

# APPENDIX 2.1

# AIR QUALITY REPORT



National significant infrastructure project in the Energy Sector Little Crow Solar Park, Scunthorpe

# **AIR QUALITY AND CARBON ASSESSMENT**

On behalf of INRG Solar (Little Crow) Ltd

November 2018



# **Document Control Sheet**

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## **Table of Contents**

Execut	tive Summary1
1	Introduction1
1.1	Scope of Assessment1
2	Air Quality – Legislative Context
2.1	Air Quality Strategy
2.2	Local Air Quality Management (LAQM)4
2.3	Air Quality Guidance for Construction Sites5
2.4	Background Concentrations Used in the Assessment6
3	Assessment Methodology7
3.1	Construction Effects7
3.2	Carbon Footprint8
4	Results
4.1	Construction Phase
4.2	Operational Phase11
5	Recommended Mitigation Measures12
5.1	Short-term Impacts during Construction12
6	Carbon Footprint
7	Conclusions17
7.1	Construction Effects17
7.2	Operational Effects17
7.3	Carbon Footprint



## List of Tables

Table 2.1 – Examples of where the Air Quality Objectives should apply	3
Table 2.2 – Relevant National AQ Objectives for the Assessed Pollutants	4
Table 2.3 – Defra Background Pollutant Concentrations	6
Table 4.1 – Construction Dust Emission Magnitude	9
Table 4.2 – Sensitivity of Surrounding Area	10
Table 4.3 – Summary of Dust Risk	10
Table 6.1 – Expected kWh Profile	15
Table 6.2 – Construction Vehicle Generated CO <sub>2</sub>	16

# List of Figures

Figure 1.1 – Site Location	2
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# **Executive Summary**

Bureau Veritas UK Ltd has been commissioned by INRG Solar (Little Crow) Ltd. to undertake an air quality assessment of construction traffic emissions together with a carbon offset assessment as a result of the proposed Little Crow Solar Park. The development site is located to the east of Scunthorpe, adjacent to the Harsco Steel works and is accessed via the B1208. The nearby settlement of Raventhorpe (<5 miles south of the proposed development) contains an existing 78.5ha solar farm

The development site currently consists of disused grassland/farmland and is bordered by the proposed construction traffic route, which is to run along the B1208 in the direction of the A18, A15 and M180. This route bypasses a number of pollution receptors; residential properties in Broughton, located 1km east of the proposed site boundary. The closest properties to the proposed site consists of two farm structures with at least one structure being used as a residential dwelling and are located east of the proposed site and North of Broughton at distances of 280m and 415m from the site boundary. The proposed Solar Park area is located within the boundary of an Air Quality Management Area (AQMA) declared by North Lincolnshire Council. The AQMA was declared due to exceedances of the 24-hour mean air quality objective for PM<sub>10</sub>. The most recently recorded annual mean concentration of PM<sub>10</sub> from the closest monitoring site, CM3, reported an annual mean concentration of PM<sub>10</sub> from the closest monitoring site, CM3, reported an annual mean concentration of PM<sub>10</sub> annual mean AQS objective of  $40\mu g/m^3$ . Furthermore, there were no reported below the PM<sub>10</sub> annual mean AQS objective at any monitoring location within the council area.

Defra's 2017 background air pollution data for the proposed site suggests an annual mean background concentration of  $11.2\mu g/m^3$  for NO<sub>2</sub> and  $15.2\mu g/m^3$  for PM<sub>10</sub>, which are both below the respective objectives (40µg/m<sup>3</sup>).

A qualitative dust and air quality assessment has been prepared to determine the significance of air quality and construction traffic dust impacts during the construction and operational phases of the proposed development, in addition to an assessment of the carbon footprint and potential savings introduced as a result of the site's introduction.

A qualitative assessment of impacts of construction activities upon air quality was undertaken following the Institute of Air Quality Management (IAQM) guidance methodology.

The main findings of the air quality assessment are summarised as follows:

- Following the construction dust assessment the development site is found, in relation to dust soiling, to be **negligible** during the construction phase of the proposed site. For the earthworks and trackout activities, the impact was found to be a **low risk**. In relation to human health impacts, the risk ratings are the same as with dust soiling for each of the three activities.
- Providing effective mitigation measures are implemented, such as those outlined in Section 5.1 of this report, impacts from dust emissions during the construction phase would be **not significant**.
- The estimated CO<sub>2</sub> offset from the Little Crow Solar Park is 35,186 tonnes for the first year taking into consideration the CO<sub>2</sub> produced as a result of the construction vehicle movements during the construction phase. The following years CO<sub>2</sub> offset will be greater as the construction phase works will have been completed.



# **1** Introduction

Bureau Veritas UK Ltd has been commissioned by INRG Solar (Little Crow) Ltd. to undertake an air quality assessment of construction traffic emissions together with a carbon offset assessment as a result of the proposed Little Crow Solar Park. The development site is located to the east of Scunthorpe, adjacent to the Harsco Steel works and is accessed via the B1208. The proposed Solar Park is approximated at 226.8ha with a maximum of 150MW generation per annum from the solar modules and 90MW pa from its battery storage facility. The nearby settlement of Raventhorpe (<5 miles south of the proposed development) contains an existing 78.5ha solar farm.

The most significant source of air pollution is likely to derive from construction related traffic during the construction phase of the development. The construction traffic route is proposed to run along the B1208 in the direction of the A18, A15 and M180. This route bypasses the closest pollution receptors; residential properties in Broughton, located to the east of the proposed site boundary.

North Lincolnshire Council has declared an Air Quality Management Area (AQMA), which incorporates part of Scunthorpe town centre and an area east of Scunthorpe, including the Harsco Steel works site. The proposed Solar Park is located within this AQMA. The AQMA was declared due to exceedances of the 24-hour mean air quality objective for PM<sub>10</sub>. The most recently recorded annual mean concentration of PM<sub>10</sub> from the closest monitoring site, CM3, reported an annual mean concentration of 22µg/m<sup>3</sup> in 2016 together with 25 exceedances of the 24-hour mean objective ( $50\mu$ g/m<sup>3</sup> not to be exceeded more than 35 times a year). All nearby monitoring locations also reported below the PM<sub>10</sub> annual mean AQS objective of  $40\mu$ g/m<sup>3</sup>. Furthermore, there were no reported exceedances of the NO<sub>2</sub> annual mean air quality objective at any monitoring location within the council area.

# **1.1 Scope of Assessment**

Defra's 2017 background air pollution data for the proposed site suggests an annual mean background concentration of  $11.2\mu g/m^3$  for NO<sub>2</sub> and  $15.2\mu g/m^3$  for PM<sub>10</sub>, which are both below the respective objectives (40µg/m<sup>3</sup>).

As it is anticipated that the proposed development will introduce additional road traffic and construction dust and, with consideration to the nearby AQMA, a construction phase impact assessment is to firstly be undertaken together with the carbon offset assessment. The scope of this assessment is therefore to undertake:

- A qualitative assessment of dust and air quality impacts during the construction works. The construction dust assessment will involve the use of a Geographic Information System (GIS) and be undertaken with reference to current best-practice guidance, such as those published by the Institute of Air Quality Management (IAQM).
- Construction related road traffic emissions will be considered relative to published guidance. Based upon the preliminary construction traffic management plan and indicative flows provided therein, Bureau Veritas do not consider there to be a requirement for detailed assessment of the road traffic emissions, rather a screening based assessment against IAQM criteria is considered sufficient.
- Mitigation measures during the construction phase including measures to control the emission of dust and dirt during construction and demolition.
- The carbon footprint of the construction phase activities, in the context of the associated traffic generation, will be calculated and subtracted against the carbon savings associated with the generation of electricity via solar power.

The Site plan and location is illustrated in Figure 1.1.

#### Proposed Development, Little Crow Solar Park Air Quality and Carbon Assessment



## Figure 1.1 – Site Location





# 2 Air Quality – Legislative Context

# 2.1 Air Quality Strategy

The importance of existing and future pollutant concentrations can be assessed in relation to the national air quality standards and objectives established by Government. The Air Quality Strategy (AQS) provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the UK Government and Devolved Administrations to protect human health. The air quality objectives incorporated in the AQS and the UK Legislation are derived from Limit Values prescribed in the EU Directives transposed into national legislation by Member States.

The CAFE (Clean Air for Europe) programme was initiated in the late 1990s to draw together previous directives into a single EU Directive on air quality. The CAFE Directive<sup>1</sup> has been adopted and replaces all previous air quality Directives, except the 4<sup>th</sup> Daughter Directive<sup>2</sup>. The Directive introduces new obligatory standards for PM<sub>2.5</sub> for Government but places no statutory duty on local government to work towards achievement of these standards.

The EU Limit Values are considered to apply everywhere with the exception of the carriageway and central reservation of roads and any location where the public do not have access (e.g. industrial sites).

The air quality objectives apply at locations outside buildings or other natural or man-made structures above or below ground, where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period. Typically these include residential properties and schools/care homes for long-term (i.e. annual mean) pollutant objectives and high streets for short-term (i.e. 1-hour) pollutant objectives. Table 2.1 taken from LAQM.TG(16) provides an indication of those locations that may or may not be relevant for each averaging period. Typically these include residential properties and schools/care homes for long-term (i.e. annual mean) pollutant objectives.

This assessment focuses on,  $NO_2$ ,  $PM_{10}$  and  $PM_{2.5}$  as these are the pollutants of principal concern arising from road traffic and construction dust.

Averaging Period	AQ Objectives should apply at:	AQ Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed Building facades of residential properties, schools, hospitals,	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence.
	care homes etc.	Gardens of residential properties.
		Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term

Table 2.1 – Examples of where the Air Qual	lity Objectives should apply
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<sup>&</sup>lt;sup>1</sup> Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.

<sup>&</sup>lt;sup>2</sup> Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic hydrocarbons in ambient air.



Averaging Period	AQ Objectives should apply at:	AQ Objectives should generally not apply at:
24-hour mean and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels. Gardens of residential properties <sup>1</sup> .	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives would apply. Kerbside sites (e.g. pavements of busy shopping streets).	Kerbside sites where the public would not be expected to have regular access.
	Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend one hour or more.	
	Any outdoor locations at which the public may be expected to spend one hour or longer.	
15-minute mean	All locations where members of the public might reasonably be expected to spend a period of 15 minutes or longer.	

Note <sup>1</sup> For gardens and playgrounds, such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

Pollutant	AQS Objective	Concentration Measured as:	Date for Achievement	
Nitrogen Dioxide (NO₂)	200µg/m³ not to be exceeded more than 18 times per year	1-hour mean	31 December 2005	
	40µg/m³	Annual mean	31 December 2005	
Particles	50µg/m³ not to be exceeded more than 7 times per year	24-hour mean	31 <sup>st</sup> December 2004	
(PM <sub>10</sub> )	40µg/m³	Annual mean	31 <sup>st</sup> December 2004	
	25µg/m³	Annual mean	2020	
Particles (PM <sub>2.5</sub> )	Target of 15% reduction in concentrations at urban background	Annual Mean	2020	

## Table 2.2 – Relevant National AQ Objectives for the Assessed Pollutants

# 2.2 Local Air Quality Management (LAQM)

Part IV of the Environment Act 1995<sup>3</sup> places a statutory duty on local authorities to periodically Review and Assess the current and future air quality within their area, and determine whether they are likely to meet the objectives set down by Government for a number of pollutants – a process known a Local Air Quality Management (LAQM). The objectives that apply to LAQM are defined for seven pollutants: benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide and particulate matter.

Where the results of the Review and Assessment process highlight that problems in the attainment of health-based objectives for air quality will arise, the authority is required to declare an AQMA – a

<sup>&</sup>lt;sup>3</sup> <u>http://www.legislation.gov.uk/ukpga/1995/25/part/IV</u>



geographic area defined by high concentrations of pollution and exceedances of health-based standards.

Where an authority has declared an AQMA, and development is proposed to take place either within or near the declared area, further deterioration to air quality resulting from a proposed development can be a potential barrier to gaining consent for the development proposal. Similarly, where a development would lead to an increase of the population within an AQMA, the protection of residents against the adverse long-term impacts of exposure to existing poor air quality can provide the barrier to consent. As such, after a high number of declarations across the UK, it has become standard practice for planning authorities to require an air quality assessment to be carried out for a proposed development (even where the size and nature of the development indicates that a formal Environmental Impact Assessment (EIA) is not required).

One of the objectives of the LAQM regime is for local authorities to enhance integration of air quality into the planning process. Current LAQM Policy Guidance<sup>4</sup> clearly recognises land-use planning as having a significant role in terms of reducing population exposure to elevated pollutant concentrations. Generally, the decisions made on land-use allocation can play a major role in improving the health of the population, particularly at sensitive locations – such as schools, hospitals and dense residential areas.

# 2.3 Air Quality Guidance for Construction Sites

There are a number of regulatory and legislative constraints in place to control pollution from construction and demolition activities. The Building Act 1984 and subsequent Building Regulations 2000 are in place to ensure the safety of people in and around the building during work. Part III of the Environmental Protection Act (EPA) 1990 identifies the emission of dust from construction sites as having the potential to be a statutory nuisance and requires its control under Section 80.

A number of best practice guides are available<sup>5</sup>, which provide a basis against which Codes of Construction Practice may be benchmarked. The Greater London Authority (GLA) in partnership with London Councils has produced a guidance document<sup>6</sup> that recommends mitigation measures, depending upon the scale of development and its location, to control nuisance dust from various activities during construction and demolition phases.

BRE (Building Research Establishment) has also produced a report<sup>7</sup> that outlines the measures to control the emissions of nuisance dust.

In December 2011, the IAQM published a guidance document to assess the impact of construction on air quality. The guidance was reviewed in January 2012<sup>8</sup> and updated in February 2014 to incorporate new evidence<sup>9</sup>. The approach adopted in this assessment is based on adopting the methodology published in the 2014 version of the IAQM guidance.

The significance of the impact of the construction phase on air quality has been determined through application of the criteria outlined in IAQM construction guidance.

<sup>&</sup>lt;sup>4</sup> LAQM Policy Guidance LAQM.PG(16) – April 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

<sup>&</sup>lt;sup>5</sup> Kukadia, Upton, Grimwood and Yu (2003) BRE Pollution Control Guides: Controlling particles, vapours and noise pollution from construction sites. BRE Publications.

<sup>&</sup>lt;sup>6</sup> Mayor of London (2014). The control of dust and emissions during construction and demolition – Supplementary Planning Guidance. Produced in partnership by the Greater London Authority and London Councils.

<sup>&</sup>lt;sup>7</sup> Kukadia V, Upton S, Hall D (2003). Control of dust from construction and demolition activities. BRE Publications.

<sup>&</sup>lt;sup>8</sup> Institute of Air Quality Management (IAQM) (2012) Guidance on the Assessment of the Impacts of Construction on Air

<sup>&</sup>lt;sup>9</sup> Institute of Air Quality Management (IAQM) (2014) *Guidance on the Assessment of Dust from Demolition and Construction.* 



# 2.4 Background Concentrations Used in the Assessment

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1km grid square resolution. The data sets include annual average concentration estimates for NO<sub>x</sub>, NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>, using a base year of 2015. The Pollution Climate Mapping (PCM) model on which these are based is semi-empirical in nature; it uses the National Atmospheric Emissions Inventory (NAEI) emissions to model-predict the concentrations of pollutants at the centroid of each 1km grid square, but then calibrates these concentrations in relation to actual monitoring data.

Annual mean background concentrations for use in this assessment for NO<sub>x</sub>, NO<sub>2</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> have derived from the background maps available on the Defra UK-Air website<sup>10</sup>. Sample locations include 1km grid squares within the proposed development itself and two receptor sites located 280m and 1km east of the proposed site.

The mapped background concentrations for the base year of 2017 and the sample year of 2020 are presented in Table 2.3.

Grid Square (X,Y)	2017 Annual Mean Background Concentration (µg/m³)			2020 Annual Mean Background Concentration (µg/m³)				
()	NOx	NO <sub>2</sub>	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>	NOx	NO <sub>2</sub>	<b>PM</b> 10	PM <sub>2.5</sub>
494500, 410500	15.2	11.2	15.2	9.5	13.9	10.3	15.0	9.3
494500, 409500	15.0	11.1	14.8	9.4	13.6	10.1	14.5	9.1
494500, 408500	14.8	10.9	13.5	8.7	13.1	9.8	13.2	8.5
AQS objective	-	40	40	25	-	40	40	25

#### Table 2.3 – Defra Background Pollutant Concentrations

All of the mapped background concentrations presented are well below the respective annual mean air quality objectives.

<sup>&</sup>lt;sup>10</sup> https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015



# 3 Assessment Methodology

The approach applied to this assessment has been based on the following:

- A qualitative assessment of dust and air quality impacts during the construction works. The construction dust assessment will involve the use of a Geographic Information System (GIS) and be undertaken with reference to current best-practice guidance, such as those published by the Institute of Air Quality Management (IAQM).
- Construction related road traffic emissions will be considered relative to published guidance. Based upon the preliminary construction traffic management plan and indicative flows provided therein, Bureau Veritas do not consider there to be a requirement for detailed assessment of the road traffic emissions, rather a screening based assessment against IAQM criteria is considered sufficient.
- Mitigation measures during the construction phase including measures to control the emission of dust and dirt during construction and demolition.
- The carbon footprint of the construction phase activities, in the context of the associated traffic generation, will be calculated and subtracted against the carbon savings associated with the generation of electricity via solar power.

# 3.1 Construction Effects

The assessment of potential dust/PM<sub>10</sub> effects in relation to the development's construction phase has been undertaken qualitatively in accordance with IAQM Guidance<sup>11</sup>. The guidance proposes a method to assess the significance of construction dust impacts by considering the annoyance due to dust soiling, as well as harm to ecological receptors and the risk of health effects due to significant increases in dust/PM<sub>10</sub> concentrations.

Construction site activities are divided into four types to reflect their different potential impacts. These activities are:

- Demolition an activity involved with the removal of an existing structure or structures;
- Earthworks the processes of soil-stripping, ground-levelling, excavation and landscaping;
- Construction an activity involved in the provision of a new structure; and
- Trackout the transport of dust and dirt from the site onto the public road network. This arises when lorries leave site with dusty materials or transfer dust and dirt onto the road having travelled over muddy ground on-site.

A detailed assessment is required where a sensitive human receptor is located within 350m from the Site boundary and/or within 50m of the route(s) used by vehicles on the public highway, up to 500m from the Site entrance(s).

There are no notable ecological receptors within a 200m vicinity of the development. There are, however, two residential properties less than 350m from the boundary of the Site. There are a number of properties approximately1km of the Site, notably the residential town of Broughton, located east of the proposed development.

<sup>&</sup>lt;sup>11</sup> Institute of Air Quality Management (IAQM) (2014) *Guidance on the Assessment of Dust from Demolition and Construction.* 



The first step of the detailed assessment is to assess the risk of dust impacts. This is undertaken separately for each of the four activities (demolition, earthworks, construction and trackout) and takes account of:

- The scale and nature of the works, which determines the potential dust emission magnitude; and
- The sensitivity of the area.

These factors are combined to give an estimate of the risk of dust impacts occurring. Risks are described in terms of there being a low, medium or high risk of dust impact for each of the four separate potential activities. Where there are low, medium or high risks of an impact, then site specific mitigation will be required, proportionate to the level of risk.

Based on the threshold criteria and professional judgment, one or more of the groups of activities may be assigned a 'negligible' risk. Such cases could arise, for example, because the scale is very small and there are no receptors near to the activity.

Site-specific mitigation for each of the four potential activities is then determined based on the risk of dust impacts identified. Where a local authority has issued guidance on measures to be adopted at demolition/construction sites, these should also be taken into account. Professional judgment is then employed to examine the residual dust effects assuming mitigation to determine whether or not they are significant.

In regards to construction phase vehicle movements, the Land-Use Planning & Development Control: Planning for Air Quality IAQM guidance has been used to assess the change in traffic flow during the construction period. The development will cause a significant change in Heavy Duty Vehicles (HDVs) if the change of HDV flow is greater than 100 annual average daily traffic (AADT) outside of an AQMA. Estimated vehicle numbers as specified in the Construction Management Transport Plan will be compared against this criterion to assess whether construction vehicles will result in a significant impact on the surrounding area.

# 3.2 Carbon Footprint

There are various degrees of detail which can be employed to calculating the carbon offset of a development. However, due to the nature of the site and the type of construction phase activities undertaken, the carbon offset assessment will focus on the traffic generation associated with the construction phase.

The carbon dioxide (CO<sub>2</sub>) generated from the construction traffic will be calculated using the UK Government Greenhouse Gas (GHG) conversion factors provided by Defra for company reporting<sup>12</sup>. The most recent factors were published in July 2018 and are deemed to be the most relevant for the study. Factors were provided for a breakdown of vehicle types. The total CO<sub>2</sub> produced was calculated based on the total kilometres/miles each vehicle type travelled.

The total  $CO_2$  generated as a result of the construction phase vehicle movements will be subtracted against the carbon saving associated with the generation of electricity via solar power. The carbon savings will be quantified based on a direct comparison against the amount of  $CO_2$  produced if an equal amount of electricity was produced using alternative fuels operated on the National Grid. The July 2018 GHG conversion factor spread sheet includes an estimated average amount of  $CO_2$  emitted for each kWh of electricity produced for the grid assuming a range of energy sources e.g. coal, gas and renewable electricity generation.

The total annual  $CO_2$  offset from the Little Crow Solar Park will then be calculated taking into account the  $CO_2$  generated during the construction phase.

<sup>&</sup>lt;sup>12</sup> https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018



# 4 Results

## 4.1 Construction Phase

### 4.1.1 Dust/PM<sub>10</sub> Emissions

This assessment of dust/PM<sub>10</sub> presents the effects which are likely to be relevant both prior to and following the use of the appropriate mitigation measures on-site, which would be outlined by the site contractor and in a site Dust Management Plan (DMP). As per the IAQM guidance<sup>12</sup>, the risk associated with the site to potentially generate dust/PM<sub>10</sub> is identified. Potential unmitigated effects at receptor locations are determined, and site-specific recommendations are then made to ensure residual dust/PM<sub>10</sub> effects associated with the construction phase are not significant.

The assessment of construction dust will focus on dust arising from three of the dust producing construction activities outlined in the IAQM guidance<sup>12</sup> (i.e. earthworks, construction and trackout). No demolition is proposed on site and therefore has been scoped out of the assessment.

#### Earthworks

Potential sources of impacts associated with earthworks/ground preparation activities include fugitive dust/ $PM_{10}$  emissions resulting from disturbance of dusty materials by construction plant, the construction materials used, vehicle movements and wind action. The total site area is greater than  $10,000m^2$  and although it is not anticipated that there will be anything larger than a moderate number of earth moving vehicles on site at any one time, the worst case scenario has been assumed due to the scale of the site. The dust emission magnitude for earthworks is therefore considered to be large.

#### Construction

Potential sources of impacts associated with construction activities include fugitive dust/PM<sub>10</sub> emissions resulting from disturbance of dusty materials by construction plant, the construction materials used, vehicle movements and wind action. Construction activities at the development site are expected to include a total building volume of less than 25,000 with a low potential for dust release as the solar panels to be installed will be largely metal structures secured with metal bolts into the ground. The dust emission magnitude for construction is therefore considered to be small.

### Trackout

Dust emissions during trackout from the site may occur from the transport of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. The number of predicted outward HDV (i.e. >3.5 tonne) movements in any one day is not anticipated to be in excess of 50 at any point during construction, however as the unpaved roadways are in excess of 100m, a worst case assumption must be employed. The dust emission magnitude for trackout is therefore considered to be large.

### Summary

A summary of the dust emission magnitude for the four activities is detailed in Table 4.1.

#### Table 4.1 – Construction Dust Emission Magnitude

Activity	Dust Emission Magnitude
Earthworks	Large
Construction	Small
Trackout	Large



#### Sensitivity of the Area

The residential area of Broughton is located in excess of 1km east of the site and resides a population of over 5,000 residents, which is supported by a relative number of properties and services<sup>13</sup>. The closest properties to the proposed site consists of two farm structures with at least one structure being used as a residential dwelling and are located east of the proposed site and North of Broughton at distances of 280m and 415m from the site boundary. These two properties are accessible from the main site access route B1207 road and are bordered to the north by a narrower loose tracked road which is also to be used for site access during and following construction. Due to the nature and proximity of nearby properties, given the low number of nearby receptors identified, the sensitivity of the area with respect to the dust soiling effects on people and property in relation to earthworks, construction and trackout activities is therefore considered to be low.

The existing background  $PM_{10}$  concentration is 15.2µg/m<sup>3</sup>; which is below the AQS objective. Given the above information regarding the number of receptors in excess of 200m of the Site boundary and within 60m from the main access route, the sensitivity of the area with respect to human health impacts in relation to earthworks, construction and trackout is therefore low.

There are no designated ecological sites within 50m of the development Site as listed on the Defra Magic Map resource<sup>14</sup>. In accordance with the IAQM methodology<sup>12</sup>, there is no need to consider potential dust effects on ecological receptors further as part of this assessment.

A summary of the sensitivity of the surrounding area is detailed in Table 4.2 below.

#### Table 4.2 – Sensitivity of Surrounding Area

Potential Impact	Sensitivity of the Surrounding Area		
Potential impact	Earthworks	Construction	Trackout
Dust Soiling	Low	Low	Low
Human Health	Low	Low	Low

#### **Risk of Dust Impacts**

The risk of dust impacts is defined using Tables 7, 8 and 9 in the IAQM guidance<sup>12</sup> for earthworks, construction and trackout respectively. The dust emission magnitude classes in Table 4.1 combined with the sensitivity of surrounding area classes in Table 4.2, result in the site risk categories as shown in Table 4.3.

### Table 4.3 – Summary of Dust Risk

Potential Impact	Risk		
Potential impact	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	Negligible	Low Risk
Human Health	Low Risk	Negligible	Low Risk

Following the construction dust assessment, the development Site is found to be, at worst, a Low Risk in relation to dust soiling effects on people and property and a Low Risk in relation to human health impacts, as summarised in Table 4.3.

Due to the above designation, mitigation measures are required to ensure that any potential impacts arising from the construction phase of the proposed development are reduced and, where possible, completely removed. Providing effective mitigation measures are implemented, such as those outlined in Section 5.1, construction dust impacts are considered to be not significant.

<sup>&</sup>lt;sup>13</sup> https://www.ons.gov.uk/help/localstatistics

<sup>&</sup>lt;sup>14</sup> Magic Maps (2017), available online at <u>http://www.natureonthemap.naturalengland.org.uk/</u>



## 4.1.2 Construction Vehicle Emissions

The construction phase is proposed to take place over a 47 week period, with a 26 week period identified for site deliveries<sup>15</sup>. During thisperiod there will be a number of HDV movements delivering materials for construction activities on site. It is estimated that the total number of two-way vehicle movements during the construction phase of both the solar farm and battery storage facility will be4,472. It is expected the majority of these will be associated with the delivery of the solar modules and mounting structures. In total a maximum of 25 AADT is expected during the construction phase period.

The average number of two-way vehicle movements per day is well below the 100 AADT criteria. Therefore it is not considered that there will be any potential for significant air quality effects from development related road traffic emissions during the construction phase. Furthermore, the construction vehicle designated route to the site actively avoids residential areas to minimise impacts. Such potential impacts have therefore been scoped out from requiring a detailed assessment on the basis of their low and negligible impacts.

# 4.2 **Operational Phase**

General maintenance of the site will be carried out by the existing farm tenant and additional equipment maintenance performed approximately four times a year. Therefore it is unlikely that the number of vehicle movements during the operational phase will exceed those of the construction phase. As a result, operational phase impacts associated with road traffic emissions are deemed to be not significant and therefore scoped out of requiring a detailed assessment.

<sup>&</sup>lt;sup>15</sup> Paragraph 5.1 of TPA's 'Construction Traffic Management Plan', November 2018



# **5** Recommended Mitigation Measures

# 5.1 Short-term Impacts during Construction

As discussed in Section 4, construction impacts associated to the proposed development would result in the generation of a small magnitude of dust and  $PM_{10}$ . It is considered that employment of construction best practice should ensure that no problematic dust or  $PM_{10}$  concentrations occur during the construction process.

IAQM guidance<sup>12</sup> outlines a number of site specific mitigation measures based on the assessed site risk. The measures are grouped into those which are 'highly recommended' (i.e. should be employed) and those which are 'desirable' (i.e. should be considered under best practice).

As the site is classed as low risk the following mitigation measures are highly recommended:

- With respect to communications:
  - Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
  - o Display the head or regional office contact information.
- With respect to site management:
  - Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
  - o Make the complaints log available to the local authority when asked.
  - Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
- With respect to monitoring:
  - Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
  - Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- With respect to preparing and maintaining the site:
  - Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
  - Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- With respect to operating vehicle/machinery and sustainable travel:
  - o Ensure all vehicles switch off engines when stationary no idling vehicles.
  - Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.



- With respect to operations:
  - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
  - Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
  - Use enclosed chutes and conveyors and covered skips.
  - Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- With respect to waste management:
  - o Avoid bonfires and burning of waste materials.
  - Additionally as the site is classed as low risk the following mitigation measures are desirable:
- With respect to communications:
  - Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. In London additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real time PM<sub>10</sub> continuous monitoring and/or visual inspections.
- With respect to monitoring:
  - Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
- With respect to preparing and maintaining the site:
  - Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.
  - Keep site fencing, barriers and scaffolding clean using wet methods.
  - Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
  - o Cover, seed or fence stockpiles to prevent wind whipping.
- With respect to operating vehicle/machinery and sustainable travel:
  - Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the



approval of the nominated undertaker and with the agreement of the local authority, where appropriate).

- With respect to operations:
  - Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

As the site is classed as low risk for earthworks no mitigation measures are required with respect to earthworks.

As the site is classed as low risk for trackout the following mitigation measures are desirable:

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).



# 6 Carbon Footprint

The Little Crow Solar Park is expected to generate 150MW of clean, renewable energy from the photovoltaic panels installed at the solar park each year, with an additional 90MW battery storage capability. It is estimated the power generated will be able to service 36,000 homes a year. The electricity generated will connect to the existing local 132kVA electrical network which runs through the proposed site.

In order to assess the carbon savings from solar panels, a calculation can be used which assumes that all of the generated solar electricity directly displaces 'grid' electricity. In regards to the Little Crow Solar Park, the calculation will assume the power stations producing 'grid' electricity will be producing up to 150MW/h less electricity. In order to calculate the saving the 'average grid carbon intensity' i.e. the average amount of CO<sub>2</sub> emitted for each kWh of electricity produced for the grid, is required. According to the July 2018 recommended conversion factors provided by Defra as part of its Environmental Reporting Guidelines<sup>16</sup>, it is estimated that approximately 0.283kg of CO<sub>2</sub> is produced per kWh of electricity from the grid.

Table 6.1 shows the expected kWh profile for the first calendar year from January to December (based on a 135MWp) installation. The total  $CO_2$  savings over the year is therefore 0.283kg x 125,834,402kWh = 35,611,136kg  $CO_2$  (35,611 tonnes per year). The efficiency of the solar panels has been calculated as approximately 10%, based on the provided information. This is considered a conservative assumption of the efficiency of the solar panels per annum.

Month	kWh
Jan	3,797,939
Feb	6,074,880
Mar	9,739,809
Apr	14,161,443
Мау	16,605,001
Jun	16,313,813
Jul	17,167,282
Aug	15,302,901
Sep	11,252,122
Oct	7,832,672
Nov	4,686,762
Dec	2,899,778
Total	125,834,402

### Table 6.1 – Expected kWh Profile

The construction of the solar park will inevitably generate  $CO_2$  emissions. Therefore,  $CO_2$  generated needs to be factored into the total  $CO_2$  savings from the park. The most significant source of  $CO_2$  emissions during the construction phase will be derived from the construction vehicles travelling to and from the site. Table 6.2 provides details with regards to the estimated total amount of  $CO_2$  generated by the construction vehicles visiting the site. The estimated kg  $CO_2$  per km for each vehicle type has been derived from the July 2018 recommended conversion factors provided by Defra.

<sup>&</sup>lt;sup>16</sup> https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018



Table 6.2 – Cons	truction Vehicle	Generated	$CO_2$
------------------	------------------	-----------	--------

Vehicle Type	Total km travelled*	kg CO₂ per km	Total Number of Vehicles	Total kg CO2
Rigid HGVs	200	0.80746	110	17,764
Articulated HGVs	200	0.93428	4,200	784,795
Vans	200	0.25299	3,290	166,467
			Total Tonnes of CO <sub>2</sub>	969
Notes: * As no distance information was available a distance of 200km has been assumed for each vehicle. <sup>1</sup> All rigids and average laden <sup>2</sup> All artics and average laden				

<sup>3</sup> Assumed 50% diesel and 50% petrol vans

Overall, the total  $CO_2$  offset as a result of the Little Crow Solar Park, taking into account the  $CO_2$  generated as a result of the construction vehicle activities, is 34,642 tonnes. It should be noted that the  $CO_2$  generated as a result of the construction vehicles will be a onetime occurrence and should not be factored into future years.



# 7 Conclusions

Bureau Veritas UK Ltd has been commissioned by INRG Solar (Little Crow) Ltd. to undertake an air quality assessment of construction traffic emissions together with a carbon offset assessment as a result of the proposed Little Crow Solar Park. The development site is located to the east of Scunthorpe, adjacent to the Harsco Steel works and is accessed via the B1208.

