BDW TRADING LIMITED

NIAB Phase 1, Huntingdon Rd, Cambridge

Report for Main Site Investigation

25459

OCTOBER 2012

RSK GENERAL NOTES

Project No.: 25459-01(00)

Title: Report for Main Site Investigation: NIAB Phase 1, Huntingdon Road, Cambridge

Client: BDW Trading Limited

Date: 25 October 2012

Office: Hemel Hempstead

Status: Final

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1 INTRODUCTION

RSK Environment Limited (RSK) was commissioned by BDW Trading Limited to carry out a geotechnical and contaminated land assessment of a plot of land known as NIAB 1, currently owned by the National Institution of Agricultural Botany (NIAB). It is understood that current proposals include for the redevelopment of the site with a mixed-use development, specifically comprising residential, retail and school infrastructure.

This report is subject to the RSK service constraints given in Appendix A.

1.1 Background

RSK have been provided with two previous reports associated, in part, with the subject site area. The reports were both compiled by Millard Consulting Engineers in 2006 and comprise an initial stand-alone Phase 1 Environmental Risk Assessment and a subsequent follow-on Phase 2 Intrusive Environmental and Geotechnical Site Investigation. A brief summary of these reports is provided in section 2.

1.2 Objective and aims

The objective of the work is to assess the site in relation to the proposed future redevelopment. The scope of investigation and positioning of the exploratory locations was based on the drawing provided by Woods Hardwick (drawing reference 16483/1015, dated January 2011) and a scope of investigation prescribed by Wilson Bowden, specifically associated with the proposed food store and “Centre Point. It is anticipated that this main investigation will support an outline planning submission for the mixed-use redevelopment of the site.

The aims of this assessment are to:

- Enable an assessment of the site and surrounding area in terms of history and environmental setting from which a conceptual model can be collated to inform site investigation works;
- Obtain sufficient information regarding ground conditions from which risks to end-users, the environment and structures can be assessed plus geotechnical issues including the design of foundations and infrastructure; and
- Enable an initial assessment of the potential waste classification implications of soil arisings.

1.3 Scope

The scope of the investigation and layout of this report has been designed with consideration of CLR11 (Environment Agency, 2004a), BS 10175: 2011 (BSI, 2011) and PPS23 (ODPM, 2004), plus guidance on land contamination reports issued by the Environment Agency (2010a).

The project was carried out to an agreed brief as set out in RSK's proposal (ref. 25459-01T(00), dated 9 February 2012), and subsequent revisions, including the scope of works prescribed by Wilson Bowden, summarised in email dated 14 August 2012. The scope of works for the assessment included:

- An updated preliminary risk assessment (PRA) to include a review of existing reports, geological, hydrogeological and hydrological information, a commercially available environmental database, and historical plans; correspondence with regulatory authorities; and a site walkover – this information is used to develop an initial conceptual site model to consider any potentially complete pollutant linkages;
- An intrusive investigation consisting of 5 no. boreholes (2 no. associated with the Wilson Bowden Scope of works), 52 no. trial pits (4 no. associated with the Wilson Bowden scope of works), 9 no. infiltration test locations, 28 no. drive-in window sampler boreholes (4 no. associated with the Wilson Bowden scope of works) with laboratory analysis plus subsequent groundwater and gas monitoring;
- Development of a refined conceptual site model followed by generic quantitative risk assessment (GQRA) to assess complete pollutant linkages that may require mitigation measures to be implemented to facilitate redevelopment;
- Identification of outline mitigation measures for complete pollutant linkages or recommendations for further work;
- Interpretation of ground conditions and geotechnical data to provide recommendations with respect to foundations and infrastructure design; and
- A factual and interpretative report with recommendations for further works (i.e. undertake a remedial options appraisal to identify appropriate mitigation measures/produce a remedial implementation and verification plan) and/or remediation as necessary.

1.4 Existing reports

The following reports detailing previous works at the site were made available for review:

- Proposed Development Site, Huntingdon Road/Histon Road, Cambridge, Report ref: 5593/04/CM/03-06/1213, 'Phase 1 Environmental Risk Assessment', Millard Consulting Engineers, March 2006;
- Proposed Development Site, Huntingdon Road/Histon Road, Cambridge, Report ref: 5593/14/RT/09-06/1371, 'Phase 2 Intrusive Environmental and Geotechnical Site Investigation', Millard Consulting Engineers, September 2006;

These have been summarised in Section 2.

2 THE SITE

2.1 Site location and description

The site is located to the northeast of the main administration/office buildings of the National institute of Agricultural Botany (NIAB), off Huntington Road, Cambridge at National Grid reference 543818, 260766, as shown on Figure 1.

The site covers approximately 54.6 hectares and generally slopes downwards to the north/northeast with a highest elevation of 19.93m in the south east corner and the lowest at 12.03m in the north. The site land use comprises entirely of arable farmland, most recently used for agricultural research, with the exception of a disused cricket pavilion and associated storage sheds/outbuildings in the far southeast corner. The arable farmland is sectioned off into approximately eight separate fields with a further field beyond a concrete access road in the far north. The field boundaries comprise a combination of hedgerows, drainage ditches and an access road running between the central fields, providing access to the westerly NIAB farm premises. There is also a public right of way, which for most of its length, coincides with the northern site boundary and the boundary between South Cambridgeshire District and Cambridge City. Figure 3 shows the existing site layout.

The A14 is located north of the site, oriented in an east-west direction. Residential and academic land-uses occupy the area to the east of the site. The main NIAB office building is situated immediately south/southwest, between the site itself and Huntingdon Road. A mixture of residential and undeveloped/agricultural land surround the periphery of the site to both the south and west.

2.2 Proposed development

The site in question is being considered for a mixed-use redevelopment as described in section 1.The planned layout of the site is shown on Figure 2.

2.3 Key information from previous reports

Two previous investigations undertaken by Millard Consulting Engineers have been reviewed as part of the preliminary risk assessment. The following sections provide a review of pertinent information from the reports noted in section 1.4.

2.3.1 Phase 1 Environmental Risk Assessment, March 2006

This investigation comprised a phase 1 study of a wider site area than the current study, also encompassing the designated NIAB 1 site itself. The study was undertaken in connection with the intention for David Wilson Estates to apply for planning approval to redevelop the site for residential use. The site considered as part of the study included a parcel of land located between the existing main NIAB buildings and Whitehouse Lane (recently been redeveloped, in part, and currently under construction). The assessment also included correspondence with a number of consultees, including various departments of Cambridge City Council and the Environment Agency. A summary of key information extracted from the report is provided below:

- The NIAB facility has existed, in various forms, since the early 20th Century, prior to which the site was entirely occupied by open fields. The facility is used for agricultural and food research, along with general agricultural activities and has been supported by a number of buildings used as offices, laboratories, greenhouses and farm yards in the south-western portion of the site;

- Anecdotal information confirmed that a number of the buildings located on the site contained asbestos containing materials (ACM's). However, it is understood that the buildings referenced are not located in the current study area and are predominantly associated with the former NIAB laboratories, greenhouses and offices located between the existing NIAB main office and Whitehouse Lane to the south/southwest of the site;

- An above ground diesel storage tank was located on hard standing in the premises of the disused sports pavilion, adjacent to the former sports field in the southeast portion of the site;

- The site activities require the use and storage of agricultural chemicals, principally pesticides and herbicides;

- Off-site sources of contamination (referenced also as on-site sources in the report, owing to the variation in study area) were also noted, associated with the wider NIAB facility. The identified sources included the following:

    - Bulk storage of hydrocarbons in above ground storage tanks;

    - Storage and use of agricultural chemical, referenced above;

    - ACM's in the fabric of existing buildings (predominantly to the west/southwest of the current site area);

    - Gas cylinders (predominantly to the west/southwest of the current site area); and

    - Mixing of chemicals within a bunded chemical mixing point.

- An off-site historical gravel pit (worked during the early to middle part of the 20th Century) was located to the south of Huntingdon Road and has now been infilled. Adjacent to this, an area containing Roman coffins was also noted. Both are in excess of 200m from the study area. Petrol stations, nurseries and a laundry were also recorded in the vicinity of the site;

- The findings of the study identified the following risks associated with the site :

  - Residential end-users – a **moderate risk** identified from potentially contaminated soils and a moderate to low risk associated with ACM's in the buildings (it is noted that the buildings referred to are not located on the study site itself, and many no longer exist);

  - Construction workers – a **moderate risk** identified from potentially contaminated soils and ACM's (ACM's associated with buildings that are not located on the study site itself, and many no longer exist), and a moderate/low risk associated with the bulk storage of hydrocarbons and an electricity sub-station (located to the west/southwest of the existing study site);

  - A **low risk** was identified to flora and fauna, groundwater, surface water, and building structures and services.

- The phase 1 assessment undertaken Millard Consulting Engineers culminated in a number of recommendations, as follows:

  - The production of an archaeological desk study; and

  - The completion of a preliminary Phase 2 land quality assessment to refine the initial conceptual model.

2.3.2 Phase 2 Environmental and Geotechnical Site Investigation, September 2006

Millard Consulting Engineers carried out a phase 2 investigation of the study area described in section 2.3.1. The scope of work included the excavation of six cable percussive boreholes, thirteen window sampler boreholes, six mechanical trial pits, installation of seven monitoring wells and associated in-situ testing and laboratory analysis. A number of the exploratory holes were located in areas between former and existing NIAB buildings, which form the majority of the recent redevelopment area alongside Huntingdon Road. However, sixteen of the exploratory holes were located on the NIAB 1 site area, specifically BH1 to BH4, TP1, TP2, TP5, TP6, TP7, WS6, WS7 and WS CH1 to CH5. A summary of pertinent information in relation to the existing assessment of NIAB 1 is provided below:

- A variable thickness of made ground/topsoil was encountered ranging between 0.1m and 1.6m thickness, with a typical thickness of around 0.3m. The greatest thickness of made ground was encountered in CH5, where concrete and brick was encountered between 1.5m and 1.6m bgl;

- River Terrace Deposits were encountered in localised areas of the site, generally increasing in frequency and thickness to the northeast where granular deposits were encountered to the terminal depth of the exploratory hole designated CH WS1 at 4.0m bgl. Deposits of the Gault Clay Formation were encountered directly below the made ground/topsoil or River Terrace Deposits, where present;

- Significant contamination issues were not identified, albeit the presence of localised elevated concentrations of heavy metals and TPH were encountered with respect to a residential (with plant uptake) end-use. Specifically, elevated concentrations of arsenic and cadmium within the shallow made ground soils at WS6 and TPH within the shallow made ground and Gault Clay deposits in WS8 (in proximity to the former above ground fuel storage tank in proximity to the sports pavilion) were recorded;

- Topsoil across the site was generally recorded to be suitable for use, albeit with further testing required to delineate the potential sources of contamination associated with WS6 in the west of the site and WS8 in the southeast.

- Analysis of groundwater demonstrated that the underlying Secondary Aquifer associated with the granular River Terrace Deposits was not impacted with contamination. Furthermore, a single sample of groundwater recovered from an abstraction well on the NIAB premises indicated that there has been '*no measurable impact on the underlying Lower Greensand aquifer*';

- The report made the following recommendations in relation to foundations and allowable ground bearing pressures:

    - River Terrace Deposits – Loose to medium dense sands and gravels: 150kN/m^2 at a minimum foundation depth of 0.75m bgl;

    - River Terrace Deposits – soft to firm sandy clay: 100kN/m^2 at a minimum foundation depth of 0.9m bgl;

    - Gault Clay – stiff blue/grey clay: 175 kN/m^2 at a minimum foundation depth of 0.9m bgl;

    - A piled foundation solution may provide the most economical option in areas of deeper made ground, such as BH1 and CH5; and

    - Cohesive soils were identified as having medium volume change potential. Where the proposed founding stratum comprises cohesive deposits and within the zone of influence of trees, foundation depths and heave protection should be considered in accordance with NHBC Standards Chapter 4.2.

