk Zones

Records on site

1

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

Features are displayed on the SSSI Impact Zones and Units map on **page 63**

ID	Location	Type of developments requiring consultation
1	On site	Infrastructure - Airports, helipads and other aviation proposals.

This data is sourced from Natural England.

10.18 SSSI Units

Records within 2000m

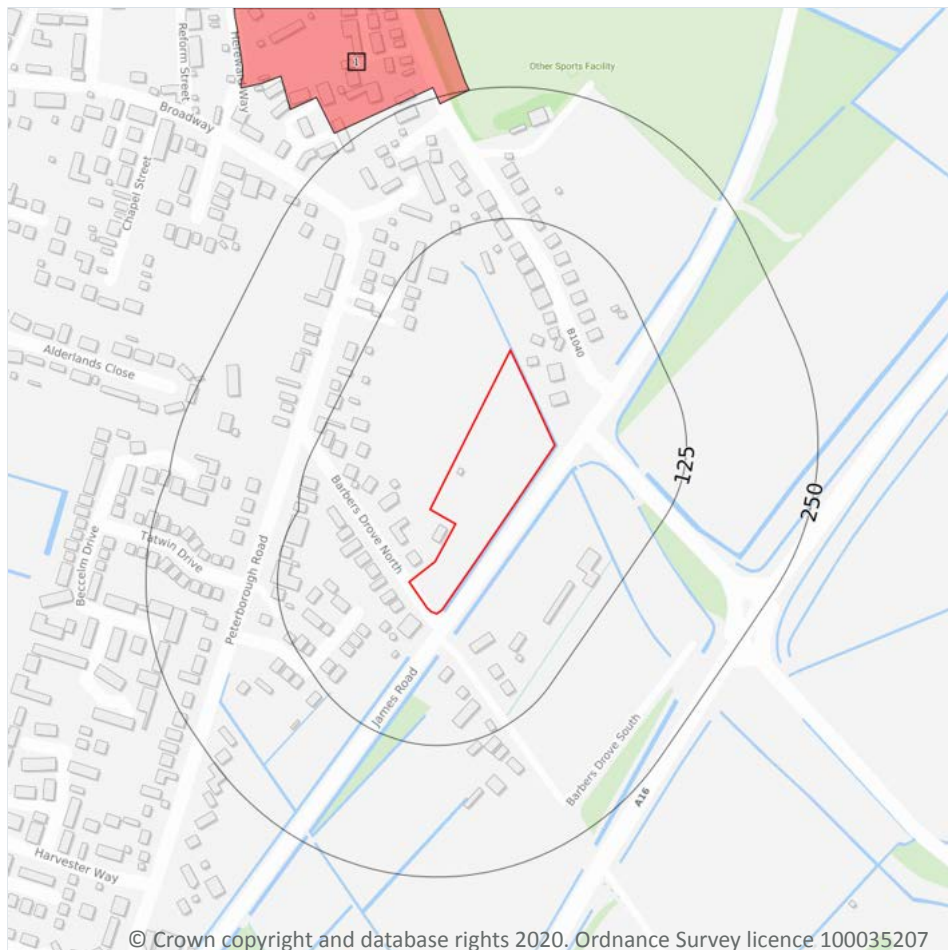
0

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

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



11 Visual and cultural designations



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

11.1 World Heritage Sites

Records within 250m

0

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

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

11.2 Area of Outstanding Natural Beauty

Records within 250m**0**

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

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

11.3 National Parks

Records within 250m**0**

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

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

11.4 Listed Buildings

Records within 250m**0**

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

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

11.5 Conservation Areas

Records within 250m**1**

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



Features are displayed on the Visual and cultural designations map on **page 65**

ID	Location	Name	District	Date of designation
1	243m N	Crowland	South Holland	1970

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

11.6 Scheduled Ancient Monuments

Records within 250m

0

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

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

11.7 Registered Parks and Gardens

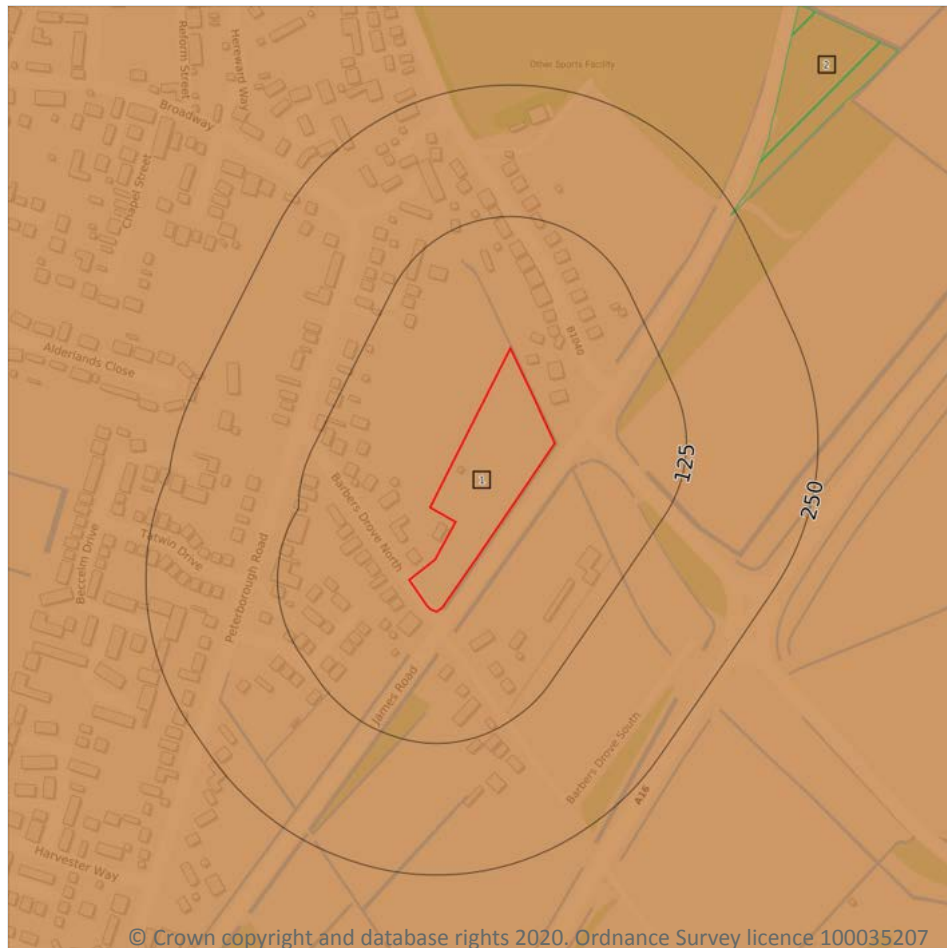
Records within 250m

0

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

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

12 Agricultural designations



- Site Outline
- Search buffers in metres (m)
- Grade 1 - excellent quality
- Grade 2 - very good quality
- Grade 3 - good to moderate quality
- Grade 3a - good quality
- Grade 3b - moderate quality
- Grade 4 - poor quality
- Grade 5 - very poor quality
- Non-agricultural land
- Urban land
- Exclusion land
- Tree felling licences
- Open Access land

12.1 Agricultural Land Classification

Records within 250m

1

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

Features are displayed on the Agricultural designations map on **page 68**

ID	Location	Classification	Description
1	On site	Grade 2	Very good quality agricultural land. Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.

This data is sourced from Natural England.

12.2 Open Access Land

Records within 250m	0
----------------------------	----------

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

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

12.3 Tree Felling Licences

Records within 250m	1
----------------------------	----------

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

Features are displayed on the Agricultural designations map on **page 68**

ID	Location	Description	Reference	Application date
2	245m NE	Selective Fell/Thin (Unconditional)	014/142/07-08	06/03/2008

This data is sourced from the Forestry Commission.

12.4 Environmental Stewardship Schemes

Records within 250m	0
----------------------------	----------

Environmental Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment.

This data is sourced from Natural England.