An air quality assessment has been prepared to determine the significance of air quality impacts during the construction and operational phases of the proposed development, in addition to confirming the suitability of the Site for the proposed use.

A qualitative assessment of impacts of construction activities upon air quality was undertaken following the Institute of Air Quality Management (IAQM) guidance<sup>12</sup>. methodology. A quantitative assessment of from the impact of road traffic emissions on air quality was undertaken following IAQM dust guidance<sup>12</sup>.

The carbon footprint of the construction phase activities, in the context of the associated traffic generation, was calculated and subtracted against the carbon savings associated with the generation of electricity via solar power. The CO<sub>2</sub> generated from the construction traffic was calculated using the UK Government Greenhouse Gas (GHG) conversion factors provided by Defra for company reporting<sup>17</sup>.

The carbon saving from generating electricity via solar power was further quantified based on a direct comparison against the amount of  $CO_2$  produced where an equal amount of electricity is produced using alternative fuels operated on the National Grid. The July 2018 GHG conversion factor spread sheet includes an estimated average amount of  $CO_2$  emitted for each kWh of electricity produced for the grid assuming a range of energy sources e.g. coal, gas and renewable electricity generation. The total annual  $CO_2$  offset was calculated based on this factor.

The following section provides the conclusions of this assessment.

# 7.1 Construction Effects

The assessment of dust/PM<sub>10</sub> effects from the construction phase of the development was subject to a qualitative assessment following IAQM guidance<sup>12</sup>. Following the construction dust assessment the development site is found, in relation to dust soiling, to be at worst low risk from earthworks, construction and trackout. In relation to human health impacts, the development Site is found to be at worst low risk for all three activities.

In regards to construction phase vehicle movements, the average number of two-way HDV movements per day is expected to be well below the 100 AADT criteria. Therefore it is not considered that there will be any potential for significant air quality effects from development related road traffic emissions during the construction phase. Such potential impacts have therefore been scoped out from requiring a detailed assessment on the basis of their low and negligible impacts.

Effective mitigation measures were not specified as there is no risk defined. Furthermore, impacts from dust emissions during the construction phase would be **not significant**, which is supported by the low levels of annual mean emissions as detailed in Section 2.4. It is considered that despite there not being a defined risk present, it is still advisable that a number of good practice measures are implemented, such as considerate traffic speed and observing minimal dust dispersion where at all possible during construction and transport activities.

# 7.2 Operational Effects

Maintenance vehicles are only expected to visit the site four times a year. Therefore it is unlikely that the number of vehicle movements during the operational phase will exceed those of the construction

<sup>&</sup>lt;sup>17</sup> https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018



phase. As a result, operational phase impacts associated with road traffic emissions are deemed to be not significant and therefore scoped out of requiring a detailed assessment.

# 7.3 Carbon Footprint

Based on the calculations in Section 6, it is estimated the Little Crow Solar Park will offset 34,642 tonnes of  $CO_2$  in the first year. This value has taken into consideration the estimated amount of  $CO_2$  generated as a result of the construction vehicles transporting materials to and from the site during the construction phase. A greater carbon saving will be experienced in the future years as all construction activities would have been completed by the end of the first year.



# APPENDIX 2.2

PHASE 1 GROUND CONDITIONS REPORT



National significant infrastructure project in the Energy Sector Little Crow Solar Park, Scunthorpe

# PHASE 1 GROUND CONDITIONS DESK STUDY

On behalf of INRG Solar (Little Crow) Ltd

November 2018



Proposed Solar Energy Scheme Little Crow Solar Farm Scunthorpe Lincolnshire DNI6 IXP

# PHASE I GROUND CONDITIONS DESK STUDY

REPORT NO. 1844 Vers. 5, November 2018

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Phase I Ground Conditions Desk Study Little Crow Solar Farm Scunthorpe Lincolnshire DN16 IXP

Client: INRG Solar (Little Crow) Limited

Intégrale Report No. 1844, Version 5, November 2018

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# LIST OF CONTENTS

# - EXECUTIVE SUMMARY -

1.0	INT	ITRODUCTION 2		
2.0	THE	SITE		3
	2.1	Locatio	on and Description	3
	2.2	Publish	ned Geology and Mining	3
		2.2.1	British Geological Survey Mapping	3
		2.2.2	BGS Previous Investigation Records	4
		2.2.3	Soils Information	4
		2.2.4	Past Mining	4
		2.2.4	I Historical Mapping Evidence	4
		2.2.4	.2 Humberside Minerals Resources (2006)	5
		2.2.4	.3 TerraSearch Assess Report (August 2017)	5
		2.2.4	.4 Conventional Oil Well	5
	2.3	Outlin	e History	6
	2.4	Hydro	geology, Hydrology & Groundwater Vulnerability	7
	2.5	Enviro	nmental Information	8
		2.5.1	Pollution Information and Licencing	8
		2.5.2	Geological Information	8
		2.5.3	Background Soils Chemistry	9
		2.5.4	Contemporary Trade Directories	9
		2.5.5	Groundsure Radon Risk Information	9
	2.6	Conce	ptual Exposure Model	9
		2.6.1	Proposed Redevelopment	9
		2.6.2	Potential Sources of Contamination	10
		2.6.3	Potential Receptors	11
		2.6.4	Potential Pathways	11
		2.6.5	Conceptual Site Model with Respect to Human Health	11
		2.6.6	Conceptual Site Model with Respect to Controlled Waters	12
3.0	ANT	FICIPATI	ed ground & groundwater conditions	13
	3.1	Anticip	pated Strata	13
	3.2	Anticip	pated Groundwater and Leachate	14
	3.3	Anticip	pated Ground Gas Regime	14
4.0	COI		JATED LAND CONSIDERATIONS	15
	4	Gener	al	15
	4.2	Oualitz	ative Risk Assessment	15
	4.3	Conclu	usions	15
5.0	GEC	TECHN	JICAL CONSIDERATIONS	17
APPE		S		

- A. Site Location & Layout Plans
- B. Site PhotographsC. Geological Information
- D. Terrafirma Mining Report
- E. Groundsure Data Report



## **EXECUTIVE SUMMARY**

## Little Crow Solar Farm – Phase I Ground Conditions Desk Study Report No. 1844, November 2018

A Phase I Desk Study on ground conditions, geotechnical and contamination aspects for this proposed solar energy scheme has been completed.

The approximate 227 hectare site comprises a higher eastern area of level or gently eastward sloping arable land, a central zone moderately sloping down to the west, and a lower western area of very gentle to level ground. Agricultural soils predominate, with small areas of woodland & vegetation. To the west of the site are opencast ironstone workings and steel works

Geological records indicate the lower slopes overlain by Blown Sand comprising up to 7m of fine-grained silty sand. The bedrock beneath forms a sequence of north-south outcrops. The higher eastern area comprises Jurassic limestones; the central area is underlain by Jurassic mudstones and locally limestones; the middle and lower slopes are blanketed in the Blown Sand, underlain by mudstones and marls, including the commercially important Pecten Ironstone. The complete site area is classified as freely draining slightly acid sandy soils.

There are potentially small-scale surface ironstone workings in the lower western area. Northeast of the site is the Broughton B1 conventional oil well, sunk to 1.9km depth. Available data suggests it is not active.

Historically the majority of site has remained agricultural, with Gokewell Priory Farm in the north. Overhead power cable routes cross the site and mapping indicates periodic expansion of the ironstone workings and steel plant to the west. A former WWII anti-aircraft battery in the eastern area is reported removed.

In the higher area, the regional strata dip to the east directs surface water and moderate depth groundwater flow to the east, forming a Principal Aquifer. Midslope surface water and shallow groundwater flow within the Blown Sand is to the west, forming a Secondary A Aquifer, with a discontinuous springline midslope. Very shallow groundwater is anticipated in the lower western area where drainage ditches are frequent, with hummocky marshy areas.

Potential contaminant sources are considered limited to remnant metals in soils within any localised backfilled ironstone pits, and air-borne particulates from the industrial complex to the west, within topsoil. Potential receptors comprise construction workers and maintenance staff. Drainage ditches and the groundwater within the Principal and Secondary A aquifers are controlled waters receptors. For the limited groundworks, risk to groundworkers is considered negligible with standard protection.

The shallow groundworks will have negligible potential to cause or increase leaching. Run-off during construction works will need to be controlled and managed, as standard practice. Future run-off is unlikely due to predominant topsoil cover and anticipated infiltration characteristics, but requires consideration.

Combined geotechnical and contaminated land assessment should concentrate on specific features from historical maps to confirm ground conditions within solar array zones, occurrence of small scale ironstone working, typical gas regime, infiltration and permeability of near surface soils and identify any specific areas of concern.

There is no current evidence of ground conditions that would preclude development.



## I.0 INTRODUCTION

INRG Solar (Little Crow) Limited are considering development of a 150MWp energy scheme comprising ground mounted solar PV modules and battery storage. Their planning consultants are Pegasus Planning Group.

Integrale Limited are commissioned to undertake a Phase I Desk Study, concentrated on ground conditions, geotechnical and contamination aspects. The desk study is also to inform drainage considerations by Clive Onions Limited.

This desk study report describes the geological setting, mining risk and historical and environmental data reports. The ground and groundwater conditions are anticipated and used to establish a conceptual model of potential pollutant linkages. Implications for the development are discussed and recommendations for further investigation or potential remedial works or design measures given.



# 2.0 THE SITE

## 2.1 Location and Description

As shown in Appendix A, the site is located to the east of Scunthorpe and north of Ravensthorpe. It has a central Ordnance Survey Grid Reference of 494000 410000 and postcode DN16 IXP. A slightly smaller site area was initially considered, and has subsequently been extended to comprise the area shown bounded in red in Appendix A.

No site reconnaissance visit has been completed by Integrale Limited, and the typical photographs included in Appendix B have been provided by the client. The main features and pertinent aspects on the site and immediately adjacent land are summarised below:

Current Use	Predominantly arable agricultural land.	
Site Area & Plan Shape	226.81 Hectares (2.268 km²).	
Maximum Dimensions	1700m N-S by 1100-1500m E-W.	
Ground Slopes & Topography	Higher eastern half at 60-67mAOD, level or with very gentle slopes down to east. Central quarter at 40-60mAOD, with moderate slopes (1:15 to 1:20) down to west. Western zone at 30-40mAOD, with moderate slope (1:12) down to west. Extreme western zone at 25-30m, with very gentle slope (1:50 to 1:60).	
<b>Buildings &amp; Condition</b>	None significant.	
Surfacings & Condition Vegetation & Trees	Agricultural soils predominate, with small areas of woodland & vegetation. Three large plantations of trees (Gokewell Strip & Icehouse Strip in SE quadrant, and Little Crow Covert in northwest) do not form part of proposed development area.	
Water Courses	Mapping shows numerous drainage ditches within western zone run down to west, feeding into north-south drains. Pond at site of former Gokewell Priory may feed into stream flowing northwest into a lower pond adjacent to Santon Wood.	
Site Boundary Features	Agricultural fencing & hedges predominantly.	
Contamination Issues	None noted from photographs. Beyond to west is area of opencast ironstone workings and steel works. Google Earth imagery shows substantial mound in SW from 2003 and centrally from 2008 (see below).	
Geotechnical Issues Former ironstone workings etc. – see below. Former Oil Well off-site to northeast – see historical maps and below		

### 2.2 Published Geology and Mining

## 2.2.1 British Geological Survey Mapping

BGS geological maps indicate the following strata beneath and adjacent to the site:

Map / Scale	Sheet 89 at 1:50,000 scale (Solid & Drift Sheets).	
BGS On-Line Viewer	e Viewer BGS Maps Portal Accessed 8th August 2017.	
Artificial Ground None mapped on site. Frodingham Ironstone Backfilled Opencast W immediately beyond western boundary.		
Superficial Deposits	Lower slopes overlain by Sutton Sand (Devensian Blown Sand): up to 7m of fine grained silty sand. Further area of Blown Sand mapped at high level beyond eastern site boundary is likely to form a thin cover in parts of the eastern zone.	



	Sequence of north-south outcrops from:
	I. Kirton Cementstones of Lower Lincolnshire Limestone Formation (LLLS) of
	Middle Jurassic period forming higher eastern area, including Scawby Limestone
Solid Geology	and Santon Oolite, overlies;
	2. Lower Estuarine Series and Northampton Sands (10-20m thickness), overlies;
	3. Coleby Mudstones with Marlstone Rock of Lias Group of Lower Jurassic
	period on middle and lower slopes, including Pecten Ironstone.
	None mapped other than superficial Blown Sand masking Jurassic bedrock. No
Geological Features	dip arrows, however cross-section & more remote data indicates regional dip
_	down to east at 1-3°.

Summary drawings of the geological formations and potential groundwater zones are included in Appendix C.

## 2.2.2 BGS Previous Investigation Records

Previous investigation records available on the BGS website under the Open Government Licence include 5 boreholes sunk across the northern area. These are also included in Appendix C and indicate:

- Higher Eastern half of site, at or above 55mAOD Topsoil over Weathered oolitic limestone of Lincolnshire Limestone Formation;
- Central northern area between 40-50mAOD Blown Sand to 2-4m depth, overlying Middle & Lower Lias mudstones and locally limestones;
- Lower northwestern area at 36mAOD yellow and grey clays of Coleby Mudstones (with thin veneer of Blown Sand likely).

No details of groundwater levels are included in these records.

## 2.2.3 Soils Information

Data available on the LandlS Soilscapes Viewer and within a Soil Site Extended Report is included in Appendix C and indicates:

- The complete site area is classified as underlain by freely draining slightly acid sandy soils. These have typically low fertility arable land cover, and drain to groundwater.
- The complete site area is underlain by Newport I Type Soils. These are deep well drained sandy and coarse loamy soils. They are free draining and permeable in unconsolidated sands or gravels, which have a relatively high permeability and high storage capacity. They have a very low potential for ground movement (shrinkage or swelling).
- These soils will, by nature of their high permeability, readily transmit a wide range of pollutants because of the rapid drainage and low attenuation potential.
- The uppermost 300mm of the soil profile is sandy and 'light'.
- Newport I Soils have typically an upper 250mm of dark brown slightly stony sandy loam or loamy sand, overlying brown slightly stony loamy sand or sand, with a weak fine subangular blocky structure. Below 500-550mm depth, these develop into yellowish red or brownish yellow slightly stony sand of single grain structure.

## 2.2.4 Past Mining

## 2.2.4.1 Historical Mapping Evidence

Historical maps are discussed in more detail below and are included in Appendix E. There is evidence for potential small scale near surface workings in the lower western area, where small pit features, some ponds and a hummocky area in the extreme southwest are shown.



A summary plan of such historical features has been included after those maps at the end of Appendix E. It is assumed that if these are evidence for surface working or mining, they represent ironstone extraction. It is noted that several such features align north-south, potentially reflecting the geological trend of ironstone outcrops. Google Earth imagery shows a substantial vegetated mound with approximate maximum dimensions of 70m by 45m in the southwest area between 20-26mAOD from 2003 onwards, which could relate to such workings. From 2008 a mound of material approximately 50m diameter appears centrally, south of the main access track to Gokewell Priory Farm, perhaps more likely to be agricultural in origin or related to the demolition of farm buildings.

The opencast workings to the west include a linear excavation, with steep side slopes and apparently extending well below 5mAOD, based on Google Earth spot heights.

## 2.2.4.2 Humberside Minerals Resources (2006)

The Humberside Minerals Resources plan obtained from the BGS website (an extract of which is included in Appendix C) indicates the complete site area as having "Underground planning permission (valid and expired)". This suggests that the Minerals Planning Authority had granted permission for (assumed) ironstone working by underground mining, presumably as an extension to the opencast area to the west, but that this has now expired. Whether any workings beneath the site area did in fact occur, remains undetermined to date.

## 2.2.4.3 TerraSearch Assess Report (August 2017)

A Terra Search Assess report was therefore obtained from TerraFirma Mine Searches Limited and is included in Appendix D. The report is based on the original slightly smaller site area (as shown on the maps) however, it includes information from a larger surrounding 'buffer zone' and therefore covers the complete current boundaries. This indicates:

- Negligible to low risk from past coal mining, evaporate working, brine extraction, or metalliferous mining for tin, lead etc.
- Moderate risk of past limestone or other stone extraction.
- Moderate risk of planned or future mineral extraction (of ironstone).

For ongoing current site use, TerraFirma therefore conclude:

- A Moderate risk from past ironstone extraction, due to a number of suspected extraction features (see hazard map within report).
- A Moderate risk due to a hydrocarbon well off-site to the northeast. TerraFirma have confirmed that DECC (Dept. of Energy & Climate Change) data indicates the hydrocarbon field area extends within the site boundary. "Therefore associated extraction features such as underground workings and shafts could be present and have the potential to impact ground stability in the area". See also Section 2.3.

For future development of the site, TerraFirma therefore conclude:

• "...prior to any site works or future development activity, it is considered prudent to commission a full Site Survey by a qualified mining geologist/engineer."

### 2.2.4.4 Conventional Oil Well

Immediately northeast of the site at Top Wood is the site of a conventional oil well, known as Broughton B1. This was sunk in 1984 by BP Petroleum Development Limited. Details have been obtained from the UK Onshore Geophysical Library open-access resource and is included in Appendix C.



This indicates:

- Well was sunk at 63.1mAOD and taken to 1920m depth, as a vertical boring;
- The well is cased to 1909m depth, casing decreasing from 340mm to 140mm down its length;
- The Upper, Middle and Lower Lias strata were proven from surface to 100m depth. The underlying Triassic, Penarth and Mercia Mudstone Groups, and Upper Permian strata occur to 800m. Beneath, the Lower Permian marl/shale and Rotliegendes Sandstone reservoir were found to 1120m, with Carboniferous strata below to the base of the well. It is tentatively assumed that the oil shales or sandstones being targeted are those below 800m depth.

On-line searches for details of this oil well found that Egdon Resources plc have stated: "The two prospects are located along an oil productive trend with the Crosby Warren producing oil field at one end and the Brigg oil discovery at the other. The Broughton-BI well drilled by BP in 1984 flowed on test at up to 40 barrels of oil per day before being abandoned". This does not suggest that the well is currently active, and no further detail of the likelihood of future exploitation is readily available at this time

## 2.3 Outline History

Historical maps obtained from a Groundsure report are included in Appendix E, together with a summary plan of pertinent features. The Groundsure report is based on the original slightly smaller site area (as shown on the maps) however, it includes information from a larger surrounding 'buffer zone' and therefore covers the complete current boundaries. These indicate the following pertinent information:

Map Date	Site Features / Land Use	Adjacent Features (distance from site)
1885- 1906	Majority of site agricultural fields with drainage ditches in lower area. Gokewell Priory Farm with pond in N area. Hummocky /marshy area in extreme lower SW with pond. Several small scale excavations or pits in lower W area may indicate surface diggings for ironstone.	Icehouse and Gokewell Strip woodlands present as existing. Redbourne Hill and Appleby Iron Works 2kms W and NW respectively. Small excavations (surface ironstone workings?) beyond SW corner near Gorse Covert. Larger ironstone quarries 1.5kms SW at Emmanuel Bridge
1948-55	No significant changes apparent within site	Ironstone quarries extended to within 800m of W boundary. Iron & Steel Works extended to within 750m NW.
1968-80	Overhead powerlines constructed crossing SW to NE from substation within Iron & Steel Works to SW. Possible new drainage ditches (and small pond?) within hummocky area in extreme NW near Crow Covert. Clearance of Sodwall Plantation (possible ironstone workings?)	Iron & Steel Works expanded to within 500m W. Opencast Ironstone Workings mapped to within 500m NW. Emanuel Air Strip West and East within 500-750m SW of site. Drainage ditches apparently expanded just beyond site to SW, around Bottesford Beck. By 1979 Iron & Steel Works had expanded to SW site corner across former Air Strips and opencast ironstone workings typically to within 100m W. In extreme SW corner, opencast extended to site boundary, and two parallel drainage ditches constructed at cutting face.
1994 - 2002	Gokewell Priory Farm buildings demolished – exact date unclear from mapping. Opencast ironstone workings annotated in extreme SW site extension area.	Poultry Farm constructed beyond central E boundary near Heron Holt woodland.



2002 - 14	No significant changes apparent.	Oil Well mapped at Top Wood c. 100m NE*.
	Maximum elevation of drainage ditches /	Opencast workings to W marked as Disused.
	surface water courses on this mapping at	Linear water feature c. 100-200m W of site
	36mAOD in N, 43mAOD centrally,	reflects flooded workings (also shown on Google
	35mAOD central southern, and 30mAOD	Earth imagery from 2003). Tree planting beyond
	in southern area.	SW corner on former opencast area.

\* See 2.2.4.4 above.

A Built Heritage Assessment by Cotswold Archaeology has identified a WWII Heavy Anti-Aircraft Battery in the upper eastern area (north of Gokewell Strip). They report it de-armed in 1942 and conclude that remains are unlikely to survive below ground.

## 2.4 Hydrogeology, Hydrology & Groundwater Vulnerability

BGS groundwater data available on-line indicates that a hydrometric area boundary runs north-south across the higher slopes of the eastern area. Upslope of the highest main extent of the Devensian Blown Sand (Sutton Sand) is approximately 45-55mAOD, the regional geological dip of the bedrock strata at 1-3° to the east directs both any surface water flows and groundwater flow direction eastwards. (The nearest surface water course to the higher eastern boundary is 600-800m remote). Downslope of 45-55mAOD, where the bedrock is overlain by the Blown Sand, both surface water and shallow groundwater flow within the Sand is to the west. The contours on the estimated minimum groundwater level or pressure surface within the Lincolnshire Limestone was also at c. 45mAOD (based on mid 1960's data).

From the published geological strata and topographic maps showing surface water courses, the following can be anticipated at this site:

Shallow Soils	Permeable with intergranular flow in superficial deposits. High fracture/fissure
Permeability	permeability in limestone bedrock.
Anticipated	Very Shallow (<3m below ground level) in lowest western area.
Groundwater Table	Shallow (3-5m below ground level) centrally.
Depth	Moderate (5-10m below ground level) in higher eastern area.
Anticipated	Extreme western boundary zone with opencast & ironworks, flow direction
Croundwater Flow	may be controlled by drainage ditches and likely low flow rate.
Direction	Western zone and up to 45-55mAOD, flow direction to west.
Direction	Eastern boundary and down to 45-55mAOD, down dip to east.
Surface Water Courses	Unnamed drainage ditches (unnamed Tertiary Rivers) on site in western area,
and Flow Direction	typically flow west and north-south. Springs & stream in Far Wood/ Heron
	Holt c. 600m east of site at c. 42mAOD flow east northeast.
	Secondary A Permeable layers in superficial deposits.
	Bedrock strata from east to west:
Aquifor Type	Principal Aquifer in higher limestones.
Additer Type	Secondary Aquifer in lower Coleby Mudstones and Marlstone Rock.
	Unproductive Strata formed by upper Coleby Mudstones.
	(See page 33 of Groundsure Environmental Data for details).
Environment Agency	High leaching potential.
Soils Classification	
Hydraulic Continuity of	Likely throughout site.
Groundwater and Water	
Courses	

A summary plan has been included in Appendix C to indicate:

- Western area below 30mAOD has the likely shallowest groundwater table draining westwards;
- Likely hydraulic continuity with artificial drainage ditches also flowing north-south;
- There is a potential discontinuous springline at 40-43mAOD;


- The upper eastern area drains to east and water table is likely below 45-55mAOD;
- This causes spring issues at c. 40-45mAOD remote from the site to the east;
- Shallow depth soils in complete area are classed as being well drained.

## 2.5 Environmental Information

The following pertinent information on activities within 250m of the site has been extracted from the Groundsure report included in Appendix E.

## 2.5.1 Pollution Information and Licencing

	Number	Distance from Site
Surface Water Abstractions	0	
Groundwater Abstractions	0	
Contaminated Land Register	0	
Entry/ Enforcement / Prohibition	U	
Known Pollution to Controlled Waters	0	
Integrated Pollution Control	0	
Fuel Station Entry	0	
Registered Radioactive Substances	0	
Discharge Consent	1	Revoked (1997) effluent discharge
Discharge Consent	1	Cokewell Priory
		190mW Crosby North Landfill Waste
	2	landfilling (excluding Inert) Current
Known Landfills / Waste Management /		144m W Scunthorpe Concast
Transfer Sites within 250m	2	Surrendered Licence for Industrial, liquid,
		sludge, British Steel Corporation, last
		recorded 1992.
Source Protection Zones	None	
Electronic Area / Elect Warning Status	None	Potential for groundwater flooding at
riooupiani Area / rioou warning status	INDIE	surface locally

## 2.5.2 Geological Information

Hazard Type	Hazard Rating	
Natural and Mining Cavities	Possible small scale mining within site boundaries for	
	ironstones (see historical maps also)	
Potential for Ground Dissolution	Very Low	
Stability Hazard	very Low	
Potential for Landslide Ground Stability	Madarata	
Hazard	roderate	
Potential for Shrinking/Swelling Clay		
Ground Stability Hazard	LOW	
Potential for Compressible Deposits	Madarata	
Ground Stability Hazard	riouerate	
Potential for Collapsible Deposits Ground	Venulow	
Stability Hazard		
Potential for Running Sands Ground	Low	
Stability Hazard	LOW	



## 2.5.3 Background Soils Chemistry

The Groundsure report includes BGS estimated background soil chemistry for 5 metals within shallow soils. This indicates that naturally occurring chromium marginally raised in this area. However interpretation suggests that at these levels, such metals would be unlikely to exceed generic assessment criteria for commercial use. Current National Planning Policy guidance does not consider naturally occurring metals as evidence of contamination.

## 2.5.4 Contemporary Trade Directories

Potentially Contaminative Activities on Site	No additional activities other than the overhead power
Totentially Containinative Activities on Site	supply pylons are given in the Groundsure data.
Potentially Contaminative Business Activitie	No additional significant activities other than the oil well detailed above and the steel works westwards are given in
	the Groundsure data.

## 2.5.5 Groundsure Radon Risk Information

The Groundsure report indicates that the specific site lies in a Radon Affected Area, requiring Full protection measures, for new buildings and dwellings.

## 2.6 Conceptual Exposure Model

This section draws together desk study information, outlines an initial conceptual exposure model, and provides a qualitative assessment of potential contamination via a source-pathway-receptor framework for the proposed redevelopment.

## 2.6.1 Proposed Redevelopment

Outline details of the proposed redevelopment are shown in Appendix A and can be summarised as:

Buildings	None anticipated
Car Parking	Minimal
Access Roads	Main access from northeastern area to centre and former
	Gokewell Priory area. Smaller access roadways to each
	solar PV module area and inverter stations
Landscaping	Not considered substantial
Development Level	As existing
Drainage	Watercourses to be retained with 8m buffer zone alongside.
	Swales (c. 300mm depth by 3m width) to run N-S across
	central lower and extreme southwest areas to limit
	overland flows into watercourses.
Substations and Battery Storage	Battery Storage Zone, Inverter & Transformer stations for
	each area of solar PV modules

- The proposed solar arrays comprise photo voltaic panels laid in rows approximately east west across the field enclosures. Arrays are typically mounted on a metal framework, fixed onto steel pins driven between 0.5-0.75m depth into the ground, depending on the ground conditions. Alternatively, a system of installing small 'foot pads' for the arrays may be adopted, again to a maximum of 0.5-0.75m depth. It is assumed that the east-west alignment across these gentle to moderate westerly facing slopes will require either very minor cutting into the slope, or more likely design of the metal frameworks to incorporate any more critical slope angles.
- In addition there will be a requirement for shallow depth cable trenches, assumed no deeper than 0.5m below existing ground level. Gravel filled drainage trenches of up to 0.5m depth are also assumed.
- The transformer and containerised battery units will be placed on a 300mm permeable gravel bed to allow attenuation and infiltration of rainfall and surface run-off into the underlying soil.



- Structures are limited to inverter and transformer stations, which typically site on reinforced concrete foundation slab, on sub-base aggregate, with a drain surrounding if required. Fencing and CCTV cameras are generally required around the boundary.
- The proposed layout shows the area of the former Gokewell Priory Farm, its associated pond and stream course remaining as existing. There are to be no solar modules within the overhead power cable and pylon corridor.

## 2.6.2 Potential Sources of Contamination

The desk study has been used to identify the likely remnant contaminant sources and distribution. The potential current and historical on- and off-site sources and the contaminants associated with these, derived using CLR8 Potential Contaminants for the Assessment of Land, and through experience of industrial land use, are detailed below.

Potential Contaminants Associated with On-Site Sources			
Description	Metals, semi-metals, non-	Organic chemicals	Ground Gases
	metals, inorganic chemicals		& Vapours
	and others		
Localised small	Range of metals possible,	Unlikely given age of likely	Unlikely given age of likely
ironstone pits, if	given age	backfilling	backfilling
backfilled			
Recent	Unlikely significant given usage	e and historical development	
Agricultural Use			
& Maintenance			

	Potential Relevant Contami	nants Associated with Off-Site	Sources
Description	Metals, semi-metals, non-	Organic chemicals	Ground Gases
	metals, inorganic chemicals		& Vapours
	and others		
Opencast	Range of contaminants	Range of contaminants	Unlikely given distance,
Ironstone	possible, although unlikely	possible, although unlikely	topography and ground
Workings, if	mobile in site direction	mobile in site direction	conditions
backfilled			
Electricity	Unlikely to impact within site	boundaries due to distance, to	pography and ground
Substation and	conditions		
overhead			
cables/pylons			
infrastructure			
Iron & Steel	Air borne dust & particulate	Unlikely given distance, topog	raphy and ground conditions
Works	contamination possible for		
	range of metals		
Oil Well	Unlikely given land usage and	ground conditions, depth of dr	illing and date of operational
Infrastructure at	use (1980's?)		
Top Wood			
(95m remote)			

The potential relevant contamination sources are therefore considered to be limited to remnant metals in soils within any localised backfilled ironstone pits, and air borne derived particulates from the extensive industrial complex to the west and southwest, remaining within shallow depth site topsoil. The Gokewell Priory Farm building area has been demolished since 1994-2002, and no specific development in that area is proposed. The hummocky areas west of this (near Crow and Little Crow Coverts) may relate to either this demolition or drainage works, or less likely to ironstone working.



## 2.6.3 Potential Receptors

A future solar farm end use and known neighbouring agricultural land uses have been used to develop an understanding of the likely sensitive human receptors. In view of the very limited ground intrusion needed to install the panels, and the shallow depth of any service runs, or access track/roadways, it is envisaged that potential receptors to contamination (if present within the soils on-site, or via migration from adjacent sites) are limited to:

- Construction Workers during installation or maintenance. The most critical receptor would therefore be a female adult.
- Future maintenance staff or neighbouring workers.

Information gathered during the site research has been used to develop an understanding of the likely sensitive controlled waters receptors. These are considered to be the drainage ditches, streams and ponds on-site, and the groundwater within the Principal and Secondary A aquifers.

## 2.6.4 Potential Pathways

The presence of Blown Sand superficial deposits beneath both the site and adjacent areas creates a direct potential pathway for cross-migration of ground gases, leachate or mobile contaminants. The presence of drainage water courses indicates a potential pathway for leachate or other mobile contaminants within the site to locally impact on water receptors.

To develop further an understanding of the potential risks posed by the contaminants to human receptors, the pathways through which contaminants may impact sensitive receptors need to be identified. The CLEA model indicates potential exposure routes for assessing risks to human health for a solar array use to be limited to:

- Dermal exposure if contaminated soil exposed during groundworks;
- Inhalation of particulates if contaminated soil exposed during groundworks.

It is considered that the potential pathways with respect to controlled waters will be limited to:

- Lateral migration of perched groundwater or leachate to surface water (drainage ditches or ponds) during construction.
- Surface run-off to water courses if uncontrolled drainage allowed.

## 2.6.5 Conceptual Site Model with Respect to Human Health

The conceptual site model has been developed based upon the following potential source-pathwayreceptor linkages:

SOURCE		PATHWAY		RECEPTOR
Contaminated soils	$\rightarrow$	Dermal exposure (if exposed during groundworks).	$\rightarrow$	On-site female adult construction worker.
Contaminated soils	$\rightarrow$	Outdoor inhalation of soil dust/particulates.	$\rightarrow$	On-site female adult construction worker.

The construction of foundations for the solar arrays typically comprises driving a short pre-formed steel pin into the ground, without production of spoil, or installation of a small diameter 'foot-pad' to support the steel legs. In view of the very limited groundworks required, and the minimal interaction with existing soils, it is considered that the actual risk to groundworkers, should contaminated soils be present within the topsoil and subsoil, is negligible.



## 2.6.6 Conceptual Site Model with Respect to Controlled Waters

The conceptual site model has been developed, based upon the following potential source-pathway-receptor linkages:

SOURCE		ΡΑΤΗΨΑΥ		RECEPTOR
Contaminated soils (if present within construction depth)	→	Leaching from soils or migration of liquid contaminants through the unsaturated zone by means of new man-made or natural pathways	$\rightarrow$	Surface Water Courses & Groundwater
Contaminated soils (if present within construction depth)	→	Run-off from disturbed surface soils	<b>→</b>	Surface Water Courses

The very limited groundworks required to install the solar arrays is considered to have negligible potential to cause or increase leaching, should any contaminated soils be present within the shallow depth of penetration. Run-off during construction works will need to be controlled and managed, as is standard practice. During future use, run-off is unlikely due to the predominant topsoil and turf cover and anticipated infiltration characteristics, but requires consideration.