- Soakaways were only considered to be possible in the vicinity of TP5, where an infiltration rate of 1.87 x 10-5 m/s calculated;

- Standing groundwater levels were recorded between 1.64 and 2.2m bgl adjacent to the site boundaries in the central eastern and western portions of

the site. Groundwater strikes were encountered in the northern portion of the site at depths ranging between 3.0 and 3.50m bgl;

- In relation to the existing study area, the following recommendations were made:

  - Further testing to investigate the extent of TPH contamination in proximity to the former AST alongside the pavilion building in the southeast of the site;

  - Additional sampling to be carried out to quantify the potential for pesticides/herbicide residues to be present within the shallow soils of agricultural areas of the site which were not previously accessible;

  - Further infiltration testing to supplement the existing data, particularly in the northern-most area of the site (referred to previously as the 'Chivers land';

  - Further geotechnical investigation to refine the findings of the report and to more accurately delineate the boundaries of differing soil conditions.

3 PRELIMINARY RISK ASSESSMENT (PRA)

This section is based on the information obtained from previous phases of investigation, including desk-based information summarised in the earlier report, and data obtained from an updated desk-based study.

3.1 Site walkover

The site was visited on 17th August 2012 to undertake a site walkover. Photographs are provided in Appendix C. No significant contamination or geotechnical issues were identified, although it is recognised that the previous investigation by Millard Consulting Engineers identified the presence of TPH contamination in proximity to the disused sports pavilion. However, no surface staining was observed during the recent walkover survey in the location that is understood to have historically supported the tank.

The site appeared to have remained largely unchanged from the observations made in the Millard Consulting Phase 1 investigation. However, it was noted that the field immediately adjacent to the sports pavilion has most recently been used for agricultural purposes, rather than sporting activities. The sports pavilion itself appears to have been disused for some time. Furthermore, the outbuilding along the site boundary to the northeast of the pavilion is also disused.

The drainage ditch dividing the southern portion of the site from the fields, formerly referred to as 'Chivers land' was very overgrown at the time of the site visit, but appeared to be dry. The drainage ditch dividing the two former 'Chivers' fields in the northeast was also predominantly dry at the time of inspection, however, it is understood to discharge off-site towards the east. Discussions with NIAB personnel confirmed that the irrigation water mains, which traverse the site, are now redundant. It is understood that these were located beneath the concrete track way, which separates the most southerly located fields from the central fields. A number of small electricity pylons (and associated overhead cabling) are also located in the central/southern site area.

The closest off-site sources of potential contamination are associated with the NIAB operations. However, these appeared to be limited to:

- Agricultural chemical storage and usage – NIAB personnel confirmed that only approved pesticides and herbicides are used. The chemicals are mixed in a bunded chemical mixing point (with spill catchment and drainage channel) in the main NIAB farmyard area to the northwest of the central site area;
- Bunded above ground fuel storage tanks – Located within the main NIAB farmyard area. Used for the storage of red diesels and oils;
- It is possible that ACM's are associated with the building fabric of the existing NIAB buildings. It is understood that an asbestos register is available on site.

No waste is currently generated on the study site itself. A waste management system appeared to be well established within the existing off-site NIAB facilities.

3.2 Ground conditions

3.2.1 Geology

Published geological records indicate that the Gault Clay Formation of the cretaceous period is located immediately beneath the southern portion of the site. A tract of River Terrace Deposits is located above the Gault Clay in the northern portion of the site, feathering southwards and eastwards into the central site area. River Terrace Deposits are also absent between the southern-most and northern-most fields. This correlates precisely with the location of a drainage ditch separating the southern part of the site with the 'Chivers land' to the northeast. This succession was generally confirmed by the intrusive investigation undertaken by Millard Consulting Engineers in 2006. In addition, an outcrop of the West Melbury Marly Chalk Formation (formerly referred to as the Lower Chalk) and Head Deposits are recorded immediately south of the site. Published records (British Geological Survey, 1981) for the area (Sheet 188 "Cambridge") indicated the geology of the site to be characterised by the succession recorded in Table 1.

Table 1: Geology at the site

Geological unit	Description	Estimated thickness (m)
River Terrace Deposits	Sand and gravel, locally with lenses of silt, clay and/or potentially peat.	up to 4m + where encountered
Gault Formation	Pale to dark grey or blue-grey clay or mudstone, glauconitic in part, with a sandy base. Discrete bands of phosphatic nodules (commonly preserving fossils), some pyrite and calcareous nodules.	30m +
Lower Greensand Formation	Mainly sands and sandstones (varying from well-sorted fine-grained to poorly sorted medium- to coarse-grained) with occasional interbedded silts and clays.	30m +
Source: BGS website and previous investigation report by Millard Consulting Engineers		

In addition to the published geological map records, two boreholes were sourced from the British Geological Survey website to provide further information regarding ground conditions on the site. Both boreholes were located on the site itself and confirmed the presence of up to 4m of drift deposits (comprising topsoil, weathered cohesive deposits and granular terrace deposits), overlying Gault Clay. The deeper of the two boreholes appears to have been drilled for the installation of an abstraction well during the 1960's.

This confirmed the presence of Gault Clay to an approximate depth of 35m bgl, overlying deposits of the Greensand Formation to the terminal depth of the investigation at 45m bgl. Copies of these are included in Appendix F.

The existing topography, history of development and previous phases of investigation indicate that, in addition to these natural strata, made ground (predominantly associated with agricultural activities and cultivation) should be expected beneath the site.

3.2.2 Cambridge and Peterborough Mineral Safeguarding Area (MSA)

A review of the Minerals Safeguarding Areas maps within the Cambridgeshire and Peterborough Minerals and Waste Development Plan indicates that the northeast part of the site is located within an MSA. The reason for this designation is likely to be a result of the granular River Terrace Deposits present in this part of the site. The Cambridgeshire County Council website states that the designation of the MSA's are designed to '*ensure that consultation takes place between the County Council (as Mineral Planning Authority) and district/city councils when development is proposed on mineral bearing land. The aim is to avoid the County's finite mineral resource being unknowingly or unnecessarily sterilised'.*

3.2.3 Radon

The environmental database report indicates that the site is not located within an 'Affected Area' as defined by the Documents of the National Radiological Protection Board (Radon Atlas of England and Wales, NRPB-W26-2002) and therefore the risk of significant ingress of radon into structures on-site is considered low.

3.2.4 Mining and quarrying

Evidence has been sought to identify any mining and quarrying operations, past and present, which have taken place in the vicinity of the site. The information referenced in this element of the desk study is sourced from the environmental database report.

- GroundSure environmental database report and historical mapping;
- Records held by Cambridge City Council; and
- Records held by the Environment Agency.

With reference to the above data there is one recorded potential non-coal mining activity within a 250m radius of the site. This is associated with the potential 'infrequent minor mining of chalk restricted in extent' 122m to the south direction of the site. In addition, a number of historic surface ground working features are located within 250m of the site. The two closest to the site itself relate to an 'unspecified pit' and 'unspecified heap' recorded during the 1950's some 128m east of the north-eastern portion of the site and 170m to the south west of the south-western site boundary, respectively. The feature to the south is known to be a former gravel pit.

3.2.5 Landfilling and land reclamation

Evidence has been sought to identify any landfilling or land reclamation operations, past and present, which have taken place in the vicinity of the site. The sources of information referenced in this element of the desk study include:

- GroundSure environmental database report
- Records held by Cambridge City Council;
- Records held by the Environment Agency; and
- Geological maps (see Section 3.2)

There are no records of landfill sites (former or current) within 250m of the site (i.e. within the planning consultation zone). According to the environmental database report, the nearest historical landfill is located approximately 390m distant to the southwest. The landfill, operated by Cambridge University Farm and regulated by the EA, managed inert waste, although there is no known restriction on source of waste. It is assumed that a record of a closed landfill some 450m from the site relates to the same site, also operated by Cambridge University Farm. Information contained within the Millard Consulting Engineers Phase 1 report indicates that the site was authorised to accept excavated natural materials. There are no further landfills within 1km of the site.

Given the underlying geological sequence and the distance of the landfill from the site, it is not considered to represent a significant potential risk to the site as a result of landfill gas migration and/or leachate.

In addition to the above, it is noted that the mineral workings to the south of Huntingdon Road have been infilled since gravel extraction has ceased.

3.2.6 Ground gas

Given the anticipated ground conditions the risk associated with ground gas is considered to be low in accordance with CIRIA C665 (Wilson et al., 2007).

3.3 Hydrogeology

3.3.1 Aquifer characteristics

Based on the published geological map referred to above and information sourced from the environmental agency, the hydrogeology of the site is likely to be characterised by the presence of an semi-confined shallow aquifer (Secondary A) comprising the River Terrace Deposits in the northern and central portion of the site. These water-bearing deposits are immediately underlain by the unproductive Gault Clay Formation.

The anticipated depth to the groundwater table is in the order of 2 to 3m below ground level.

It is also possible that localised perched water may also be present in the made ground on site.

The presence of low permeability clay at relatively shallow depths beneath the site, while restricting downwards migration, may increase the potential for lateral migration of shallow groundwater (and therefore mobile contamination, if present).

3.3.2 Vulnerability of groundwater resources

The hydrogeology of the site has been classified by the Environment Agency as follows:

- Secondary A aquifer: In areas of the site underlain by River Terrace Deposits, 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
- 'Unproductive' strata: In areas of the site where River Terrace Deposits are absent and only Gault clay is present, low permeability with negligible significance for water supply or river base flow.

The River Terrace Deposits beneath the site are classified as having Intermediate Leaching Potential.

3.3.3 Licensed groundwater abstraction

The environmental database report indicates that there are 28 current licensed groundwater abstractions within a 2km radius of the site. Groundwater abstractions within a 250m radius and/or within a principal aquifer zone are summarised in Table 2. The nearest two are located on the wider NIAB site itself and operated by NIAB for direct and storage spray irrigation purposes. No potable water abstraction licenses exist within a 2 km radius of the site.

Table 2: Groundwater abstractions

Reference	Distance and orientation from site (m)	Comment
Borehole No.1 At Cambridge	On the wider NIAB site (assumed to be close to the northwest site boundary)	Spray Irrigation – Direct. Permit start date was 1st April 1998; expiry date was 31st December 2007.
Borehole south of Impington	2m, 53m and 64m, 137m, 225m, 238m and 245m East [(a)]	General Farming and Domestic. Permit start date was 1st March 1966; expiry date not supplied.
Borehole south of Impington	122m Southeast [(a)]	General Farming and Domestic. Permit start date was 1st March 1966; expiry date not supplied.
It is assumed that the groundwater abstractions detailed above are from the Greensand Formation.		

In terms of aquifer protection, the EA generally adopts a three-fold classification of source protection zones (SPZ) for public supply abstraction wells.

- zone 1 or ‘inner protection zone’ is located immediately adjacent to the groundwater source and is based on a 50-day travel time. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- zone 2 or ‘outer protection zone’ is defined by a 400-day travel time to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants.
- zone 3 or ‘total catchment’ is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

Information available on the EA website indicates that the site does not lie within a currently designated groundwater Source Protection Zone.

3.4 Hydrology

3.4.1 Surface watercourses

There are no recorded surface watercourses on the site itself. Two notable shallow drainage ditches (dry at the time of the investigation) are found along the northern edges of two of the fields within the site footprint. These ditches are understood to discharge to locations beyond the eastern/south-eastern site boundary, although their precise terminal output location is not known.

There are no EA classifications of surface water quality within a 1500m area of the study site.

3.4.2 Surface water abstractions

Based on the environmental database report, one surface water abstraction is located within a 2km radius of the site. It is situated along the River Cam in Cambridge, 1812m to the southeast of the site. The purpose of the abstraction is for general farming and domestic use.

3.4.3 Site drainage

Surface drainage from the site appears to be discharged via drainage ditches between fields within the site’s footprint. Furthermore, observations during the walkover and discussions with employees of NIAB indicate that field drains discharge into these drainage ditches.