12.5 Countryside Stewardship Schemes

Records within 250m

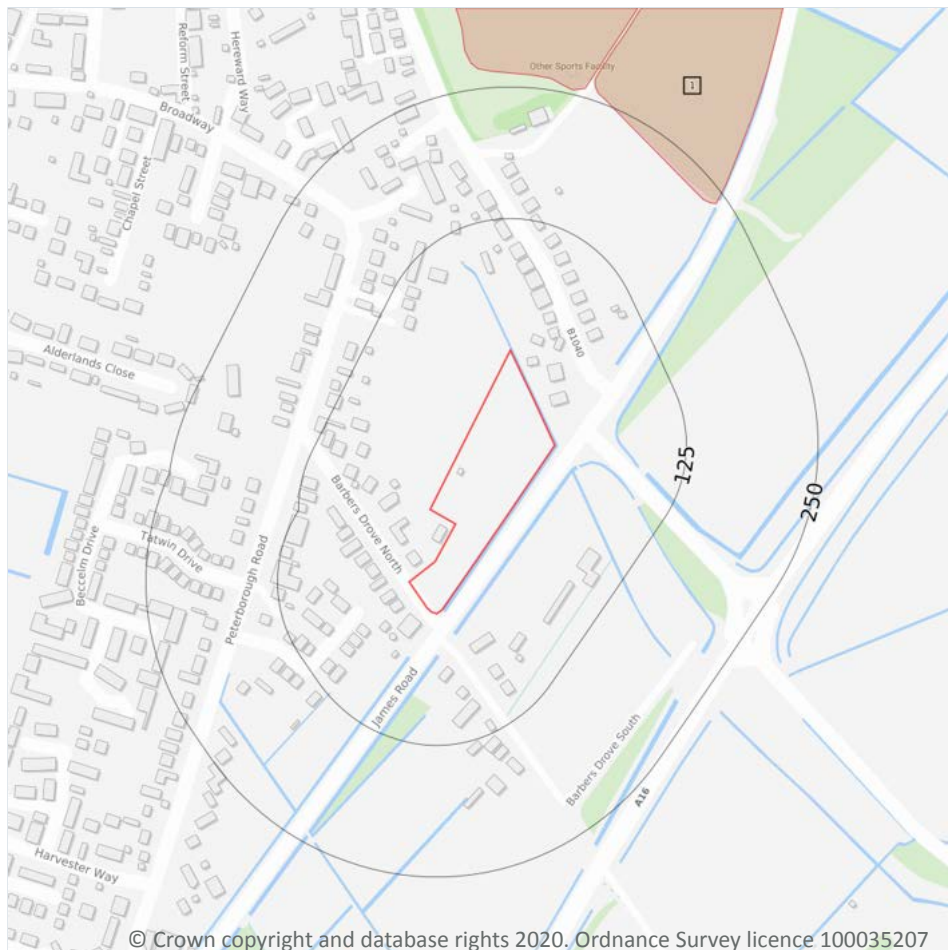
0

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

This data is sourced from Natural England.



13 Habitat designations



- Site Outline
- Search buffers in metres (m)
- Priority Habitat Inventory
- Open Mosaic Habitat
- Limestone Pavement Orders
- Habitat Networks
- Primary Habitat
- Restorable Habitat
- Associated Habitats
- Habitat Restoration-Creation
- Network Enhancement Zone 1
- Network Enhancement Zone 2

13.1 Priority Habitat Inventory

Records within 250m

1

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

Features are displayed on the Habitat designations map on **page 71**

ID	Location	Main Habitat	Other habitats
1	231m NE	Coastal and floodplain grazing marsh	Main habitat: CFPGM (INV > 50%)

This data is sourced from Natural England.



13.2 Habitat Networks

Records within 250m

0

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

This data is sourced from Natural England.

13.3 Open Mosaic Habitat

Records within 250m

0

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

This data is sourced from Natural England.

13.4 Limestone Pavement Orders

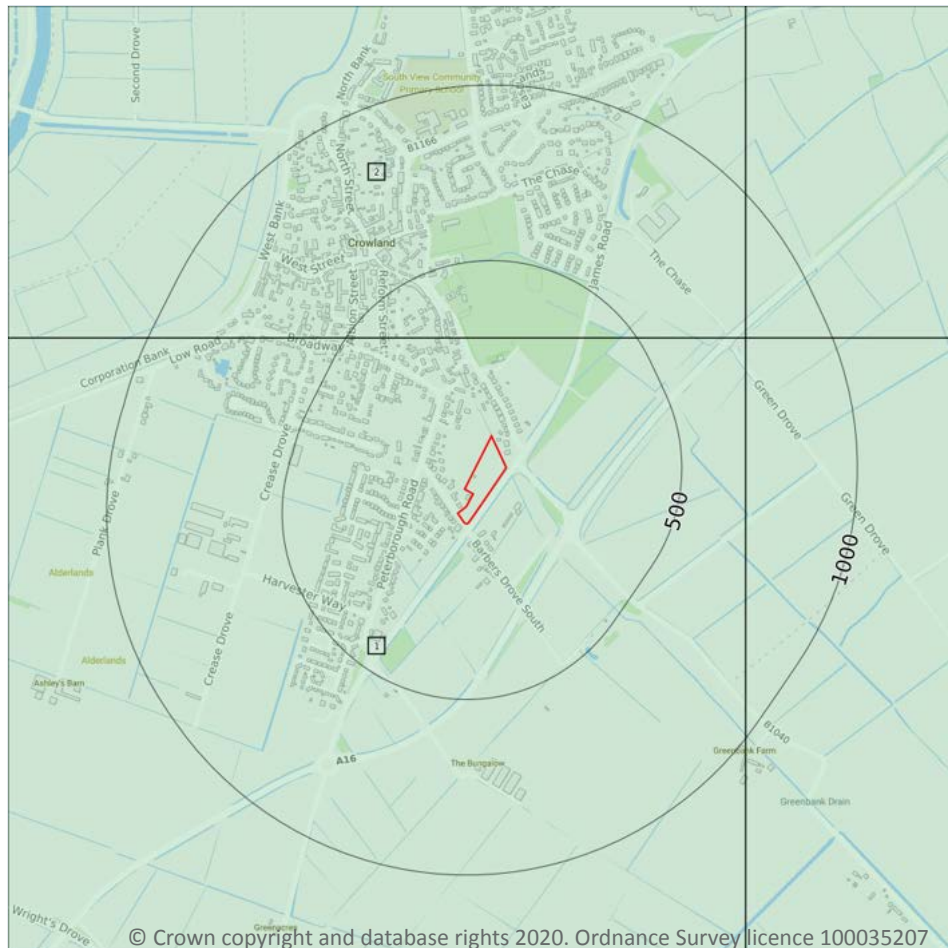
Records within 250m

0

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

This data is sourced from Natural England.

14 Geology 1:10,000 scale - Availability



— Site Outline
Search buffers in metres (m)

- Full coverage
- Partial coverage
- No coverage

14.1 10k Availability

Records within 500m

2

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

Features are displayed on the Geology 1:10,000 scale - Availability map on **page 73**

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	On site	No coverage	Full	Full	No coverage	TF20NW
2	280m N	No coverage	Full	Full	No coverage	TF21SW

This data is sourced from the British Geological Survey.