## 3.0 ANTICIPATED GROUND & GROUNDWATER CONDITIONS

## 3.1 Anticipated Strata

In view of the above, the following ranges of ground conditions are anticipated:

## Higher Eastern Area at or Above 60m AOD

Weathered Oolitie	c Limestones (Lincolnshire Limestone Formation of Inferior Oolite Group)
<u>Depth (m)</u>	Description
GL to 0.5/0.75	TOPSOIL and SUBSOIL (brashy/stony and sandy with limestone gravel)
0.5/0.75 to 1.0/3.0	Medium dense silty SAND with increasing gravel and sandy GRAVEL with a variable (loamy) silty binder, clayey in parts (WEATHERED INFERIOR OOLITE GROUP)
Below 1.0/3.0	Cream oolitic LIMESTONE, highly fractured with brown sandy SILT infilling (INFERIOR OOLITE GROUP)

## Central Area between 50-60m AOD

Sandy Ironstone and Sandstones (Grantham Formation & Northampton Sand) or Coleby Mudstones)

<u>Depth (m)</u> GL to 0.5/0.75	<u>Description</u> TOPSOIL and SUBSOIL (slightly stony and very sandy)
0.5/0.75 to 1.0/2.0	Medium dense silty SAND and SILT (WEATHERED OOLITE OR LIAS GROUP)
1.0/2.0 to 2.0/4.0	Dense gravel becoming weathered bedrock of SILTSTONE, sandy IRONSTONE and SANDSTONE (NORTHAMPTON SAND) or Firm yellow or grey CLAY, highly weathered laminated MUDSTONE/ SILTSTONE OR SANDSTONE (LIAS GROUP)

## Central & Western area between 30-50m AOD

Blown Sand overlying Lias mudstones and locally limestones

Depth (m)	Description
GL to 0.5/0.75	TOPSOIL and SUBSOIL (slightly stony and very sandy)
0.5/0.75 to 2.0/4.0	Loose or medium dense yellow brown silty SAND with some gravelly sand (SUTTON SAND / DEVENSIAN BLOWN SAND)
Below 2.0/4.0	Dense sandy IRONSTONE and SANDSTONE (NORTHAMPTON SAND) or

Firm yellow or grey CLAY, highly weathered laminated MUDSTONE/ SILTSTONE OR SANDSTONE (LIAS GROUP)

## Lower Western area at or below 30m AOD Blown Sand overlying Lias Mudstones

Biowin Sand Overiy	
<u>Depth (m)</u>	Description
GL to 0.5/0.75	TOPSOIL and SUBSOIL (slightly stony and clayey, very sandy)
0.5/0.75 to 2.0/4.0	Loose or medium dense yellow brown slightly clayey silty SAND with some gravelly sand (SUTTON SAND / DEVENSIAN BLOWN SAND)
Below 2.0/4.0	Firm dark grey CLAY, highly weathered laminated shaley MUDSTONE/ SILTSTONE (LIAS GROUP) (includes Pecten Ironstone)



## 3.2 Anticipated Groundwater and Leachate

It is anticipated that rainfall infiltration will rapidly move down through the free-draining topsoil and into the superficial granular deposits in the central and western area, and into the fissured predominant limestones in the higher eastern area. The potential groundwater conditions, springline and drainage directions are shown on an annotated plan included in Appendix C.

The groundwater table within the higher Lincolnshire Limestone Formation will be controlled by regional dip direction, which here is predominantly eastwards at  $1-3^{\circ}$ . The likely groundwater elevation is between 45-55mAOD, ie at least 5m below ground level in this higher area.

Below 50mAOD the occurrence of Blown Sand deposits appears to promote good drainage of the shallow depth soils, and the moderate slopes within the central area at 1 in 10 to 1 in 20, are likely to have an unconfined groundwater table within the basal layers of these sands.

Below 30mAOD on the lowest western area, the Blown Sands may well become more clayey or silty, and the underlying Coleby Mudstone of the Upper Lias, with a shallow surface slope of 1 in 50 to 1 in 60 appears to promote a shallower water table. Spring issues are noted on the historical mapping at around 40-43mAOD and drainage ditches are prevalent below this elevation. Below 30mAOD the extreme western area may well have more poorly draining shallow soils, with frequent drainage ditches required. In addition, any backfilled ironstone workings could create localised poorly drained surface soils.

Nevertheless, the soils throughout the complete site area are classified as well drained or free draining.

## 3.3 Anticipated Ground Gas Regime

There is a substantial industrial area downslope to the west and major opencast ironstone workings, which may have been partially backfilled. It is not anticipated that an abnormal ground gas regime will be present beneath the majority of the site, in view of the topography, distance and apparent lack of continuity within the Blown Sand deposits.

However there remains a potential for abnormal ground gas development beneath the more level and closer western zone, and locally where small scale ironstone workings may have been backfilled.



## 4.0 CONTAMINATED LAND CONSIDERATIONS

## 4.1 General

The desk study has indicated that the current site has a prolonged history of agricultural usage. There is no specific evidence of significant large-scale ironstone extraction or landfilling within the boundaries proven to date, with the exception of the extreme southwestern zone, where opencast workings are annotated on the 1994 map. There appears also to have been small scale extraction via pits and near surface digging in the lower western area. Adjacent to the west and northwest boundaries, where there has been substantial ironstone working off-site, both opencast and underground mining areas may well be backfilled with unknown materials. There has been prolonged heavy industry immediately beyond the site boundaries.

## 4.2 Qualitative Risk Assessment

The currently proposed solar farm is likely to involve construction activity within the uppermost 500-1500mm of ground level. The likelihood of solar array construction creating an adverse, or worsening impact on the contaminant exposure model given above, is therefore considered negligible for most of the site and low for potential backfilled features.

There is a negligible risk of a new controlled waters pollutant linkage being created due to the very shallow depth of construction activity, and the non-polluting nature of the development.

It is not currently anticipated that shallow depth soils will include significant remnant contamination, however this will need to be confirmed in view of the proximity of industrial sites and suggested small scale pit extraction in the extreme western boundary area, and recent 1990's opencast working in one small area. The majority of proposed construction however involves minimal ground intrusion, and it is considered that the pathway for exposure of groundworkers during construction is unlikely to create a significant contaminant linkage, with standard practice.

The overall ground gas regime beneath the site is likely to be normal or near normal. The proposed construction of solar arrays will not have any overall adverse impact on that ground gas regime. In the lower western area there is potential for an abnormal ground gas regime, due to any backfilled workings, and requires further consideration in view of the proposal for buried electrical plant and cabling.

## 4.3 Conclusions

In view of the above low levels of risk and proposed change of use, it is advisable that limited investigation/assessment be completed. It is concluded that for contaminated land assessment:

- Confirmatory intrusive contamination investigation is recommended, concentrated on the western boundary, targeted at specific features shown on historical maps. This will provide data on the occurrence and variation in shallow depth soils conditions (typically between ground level to Im depth, and with deeper investigation at limited locations). The most technically appropriate method of investigation would be with shallow open-drive sampling boreholes.
- If these boreholes confirm the absence of significant extraction or landfilling in the western boundary zone, it seems unlikely to be necessary to undertake further investigation for this aspect across the remainder of the site. However where other geotechnical or drainage investigations are to be undertaken to provide data for design and construction, the opportunity to inspect and sample at those locations can be taken, to confirm deeper ground conditions and obtain additional soils samples for confirmatory analyses.
- Near surface and deeper gas monitoring should confirm the typical gas regime, particularly in the lower western area. This can be achieved by gas measurements within the borehole standpipes, which should have a variety of response zone depths. A sufficient programme of gas and groundwater monitoring would be I- 2 visits initially during low or rapidly falling atmospheric pressure periods. That would identify whether any further monitoring is required.



• Assuming groundwater is proven within the standpipe installations, sampling can provide analyses of water quality and confirm any contaminant impact on controlled waters beneath the current site.

Following intrusive investigations the conceptual model can be updated and a quantitative risk assessment made. That will identify any specific areas of concern and the need for any further investigation, risk assessment or design measures.



## 5.0 GEOTECHNICAL CONSIDERATIONS

The anticipated ground conditions indicate predominantly granular superficial deposits or over-consolidated mudstones beneath the majority of the western and central area, and limestone derived soils in the higher eastern area. Under the anticipated minor loading changes due to solar array construction, these soils are unlikely to prove problematic.

If confirmation of shallow depth soils characteristics suggests it is merited, for instance in any shallow backfilled ironstone pits or backfilled workings, consideration could either be given to use of geogrid reinforcement in specific areas to increase soil stability and tensile strength, or shallow vibro compaction simply to produce a uniform formation and limit differential movement of solar arrays to within acceptable limits. The stability of the proposed anchoring / foundation system should provide adequate resistance to self-weight, wind and snow loadings.

The construction of the arrays should ensure that enhanced surface run-off, or erosion does not occur. Across the majority of the proposed array areas this is not considered likely, in view of the granular soils, described as being well-drained or free-draining. However where transformer and battery units are proposed, these should be sat on a permeable gravel bed to promote attenuation and infiltration to the underlying soils.

Intrusive geotechnical investigation will therefore be required to confirm the following aspects:

- The typical thickness of topsoil, subsoil and superficial deposits and their material, grading and strength properties;
- Description and classification of shallow depth soils, along with field infiltration trials via soakaway testing, to measure in situ permeability of near surface soils, and to compare against design permeability, drainage assumptions and design;
- Evidence for past shallow ironstone working or backfilling of such features, perhaps by 'bell pit' extraction or similar, in the lower western area, specifically investigating features indicated on historical mapping, where they occur within proposed solar array zones.

It would be prudent to take specialist advice on the need for Unexploded Ordnance supervision during any works close to the former WWII anti-aircraft battery identified by the heritage consultant in the eastern area.

It would also be prudent for the project team to obtain further details of the nearby oil well permissions, reservoir depth(s) and potential zone of influence, should future exploitation be proposed.

The geotechnical investigation should be combined with contamination assessments discussed above. Machine excavated trial pitting will be the most appropriate technique for investigation and soakaway trials on this large area.



Appendix A

Site Location

GEOLOGICAL • GEOTECHNICAL • ENVIRONMENTAL • ENGINEERING

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom Tel: 01275 333 036 www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37





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LITTLE CROW SOLAR PARK - SITE LOCATION PLAN Pegasus

A CANADA A





Appendix B

Site Description/Photographs

GEOLOGICAL • GEOTECHNICAL • ENVIRONMENTAL • ENGINEERING

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom Tel: 01275 333 036 www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37

# Santon Solar/Battery Site survey photos







View 6











View 8







View 9 Fox tbc





View 12 Track to Raventhorpe

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View 25





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# View 28















View 34

View 35





View 36



























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View 49

High Santon Farm View 50







View 52







Appendix C

Geological Information

GEOLOGICAL • GEOTECHNICAL • ENVIRONMENTAL • ENGINEERING

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## **Soil Site Report**

**Extended Soil Report** 

## Santon 1844

Easting: 493973 Northing: 409748 Site Area: 1km x 1km

Prepared for: Kay Boreland, Integrale Ltd Date: 08 Aug 2017





## Citation

Citations to this report should be made as follows:

National Soil Resources Institute (2017) Soils Site Report for location 493973E, 409748N, 1km x 1km, National Soil Resources Institute, Cranfield University. Accessed via: https://www.landis.org.uk/sitereporter

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## **About this report**

This Soil Site Report identifies and describes the properties and capacities of the soil at your specified location as recorded in the National Soil Map for England and Wales. It has been produced by Cranfield University's <u>National Soil Resources Institute</u>.

The National Soil Map represents the most accurate and comprehensive source of information about the soil at the national coverage in England and Wales. It maps the distribution of soil mapping units (termed soil associations) which are defined in terms of the main soil types (or soil series) that were recorded for each soil association during field soil survey. Each soil association is named after its principal soil series and these bear the location name from where they were first described (e.g. Windsor). Each of these soil associations have differing environmental characteristics (physical, chemical and biological) and it is by mapping these properties that the range of thematic maps in this report have been produced.

Soil types and properties vary locally, as well as at the landscape scale. It is not possible to identify precisely the soil conditions at a specific location without first making a site visit. We have therefore provided you with information about the range of soil types we have identified at and around your selected location. Schematic diagrams are also provided to aid accurate identification of the soil series at your site.

Whilst an eight-figure national grid reference should be accurate to within 100m, a single rural Postcode can cover a relatively large geographical area. Postcodes can therefore be a less precise basis for specifying a location. The maps indicate the bounded area the reports relate to.

Your Site Soil Report will enable you to:

- identify the soils most likely to be present at and immediately around your specified location;
- understand the patterns of soil variation around your location and how these correlate with changes in landscape;
- identify the nature and properties of each soil type present within the area;
- understand the relevant capacities and limitations of each of the soils and how these might impact on a range of factors such as surface water quality.

Provided that this Site Soil Report is not modified in any way, you may reproduce it for a thirdparty.

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## **Table of Contents**

## 1. Soil Thematic Maps

1a Soils - Spatial Distribution	2
1b Hydrology of Soil Type (HOST)	4
1c Ground Movement Potential	6
1d Flood Vulnerability	8
1e Risk of Corrosion to Ferrous Iron	10
1f Pesticide Leaching Risk	12
1g Pesticide Runoff Risk	14
1h Potential for Pesticide Adsorption	16
1i Hydrogeological Rock Type	18
1j Ground Water Protection Policy (GWPP)	20
1k Soil Parent Material	22
1I Expected Crops and Land Use	24
1m Natural Soil Fertility	26
1n Simple Topsoil Texture	28
1o Typical Habitats	30
2. Soil Association Descriptions	32
BANBURY (544)	33
NEWPORT 1 (551d)	35
3. Soil Series Properties	37
SOIL PROPERTY DEFINITIONS	38
5.44 BANBURY (Bp) (101)	39
8.21 BLACKWOOD (bK) (124)	40
5.45 IRONDOWN (Ir) (802)	41
5.51 NEWPORT (Na) (1310)	42
5.53 RUDGE (rJ) (1743)	43
5.44 TADMARTON (tM) (1900)	44
5.41 WICK (wQ) (2225)	45
4. Topsoil Element Background Levels	46
a. Analysis Within a 15km Radius (28 Sample Points)	48
b. Analysis Within a 50km Radius (271 Sample Points)	49
c. National Analysis (5686 Sample Points)	50
SOIL GUIDELINES VALUES (SGV)	51
ANALYSES DEFINITIONS	52
References	55



## **1. Soil Thematic Maps**

This section contains a series of maps of the area surrounding your selected location, presenting a number of themes relating to the characteristics of the soils. These provide an overview of the nature and condition of the local soil conditions. It is these conditions that may be used to infer the response of an area to certain events (with the soil as a receptor), such as pollution contamination from a chemical spill, or an inappropriate pesticide application and the likelihood of these materials passing though the soil to groundwater. Other assessments provide an insight into the way a location may impact, by corrosive attack or ground movement, upon structures or assets within the ground, for example building or engineering foundations or pipes and street furniture.

Soil is a dynamic environment with many intersecting processes, chemical, physical and biological at play. Even soils 'sealed' over by concrete and bitumen are not completely dormant. The way soils respond to events and actions can vary considerably according to the properties of the soil as well as other related factors such as land-use, vegetation, topography and climate. There are many threats facing our national soil resource today and importance should be given to identifying the best measures aimed towards soil protection, ensuring the usage of soils in the most sustainable way. This report is therefore a useful snapshot of the soil properties for your given area, providing a summary of a broad range of ground conditions



Figure 1: Location of study area



## **1a Soils - Spatial Distribution**



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## **Soils - Spatial Distribution Key**

Well drained brashy fine and coarse loamy ferruginous soils over ironstone.

544 BANBURY

551d NEWPORT 1 Deep well drained sandy and coarse loamy soils.

#### SOIL ASSOCIATION DESCRIPTION

Soil associations represent a group of soil series (soil types) which are typically found occurring together, associated in the landscape (Avery, 1973; 1980; Clayden and Hollis, 1984). Soil associations may occur in many geographical locations around the country where the environmental conditions are comparable. For each of these soil associations, a collection of soil types (or soil series) are recorded together with their approximate proportions within the association. Soil associations have codes as well as textual names, thus code '554a' refers to the 'Frilford' association. Where a code is prefixed with 'U', the area is predominantly urbanised (e.g. 'U571v'). The soil associations for your location, as mapped above, are described in more detail in Section 2: Soil Association Descriptions.



## 1b Hydrology of Soil Type (HOST)



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## Hydrology of Soil Type (HOST) Key



2 Free draining permeable soils on 'brashy' or dolomitic limestone substrates with high permeability and moderate storage capacity

5 Free draining permeable soils in unconsolidated sands or gravels with relatively high permeability and high storage capacity

#### HOST CLASS DESCRIPTION

The Hydrology of Soil Types (HOST) classification describes the dominant pathways of water movement through the soil and, where appropriate, the underlying substrate. Eleven drainage models are defined according to the permeability of the soil and its substrate and the depth to a groundwater table, where one is present (Boorman et al,1995). These are further subdivided into 29 HOST classes to which all soil series have been assigned. These classes identify the way soil water flows are partitioned, with water passing over, laterally through, or vertically down the soil column. Analysis of the river hydrograph and the extent of soil series for several hundred gauged catchments allowed mean values for catchment hydrological variables to be identified for each HOST class, The HOST classification is widely used to predict river flows and the frequency and severity of flood events and also to model the behaviour of diffuse pollutants (Hollis et al, 1995).



## **1c Ground Movement Potential**



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## **Ground Movement Potential Key**



1 Very low

\* If a High class is starred, a Very High ground movement potential is likely to be achieved if these soils are drained to an effective depth of at least two metres.

#### **GROUND MOVEMENT POTENTIAL DESCRIPTION**

Clay-related ground movement is the most widespread cause of foundation failure in the UK and is linked to seasonal swelling and shrinkage of the clay. The content of clay within the soils of your selected area has therefore a direct bearing upon the likelihood of ground movement.

Among the inorganic particles that constitute the solid component of any soil, clay particles are the smallest and defined as being less than 0.002 mm - equivalent spherical diameter (esd) in size. Clay particles occur in most kinds of soil but they only begin to exert a predominant influence on the behaviour of the whole soil where there is more than 35 per cent (by weight) of clay-sized material present.

Because clay particles are very small and commonly platy in shape they have an immense surface area onto which water can be attracted, relative to the total volume of the soil material. In addition to surface attraction or inter-crystalline absorption of water, some clay minerals, those with three layers of atoms (most other kinds of clay have only two layers of atoms) are able to absorb and hold additional water between these layers. It is these types of clay mineral, which are widespread in British soils and commonly known as smectites that have the greatest capacity to shrink and swell.

In a natural undisturbed condition, the moisture content of deep subsoil clay does not change greatly through the year and consequently there are no changes in volume leading to shrinkage and swelling. However, when clays are exposed at or near the ground surface and especially when vegetation is rooting in them seasonal moisture and volume changes can be dramatic. Plants and trees transpire moisture from the soil to support their growth and transfer necessary nutrients into their structures. Surface evaporation also takes place from soil and plant structures, and the combination of evaporation from surfaces and transpiration by plants and trees is termed evapotranspiration. Thus, the layer of soil material down to 2m depth into which plants will root is critical when assessing the vulnerability of land to subsidence.

Whenever soil moisture is continuously being replenished by rainfall, the soil moisture reserves will be unaffected by the removal of moisture by plants as there is no net loss. However, in many parts of Britain, particularly in the south and east, summer rainfall is small and is exceeded by evapotranspiration. Water reserves are then not sufficiently replenished by rainfall and so a soil moisture deficit develops. The water removed from a clayey soil by evapotranspiration leads to a reduction in soil volume and the consequent shrinkage causes stress in the soil materials leading in turn to stress on building foundations that are resting in the soil (Hallett, et al, 1994).

The foundations themselves may then move and thus cause damage to building structures. This problem can be exacerbated by the fact that the soil beneath the structure may not dry out uniformly, so that any lateral pressure exerted on the building foundation is made effectively greater. This assessment identifies the likelihood of soil conditions being prone to ground movement given these other factors.



## 1d Flood Vulnerability



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#### Flood Vulnerability Key



1 Minor risk

#### FLOOD VULNERABILITY DESCRIPTION

The inundation of properties by flood water can occur in a number of circumstances. Surface run-off can collect on low-lying land from upslope following heavy rainfall. More commonly rivers, lakes and/or the sea extend beyond their normal limits as a result of prolonged or intense rainfall, unusually high tides and/or extreme wind events. Water damage to properties and their contents is compounded by the deposition of sediment suspended in the flood waters. The spatial distribution of such waterborne sediment (or alluvium as defined in soil science) is one basis upon which land that has been subject to historical flooding can be mapped, and this forms a basis for present-day flooding risk assessment.

Both riverine and marine alluvium are identified as distinct soil parent materials within the British soil classifications. Combining soil map units that are dominated by soil series developed in alluvium across Great Britain identifies most of the land that is vulnerable to flooding. This assessment does not account for man-made flood defence measures, showing instead the areas where once water has stood.



## **1e Risk of Corrosion to Ferrous Iron**



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#### **Risk of Corrosion to Ferrous Iron Key**



1 Non-aggressive

\* If a class is starred, it is assumed that there are moderate amounts of sulphate in the soil. If there is abundant sulphate present, the soil may be one class more aggressive. Conversely, if there is very little sulphate, the soil may be one class less aggressive to

buried ferrous iron.

**RISK OF CORROSION TO FERROUS IRON DESCRIPTION** 

Buried iron pipes and other infrastructure corrode at rates that are influenced by soil conditions (Jarvis and Hedges, 1994). Soil acidity, sulphide content, aeration and wetness all influence the corrosivity of the soil. These factors are used to map 5 major classes of relative corrosivity.



## **1f Pesticide Leaching Risk**



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#### Pesticide Leaching Risk Key

H2mo Sandy soil with low organic matter; groundwater at moderate depth

I1dl Deep loamy soil over soft limestone with deep groundwater

#### PESTICIDE LEACHING CLASS DESCRIPTION

The natural permeability and water regime of soils are influential in determining the fate and behaviour of pesticides applied to the crop and soil surface (Hollis et al, 1995). A system of vulnerability assessment was devised as part of the national system for Policy and Practice for the Protection of Groundwater. This divided soils into three primary vulnerability classes.

H - Soils of high leaching capacity with little ability to attenuate non-adsorbed pesticide leaching which leave underlying groundwater vulnerable to pesticide contamination.

- I Soils of intermediate leaching capacity with a moderate ability to attenuate pesticide leaching.
- L Soils of low leaching capacity through which pesticides are unlikely to leach.

The primary classes have been further subdivided into nearly forty subclasses. These subclasses, with their descriptions, are mapped above. These classes do not account for differences in land cultivation, which can also have a significant impact on pesticide behaviour.



## 1g Pesticide Runoff Risk



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## Pesticide Runoff Risk Key



S5 Very low run-off potential.

#### PESTICIDE RUNOFF RISK DESCRIPTION

The physical properties and natural water regime of soils influence the speed and extent of lateral water movement over and through the soil at different depths (Hollis et al, 1995). At as result, soils can be classed according to the potential for pesticide run-off. Five runoff potential classes are identified for mineral soils and a further two for peat soils.



## **1h Potential for Pesticide Adsorption**



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## **Potential for Pesticide Adsorption Key**



m Moderate adsorption potential.



v Very low adsorption potential.

#### POTENTIAL FOR PESTICIDE ADSORPTION DESCRIPTION

The physical properties and natural water regime of soils influence the speed and extent of lateral water movement over and through the soil at different depths (Hollis et al, 1995). The mineral soil classes are further subdivided according to their potential for pesticide adsorption.



## 1i Hydrogeological Rock Type



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#### Hydrogeological Rock Type Key

4 soft Magnesian, brashy or Oolitic limestone and ironstone



34 sand

#### HYDROGEOLOGICAL ROCK TYPE DESCRIPTION

The hydrogeological classification of the soil parent materials provides a framework for distinguishing between soil substrates according to their general permeability and whether they are likely to overlie an aquifer. Every soil series has been assigned one of the 32 substrate classes and each of these is characterised according to its permeability (being characterised as permeable, slowly permeable or impermeable). For further information, see Boorman et al (1995).

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## 1j Ground Water Protection Policy (GWPP)



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## **Ground Water Protection Policy (GWPP) Key**

H2 Deep, permeable coarse textured soils of high leaching potential, which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential

11 Soils of intermediate leaching potential which have a moderate ability to attenuate a wide range of diffuse source pollutants but in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soil layer

#### **GWPP LEACHING CLASS DESCRIPTION**

The Ground Water Protection Policy classes describe the leaching potential of pollutants through the soil (Hollis, 1991; Palmer et al, 1995). The likelihood of pollutants reaching ground water is described. Different classes of pollutants are described, including liquid discharges adsorbed and non-adsorbed pollutants.



## **1k Soil Parent Material**



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#### Soil Parent Material Key



85 Glaciofluvial drift



106 Jurassic and Cretaceous ironstone

#### SOIL PARENT MATERIAL DESCRIPTION

Along with the effects of climate, relief, organisms and time, the underlying geology or 'parent material' has a very strong influence on the development of the soils of England and Wales. Through weathering, rocks contribute inorganic mineral grains to the soils and thus exhibit control on the soil texture. During the course of the creation of the national soil map, soil surveyors noted the parent material underlying each soil in England and Wales. It is these general descriptions of the regional geology which is provided in this map.



## **1I Expected Crops and Land Use**



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#### **Expected Crops and Land Use Key**



269 Winter cereals with short term grassland, some potatoes; permanent grassland on valley slopes; some sugar beet In Eastern Region.

283 cereals, sugar beet and potatoes; dairying on short term grassland in Cheshire and Wales.

#### EXPECTED CROPS AND LAND USE DESCRIPTION

Individual soils are commonly associated with particular forms of land cover and land use. Whilst the soil surveyors were mapping the whole of England and Wales, they took careful note of the range of use to which the land was being put. This map shows the most common forms of land use found on each soil unit.



## **1m Natural Soil Fertility**



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## National Soil Resources Institute



#### Natural Soil Fertility Key

1 High



#### NATURAL SOIL FERTILITY DESCRIPTION

Soil fertility can be greatly altered by land management especially through the application of manures, lime and mineral fertilisers. What is shown in this map, however, is the likely natural fertility of each soil type. Soils that are very acid have low numbers of soil-living organisms and support heathland and acid woodland habitats. These are shown as of very low natural fertility. Soils identified as of low natural fertility are usually acid in reaction and are associated with a wide range of habitat types. The moderate class contains neutral to slightly acid soils, again with a wide range of potential habitats. Soil of high natural fertility are both naturally productive and able to support the base-rich pastures and woodlands that are now rarely encountered. Lime-rich soils contain chalk and limestone in excess, and are associated with downland, herb-rich pastures and chalk and limestone woodlands.


## **1n Simple Topsoil Texture**



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### Simple Topsoil Texture Key

2 Loamy

4 5

4 Sandy

#### SIMPLE TOPSOIL TEXTURE DESCRIPTION

Soil texture is a term used in soil science to describe the physical composition of the soil in terms of the size of mineral particles in the soil. Specifically, we are concerned with the relative proportions of sand, silt and clay. Soil texture can vary between each soil layer or horizon as one moves down the profile. This map indicates the soil texture group of the upper 30 cm of the soil. `Light? soils have more sand grains and are described as sandy, while `heavy? soils have few sand grains but a lot of extremely small particles and are described as clayey. Loamy soils have a mix of sand, silt and clay-sized particles and are intermediate in character. Soils with a surface layer that is dominantly organic are described as Peaty. A good understanding of soil texture can enable better land management.



## **10 Typical Habitats**



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### **Typical Habitats Key**

1 Acid dry pastures; acid deciduous and coniferous woodland; potential for lowland heath

3 Base-rich pastures and deciduous woodlands

#### TYPICAL HABITATS DESCRIPTION

There is a close relationship between vegetation and the underlying soil. Information about the types of broad habitat associated with each soil type is provided in this map. Soil fertility, pH, drainage and texture are important factors in determining the types of habitats which can be established. Elevation above sea level and sometimes even the aspect, the orientation of a hillslope, can affect the species present. This map does not take into account the recent land management, but provides the likely natural habitats assuming good management has been carried out.



# 2. Soil Association Descriptions

The following pages describe the following soil map units, (soil associations), in more detail.



**BANBURY 544** 

Well drained brashy fine and coarse loamy ferruginous soils over ironstone.

NEWPORT 1 551d Deep well drained sandy and coarse loamy soils.

The soil associations are described in terms of their texture and drainage properties and potential risks may be identified. The distribution of the soils across England and Wales are provided. Further to this, properties of each association's component soil series are described in relation to each other. Lastly, schematic diagrams of each component series are provided for greater understanding and in-field verification purposes.

### BANBURY (544)

Well drained brashy fine and coarse loamy ferruginous soils over ironstone.

#### a. General Description

Well drained brashy fine and coarse loamy ferruginous soils over ironstone.Some deep fine loamy over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.

The major landuse on this association is defined as Winter cereals with short term grassland, some potatoes; permanent grassland on valley slopes; some sugar beet In Eastern Region.

#### b. Distribution (England and Wales)

The BANBURY association covers 712 km<sup>2</sup> of England and Wales which accounts for 0.47% of the landmass. The distribution of this association is shown in figure 2. Note that the yellow shading represents a buffer to highlight the location of very small areas of the association.

#### c. Comprising Soil Series

BANBURY (Bp)

**IRONDOWN** (Ir)

OTHER

TADMARTON (tM)

Multiple soil series comprise a soil association. The soil series of the BANBURY association are outlined in Table 1 below. In some cases other minor soil series are present at a particular site, and these have been grouped together under the heading 'OTHER'. We have endeavoured to present the likelihood of a minor, unnamed soil Figure 2: Association Distribution series occuring in your site in Table 1.

Schematic diagrams of the vertical soil profile of the major constituent soil series are provided in Section D to allow easier identification of the particular soil series at your site.

Table 1: The component soil series of the BANBURY soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided. **Soil Series** Description

material passing to clay or soft mudstone

other minor soils

ferruginous medium loamy material over lithoskeletal ironstone

ferruginous medium loamy or medium silty drift over clayey

ferruginous light loamy material over lithoskeletal ironstone

Area %

50%

25%

15%

10%







### **BANBURY (544)**

Well drained brashy fine and coarse loamy ferruginous soils over ironstone.

#### d. BANBURY Component Series Profiles



### **NEWPORT 1 (551d)**

Deep well drained sandy and coarse loamy soils.

#### a. General Description

Deep well drained sandy and coarse loamy soils.Some sandy soils affected by groundwater. The major landuse on this association is defined as cereals, sugar beet and potatoes; dairying on short term grassland in Cheshire and Wales.

#### b. Distribution (England and Wales)

The NEWPORT 1 association covers 1191 km<sup>2</sup> of England and Wales which accounts for 0.79% of the landmass. The distribution of this association is shown in figure 3. Note that the yellow shading represents a buffer to highlight the location of very small areas of the association.

#### c. Comprising Soil Series

Multiple soil series comprise a soil association. The soil series of the NEWPORT 1 association are outlined in Table 1 below. In some cases other minor soil series are present at a particular site, and these have been grouped together under the heading 'OTHER'. We have endeavoured to present the likelihood of a minor, unnamed soil series occuring in your site in Table 2.

Schematic diagrams of the vertical soil profile of the major constituent soil series are provided in Section D to allow easier identification of the particular soil series at your site.

**Figure 3: Association Distribution** 

Table 2: The	component	soil series o	of the NEW	PORT 1 so	I association	n. Because	absolute p	roportions o	of the
comprisina s	series in this	association	varv from	location to	location. the	e national	proportions	are provide	ed.

Soil Series	Description	Area %
NEWPORT (Na)	sandy drift with siliceous stones	40%
WICK (wQ)	light loamy drift with siliceous stones	20%
BLACKWOOD (bK)	sandy drift with siliceous stones	10%
RUDGE (rJ)	sandy drift with siliceous stones	10%
OTHER	other minor soils	20%









### NEWPORT 1 (551d)

Deep well drained sandy and coarse loamy soils.

### d. NEWPORT 1 Component Series Profiles





# **3. Soil Series Properties**

The following pages describe the following soil series in more detail:

BANBURY (Bp)	ferruginous medium loamy material over lithoskeletal ironstone
BLACKWOOD (bK)	sandy drift with siliceous stones
IRONDOWN (Ir)	ferruginous medium loamy or medium silty drift over clayey material passing to clay or soft mudstone
NEWPORT (Na)	sandy drift with siliceous stones
RUDGE (rJ)	sandy drift with siliceous stones
TADMARTON (tM)	ferruginous light loamy material over lithoskeletal ironstone
WICK (wQ)	light loamy drift with siliceous stones



### SOIL PROPERTY DEFINITIONS

The following terms are used in the report.

### DROCK (Depth to rock (cm))

Depth (cm) to rock. 999 implies no rock

#### DGLEY (Depth to gleying (cm))

Depth to gleyed horizon (cm). 999 implies NO gleyed horizon present.