3.4.4 Preliminary flood risk assessment

The environmental database report indicates that the site is not situated on or within 250m of an Environment Agency designated fluvial floodplain. However, it should be noted that this report is not intended to replace a comprehensive flood risk assessment study.

3.5 History of site and surrounding area

The history of the land-use and development of the site and surrounding area has been assessed based on the following sources:

- historical maps within the environmental database from 1901 to 2012;
- pre-Ordnance Survey (County Series) maps;
- Interviews with site staff; and
- information from the local planning authority.

Copies of OS and County Series maps are included in the environmental database report in Appendix E. Reference to historical maps provides invaluable information regarding the land use history of the site, but historical evidence may be incomplete for the period pre-dating the first edition and between successive maps.

Planning records held by Cambridge City Council are limited given the undeveloped nature of the site. However, based on direct contact with Cambridge City Council, it is understood that an outline application was granted permission for a mixed end use (including student accommodation and retail). The publically available council archives also holds planning records back to 1965, when consent to construct a seed store was granted, associated with the wider NIAB site. Subsequent planning consents of note, associated with the wider NIAB site, are referenced in Table 4.

Table 4: Planning information

Year	Details
1967	• Off-site - Construction of shelters attached to side of granery building to provide covered shelter for implements and machines
1968 - 1973	• Off-site - Multi-storey administrative office and laboratory development; • Off-site - Glasshouse unit; and • Off-site - The erection of canteen, toilets and glass office
1981 - 1984	• Off-site – Erection of library buildings, alterations to access and carparking ; • Off-site – Erection of toilet block to existing changing rooms; • Off-site – Erection of agricultural implement and vehicle store; and • Off-site – Erection of glass houses, storage buildings and provision of access.

The development history of the site and surrounding area from the above sources is detailed in Table 5 and summarised below.

Table 5: Summary of historical development

Date	Land use/features on site	Land use/features in vicinity of site (of relevance to the assessment)
1901	Agricultural land with an orchard in the northern central field.	Close Farm immediately west of the southwestern corner of the site. Gravel pits 250m to the south of the site between 1901 and 1966. Roman Coffins found approximately 200m south of the site in 1868. Girton college located to the west.
1927	Sports ground developed in the south east corner of the site. A building structure was developed within the same vicinity close to the site boundary, presumably as part of the same facility.	Close Farm redeveloped into what is referred to as 'White House'. Development of the National Institute of Agricultural Botany (NIAB) buildings immediately south of the site. Station usage is for official seed testing. Scotsdale Laundry established approximately 100m east of the orchard in the central northern part of the site.
1957 - 1959	Redevelopment of the building structure in the south east corner of the site to its present state as a pavilion. Wooden electricity pylons established which cross the southern portion of the site. Structures remain at present.	N/A
1959 – Present	Development of two buildings related to general farm use close to the site boundary within the centrally east oriented portion of the site. Both demolished by 1980.	By 1980, the A14 was constructed with a junction approximately 150m north of the site boundary. Development of land use to the east of the site's footprint from allotments to residential housing. Development of the NIAB farm buildings immediately west of the central site area. General development and growth of the NIAB facility.

3.6 Sensitive land uses

No national or internationally designated sensitive land uses such as sites of special scientific interest (SSSI) were identified in the vicinity of the site.

3.7 Licences and permissions

A single groundwater abstraction license is recorded for spray irrigation purposes. However, according to the environmental database report, the license expired in 2007. This record is also supported by Cambridge City Council records.

3.8 Local authority environmental health department information

The environmental health department (EHD) of Cambridge City Council has no records of contamination in connection with the site.

The site has not been identified as contaminated land under Part IIA of the Environmental Protection Act 1990. The council also confirmed that any potential contamination issues would be regulated via planning (through the contamination condition).

The contaminated land officer also confirmed that the council have had sight of the two Millard Consulting Engineers reports, reviewed in section 2.3 and confirmed that the reports did not record any significant contamination.

A copy of the response is included in Appendix G.

3.9 Initial conceptual model

The information presented in Sections 2 and 3.1 to 3.8, has been used to compile an initial conceptual model. The identified potential sources of contamination, associated contaminants and receptors have been considered with plausible pathways that may link them. The resulting potential pollutant linkages are considered in Section 3.11.4. The risk classification has been estimated in accordance with information in Appendix D.

3.9.1 Summary of potential contaminant sources

Potential sources and contaminants of concern are summarised in 6.

Table 6: Potential sources and types of contamination

Potential sources	Contaminants of concern
On-site historical	
Minor farm buildings / sports pavillion (1971-1984) – **Point**, predominantly southeast portion of site	Made ground, possible ACM.
Fuel storage – **Point**, southeast portion of site and potentially alongside central northern boundary	TPH, PAH and potentially asbestos
On-site present day	
Agricultural land - **Diffuse**	Commonly used agricultural fertilisers and

Potential sources	Contaminants of concern
	pesticides
Off-site	
Laundry services, approximately 100m east	Organic solvents
Adjacent and nearby former and current farmland activities.	Fuels, oils, pesticides and herbicides.
Dual Carriageway, 100m north of site (1980 to present)	Fuel oils, heavy metals and PAH
Ground workings – gravel pits (c. 1950's)	Generation of ground gases, dependent on nature of backfill (potentially carbon dioxide and methane)

The potential for contamination to be present on the site as a result of existing or recent activities is limited to the use of agricultural chemicals (fertilisers and pesticides). Potential sources of contamination as a result of historic land-use are much the same for the majority of the site, with the exception of fuel-storage, which is understood to have existed in the form of an above-ground fuel storage tank adjacent to the former sports pavillion in the southeast corner of the site. In addition, the Millard Consulting Engineers phase 1 report makes reference to the presence of an above ground tank located in the central part of the northern site boundary. It is understood that the tank supplied a generator during the observations made in 2006. However, there was no evidence of its existence during the latest investigation and it is considered that it may have been a reference to a tank outside of the site boundary for the current study.

Potential current and historic off-site sources of contamination are somewhat limited. The NIAB facilities to the south/south-west and northwest of the site may pose a slight risk of contamination, although inspection of the current activities indicates that these are generally minimal. A potential source of contamination could also be associated with backfill materials used to level the historic ground workings (including gravel pit to the south). However, the underlying lithological conditions and associated potential pathways for migration should be considered when quantifying any potential risk from such sources.

3.9.2 Sensitive receptors

Sensitive receptors at this site include:

- future site occupants
- adjacent site users
- vegetation
- water supply pipes
- buildings and infrastructure
- groundwater beneath the site

- groundwater in wider aquifer body (including existing abstractions in proximity to the site)
- surface watercourses (predominantly 'tertiary' watercourses beyond the western/north-western site boundary)

Please note that construction workers have not been identified in the conceptual model as receptors because risks are considered to be managed through health and safety procedures including CDM regulations.

3.9.3 Summary of plausible pathways

The plausible pathways are summarised below:

- direct contact (soil, dust and vegetable ingestion, dermal contact and dust inhalation)
- ground gas and soil gas inhalation
- vertical and lateral migration including leaching
- root uptake
- chemical attack of infrastructure (including water supply pipes) and buildings.

3.9.4 Potentially complete pollutant linkages

The outline conceptual model is summarised in Table 7. The risk classification has been undertaken in accordance with CIRIA C552 (Rudland et al., 2001), a summary of which is included in Appendix D.

Table 7: Risk estimation for potentially complete pollutant linkages

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Risk and justification
Agricultural use, including fertilisers and pesticides	Future site occupants (human health) Groundwater resources (Secondary A Aquifer)	Contact with contaminated ground/liquid/ vapour Ingestion of contaminated soil/dust/ liquid Uptake into home grown produce Vertical and lateral migration	Low likelihood	Medium	**Moderate / Low** NIAB have confirmed the use of pesticides and fertilisers, however, previous phases of investigation have not identified significant concentrations present in the shallow soils

Historic above-ground fuel storage tanks – TPH contamination	Future site occupants (human health) Buildings and infrastructure	Contact with contaminated ground/liquid/ vapour Ingestion of contaminated soil/dust/ liquid Inhalation of contaminated dust and vapours/gases Uptake into home grown produce	Low likelihood	Medium	**Moderate / Low** Previous investigation identified localised significant TPH concentrations, however, these were encountered in unproductive strata and source has been removed
Made Ground (contaminated soil and ground gas)	Future site occupants (human health) Groundwater resources (Secondary A Aquifer) Buildings and infrastructure Vegetation	Contact with contaminated ground/liquid/ vapour Vertical and lateral migration Ingestion of contaminated soil/dust/ liquid Inhalation of contaminated dust and vapours/gases Uptake into home grown produce	Low likelihood	Mild	**Low** Site area has generally remained undeveloped and previous phases of investigation have confirmed the absence of widespread contamination

No pollutant linkages have been considered in relation to the historic presence of off-site gravel workings. This is due to the predominantly cohesive geology anticipated between any potentially significant sources and the site.

The potential pollutant linkages with a risk of moderate or above that may drive site investigation works are:

- (1) Risk posed to human health from contaminants contained within the shallow made ground, including herbicides and pesticides and locally hydrocarbons via direct contact, ingestion and root uptake pathways;
- (2) Risk posed to vegetation by contaminants contained within the shallow made ground via root uptake;
- (3) Risk posed to building materials and infrastructure, principally potable water supplies from contaminants contained within the made ground via chemical attack;
- (4) Risk posed to human health from ground gases generated by the degradation of organic material within the made ground soils via inhalation; and
- (5) Risk posed to the shallow aquifer from the vertical migration of herbicides and pesticides via lateral migration pathways.

4 SITE INVESTIGATION METHODOLOGY

RSK carried out intrusive investigation work and subsequent ground gas and groundwater monitoring between 31st August and 11th October to investigate the potential pollutant linkages identified in the outline conceptual model, to confirm the absence of potential pollutant linkages, and to inform geotechnical constraints.

4.1 Sampling strategy and methodology

The techniques adopted for the investigation have been chosen considering the anticipated ground conditions, existing land use and the proposed development.

Prior to intrusive investigation, each of the exploratory holes were staked out using Leica GPS equipment to ensure that the exploratory hole locations were appropriately located in relation to the proposed site layout, shown on Figure 2.

The combination of investigation techniques and the frequency of exploratory locations were designed to ensure that sufficient geotechnical and geo-environmental data could be collected to investigate the site to an appropriate level of confidence for it's proposed future residential land use.

Infiltration testing locations were backfilled with 20mm shingle during construction to maintain stability during testing and ensure that, where possible, testing was undertaken in strict accordance with BRE 365.

4.1.1 Health and safety considerations

Service plans were provided by the Client and studied prior to commencement of the intrusive investigation works. Each exploratory location was also scanned using a Cable Avoidance Tool (CAT) to ensure the absence of detectable buried services.

4.1.2 Investigation locations

The following site work was carried out between 31 August and 12 September 2012:

- 5 no. Cable percussive boreholes to a maximum 15m depth, with associated sampling and in-situ testing;
- 28 no. Drive-in window sampler boreholes to a maximum 5m depth, with associated sampling and in-situ testing;
- 53 no. Machine excavated trial pits to approximately 3m depth, with associated sampling and in-situ testing;
- 9 no. Infiltration test locations; and
- 24 no. in-situ CBR determinations using vehicle mounted plunger method.

The investigation and the soil descriptions were carried out in general accordance with 'BS 5930:2012. Code of Practice for Site Investigations' (BSI, 2012). The exploratory hole logs are presented in Appendix H and the rationale for the exploratory hole locations are provided in Table 8.