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

14.2 Artificial and made ground (10k)

Records within 500m

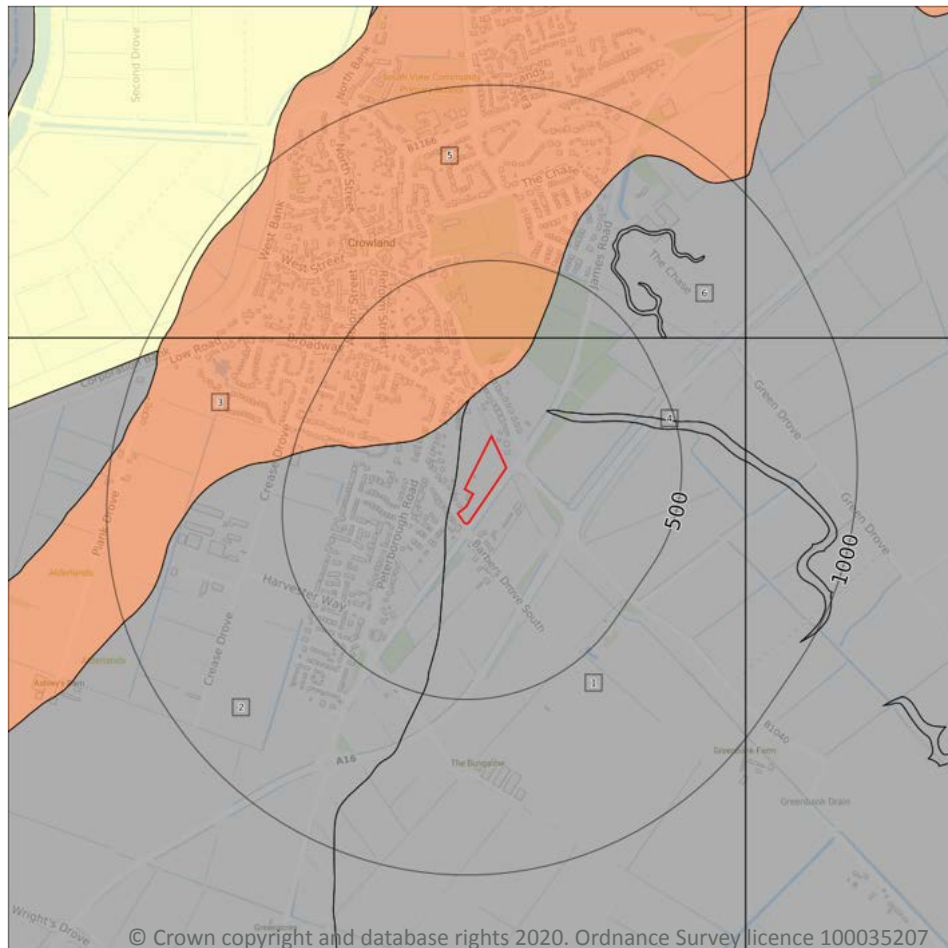
0

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

This data is sourced from the British Geological Survey.



Geology 1:10,000 scale - Superficial



- Site Outline
- Search buffers in metres (m)
- Landslip (10k)
- Superficial geology (10k)
Please see table for more details.

14.3 Superficial geology (10k)

Records within 500m

6

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

Features are displayed on the Geology 1:10,000 scale - Superficial map on **page 75**

ID	Location	LEX Code	Description	Rock description
1	On site	BYD-XCZ	Barroway Drove Beds - Clay And Silt	Clay And Silt
2	28m W	NP-P	Nordelph Peat - Peat (unlithified Deposits Coding Scheme)	Peat
3	118m NW	ABSG-XSV	Abbey Sand And Gravel - Sand And Gravel	Sand And Gravel
4	174m NE	BYD-XSZ	Barroway Drove Beds - Sand And Silt	Sand And Silt



ID	Location	LEX Code	Description	Rock description
5	280m N	ABSG-XSV	Abbey Sand And Gravel - Sand And Gravel	Sand And Gravel
6	305m NE	BYD-XCZ	Barroway Drove Beds - Clay And Silt	Clay And Silt

This data is sourced from the British Geological Survey.

14.4 Landslip (10k)

Records within 500m

0

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

This data is sourced from the British Geological Survey.



Geology 1:10,000 scale - Bedrock



— Site Outline

Search buffers in metres (m)

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

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

14.5 Bedrock geology (10k)

Records within 500m

2

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

Features are displayed on the Geology 1:10,000 scale - Bedrock map on **page 77**

ID	Location	LEX Code	Description	Rock age
1	On site	OXC-MDST	Oxford Clay Formation - Mudstone	Oxfordian Age - Callovian Age
2	280m N	OXC-MDST	Oxford Clay Formation - Mudstone	Oxfordian Age - Callovian Age

This data is sourced from the British Geological Survey.



14.6 Bedrock faults and other linear features (10k)

Records within 500m

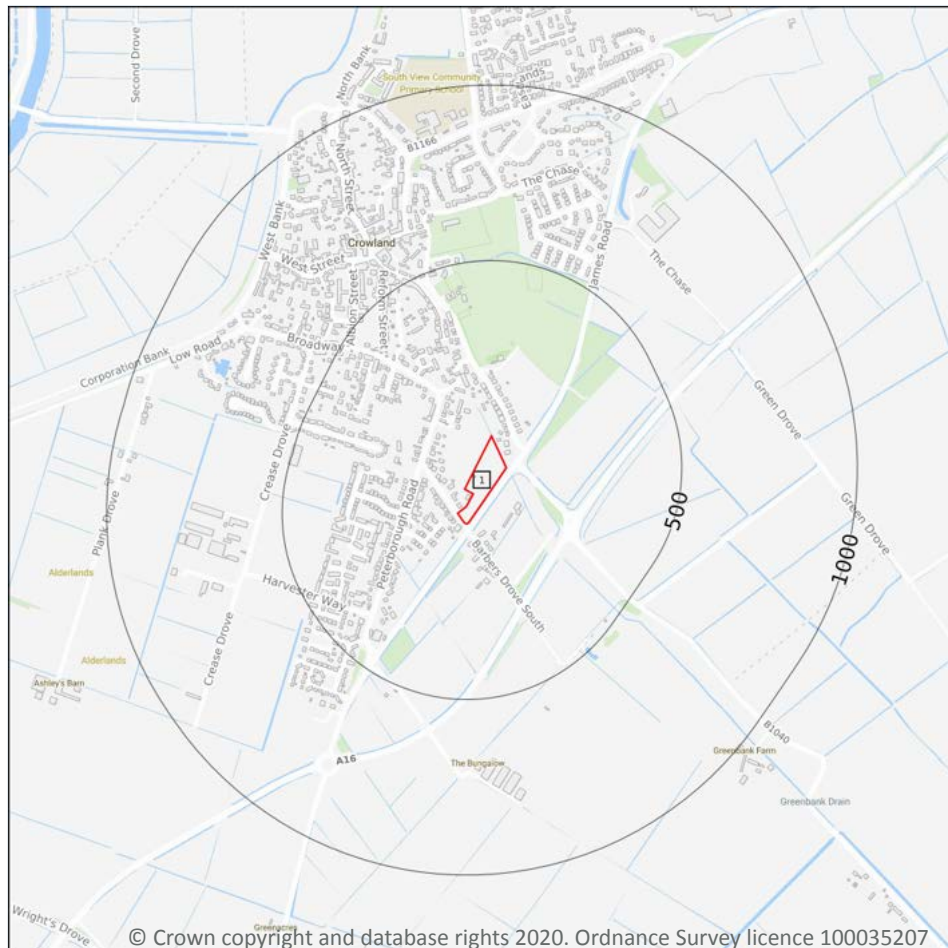
0

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

This data is sourced from the British Geological Survey.



15 Geology 1:50,000 scale - Availability



— Site Outline
Search buffers in metres (m)

☐ Geological map tile

15.1 50k Availability

Records within 500m

1

An indication on the coverage of 1:50,000 scale geology data for the site. Either 'Full' or 'No coverage' for each geological theme.

Features are displayed on the Geology 1:50,000 scale - Availability map on **page 79**

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	On site	Full	Full	Full	No coverage	EW158_peterborough_v4

This data is sourced from the British Geological Survey.



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

15.2 Artificial and made ground (50k)

Records within 500m

0

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

This data is sourced from the British Geological Survey.