#### DIMP\_DP (Depth to slowly permeable layer (downward percolation) (cm))

Depth (cm) to slowly permeable layer, i.e. in which effectively there is no downward percolation of water - 999 implies NO slowly permeable layer

#### DIMP\_UD (Depth to slowly permeable layer (upward diffusion) (cm))

Depth (cm) to slowly permeable layer - upward diffusion, i.e. in which effectively there is no upward movement of water - 999 implies NO slowly permeable layer

#### IAC\_DP (Integrated air capacity (IAC) (mm))

Integrated air capacity (downward percolation), a measurement of the volume of air in moist soils (0.05 bar suction) integrated from the surface to either an impermeable horizon, bedrock or 1m whichever is the shallowest, used for estimating the water storage potential of a soil

#### SPR (Standard percentage runoff (SPR) (%))

Standard Percentage Run-off. Dimensionless variable (range 0 to 100 %) that represents the percentage of rainfall that causes the short-term increase in flow at the catchment outlet seen after the storm event

#### BFI (Base flow index (BFI) (0 to 1))

Baseflow index. Dimensionless variable (range 0 to 1) that expresses the fraction of the average flow volume (in a river), represented by the contribution from groundwater storage

#### AWC (Available water (AWC) (mm))

Available water to 1m for a specific soil type, water available between suctions 5 and 1500kPa

#### AP\_GRASS (Available water for grass (mm))

Available water (AP) in the profile for grass (mm); water available between suctions 5 and 1500 kPa

#### AP\_CEREAL (Available water for cereal (mm))

Available water (AP) in the profile for cereals (mm); water available between suctions 5 and 1500 kPa

#### AP\_SB (Available water for sugar (mm))

Available water (AP) in the profile for sugar beet (mm); water available between suctions 5 and 1500 kPa

#### AP\_POT (Available water for potatoes (mm))

Available water (AP) in the profile for potatoes (mm); water available between suctions 5 and 1500 kPa



# 5.44 BANBURY (Bp) (101)

Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.0.D. Most are in agricultural use.
Soil group:	4 brown earths	Non-alluvial, with non-calcareous loamy or clayey subsoils without significant clay enrichment.
Soil Subgroup:	4 ferritic brown earths	(unmottled with bright ochreous iron-rich subsoil)
Soil Series:	Banbury series	ferruginous medium loamy material over lithoskeletal ironstone

Property	Value	0
Depth to rock (cm)	70	(Ap) Dark brown, slightly stony clay loam or sandy clay loam.
Depth to gleying (cm)	n/a*	(Bw) Strong brown, slightly stony clay loam;
Depth to slowly permeable layer (downward percolation) (cm)	n/a*	strong medium granular or fine angular blocky structure.
Depth to slowly permeable layer (upward diffusion) (cm)	n/a*	(BCu) Strong brown or reddish brown, very 
Integrated air capacity (IAC) (mm)	157	70
Standard percentage runoff (SPR) (%)	2	(Cr) Strong brown or reddish brown, extremely stony clay loam; massive structure.
Base flow index (BFI) (0 to 1)	0.98	
Available water (AWC) (mm)	120	
Available water for grass (mm)	120	
Available water for cereal (mm)	115	
Available water for sugar (mm)	120	
Available water for potatoes (mm)	120	BANBURY (Bp)



## 8.21 BLACKWOOD (bK) (124)

Major soil group:	08 ground-water gley soils	Seasonally waterlogged soils affected by a shallow fluctuating groundwater-table. They are developed mainly within or over permeable material and have prominently mottled or greyish coloured horizons within 40 cm depth Most occupy low-lying or depressional sites.
Soil group:	2 sandy gley soils	Sandy, with distinct topsoil and no clay-enriched subsoil.
Soil Subgroup:	1 typical sandy gley soils	(with non calcareous subsoil)
Soil Series:	Blackwood series	sandy drift with siliceous stones

Property	Value	0
Depth to rock (cm)	n/a*	(Ap) Very dark greyish brown, slightly stony or stoneless loamy sand.
Depth to gleying (cm)	30	- 20 (Bg1) Pale brown, mottled, slightly stony loamy - sand; weak medium and coarse subangular blocky structure
Depth to slowly permeable layer (downward percolation) (cm)	n/a*	
Depth to slowly permeable layer (upward diffusion) (cm)	n/a*	(Bg2) Light brownish grey, mottled, slightly stony — loamy sand; weak medium subangular blocky or
Integrated air capacity (IAC) (mm)	208	single grain structure.
Standard percentage runoff (SPR) (%)	35	90 (Cg) Greyish brown, mottled, stoneless, slightly
Base flow index (BFI) (0 to 1)	0.52	100 or moderately stony sand; single grain structure.
Available water (AWC) (mm)	130	
Available water for grass (mm)	125	
Available water for cereal (mm)	125	
Available water for sugar (mm)	145	
Available water for potatoes (mm)	105	BLACKWOOD



# 5.45 IRONDOWN (Ir) (802)

Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.0.D. Most are in agricultural use.
Soil group:	4 brown earths	Non-alluvial, with non-calcareous loamy or clayey subsoils without significant clay enrichment.
Soil Subgroup:	5 stagnogleyic ferritic brown earths	(faintly mottled with bright ochreous iron-rich slowly permeable subsoil)
Soil Series:	Irondown series	ferruginous medium loamy or medium silty drift over clayey material passing to clay or soft mudstone

Property	Value	0
Depth to rock (cm)	100	— (Ap) Dark brown, slightly stony clay loam.
Depth to gleying (cm)	57	25 -
Depth to slowly permeable layer (downward percolation) (cm)	57	(Bw(g)) Yellowish brown, slightly mottled, — slightly stony clay loam; moderate medium subangular blocky structure.
Depth to slowly permeable layer (upward diffusion) (cm)	57	60
Integrated air capacity (IAC) (mm)	78	(BCg) Olive brown, mottled, stoneless clay; weak very coarse prismatic structure.
Standard percentage runoff (SPR) (%)	47	(Cg) Olive brown, mottled, stoneless silty clay; massive structure.
Base flow index (BFI) (0 to 1)	0.52	
Available water (AWC) (mm)	145	
Available water for grass (mm)	125	
Available water for cereal (mm)	125	
Available water for sugar (mm)	160	
Available water for potatoes (mm)	105	IRONDOWN (ir)



# 5.51 NEWPORT (Na) (1310)

Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.0.D. Most are in agricultural use.
Soil group:	5 brown sands	Non-calcareous sandy or sandy gravelly.
Soil Subgroup:	1 typical brown sands	(unmottled with no clay-enriched subsoil)
Soil Series:	Newport series	sandy drift with siliceous stones

Property	Value	0
Depth to rock (cm)	n/a*	(Ap) Dark brown, slightly stony sandy loam or loamy sand.
Depth to gleying (cm)	n/a*	25
Depth to slowly permeable layer (downward percolation) (cm)	n/a*	(Bw) Brown, slightly stony loamy sand or sand; weak fine subangular blocky structure.
Depth to slowly permeable layer (upward diffusion) (cm)	n/a*	55
Integrated air capacity (IAC) (mm)	256	
Standard percentage runoff (SPR) (%)	12	(Cu) Yellowish red or brownish yellow, slightly stony sand; single grain structure.
Base flow index (BFI) (0 to 1)	0.88	
Available water (AWC) (mm)	95	120
Available water for grass (mm)	85	
Available water for cereal (mm)	95	
Available water for sugar (mm)	110	
Available water for potatoes (mm)	70	NEWPORT (Na)



# 5.53 RUDGE (rJ) (1743)

Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.0.D. Most are in agricultural use.
Soil group:	5 brown sands	Non-calcareous sandy or sandy gravelly.
Soil Subgroup:	3 stagnogleyic brown sands	(faintly mottled with slowly permeable subsoil)
Soil Series:	Rudge series	sandy drift with siliceous stones

Property	Value
Depth to rock (cm)	n/a*
Depth to gleying (cm)	70
Depth to slowly permeable layer (downward percolation) (cm)	80
Depth to slowly permeable layer (upward diffusion) (cm)	80
Integrated air capacity (IAC) (mm)	176
Standard percentage runoff (SPR) (%)	47
Base flow index (BFI) (0 to 1)	0.52
Available water (AWC) (mm)	120
Available water for grass (mm)	110
Available water for cereal (mm)	115
Available water for sugar (mm)	135
Available water for potatoes (mm)	95



## 5.44 TADMARTON (tM) (1900)

Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.0.D. Most are in agricultural use.
Soil group:	4 brown earths	Non-alluvial, with non-calcareous loamy or clayey subsoils without significant clay enrichment.
Soil Subgroup:	4 ferritic brown earths	(unmottled with bright ochreous iron-rich subsoil)
Soil Series:	Tadmarton series	ferruginous light loamy material over lithoskeletal ironstone

Property	Value	0
Depth to rock (cm)	70	— (Ap) Dark brown, slightly stony sandy loam.
Depth to gleying (cm)	n/a*	25 -
Depth to slowly permeable layer (downward percolation) (cm)	n/a*	(Bw) Strong brown, slightly or moderately stony — sandy loam; moderate fine angular blocky
Depth to slowly permeable layer (upward diffusion) (cm)	n/a*	
Integrated air capacity (IAC) (mm)	174	(Cr) Strong brown, extremely stony sandy loam:
Standard percentage runoff (SPR) (%)	2	ironstone or sandstone.
Base flow index (BFI) (0 to 1)	0.98	100 -
Available water (AWC) (mm)	115	
Available water for grass (mm)	115	
Available water for cereal (mm)	110	
Available water for sugar (mm)	115	
Available water for potatoes (mm)	100	TADMAR TON (tM)



# 5.41 WICK (wQ) (2225)

Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.0.D. Most are in agricultural use.
Soil group:	4 brown earths	Non-alluvial, with non-calcareous loamy or clayey subsoils without significant clay enrichment.
Soil Subgroup:	1 typical brown earths	(unmottled)
Soil Series:	Wick series	light loamy drift with siliceous stones

Property	Value	0
Depth to rock (cm)	n/a*	(Ap) Dark brown, slightly stony sandy loam or sandy silt loam.
Depth to gleying (cm)	n/a*	30 -
Depth to slowly permeable layer (downward percolation) (cm)	n/a*	(Bw) Brown, slightly stony sandy loam or sandy — silt loam; moderate medium subangular blocky
Depth to slowly permeable layer (upward diffusion) (cm)	n/a*	60 - (Bw) Vellowish brown, slightly or moderately
Integrated air capacity (IAC) (mm)	206	- stony loamy sand or sandy loam; weak medium angular blocky or single grain structure.
Standard percentage runoff (SPR) (%)	12	(2BCu) Brownish vellow, slightly or moderately
Base flow index (BFI) (0 to 1)	0.88	<ul> <li>stony sand or loamy sand; weak coarse angular blocky or single grain structure.</li> </ul>
Available water (AWC) (mm)	140	120
Available water for grass (mm)	130	
Available water for cereal (mm)	140	
Available water for sugar (mm)	165	
Available water for potatoes (mm)	100	WICK (wQ)



# 4. Topsoil Element Background Levels



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### **Topsoil Element Background Levels Key**



NSI sample points



### TOPSOIL ELEMENT BACKGROUND LEVELS DESCRIPTION

The National Soil Inventory (NSI) covers England and Wales on a 5 km grid and provides detailed information for each intersect of the grid. Collectively NSI data are statistically representative of England and Wales soils. The original sampling was undertaken around 1980 and there were partial resamplings in the mid-1990s. The most up-to-date data is presented here.

Analysis of the NSI samples provides detailed measurements of over 20 elements from the soils, in addition to pH. This data is summarised over three areas to provide you with an understanding of how your site, and your data for it, sits within the local, regional and national context.

Where available, the soil element levels are compared with the Soil Guideline Values and where a soil sample we have analysed has been found in excess of the SGV guidelines for "residential with plant uptake" land, this is displayed in red in the tables which follow.

SGV levels are provided for the following elements: lead, selenium, nickel, mercury, chromium, cadmium and arsenic.

In the following pages, a number of analyses of the topsoil are provided. The majority of analyses have been performed on the full compliment of sample points, however, in some areas, for some elements, only a few samples were analysed as part of subsequent programmes. In order to present the full suite of possible datasets, and accurately convey the validity of the data, the number of actual measured samples is stated for each analysis. Care should be taken where the number of samples is disproportionately low.



### a. Analysis Within a 15km Radius (28 Sample Points)

ANALYSES	SAMPLES	MEAN	MIN	MAX	ST.DEV
pH (PH)	28	7.2	4.8	8.3	0.9
Carbon (CARBON)	28	2.8	0.7	12.6	2.3
Aluminium (AL_ACID)	28	26493.0	3935.0	56855.0	13742.5
Arsenic (AS_ACID)	23	7.4	0.0	35.2	9.2
Barium (BA_ACID)	28	139.7	27.0	391.0	94.8
Calcium (CA_ACID)	28	13982.2	1412.0	61625.0	15388.1
Cadmium (CD_ACID)	28	0.6	0.0	1.5	0.5
Cadmium (Extractable) (CD_EDTA)	28	0.3	0.1	0.6	0.1
Cobalt (CO_ACID)	28	11.7	2.6	29.7	5.9
Cobalt (Extractable) (CO_EDTA)	28	1.4	0.1	7.2	1.5
Chromium (CR_ACID)	28	34.5	4.3	78.9	19.9
Copper (CU_ACID)	28	17.7	4.9	34.4	7.0
Copper (Extractable) (CU_EDTA)	28	6.1	2.8	12.0	2.4
Fluoride (F_ACID)	20	87.3	0.0	185.8	39.7
Iron (FE_ACID)	28	31167.9	8909.0	90620.0	15853.3
Mercury (HG_ACID)	19	0.1	0.0	0.3	0.1
Potassium (K_ACID)	28	4955.0	755.0	11384.0	3222.3
Potassium (Extractable) (K_NITRATE)	28	261.0	71.0	824.0	176.3
Magnesium (MG_ACID)	28	4602.7	452.0	11610.0	3908.3
Magnesium (Extractable) (MG_NITRATE)	28	128.9	5.0	412.0	104.0
Manganese (MN_ACID)	28	838.4	230.0	3915.0	698.0
Manganese (Extractable) (MN_EDTA)	28	252.2	53.0	1666.0	303.5
Molybdenum (MO_ACID)	23	0.8	0.0	5.7	1.1
Sodium (NA_ACID)	28	315.5	104.0	783.0	209.3
Nickel (NI_ACID)	28	28.4	6.6	58.1	15.3
Nickel (Extractable) (NI_EDTA)	28	2.5	0.5	6.1	1.9
Phosphorus (P_ACID)	28	755.2	387.0	1585.0	246.2
Phosphorus (Extractable) (P_OLSEN)	28	37.5	11.0	82.0	18.1
Lead (PB_ACID)	28	41.4	15.0	111.0	25.6
Lead (Extractable) (PB_EDTA)	28	17.0	6.4	43.7	9.3
Selenium (SE_ACID)	23	0.3	0.0	0.8	0.2
Strontium (SR_ACID)	28	45.0	12.0	115.0	29.1
Vanadium (V_ACID)	23	51.2	9.2	172.0	37.1
Zinc (ZN_ACID)	28	86.0	33.0	161.0	33.8
Zinc (Extractable) (ZN_EDTA)	28	7.2	2.8	26.1	4.8

for units, see Analyses Denitions (p52)



## b. Analysis Within a 50km Radius (271 Sample Points)

ANALYSES	SAMPLES	MEAN	MIN	MAX	ST.DEV
pH (PH)	270	7.1	3.5	8.6	0.9
Carbon (CARBON)	269	3.3	0.1	48.8	4.8
Aluminium (AL_ACID)	270	26629.6	2974.0	66580.0	12042.5
Arsenic (AS_ACID)	145	4.6	0.0	35.2	5.6
Barium (BA_ACID)	270	149.3	16.0	847.0	105.5
Calcium (CA_ACID)	270	16783.6	91.0	277260.0	31281.7
Cadmium (CD_ACID)	270	0.6	0.0	10.4	0.9
Cadmium (Extractable) (CD_EDTA)	270	0.3	0.0	7.3	0.6
Cobalt (CO_ACID)	270	9.9	0.3	42.6	5.3
Cobalt (Extractable) (CO_EDTA)	270	1.0	0.0	7.2	1.0
Chromium (CR_ACID)	270	33.7	0.0	165.6	20.1
Copper (CU_ACID)	270	21.0	4.1	322.6	21.8
Copper (Extractable) (CU_EDTA)	270	7.5	0.7	196.9	12.6
Fluoride (F_ACID)	162	70.9	0.0	452.8	64.0
Iron (FE_ACID)	270	25555.2	3032.0	104642.0	12432.5
Mercury (HG_ACID)	124	0.1	0.0	0.6	0.1
Potassium (K_ACID)	270	4614.5	643.0	12048.0	2575.9
Potassium (Extractable) (K_NITRATE)	270	221.0	16.0	1294.0	156.8
Magnesium (MG_ACID)	270	4629.3	286.0	55895.0	5623.3
Magnesium (Extractable) (MG_NITRATE)	270	213.5	5.0	1128.0	214.0
Manganese (MN_ACID)	270	641.1	24.0	3915.0	496.9
Manganese (Extractable) (MN_EDTA)	270	154.1	3.0	1666.0	157.2
Molybdenum (MO_ACID)	224	0.8	0.0	7.4	1.0
Sodium (NA_ACID)	270	279.8	46.0	2397.0	196.8
Nickel (NI_ACID)	270	24.9	0.0	104.0	13.4
Nickel (Extractable) (NI_EDTA)	270	1.9	0.2	19.0	1.9
Phosphorus (P_ACID)	270	688.5	164.0	3240.0	339.2
Phosphorus (Extractable) (P_OLSEN)	269	36.6	2.0	337.0	29.2
Lead (PB_ACID)	270	41.3	7.0	556.0	44.2
Lead (Extractable) (PB_EDTA)	270	17.3	1.8	259.3	19.9
Selenium (SE_ACID)	145	0.4	0.0	2.4	0.4
Strontium (SR_ACID)	270	45.4	0.0	441.0	47.1
Vanadium (V_ACID)	224	38.4	0.0	235.3	27.6
Zinc (ZN_ACID)	270	84.1	6.0	993.0	74.3
Zinc (Extractable) (ZN_EDTA)	270	9.6	1.1	320.4	25.6

for units, see Analyses Denitions (p52)



### c. National Analysis (5686 Sample Points)

ANALYSES	SAMPLES	MEAN	MIN	MAX	ST.DEV
pH (PH)	5630	6.0	3.1	9.2	1.3
Carbon (CARBON)	5672	6.1	0.1	61.5	8.9
Aluminium (AL_ACID)	5677	26775.3	491.0	79355.0	12772.2
Arsenic (AS_ACID)	2729	4.6	0.0	110.0	5.7
Barium (BA_ACID)	5677	150.0	7.0	3840.0	159.5
Calcium (CA_ACID)	5677	13768.7	0.0	339630.0	37785.0
Cadmium (CD_ACID)	5677	0.7	0.0	40.9	1.0
Cadmium (Extractable) (CD_EDTA)	5655	0.5	0.0	85.0	3.0
Cobalt (CO_ACID)	5677	10.6	0.0	567.0	13.7
Cobalt (Extractable) (CO_EDTA)	5655	1.1	0.0	26.5	1.2
Chromium (CR_ACID)	5677	38.9	0.0	2339.8	43.7
Copper (CU_ACID)	5677	22.6	0.0	1507.7	36.8
Copper (Extractable) (CU_EDTA)	5655	6.4	0.3	431.4	11.1
Fluoride (F_ACID)	3320	58.5	0.0	6307.9	186.2
Iron (FE_ACID)	5677	28147.8	395.0	264405.0	16510.5
Mercury (HG_ACID)	2159	0.1	0.0	2.4	0.2
Potassium (K_ACID)	5677	4727.7	60.0	23905.0	2700.2
Potassium (Extractable) (K_NITRATE)	5609	182.0	6.0	2776.0	151.6
Magnesium (MG_ACID)	5677	3648.1	0.0	62690.0	3284.1
Magnesium (Extractable) (MG_NITRATE)	5609	146.0	1.0	1601.0	147.5
Manganese (MN_ACID)	5677	777.0	3.0	42603.0	1068.8
Manganese (Extractable) (MN_EDTA)	5654	159.4	0.0	3108.0	188.6
Molybdenum (MO_ACID)	4417	0.9	0.0	56.3	2.0
Sodium (NA_ACID)	5677	323.3	17.0	25152.0	572.3
Nickel (NI_ACID)	5677	25.4	0.0	1350.2	29.2
Nickel (Extractable) (NI_EDTA)	5655	1.6	0.1	73.2	2.0
Phosphorus (P_ACID)	5677	792.1	41.0	6273.0	433.9
Phosphorus (Extractable) (P_OLSEN)	5604	27.4	0.0	534.0	25.5
Lead (PB_ACID)	5677	73.3	0.0	17365.0	280.6
Lead (Extractable) (PB_EDTA)	5655	27.8	1.2	6056.5	119.7
Selenium (SE_ACID)	2729	0.6	0.0	22.8	0.8
Strontium (SR_ACID)	5677	42.3	0.0	1445.0	67.8
Vanadium (V_ACID)	4428	41.0	0.0	854.4	33.9
Zinc (ZN_ACID)	5677	90.2	0.0	3648.0	104.4
Zinc (Extractable) (ZN_EDTA)	5655	9.6	0.5	712.0	24.6

for units, see Analyses Denitions (p52)



### SOIL GUIDELINE VALUES (SGV)

Defra and the Environment Agency have produced soil guideline values (SGVs) as an aid to preliminary assessment of potential risk to human health from land that may be contaminated. SGVs represent 'intervention values', which, if exceeded, act as indicators of potential unacceptable risk to humans, so that more detailed risk assessment is needed.

The SGVs were derived using the Contaminated Land Exposure Assessment (CLEA) model for four land uses:

- 1. residential (with plant uptake / vegetable growing)
- 2. residential (without vegetable growing)
- 3. allotments
- 4. commercial / industrial

SGVs are only designed to indicate whether further site-specific investigation is needed. Where a soil guideline value is exceeded, it does not mean that there is necessarily a chronic or acute risk to human health.

The values presented in this report represent those from a number of sample points (given in the "Samples" column in each table) providing local, regional and national background levels. Figures which appear in red indicate that a bulked sample from 20m surrounding a sample point, has at a past date, exceeded the SGV for the 'residential with plant uptake' land use.

It is always advisable to perform site specific investigations.

More details on all the SGVs can be found on the Environment Agency Website.

All units are mg/kg which is equivalent to parts per million (ppm)

SUBSTANCE	RESIDENTIAL WITH PLANT UPTAKE	RESIDENTIAL WITHOUT PLANT UPTAKE	ALLOTMENTS	COMMERCIAL /INDUSTRIAL
LEAD	450	450	450	750
SELENIUM	35	260	35	8000
NICKEL	50	75	50	5000
MERCURY	8	15	8	450
CHROMIUM	130	200	130	5000
CADMIUM (pH 6)	1	30	1	1400
CADMIUM (pH 7)	2	30	2	1400
CADMIUM (pH 8)	8	30	8	1400
ARSENIC	20	20	20	500



### **ANALYSES DEFINITIONS**

#### PH (pH)

pH of soil measure after shaking 10ml of soil for 15 minutes with 25ml of water

#### **CARBON** (Carbon)

Organic Carbon (% by wt) measured either by loss-on-ignition for soils estimated to contain more than about 20% organic carbon or by dichromate digestion.

#### AL\_ACID (Aluminium)

Total Aluminium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### AS\_ACID (Arsenic)

Total Arsenic concentration (mg/kg) determined by Hydride Atomic Absorption Spectrometry (AAS), extracted into hydrochloric acid after digestion with nitric acid and ashing with magnesium nitrate

#### **BA\_ACID** (Barium)

Total Barium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### CA\_ACID (Calcium)

Total Calcium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### CD\_ACID (Cadmium)

Total Cadmium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### **CD\_EDTA (Cadmium Extractable)**

Extractable Cadmium concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

#### CO\_ACID (Cobalt)

Total Cobalt concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### CO\_EDTA (Cobalt Extractable)

Extractable Cobalt concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

#### CR\_ACID (Chromium)

Total Chromium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### CU\_ACID (Copper)

Total Copper concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### CU\_EDTA (Copper Extractable)

Extractable Copper concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering



### **ANALYSES DEFINITIONS continued**

#### F\_ACID (Flouride)

Flouride extracted with 1mol / I sulphuric acid and determined by Ion Selective Electrode (ISE)

#### FE\_ACID (Iron)

Total Iron concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### HG\_ACID (Mercury)

Total Mercury concentration (mg/kg) determined by Hydride Atomic Absorption Spectrometry (AAS), digested in a nitric/sulphuric acid mixture

#### K\_ACID (Potassium)

Total Potassium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### K\_NITRATE (Potassium Extractable)

Extractable Potassium concentration (mg/l) determined by shaking 10ml of air dry soil with 50ml of 1.0M ammonium nitrate for 30mins, filtering and then measuring the concentration by flame photometry

#### MG\_ACID (Magnesium)

Total Magnesium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### **MG\_NITRATE (Magnesium Extractable)**

Extractable Magnesium concentration (mg/l) determined by shaking 10ml of air dry soil with 50ml of 1.0M ammonium nitrate for 30mins, filtering and then measuring the concentration by flame photometry

#### MN\_ACID (Manganese)

Total Manganese concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### MN\_EDTA (Manganese Extractable)

Extractable Manganese concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

#### MO\_ACID (Molybdenum)

Total Molybdenum concentration (mg/kg) determined by Atomic Adsorption Spectrometyr (AAS) in an aqua regia digest

#### MO\_EDTA (Molybdenum Extractable)

Extractable Molybdenum concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

#### NA\_ACID (Sodium)

Total Sodium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### NI\_ACID (Nickel)

Total Nickel concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest



### **ANALYSES DEFINITIONS continued**

#### NI\_EDTA (Nickel Extractable)

Extractable Nickel concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

#### P\_ACID (Phosphorus)

Total Phosphorus concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### P\_OLSON (Phosphorous Extractable)

Extractable Phosphorus concentration (mg/l) determined by shaking 5ml of air dry soil with 100ml of 0.5M sodium bicarbonate for 30mins at 20 deg.C, filtering and then measuring the absorbance at 880 nm colorimetrically with acid ammonium molybdate solution

#### PB\_ACID (Lead)

Total Lead concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### **PB\_EDTA (Lead Extractable)**

Extractable Lead concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

#### SE\_ACID (Selenium)

Total Selenium concentration (mg/kg) determined by Hydride Atomic Absorption Spectrometry (AAS), extracted into hydrochloric acid after digestion with nitric acid and ashing with magnesium nitrate

#### SR\_ACID (Strontium)

Total Strontium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### V\_ACID (Vanadium)

Total Vanadium concentration (mg/kg) determined by Atomic Adsorption Spectrometyr (AAS) in an aqua regia digest

#### ZN\_ACID (Zinc)

Total Zinc concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

#### ZN\_EDTA (Zinc Extractable)

Extractable Zinc concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering



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To view a glossary visit: <u>www.landis.org.uk/sitereporter/glossary.pdf</u> For a list of further reading visit: <u>www.landis.org.uk/sitereporter/FURTHER\_READING.pdf</u>

#### **GIS Datasets:**

The GIS data used in the creation of this report is available to lease for use in projects. To learn more about, or acquire the GIS datasets used in the creation of this report, please contact the Nationals Soil Resources Institute:

### nsridata@cranfield.ac.uk

+44 (0) 1234 75 2992 National Soil resources Institute Cranfield University Bedfordshire MK43 0AL United Kingdom www.landis.org.uk

Soil Site Report (C) Cranfield university, 2017





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	EVAPORITES       Potash       Potash       Approximate western limit of Boulby Potash       Salt       Approximate western limit of Boulby Halite	MINERAL PLANNING PERMISSION (as at 01.08.05) Source: Mineral Planning Authorities	Surface planning permission (valid and expired)	Underground planning permission (valid and expired)	MINERAL WORKINGS	Melton Ross Active site	Burstwick Inactive (including yet to be worked), worked-out and/or restored site	Mineral commodity	Ch Chalk Istn Ironstone Peat Peat Cl Clay & Shale Lst Limestone San Sand	CR Crushed Rock Oil Oil Sg Sand & Gravel Fi Flint Min Unspecified mineral SiS Silica Sand Gas Natural Gas MSg Marine sand and gravel	<ul> <li>Active rail aggregate depot</li> <li>Active marine wharf</li> </ul>	ENVIRONMENTAL DESIGNATIONS (as at 03/11/04)  National nature conservation designations (SSSIs and NNRs)
30						20						

# **UK Onshore Geophysical Library**

A charitable body providing a substantial open-access resource of commercial data on the deep geology beneath our feet – promoting education, research and development

#### INTERACTIVE MAP FULL SCREEN 🗷

UK Onshore									
Geophysical	Library								
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Show Legend Main Depths Directional Images Contents									
	Datum (ft)		RT 224						
☐ Wells ❤	Datum (m)		RT 68.2						
	GL (ft)		207						
	GL (m)		63.1						
	TD (ft)		6300						
	TD (m)		1920						
	TVD SS (ft)		6076						
	TVD SS (m)		1851.8						
	TD Period		Carboniferous						
Contouto M	TD Detail		Dinantian						
		O Ad	d to Selection	Q Zoom To					



# Additional Borehole Coverage

As a supplement to our primary Exploration wells coverage we now serve an additional wells layer of selected additional deep boreholes compiled over areas of limited exisiting coverage and control.

Providing access to an expanded Formation Tops database this resource has been compiled from a number of open access sources and sub surface memoirs, primarily derived from information held within the British Geological Survey's Borehole Scans archive. For further information and access to extensive source records please visit the BGS site.

This compilation is an ongoing project and is still in its early stages, with the initial focus being across the south of England. New data will be added on a regular basis and this layer, shown as blue ringed well

|UK Onshore |Geophysical Library

www.ukogl.org.uk

## **BROUGHTON B1**

Surface Easting:	494627	Datum for MD:		RT			
Surface Northing:	410760				(f)	(m)	
Deviated: N		Elevation	Elevation Datum:		224	68.2	
Driginal Depth Units: metres		Elevation	Elevation GL:		207	63.1	
Surface Formation:	Upper Lias						
Top		<u>MD (f)</u>	<u>MD (m)</u>	<u>TVDSS (f)</u>	<u>TVDSS (m)</u>	<u>TWT (s)</u>	Detail
Upper Lias		17	5.1	-207	-63.1	-	-
Middle Lias		90	27.5	-134	-40.7	-	-
Lower Lias		330	100.5	106	32.2	0.031	-
Triassic		603	183.8	379	115.6	0.100	-
Penarth Group (Rhaetic)		603	183.8	379	115.6	0.100	-
Mercia Mudst (Keuper)		631	192.2	407	124.0	0.107	-
Muschelkalk		1460	445.0	1236	376.8	0.283	-
Zechstein (U.Permian)		2630	801.5	2406	733.3	0.522	-
L. Permian Marl/Shale		3597	1096.2	3373	1028.0	0.643	-
Rotliegendes/Leman SS		3674	1119.8	3450	1051.6	0.654	-
Westphalian C & D		3697	1126.8	3473	1058.6	0.659	-
Westphalian B		4099	1249.2	3875	1181.0	0.731	-
Westphalian A		4672	1424.0	4448	1355.8	0.835	-
Namurian		5211	1588.3	4987	1520.1	0.923	-
Dinantian		6188	1886.0	5964	1817.8	1.067	-
TD		6300	1920.0	6076	1851.8	1.078	Dinantian
Comments: -							
The information	given here is based on ope	en file records available in t	he OGA well lib	rary and other p	oublic sources. Al	details are to	aken from interpretations made at the time
the well was dri	led and also from later re-	-evaluations and calculation	ns. This informa	ition is provided	l for guidance on	ly and UKOGL	does not warrant its accuracy. Details are
subiect to on	aoina revision. See the OG	GA website for details of for	mal release aa	ents in order to a	obtain hard conv	scans, diaital	data and reports for UK onshore wells.





Appendix D

Terrafirma Mining Report

GEOLOGICAL • GEOTECHNICAL • ENVIRONMENTAL • ENGINEERING

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# TERRASEARCH ASSESS

# **NON-RESIDENTIAL**

# PASSED

COAL	NEGLIGIBLE RISK	Report on: LARGE SITE AT SANTON.	
STONE (Incl. Limestone, Clay, Bath Stone & Chalk)	MODERATE RISK	SCUNTHORPE	
EVAPORITES (Incl. Gypsum)	NEGLIGIBLE RISK		
METALLIFEROUS (Incl. Tin, Lead and Iron)	LOW RISK	Date:	
HYDROCARBONS (Incl. Fracking)	MODERATE RISK	14/08/2017 Our Ref:	
CHESHIRE BRINE	NEGLIGIBLE RISK	TFC201708081425-SITE Client Ref:	
DEVELOPMENT POTENTIAL	High Risk 📕	LARGE SITE	
PLANNED/FUTURE MINERAL EXTRACTION	MODERATE RISK	TerraSearch® Assess is a site- specific evaluation of all mining	
Professional Opinion		and mineral extraction hazards. The report reviews available	
Within the scope of this assessment, the Site is not c significant risk from past, present or future mineral extractio unlikely to have an adverse effect on the security of the S purposes. However, your attention is drawn to the prudent e the report recommendations.	onsidered to be at a on. Mining hazards are ite for normal lending enquiries suggested in	records, allowing us to experi conclude the risk to the si from past, present and planne mining hazards, befo providing practical next step based on the level of ris identified. Terrafirma's terms & condition provide liability cover of £100 per report. All TerraSearch Assess reports adhere to Th	
Contact the report author directly by telephone on: 0330 900 7500		Search Code and are regulated by the Council of Property Search Organisations.	