Table 8: Exploratory hole location rationale

Exploratory hole number	Location	Rationale
BH1 to BH3	Non-targeted – NIAB 1 redevelopment area	To prove the geological succession beneath the site, obtain geotechnical data and to install dual-purpose groundwater and ground gas monitoring wells
BHG and BHK	Targeted - Proposed food store and Local Centre redevelopment area	To prove the geological succession beneath the site, obtain geotechnical data and to install dual-purpose groundwater and ground gas monitoring wells at locations prescribed by Wilson Bowden
WS1 to WS24	Non-targeted- Main NIAB 1 redevelopment area	To prove the geological succession beneath the site, to install groundwater and ground gas monitoring wells as necessary and provide non-targeted coverage of the site
WSB, WSE, WSH and WSM	Targeted - Proposed food store and Local Centre redevelopment area	To prove the geological succession beneath the site, to install groundwater and ground gas monitoring wells as necessary and provide coverage of the site at locations prescribed by Wilson Bowden
TP1 to TP39	Non-targeted - Main NIAB 1 redevelopment area	To accurately log the upper strata and provide non-targeted coverage across the proposed redevelopment area, including the provision of in-situ testing as appropriate
TPC, TPD, TPI, TPL, TPO	Targeted - Proposed food store and Local Centre redevelopment area	To accurately log the upper strata and provide coverage across the proposed redevelopment area at locations locations prescrbed by Wilson Bowden
TP1(I) to TP9(I)	Targeted - Main NIAB 1 redevelopment area	To accurately log the upper strata and undertake infiltration testing at locations agreed with the client in respect to the proposed development layout
CBR1 to CBR20	Targeted - Proposed road layout	To provide in-situ CBR determinations, targeted in proposed road locations
CBRA, CBRF, CBRJ and CBRN	Targeted - Proposed foodstore and local centre redevelopment area	To provide in-situ CBR determinations at locations prescribed by Wilson Bowden

Exploratory hole number	Location	Rationale
BH1 to BH3, BHG, BHK, WS3, WSH and WS17	Non-targeted	Ground gas and water level monitoring in monitoring well installations

The ground levels at the borehole locations have been determined by rigorous surveying techniques.

4.1.3 Soil sampling, in situ testing and laboratory analysis

The sampling strategy was designed to characterise topsoil, made ground and natural strata at shallow level (within the top 1m) in relation to potential sources of contamination identified in the CSM. In addition, samples were selected for geotechnical analysis in relation to the proposed redevelopment of the site.

Selected samples were placed in polythene bags for headspace screening with a photo-ionisation detector (PID) fitted with a 10.2eV bulb. Soils collected for laboratory analysis were collected in a variety of containers appropriate to the anticipated testing suite required. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination.

The samples were transported to the laboratory in chilled cool boxes. Laboratory chain of custody forms can be provided if required. A record of the soil chemical analysis undertaken is presented in Table 9.

Table 9: Scheduled environmental analysis across the proposed NIAB 1 redevelopment area

Strata	Test Undertaken	No. of Tests
Topsoil	Heavy Metals	31
	Asbestos Screen	23
	Pest-C Suite	5
	Pyrothroids	5
	pH and Water Soluble Sulphates	9
	Soil Organic Matter	12
	Triazines	5
	Speciated PAH	11
Made Ground	Heavy Metals	48
	Asbestos Screen	18
	Pest-C Suite	2
	Pyrothroids	2
	pH and Water Soluble Sulphate	4
	Soil Organic Matter	10

Strata	Test Undertaken	No. of Tests
	Triazines	2
	Speciated PAH	24
Natural Ground (Gault Clay and River Terrace Deposits)	Heavy Metals	12
	pH and Water Soluble Sulphate	24
	Soil Organic Matter	2

Standard penetration tests (SPTs) or cone penetration tests (CPTs) were carried out within both cohesive and granular deposits at regular intervals, alternated with U100 samples at the same frequency, where appropriate. SPTs or CPTs were undertaken in accordance with part 9 of BS 1377:1990 (BSI, 1990). Test results are given on the borehole logs presented in Appendix F. Disturbed samples were taken from each strata encountered to facilitate subsequent geotechnical analysis.

4.1.4 Groundwater monitoring and levelling

Depths to groundwater were recorded using an electronic dip meter on three return visits to site between 19 September and 11 October 2012. The monitoring results are given in Section 5.1.4.

The ground levels and the highest point of the top of casing of the monitoring wells were established in relation relative to ordnance datum.

The groundwater monitoring data are given in Appendix I.

4.1.5 Ground gas monitoring

In line with the conceptual model, three monitoring rounds have been undertaken. This included periods of low and/or falling atmospheric pressures and after/during rainfall.

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

In addition, the atmospheric pressure before and during monitoring, together with the weather conditions, was recorded.

All monitoring results together with the temporal conditions are contained within Appendix I and discussed in Section 5.2.

4.1.6 In-situ infiltration testing

Soakaway tests were carried out in trial pits TP1(I) to TP9(I) to establish the infiltration rate of the underlying soils, specifically the River Terrace Deposits to the northern/north-eastern end of the site, and the Gault Clay Formation in the southern portion of the site. The tests were carried out generally in accordance with the method described in BRE Digest 365 (BRE, 2007). However, it should be noted that the geological conditions in the southern portion of the site (principally TP1(I) to TP3(I)) resulted in slow infiltration and only one test could be undertaken, rather than the three tests prescribed by the BRE. Infiltration testing involved the construction of test locations by backfilling excavations with 20mm shingle for stability and subsequently filling the pits with water from a towable bowser and recording the drop in water level with time using an electronic dip-meter and a pre-installed automated water level-logger as the water soaked into the ground. The data are presented in Appendix H including the calculations in line with BS 5930 (BSI, 1999).

5 GROUND CONDITIONS

The results of the intrusive investigation and subsequent laboratory analysis undertaken are detailed below. The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, samples taken, field observations of soil and groundwater, *in situ* testing and details of monitoring well installations are included on the exploratory hole records presented in Appendix H.

5.1 Soil

The exploratory holes revealed that the site is underlain by a variable thickness of topsoil and/or made ground generally overlying a succession of River Terrace Deposits and Gault Clay in the north/northeast and directly overlying Gault Clay in the south. Deposits of the Gault Clay Formation were encountered to the terminal depth of the investigation at 15m bgl. This confirms the stratigraphical succession described within the initial conceptual model. For the purpose of discussion, the ground conditions are summarised in Table 10 and the strata discussed in subsequent subsections.

Table 10: General succession of strata encountered

Strata	Exploratory holes encountered	Depth to top of stratum m bgl	Thickness (m)
Topsoil / made ground	All	Ground level	0.15 to 0.75
River Terrace Deposits	All except TP1 to TP5, TP21, TP22, TP29, TP33, TPC, TPD, TPI, TPO, TP1(I) to TP3(I), WS1 to WS6, WS12, WSE, and BH1	0.25 to 0.95	0.75m to 4.0m
Gault Clay Formation	All except TP9 to TP12, TP14, TP16, TP23, TP24, TP26, TP26 to TP28, TP31, TP34, TP36 to TP39, WS7, WS10, WS13, WS16, WS19, WS22, WSM	0.25 to 4.0	Proven to 15.0

5.1.1 Topsoil / Made ground

The made ground / topsoil generally comprised an organic-rich cohesive soil with variable proportions of flint, chalk and organic matter. Made ground soils were

encountered in 32 locations, which accounted for approximately 35% of exploratory holes. The composition of the made ground soils were much the same as the topsoil, albeit with the infrequent inclusion of anthropogenic materials such as brick, clay tiling, ceramics and occasional clinker and charcoal. Made ground was encountered to a maximum depth of 0.75m bgl, although it is recognised that humic-rich and organic-rich soils were generally limited to the upper 0.5m of the soil profile. Rootlets and roots were also frequently noted throughout. Field drains, constructed from clay drain tile, were also infrequently encountered at (or towards) the base of the made ground.

The typical thickness of topsoil and/or organic-rich made ground ranged between 0.2 and 0.6m across the entire NIAB 1 redevelopment site. An average thickness has been calculated as a result of the most recent data set at marginally under 0.4m. It is noted that the previous investigation undertaken by Millard Consulting Engineers encountered a maximum thickness of 1.6m in the northern portion of the site (previously referred to as the Chivers field), where concrete and brick was encountered between 1.5m and 1.6m depth. The cable percussive holes formed during the Millard investigation within the current study area also encountered significant thicknesses of made ground between 0.7m and 1.5m depth, although the typical thickness of made ground was noted to be around 0.3m.

The current investigation also noted the localised presence of deeper reworked soils beneath an initial surfacing layer of topsoil/made ground to a depth of 0.8 to 0.9m bgl. This was attributed to the agricultural activity / cultivation of the land.

Visual and olfactory evidence of contamination was rarely encountered and generally limited to the localised presence of clinker and charcoal. No elevated PID readings were recorded during the investigation.

5.1.2 River Terrace Deposits

Where present, cohesive and granular River Terrace Deposits were encountered directly below the topsoil/made ground, generally increasing in thickness and spatial extent to the north/north-east of the site. River Terrace Deposits were absent to the south/southwest of trial pit TP7.

The River Terrace Deposits encountered included both cohesive and granular horizons. The cohesive portion generally comprised a firm sandy gravelly clay with variable proportions of flint, chert, quartzite and chalk. The granular horizons generally comprised a combination of medium dense to dense sandy gravels and gravelly sands, with variable clay content.

In general, the sequence of deposits encountered initially comprised a cohesive portion, underlain by granular deposits and/or a sequence of interbedded granular and cohesive layers. The distribution of significant granular horizons was discontinuous across the site, albeit with a general trend of increasing thickness and distribution to the northwest.

A summary of the in-situ and laboratory test results in this stratum is presented in Table 11. The laboratory test results can be found in Appendix N.

Table 11: Summary of in-situ and laboratory test results for River Terrace Deposits

Soil parameters	Range	Reference
Liquid limit (%)*	27 to 57	Appendix N
Plastic limit (%)*	12 to 22	Appendix N
Plastic index (%)*	9 to 35	Appendix N
Modified Plastic index (%)*	3.9 to 28	-
Plasticity term*	Low to high	-
Volume Change Potential (NHBC)*	Low to medium (predominantly low)	-
Moisture content (%)*	15 to 23	Appendix N
SPT 'N' values*	4 to 18	Appendix H
Undrained shear strength measured by shear vane testing (kN/m^2)*	43 to 130+	-
Consistency term*	Soft to firm	Appendix H
Strength term	Medium to high	-
SPT 'N' values	4** to 53	
Density term	Generally medium dense to dense	-

*Denotes soil parameters associated with cohesive River Terrace Deposits

**Lowest values associated with instability and therefore not a true reflection of soil density

5.1.3 Gault Clay Formation

Gault Clay was encountered directly beneath the made ground/topsoil and/or River Terrace Deposits at depths between 0.25 and 4.0m below ground level to the full depth of investigation. Based on the site descriptions, in-situ and laboratory test results, this stratum can generally be described as a firm to stiff overconsolidated blue/grey clay. Localised sandy and ferruginous lenses/horizons were encountered and variable proportions of chalk and flint. A horizon of sandy clayey gravel was encountered between 9.0 and 9.4m depth. The weathered upper horizons of Gault Clay were generally encountered as firm to stiff clay with variable sand and generally reducing gravel content with depth.

No obvious signs of desiccation was observed within the Gault Formation during the investigation. However, an initial comparison between moisture contents and plastic limits infer the potential for desiccation within the stratum at shallow depth, this may however, simply be a function of the overconsolidated nature of the soils.

A summary of the in-situ and laboratory test results in this stratum is presented in Table 12. The laboratory test results can be found in Appendix N.

Table 12: Summary of in-situ and laboratory test results for Gault Clay

Soil parameters	Range	Reference
Liquid limit (%)	41 to 78 (average of 73)	Appendix N
Plastic limit (%)	22 to 35 (average of 30)	Appendix N
Plastic index (%)	19 to 51 (average of 43)	Appendix N
Plasticity term	Intermediate to very high (predominantly high to very high)	-
Volume Change Potential (NHBC)	Low to high (predominantly high)	-
Moisture content (%)	28 to 33	Appendix N
SPT 'N' values	6 to 47	Appendix H
Undrained shear strength measured by triaxial testing (kN/m^2)	50 to 213	Appendix N
Undrained shear strength measured by shear vane testing (kN/m^2)	49 to 130+	Appendix H
Stiffness term	Firm to Very Stiff	-
Strength term	Medium to Very High	Appendix H

5.1.4 Groundwater

Groundwater was encountered during the investigation as detailed in Table 13.