15.3 Artificial ground permeability (50k)

Records within 50m

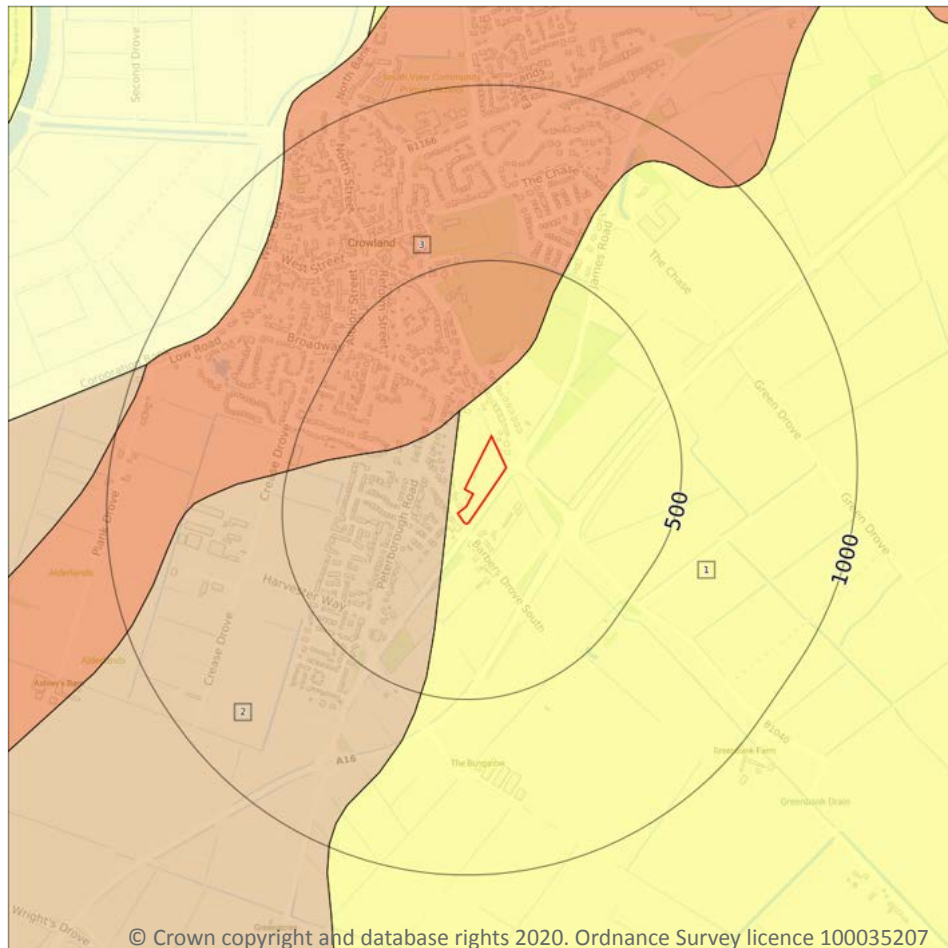
0

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

This data is sourced from the British Geological Survey.



Geology 1:50,000 scale - Superficial



- Site Outline
- Search buffers in metres (m)
- Landslip (50k)
- Superficial geology (50k)
Please see table for more details.

15.4 Superficial geology (50k)

Records within 500m

3

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

Features are displayed on the Geology 1:50,000 scale - Superficial map on **page 81**

ID	Location	LEX Code	Description	Rock description
1	On site	TFD1-XCZ	TIDAL FLAT DEPOSITS, 1	CLAY AND SILT
2	29m W	PEAT-P	PEAT	PEAT
3	113m NW	ABSG-XSV	ABBAY SAND AND GRAVEL	SAND AND GRAVEL

This data is sourced from the British Geological Survey.



15.5 Superficial permeability (50k)

Records within 50m

2

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

Location	Flow type	Maximum permeability	Minimum permeability
On site	Mixed	Low	Very Low
29m SW	Mixed	Low	Very Low

This data is sourced from the British Geological Survey.

15.6 Landslip (50k)

Records within 500m

0

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

This data is sourced from the British Geological Survey.

15.7 Landslip permeability (50k)

Records within 50m

0

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

This data is sourced from the British Geological Survey.

Geology 1:50,000 scale - Bedrock



— Site Outline

Search buffers in metres (m)

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

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

15.8 Bedrock geology (50k)

Records within 500m

1

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

Features are displayed on the Geology 1:50,000 scale - Bedrock map on **page 83**

ID	Location	LEX Code	Description	Rock age
1	On site	OXC-MDST	OXFORD CLAY FORMATION - MUDSTONE	CALLOVIAN

This data is sourced from the British Geological Survey.



15.9 Bedrock permeability (50k)

Records within 50m

1

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

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

This data is sourced from the British Geological Survey.

15.10 Bedrock faults and other linear features (50k)

Records within 500m

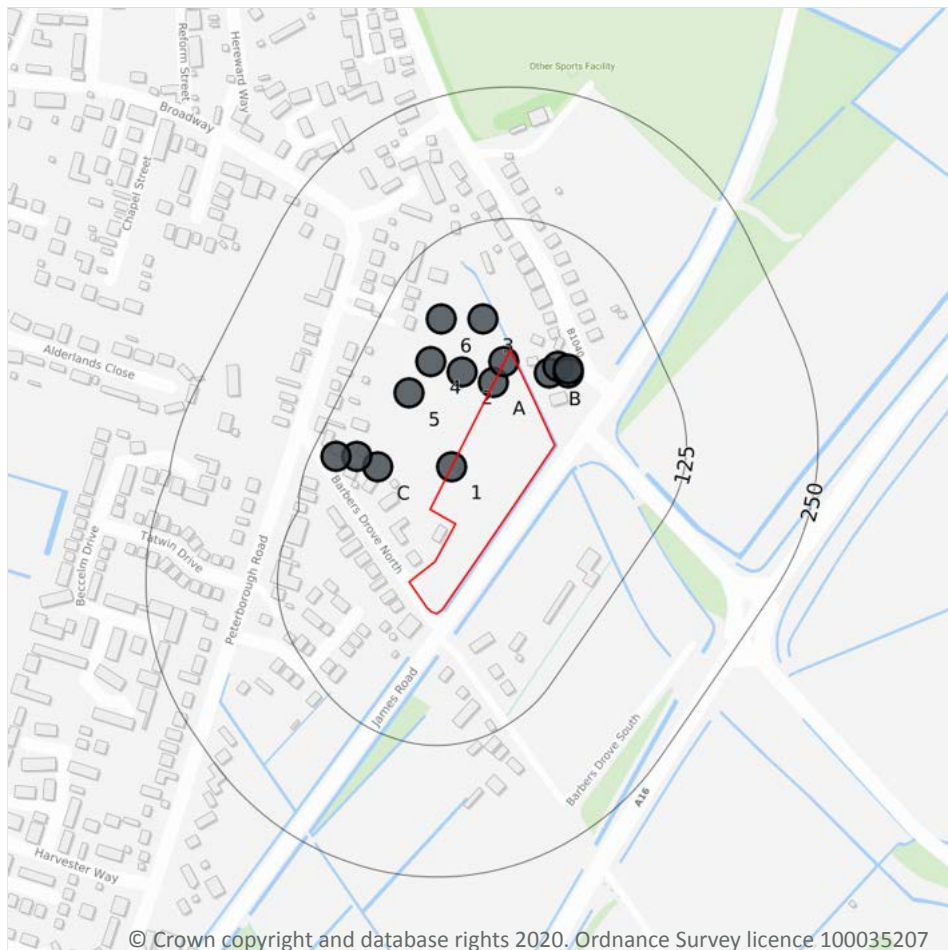
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Linear features at the ground or bedrock surface at 1:50,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

This data is sourced from the British Geological Survey.