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# **Conclusions and Expert Interpretation of Risk**

Considering the ongoing current use of the Site:

# **MODERATE RISK**

Terrafirma have reviewed all available site investigation, local geological, historical and land use records and consider that, in this instance and considering its ongoing current use, the Site is at **moderate risk** from ground instability associated with historical **ironstone** extraction.

The Site is located in an area that has been extensively exploited for ironstone resources. Within the Site a number of suspected extraction features have been identified (highlighted by dashed lines - see hazard map) and these are considered likely to be associated with ironstone mining. Furthermore, northeast of the Site a historic hydrocarbon well, operated by BP for oil extraction, has also been located. The hydrocarbon field associated with this well extends within the Site boundary. Due to the nature of mineral extraction in the area and suitable geological conditions on Site, it is considered possible that both ironstone and oil extraction occurred within the Site boundary. Therefore, associated extraction features, including underground workings and shafts could be present and have the potential to impact ground stability in the area.

### Considering the future development of the Site:

# **HIGH RISK**

The presence of unrecorded surface and/or shallow mineral workings beneath the Site cannot be discounted and therefore prior to any site works or future development activity, it is considered prudent to commission a full Site Survey by a qualified mining geologist/engineer. Please contact Terrafirma directly if you require further information.



# 

# **Professional Recommendations**

Based on the Site's current use, no further assessment of mineral extraction is required. However, due to suspected historic extraction on Site, it is strongly recommended that should the Site be developed, a full site investigation is undertaken prior to development. It is further recommended that close attention is also paid to the suspected features highlighted in the included hazard map (page 5.) during any future Site works.

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A

**Mining Hazards:** 

NOT DETECTED WITHIN 1000 METRES 📀

DETECTED WITHIN 1000 METRES

Alabaster	$\bigcirc$	Alum Shale	$\bigcirc$	Anhydrite	$\bigcirc$	Antimony	$\bigcirc$
Arsenic	$\bigcirc$	Ball Clay	Ø	Barite	$\bigcirc$	Bath Stone	0
Bideford Black	$\bigcirc$	Brick Clay	Ø	Brine Solution	$\bigcirc$	Celestine	0
Chalk	$\bigcirc$	Chert	Ø	China Clay	$\bigcirc$	Clay and Shale	$\bigcirc$
Coal	0	Copper	Ø	Coprolite	$\bigcirc$	Delphstone	0
Diatomite	$\bigcirc$	Dolerite/Basalt	Ø	Dolomite	$\bigcirc$	Flagstone	0
Fireclay	$\bigcirc$	Fluorspar/Calcite	Ø	Free Stone	$\bigcirc$	Fuller's Earth	0
Gas	$\bigcirc$	Granite	Ø	Gold	$\bigcirc$	Gypsum	0
Iron Ore/Hematite	$\bigcirc$	Iron Ochre	Ø	Ironstone	0	Jet	0
Kentish Ragstone	$\bigcirc$	Lead/Zinc	Ø	Lignite	$\bigcirc$	Limestone	0
Manganese	0	Metamorphic Rock	0	Non-Ferrous Metals	Ø	Oil	0
Oil Shale	$\bigcirc$	Peat	$\bigcirc$	Platinum	$\bigcirc$	Potash	$\bigcirc$
Rock Salt/Halite	$\bigcirc$	Sand and Gravel	Ø	Sandstone	$\bigcirc$	Sec. Aggregate	$\bigcirc$
Shale Gas	$\bigcirc$	Silica Sand	0	Siltstone	$\bigcirc$	Silver	0
Slate	$\bigcirc$	Soapstone	Ø	Tin	$\bigcirc$	Tufa	0
Tungsten	$\bigcirc$	Witherite	Ø	Whinstone	$\bigcirc$	Whetstone	Ø

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# Mining Hazard Map



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# TERRAFIRMA

# **Geological Conditions**

Bedrock Geology	Jurassic Age Charmouth Mudstone Formation, Pecten Ironstone, Marlstone Rock Formation (Limestone And Sandstone), Whitby Mudstone Formation, Grantham Formation, Northampton Sand Formation, Kirton Cementstone Beds and Hibaldstow Limestone	
Superficial Geology	Quaternary Age Sutton Sand Formation - Sand	
Geological Faults	None Recorded	
Artificial Deposits	Artificially infilled ground is present in the South West region of the site	
<b>Mineralised Deposits</b>	Iron mineralisation is known to be present within the local bedrock	
Wells	None Recorded	

# Detailed Findings of Past Non-Coal Mineral Extraction (Within 500 Metres of Site)

Ironstone	Overall Risk:	MODERATE
Background Information:	Mining Hazards Within:	Beneath Site
The Site is located within an area that has been historically exploited for Ironstone by surface and underground mining.	Nearest Mining Hazard:	See hazard Map
	Type of Mining Hazard:	Suspected Extraction Features

Expert Interpretation of Risk:

The Site is **considered** to be at moderate risk from ground instability associated with historical lronstone extraction. The local geological conditions are considered to be suitable for small, unrecorded extraction features to be present within/beneath the Site boundary.

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# **Present Non-Coal Mineral Extraction**

	Overall Impact: NEO	GLIGIBLE
Expert Interpretation of Mineral Extraction Activity: The Site is considered to be at a low risk from the impact of current non-coal mineral extraction.	No Extraction Sites Within: 1	000 metres
	Nearest Extraction Site:	N/A
	Type of Extraction Activity:	N/A
	Type of Mineral Resource:	N/A
Recommendation:		

None.

# Planned Non-Coal Mineral Extraction

	Overall Impact:	MODERATE
Expert Interpretation of Mineral Extraction Activity:	Extraction Sites Within:	Within Site boundary
The Site is considered to be at a moderate risk from the impact of current non-coal mineral extraction. A dormant mineral planning permission associated with Emmanuel Bridge extends within the western Site boundary. It is considered, due to the underground nature of the licence, that future extraction could occur. This has the potential to impact both ground stability and the quiet enjoyment of the Site.	Nearest Extraction Site:	N/A
	Type of Extraction Activity:	Underground and Surface Mining
	Type of Mineral Resource:	Ironstone, Limestone, Sand and Gravel

### Recommendation:

For more information, contact the area's local council.



### Hydrocarbons (Inc. Fracking)

	Overall Impact:	MODERATE
Recommendation: The Site is within PEDL 180 (south) and 182 (north) operated	License Block Name:	PEDL 180 & 182
by Europe Oil & Gas and Egdon Resources U.K. respectively. Records show a well associated with the PEDL 185 block, 165 metres north east of the site, was constructed in 1984 and used for oil extraction. This was operated by BP and was abandoned/released in 1989. Egdon Resources U.K. have now developed a new well up-dip, approximately 1000 metres from the Site. There is no evidence for the depth of the well(s).	Type of License Block:	Exploration
	Hydrocarbon Well Within:	1000 metres
	Hydrocarbon Resource:	Oil Shale

Expert Interpretation of Hydrocarbon Extraction:

The property is situated within a block awarded for exploration, as defined by the OGA or DECC.

An assessment of Petroleum Exploration and Development Licence areas (PEDL's), has been made by reference to information provided by the Oil and Gas Authority (OGA) and the Department of Energy and Climate Change (DECC). A PEDL offers exclusive rights for the exploration and retrieval of hydrocarbons using conventional oil and gas extraction techniques, coal bed methane extraction, mine gas exploitation or shale gas fracking techniques within set Ordnance Survey (OS) referenced 'blocks'.





# TERRASEARCH COAL

Overall Coal Mining Assessment	NEGLIGIBLE RISK		
Within Coal Mining Reporting Area	No		
Within Brine Compensation District	No		
Coal Mining Features*		Assessment**	
Past underground	No	NEGLIGIBLE RISK	
Present underground	No	NEGLIGIBLE RISK	
Planned underground	No	NEGLIGIBLE RISK	
Mine shafts and adit entries	No	NEGLIGIBLE RISK	
Geological conditions	No	NEGLIGIBLE RISK	
Pastopencast	No	NEGLIGIBLE RISK	
Present opencast	No	NEGLIGIBLE RISK	
Planned opencast	No	NEGLIGIBLE RISK	
Coal subsidence claims	No	NEGLIGIBLE RISK	
Mine gas	No	NEGLIGIBLE RISK	
Hazards	No	NEGLIGIBLE RISK	
Withdrawal of Support	No	NEGLIGIBLE RISK	
Working Facilities Order	No	NEGLIGIBLE RISK	
Payments to Copyhold Land	No		
Brine Subsidence	No		

\*Coal Mining Features are identified solely from The Coal Authority licensed data.

\*\*Assessment is the risk of subsidence or impact to the Site based on Terrafirma's interpretation of Coal Authority licensed data and third party data.





### **Detailed Findings of Coal Mining Hazards:**

#### Past underground

NEGLIGIBLE RISK

The Site is not within a surface area that could be affected by historical deep underground mining.

The Site is not within a surface area that could be affected by historical recorded shallow underground mining.

The Site is not within a surface area that could be affected by historical unrecorded shallow underground mining.

Present underground

NEGLIGIBLE RISK

The Site is not situated within an area which could be affected by currently active underground coal mining.

Planned underground	NEGLIGIBLE RISK

The Site is not situated within an area which could be affected by any future underground coal mining. The Site is not situated within 50 metres of a Section 46 Notice.

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Mine shafts and adit entries

There are no recorded mine entries within 20 metres of the Site.

Geological conditions

NEGLIGIBLE RISK

There are no recorded faults, fissures or breaklines beneath or within the vicinity of the Site.

Past opencast

NEGLIGIBLE RISK

The Site is not situated within or proximal to any past licence areas for the opencast extraction of coal.

There are no unlicensed opencast pits or extraction sites within 200 metres of the Site.

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Present opencast

NEGLIGIBLE RISK

The Site is not situated within an area which could be affected by currently active opencast coal mining.

Planned opencast	NEGLIGIBLE RISK

There are no plans by the Coal Authority to grant a licence to extract coal using opencast methods within 800 metres surrounding the Site.

Coal subsidence claims NEGLIGI
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There is no record of any coal mining-related damage notices or subsidence claims for the Site or for any Site within 50 metres of the Site, since 1994.

There is no record of a request that has been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

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Hazards

There are no records of any mine gas wells within 25 metres of the Site and there is no record of a mine gas emission requiring action.

NEGLIGIBLE RISK

NEGLIGIBLE RISK

NEGLIGIBLE RISK

The Site is not situated within 25 metres of a coal mining-related hazard. There have been no remedial works undertaken by or on behalf of the Coal Authority, under its Emergency Surface Hazard Call Out procedures.

Withdrawal of Support

The property is not within an area where notices to withdraw support were given in 1946.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Working Facilities Order

The property is not in an area for which the Sherwood Area Order dated 1938 has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

Payments to former owners of Copyhold Land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Brine subsidence

NEGLIGIBLE RISK

NEGLIGIBLE RISK

Site is not situated within 25 metres of a coal mining-related hazard. There have been no remedial works undertaken by or on behalf of the Coal Authority, under its Emergency Surface Hazard Call Out procedures.

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# 

### **Notice of Statutory Cover**

In the unlikely event of any future damage, the terms of the Coal Mining Subsidence Act 1991 (as amended by the Coal Industry Act 1994) apply, and the Coal Authority / Licensee has a duty to take remedial action in respect of subsidence caused by the withdrawal of support from land and/or property in connection with lawful coal-mining operations. Typically, these actions will not need to involve either your insurance company or mortgage lender and therefore the end user(s) should not incur any costs or liability.

In addition to the above, it should also be noted that the Coal Authority offer a Public Safety and Subsidence Department that provides a 24 hour 7 day a week call out service (Tel: 01623 646 333) to take remedial action in respect of hazards associated with the movement or collapse of any coal mineshaft or entrances to coal mines and from other coal mining related surface hazards. Further information can be found on their website: www.groundstability.com.



# 

# **Report Limitations**

This TerraSearch® Report has been carried out with reference to Terrafirma's bespoke GIS, an extensive collection of abandoned mine plans, maps, records and archives in our possession. The report does not consider natural ground stability hazards, such as subsidence, landslip or coastal erosion.

From this material, we have endeavoured to provide as accurate a report as possible. It should be realised that totally unrecorded or unindicated workings can exist between known workings and therefore Terrafirma cannot be held responsible for any settlement or subsidence problems as a result of a Site being affected by unrecorded mining features or natural ground cavities. The assessment of the 'risk' of ground instability arising from existing or planned mineral exploration or extraction is based on extant mineral planning or safeguarding areas as defined by the relevant Mineral Planning Authority (MPA) policies at the time of writing. Terrafirma cannot be held liable for any updates or changes in existing mineral operations or policies.

It is a 'remote' investigation and reviews only information provided by the client and from the databases of publicly available information that have been chosen to enable a desk based environmental assessment of the Site. The Certificate does not include a Site Investigation, nor does Terrafirma make specific information requests of the regulatory authorities for any relevant information they may hold.

This report is concerned solely with the Site searched and should not be used in connection with adjacent properties as only relevant known mining features have been mentioned and any known features that could potentially have a direct influence upon the target Site. Other features which may be present in the general area may have been omitted for clarity.

The report is based upon the Site boundaries as shown on the supplied location plan. This report is confidential to the client, the client's legal advisor and the client's Mortgage lender, as defined in the TerraSearch® terms & conditions, and as such may be used by them for conveyancing or related purposes. We have no liability toward any person or organisation not party to commissioning this report. This report or any part of it is not permitted to be reproduced, copied, altered or in any other way distributed by any other person or organisation.

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This report meets the principles and requirements of the Property Codes Compliance Board Compliance Note CN02J in respect of Coal Mining Searches.

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- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in Site search reports undertaken by subscribers on residential and commercial Site within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practice and quality standards within the industry for the benefit of consumers and Site professionals
- enables consumers and Site professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

#### The Code's core principles (Firms which subscribe to the Search Code will):

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

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# Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Site Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

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### **TPOs Contact Details:**

The Site Ombudsman scheme, Milford House, 43-55 Milford Street, Salisbury, Wiltshire SP1 2BP, Tel: 01722 333306, Fax: 01722 332296, Email: admin@tpos.co.uk

You can get more information about the PCCB from <u>www.Sitecodes.org.uk</u> or from our website at <u>www.minesearches.co.uk</u>.

# **Complaints Procedure**

If you want to make a complaint directly to Terrafirma, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

Complaints should be sent to: Tom Backhouse, Managing Director & Senior Executive, Terrafirma Mine Searches Ltd - Address: 2440 The Quadrant, Aztec West Business Park, Almondsbury, Bristol, BS32 4AQ; Email: <u>info@terrafirmaminesearches.co.uk;</u> Telephone: 0330 900 7500.

If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 01722 333306, E-mail: <u>admin@tpos.co.uk</u>. We will co-operate fully with the Ombudsman during an investigation and comply with his final decision.

### WE TRUST THIS REPORT PROVIDES THE INFORMATION YOU REQUIRE. PLEASE CONTACT US IF YOU HAVE ANY QUERIES OR IF WE CAN BE OF ANY FURTHER ASSISTANCE.





Appendix E

Groundsure Data Report

GEOLOGICAL • GEOTECHNICAL • ENVIRONMENTAL • ENGINEERING

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP United Kingdom Tel: 01275 333 036 www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX United Kingdom VAT Reg. No. 609 7402 37



CENTREMAPS

Open Space, Upper Interfields, Worcester, WR14 1UT Groundsure<br/>Reference:CMAPS-CM-643992-13238-<br/>310717EDRYour Reference:13238Report Date31 Jul 2017Report Delivery<br/>Method:Email - pdf

# **Enviro Insight**

Address: Santon, Scunthorpe, DN16 1XP

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 01886 832972 quoting the above CENTREMAPS reference number.

Yours faithfully,

CENTREMAPS

Enc. Groundsure Enviroinsight

# Groundsure Enviro Insight

Address:	Santon, Scunthorpe, DN16 1XP
Date:	31 Jul 2017
Reference:	CMAPS-CM-643992-13238-310717EDR
Client:	CENTREMAPS

NW

NE

Е



S

W

SW

Aerial Photograph Capture date:16-Aug-2015Grid Reference:494018,409842Site Size:156.74ha

Report Reference: CMAPS-CM-643992-13238-310717EDR Client Reference: 13238

SE

![](_page_165_Picture_0.jpeg)

![](_page_165_Picture_1.jpeg)

# **Contents Page**

Contents Page	3
Overview of Findings	6
Using this report	10
1. Historical Land Use	11
1. Historical Industrial Sites	12
1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping	12
1.2 Additional Information – Historical Tank Database	13
1.3 Additional Information – Historical Energy Features Database	14
1.4 Additional Information – Historical Petrol and Fuel Site Database	14
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	14
1.6 Potentially Infilled Land	15
2. Environmental Permits, Incidents and Registers Map	17
2. Environmental Permits, Incidents and Registers	18
2.1 Industrial Sites Holding Licences and/or Authorisations	18
2.1.1 Records of historic IPC Authorisations within 500m of the study site:	18
2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:	18 f tho
2.1.5 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within soom of study site:	20
2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:	20
2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:	20
2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:	20
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:	20
2.1.8 Records of Licensed Discharge Consents within 500m of the study site:	20 tho
study site:	21
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:	21
2.2 Dangerous or Hazardous Sites	21
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents	21
2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:	21
2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:	22
2.4 Sites Determined as containinated Land Under Part 2A LPA 1990	∠∠
2. Landfill and Other Waste Sites	23
3. Landfill and Other Waste Sites	24
3. I LandTill Sites	24
3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site	24 site <sup>,</sup>
	24
3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:	25
3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:	25
3.2 Other Waste Sites	25
3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:	25
5.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study s	
4. Current Land Use Map	27
4 Current Land Uses	28
4.1 Current Industrial Data	
4.2 Petrol and Fuel Sites	29
4.3 National Grid High Voltage Underground Electricity Transmission Cables	29
4.4 National Grid High Pressure Gas Transmission Pipelines	29

![](_page_166_Picture_1.jpeg)

5.1 Artificial Ground and Made Ground.       .30         5.2 Superficial Ground and Drift Geology       .30         5.3 Bedrock and Solid Geology       .30         6 Hydrogeology and Hydrology       .32         6a. Aquifer Within Superficial Geology and Abstraction Licenses       .33         6c. Hydrogeology - Source Protection Zones and Potable Water Abstraction Licenses       .34         6d. Hydrogeology - Source Protection Zones within confined aquifer       .35         6e. Hydrology - Detailed River Network and River Quality       .36         6. Hydrogeology and Hydrology       .37         6.1 Aquifer within Bedrock Deposits.       .37         6.2 Aquifer within Bedrock Deposits.       .38         6.3 Groundwater Abstraction Licences.       .39         6.4 Surface Water Abstraction Licences.       .39         6.5 Source Protection Zones.       .39         6.6 Source Protection Zones.       .39         6.7 Source Protection Zones.       .39         6.8 Groundwater Abstraction Licences.       .39         6.9 River Quality.       .41         6.9.1 Biological Quality.       .41         6.9.1 Biological Quality.       .41         6.1 Detailed River Network.       .41         6.1 Detailed River Network.       .41         6.1 Di
5.2 Superficial Ground and Drift Geology       30         5.3 Bedrock and Solid Geology       30         6 Hydrogeology and Hydrology       32         6a. Aquifer Within Superficial Geology       32         6b. Aquifer Within Bedrock Geology and Abstraction Licenses       33         6c. Hydrogeology - Source Protection Zones and Potable Water Abstraction Licenses       34         6d. Hydrogeology - Detailed River Network and River Quality       36         6.Hydrogeology and Hydrology       37         6.1 Aquifer within Superficial Deposits.       37         6.2 Aquifer within Bedrock Deposits.       38         6.3 Groundwater Abstraction Licences.       39         6.4 Surface Water Abstraction Licences.       39         6.5 Potable Water Abstraction Licences.       39         6.6 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and t
5.3 Bedrock and Solid Geology       30         6 Hydrogeology and Hydrology       32         6a. Aquifer Within Superficial Geology       32         6b. Aquifer Within Bedrock Geology and Abstraction Licenses       33         6c. Hydrogeology - Source Protection Zones and Potable Water Abstraction Licenses       34         6d. Hydrogeology - Detailed River Network and River Quality       36         6e. Hydrogeology and Hydrology       37         61. Aquifer within Superficial Deposits.       37         62. Aquifer within Bedrock Deposits.       38         63.3 Groundwater Abstraction Licences.       39         64.5 Surface Water Abstraction Licences.       39         65.6 Source Protection Zones within Confined Aquifer.       40         6.9 River Quality.       41         6.10 Detailed River Network       41         6.11 Surface Water Features.       43         71. River and Coastal Zone 2 Flooding.       46
6 Hydrogeology and Hydrology       32         6a. Aquifer Within Superficial Geology       32         6b. Aquifer Within Bedrock Geology and Abstraction Licenses       33         6c. Hydrogeology - Source Protection Zones and Potable Water Abstraction Licenses       34         6d. Hydrogeology - Source Protection Zones within confined aquifer       35         6e. Hydrology - Detailed River Network and River Quality       36         6.1 Aquifer within Superficial Deposits.       37         6.2 Aquifer within Superficial Deposits.       38         6.3 Groundwater Abstraction Licences.       39         6.4 Surface Water Abstraction Licences.       39         6.5 Source Protection Zones within Confined Aquifer.       40         6.9 Source Protection Zones within Confined Aquifer.       40         6.9 Cource Protection Zones within Confined Aquifer.       41         6.9.1 Source Protection Zones within Confined Aquifer.       41         6.9 Cource Protection Zones within Confined Aquifer.       41         6.9.2 Chemical Quality.       41         6.9.1 Source Protection Zones within Confined Aquifer.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the Sea       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRAS)       44
6a. Aquifer Within Superficial Geology       32         6b. Aquifer Within Bedrock Geology and Abstraction Licenses       33         6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses       34         6d. Hydrogeology – Detailed River Network and River Quality       36         6. Hydrogeology and Hydrology       37         6.1 Aquifer within Bedrock Deposits.       37         6.2 Aquifer within Bedrock Deposits.       38         6.3 Groundwater Abstraction Licences.       39         6.4 Surface Water Abstraction Licences.       39         6.5 Potable Water Abstraction Licences.       39         6.6 Source Protection Zones within Confined Aquifer.       40         6.8 Source Protection Zones within Confined Aquifer.       40         6.9 River Quality.       41         6.9.1 Biological Quality.       41         6.9.1 Biological Quality.       41         6.10 Detailed River Network.
6b. Aquifer Within Bedrock Geology and Abstraction Licenses       33         6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses       34         6d. Hydrogeology – Source Protection Zones within confined aquifer       35         6e. Hydrology – Detailed River Network and River Quality       36         6.Hydrogeology and Hydrology       37         6.1 Aquifer within Superficial Deposits.       37         6.2 Aquifer within Bedrock Deposits.       38         3.3 Groundwater Abstraction Licences.       39         6.4 Surface Water Abstraction Licences.       39         6.5 Source Protection Zones.       39         6.6 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Abstraction Licences.       39         6.7 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9.1 Biological Quality:       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       46         <
6c. Hydrogeology - Source Protection Zones and Potable Water Abstraction Licenses       34         6d. Hydrogeology - Source Protection Zones within confined aquifer       35         6e. Hydrology - Detailed River Network and River Quality       36         6.1 Aquifer within Superficial Deposits.       37         6.2 Aquifer within Bedrock Deposits.       38         6.3 Groundwater Abstraction Licences.       39         6.4 Surface Water Abstraction Licences.       39         6.5 Potable Water Abstraction Licences.       39         6.6 Source Protection Zones.       39         6.7 Source Protection Zones.       39         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9 Chemical Quality:       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         74. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)         74 Flood Defences.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46
6d. Hydrogeology – Source Protection Zones within confined aquifer       35         6e. Hydrology – Detailed River Network and River Quality       36         6.Hydrogeology and Hydrology       37         6.1 Aquifer within Superficial Deposits       37         6.1 Aquifer within Superficial Deposits       38         6.3 Groundwater Abstraction Licences       39         6.4 Surface Water Abstraction Licences       39         6.5 Potable Water Abstraction Licences       39         6.6 Source Protection Zones       39         6.7 Source Protection Zones within Confined Aquifer       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9 Dispical Quality.       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)         Map       45         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 2 Flooding.       46         7.3 Rike for Flood Defences.       47         7.4 Flood Defences.       47         7.5 Areas benefiting from Flood Defences.       47
6e. Hydrology – Detailed River Network and River Quality       36         6.Hydrogeology and Hydrology       37         6.1 Aquifer within Superficial Deposits.       37         6.2 Aquifer within Sederock Deposits.       38         6.3 Groundwater Abstraction Licences.       39         6.4 Surface Water Abstraction Licences.       39         6.5 Potable Water Abstraction Licences.       39         6.6 Source Protection Zones       39         6.7 Source Protection Zones within Confined Aquifer.       40         6.9 River Quality.       41         6.9.1 Biological Quality.       41         6.9.2 Chemical Quality.       41         6.10 Detailed River Network       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the Sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       46         7.1 River and Coastal Zone 2 Flooding.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Defences.       47         7.7 Aroundwater Flooding Susceptibility Areas.       47         7.7.2 What is the highest susceptibility to ground
6.Hydrogeology and Hydrology       37         6.1 Aquifer within Superficial Deposits       37         6.2 Aquifer within Bedrock Deposits       38         6.3 Groundwater Abstraction Licences       39         6.4 Surface Water Abstraction Licences       39         6.5 Fotable Water Abstraction Licences       39         6.6 Source Protection Zones       39         6.7 Source Protection Zones within Confined Aquifer       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9.1 Biological Quality.       41         6.9.2 Chemical Quality.       41         6.10 Detailed River Network       41         6.11 Surface Water Features       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       46         7.1 River and Coastal Zone 2 Flooding       46         7.2 River and Coastal Zone 3 Flooding       46         7.4 Flood Defences       46         7.5 Areas benefiting from Flood Defences       47         7.6 Areas benefiting from Flood Defences       47         7.7.7 Are thre any British Geological Survey groundwater flooding sus
6.1 Aquifer within Superficial Deposits.       37         6.2 Aquifer within Bedrock Deposits.       38         6.3 Groundwater Abstraction Licences.       39         6.4 Surface Water Abstraction Licences.       39         6.5 Potable Water Abstraction Licences.       39         6.6 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9.1 Biological Quality.       41         6.10 Detailed River Network.       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       46         7.1 River and Coastal Zone 2 Flooding.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Defences.       47         7.7.7 What is the highest susceptibility Areas.       47         7.7.8 Groundwater Flooding Confidence Areas.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Groundw
6.2 Aquifer within Bedrock Deposits.       38         6.3 Groundwater Abstraction Licences.       39         6.4 Surface Water Abstraction Licences.       39         6.5 Potable Water Abstraction Licences.       39         6.6 Source Protection Zones.       39         6.6 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9.1 Biological Quality.       41         6.9.2 Chemical Quality.       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       46         7.2 River and Coastal Zone 2 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46         7.5 Areas benefitting from Flood Defences.       46         7.6 Areas benefitting from Flood Storage.       47         7.7.2 What is the highest susceptibility Areas.       47         7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the un
6.3 Groundwater Abstraction Licences.       39         6.4 Surface Water Abstraction Licences.       39         6.5 Potable Water Abstraction Licences.       39         6.6 Source Protection Zones.       39         6.7 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9.1 Biological Quality.       41         6.9.2 Chemical Quality.       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 3 Flooding.       46         7.4 Rivod Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Defences.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditio
6.4 Surface Water Abstraction Licences.       39         6.5 Potable Water Abstraction Licences.       39         6.6 Source Protection Zones.       39         6.6 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.10 Detailed River Network.       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       45         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 2 Flooding.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Storage.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?       47         7.8 Groundwater Flooding Confidence Areas.
6.5 Potable Water Abstraction Licences.       39         6.6 Source Protection Zones.       39         6.7 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9.1 Biological Quality:       41         6.9.2 Chemical Quality:       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 2 Flooding.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       47         7.7 Groundwater Flooding Susceptibility Areas.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Designated E
6.6 Source Protection Zones.       39         6.7 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9.1 Biological Quality:       41         6.9.2 Chemical Quality:       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)         Map       45         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 2 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Storage.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?       47         7.8 Groundwater Flooding Confidence Areas.       47         8.1 Beosignated Environmentally Sensitive Sites Map<
6.7 Source Protection Zones within Confined Aquifer.       40         6.8 Groundwater Vulnerability and Soil Leaching Potential.       40         6.9 River Quality.       41         6.9.1 Biological Quality.       41         6.9.2 Chemical Quality.       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)         Map       45         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 2 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS)       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.6 Areas benefiting from Flood Defences.       46         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Designated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive Sites       49
6.8 Groundwater Vulnerability and Soil Leaching Potential       40         6.9 River Quality.       41         6.9 River Quality.       41         6.9.1 Biological Quality:       41         6.2 Chemical Quality:       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 3 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 roundwater Flooding Susceptibility Areas.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Besignated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive Sites
6.9 River Quality.       41         6.9.1 Biological Quality:       41         6.9.2 Chemical Quality:       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       45         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 3 Flooding.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.6 Areas benefiting from Flood Defences.       46         7.7 Groundwater Flooding Susceptibility Areas.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.9 Bosignated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive Sites Map       48<
6.9.1 Biological Quality:       41         6.9.2 Chemical Quality:       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       45         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 3 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Storage.       47         7.7 Groundwater Flooding Susceptibility Areas.       47         7.7.2 What is the highest susceptibility to groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Designated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive Sites Map       48
6.9.2 Chemical Quality:       41         6.10 Detailed River Network.       41         6.11 Surface Water Features.       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       45         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 3 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Storage.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Groundwater Flooding Confidence Areas.       47         8. Designated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive S
6.10 Detailed River Network       41         6.11 Surface Water Features       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       46         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 3 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Storage.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Groundwater Flooding Confidence Areas.       47         8. Designated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive Sites Map       48
6.11 Surface water Features       43         7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       45         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 3 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Storage.       47         7.7 Groundwater Flooding Susceptibility Areas.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.8 Groundwater Flooding Confidence Areas.       47         7.8 Groundwater Flooding Confidence Areas.       47         8. Designated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive Sites       49
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)       44         7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS)       45         7 Flooding       46         7.1 River and Coastal Zone 2 Flooding
7 Flooding467.1 River and Coastal Zone 2 Flooding.467.2 River and Coastal Zone 3 Flooding.467.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.467.4 Flood Defences.467.5 Areas benefiting from Flood Defences.467.6 Areas benefiting from Flood Storage.477.7 Groundwater Flooding Susceptibility Areas.477.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.477.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?478. Designated Environmentally Sensitive Sites Map488. Designated Environmentally Sensitive Sites498. Designated Environmentally Sensitive Sites49
7.1 River and Coastal Zone 2 Flooding.       46         7.2 River and Coastal Zone 3 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Storage.       47         7.7 Groundwater Flooding Susceptibility Areas.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?       47         7.8 Groundwater Flooding Confidence Areas.       47         8. Designated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive Sites       49         8. 1 Percents of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:       40
7.2 River and Coastal Zone 3 Flooding.       46         7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating.       46         7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Storage.       47         7.7 Groundwater Flooding Susceptibility Areas.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?       47         7.8 Groundwater Flooding Confidence Areas.       47         8. Designated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive Sites       49         8. 1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:       40
7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating
7.4 Flood Defences.       46         7.5 Areas benefiting from Flood Defences.       46         7.6 Areas benefiting from Flood Storage.       47         7.7 Groundwater Flooding Susceptibility Areas.       47         7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes.       47         7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?       47         7.8 Groundwater Flooding Confidence Areas.       47         8. Designated Environmentally Sensitive Sites Map       48         8. Designated Environmentally Sensitive Sites       49         8. 1 Pecords of Sites of Special Scientific Interact (SSSI) within 2000m of the study site:       40
7.5 Areas benefiting from Flood Defences
7.6 Areas benefiting from Flood Storage
7.7 Groundwater Flooding Susceptibility Areas
<ul> <li>7.7.1 Are there any British Geological Survey groundwater Rooding susceptibility areas within Som of the boundary of the study site? Yes</li></ul>
<ul> <li>7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?</li> <li>47</li> <li>7.8 Groundwater Flooding Confidence Areas</li> <li>47</li> <li>8. Designated Environmentally Sensitive Sites Map</li> <li>8. Designated Environmentally Sensitive Sites</li> <li>49</li> <li>8. 1 Pecords of Sites of Special Scientific Interact (SSSI) within 2000m of the study site:</li> </ul>
conditions?477.8 Groundwater Flooding Confidence Areas478. Designated Environmentally Sensitive Sites Map488. Designated Environmentally Sensitive Sites498. 1 Pecords of Sites of Special Scientific Interact (SSSI) within 2000m of the study site:40
7.8 Groundwater Flooding Confidence Areas
<ul> <li>8. Designated Environmentally Sensitive Sites Map</li> <li>8. Designated Environmentally Sensitive Sites</li> <li>8. Designated Environmentally Sensitive Sites</li> <li>49</li> <li>8. Pecords of Sites of Special Scientific Interact (SSSI) within 2000m of the study sites</li> <li>40</li> </ul>
8. Designated Environmentally Sensitive Sites 49 8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:
8 1 Pacards of Sitas of Spacial Scientific Interact (SSSI) within 2000m of the study sites 40
o. Trecords of Sites of Special Sciencinc Interest (555) within 200011 01 the study site
8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:
8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:
8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:
8.5 Records of Ramsar sites within 2000m of the study site:
o.o Records of Local Nature Records (LNR) within 2000m of the study site:
8.8 Records of World Heritage Sites within 2000m of the study site.
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![](_page_167_Picture_1.jpeg)