In summary, groundwater seepages within the granular River Terrace Deposits were observed in a number of the exploratory holes. Water ingress observations are recorded on the exploratory hole logs in Appendix H and were typically noted below depths of 1.5m bgl, with the shallowest seepage recorded at 1.3m bgl (TP36) and the deepest at 3.1m bgl (TP27).

Table 13: Groundwater results during investigation

BH/TP	Strata	Strike / seepage (m bgl)	Rise (m.bgl)
BH1	GC	-	2.8m (Slow water seepage over night when borehole depth at 3.0m)
BH3	GC	3.0	2.5
BH3	GC	9.0	3.6
BHG	RTD / GC	3.3	3.1
BHK	RTD	3.9	3.8 (slow seepage)
TP8(I)	RTD	1.4 – at base	-
TP9	RTD	1.9	-
TP10	RTD	1.6	-
TP11	RTD	3.0	-
TP12	RTD	2.5	-
TP13	RTD	1.6	-
TP14	RTD	2.6	-
TP16	RTD	1.6	-
TP17	RTD	1.6	-
TP19	RTD	1.5	-
TP20	RTD	1.9	-
TP23	RTD	2.0	-
TP24	RTD	1.4 – at base	-
TP26	RTD	2.7	-
TP27	RTD	3.1	-
TP28	RTD	1.7	-
TP30	RTD	2.0	-
TP31	RTD	1.5 to 1.6	-
TP32	RTD	1.5	-
TP33	GC	3.0	-
TP34	RTD	1.6	-
TP35	RTD	1.7	-
TP36	RTD	1.3	-
TP37	RTD	1.5	
TP38	RTD	2.4	2.8 on completion
TPL	RTD	2.65	
WS7	RTD	3.0	Seepage noted

BH/TP	Strata	Strike / seepage (m bgl)	Rise (m.bgl)
WS8	RTD	2.1	Seepage noted
WS9	RTD	2.6	-
WS10	RTD	2.2	-
WS13	RTD	2.6	2.5 on completion
WS14	RTD	2.0	-
WS15	RTD	2.0	1.85 on completion
WS16	RTD	2.4	-
WS17	GC	-	2.16 on completion – initial seepage assumed to be from RTD
WS18	River Terrace Deposits	1.6 (noted as depth of sample saturation)	-
WS19	RTD	2.0	2.16 on completion
WS20	RTD	-	2.35 on completion
WS21	RTD	2.2 (noted as depth of sample saturation)	-
WS22	RTD	-	2.2 on completion
WS23	RTD	-	2.55 on completion
WSB	RTD	3.0	-
WSH	RTD	2.4	-
Notes: RTD: River Terrace Deposits, GC: Gault Clay			

Standing water levels recorded during the subsequent groundwater monitoring events are summarised in Table 14.

Table 14: Groundwater monitoring data (19 September – 11 October 2012)

Monitoring well	Depth to water (m bgl)	Well cover ground level elevation (m AOD)	Groundwater elevation (m AOD)
BH1	Dry	19.13	Dry
BH2	0.85 – 1.08	16.33	15.25 – 15.48
BH3	1.38 – 1.44	12.45	11.01 – 11.07
BHG	2.12 – 2.19	18.56	16.37 – 16.44
BHK	1.97 – 2.09	18.78	16.69 – 16.81
WS3	2.57 – 2.92 (recorded as dry on one monitoring visit)	18.04	15.12 – 15.47

Monitoring well	Depth to water (m bgl)	Well cover ground level elevation (m AOD)	Groundwater elevation (m AOD)
WS17	1.85 – 1.88 (recorded as dry on one monitoring visit)	13.81	11.93 – 11.96
WSH	Dry	19.16	Dry

The findings are considered to predominantly reflect the general groundwater table in the River Terrace Deposits, albeit with perched groundwater recorded infrequently above the surface of the Gault Clay Formation in monitoring well WS3.

5.1.5 Results of infiltration testing

The results of soakaway testing are summarised in Table 15.

Table 15: Infiltration test results

Trial Pit Number	Geological unit	Test result (m/s)
TP1(I)	Gault Clay Formation	Test not valid due to slow infiltration
TP2(I)	Gault Clay Formation	Test not valid due to slow infiltration
TP3(I)	Gault Clay Formation	Test not valid due to slow infiltration
TP4(I)	River Terrace Deposits	1.41E-06 to 1.65E-06
TP5(I)	River Terrace Deposits	1.55E-06 to 2.46E-06
TP6(I)	River Terrace Deposits	3.0E-06 to 2.15E-05
TP7(I)	Gault Clay Formation	6.38E-07 to 8.18E-07
TP8(I)	River Terrace Deposits	2.7E-06 to 3.09E-06
TP9(I)	River Terrace Deposits	5.74E-06 to 9.46E-06
Notes:		

5.2 Ground gas regime

The results of the ground gas monitoring are given in Appendix I. The minimum and maximum results are recorded below in Table 16.

Table 16: Summary of ground gas monitoring results

Borehole	Response zone/strata	Probable source(s) of ground gas	No monitoring visits	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Flow rate (l/hr)	Water level (m b bgl)	Atmospheric pressure
BH1	GC	Shallow topsoil / made ground	3	<0.1 – 0.1	0.6 – 1.8	18.5 – 20.5	0.0	Dry	1005 - 1018
BH2	RTD / GC	Shallow topsoil / made ground	3	<0.1	0.5 – 1.6	18.5 – 21.0	-0.4 – 0.4	0.85 – 1.08	1004 - 1018
BH3	RTD / GC	Shallow topsoil / made ground	3	<0.1	0.7 – 1.5	17.9 – 20.7	0.0	1.38 – 1.44	1005 - 1018
BHG	MG.TS / RTD / GC	Shallow topsoil / made ground	3	<0.1	0.1 – 1.8	19.3 – 20.9	-0.1 – 0.2	2.12 – 2.19	1005 - 1018
BHK	RTD / GF	Shallow topsoil / made ground	3	<0.1 – 0.1	0.1 – 3.5	18.0 – 20.8	-0.1 – 0.2	1.97 – 2.09	1006 - 1018
WS3	MG.TS / GF	Shallow topsoil / made ground	3	<0.1 – 0.1	0.3 – 2.2	19.3 – 20.5	0.0 – 0.9	2.57 – 2.92	1006 - 1018
WS17	MG.TS / GF	Shallow topsoil / made ground	3	<0.1	0.2 – 2.9	18.6 – 21.3	0.0 – 0.2	1.85 – 1.88	1005 - 1020
WSH	MG.TS	Shallow topsoil / made ground	3	<0.1 – 0.1	0.1 – 4.2	18.0 – 20.8	0.0 – 0.2	Dry	1005 - 1018
Note: MG.TS – Made Ground / Topsoil, RTDC – River Terrace Deposits, GC – Gault Clay									

5.3 Refinement of the initial conceptual site model

The ground conditions encountered confirm those within the preliminary conceptual model of the site, which were predicted from previous phases of investigation and published geological mapping.

Based on the soil, groundwater and ground gas conditions encountered, the pollutant linkages requiring assessment are consistent with those detailed in section 3.9.4. These are assessed in detail within section 6 of this report

5.4 Mineral Safeguarding Area (MSA)

Based on the Cambridge Mineral Safeguarding Area proposal maps included in the Cambridgeshire and Peterborough Minerals and Waste Plan, only the extreme northern portion of the site is included in the designated area (i.e. the area in the vicinity of exploratory holes TP34 to TP37 and TP9(I)). The public right-of-way forming the majority of the northern-most site boundary delineates the extent of the MSA eastwards/southwards and therefore the land to the west, northwest and southwest of the site (referred to as NIAB 2) is located within the MSA.

Whilst the investigation has recorded potential reserves of sand and gravel within the designated MSA, the current proposals for this area of the site are for parkland only and therefore the risk of sterilising mineral resources is negligible. Furthermore, any granular materials excavated as part of the pond construction in the affected area of the site may be utilised for re-use as part of the road construction, or sub-base beneath hardstanding across the proposed development site.

6 QUANTITATIVE RISK ASSESSMENT

In line with CLR11 (Environment Agency, 2004a), there are two stages of quantitative risk assessment, generic and detailed. The GQRA comprises the comparison of soil, groundwater, soil gas and ground gas results with generic assessment criteria (GAC) that is appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory results or following statistical analysis depending upon the sampling procedure that was adopted.

The GAC used in this assessment are included in Appendix K for human health (together with details of their derivation) and in Appendix L for the assessment of phytotoxic effects and risks to building materials and controlled waters.

6.1 Linkages for assessment

Section 3.9.4 presents the refined conceptual model which identified the linkages that required assessment after the findings of the site investigation had been considered. These linkages together with the method of assessment are presented in Table 17.

Table 17: Linkages for generic quantitative risk assessment

Potentially relevant pollutant linkage	Assessment method
1. Direct contact with impacted soil by future residents	Human health GAC for both a proposed residential end use with private gardens and commercial end use, since redevelopment is to be for a mixed end-use. Comparison of soil gas data against reference concentrations
2. Uptake of contaminants by vegetation potentially impacting plant growth	Comparison of soil data to GAC in Appendix L
3. Contaminants Impacting building materials	Comparison of soil data to GAC in Appendix L for plastic water supply pipes and concrete assessment using UKWIR (2010) guidance
4. Concentrations of methane and carbon dioxide in ground gas entering and accumulating in: depressions and excavations that could affect workers enclosed spaces or small rooms in new buildings, which could affect future	Gas screening values (GSV) have been calculated using maximum methane and carbon dioxide concentrations with maximum flow rates recorded at the site. The GSV have been compared with the revised Wilson and Card classification presented within CIRIA report 665 (Wilson et al., 2007) owing to the development potentially comprising both high-rise residential buildings with a ground floor slab or the generic Traffic Lights, as presented within the NHBC ground gases guide (Boyle and Witherington, 2007) and the aforementioned CIRIA report 665, owing to the development comprising low-rise housing with suspended floors.

Potentially relevant pollutant linkage	Assessment method
residents. In the case of methane and CO_2, this could create a potentially explosive atmosphere, while death by asphyxiation could result from carbon dioxide.	
5. Vertical / lateral migration of herbicides and pesticides to the underlying shallow aquifer	The current investigation does not include groundwater or leachate data. The assessment is therefore based on a qualitative assessment of soil results.

6.2 Methodology and results

The methodology and results of the GQRA are presented for each relevant pollutant linkage in turn.

6.2.1 Direct contact with impacted soil by future residents / end users

The investigation comprised the collection of non-targeted soil samples to provide site-wide coverage. The standard approach to assessing the results of non-targeted analysis is by undertaking statistical analysis of the results in accordance with *Guidance on Comparing Soil Contamination Data with a Critical Concentration* (CIEH and CL:AIRE, 2008).

After review of the chemical test data collected from exploratory holes across the entire NIAB 1 site, the assessment recorded the absence of determinands in excess of the relevant GAC's, with the results for the majority of analytical results recorded well below the adopted assessment criteria values. Furthermore, no samples were considered as outliers.

In addition, the visual inspection at the laboratory identified no materials suspected of potentially containing asbestos and the scheduled laboratory screening for asbestos found no detectable asbestos fibres within the samples of made ground.

Based on the above assessments, no potentially significant risks associated with the soil contamination have been identified and it is considered that the site may be regarded as suitable for the proposed end use in respect to human health.