16 Boreholes



— Site Outline
Search buffers in metres (m)

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

16.1 BGS Boreholes

Records within 250m

15

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

Features are displayed on the Boreholes map on **page 85**

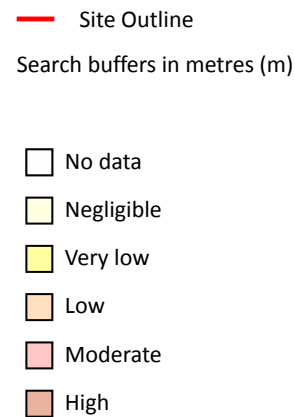
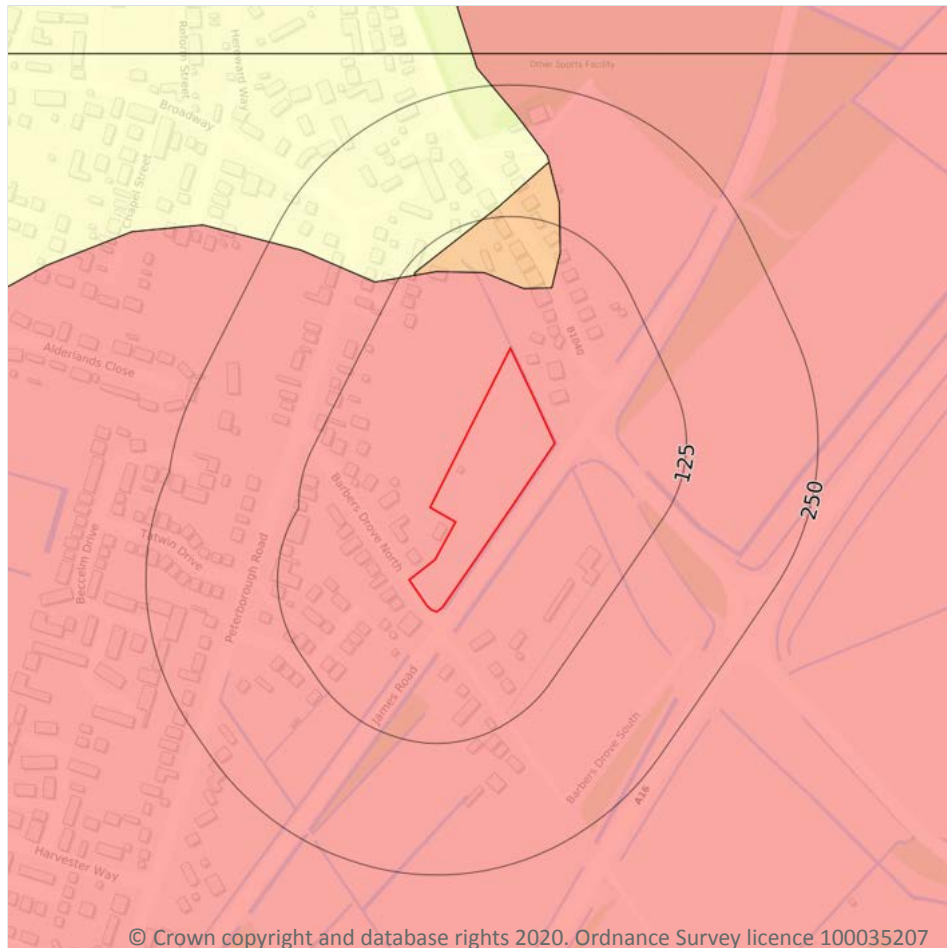
ID	Location	Grid reference	Name	Length	Confidential	Web link
1	0m NW	524220 309610	CROWLAND PETERBOROUGH TP9	-	Y	N/A
A	1m NW	524260 309690	CROWLAND PETERBOROUGH TP5	-	Y	N/A
A	1m NW	524270 309710	CROWLAND PETERBOROUGH TP6	-	Y	N/A



ID	Location	Grid reference	Name	Length	Confidential	Web link
B	24m NE	524313 309699	CROWLAND FIRE STATION 1	-	Y	N/A
2	32m NW	524230 309700	CROWLAND PETERBOROUGH TP8	-	Y	N/A
B	34m NE	524321 309705	CROWLAND FIRE STATION 2	-	Y	N/A
3	40m NW	524250 309750	CROWLAND PETERBOROUGH TP7	-	Y	N/A
B	41m NE	524331 309699	CROWLAND FIRE STATION 3	-	Y	N/A
B	42m NE	524331 309702	CROWLAND FIRE STATION 3A	-	Y	N/A
C	63m NW	524150 309610	CROWLAND PETERBOROUGH TP1	-	Y	N/A
4	63m NW	524200 309710	CROWLAND PETERBOROUGH TP3	-	Y	N/A
5	68m NW	524180 309680	CROWLAND PETERBOROUGH TP2	-	Y	N/A
6	72m NW	524210 309750	CROWLAND PETERBOROUGH TP4	-	Y	N/A
C	85m NW	524130 309620	CROWLAND PETERBOROUGH TP11	-	Y	N/A
C	103m NW	524110 309620	CROWLAND PETERBOROUGH TP10	-	Y	N/A

This data is sourced from the British Geological Survey.

17 Natural ground subsidence - Shrink swell clays



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17.1 Shrink swell clays

Records within 50m

1

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

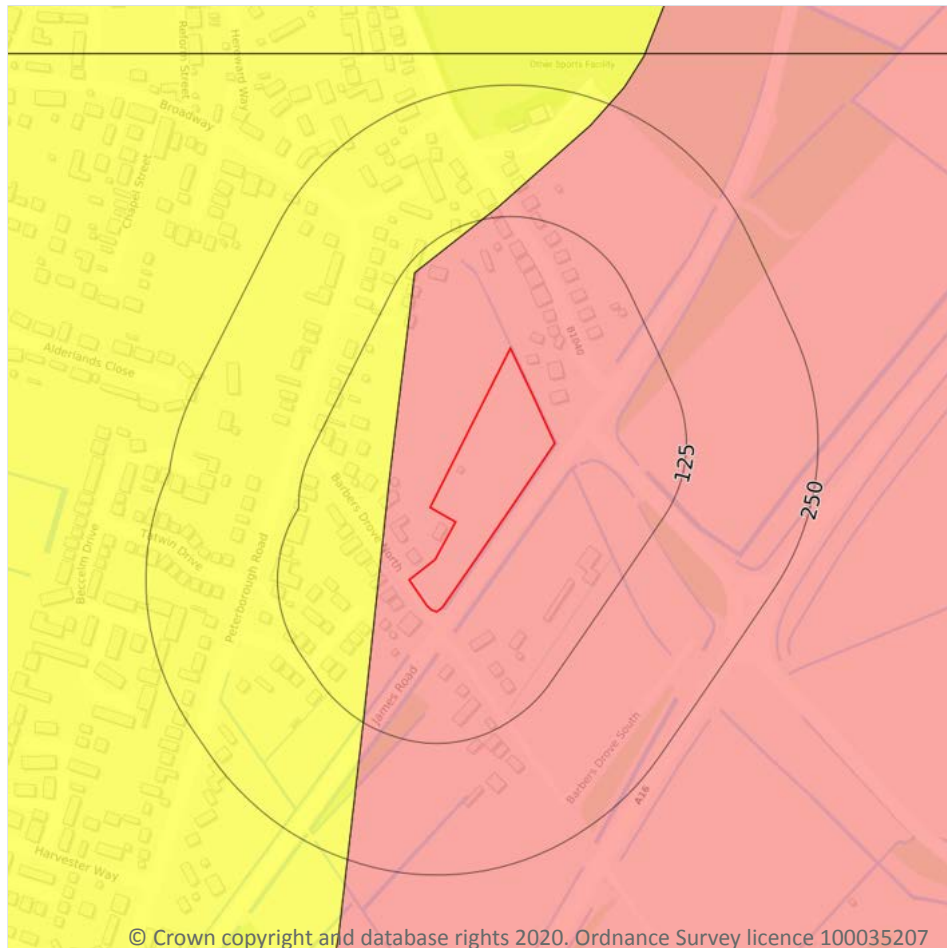
Features are displayed on the Natural ground subsidence - Shrink swell clays map on **page 87**

Location	Hazard rating	Details
On site	Moderate	Ground conditions predominantly high plasticity.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Running sands



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

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17.2 Running sands

Records within 50m

2

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

Features are displayed on the Natural ground subsidence - Running sands map on **page 88**

Location	Hazard rating	Details
On site	Moderate	Running sand conditions are probably present. Constraints may apply to land uses involving excavation or the addition or removal of water.