LOCATION INTELLIGENCE

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:	51
8.11 Records of National Parks (NP) within 2000m of the study site:	51
8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:	51
8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:	51
8.14 Records of Green Belt land within 2000m of the study site:	51
9. Natural Hazards Findings	52
9.1 Detailed BGS GeoSure Data	52
9.1.1 Shrink Swell	52
9.1.2 Landslides	52
9.1.3 Soluble Rocks	52
9.1.4 Compressible Ground	53
9.1.5 Collapsible Rocks	53
9.1.6 Running Sand	53
9.2 Radon	53
9.2.1 Radon Affected Areas	53
9.2.2 Radon Protection	54
10. Mining	55
10.1 Coal Mining	55
10.2 Non-Coal Mining	55
10.3 Brine Affected Areas	55
Contact Details	56
Standard Terms and Conditions	58

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![](_page_168_Picture_1.jpeg)

# **Overview of Findings**

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Historical Industrial Sites	On-site	0-50	51-250	251-500
1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping	19	0	18	12
1.2 Additional Information - Historical Tank Database	0	0	4	19
1.3 Additional Information – Historical Energy Features Database	0	0	3	2
1.4 Additional Information – Historical Petrol and Fuel Site Database	0	0	0	0
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	0	0	0	0
1.6 Potentially Infilled Land	17	0	25	24
Section 2: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
2.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
2.1.1 Records of historic IPC Authorisations	0	0	0	0
2.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	9
2.1.3 Records of Red List Discharge Consents	0	0	0	0
2.1.4 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
2.1.5 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
2.1.6 Records of Part A(2) and Part B Activities and Enforcements	0	0	0	0
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
2.1.8 Records of Licensed Discharge Consents	0	0	1	0
2.1.9 Records of Water Industry Referrals	0	0	0	0
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	0	0	0	0
2.2 Records of COMAH and NIHHS sites	1	0	0	0
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	0	0	0	1
2.3.2 National Incidents Recording System, List 1	0	0	0	0
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

![](_page_169_Picture_0.jpeg)

![](_page_169_Picture_1.jpeg)

Section 3: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000- 1500
3.1 Landfill Sites						
3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites	0	0	1	0	0	Not searched
3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites	0	0	1	0	0	2
3.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0
3.1.4 Records of Landfills in Local Authority and Historical Mapping Records	0	0	0	0	0	0
3.2 Landfill and Other Waste Sites Findings						
3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	Not searched	Not searched
3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites	0	0	0	0	0	3
			0.50		0 0	54 500
Section 4: Current Land Use	On-site	9	0-50m	51-25	0 2	51-500
4.1 Current Industrial Sites Data	15		0	8	No	ot searched
4.2 Records of Petrol and Fuel Sites	0		0	0		0
4.3 National Grid Underground Electricity Cables	0		0	0		0
4.4 National Grid Gas Transmission Pipelines	0		0	0		0
Section 5: Geology						
5.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?			Y	'es		
5.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes					
5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.						
Section Arm I I I I I I			0.5	00m		
Section 0. Hydrogeology and Hydrology			0-5	00111		
6.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?			Y	es		
6.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?	Yes					
	On-site	0-50m	51-250	251-500	501-1000	1000- 2000
6.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	1
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
6.7 Source Protection Zones within Confined Aquifer	0	0	0	0	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	6	0	0	0	Not searched	Not searched

![](_page_170_Picture_0.jpeg)

![](_page_170_Picture_1.jpeg)

0-500m

# Section 6: Hydrogeology and Hydrology

	On-site	0-50m	51-250	251-500	501-1000	1000- 1500
6.9 Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site?	No	No	No	No	No	Yes
6.10 Detailed River Network entries within 500m of the site	11	1	6	3	Not searched	Not searched
6.11 Surface water features within 250m of the study site	Yes	Yes	Yes	Not searched	Not searched	Not searched

# Section 7: Flooding

7.1 Are there any Enviroment Agency Zone 2 floodplains within 250m of the study site?	No
7.2 Are there any Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	No
7.3 What is the Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site?	Very Low
7.4 Are there any Flood Defences within 250m of the study site?	No
7.5 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
7.6 Are there any areas used for Flood Storage within 250m of the study site?	No
7.7 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Potential at Surface
7.8 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	High

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000- 2000
8.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	4
8.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
8.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
8.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
8.5 Records of Ramsar sites	0	0	0	0	0	0
8.6 Records of Ancient Woodlands	0	1	0	0	4	1
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
8.8 Records of World Heritage Sites	0	0	0	0	0	0
8.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0

9
Groundsure
LOCATION INTELLIGENCE

![](_page_171_Picture_1.jpeg)

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000- 2000
8.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
8.11 Records of National Parks	0	0	0	0	0	0
8.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
8.13 Records of Nitrate Vulnerable Zones	6	0	0	0	0	0
8.14 Records of Green Belt land	0	0	0	0	0	0
Section 9: Natural Hazards						
9.1 What is the maximum risk of natural ground subsidence?			Mod	erate		
9.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Low					
9.1.2 What is the maximum Landslides hazard rating identified on the study site?	n Moderate					
9.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Very Low					
9.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	Moderate					
9.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low					
9.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Low					
9.2 Radon						
9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is in a Radon Affected Area, as between 10 and 30% of properties are above the Action Level.					
9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	Full radon protective measures are necessary.					
Section 10: Mining						

10.1 Are there any coal mining areas within 75m of the study site?	No
10.2 Are there any Non-Coal Mining areas within 50m of the study site boundary?	Yes
10.3 Are there any brine affected areas within 75m of the study site?	No

![](_page_172_Picture_0.jpeg)

![](_page_172_Picture_1.jpeg)

# Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

# 1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

# 2. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

# 3. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

### 4. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

# 5. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

### 6. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

### 7. Flooding

Provides information on river and coastal flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

# 8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

### 9. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence and radon..

### 10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

### 11. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

### Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

![](_page_173_Picture_0.jpeg)

![](_page_173_Picture_1.jpeg)

# 1. Historical Land Use

![](_page_173_Figure_3.jpeg)

![](_page_174_Picture_0.jpeg)

![](_page_174_Picture_1.jpeg)

# **1. Historical Industrial Sites**

# 1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 49

ID	Distance [m]	Direction	Use	Date
1B	0	On Site	Unspecified Pit	1948
2	0	On Site	Railway Sidings	1979
3C	0	On Site	Unspecified Ground Workings	1977
4A	0	On Site	Unspecified Pit	1977
5D	0	On Site	Unspecified Pit	1977
6A	0	On Site	Unspecified Pit	1886
7E	0	On Site	Unspecified Pit	1886
8B	0	On Site	Unspecified Pit	1906
9B	0	On Site	Unspecified Pit	1955
10C	0	On Site	Unspecified Ground Workings	1994
11D	0	On Site	Unspecified Pit	1994
12A	0	On Site	Unspecified Pit	1994
13F	0	On Site	Unspecified Ground Workings	1977
14	0	On Site	Unspecified Works	1979
15B	0	On Site	Unspecified Pit	1906
16B	0	On Site	Unspecified Pit	1886
17E	0	On Site	Unspecified Pit	1886
18F	0	On Site	Unspecified Ground Workings	1994
19B	0	On Site	Unspecified Pit	1906
20T	105	W	Opencast Ironstone Workings	1979
21G	123	W	Unspecified Pit	1885
22G	123	W	Unspecified Pit	1885
23G	123	W	Unspecified Ground Workings	1905
24G	123	W	Unspecified Ground Workings	1905
25G	123	W	Unspecified Ground Workings	1886
26G	126	W	Unspecified Pit	1968
27H	134	NW	Unspecified Pit	1886
28H	135	NW	Unspecified Pit	1886
29U	139	W	Unspecified Pit	1886

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![](_page_175_Picture_1.jpeg)

LOGHTON INTELLOENCE				
301	147	W	Unspecified Pit	1886
311	147	W	Unspecified Pit	1886
32J	195	W	Opencast Ironstone Workings	1977
331	195	W	Opencast Ironstone Workings	1994
34K	217	W	Unspecified Ground Workings	1977
35K	217	W	Unspecified Ground Workings	1994
36R	228	S	Electric Substation	1979
37L	232	SW	Unspecified Tanks	1979
38L	266	SW	Unspecified Tanks	1979
39M	326	SW	Sand Pit	1885
40M	328	SW	Unspecified Pit	1905
41M	328	SW	Unspecified Pit	1905
42M	328	SW	Unspecified Pit	1886
43M	330	SW	Unspecified Pit	1955
44M	330	SW	Unspecified Heap	1968
45M	332	SW	Unspecified Pit	1948
46M	332	SW	Unspecified Pit	1938
47N	456	S	Unspecified Tanks	1979
48N	458	S	Unspecified Tanks	1979
49X	489	S	Unspecified Pit	1979

# 1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical tanks within 500m of the search boundary:

23

ID	Distance (m)	Direction	Use	Date
50L	235	SW	Unspecified Tank	1975
51L	236	SW	Unspecified Tank	1997
52L	237	SW	Unspecified Tank	1975
53L	239	SW	Unspecified Tank	1997
54L	266	SW	Tanks	1975
55L	266	SW	Unspecified Tank	1997
560	274	SW	Tanks	1975
570	275	SW	Tanks	1997
58L	286	SW	Unspecified Tank	1975
59L	287	SW	Unspecified Tank	1997
60L	292	S	Unspecified Tank	1975
61L	293	S	Unspecified Tank	1997

![](_page_176_Picture_0.jpeg)

![](_page_176_Picture_1.jpeg)

62P	370	SW	Unspecified Tank	1975
63P	372	SW	Unspecified Tank	1997
64N	454	S	Unspecified Tank	1997
65N	454	S	Unspecified Tank	1975
66N	458	S	Unspecified Tank	1997
67N	458	S	Unspecified Tank	1975
68Q	461	S	Unspecified Tank	1997
69Q	461	S	Unspecified Tank	1975
70N	483	S	Unspecified Tank	1975
71N	483	S	Unspecified Tank	1997
72	485	NW	Unspecified Tank	1964

# 1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary:

5

ID	Distance (m)	Direction	Use	Date
73R	194	S	Electricity Transformer Station	1997
74S	203	S	Electricity Substation	1975
75S	204	S	Electricity Substation	1997
76R	282	S	Electricity Substation	1975
77R	283	S	Electricity Substation	1997

# 1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary:

0

Database searched and no data found.

# 1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary: 0

Database searched and no data found.

![](_page_177_Picture_0.jpeg)

![](_page_177_Picture_1.jpeg)

# 1.6 Potentially Infilled Land

Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 66

The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

ID	Distance(m)	Direction	Use	Date
78B	0	On Site	Unspecified Pit	1955
79B	0	On Site	Unspecified Pit	1886
80F	0	On Site	Unspecified Ground Workings	1977
81F	0	On Site	Unspecified Ground Workings	1994
82A	0	On Site	Unspecified Pit	1977
83A	0	On Site	Unspecified Pit	1994
84A	0	On Site	Unspecified Pit	1886
85E	0	On Site	Unspecified Pit	1886
86C	0	On Site	Unspecified Ground Workings	1994
87C	0	On Site	Unspecified Ground Workings	1977
88B	0	On Site	Unspecified Pit	1906
89B	0	On Site	Unspecified Pit	1906
90B	0	On Site	Unspecified Pit	1906
91B	0	On Site	Unspecified Pit	1948
92D	0	On Site	Unspecified Pit	1994
93D	0	On Site	Unspecified Pit	1977
94E	0	On Site	Unspecified Pit	1886
95T	105	W	Opencast Ironstone Workings	1979
96G	123	W	Unspecified Pit	1885
97G	123	W	Unspecified Pit	1885
98G	123	W	Unspecified Ground Workings	1886
99G	123	W	Unspecified Ground Workings	1905
100G	123	W	Unspecified Ground Workings	1905
101G	124	W	Ponds	1948
102G	124	W	Ponds	1938
103G	126	W	Ponds	1955
104G	126	W	Unspecified Pit	1968
105H	134	NW	Unspecified Pit	1886
106H	135	NW	Unspecified Pit	1886
107U	139	W	Unspecified Pit	1886
108G	145	W	Ponds	1885
109G	147	W	Pond	1905

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![](_page_178_Picture_1.jpeg)

ECONTROL INTERPORTER				
110G	147	W	Pond	1905
111G	147	W	Pond	1886
1121	147	W	Unspecified Pit	1886
1131	147	W	Unspecified Pit	1886
114J	195	W	Opencast Ironstone Workings	1977
115J	195	W	Opencast Ironstone Workings	1994
116V	205	W	Pond	1977
117V	205	W	Pond	1994
118K	217	W	Unspecified Ground Workings	1977
119K	217	W	Unspecified Ground Workings	1994
120W	323	S	Pond	1885
121W	323	S	Pond	1938
122W	323	S	Pond	1948
123W	323	S	Pond	1886
124W	323	S	Pond	1905
125W	323	S	Pond	1905
126W	325	S	Pond	1955
127M	326	SW	Sand Pit	1885
128M	328	SW	Unspecified Pit	1905
129M	328	SW	Unspecified Pit	1886
130M	328	SW	Unspecified Pit	1905
131M	330	SW	Unspecified Pit	1955
132M	330	SW	Unspecified Heap	1968
133M	332	SW	Unspecified Pit	1948
134M	332	SW	Unspecified Pit	1938
135Q	440	S	Pond	1886
136Q	440	S	Pond	1905
137Q	440	S	Pond	1905
138Q	440	S	Pond	1885
139Q	441	S	Pond	1955
140Q	441	S	Pond	1968
141Q	441	S	Pond	1938
142Q	441	S	Pond	1948
143X	489	S	Unspecified Pit	1979

![](_page_179_Picture_0.jpeg)

![](_page_179_Picture_1.jpeg)

# 2. Environmental Permits, Incidents and Registers Map

![](_page_179_Figure_3.jpeg)

![](_page_179_Figure_4.jpeg)




### 2. Environmental Permits, Incidents and Registers

#### 2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

2.1.1 Records of historic IPC Authorisations within 500m of the study site:

Database searched and no data found.

2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

9

0

The following Part A(1) and IPPC Authorised Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	De	tails
13A	469	E	495020 410050	Operator: Hook2sisters Ltd Installation Name: Gokewell Farm Process: ASSOCIATED PROCESS	Permit Number: HP3633UU Original Permit Number: HP3633UU EPR Reference: - Issue Date: 26/10/2007 Effective Date: 26/10/2007 Last date noted as effective: 2017-04- 01 Status: Superceded
14A	469	E	495020 410050	Operator: Hook2sisters Ltd Installation Name: Gokewell Farm Process: ASSOCIATED PROCESS	Permit Number: TP3139TA Original Permit Number: HP3633UU EPR Reference: - Issue Date: 25/3/2010 Effective Date: 25/3/2010 Last date noted as effective: 2017-04- 01 Status: Effective
15A	469	E	495020 410050	Operator: Hook2sisters Ltd Installation Name: Gokewell Farm Process: INTENSIVE FARMING; > 40,000 POULTRY	Permit Number: HP3633UU Original Permit Number: HP3633UU EPR Reference: - Issue Date: 26/10/2007 Effective Date: 26/10/2007 Last date noted as effective: 2017-04- 01 Status: Superceded





ID	Distance (m)	Direction	NGR	Details		
16A	469	E	495020 410050	Operator: Hook2sisters Ltd Installation Name: Gokewell Farm Process: INTENSIVE FARMING; > 40,000 POULTRY	Permit Number: TP3139TA Original Permit Number: HP3633UU EPR Reference: - Issue Date: 25/3/2010 Effective Date: 25/3/2010 Last date noted as effective: 2017-04- 01 Status: Effective	
17B	496	NW	493300 410500	Operator: Tata Steel Uk Limited Installation Name: Yarborough Quarry Epr/qp3334sk Process: WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE	Permit Number: NP3631FV Original Permit Number: QP3334SK EPR Reference: - Issue Date: 12/1/2012 Effective Date: 12/1/2012 Last date noted as effective: 2017-04- 01 Status: Superceded	
18B	496	NW	493300 410500	Operator: Tata Steel Uk Limited Installation Name: Yarborough Quarry Epr/qp3334sk Process: WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE	Permit Number: QP3334SK Original Permit Number: QP3334SK EPR Reference: - Issue Date: 13/6/2006 Effective Date: 13/6/2006 Last date noted as effective: 2017-04- 01 Status: Superceded	
19B	496	NW	493300 410500	Operator: Longs Steel Uk Limited Installation Name: Yarborough Quarry Epr/fp3136al Process: WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE	Permit Number: FP3136AL Original Permit Number: FP3136AL EPR Reference: - Issue Date: 21/8/2015 Effective Date: 21/8/2015 Last date noted as effective: 2017-04- 01 Status: Superceded	
208	496	NW	493300 410500	Operator: British Steel Ltd Installation Name: Yarborough Quarry Landfill Process: WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE	Permit Number: TP3639DC Original Permit Number: FP3136AL EPR Reference: - Issue Date: 8/6/2016 Effective Date: 8/6/2016 Last date noted as effective: 2017-04- 01 Status: Effective	
21B	496	NW	493300 410500	Operator: Longs Steel Uk Limited Installation Name: Yarborough Quarry Epr/fp3136al Process: WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE	Permit Number: NP3036RS Original Permit Number: FP3136AL EPR Reference: - Issue Date: 24/2/2016 Effective Date: 24/2/2016 Last date noted as effective: 2017-04- 01 Status: Superceded	





2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

					0
			D	atabase searched and no data found.	
2.1.4	Record	s of List 1 D	angerous S	ubstances Inventory Sites within 500m of the study site:	
					0
			D	atabase searched and no data found.	
2.1.5	Record	s of List 2 D	angerous S	ubstance Inventory Sites within 500m of the study site:	
			J		0
			D	atabase searched and no data found.	Ũ
2.1.6	Record	s of Part A(	2) and Part	B Activities and Enforcements within 500m of the study site:	
					0
			D	atabase searched and no data found.	
2.1.7	Records	s of Catego	ory 3 or 4 Ra	dioactive Substances Authorisations:	
			-		0
			D	atabase searched and no data found.	Ũ
2.1.8	Record	s of License	ed Discharge	Consents within 500m of the study site:	
					1
The Perm	followin nits, Incid	g Licensed dents and F	l Discharge Registers Ma	Consents records are represented as points on the Environ p:	mental
ID	Distance (m)	Direction	NGR	Details	
2	245	E	494800 410000	Address: SITE 49 GOKEWELL PRIORY, HERON HOLT, BROUGHTON, BRIGG, SOUTH HUMBERSIDE, DN20 0BQ Effluent Type: UNSPECIFIED Permit Number: PR3LF520Receiving Water: Into L Status: PRE NRA LEGISLATIO ISSUE DATE < 01-SEP-89 (HIST) Issue date: 24/11/198 Effective Date: 24-Nov-	and N WHERE ORIC ONLY) 37 1987

Permit Version: 1

Revocation Date: 09/05/1997





2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

0

1

Database searched and no data found.

2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

Database searched and no data found.

#### 2.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site:

The following COMAH & NIHHS Authorisation records provided by the Health and Safety Executive are represented as polygons or buffered points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	Company	Address	Operational Status	Tier
12	0	On Site	Tata Steel UK Limited	Tata Steel UK Limited, Scunthorpe, Po Box 1, Brigg Road, Scunthorpe, North Lincolnshire, DN16 1BP	Current COMAH Site	COMAH Upper Tier Operator

#### 2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

1

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details		
1	461	SW	493000 408760	Incident Date: 13-Jul-2002 Incident Identification: 91233 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Fumes	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)	





0

Database searched and no data found.

#### 2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the EnvironmentalProtection Act 1990 are there within 500m of the study site?0





### 3. Landfill and Other Waste Sites Map



BGS / DoE Survey Landfill

Local Authority/Historical Mapping

Landfill Records

Search Buffers (m)

250

500





# 3. Landfill and Other Waste Sites

#### 3.1 Landfill Sites

3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

1

The following Environment Agency/Natural Resources Wales landfill records are represented as polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details			
1	190	W	493300 410500	Address: Crosby North Landfill, Brigg Road, South Humberside, DN16 1BP Landfill Reference: -9999.0 Environmental Permitting Regulations (Waste) Reference: - Landfill Type: WASTE LANDFILLING; >10 T/D WITH CAPACITY >25,000T EXCLUDING INERT WASTE	Operator: British Steel Ltd Status: Effective IPPC Reference: EPR Reference:		

### 3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

3

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	De	tails
2	144	W	493100 409200	Site Address: Scunthorpe Concast, Scunthorpe, Lincolnshire Waste Licence: Yes Site Reference: 55/19/0702, A702 Waste Type: Industrial, Liquid, sludge Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 24-Sep-1981 Licence Surrendered: 23-Sep-1992 Licence Holder Address: - Operator: British Steel Corporation Licence Holder: British Steel Corporation First Recorded: 31-Dec-1981 Last Recorded: 31-Dec-1992
3	1190	W	492100 410200	Site Address: Slag Pit, Scunthorpe, Lincolnshire Waste Licence: Yes Site Reference: 55/19/0716, A716 Waste Type: Inert, Industrial Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 01-Jan-1986 Licence Surrendered: 23-Sep-1992 Licence Holder Address: - Operator: - Licence Holder: British Steel Corporation First Recorded: 31-Dec-1986 Last Recorded: 23-Sep-1992





ID	Distance (m)	Direction	NGR	Deta	ils
Not shown	1446	SW	491900 408500	Site Address: Ashby Village, Scunthorpe, Lincolnshire Waste Licence: Yes Site Reference: 55/19/0843 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 06-Apr-1992 Licence Surrendered: 25-Apr-1993 Licence Holder Address: - Operator: - Licence Holder: Anchor Village Developments First Recorded: 31-Dec-1992 Last Recorded: 25-Apr-1993

3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:



Database searched and no data found.

3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

0

Database searched and no data found.

#### **3.2 Other Waste Sites**

3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:





3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

3

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details		
Not shown	1257	NW	492947 411434	Site Address: Yarborough Landfill Site, P O Box 1, Brigg Road, Scunthorpe, Lincolnshire, DN16 1BP Type: Industrial Waste Landfill (Factory curtilage) Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: COR003 EPR reference: - Operator: Corus Uk Ltd Waste Management licence No: 43126 Annual Tonnage: 0.0	Issue Date: 10/05/1978 Effective Date: - Modified: 05/08/2004 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Yarborough Landfill Site Correspondence Address: P O Box 1, Brigg Road, Scunthorpe, Lincolnshire, DN16 1BP	
Not shown	1257	NW	492947 411434	Site Address: Yarborough Landfill Site, P O Box 1, Brigg Road, Scunthorpe, N Lincolnshire, DN16 1BP Type: Industrial Waste Landfill (Factory curtilage) Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: COR003 EPR reference: - Operator: Corus U K Ltd Waste Management licence No: 43126 Annual Tonnage: 637500.0	Issue Date: 10/05/1978 Effective Date: - Modified: 05/08/2004 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Yarborough Landfill Site Correspondence Address: P O Box 1, Brigg Road, Scunthorpe, N Lincolnshire, DN16 1BP	
Not shown	1257	NW	492946 411433	Site Address: Yarborough Landfill Site, P O Box 1, Brigg Road, Scunthorpe, Lincolnshire, DN16 1BP Type: Industrial Waste Landfill (Factory curtilage) Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: COR003 EPR reference: - Operator: Corus Waste Management licence No: 43126 Annual Tonnage: 0.0	Issue Date: 10/05/1978 Effective Date: - Modified: 06/02/2001 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Yarborough Landfill Site Correspondence Address: Scunthorpe Works, P O Box 1, Brigg Road, Scunthorpe, North Lincs, DN16 1BP	





### 4. Current Land Use Map







### 4. Current Land Uses

#### 4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site:

23

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Directio n	Company	NGR	Address	Activity	Category
1	0	On Site	Pylon	494059 409785	Pylon, DN16	Electrical Features	Infrastructure and Facilities
2	0	On Site	Pylon	494193 410550	Pylon, DN20	Electrical Features	Infrastructure and Facilities
3	0	On Site	Pylon	494188 410277	Pylon, DN20	Electrical Features	Infrastructure and Facilities
4	0	On Site	Pylon	493986 409514	Pylon, DN16	Electrical Features	Infrastructure and Facilities
5	0	On Site	Pylon	493792 409325	Pylon, DN16	Electrical Features	Infrastructure and Facilities
6	0	On Site	Pylon	494126 410042	Pylon, DN20	Electrical Features	Infrastructure and Facilities
7	0	On Site	Pylon	494062 410055	Pylon, DN16	Electrical Features	Infrastructure and Facilities
8	0	On Site	Pylon	493828 409268	Pylon, DN16	Electrical Features	Infrastructure and Facilities
9	0	On Site	Pylon	494240 410285	Pylon, DN20	Electrical Features	Infrastructure and Facilities
10	0	On Site	Pylon	494445 410485	Pylon, DN20	Electrical Features	Infrastructure and Facilities
11	0	On Site	Pylon	494129 410306	Pylon, DN20	Electrical Features	Infrastructure and Facilities
12	0	On Site	Pylon	494007 409840	Pylon, DN16	Electrical Features	Infrastructure and Facilities
13	0	On Site	Pylon	494258 410543	Pylon, DN20	Electrical Features	Infrastructure and Facilities
14	0	On Site	Pylon	493929 409544	Pylon, DN16	Electrical Features	Infrastructure and Facilities
15	0	On Site	Pylon	493627 409061	Pylon, DN16	Electrical Features	Infrastructure and Facilities
16	84	S	Pylon	493632 408958	Pylon, DN16	Electrical Features	Infrastructure and Facilities
17	99	Ν	Pylon	494202 410751	Pylon, DN15	Electrical Features	Infrastructure and Facilities
18	130	Ν	Pylon	494131 410769	Pylon, DN15	Electrical Features	Infrastructure and Facilities
19	146	NE	Oil Well	494620 410763	Oil Well, DN15	Oil and Gas Extraction, Refinery and Product Manufacture	Extractive Industries





ID	Distance (m)	Directio n	Company	NGR	Address	Activity	Category
20	183	E	Pylon	494671 410706	Pylon, DN20	Electrical Features	Infrastructure and Facilities
21	193	S	Electricity Sub Station	493454 408879	Electricity Sub Station, DN16	Electrical Features	Infrastructure and Facilities
22	217	W	Opencast Workings (Disused)	493243 409690	Opencast Workings (Disused), DN16	Unspecified Quarries Or Mines	Extractive Industries
23	228	SW	Works	493122 408989	Works, DN16	Unspecified Works Or Factories	Industrial Features

#### 4.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site:

0

0

0

Database searched and no data found.

#### 4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site:

Database searched and no data found.

#### 4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site:





### 5. Geology

#### 5.1 Artificial Ground and Made Ground

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT

#### 5.2 Superficial Ground and Drift Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type	
SUTN-S	SUTTON SAND FORMATION	SAND	
SUTN-S	SUTTON SAND FORMATION	SAND	

#### 5.3 Bedrock and Solid Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
MRB-FGLS	MARLSTONE ROCK FORMATION	FERRUGINOUS LIMESTONE AND FERRUGINOUS SANDSTONE
GRF-SDSM	GRANTHAM FORMATION	SANDSTONE, SILTSTONE AND MUDSTONE
WHM-MDST	WHITBY MUDSTONE FORMATION	MUDSTONE
NS-FGSST	NORTHAMPTON SAND FORMATION	SANDSTONE, FERRUGINOUS
HIL-LMOOL	HIBALDSTOW LIMESTONE	LIMESTONE, OOIDAL
KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL- REEF)	LIMESTONE
KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL- REEF)	LIMESTONE
KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL- REEF)	LIMESTONE
KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL- REEF)	LIMESTONE
KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL- REEF)	LIMESTONE





Lex Code	Description	Rock Type
SYL-LMAR	SCAWBY LIMESTONE	LIMESTONE AND [SUBEQUAL/SUBORDINATE] ARGILLACEOUS ROCKS, INTERBEDDED
LLL-LMST	LOWER LINCOLNSHIRE LIMESTONE MEMBER	LIMESTONE
KCM-MDLM	KIRTON CEMENTSTONE BEDS	MUDSTONE AND LIMESTONE, INTERBEDDED
RVB-LMAR	RAVENTHORPE BEDS	LIMESTONE AND [SUBEQUAL/SUBORDINATE] ARGILLACEOUS ROCKS, INTERBEDDED
KCM-LMST	KIRTON CEMENTSTONE BEDS	LIMESTONE
KCM-LMST	KIRTON CEMENTSTONE BEDS	LIMESTONE
KCM-MDLM	KIRTON CEMENTSTONE BEDS	MUDSTONE AND LIMESTONE, INTERBEDDED
CHAM-MDST	CHARMOUTH MUDSTONE FORMATION	MUDSTONE
PTNI-FEST	PECTEN IRONSTONE (BED)	IRONSTONE
CHAM-MDST	CHARMOUTH MUDSTONE FORMATION	MUDSTONE

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)





# 6 Hydrogeology and Hydrology 6a. Aquifer Within Superficial Geology







## 6b. Aquifer Within Bedrock Geology and Abstraction Licenses



Secondary (A) Aquifer - Permeable Layers

Groundwater Abstraction Licence

Secondary (B) Aquifer - Lower Permeability Layer

Unproductive

Unknown (lakes and landslip)

Surface Water Abstraction Licence

Search Buffers (m)

500





### 6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



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Report Reference: CMAPS-CM-643992-13238-310717EDR Client Reference: 13238





### 6d. Hydrogeology – Source Protection Zones within confined aquifer



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# 6e. Hydrology – Detailed River Network and River Quality



General Quality Assessment: Chemistry





# 6.Hydrogeology and Hydrology

#### 6.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distanc e (m)	Direction	Designation	Description
1	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
3	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
4	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
5	132	W	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
6	295	E	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
7	472	NE	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
8	499	E	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





Are there records of strata classification within the bedrock geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distanc e (m)	Direction	Designation	Description
1	0	On Site	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers
2	0	On Site	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers
5	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
6	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
7	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
8	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
9	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
10	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
16	0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
17	0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
18	0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
19	0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
20	0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
26	0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
27	0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
11	61	S	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





	LOCATONIN	I CELIGENIGE		
ID	Distanc e (m)	Direction	Designation	Description
3	295	E	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers
4	444	E	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers

#### 6.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site?

Yes

No

No

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distanc e (m)	Direction	NGR	Details	
Not shown	1803	S	493550 407210	Status: Historical Licence No: 03/28/81/0036 Details: Spray Irrigation - Direct Direct Source: Groundwater Midlands Region Point: Holme - Lagoon Data Type: Point Name: C P MARSHALL (FARMS) LIMITED	Annual Volume (m <sup>3</sup> ): 13000 Max Daily Volume (m <sup>3</sup> ): 2600 Original Application No: - Original Start Date: 3/9/1996 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2010 Version End Date:

#### 6.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site?

Database searched and no data found.

#### 6.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site?

Database searched and no data found.

#### **6.6 Source Protection Zones**

Are there any Source Protection Zones within 500m of the study site?

No





Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site? No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

#### 6.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site? Yes

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.
0	On Site	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.
0	On Site	Minor Aquifer/High Leaching Potential	H2	Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.
0	On Site	Minor Aquifer/High Leaching Potential	H2	Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.
0	On Site	Major Aquifer/High Leaching Potential	H2	Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.
0	On Site	Major Aquifer/High Leaching Potential	H2	Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.





Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site? Yes

#### 6.9.1 Biological Quality:

Database searched and no data found.

#### 6.9.2 Chemical Quality:

Chemical quality data is based on the General Quality Assessment Headline Indicators scheme (GQAHI). In England, each chemical sample is measured for ammonia and dissolved oxygen. In Wales, the samples are measured for biological oxygen demand (BOD), ammonia and dissolved oxygen. The results are graded from A ('Very Good') to F ('Bad').

The following Chemical Quality records are shown on the Hydrology Map (6e):

						Chemi	cal Quality	Grade	
ID	Distanc e (m)	Direction	NGR	River Quality Grade	2005	2006	2007	2008	2009
Not shown	1104	SW	492470 408390	River Name: Brumby Beck Reach: B Steel Outlet To Bottesford Beck End/Start of Stretch: Sample Point NGR	E	E	E	E	E
Not shown	1127	SW	492480 408341	River Name: Bottesford Beck Reach: Br Culvert Exit To Black Head Ponds Bk End/Start of Stretch: Sample Point NGR	E	E	E	E	D
Not shown	1153	SW	492400 408400	River Name: Brumby Beck Reach: B Steel Outlet To Bottesford Beck End/Start of Stretch: End of Stretch NGR	E	E	E	E	E

#### 6.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site?

Yes

The following Detailed River Network records are represented on the Hydrology Map (6e):

ID	Distanc e (m)	Direction		Details
1	0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
2	0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined





ID	Distanc e (m)	Direction		Details
3	0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
4	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
5	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
6	0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
7	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
8	0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
9	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
10	0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
11	0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
12	7	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
13	104	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
14	110	W	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
15	122	W	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
16	129	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
17	159	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
18	168	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
19	452	W	River Name: Bottesford Beck Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
20	453	W	River Name: Bottesford Beck Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
21	453	W	River Name: Bottesford Beck Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined





Yes

#### 6.11 Surface Water Features

Are there any surface water features within 250m of the study site?