6.2.2 Uptake of contaminants by vegetation potentially inhibiting plant growth

The results have been compared with the GAC presented in Appendix L for this linkage. Based on an average soil pH in excess of 7.0, no elevated concentrations of phytotoxic contaminants were identified within the shallow soils, indicating that a relevant pollutant linkage is unlikely to exist.

6.2.3 Impact of organic contaminants on potable water supply pipes

The results have been compared with the GAC presented in Appendix M for this linkage, which are reproduced from *UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (UKWIR, 2010).

For initial assessment purposes, the results of the investigation have been compared against the threshold concentrations specified in Table 3.1 of Report 10/WM/03/21.

The results indicate that a relevant pollutant linkage is unlikely to exist associated with organic contaminants and therefore plastic water supply pipes are expected to be suitable for use on the development.

It should be noted that at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling/analytical strategy may be required at a later date once the route(s) of the supply pipe(s) are known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

6.2.4 Ground gas

The results have been assessed in accordance with the guidance provided in *CIRIA Report C665: Assessing risks posed by hazardous ground gases to buildings* (Wilson et al., 2007). In the assessment of risks posed by hazardous ground gases and selection of appropriate mitigation measures, CIRIA C665 identifies two types of development, termed Situation A (modified Wilson and Card method), appropriate to all development excluding traditional low-rise construction, and Situation B (National House-Building Council, NHBC) only appropriate to traditional low-rise construction with ventilated sub-floor voids.

Both methods are based on calculations of the limiting borehole gas volume flow for methane and carbon dioxide, renamed as the gas screening value (GSV). The GSV (litres of gas per hour) is calculated by multiplying borehole flow rate (litres per hour) and gas concentration (percent by volume).

In both situations, it is important to note that the GSV is a guideline value and not an absolute threshold. The GSV may be exceeded in certain circumstances, if the site conceptual model indicates it is safe to do so. Similarly, consideration of additional

factors such as very high concentrations of methane, should lead to consideration of the need to increase the Characteristic Situation or Traffic Light.

The site is to be a mixed redeveloped with both low-rise residential houses and commercial end-use and therefore falls under Situation A and B.

Situation A relates to all development types except low-rise housing and, by combining the qualitative assessment of risk (see details of refined conceptual site model in section 5.3) with the gas monitoring results, provides a semi-quantitative estimate of risk for a site. The method is based on that proposed by Wilson and Card (1999), which was a development of a method proposed in CIRIA report 149 (Card, 1995). The method uses both gas concentrations and borehole flow rates to define a characteristic situation for a site based on the limiting borehole gas volume flow for methane and carbon dioxide. Having calculated the worst case GSVs for methane and carbon dioxide, the Characteristic Situation is then determined from Table 8.5 of CIRIA C665 (Wilson et al., 2007).

Situation B is a characterisation system developed by the NHBC (Boyle and Witherington, 2007), which relates only to low rise housing development constructed with a clear ventilated underfloor void. The system provides a risk-based approach that is designed to allow an identification of gas protection for low-rise housing by comparing the measured gas emission rates to generic “Traffic Lights”. The Traffic Lights include typical maximum concentrations that are provided for initial screening purposes and risk-based GSVs for situations where the typical maximum concentrations are exceeded. Based on the typical maximum gas concentrations and the GSVs, the appropriate Traffic Light, ranging from Green through Amber 1 and Amber 2 to Red, is determined from Table 8.7 of CIRIA C665 (Wilson et al., 2007).

The gas monitoring data has identified a maximum methane concentration of 0.1% and a maximum concentration of carbon dioxide of 4.2%. A maximum gas flow rate of 0.9l/hr has been recorded. The calculated GSV for methane is 0.0009l/hr and the GSV for carbon dioxide is 0.0378l/hr. Based on the GSVs the site has been characterised as CS1 for the area of the development defined by Situation A and as Green for the remainder of the development defined by Situation B.

For both types of development, CIRIA C665 (Wilson et al., 2007) provides details of the typical scope of protective measures to be adopted for the relevant site characterisation.

The proposed mixed-use development, which fulfils the requirements of both Situation A and Situation B, has been characterised as Characteristic Situation 1 and Green, respectively. This indicates that a negligible gas regime has been identified and that gas protection measures are not considered necessary.

It is considered that the gas monitoring programme carried out to-date has established the ‘worst-case’ scenario and has characterised the ground gas regime sufficient in relation to the site conceptual model to enable the confident assessment of risk and subsequent design of an appropriate gas protection scheme(s) for the proposed development.

6.2.5 Secondary Aquifer

An assessment of the chemical test data for the shallow soils beneath the site indicate the absence of significant contamination and therefore the potential risk associated leaching and/or migration of contamination from on an on-site source into the underlying shallow aquifer is considered to negligible. Furthermore, previous groundwater testing undertaken by Millard Consulting confirmed the absence of significant contamination in the shallow groundwater beneath the site.

6.3 Environmental assessment conclusions

Based on the proposed site layout included on Figure 2, the results of the GQRA generally indicates that relevant pollutant linkages are absent and therefore the site is suitable for the proposed end use.

An assessment of the potential pollutant pathways detailed in section 3.9.4 has confirmed the absence of any relevant pollutant linkages. However, it is noted that additional sampling may be required in the south eastern corner of the site, once the pavillion and associated hardstanding has been demolished and when the final development plans have been established to investigate the potential risk associated with residual hydrocarbon contamination identified during the Millard investigation in 2006, resultant from historic leaking from a former above ground fuel storage tank. However, it appears as though this location may be underneath an area of proposed hardstanding, thereby breaking any potential pollutant linkages and possibly removing the requirement for further assessment of the area.

The concentrations of heavy metals recorded in exploratory hole WS6 during the Millard site investigation were screened for a residential end-use. This part of the site is currently proposed for a commercial end-use and, as such, the concentrations previously highlighted do not pose a risk to human health. However, it is noted that the concentration of cadmium (11mg/kg) encountered in the same location may pose a localised phytotoxic risk. Although similar concentrations were not encountered during the most recent investigation, the advice of an arboriculturist may be required when selecting plant species for any areas of soft landscaping in this area of the site.

7 GEOTECHNICAL SITE ASSESSMENT

7.1 Engineering considerations

It is understood that the proposed mixed-use development is to involve the construction of low-rise residential housing, associated infrastructure, parkland (in the centre of the site) and an area of commercial development comprising a local centre and food store. At this stage no specific information relating to building loads has been provided.

7.2 Geotechnical hazards

A summary of commonly occurring geotechnical hazards is given in Table 18 together with an assessment of whether the site may be affected by each of the stated hazards.

Table 18: Summary of main potential geotechnical hazards that may affect site

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect the site	
Sudden lateral changes in ground conditions	✓	Variable thicknesses of made ground. Feathering River Terrace Deposits of varying lithologies.		Likely to affect ground engineering and foundation design and construction
Shrinkable clay soils	✓	Cohesive River Terrace Deposits and Gault Clay		Design to NHBC Standards Chapter 4 or similar
Highly compressible and low bearing capacity soils, (including peat and soft clay)			✓	Likely to affect ground engineering and foundation design and construction
Silt-rich soils susceptible to rapid loss of strength in wet conditions	✓	Gault Clay		Likely to affect ground engineering and foundation design and construction
Running sand at and below water table	✓	Instability recorded within granular River Terrace Deposits at or below the water table		Likely to affect ground engineering and foundation design and construction

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect the site	
Karstic dissolution features (including 'swallow holes' in Chalk terrain)			✓	May affect ground engineering and foundation design and construction – refer to Section 4.1.2
Evaporite dissolution features and/or subsidence			✓	May affect ground engineering and foundation design and construction
Ground subject to or at risk from landslides			✓	Likely to require special stabilisation measures
Ground subject to peri-glacial valley cambering with gulls possibly present			✓	Likely to affect ground engineering and foundation design and construction
Ground subject to or at risk from coastal or river erosion			✓	Likely to require special protection/stabilisation measures
High groundwater table (including waterlogged ground)	✓	Groundwater seepages encountered at depths ranging between 1-2m begl		May affect temporary and permanent works
Rising groundwater table due to diminishing abstraction in urban area			✓	May affect deep foundations, basements and tunnels
Underground mining			✓	Likely to require special stabilisation measures
Existing sub-structures (e.g. tunnels, foundations, basements, and adjacent sub-structures)	✓	Limited to the foundations associated with the former pavillion and ancillary building(s)		Likely to affect ground engineering and foundation design and construction
Filled and made ground (including embankments, infilled ponds and quarries)	✓	Locally up to 0.75m of made ground encountered during current investigation. Up to 1.6m encountered during previous phase		Likely to affect ground engineering and foundation design and construction
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	✓	See section 7.3.7		May affect ground engineering and foundation design and construction
Note: Seismicity is not included in the above table as this is not normally a design consideration in the UK.				

7.3 Foundations

7.3.1 General suitability

Given the presence of competent natural soils at a relatively shallow depth it is considered that traditional shallow spread footings will be suitable for the proposed development. However, the precise nature of the commercial aspect of development is unknown and if particularly heavy loads are anticipated, a piled approach may provide a more economical foundation solution.

Specifically recommendations for the design and construction of spread foundations bearing wholly within the River Terrace Deposits, encountered across the northern portion of the site and the Gault Clay Formation, sub cropping at shallow depth towards the south and south east. In the absence of any plot-specific data, the recommendations relating to the River Terrace Deposits have been based on soil parameters for a medium strength clay with a medium volume change potential, due to the lateral and vertical variability recorded within the stratum. Where particularly heavy or sensitive structures are to be supported by this highly variable stratum, it is recommended that further plot-specific investigation be conducted to any reduce conservatism.

7.3.2 Shallow spread foundations

The recommendations for the design and construction of spread foundations bearing wholly within the River Terrace Deposits and Gault Clay Formation are set out in Table 19 and 20, respectively.

Table 19: Design and construction of spread foundations – River Terrace Deposits

Design/construction considerations	Design/construction recommendations
Founding stratum	Medium Strength Clay - River Terrace Deposits
Depth	Foundations should be taken to a minimum depth of 0.9m below finished ground level and at least 0.1m into the founding stratum below any overlying made ground or to any greater depth required in respect of the special design considerations given below.
Special design considerations	Owing to the presence of shrinkable clay soils, foundations should be designed taking into account all the normal precautions, including minimum founding depths, to minimise the risk of future foundation movements in accordance with NHBC standards or similar. In the absence of any plot specific information, the findings of the ground investigation indicate that foundations should be designed for shrinkable soils of medium volume change potential. Owing to the significant lateral and vertical variability of the River Terrace Deposits, consideration should be given to incorporating appropriate reinforcement into the strip foundations to minimise the risk of future differential foundation movements.

Design/construction considerations	Design/construction recommendations
Bearing capacity	Spread foundations with a width of up to 1.0m and constructed on cohesive river terrace deposits at a minimum depth of 0.9.m may be designed using a net allowable bearing pressure of 75 kN/m^2. The allowable bearing capacity includes an overall safety factor of 3 against bearing capacity failure and with total settlements associated with the bearing pressure estimated to be less than 25mm.
Stability of excavations	Instability was recorded within the granular portion of the stratum at or below the shallow ground water table, typically encountered at depth below 1.5m below existing ground levels. It is not anticipated that foundation trenches will extend below this and should therefore remain stable in the short term. However, in the event that foundations extend below the groundwater table or are to remain open for longer periods, consideration should be given to the use of trench support systems.
Dewatering	A shallow groundwater table was encountered within the River Terrace Deposits, typically below a depth 1.0m. Foundation trenches are not expected to extend below this depth and therefore the requirement for dewatering is unlikely to be required to facilitate foundation excavation. Should, however, excavations extend to greater depths dewatering would be required. Pumping from open sumps in non-cohesive soils should be avoided as this can result in instability and general loosening of the soils at the base of the excavation. It is therefore likely that dewatering in non-cohesive soils will require the use of well-pointing systems.
Construction considerations	All foundation excavations should be inspected, and any made ground and soft, organic or otherwise unsuitable materials removed and replaced with mass concrete.