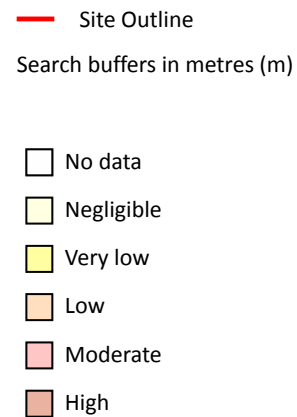
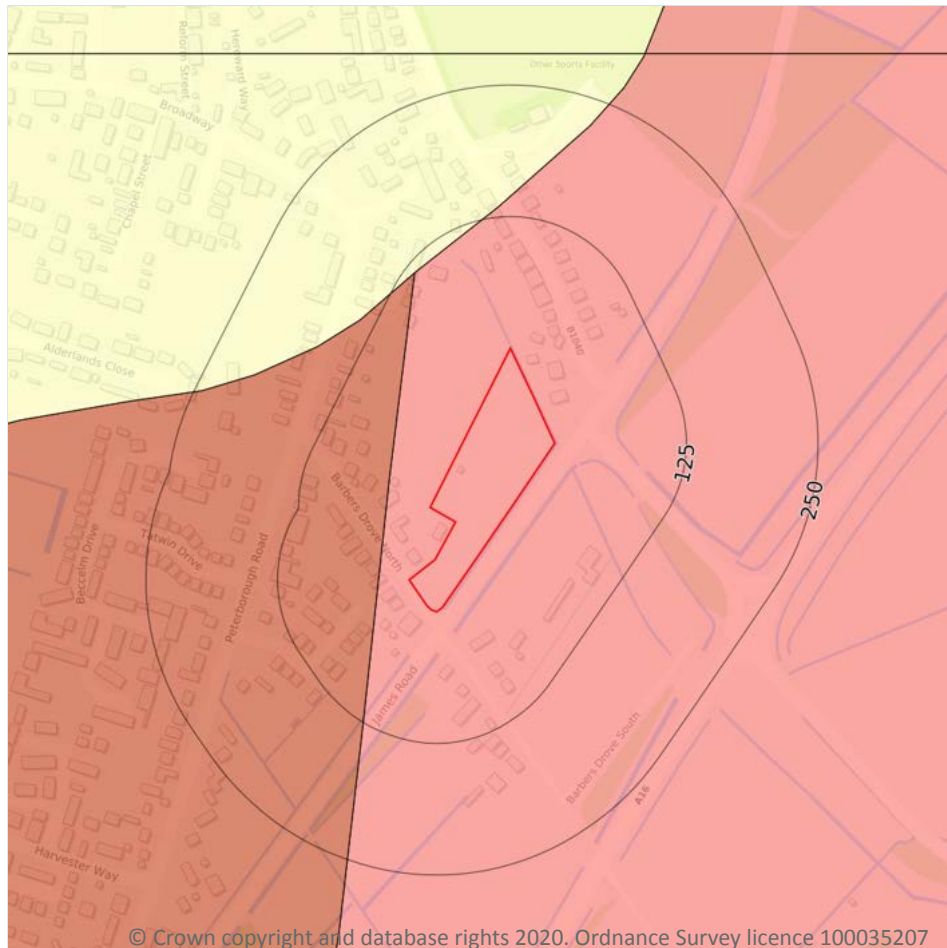


Location	Hazard rating	Details
29m W	Very low	Running sand conditions are unlikely. No identified constraints on land use due to running conditions unless water table rises rapidly.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Compressible deposits



17.3 Compressible deposits

Records within 50m

2

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

Features are displayed on the Natural ground subsidence - Compressible deposits map on **page 90**

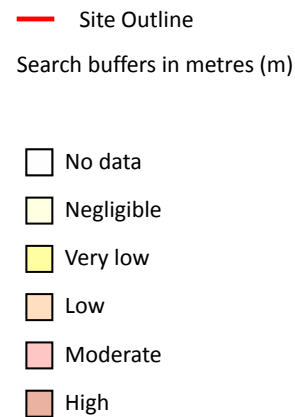
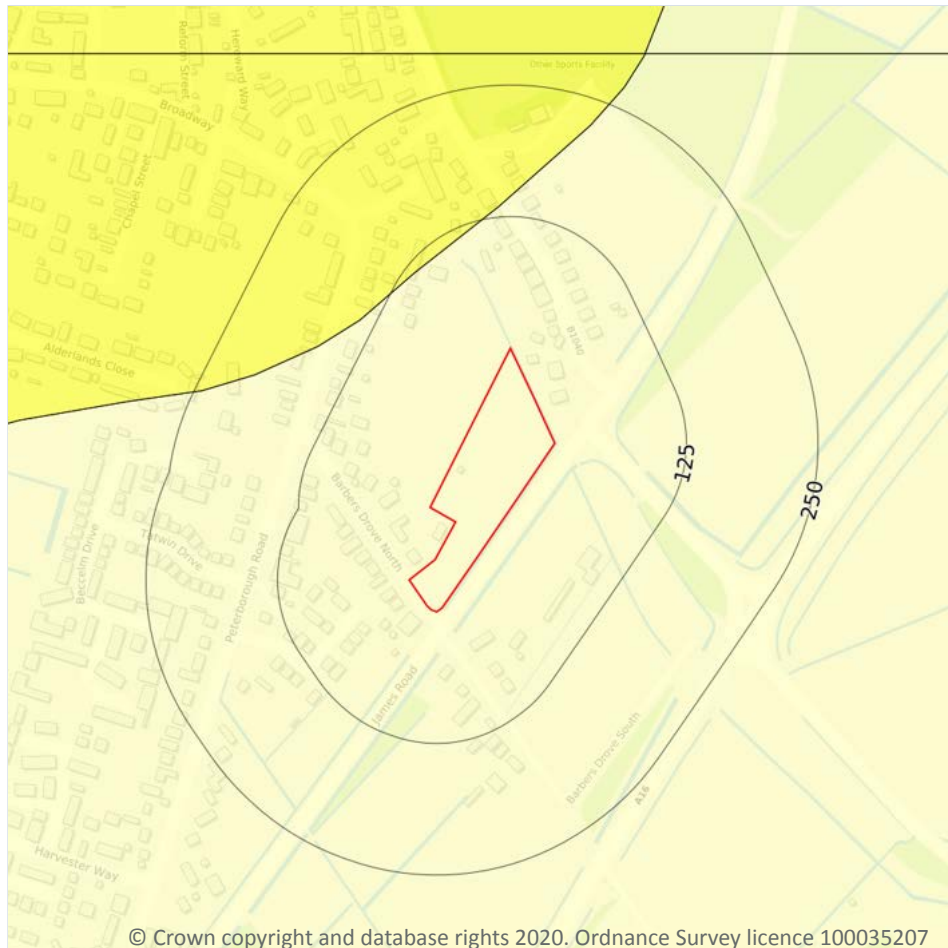
Location	Hazard rating	Details
On site	Moderate	Compressibility and uneven settlement hazards are probably present. Land use should consider specifically the compressibility and variability of the site.
29m W	High	Highly compressible strata present. Significant constraint on land use depending on thickness.



This data is sourced from the British Geological Survey.