The following surface water records are not represented on mapping:

Distance (m)	Direction
0	On Site
17	W
22	W
115	W
128	W
199	W
133	٧٧





# 7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)







# 7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map







### 7 Flooding

#### 7.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 2 floodplain? No

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

Database searched and no data found.

#### 7.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 3 floodplain? No

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

Database searched and no data found.

#### 7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

What is the highest risk of flooding onsite?

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

#### 7.4 Flood Defences

Are there any Flood Defences within 250m of the study site? Database searched and no data found.

#### 7.5 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site?

No

No

Very Low





Are there any areas used for Flood Storage within 250m of the study site?

No

#### 7.7 Groundwater Flooding Susceptibility Areas

7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes

Does this relate to Clearwater Flooding or Superficial Deposits Flooding? Superficial Deposits Flooding

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

### 7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Potential at Surface Where potential for groundwater flooding to occur at surface is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

#### 7.8 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result?

High

Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.





# 8. Designated Environmentally Sensitive Sites Map







### 8. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site?

Yes

### 8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

4

The following Site of Special Scientific Interest (SSSI) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SSSI Name	Data Source
1	1300	E	Broughton Far Wood	Natural England
2	1387	E	Broughton Alder Wood	Natural England
3	1549	E	Broughton Alder Wood	Natural England
4	1570	E	Broughton Far Wood	Natural England

#### 8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

#### 8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

#### 8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0





Database searched and no data found.

#### 8.6 Records of Ancient Woodland within 2000m of the study site:

6

0

The following records of Designated Ancient Woodland provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	Ancient Woodland Name	Data Source
11	1	NE	UNKNOWN	Ancient Replanted Woodland
12	633	NE	UNKNOWN	Ancient Replanted Woodland
13	759	S	UNKNOWN	Ancient Replanted Woodland
14	958	NE	UNKNOWN	Ancient Replanted Woodland
15	967	SE	UNKNOWN	Ancient Replanted Woodland
16	1300	E	UNKNOWN	Ancient and Semi-Natural Woodland

#### 8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

Database searched and no data found.

#### 8.8 Records of World Heritage Sites within 2000m of the study site:

Database searched and no data found.

#### 8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

0

0





### 8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

Database searched and no data found.

#### 8.11 Records of National Parks (NP) within 2000m of the study site:

Database searched and no data found.

#### 8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

6

0

0

Database searched and no data found.

#### 8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

The following Nitrate Vulnerable Zone records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

Distance (m)	Direction	NVZ Name	Data Source
0	On Site	Existing	DEFRA
0	On Site	Existing	DEFRA
0	On Site	Existing	DEFRA
0	On Site	Existing	DEFRA
0	On Site	Existing	DEFRA
0	On Site	Existing	DEFRA
	Distance (m) 0 0 0 0 0 0	Distance (m)Direction0On Site0On Site0On Site0On Site0On Site0On Site0On Site	Distance (m)DirectionNVZ Name0On SiteExisting0On SiteExisting0On SiteExisting0On SiteExisting0On SiteExisting0On SiteExisting0On SiteExisting0On SiteExisting0On SiteExisting0On SiteExisting

#### 8.14 Records of Green Belt land within 2000m of the study site:





### 9. Natural Hazards Findings

#### 9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a **Groundsure Geo Insight**, available from **our website**. The following information has been found:

#### 9.1.1 Shrink Swell

What is the maximum Shrink-Swell\*\* hazard rating identified on the study site?

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard

Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

#### 9.1.2 Landslides

What is the maximum Landslide\* hazard rating identified on the study site?

Moderate

Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard

Significant potential for slope instability with relatively small changes in ground conditions. Avoid large amounts of water entering the ground through pipe leakage or soak-aways. Do not undercut or place large amounts of material on slopes without technical advice. For new build consider the potential and consequences of ground movement during excavations, or consequence of changes to loading or drainage. For existing property probable increase in insurance risk is likely due to potential natural slope instability after changes to ground conditions such as a very long, excessively wet winter.

#### 9.1.3 Soluble Rocks

What is the maximum Soluble Rocks\* hazard rating identified on the study site?

Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard

Significant soluble rocks are present. Problems unlikely except with considerable surface or subsurface water flow. No special actions required to avoid problems due to soluble rocks. No special ground investigation required or increased construction costs are likely. An increase in financial risk due to potential problems with soluble rocks is unlikely.

\* This indicates an automatically generated 50m buffer and site.

#### 9.1.4 Compressible Ground

What is the maximum Compressible Ground\* hazard rating identified on the study site? Moderate

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Extra construction costs are likely. For existing property possible increase in insurance risk from compressibility, especially if water conditions or loading of the ground change significantly.

#### 9.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks\* hazard rating identified on the study site?

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

#### 9.1.6 Running Sand

What is the maximum Running Sand\*\* hazard rating identified on the study site?

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.

#### 9.2 Radon

#### 9.2.1 Radon Affected Areas

Client Reference: 13238

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is in a Radon Affected Area, as between 10 and 30% of properties are above the Action Level.

Very Low

low



Hazard

Hazard

Hazard

<sup>\*</sup> This indicates an automatically generated 50m buffer and site.




Is the property in an area where Radon Protection are required for new properties or extensions to existing

ones as described in publication BR211 by the Building Research Establishment?

Full radon protective measures are necessary.





### 10. Mining

#### 10.1 Coal Mining

Are there any coal mining areas within 75m of the study site?

No

Yes

Database searched and no data found.

#### 10.2 Non-Coal Mining

Are there any Non-Coal Mining areas within 50m of the study site boundary?

The following non-coal mining information is provided by the BGS:

Distance (m)	Direction	Name	Commodity	Assessment of likelihood
0.0	On Site	Not available	Jet	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered
0.0	On Site	Not available	Jet	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered

Past underground mine workings are uncommon, localised and of limited area. The rock types present in this area are such that minor mineral veins may be present within them on which it is possible that there have been attempts to work these by underground methods and/or it is possible that small scale underground extraction of other materials may have occurred. All such occurrences are likely to be restricted in size and infrequent. It should be noted, however, that there is always the possibility of the existence of other sub-surface excavations, such as wells, cess pits, follies, air raid shelters/bunkers and other military structures etc. that could affect surface ground stability but which are outside the scope of this dataset. However, if in a coalfield area you should still consider a Coal Authority mining search for the area of interest.

#### **10.3 Brine Affected Areas**

Are there any brine affected areas within 75m of the study site? Guidance: No Guidance Required.

No





### **Contact Details**

#### CENTREMAPS

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Web:**www.bgs.ac.uk** BGS Geological Hazards Reports and general geological enquiries: **enquiries@bgs.ac.uk** 

> Environment Agency National Customer Contact Centre, PO Box 544 Rotherham, S60 1BY Tel: 03708 506 506 Web: <u>www.environment-agency.gov.uk</u> Email: enquiries@environment-agency.gov.uk

Public Health England Public information access office Public Health England, Wellington House 133-155 Waterloo Road, London, SE1 8UG www.gov.uk/phe Email:**enquiries@phe.gov.uk** Main switchboard**: 020 7654 8000** 

> The Coal Authority 200 Lichfield Lane Mansfield Notts NG18 4RG Tel: 0345 7626 848 DX 716176 Mansfield 5 www.coal.gov.uk

Ordnance Survey Adanac Drive, Southampton SO16 0AS Tel: 08456 050505



British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL





The Coal Authority



Local Authority Authority: North Lincolnshire Council Phone: 01724 296 296 Web: http://www.northlincs.gov.uk/ Address: Civic Centre, Ashby Road, Scunthorpe, North Lincolns, DN16

> Gemapping PLC Virginia Villas, High Street, Hartley Witney, Hampshire RG27 8NW Tel: 01252 845444







Acknowledgements: Site of Special Scientific Interest, National Nature Reserve, Ramsar Site, Special Protection Area, Special Area of Conservation data is provided by, and used with the permission of, Natural England who retain the Copyright and Intellectual Property Rights for the data.

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CENTREMAPS

Open Space, Upper Interfields, Worcester, WR14 1UT Report Reference: CMAPS-CM-643992-13238-<br/>310717GEOYour Reference:13238Report Date31 Jul 2017

Report Delivery Email - pdf Method:

### Geo Insight

Address: Santon, Scunthorpe, DN16 1XP

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 01886 832972 quoting the above CENTREMAPS reference number.

Yours faithfully,

CENTREMAPS

Enc. Groundsure Geo Insight



Address:	Santon, Scunthorpe, DN16 1XP
Date:	31 Jul 2017
Reference:	CMAPS-CM-643992-13238-310717GEO
Client:	CENTREMAPS

NW

NE



Ν

SW

Aerial Photograph Capture date:16-Aug-2015Grid Reference:494018,409842Site Size:156.74ha

S

SE





### **Contents Page**

Contents Page	
Overview of Findings	5
1:10,000 Scale Availability	
Availability of 1:10,000 Scale Geology Mapping	9
1 Geology (1:10,000 scale)	
1.1 Artificial Ground Map (1:10,000 scale)	10
1. Geology 1:10,000 scale	
1.1 Artificial Ground	11
1.2 Superficial Deposits and Landslips Map (1:10,000 scale)	12
1.2 Superficial Deposits and Landslips	
1.2.1 Superficial Deposits/ Drift Geology	
1.2.2 Landslip	
1.3 Bedrock and Faults Map (1.10,000 Scale)	
1.3.1 Bedrock/ Solid Geology	
1.3.2 Faults	
2 Geology 1:50,000 Scale	
2.1 Artificial Ground Map	
2. Geology 1:50,000 scale	
2.1 Artificial Ground	19
2.1.1 Artificial/ Made Ground	
2.1.2 Permeability of Artificial Ground	
2.2 Superficial Deposits and Landslips Map (1:50,000 scale)	
2.2 Superficial Deposits and Landslips	
2.2.2 Permeability of Superficial Ground	
2.2.3 Landslip	
2.2.4 Landslip Permeability	
2.3 Bedrock and Faults Map (1:50,000 scale)	
2.3 Bedrock, Solid Geology & Faults	23 22
2.3.2 Permeability of Bedrock Ground	
2.3.3 Faults	
3 Radon Data	
3.1 Radon Affected Areas	
3.2 Radon Protection	
4 Ground Workings Map	
4 Ground Workings	
4.1 Historical Surface Ground Working Features derived from Historical Mapping	
4.2 Historical Underground Working Features derived from Historical Mapping	29
4.3 Current Ground Workings	
5 Mining, Extraction & Natural Cavities	
5.1 Historical Mining	
5.2 Coal Mining	
5.3 Johnson Poole and Bloomer	
5.4 Non-Coal Mining	
5.5 Non-Coal Mining Cavities	
5.6 Natural Cavities	
5.7 Brine Extraction	
5.8 Gypsum Extraction	
6 Natural Ground Subsidence	۷۵ ۲۵
6 1 Shrink-Swell Clay Man	54
6.2 Landslides Man	
6.3 Ground Dissolution of Soluble Rocks Man	۲۶ ۲۶
6.4 Compressible Deposits Map	
6.5 Collapsible Deposits Map	
6.6 Running Sand Map	
- ·	



6 Natural Ground Subsidence	40
6.1 Shrink-Swell Clays	40
6.2 Landslides	43
6.3 Ground Dissolution of Soluble Rocks	44
6.4 Compressible Deposits	45
6.5 Collapsible Deposits	45
6.6 Running Sands	46
7 Borehole Records	50
8 Estimated Background Soil Chemistry	53
9 Railways and Tunnels Map	58
9 Railways and Tunnels	
9.1 Tunnels	59
9.2 Historical Railway and Tunnel Features	59
9.3 Historical Railways	60
9.4 Active Railways	60
9.5 Railway Projects	60





### **Overview of Findings**

The Groundsure Geo Insight provides high quality geo-environmental information that allows geoenvironmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

#### Section 1: Geology 1:10,000 Scale

1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?				
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	Yes			
	1.2.2 Are there any records of landslip within 500m of the study site boundary at 1:10,000 scale?	No			
1.3 Bedrock, Solid Geology and Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.				
	1.3.2 Are there any records of faults within 500m of the study site boundary at 1:10,000 scale?	Yes			
Section 2: Geolo	gy 1:50,000 Scale				
2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	Yes			
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	Yes			
2.2 Superficial Geology and	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes			
Landslips	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	Yes			
	2.2.3 Are there any records of landslip within 500m of the study site boundary?	No			
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No			





Section 2: Geolo	Section 2: Geology 1:50,000 Scale							
2.3 Bedrock, Solid Geology and Faults	2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.							
	2.3.2 Are there any records relating to perm ground within the study site boundary?	eability of bec	drock	Yes				
	2.3.3 Are there any records of faults within 5 boundary?	500m of the st	tudy site		Yes			
Section 3: Rador	1							
3. Radon	3.11s the property in a Radon Affected Area a Protection Agency (HPA) and if so what perc above the Action Level?	as defined by t centage of hor	the Health nes are	The property is in a Radon Affected Area, as between 10 and 30% of properties are above the Action Level.				
	3.2Radon Protection			Full radon protective measures are necessary.				
Section 4: Ground Workings		On-site	0-50m	51-250	251-500	501-1000		
4.1 Historical Surfac Scale Mapping	e Ground Working Features from Small	13	0	14	Not Searched	Not Searched		
4.2 Historical Under	ground Workings from Small Scale Mapping	0	0	0	0	0		
4.3 Current Ground	Workings	0	0	0	2	0		
Section 5: Mining	g, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000		
5.1 Historical Mining	l i i i i i i i i i i i i i i i i i i i	0	0	3	0	2		
5.2 Coal Mining		0	0	0	0	0		
5.3 Johnson Poole a	nd Bloomer Mining Area	5	1	0	8	4		
5.4 Non-Coal Mining	*	2	0	0	0	1		
5.5 Non-Coal Mining	g Cavities	1	0	0	1	0		
5.5 Natural Cavities	0	0	0	0	0			

Report Reference: CMAPS-CM-643992-13238-310717GEO Client Reference: 13238





Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0
Section 6: Natural Ground Subsidence	On-sit	e			
6.1 Shrink-Swell Clay	Low				
6.2 Landslides	Modera	te			
6.3 Ground Dissolution of Soluble Rocks	Very Lo	W			
6.4 Compressible Deposits	Modera	te			
6.5 Collapsible Deposits	Very Lo	W			
6.5 Running Sand	Low				
Section 7: Borehole Records	On-si	te	0-50m	5	1-250
7 BGS Recorded Boreholes	27		8		14
Section 8: Estimated Background Soil Chemistry	On-si	te	0-50m	5	1-250
8 Records of Background Soil Chemistry	164		37		0
Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500	
9.1 Tunnels	0	0	0	Not Searchec	
9.2 Historical Railway and Tunnel Features	1	0	3	Not Searched	
9.3 Historical Railways	0	0	0	Not Searched	
9.4 Active Railways	0	0	16	Not Searchec	
9.5 Railway Projects	0	0	0	0	





### 1:10,000 Scale Availability





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### Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	Some deposits are mapped	Full	Full	No coverage
2	0.0	Some deposits are mapped	Full	Full	Some deposits are mapped
3	295.0	Some deposits are mapped	Full	Full	No coverage
4	444.0	Some deposits are mapped	Full	Full	No coverage

Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

Geology	Full Coverage	Partial Coverage	No Coverage
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage





### 1 Geology (1:10,000 scale). 1.1 Artificial Ground Map (1:10,000 scale)







### 1. Geology 1:10,000 scale

#### 1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? Yes

_						
	ID	Distance	Direction	LEX Code	Description	Rock Description
	1	0.0	On Site	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
	2	24.0	S	WMGR-ARTDP	Infilled Ground	Artificial Deposit
	3	165.0	W	WMGR-ARTDP	Infilled Ground	Artificial Deposit
	4	390.0	S	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit





### **1.2 Superficial Deposits and** Landslips Map (1:10,000 scale)



SW

Artificial Ground Legend

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**Oroundsure** 



### 1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

#### 1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? Yes

	ID	Distance (m)	Direction	LEX Code	Description	Rock Description
	1	0.0	On Site	BSA1-S	Blown Sand, 1 - Sand	Sand
	2A	0.0	On Site	BSA1-S	Blown Sand, 1 - Sand	Sand
	3	0.0	On Site	BSA1-S	Blown Sand, 1 - Sand	Sand
	4	0.0	On Site	ALV-XCZSV	Alluvium - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel
!	5A	0.0	On Site	BSA1-S	Blown Sand, 1 - Sand	Sand
	6	128.0	W	BSA1-S	Blown Sand, 1 - Sand	Sand
	7	295.0	E	BSA1-S	Blown Sand, 1 - Sand	Sand
	8	479.0	NE	BSA1-S	Blown Sand, 1 - Sand	Sand

#### 1.2.2 Landslip

Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

No

#### Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.





### 1.3 Bedrock and Faults Map (1:10,000 scale)



Bedrock and Faults Legend

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### **1.3 Bedrock and Faults**

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

#### 1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

ID	Distance (m)	Direction	LEX Code	Description	Rock Age
1A	0.0	On Site	GRF-SDSM	Grantham Formation - Sandstone, Siltstone And Mudstone	Aalenian Age
2	0.0	On Site	SNO- LMOOL	Santon Oolite - Ooidal Limestone	Bajocian Age
3E	0.0	On Site	KCM-MDLM	Kirton Cementstone Beds - Mudstone And Limestone, Interbedded	Bajocian Age
4U	0.0	On Site	HIL-LMOOL	Hibaldstow Limestone - Ooidal Limestone	Bajocian Age
5	0.0	On Site	NS-FGSST	Northampton Sand Formation - Ferruginous Sandstone	Aalenian Age
6	0.0	On Site	SYL-LMAR	Scawby Limestone - Interbedded Limestone And [subequal/subordinate] Argillaceous Rocks	Bajocian Age
7	0.0	On Site	KCMK-LMST	Kirton Cementstone Beds (knoll-reef) - Limestone	Bajocian Age
8B	0.0	On Site	KCMK-LMST	Kirton Cementstone Beds (knoll-reef) - Limestone	Bajocian Age
9	0.0	On Site	KCMK-LMST	Kirton Cementstone Beds (knoll-reef) - Limestone	Bajocian Age
10	0.0	On Site	RVB-LMAR	Raventhorpe Beds - Interbedded Limestone And [subequal/subordinate] Argillaceous Rocks	Bajocian Age
11	0.0	On Site	KCM-MDLM	Kirton Cementstone Beds - Mudstone And Limestone, Interbedded	Bajocian Age
12A	0.0	On Site	CML-LMST	Cleatham Limestone - Limestone	Bajocian Age
13	0.0	On Site	KCMK-LMST	Kirton Cementstone Beds (knoll-reef) - Limestone	Bajocian Age
14B	0.0	On Site	KCMK-LMST	Kirton Cementstone Beds (knoll-reef) - Limestone	Bajocian Age
15	0.0	On Site	WHM-MDST	Whitby Mudstone Formation - Mudstone	Toarcian Age
16	0.0	On Site	RVB-LMAR	Raventhorpe Beds - Interbedded Limestone And [subequal/subordinate] Argillaceous Rocks	Bajocian Age
17	0.0	On Site	CHAM- MDST	Charmouth Mudstone Formation - Mudstone	Pliensbachian Age - Sinemurian Age
18	0.0	On Site	SNO- LMOOL	Santon Oolite - Ooidal Limestone	Bajocian Age
19	0.0	On Site	MRB-FGLS	Marlstone Rock Formation - Ferruginous Limestone And Ferruginous Sandstone	Toarcian Age - Pliensbachian Age
20	0.0	On Site	PTNI-FEST	Pecten Ironstone (bed) - Ironstone	Pliensbachian Age
21	0.0	On Site	CHAM- MDST	Charmouth Mudstone Formation - Mudstone	Pliensbachian Age - Sinemurian Age
22C	0.0	On Site	MRB-FGLS	Marlstone Rock Formation - Ferruginous Limestone And Ferruginous Sandstone	Toarcian Age - Pliensbachian Age

9
Groundsure
LOCATION INTELLIGENCE



 ID	Distance (m)	Direction	LEX Code	Description	Rock Age
 23C	0.0	On Site	WHM-MDST	Whitby Mudstone Formation - Mudstone	Toarcian Age
24D	0.0	On Site	KCM-MDLM	Kirton Cementstone Beds - Mudstone And Limestone, Interbedded	Bajocian Age
25S	0.0	On Site	GRF-SDSM	Grantham Formation - Sandstone, Siltstone And Mudstone	Aalenian Age
 26	0.0	On Site	CML-LMST	Cleatham Limestone - Limestone	Bajocian Age
 27J	0.0	On Site	RVB-LMAR	Raventhorpe Beds - Interbedded Limestone And [subequal/subordinate] Argillaceous Rocks	Bajocian Age
 28	0.0	On Site	CHAM- MDST	Charmouth Mudstone Formation - Mudstone	Pliensbachian Age - Sinemurian Age
 29	0.0	On Site	NS-FGSST	Northampton Sand Formation - Ferruginous Sandstone	Aalenian Age
 30D	0.0	E	SYL-LMAR	Scawby Limestone - Interbedded Limestone And [subequal/subordinate] Argillaceous Rocks	Bajocian Age
31	9.0	S	GRF-SDSM	Grantham Formation - Sandstone, Siltstone And Mudstone	Aalenian Age
 32	11.0	W	PTNI-FEST	Pecten Ironstone (bed) - Ironstone	Pliensbachian Age
33	48.0	W	CHAM- MDST	Charmouth Mudstone Formation - Mudstone	Pliensbachian Age - Sinemurian Age
34	52.0	S	FI-FEST	Frodingham Ironstone Member - Ironstone	Sinemurian Age
35	171.0	E	SYL-LMAR	Scawby Limestone - Interbedded Limestone And [subequal/subordinate] Argillaceous Rocks	Bajocian Age
36V	295.0	E	HIL-LMOOL	Hibaldstow Limestone - Ooidal Limestone	Bajocian Age
37E	302.0	S	KCMK-LMST	Kirton Cementstone Beds (knoll-reef) - Limestone	Bajocian Age
 38	338.0	E	KCM-MDLM	Kirton Cementstone Beds - Mudstone And Limestone, Interbedded	Bajocian Age
 39	344.0	SE	KCM-MDLM	Kirton Cementstone Beds - Mudstone And Limestone, Interbedded	Bajocian Age
 40	347.0	SE	KCM-MDLM	Kirton Cementstone Beds - Mudstone And Limestone, Interbedded	Bajocian Age
 41X	388.0	SE	SYL-LMAR	Scawby Limestone - Interbedded Limestone And [subequal/subordinate] Argillaceous Rocks	Bajocian Age
 42F	409.0	NE	KCMK-LMST	Kirton Cementstone Beds (knoll-reef) - Limestone	Bajocian Age
 43F	420.0	NE	KCMK-LMST	Kirton Cementstone Beds (knoll-reef) - Limestone	Bajocian Age
 44	442.0	E	KCM-MDLM	Kirton Cementstone Beds - Mudstone And Limestone, Interbedded	Bajocian Age
 45	444.0	E	KCM-MDLM	Kirton Cementstone Beds - Mudstone And Limestone, Interbedded	Bajocian Age
 46	457.0	E	SYL-LMAR	Scawby Limestone - Interbedded Limestone And [subequal/subordinate] Argillaceous Rocks	Bajocian Age
 47K	492.0	E	KCM-MDLM	Kirton Cementstone Beds - Mudstone And Limestone, Interbedded	Bajocian Age





Are there any records of Faults within 500m of the study site boundary at 1:10,000 scale?

Yes

ID	Distance (m)	Direction	Category Description	Feature Description
93	0.0	On Site	LANDFORM	Dune, form-line at base of mound
94	0.0	On Site	LANDFORM	Dune, form-line at base of mound
95	0.0	On Site	LANDFORM	Dune, form-line at base of mound
96	17.0	Ν	LANDFORM	Dune, form-line at base of mound
97	27.0	W	LANDFORM	Dune, form-line at base of mound
98	73.0	NW	LANDFORM	Dune, form-line at base of mound
99	135.0	W	LANDFORM	Dune, form-line at base of mound
100U	174.0	NE	LANDFORM	Dune, form-line at base of mound
101	181.0	NW	LANDFORM	Dune, form-line at base of mound
102V	263.0	E	LANDFORM	Dune, form-line at base of mound
103V	264.0	E	LANDFORM	Dune, form-line at base of mound
104V	305.0	E	LANDFORM	Dune, form-line at base of mound
105F	346.0	NE	LANDFORM	Dune, form-line at base of mound
106F	350.0	NE	LANDFORM	Dune, form-line at base of mound
107F	382.0	NE	LANDFORM	Dune, form-line at base of mound

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.





## 2 Geology 1:50,000 Scale 2.1 Artificial Ground Map



500 Search Buffers (m) 1000



Infilled Ground



**Reclaimed Ground** 





### 2. Geology 1:50,000 scale

#### 2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 089

#### 2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? Yes

	ID	(m)	Direction	LEX Code	Description	Rock Description	
1 28.0 S WMGR-ARTDP INFILLED GROUND	1	28.0	S	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT	

#### 2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? Yes

28.0 S Mixed Very High Low	Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
	 28.0	S	Mixed	Very High	Low





### 2.2 Superficial Deposits and Landslips Map (1:50,000 scale)



Ground Workings Legend

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Groundsure



# 2.2 Superficial Deposits and Landslips

#### 2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? Yes

ID	Distance	Direction	LEX Code	Description	<b>Rock Description</b>
1	0.0	On Site	SUTN-S	SUTTON SAND FORMATION	SAND
2	0.0	On Site	SUTN-S	SUTTON SAND FORMATION	SAND
3	499.0	E	SUTN-S	SUTTON SAND FORMATION	SAND

#### 2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? Yes

	Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
	0.0	On Site	Intergranular	High	High
	0.0	On Site	Intergranular	High	High
	0.0	On Site	Intergranular	High	High
	0.0	On Site	Intergranular	High	High
-					

#### 2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary?

No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

#### 2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary?

No

Database searched and no data found.





### 2.3 Bedrock and Faults Map (1:50,000 scale)



Ground Workings Legend

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### 2.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 089

#### 2.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	SYL-LMAR	SCAWBY LIMESTONE - LIMESTONE AND [SUBEQUAL/SUBORDINATE] ARGILLACEOUS ROCKS, INTERBEDDED	BAJOCIAN
2	0.0	On Site	NS-FGSST	NORTHAMPTON SAND FORMATION - SANDSTONE, FERRUGINOUS	AALENIAN
3	0.0	On Site	WHM-MDST	WHITBY MUDSTONE FORMATION - MUDSTONE	TOARCIAN
4	0.0	On Site	LLL-LMST	LOWER LINCOLNSHIRE LIMESTONE MEMBER - LIMESTONE	BAJOCIAN
5	0.0	On Site	GRF-SDSM	GRANTHAM FORMATION - SANDSTONE, SILTSTONE AND MUDSTONE	AALENIAN
6	0.0	On Site	RVB-LMAR	RAVENTHORPE BEDS - LIMESTONE AND [SUBEQUAL/SUBORDINATE] ARGILLACEOUS ROCKS, INTERBEDDED	BAJOCIAN
7	0.0	On Site	MRB-FGLS	MARLSTONE ROCK FORMATION - FERRUGINOUS LIMESTONE AND FERRUGINOUS SANDSTONE	PLIENSBACHIAN
8A	0.0	On Site	KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL-REEF) - LIMESTONE	BAJOCIAN
9A	0.0	On Site	KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL-REEF) - LIMESTONE	BAJOCIAN
10A	0.0	On Site	KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL-REEF) - LIMESTONE	BAJOCIAN
11	0.0	On Site	CHAM-MDST	CHARMOUTH MUDSTONE FORMATION - MUDSTONE	SINEMURIAN
12	0.0	On Site	KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL-REEF) - LIMESTONE	BAJOCIAN
13	0.0	On Site	KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL-REEF) - LIMESTONE	BAJOCIAN
14B	0.0	On Site	HIL-LMOOL	HIBALDSTOW LIMESTONE - LIMESTONE, OOIDAL	BAJOCIAN
15B	0.0	On Site	KCM-MDLM	KIRTON CEMENTSTONE BEDS - MUDSTONE AND LIMESTONE, INTERBEDDED	BAJOCIAN
16	0.0	On Site	KCM-LMST	KIRTON CEMENTSTONE BEDS - LIMESTONE	BAJOCIAN
17	0.0	On Site	KCM-MDLM	KIRTON CEMENTSTONE BEDS - MUDSTONE AND LIMESTONE, INTERBEDDED	BAJOCIAN
18	0.0	On Site	PTNI-FEST	PECTEN IRONSTONE (BED) - IRONSTONE	PLIENSBACHIAN
19	0.0	On Site	CHAM-MDST	CHARMOUTH MUDSTONE FORMATION - MUDSTONE	SINEMURIAN
20	0.0	On Site	KCM-LMST	KIRTON CEMENTSTONE BEDS - LIMESTONE	BAJOCIAN





ID	Distance	Direction	LEX Code	Rock Description	Rock Age
21	61.0	S	FI-FEST	FRODINGHAM IRONSTONE MEMBER - IRONSTONE	SINEMURIAN
22	313.0	S	KCMK-LMST	KIRTON CEMENTSTONE BEDS (KNOLL-REEF) - LIMESTONE	BAJOCIAN

#### 2.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site boundary? Yes

Distanc e	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Mixed	High	Moderate
0.0	On Site	Fracture	Low	Low
0.0	On Site	Mixed	Very High	Very High
0.0	On Site	Mixed	High	Moderate
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Fracture	Very High	Low
0.0	On Site	Fracture	High	Low
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Mixed	High	Moderate
0.0	On Site	Mixed	High	Moderate
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Fracture	Very High	Very Low
0.0	On Site	Fracture	Very High	Very Low
0.0	On Site	Fracture	Low	Low
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Fracture	Low	Low
0.0	On Site	Mixed	High	Moderate
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Fracture	High	Low
0.0	On Site	Mixed	Moderate	Low
0.0	On Site	Mixed	Moderate	Low
0.0	On Site	Fracture	Very High	Very Low
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Fracture	Low	Low
0.0	On Site	Mixed	High	Moderate
0.0	On Site	Fracture	Very High	Very High
0.0	On Site	Fracture	Low	Low





Yes

#### Are there any records of Faults within 500m of the study site boundary?

ID	Distance	Direction	Category Description	Feature Description
46	0.0	On Site	LANDFORM	Dune, form line at base
47	0.0	On Site	LANDFORM	Dune, form line at base
48	13.0	E	LANDFORM	Dune, form line at base
49	41.0	NW	LANDFORM	Dune, form line at base
50	130.0	Ν	LANDFORM	Dune, form line at base
51	160.0	NW	LANDFORM	Dune, form line at base
52	275.0	E	LANDFORM	Dune, form line at base
53	352.0	NE	LANDFORM	Dune, form line at base
54H	490.0	Ν	LANDFORM	Dune, form line at base
55H	492.0	Ν	LANDFORM	Dune, form line at base

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nation wide coverage.





#### 3.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is in a Radon Affected Area, as between 10 and 30% of properties are above the Action Level.