Table 20: Design and construction of spread foundations – Gault Clay Formation

Design/construction considerations	Design/construction recommendations
Founding stratum	Medium to Very High Strength Clay - Gault Clay Formation
Depth	Foundations should be taken to a minimum depth of 1.0m below finished ground level and at least 0.1m into the founding stratum below any overlying made ground or to any greater depth required in respect of the special design considerations given below.
Special design considerations	The findings of the ground investigation indicate that foundations constructed within the Gault Clay should be designed for shrinkable soils of high volume change potential Minimum foundation depths for properties located near trees and shrubs (past, present and future) will therefore need to be increased in line with the NHBC guidance for high volume change potential soils and below any active root structures.

Design/construction considerations	Design/construction recommendations
Bearing capacity	Spread foundations with a width of up to 1.0m and constructed on the Gault Clay at a minimum depth of 1.0m may be designed using a net allowable bearing pressure of 100 kN/m^2. The allowable bearing capacity includes an overall safety factor of 3 against bearing capacity failure and with total settlements associated with the bearing pressure estimated to be less than 25mm.
Stability of excavations	Generally the trial pits within wholly cohesive deposits remained stable during excavation, which indicates that foundation excavations should also remain stable in the short term. In the event that excavations are to remain open for longer periods, consideration should be given to the use of trench support systems.
Dewatering	The cohesive nature of the soils encountered suggests that pumping from open sumps should be sufficient to keep the excavations reasonably dry.
Construction considerations	All foundation excavations should be inspected, and any made ground and soft, organic or otherwise unsuitable materials removed and replaced with mass concrete.

7.3.3 Piled foundations

Recommendations for the design and construction of pile foundations in relation to the ground conditions are set out in Table 21.

Table 21: Design and construction of piled foundations

Design/construction considerations	Design/construction recommendations	
Pile type	The construction of both bored and driven piles is considered technically feasible at this site	
Possible constraints on choice of pile type	Given the close proximity of the site to a residential area it is considered possible that the vibration/noise associated with pile driving may not be acceptable	
Temporary casing	Given the presence of groundwater strikes at shallow depth during the investigation bored piles will require temporary casing. Alternatively, the use of continuous-flight-auger (CFA) injected bored piles or driven piles usually overcomes this issue	
Hard strata	An allowance should be made for the presence of thin 'rock' bands (claystone) within the Gault Clay Formation	
Pile design parameters for granular River Terrace Deposits	Pile design parameter	Bored
	Shaft friction factor (k_s.tan δ)	0.22
	Limiting shaft friction (kN/m^2)	110
Pile design parameters for cohesive deposits	Undrained shear strength c_u (kN/m^2)	65 + 5z kN/m^2 where z = depth into clay

Design/construction considerations	Design/construction recommendations	
	Adhesion factor α	0.5
General parameters	Limiting concrete stress (kN/m^2)	$7.5N/mm^2$
	Global margin of safety	3.0
Special precautions relating to bored pile shafts and bases	Bored pile concrete should be cast as soon after completion of boring as possible and in any event the same day as boring. Prior to casting the base of the pile bore should be clean, otherwise a reduced safe working load will be required. Similarly, if the pile bore is left open the shaft walls may relax/soften, leading to a reduced safe working load.	

The design procedure for piles varies considerably, depending on the proposed type of pile. However, for illustrative purposes Table 22 gives likely working pile loads for traditional bored, cast-in-situ concrete piles of various diameters and lengths, based on the design parameters given in Table 21 where cohesive deposits are encountered with the absence of overlying granular soils. Table 23 gives likely working pile loads for traditional bored, cast-in-situ concrete piles of various diameters and lengths, based on the design parameters given in Table 21 where cohesive Gault Clay deposits are encountered below granular soils.

Table 22: Illustration of typical pile working loads for bored cast-in-situ piles – cohesive deposits present only

Typical pile working loads (kN)				
Depth of pile below existing ground level (m)	Pile diameter			
	300mm	450mm	600mm	750mm
10	130	215	310	420
12.5	180	290	415	550
15	235	375	530	700

Table 23: Illustration of typical pile working loads for bored cast-in-situ piles – granular deposits overlying cohesive deposits

Typical pile working loads (kN)				
Depth of pile below existing ground level (m)	Pile diameter			
	300mm	450mm	600mm	750mm
7.5	85	150	240	350
10	110	200	300	420
12.5	140	240	360	500
15	175	290	420	570

7.3.4 Foundation works risk assessment

It is anticipated that a foundation works risk assessment report will not be required for the development due to the absence of any significant sources of contamination.

7.3.5 Floor slabs

The nature of the soils encountered during the investigation indicates that ground bearing floor slabs may be adopted with a suitable sub-base layer for the proposed development. However, it may be prudent to suspend any floor slabs where proposed plots are in the vicinity of trees and where cohesive soils form the formation layer.

All formation levels should be proof-rolled and all topsoil and any other loose, soft, organic or otherwise unsuitable materials should be removed and replaced with well-compacted, suitable granular fill.

7.3.6 Roads, hardstanding and drainage

In the 1m to 1.5m below the proposed finished ground level the exploratory holes have revealed a soil profile comprising topsoil/made ground, River Terrace Deposits (cohesive and granular) and Gault Clay. The potentially poorest sub-grade material within this profile is the cohesive portion of the topsoil/made ground.

In pavement design terms, the groundwater conditions are anticipated to comprise a low to intermediate water table, i.e. between 300mm and 1m or least 1m below the pavement formation level.

The estimated minimum, equilibrium soil-suction, California bearing ratio (CBR) value for the soils and groundwater conditions described above under a completed pavement is between 2 to 3% and 20 to 60%, after Table C1 in TRRL (1984) Report LR1132.

The results of in situ testing, targeted to locations consistent with the proposed roads, indicate that the near surface soils have a CBR value that ranges from between 1.4 and 15%, the results are summarised in Table 24.

Table 24: Summary of CBR values derived from in situ landrover plunger tests

Test location / depth (m)	Material description	CBR value determined below surfacing layer of made ground / topsoil
CBR1 / 0.3	Slightly gravelly slightly sandy clay	4.7
CBR2 / 0.3	Slightly gravelly clay	5.9
CBR3 / 0.2	Slightly gravelly clay	1.7
CBR4 / 0.2	Slightly gravelly clay	2.0

Test location / depth (m)	Material description	CBR value determined below surfacing layer of made ground / topsoil
CBR5 / 0.2	Slightly gravelly slightly sandy clay	1.4
CBR6 / 0.2	Slightly gravelly slightly sandy clay	6.9
CBR7 / 0.3	Slightly gravelly sandy clay	12
CBR8 / 0.4	Slightly gravelly sandy clay	3.4
CBR9 / 0.4	Slightly gravelly slightly sandy clay	6.5
CBR10 / 0.4	Slightly gravelly slightly sandy clay	3.9
CBR11 / 0.3	Slightly gravelly slightly sandy clay	7.7
CBR12 / 0.2	Slightly gravelly clay	2.9
CBR13 / 0.2	Slightly gravelly sandy clay	6.1
CBR14 / 0.2	Slightly gravelly clay	7.1
CBR15 / 0.3	Slightly gravelly slightly sandy clay	6.0
CBR16 / 0.4	Slightly gravelly slightly sandy clay	2.7
CBR17 / 0.4	Slightly gravelly slightly sandy clay	2.7
CBR18 / 0.3	Slightly gravelly slightly sandy clay	3.8
CBR19 / 0.3	Slightly gravelly slightly sandy clay	4.8
CBR20 / 0.4	Slightly gravelly slightly sandy clay	7.4
CBRA /	Slightly gravelly	12

Test location / depth (m)	Material description	CBR value determined below surfacing layer of made ground / topsoil
0.3	clay	
CBRF / 0.2	Slightly gravelly slightly sandy	3.6
CBRJ / 0.3	Slightly gravelly sandy clay	5.9
CBRN / 0.3	Slightly gravelly sandy clay	15

In addition to the testing targeted to the proposed roads summarised above, CBR determinations were calculated using Clegg Hammer apparatus in various trial pit locations during the course of the investigation to provide non-targeted coverage of the site. The results indicated CBR values at or below the anticipated formation depth between 2 and 15% (generally <10%), with localised higher values reported at 0.9m in TP27 (21%) and at 1.0m in TP38 (19%).

Given that cohesive soils were generally encountered at shallow depth, the sub-grade soils in the vicinity of test locations may not be susceptible to improvement by rolling with conventional compaction plant. However, it was noted that granular deposits were encountered at shallow depth in certain areas of the site. Where granular deposits were encountered at shallow depth, improvement by rolling with conventional compaction plant would be feasible.

The recommended sub-grade soil CBR value for road pavement design based on the result of in-situ testing and the ground conditions encountered is therefore 3%. This value assumes that during construction the formation level will be carefully compacted and any soft spots removed and replaced with well-compacted granular fill.

With the exception of areas of the site with cohesive River Terrace Deposits at the proposed formation level, the sub-grade soils can be regarded as non-frost-susceptible, after the criteria given in Appendix 1 of TRRL (1970) Report Road Note 29. When the sub-grade is frost-susceptible the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450mm.

7.3.7 Chemical attack on buried concrete

The results of chemical tests carried out on soil samples indicate 2:1 water soil extract sulphate contents of up to 0.58g/l with alkaline pH values in excess of 8.0. However, it is noted that the mean of the highest 20% is below 0.5g/l.

These results indicate that, in accordance with *BRE Special Digest 1: 2005 Concrete in aggressive ground* (BRE, 2005), the “Aggressive Chemical Environment for Concrete (ACEC) Classification” is AC-1 with a “Design Sulfate Class” for the site of DS-1 This

assumes nominally static groundwater conditions and that no significantly disturbed clay comes into contact with concrete foundations or structures.

7.3.8 Soakaways

Infiltration testing conducted within the River Terrace Deposits has recorded infiltration rates ranging between 1.41E-06m/s to 2.15-05m/s. The tests confirm the suitability of the stratum from a geotechnical viewpoint for the use of pit soakaways to discharge surface run-off water and infiltration rates, albeit noted that the increase in infiltration rate is associated with an increase in granular River Terrace Deposits.

Conversely, soakage tests conducted within the southern and south eastern portion of the site, directly underlain by the Gault Clay, recorded negligible infiltration. Soakaways will not therefore be suitable in this area of the site.

For environmental reasons, careful consideration will have to be given to selecting their locations and design details. Although the construction of soakaways is technically feasible from a geotechnical point of view, the presence of a relatively shallow groundwater table across large areas of the site may preclude the use of traditional pit soakaways. The adoption of trench soakaways may therefore provide a more efficient solution. However, localised investigation into their proposed locations, the locations and extent of granular soils and depth to groundwater may be required.

The Environment Agency should be contacted at the design stage in order to obtain a 'consent to discharge'. This may not be forthcoming where soakage will be into or just above the water table, particularly in the Agency’s sensitive aquifer protection zones. In addition, planning approval will have to be sought for their use.

8 REUSE OF MATERIALS AND WASTE

In accordance with the *CL:AIRE Code of Practice* (2011) (CoP) materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Thus, contaminated material does not become waste until the aforementioned criteria are met.

Under the CoP , soil may be re-used on the site where they were produced provided they are:

- certain to be used
- are suitable for use both chemically and geotechnically
- only the required quantity is used.

The CoP requires the preparation of a materials management plan that confirms the three criteria above will be met. This plan needs to be reviewed by a 'Qualified Person' who will then issue a declaration form to the Environment Agency. RSK has 'Qualified Persons' to enable compliance with the CoP.

8.1 Treatment to meet suitable-for-use criteria

Where materials do not meet the suitable for use criteria it may be possible to treat them under an environmental permit (mobile treatment licence) to enable them to be reused onsite. RSK holds an environmental permit to enable this treatment to be completed.

To enable the treatment options to be determined, RSK can prepare an appraisal of the options and prepare a remediation strategy document to support discussion of the issues with regards to regulators and third parties.