Natural ground subsidence - Collapsible deposits



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17.4 Collapsible deposits

Records within 50m

1

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

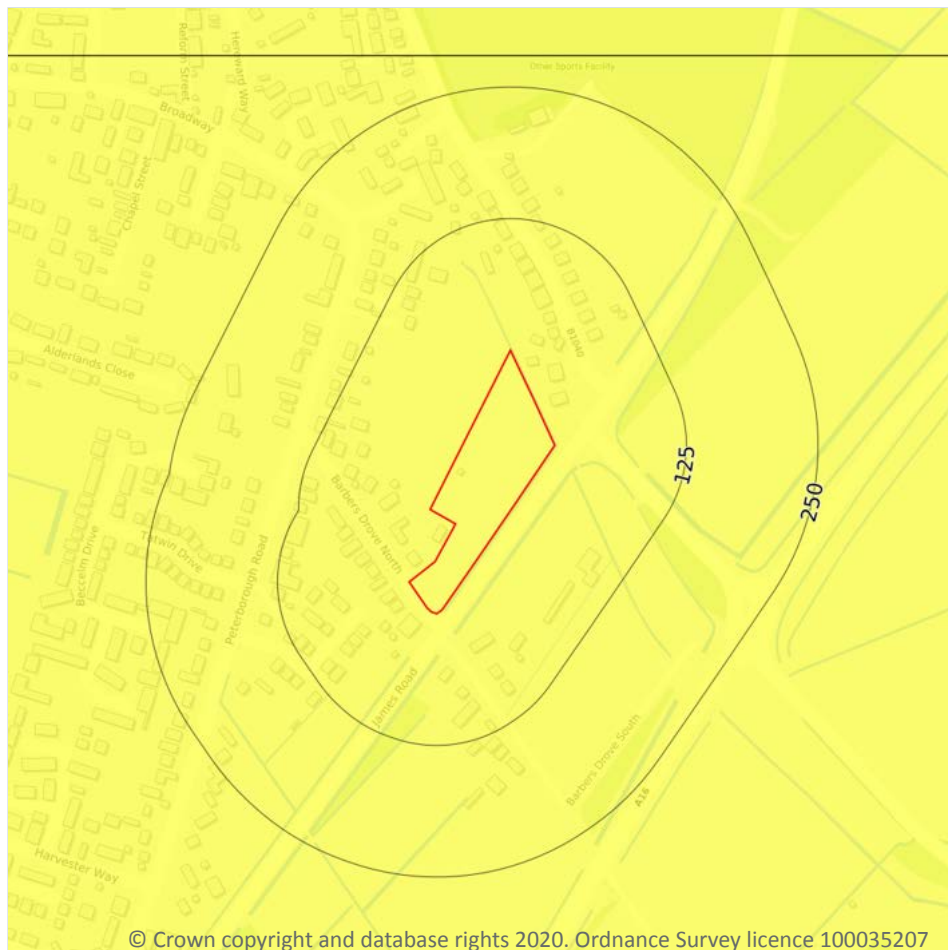
Features are displayed on the Natural ground subsidence - Collapsible deposits map on **page 92**

Location	Hazard rating	Details
On site	Negligible	Deposits with potential to collapse when loaded and saturated are believed not to be present.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Landslides



— Site Outline
Search buffers in metres (m)

- ☐ No data
- ☐ Negligible
- ☐ Very low
- ☐ Low
- ☐ Moderate
- ☐ High

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17.5 Landslides

Records within 50m

1

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

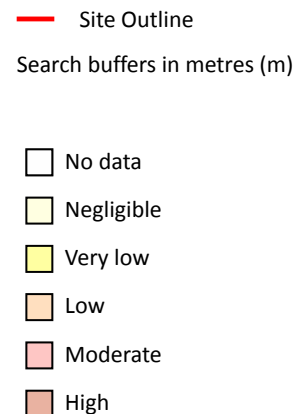
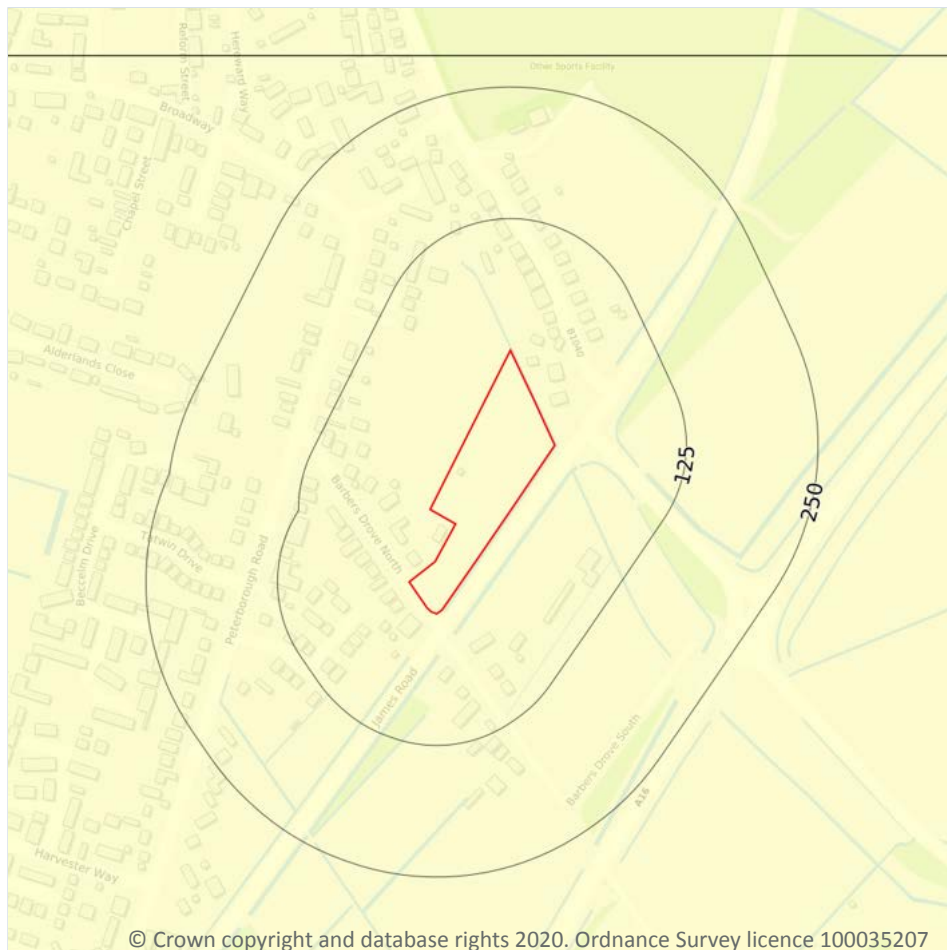
Features are displayed on the Natural ground subsidence - Landslides map on **page 93**

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

This data is sourced from the British Geological Survey.



Natural ground subsidence - Ground dissolution of soluble rocks



17.6 Ground dissolution of soluble rocks

Records within 50m

1

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

Features are displayed on the Natural ground subsidence - Ground dissolution of soluble rocks map on **page 94**

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

This data is sourced from the British Geological Survey.



18 Mining, ground workings and natural cavities

18.1 Natural cavities

Records within 500m

0

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

This data is sourced from Peter Brett Associates (PBA).

18.2 BritPits

Records within 500m

0

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

This data is sourced from the British Geological Survey.

18.3 Surface ground workings

Records within 250m

0

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

This data is sourced from Ordnance Survey/Groundsure.

18.4 Underground workings

Records within 1000m

0

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

This data is sourced from Ordnance Survey/Groundsure.

18.5 Historical Mineral Planning Areas

Records within 500m

0

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

This data is sourced from the British Geological Survey.

18.6 Non-coal mining

Records within 1000m

0

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

This data is sourced from the British Geological Survey.

18.7 Mining cavities

Records within 1000m

0

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

This data is sourced from Peter Brett Associates (PBA).

18.8 JPB mining areas

Records on site

0

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

This data is sourced from Johnson Poole and Bloomer.

18.9 Coal mining

Records on site

0

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

This data is sourced from the Coal Authority.



18.10 Brine areas

Records on site	0
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The Cheshire Brine Compensation District indicates areas that may be affected by salt and brine extraction in Cheshire and where compensation would be available where damage from this mining has occurred. Damage from salt and brine mining can still occur outside this district, but no compensation will be available.

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

18.11 Gypsum areas

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

Generalised areas that may be affected by gypsum extraction.

This data is sourced from British Gypsum.

18.12 Tin mining

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

Generalised areas that may be affected by historical tin mining.

This data is sourced from Mining Searches UK.