#### 3.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? Full radon protective measures are necessary.





### 4 Ground Workings Map







### **4 Ground Workings**

#### 4.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on Groundsure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes

Distance (m)	Direction	NGR	Use	Date
0.0	On Site	493748 409553	Unspecified Pit	1951
0.0	On Site	494217 410278	Unspecified Ground Workings	1994
0.0	On Site	494217 410278	Unspecified Ground Workings	1977
0.0	On Site	494146 410173	Unspecified Pit	1977
0.0	On Site	494146 410173	Unspecified Pit	1994
0.0	On Site	494048 410235	Unspecified Pit	1977
0.0	On Site	494048 410235	Unspecified Pit	1994
0.0	On Site	493917 410234	Unspecified Ground Workings	1977
0.0	On Site	493917 410234	Unspecified Ground Workings	1994
0.0	On Site	493749 409556	Unspecified Pit	1948
0.0	On Site	493749 409556	Unspecified Pit	1906
0.0	On Site	494049 410235	Unspecified Pit	1886
0.0	On Site	493837 410252	Unspecified Pit	1886
105.0	W	493099 409549	Opencast Ironstone Workings	1979
124.0	W	493174 409059	Ponds	1938
124.0	W	493174 409059	Ponds	1905
126.0	W	493174 409059	Unspecified Pit	1968
126.0	W	493174 409059	Ponds	1951
134.0	NW	493429 410197	Unspecified Pit	1886
139.0	W	493314 409857	Unspecified Pit	1886
147.0	W	493294 409694	Unspecified Pit	1886
	Distance (m)   0.0   105.0   124.0   126.0   134.0   139.0   147.0	Distance (m) Direction   0.0 On Site   0.0 W   105.0 W   124.0 W   126.0 W   134.0 NW   139.0 W	Distance (m) Direction NGR   0.0 On Site 493748 409553   0.0 On Site 494217 410278   0.0 On Site 494217 410278   0.0 On Site 494217 410278   0.0 On Site 494146 410173   0.0 On Site 494048 410235   0.0 On Site 494048 410235   0.0 On Site 493017 410234   0.0 On Site 493917 410234   0.0 On Site 493917 410234   0.0 On Site 493917 410234   0.0 On Site 493917 410234   0.0 On Site 493749 409556   0.0 On Site 493749 409556   0.0 On Site 493837 410235   0.0 On Site 493837 410252   105.0 W 493174 409059   124.0 W 493174 409059   126.0 W 493174 409059   134.0 W 493174 409857   139.0 <td< td=""><td>Distance (m)DirectionNGRUse0.0On Site493748 409553Unspecified Pit0.0On Site49217 410278Unspecified Ground Workings0.0On Site494217 410278Unspecified Ground Workings0.0On Site494217 410278Unspecified Pit0.0On Site494146 410173Unspecified Pit0.0On Site494146 410173Unspecified Pit0.0On Site494048 410235Unspecified Pit0.0On Site494048 410235Unspecified Pit0.0On Site493017 410234Unspecified Ground Workings0.0On Site493749 409556Unspecified Pit0.0On Site493749 409556Unspecified Pit0.0On Site493749 409556Unspecified Pit0.0On Site4933749 409556Unspecified Pit0.0On Site4933749 400556Unspecified Pit0.0On Site4933749 400556Unspecified Pit105.0W493374 409059Ponds124.0W493174 409059Ponds126.0W493174 409059Unspecified Pit134.0NW493174 409059Unspecified Pit134.0NW493174 409059Unspecified Pit134.0NW493174 409059Unspecified Pit134.0NW493174 409059Unspecified Pit134.0NW493324 409059</td></td<>	Distance (m)DirectionNGRUse0.0On Site493748 409553Unspecified Pit0.0On Site49217 410278Unspecified Ground Workings0.0On Site494217 410278Unspecified Ground Workings0.0On Site494217 410278Unspecified Pit0.0On Site494146 410173Unspecified Pit0.0On Site494146 410173Unspecified Pit0.0On Site494048 410235Unspecified Pit0.0On Site494048 410235Unspecified Pit0.0On Site493017 410234Unspecified Ground Workings0.0On Site493749 409556Unspecified Pit0.0On Site493749 409556Unspecified Pit0.0On Site493749 409556Unspecified Pit0.0On Site4933749 409556Unspecified Pit0.0On Site4933749 400556Unspecified Pit0.0On Site4933749 400556Unspecified Pit105.0W493374 409059Ponds124.0W493174 409059Ponds126.0W493174 409059Unspecified Pit134.0NW493174 409059Unspecified Pit134.0NW493174 409059Unspecified Pit134.0NW493174 409059Unspecified Pit134.0NW493174 409059Unspecified Pit134.0NW493324 409059





ID	Distance (m)	Direction	NGR	Use	Date	
22G	195.0	W	493058 410820	Opencast Ironstone Workings	1977	
23G	195.0	W	493058 410820	Opencast Ironstone Workings	1994	
24H	205.0	W	493644 410496	Pond	1977	
25H	205.0	W	493644 410496	Pond	1994	
261	217.0	W	493270 410135	Unspecified Ground Workings	1994	
271	217.0	W	493270 410135	Unspecified Ground Workings	1977	

#### 4.2 Historical Underground Working Features derived from Historical Mapping

This data is derived from the Groundsure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? No

Database searched and no data found.

#### 4.3 Current Ground Workings

This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary?

Yes

The following Current Ground Workings information is provided by British Geological Survey:

ID	Distanc e (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
28	340.0	W	493000 409000	Ironstone	Yarborough	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
29	462.0	NW	493200 410400	Ironstone	Emanuel Bridge	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Inactive





### 5 Mining, Extraction & Natural Cavities Map







Yes

### 5 Mining, Extraction & Natural Cavities

#### 5.1 Historical Mining

This dataset is derived from Groundsure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary?

Distance Direction ID NGR Details Date (m) 493099 6 105.0 W 1979 Opencast Ironstone Workings 409549 493058 7A 195.0 W **Opencast Ironstone Workings** 1977 410820 493058 8A 195.0 W **Opencast Ironstone Workings** 1994 410820 492399 9 730.0 W **Opencast Ironstone Workings** 1968 409130 492409 10 872.0 W Iron Stone Quarry 1951 409222

The following Historical Mining information is provided by Groundsure:

#### 5.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

#### 5.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary?

Yes

The following information provided by JPB is not represented on mapping: Whilst outside of an area where The Coal Authority have information on coal mining activities, Johnson Poole & Bloomer (JPB) have information such as mining plans and maps held within their archive of mining activities that have occurred within 1km of this property. Further details and a quote for services can be obtained by emailing this report to enquiries.gs@jpb.co.uk.




This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary?

Yes

The following non-coal mining information is provided by the BGS:

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
1	0.0	On Site	Not available	Jet	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered
2	0.0	On Site	Not available	Jet	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered
Not shown	834.0	S	Ashby	Iron Ore (Bedded)	Underground mining is known to have occurred within or very close to the area. Potential for difficult ground conditions should be investigated. Potential for localised subsidence is at a level where it should be considered

#### 5.5 Non-Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? Yes

The following Non-Coal Mining Cavities information provided by Peter Brett Associates:

ID	Distanc (m)	<sup>e</sup> Direction	NGR	Address	Superficial Deposits	Bedrock Deposits	Extracted Mineral
2	4 0.0	On Site	494000 410000	HIGH SANTON, Humberside	-	-	Magnatite, Marcasite, Siderite, Ironstone
Į.	5 486.0	W	493000 410000	EMMANUEL BRIDGE, Humberside	-	-	Magnatite, Marcasite, Siderite, Ironstone

#### **5.6 Natural Cavities**

This dataset provides information based on Peter Brett Associates natural cavities database.

Are there any Natural Cavities within 1000m of the study site boundary?

No

Database searched and no data found.





This data provides information from the Coal Authority issued on behalf of the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary?

Database searched and no data found.

#### 5.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary?

No

No

Database searched and no data found.

#### 5.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level..

Are there any Tin Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

#### 5.10 Clay Mining

This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

Are there any Clay Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.





# 6 Natural Ground Subsidence 6.1 Shrink-Swell Clay Map



Very Low

Client Reference: 13238





### 6.2 Landslides Map



Very Low

High

250





## 6.3 Ground Dissolution of Soluble Rocks Map







## 6.4 Compressible Deposits Map



Negligible

Very Low

Search Buffers (m)

25

250

Moderate





### 6.5 Collapsible Deposits Map



Very Low

Report Reference: CMAPS-CM-643992-13238-310717GEO Client Reference: 13238

Search Buffers (m)

25

250





### 6.6 Running Sand Map



Very Low

Search Buffers (m)

25

250





### 6 Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site\*\* boundary? Moderate

#### 6.1 Shrink-Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
2	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
3	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
4	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

<sup>\*</sup> This includes an automatically generated 50m buffer zone around the site





ID	Distance (m)	Direction	Hazard Rating	Details
5	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
6	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.
7	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.
8	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
9	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
10A	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
11A	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
12	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.





LOCATION INTELLIGENCE

ID	Distance (m)	Direction	Hazard Rating	Details
13	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
14	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
15	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
16	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
17B	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.
18B	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
19	17.0	E	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.





The following Landslides information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.
2	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
3	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
4	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
5	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
6	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
7	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.





ID	Distance (m)	Direction	Hazard Rating	Details
8	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
9	0.0	On Site	Moderate	Significant potential for slope instability with relatively small changes in ground conditions. Avoid large amounts of water entering the ground through pipe leakage or soak-aways. Do not undercut or place large amounts of material on slopes without technical advice. For new build - consider the potential and consequences of ground movement during excavations, or consequence of changes to loading or drainage. For existing property - probable increase in insurance risk is likely due to potential natural slope instability after changes to ground conditions such as a very long, excessively wet winter.
10	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
11	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

#### 6.3 Ground Dissolution of Soluble Rocks

The following Ground Dissolution information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.
2	0.0	On Site	Very Low	Significant soluble rocks are present. Problems unlikely except with considerable surface or subsurface water flow. No special actions required to avoid problems due to soluble rocks. No special ground investigation required or increased construction costs are likely. An increase in financial risk due to potential problems with soluble rocks is unlikely.
3	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.





ID	Distance (m)	Direction	Hazard Rating	Details
4	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.
5	0.0	On Site	Very Low	Significant soluble rocks are present. Problems unlikely except with considerable surface or subsurface water flow. No special actions required to avoid problems due to soluble rocks. No special ground investigation required or increased construction costs are likely. An increase in financial risk due to potential problems with soluble rocks is unlikely.
6	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.
7	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

#### 6.4 Compressible Deposits

The following Compressible Deposits information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
2	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
3	28.0	S	Moderate	Significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build - consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Extra construction costs are likely. For existing property - possible increase in insurance risk from compressibility, especially if water conditions or loading of the ground change significantly.

#### 6.5 Collapsible Deposits

The following Collapsible Rocks information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for collapsible deposits identified. No actions required to avoid problems due to collapsible deposits. No special ground investigation required, or increased construction costs or increased financial risk due to potential problems with collapsible deposits.



ID	Distance (m)	<sup>e</sup> Direction	Hazard Rating	Details
2	0.0	On Site	Negligible	No indicators for collapsible deposits identified. No actions required to avoid problems due to collapsible deposits. No special ground investigation required, or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
3	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
4	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
5	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
6	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
7	0.0	On Site	Negligible	No indicators for collapsible deposits identified. No actions required to avoid problems due to collapsible deposits. No special ground investigation required, or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
8	0.0	On Site	Negligible	No indicators for collapsible deposits identified. No actions required to avoid problems due to collapsible deposits. No special ground investigation required, or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
9	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
10	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
11	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
12	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
13	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
14	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
15	34.0	S	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

#### 6.6 Running Sands

The following Running Sands information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.





I	D Distance (m)	Direction	Hazard Rating	Details
	2 0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
	3 0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
	4 0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
	5 0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
	6 0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
	7 0.0	On Site	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.
;	8 0.0	On Site	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.
	9 0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
1	0 0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
1	1 0.0	On Site	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.
1	2 0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
1	3 0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.





ID	Distance (m)	Direction	Hazard Rating	Details
14	0.0	On Site	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.
15	28.0	S	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
16	34.0	S	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.





### 7 Borehole Records Map







250





### **7 Borehole Records**

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary:

49

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
1	0.0	On Site	493678 409460	SE90NW14	-1.0	SHOTHOLE RECORDS SCUNTHORPE
2	0.0	On Site	493587 409778	SE90NW135	-1.0	SODWALL PLANTATION EAST NO 1
3	0.0	On Site	493479 409136	SE90NW13	-1.0	SHOTHOLE RECORDS SCUNTHORPE
4	0.0	On Site	493578 409476	SE90NW43	-1.0	GOKEWELL ICEHOUSE WEST
5	0.0	On Site	493454 409404	SE90NW158	-1.0	MANBY HALL SOUTH- EAST
6	0.0	On Site	494460 410510	SE91SW461	-1.0	OVERHEAD LINE TOWERS TP 2
7B	0.0	On Site	494210 410280	SE91SW458	-1.0	OVERHEAD LINE TOWERS PBR7
8	0.0	On Site	494180 409963	SE90NW45	-1.0	GOKEWELL
9	0.0	On Site	494086 410124	SE91SW31	-1.0	SHOTHOLE REORDS RETFORD & SCUNTHORPE
10	0.0	On Site	493848 409381	SE90NW137	-1.0	GOKEWELL STRIP SOUTH 1
11	0.0	On Site	494245 409055	SE90NW142	-1.0	WEST WOOD WEST NO.3
12	0.0	On Site	493793 410059	SE91SW393	64.92	LITTLE CROW COVERT EAST
13	0.0	On Site	494165 409255	SE90NW46	-1.0	ICEHOUSE STRIP EAST
14	0.0	On Site	494148 409426	SE90NW138	-1.0	GOKEWELL STRIP PLANTATION NO.2
15A	0.0	On Site	494468 410687	SE91SW138	102.11	TOP WOOD 1
16A	0.0	On Site	494419 410651	SE91SW33	-1.0	SHOTHOLE REORDS RETFORD & SCUNTHORPE
17	0.0	On Site	494272 410368	SE91SW32	-1.0	SHOTHOLE REORDS RETFORD & SCUNTHORPE
18	0.0	On Site	494270 410320	SE91SW460	-1.0	OVERHEAD LINE TOWERS 1
19B	0.0	On Site	494190 410310	SE91SW459	-1.0	OVERHEAD LINE TOWERS JP PBR7
20	0.0	On Site	494208 410142	SE91SW392	86.56	GOKEWELL SOUTH
21C	0.0	On Site	494087 410523	SE91SW395	76.2	GOKEWELL FARM NORTH





LOCATION INTELLIGENCE

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
22	0.0	On Site	493867 409046	SE90NW141	-1.0	WEST WOOD WEST NO.2
23	0.0	On Site	494548 409415	SE90NW139	-1.0	GOKEWELL STRIP SOUTH 3
24	0.0	On Site	493959 409210	SE90NW16	-1.0	SHOTHOLE RECORDS SCUNTHORPE
25	0.0	On Site	493833 409774	SE90NW136	-1.0	SODWALL PLANTATION EAST NO 2
26	0.0	On Site	493832 409871	SE90NW15	-1.0	SHOTHOLE RECORDS SCUNTHORPE
27C	0.0	On Site	494052 410512	SE91SW3	12.8	GOKEWELL COTTAGE, HIGH SANTON LANE, LINCS
28	3.0	W	493479 409933	SE90NW44	-1.0	SODWALL PLANTATION
29	7.0	SE	494553 408979	SE90NW49	-1.0	MANBY WOOD
30	8.0	W	493859 410390	SE91SW141	56.39	GOKEWELL PRIORY FARM
31	13.0	E	494583 409056	SE90NW143	-1.0	WEST WOOD WEST NO.4
32	15.0	E	494555 410167	SE91SW391	102.11	GOKEWELL SOUTHEAST
33	20.0	NE	494572 409558	SE90NW42	-1.0	GOKEWELL STRIP
34	33.0	SW	493689 408992	SE90NW48	-1.0	GOKEWELL ICEHOSE NO 2
35	33.0	S	493501 409036	SE90NW140	-1.0	WEST WOOD WEST NO.1
36	51.0	S	494269 408938	SE90NW17	-1.0	SHOTHOLE RECORDS SCUNTHORPE
37	100.0	W	493392 410044	SE91SW394	44.81	LITTLE CROW COVERT WEST
38	105.0	W	493229 409108	SE90NW104	-1.0	YARBOROUGH
39	122.0	E	494630 410500	SE91SW462	-1.0	OVERHEAD LINE TOWERS TP 3
40	125.0	W	493229 409243	SE90NW105	-1.0	YARBOROUGH
41	146.0	W	493226 409358	SE90NW106	-1.0	YARBOROUGH
42	150.0	NE	494624 410766	SE91SW456	-1.0	BROUGHTON B1
43	175.0	S	494537 408808	SE90NW18	-1.0	SHOTHOLE RECORDS SCUNTHORPE
44	182.0	W	493209 409486	SE90NW107	-1.0	YARBOROUGH
45	186.0	E	494680 410650	SE91SW463	-1.0	OVERHEAD LINE TOWERS 3
46	204.0	NW	493224 409617	SE90NW91	-1.0	YARBOROUGH MINES
47	224.0	W	493119 409009	SE90NW47	-1.0	GOKEWELL ICEHOSE NO 2
48	230.0	W	493104 409120	SE90NW110	-1.0	YARBOROUGH
49	240.0	W	493111 409232	SE90NW109	-1.0	YARBOROUGH





The borehole records are available using the hyperlinks below: Please note that if the donor of the borehole record has requested the information be held as commercial-in-confidence, the additional data will be held separately by the BGS and a formal request must be made for its release.

#9: scans.bgs.ac.uk/sobi\_scans/boreholes/134113
#12: scans.bgs.ac.uk/sobi\_scans/boreholes/134477
#15A: scans.bgs.ac.uk/sobi\_scans/boreholes/134222
#16A: scans.bgs.ac.uk/sobi\_scans/boreholes/134115
#17: scans.bgs.ac.uk/sobi\_scans/boreholes/134114
#20: scans.bgs.ac.uk/sobi\_scans/boreholes/134476
#21C: scans.bgs.ac.uk/sobi\_scans/boreholes/134479
#27C: scans.bgs.ac.uk/sobi\_scans/boreholes/134078
#30: scans.bgs.ac.uk/sobi\_scans/boreholes/134475
#32: scans.bgs.ac.uk/sobi\_scans/boreholes/134475

Groundsure



201

## 8 Estimated Background Soil Chemistry

Records of background estimated soil chemistry within 250m of the study site boundary:

For further information on how this data is calculated and limitations upon its use, please see the Groundsure Geo Insight User Guide, available on request.

Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
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0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg

9
Groundsure
LOCATION INTELLIGENCE



Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg

9
Groundsure
LOCATION INTELLIGENCE



Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg

9
Groundsure
LOCATION INTELLIGENCE



Dist	tance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
	0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
-	0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
-	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	1.0	E	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	4.0	Ν	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	4.0	Ν	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	5.0	S	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	5.0	S	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	5.0	S	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	5.0	S	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
-	5.0	S	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	5.0	S	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	5.0	S	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	5.0	S	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	6.0	E	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	7.0	E	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	10.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	10.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	10.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	10.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	10.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	10.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	11.0	Ν	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	11.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	11.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	13.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	13.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	16.0	W	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	17.0	W	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	17.0	W	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	20.0	Ν	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	<15 mg/kg	<100 mg/kg
	24.0	Ν	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	24.0	N	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	25.0	E	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
	29.0	E	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	34.0	S	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	34.0	S	RuralSoil	<15 mg/kg	<1.8 mg/kg	20 - 40 mg/kg	<15 mg/kg	<100 mg/kg
	43.0	W	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg





Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
43.0	W	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	<15 mg/kg	<100 mg/kg
47.0	SW	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	<15 mg/kg	<100 mg/kg

\*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.





### 9 Railways and Tunnels Map







### 9 Railways and Tunnels

#### 9.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary?	No
Have any underground railway lines been identified within 250m of the study site boundary?	No
Database searched and no data found.	
Any records that have been identified are represented on the Railways and Tunnels Map.	
This data is derived from Ordnance Survey manning and provides information on the possible location	e ef

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary?	No

Have any other railway tunnels been identified within 250m of the site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

#### 9.2 Historical Railway and Tunnel Features

This data is derived from Groundsure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? Yes

Have any historical railway or tunnel features been identified within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Details	Date
1	0	On Site	492330 409132	Railway Sidings	1979
 2	87	SW	493155 409087	Railway Sidings	1997
3	212	SW	493303 408773	Railway Sidings	1997
 4	221	SW	493324 408599	Railway Sidings	1975

Any records that have been identified are represented on the Railways and Tunnels Map.





This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary?	No
Have any historical railway lines been identified within 250m of the study site boundary?	No
Database searched and no data found.	
Multiple sections of the same track may be listed in the detail above Any records that have been identified are represented on the Railways and Tunnels Map.	

#### 9.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway	lines been identified within the stud	y site boundary?	No
-------------------------	---------------------------------------	------------------	----

Have any active railway lines been identified within 250m of the study site boundary? Yes

Distance (n	n) Direction	Name	Туре
82	SW	Not given	Multi Track
82	SW	Not given	Multi Track
95	S	Not given	Rail
95	S	Not given	Rail
104	SW	Not given	Multi Track
104	SW	Not given	Multi Track
119	SW	Not given	Multi Track
119	SW	Not given	Multi Track
119	SW	Not given	Multi Track
119	SW	Not given	Multi Track
200	S	Not given	Rail
200	S	Not given	Rail
204	S	Not given	Rail
204	S	Not given	Rail
215	SW	Not given	Rail
215	SW	Not given	Rail

Multiple sections of the same track may be listed in the detail above Any records that have been identified are represented on the Railways and Tunnels Map.

#### 9.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail 1 .

Is the study site within 5km of the route of the High Speed 2 rail project? No

Is the study site within 500m of the route of the Crossrail 1 rail project?

Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a Groundsure HS2 and Crossrail 1 Report.

No





The route data has been digitised from publicly available maps by Groundsure. The route as provided relates to the Crossrail 1 project only, and does not include any details of the Crossrail 2 project, as final details of the route for Crossrail 2 are still under consultation.

Please note that this assessment takes account of both the original Phase 2b proposed route and the amended route proposed in 2016. As the Phase 2b route is still under consultation, Groundsure are providing information on both options until the final route is formally confirmed. Practitioners should take account of this uncertainty when advising clients.





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**Small Scale Grid Index** 











































































































# APPENDIX 2.3

# FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY REPORT



National significant infrastructure project in the Energy Sector Little Crow Solar Park, Scunthorpe

# FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

On behalf of INRG Solar (Little Crow) Ltd

November 2018

# Contents

- 1 Introduction
- 2 Site Location and Setting
- 3 Existing Site and Ground Conditions
- 4 Proposed Development
- 5 Hydrology and Flood Risk
- 6 Surface Water Drainage
- 7 Construction Process
- 8 Management and Maintenance
- 9 Conclusions and Recommendations

Report prepared by Sam Rice – BSc (Hons) Report approved by Clive Onions - BSc CEng FICE FCIWEM MIStructE MCIHT

### Version history

Version	Date	Prepared by	Approved by	Comment	
D1	31.08.17	SR	со	Issued for approval	
D2	25.09.17	SR	СО	Extended site included	
V1	20.07.18	СО	СО	Final layout inserted	
V2	26.07.18	СО	СО	Minor amendments	
V3	16.11.18	SR	IJ	Updated with revised layout	

#### **Issue history**

Version	Date	Issued to	Method
D1	31.08.17	Pegasus Group	Email pdf
D2	25.09.17	Ditto	Ditto
V1	20.07.18	Ditto	Ditto
V2	26.07.18	Ditto	Ditto
V3	16.11.18	Ditto	Ditto

### 1. Introduction

INRG Solar (Little Crow) Ltd proposes to develop an energy scheme comprising up to 150MWp ground mounted solar arrays and up to 90MW of battery store on land to the east of the British Steel site at Scunthorpe.

This Flood Risk Assessment and Drainage Strategy (FRADS) has been prepared to consider the impact of the solar farm on the existing hydrology in the area, to show that flood risk is not increased off-site and that the solar farm is safe to operate for its lifetime. It considers the construction and operation stages.

The assessment shows that water quality entering the environment will be improved, infiltration will improve and runoff rates will be reduced, bring overall benefit to the environment.

## 2. Site Location and Setting

The site is located on land to the east of British Steel, Scunthorpe DN16 1XP.



Fig 1 Site location to the east of Scunthorpe (Streetmap).

The site is in the following setting:

- North of the site is Santon Wood, beyond which is mainly arable farmland, on land generally falling to the west.
- East of the site is woodland, a poultry farm and the town of Broughton on land falling gently to the east

- South of the site is strip of woodland, beyond which is arable farmland, solar farm, covered reservoirs, golf course, further woodland, etc., on land which falls to the west.
- West of the site is an access track, a narrow strip of green land containing a small arable field, beyond which is a deep excavation resulting from open cast mining, containing standing water some 20m below the level of the site boundary. Beyond this is Bottlesford Beck, at similar level to the site boundary, which drains the adjacent steel works and industrial estate.

In summary, the site is to the west of an important industrial area, within an area of woodland, arable farmland to the north and mixed uses to the south.



Fig 2 Oblique view of land between the industrial land and site, showing the 20m (approx.) deep excavation and standing water (Google Earth image by Getmapping plc).

### 3. Existing Site and Ground Conditions

The site occupies approx. 20 fields separated by hedgerows with occasional trees and fences. The fields are predominantly used for arable farming. The site excludes two strips of woodland in the southeast.

The site includes watercourses which are described later, but tend to flow eastwards from a spring line, which runs along the north-south axis of the site.

The shape of the site is irregular and is approx. 1,850m north-south and 1,550m east-west. There are no buildings shown within the site, although pylons carrying two main overhead electrical circuits cross north-south through the site.

The site is on land which slopes from approximately 60m AOD in the east to 25m AOD in the west, giving a slope of about 1 in 25. The northwestern part of the site is generally level at about 60m AOD, with a gentle 1 in 100 slope to 55m AOD along the north-eastern boundary.



Fig 3 Satellite view showing predominantly arable use within the site (Getmapping Plc.).



Fig 4 More detailed view of site showing steel works to the west, Bottlesford Beck, opencast steelworks and then the site, with an oil well to the northeast and a poultry farm to the east. Within the site are the power lines running north-south and the watercourses flowing westwards from the spring line (Streetmap).

A separate geotechnical report has been prepared by Integrale, but in summary the British Geological Survey Viewer shows sand above mudstone in the west and mudstone and limestone in the east. The Cranfield University Soilscapes Viewer shows the soil within the site to be free draining. This assessment suggests that the site is likely to be permeable, with limited runoff from rainfall.

It is however likely that in autumn and winter high levels of runoff and silt occur after ploughing, and before the vegetation/crops have established. These characteristics would cause high rates of runoff in autumn, and low rates in the growing seasons lading to high variations of flow in the receiving watercourses and potentially increasing the risk of silting given the shallow gradients.



Fig 5 The superficial geology, noting none is recorded (British Geological Survey).



Fig 6 The bedrock geology, showing the variety of permeable limestones on the higher (eastern) ground and less permeable mudstones on the lower (western) ground (British Geological Survey).



Fig 7 Soilscapes Viewer showing the soil throughout the site to be free-draining (Cranfield University Soilscapes Viewer).

#### 4. Proposed Development

The proposed development comprises the installation of a solar farm with battery storage area and associated 132 KV Substation. The works also include transformers and cables within the site to manage and convey the power.

The solar arrays will be aligned east-west, to collect sun from the south, with the low edge 800mm off the ground, and the high (northern) edge up to 3.5m off the ground; the dimensions vary with the local topography. The solar arrays incorporate gaps along the array, and several gaps up the slope, which are fundamental for thermal movement. These gaps avoid encourage rainwater to disperse along the array and avoid concentrated flows from the lower edge.



Fig 8 Typical section through solar array. Height dimensions will vary with undulations in the ground.

The arrays are positioned to provide access space between the arrays, and between the arrays, fence and hedge, to allow for maintenance. These dimensions also allow access for maintenance of the hedge outside the fence, and camera surveillance within the fence.

The site will be enclosed within deer fences, with open mesh and set 100mm above the ground to allow movement of wildlife and surface water. The fences will cross watercourses in such a way to reduce the risk of blockage, spanning the channel.

Vehicular access will be from an unnamed existing track to the northeast of the site, connected to the B1207 along an existing track serving the oil well etc.



Fig 9 Existing track from B1207 along the north of the site.



Fig 10 Existing rack running to the east and north of poultry farm.

Another track will also serve the solar farm which leads to the poultry farm and north into the site.

These tracks which run to and into the site will be retained – new tracks to key equipment on site will be formed in permeable material; the tracks tend to green over due to low usage which helps manage runoff and provides further varied habitat.

The fields on which the solar arrays are located will be prepared on completion of the solar farm, to loosen compacted ground, and then seeded where necessary to encourage a vegetated surface throughout with native grasses, and vegetation restored where construction has caused damage. The area within the fence will become a haven for invertebrates, reptiles, amphibians, small mammals and birds, as has been observed on other completed solar farm sites.

The site will be grazed at low density by sheep and inspected seasonally so that tall plants can be trimmed and avoided from shading the panels. Bare areas of earth will be prepared, seeded and protected to encourage growth.



Fig 11 Proposed site layout with key features highlighted.

## 5. Hydrology and Flood Risk

The site is located in Flood Zone 1, at low risk of flooding, according to the Environment Agency (EA) Flood Map for Planning, consistent with its elevated location, and is therefore appropriate development in terms of fluvial flood risk in accordance with the National Planning Policy Framework (NPPF).



Fig 12 The EA Flood Risk Map for Planning showing the site to be in Flood Zone 1.

The EA Surface Water Flood Risk Map shows isolated ponding within a few areas in the site – indicative of the generally free-draining nature of the soil. In the west of the site the water is shown to issue from a spring line and flows westwards. The spring line is shown below, in an image which has been extracted from the Geotechnical Report.

Localised areas up to 50m wide appear to have a very gentle fall to the east, and, leading through woodland. There are no evident watercourses or signs of surface water flows to the east, indicating that the rainfall infiltrates into the ground where it lands, ie the shallow gradient allows infiltration.

The site contains a number of watercourses, generally running north south along the slope, and linked by watercourses flowing down the slope, which are shown on the maps. A detailed topographic survey has been undertaken of the site and shows that the channels are well-defined and approximately 1m deep.



Fig 13 Extract from the EA Surface Water Flood Risk Map showing isolated areas of the site at risk from surface water ponding in the 1 in 1000 year event, and an area of shallow streaming in the northwest.



Fig 14 Extract from Integrale's Phase 1 Ground Conditions Desk Study, showing the spring line and proposed battery store to the east (uphill) of the spring line.

#### 6. Surface Water Drainage

The soil is shown to be free-draining, and the underlying soil is naturally drained by the springs which issue along the spring line. The mechanism would therefore be that rainfall infiltrates into the soil, and then follows a layer with low permeability and issues at a generally low rate over a prolonged period from the ground, forming a watercourse. It is proposed to retain the watercourses which issue from the spring line, and provide a minimum 8m buffer from top of bank with no development. The boundary fence will cross the watercourses where they flow across the western boundary and special measures might be required to limit blockages.

Swales will be formed on the uphill side of the main watercourses as a precautionary measure especially to manage runoff and silt during the construction period.

A swale is also proposed along the west and north of the poultry farm to reduce the risk of runoff nuisance.

The swales will be formed by excavating a 300mm deep valley and placing the soil on the downhill slope, and about 3m wide.



Fig 15 Plan showing site shaded to highlight existing watercourses. All structures such as fences, tracks, solar arrays and infrastructure will be more than 8m from illustrated watercourses, but fences will cross where watercourses cross the site boundary. The red circles represent locations where fences will cross watercourses.



Fig 16 Typical form of swale formed with ridge and furrow technique and vegetated on completion.

Transformer units etc will be positioned on legs with 300mm permeable gravel bed below to provide attenuation and infiltration into the underlying and adjacent soil.

The battery units, which will be containerised, will also be formed over a similar gravel bed to encourage infiltration and allow attenuation.

The fields will no longer be applied with pesticides and fertilizers, thus the water quality entering the environment will be improved. The fields will not be bare and compacted in the autumn and winter, thus improving infiltration and eliminating silt runoff.



Fig 17 Typical transformer unit on legs over permeable gravel bed.



Fig 18 Typical containerised batteries on legs with permeable gravel base below.



Fig 19 Typical expanded view showing retention of green corridors with vegetation and zones with watercourse and swales. The arrays are 6m wide, given a scale for the watercourse zones, which are in the order of 20m wide.

#### 7. Construction Process

To minimise damage to the soil structure within the solar farm site, the contractor should manage the work appropriate to the prevailing weather conditions and use appropriate machinery for the circumstances.

Existing watercourses will be protected by silt fences if there is a risk of silt runoff occurring during the works, dependent on weather and prevailing characteristics

Machinery used within the solar farm should have low earth pressure tyres or tracks, such as is typical with farm machinery, to minimise compaction of the ground.

A delivery sequence by vehicles should be devised which minimises repeated journeys over the pasture to reduce rutting and damage to the pasture and soil structure.

On completion of the works the pasture should be restored using light farming machines and the soil prepared appropriately for seeding to encourage early growth, restoration of the soil structure and natural creation of meadow grass.

## 8. Management and Maintenance

The general solar farm, watercourses, permeable tracks, permeable beds below units etc within the site will be maintained by the site operator.

The watercourses should be inspected at the start of the autumn and in late spring, and at other times if prevailing conditions suggest, and the following steps taken:

- Any blockages from branches, intense bramble growth etc. should be removed so that the swales can be readily inspected to confirm their clear operation.
- Any raised bed due to animal activity etc. which may hinder water flow should be removed to restore performance.
- Trees and shrubs should be removed before they can establish.
- Grass and wild flowers should be inspected and strimmed back from time to time.
- Bare earth areas should be inspected, prepared and seeded to re-establish grass and wildflower growth as appropriate.
- If water ponds for prolonged periods inspections should be made and the bed treated to restore performance and aid infiltration.

### 9. Conclusions and Recommendations

INRG Solar (Little Crow) Ltd proposes to develop an energy scheme comprising up to 150MWp ground mounted solar arrays and up to 90MW of battery store, with associated infrastructure, surrounded by a deer fence, on land to the east of Scunthorpe.

In summary:

- The site is entirely in Flood Zone 1 according to the EA Flood Map for Planning and appropriate development in this area.
- The local area to the site is not sensitive in terms of surface water flood risk.
- The site is currently used for arable farming which causes compaction, reduces absorption of rainwater by the soil and increases soil runoff, particularly after harvesting.
- The soil within the site is recorded as being free-draining.
- Swales are proposed to reduce the risk of runoff affecting the watercourse flows and the poultry farm.
- The proposal will eliminate compaction, allow the soil and vegetation properties to improve and contain the rainfall within the site, by infiltration into the ground.
- Runoff quality entering the environment will improve through ceasing the application of pesticides and fertilizers.

- Tracks will be formed in permeable construction.
- Transformer and battery units will be formed with permeable gravel beds to encourage infiltration.
- A management programme is described which ensures the soil and watercourse conditions will remain favourable for the lifetime of the development.

The proposal therefore brings significant benefit to the management of surface water, a reduction in runoff leaving the site and the improvement in water quality entering the environment. The development does not increase the risk of flooding to the local area or lower in the catchment.