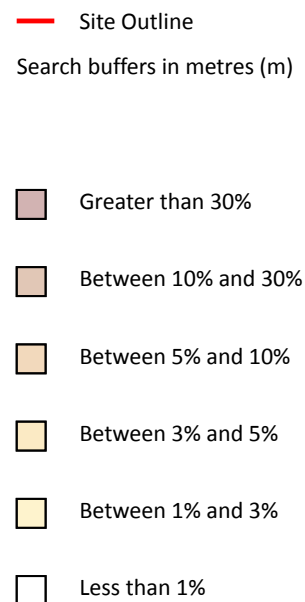
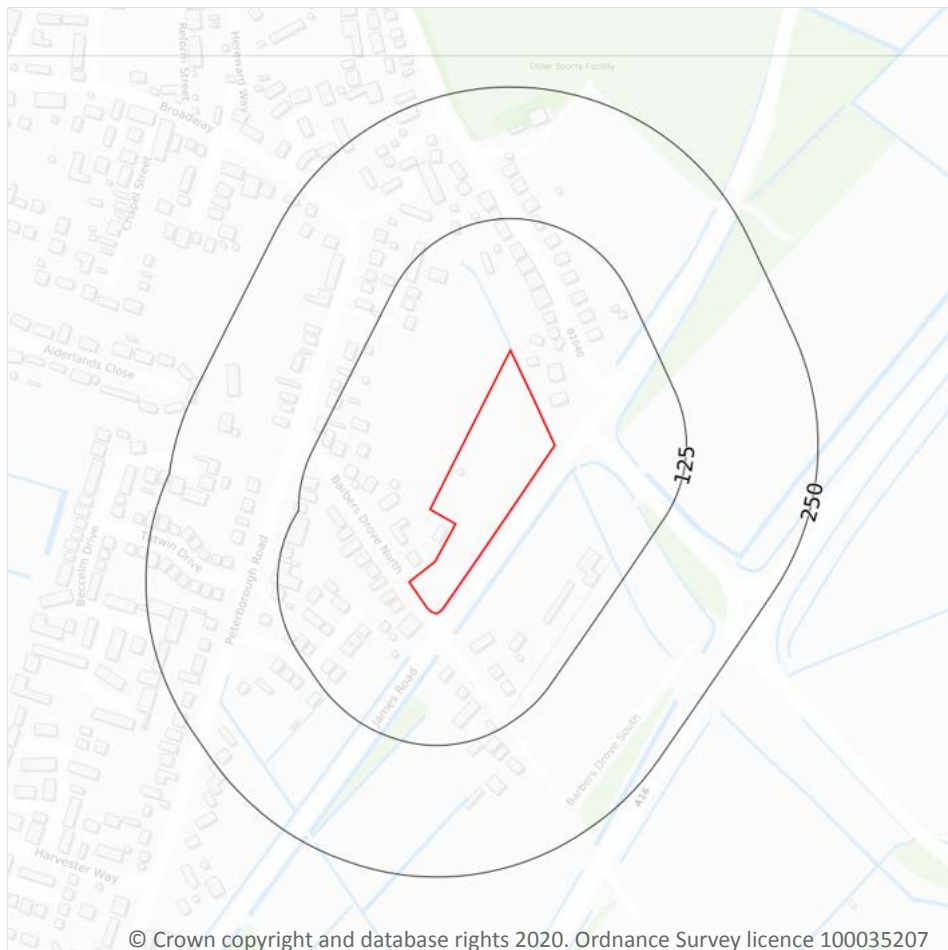
18.13 Clay mining

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

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

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

19 Radon



19.1 Radon

Records on site

1

Estimated percentage of dwellings exceeding the Radon Action Level. This data is the highest resolution radon dataset available for the UK and is produced to a 75m level of accuracy to allow for geological data accuracy and a 'residential property' buffer. The findings of this section should supersede any estimations derived from the Indicative Atlas of Radon in Great Britain. The data was derived from both geological assessments and long term measurements of radon in more than 479,000 households.

Features are displayed on the Radon map on **page 98**

Location	Estimated properties affected	Radon Protection Measures required
On site	Less than 1%	None**

This data is sourced from the British Geological Survey and Public Health England.



20 Soil chemistry

20.1 BGS Estimated Background Soil Chemistry

Records within 50m

4

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

Location	Arsenic	Bioaccessible Arsenic	Lead	Bioaccessible Lead	Cadmium	Chromium	Nickel
On site	15 - 25 mg/kg	No data	100 mg/kg	60 mg/kg	1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg
On site	15 - 25 mg/kg	No data	100 mg/kg	60 mg/kg	1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg
29m W	15 - 25 mg/kg	No data	100 mg/kg	60 mg/kg	1.8 mg/kg	90 - 120 mg/kg	45 - 60 mg/kg
29m SW	15 - 25 mg/kg	No data	100 mg/kg	60 mg/kg	1.8 mg/kg	90 - 120 mg/kg	45 - 60 mg/kg

This data is sourced from the British Geological Survey.

20.2 BGS Estimated Urban Soil Chemistry

Records within 50m

0

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

This data is sourced from the British Geological Survey.



20.3 BGS Measured Urban Soil Chemistry

Records within 50m

0

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

This data is sourced from the British Geological Survey.



21 Railway infrastructure and projects

21.1 Underground railways (London)

Records within 250m	0
---------------------	---

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

This data is sourced from publicly available information by Groundsure.

21.2 Underground railways (Non-London)

Records within 250m	0
---------------------	---

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

This data is sourced from publicly available information by Groundsure.

21.3 Railway tunnels

Records within 250m	0
---------------------	---

Railway tunnels taken from contemporary Ordnance Survey mapping.

This data is sourced from the Ordnance Survey.

21.4 Historical railway and tunnel features

Records within 250m	0
---------------------	---

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

This data is sourced from Ordnance Survey/Groundsure.

21.5 Royal Mail tunnels

Records within 250m	0
---------------------	---

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



This data is sourced from Groundsure/the Postal Museum.

21.6 Historical railways

Records within 250m	0
---------------------	---

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

This data is sourced from OpenStreetMap.

21.7 Railways

Records within 250m	0
---------------------	---

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

This data is sourced from Ordnance Survey and OpenStreetMap.

21.8 Crossrail 1

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

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

This data is sourced from publicly available information by Groundsure.

21.9 Crossrail 2

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

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

This data is sourced from publicly available information by Groundsure.

21.10 HS2

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

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

This data is sourced from HS2 Ltd.



Data providers

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

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APPENDIX 3

CLASSIFICATION OF AGGRESSIVE CHEMICAL ENVIRONMENT FOR BURIED CONCRETE

TABLE C1 – AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE

(ACEC) CLASSIFICATION FOR NATURAL GROUND LOCATIONS^a

Table C1 Aggressive Chemical Environment for Concrete (ACEC) classification for natural ground locations ^a						
Sulfate				Groundwater		ACEC
Design Sulfate Class for location	2:1 water/soil extract ^b	Groundwater	Total potential sulfate ^c	Static water	Mobile water	Class for location
1	2 (SO ₄ mg/l)	3 (SO ₄ mg/l)	4 (SO ₄ %)	5 (pH)	6 (pH)	7
DS-1	< 500	< 400	< 0.24	≥ 2.5	> 5.5 ^d 2.5–5.5	AC-1s AC-1 ^d AC-2z
DS-2	500–1500	400–1400	0.24–0.6	> 3.5 2.5–3.5	> 5.5 2.5–5.5	AC-1s AC-2 AC-2s AC-3z
DS-3	1600–3000	1500–3000	0.7–1.2	> 3.5 2.5–3.5	> 5.5 2.5–5.5	AC-2s AC-3 AC-3s AC-4
DS-4	3100–6000	3100–6000	1.3–2.4	> 3.5 2.5–3.5	> 5.5 2.5–5.5	AC-3s AC-4 AC-4s AC-5
DS-5	> 6000	> 6000	> 2.4	> 3.5 2.5–3.5	≥ 2.5	AC-4s AC-5

Notes

- ^a Applies to locations on sites that comprise either undisturbed ground that is in its natural state (ie is not brownfield – Table C2) or clean fill derived from such ground.
- ^b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous Digests (Box C7).
- ^c Applies only to locations where concrete will be exposed to sulfate ions (SO₄) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance (Appendix A1 and Box C8).
- ^d For flowing water that is potentially aggressive to concrete owing to high purity or an aggressive carbon dioxide level greater than 15 mg/l (Section C2.2.3), increase the ACEC Class to AC-2z.

Explanation of suffix symbols to ACEC Class

- Suffix 's' indicates that the water has been classified as static.
- Concrete placed in ACEC Classes that include the suffix 'z' primarily have to resist acid conditions and may be made with any of the cements or combinations listed in Table D2 on page 42.

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