8.2 Reuse of waste materials

If material is discarded as waste then its reuse on site is possible. Waste soils can be reused on site under a standard rules environmental permit or a U1 waste exemption from the Environmental Permitting (England and Wales) Regulations 2010. However, it should be noted that these have strict limits on the quantity of material that can be reused.

8.3 Wastes for landfill disposal

Wastes require pre-treatment prior to disposal at landfill. Pre-treatment must be a physical, thermal, chemical or biological process (including sorting) that changes the characteristics of the waste to reduce its volume, reduce its hazardous nature, facilitate its handling and enhance its recovery. It is best practice to provide your waste collector (or the disposal site) with details of how the waste has been treated. Your waste

collector may provide a pre-treatment confirmation form or space on the waste transfer note to detail the pre-treatment. Alternatively, a standard form produced by the Environment Agency may be used (http://www.environment-agency.gov.uk/commondata/acrobat/annex1_1898741.pdf).

Envirolab (an RSK company) has developed a waste soils characterisation assessment tool, which follows the guidance within the Environment Agency's 'Technical Guidance WM2' (2003), Interpretation of the definition and classification of hazardous waste. The analytical results have been run through this assessment tool for potential off-site disposal of materials in the future. The results of the assessment classify the soils into non-hazardous and hazardous waste categories and do not further divide the waste into inert waste classificiation. As such, table 27 below summarises the results and an interpretation of the likely classification in brackets.

Table 27: Results of waste soils characterisation assessment (HASWASTE)

Soil type	Waste classification
Topsoil / made ground	Non-hazardous (Inert)*
Natural soils	Non-hazardous (Inert)
Notes: *The naturally occurring organic matter content in the shallow topsoil / made ground may alter the waste classification	

Based on the chemical results of the majority of determinands, it is considered that the soils encountered during the most recent investigation are most likely to be classified as inert. However, it is recognised that an organic matter content of up to 6% (generally between 2 to 3%) was recorded in the shallow topsoil / made ground soils and therefore, a more stringent waste classification may be derived for the soils based on waste acceptance criteria testing should these soils be disposed of to landfill.

Not withstanding the above, the results of the investigation indicate that the topsoil / made ground may be chemically suitable for re-use in landscaped areas across the proposed redevelopment, including residential private garden areas and communal soft landscaping. Furthermore, the nature of these soils mean that consideration could be given to re-use of these soils on other development sites, under an appropriate Materials Management Plan (MMP).

8.4 Waste acceptance criteria

All inert, stable non-reactive hazardous and hazardous wastes must be tested and found to be below the waste acceptance criteria (WAC) leaching limit values for the classification of landfill they are being disposed in. Currently, no WAC are in place for non-hazardous waste.

8.5 Landfill tax

Waste producers disposing of material to landfill are required to pay landfill tax by HM Revenue and Customs unless an exemption is available. However, only exemptions registered before November 2008 and implemented by 2010 remain valid and sites holding a valid exemption need to complete their disposal by March 2012 to receive the benefit.

Currently (since April 2011), landfill tax is £56 per tonne and the tax rate will increase annually by £8 until the cost hits £80 in 2014. Further, the Treasury has confirmed that for five years thereafter the tax will not fall below £80.

Material disposed of at a soil treatment centre will not be required to pay landfill tax.

8.6 Groundwater

When there is an intention to discard groundwater, chemical test results will indicate the appropriate disposal options. This could include disposal to treatment facility, via consent (issued by the water authority) to foul sewer or via consent (issued by the Environment Agency) to watercourse. RSK can arrange for these consents to be obtained.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

- The exploratory holes revealed that the site is underlain by a variable thickness of topsoil and/or made ground generally overlying a succession of River Terrace Deposits and Gault Clay in the north/northeast and directly overlying Gault Clay in the south. Deposits of the Gault Clay Formation were encountered to the terminal depth of the investigation at 15m bgl. Made ground was encountered to a maximum depth of 0.75m bgl, however, a previous investigation by Millard Consulting locally identified a thickness of made ground to 1.6m bgl. No obvious signs of desiccation was observed within the Gault Formation during the investigation, although an initial comparison between moisture contents and plastic limits infer the potential for desiccation within the stratum at shallow depth. This may, however, simply be a function of the overconsolidated nature of the soils.

- Groundwater was encountered during the investigation, and generally limited to areas of the site where River Terrace Deposits were present.

- Whilst the investigation has recorded potential reserves of sand and gravel within the designated Mineral Safeguarding Area (MSA), the current proposals for this area of the site are for parkland only and therefore the risk of sterilising mineral resources is negligible. Furthermore, any granular materials excavated as part of the pond construction in the affected area of the site may be utilised for re-use as part of the road construction, or sub-base beneath hardstanding across the proposed development site.

- An assessment of the potential pollutant pathways detailed in section 3.9.4 has confirmed the absence of any relevant pollutant linkages.

- The programme of ground gas monitoring undertaken indicates that the proposed mixed-use development, which fulfils the requirements of both Situation A and Situation B, has been characterised as Characteristic Situation 1 and Green, respectively. This indicates that a negligible gas regime has been identified and that gas protection measures are not considered necessary.

- The topsoil / made ground appears chemically suitable for re-use in landscaped areas across the proposed redevelopment site, including residential private garden areas and communal soft landscaping. Soils encountered during the most recent investigation are most likely to be classified as inert. However, it is recognised that an organic matter content of up to 6% (generally between 2 to 3%) was recorded in the shallow topsoil / made ground soils and therefore, a more stringent waste classification may be derived for the soils based on waste acceptance criteria testing should these soils be disposed of to landfill.

- The presence of competent natural soils at a relatively shallow depth indicates that traditional shallow spread footings will be suitable for the proposed development.

- Recommendations relating to the River Terrace Deposits have been based on soil parameters for a medium strength clay with a medium volume change potential and spread foundations with a width of up to 1.0m and constructed on cohesive river terrace deposits at a minimum depth of 0.9.m may be designed using a net allowable bearing pressure of 75 kN/m^2. Specific design/construction recommendations are provided in Table 19.

- Recommendations relating to the Gault Clay have been based on soil parameters for a medium to very high strength clay with a high volume change potential and spread foundations with a width of up to 1.0m and constructed on the Gault Clay at a minimum depth of 1.0m may be designed using a net allowable bearing pressure of 100 kN/m^2. Specific design/construction recommendations are provided in Table 20.

- A piled foundation solution may provide a more economical foundation solution if particularly heavy loads are anticipated in connection with the commercial aspect of the development. Recommendations on specific design and construction details are provided in Tables 21, 22 and 23.

- It is anticipated that a foundation works risk assessment report will not be required for the development due to the absence of any significant sources of contamination.

- The nature of the soils encountered during the investigation indicates that ground bearing floor slabs may be adopted with a suitable sub-base layer for the proposed development. However, it may be prudent to suspend any floor slabs where proposed plots are in the vicinity of trees and where cohesive soils form the formation layer.

- The recommended sub-grade soil CBR value for road pavement design based on the result of in-situ testing and the ground conditions encountered is 3%.

- Infiltration testing conducted within the River Terrace Deposits has recorded infiltration rates ranging between 1.41E-06m/s to 2.15-05m/s. Soakage tests conducted within the southern and south eastern portion of the site, directly underlain by the Gault Clay, recorded negligible infiltration. The presence of a relatively shallow groundwater table across large areas of the site may preclude the use of traditional pit soakaways. The adoption of trench soakaways may therefore provide a more efficient solution. However, localised investigation into their proposed locations, the locations and extent of granular soils and depth to groundwater may be required

9.2 Recommendations

- It is noted that additional sampling may be required in the south eastern corner of the site, once the pavillion and associated hardstanding has been demolished and when the final development plans have been established to investigate the potential risk associated with residual hydrocarbon contamination identified during the Millard investigation in 2006, resultant from historic leaking from a former above ground fuel storage tank.

- Where particularly heavy or sensitive structures are to be supported by the highly variable River Terrace Deposits, it is recommended that further plot-specific investigation be conducted to any reduce conservatism.

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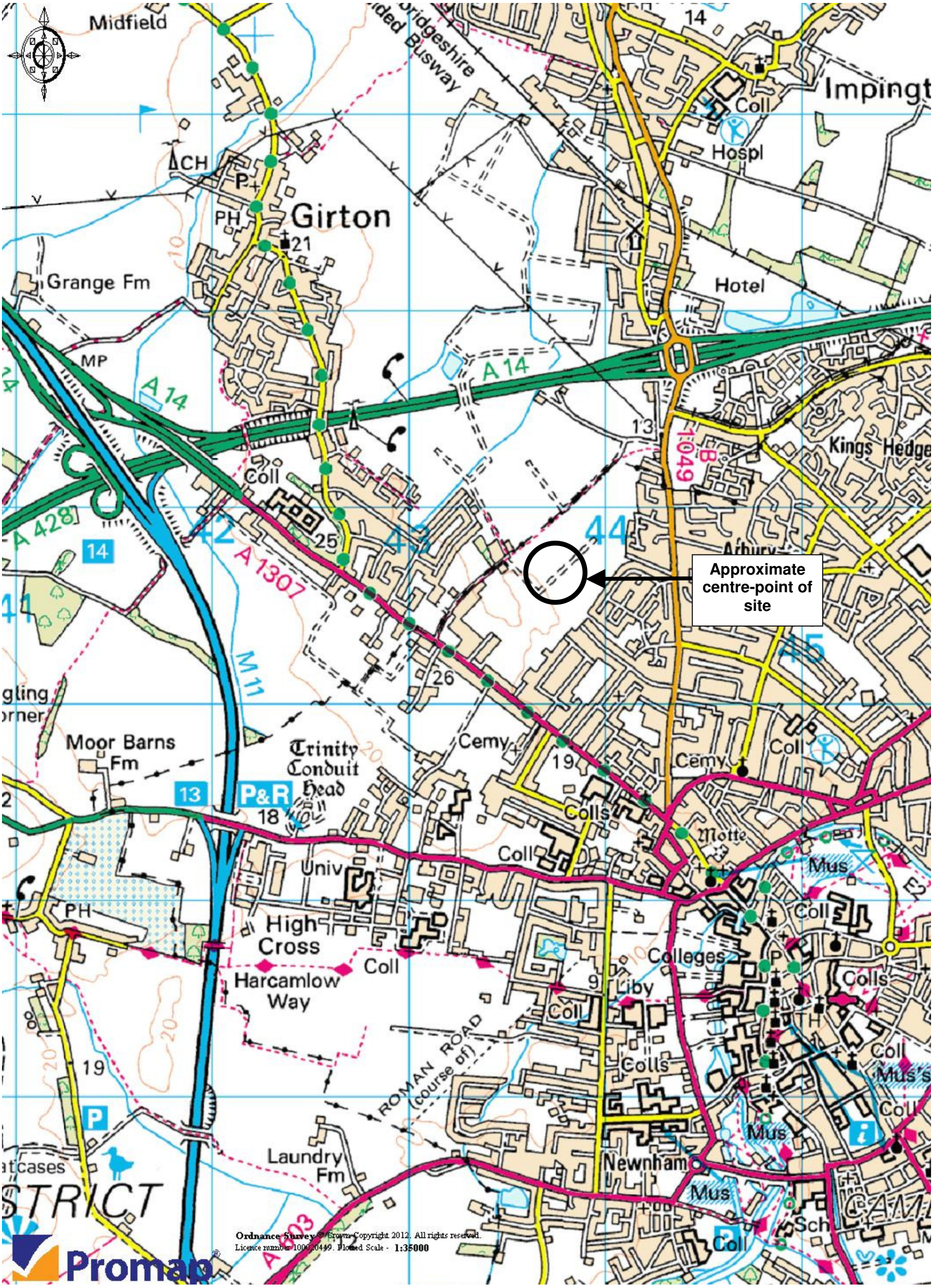
FIGURES



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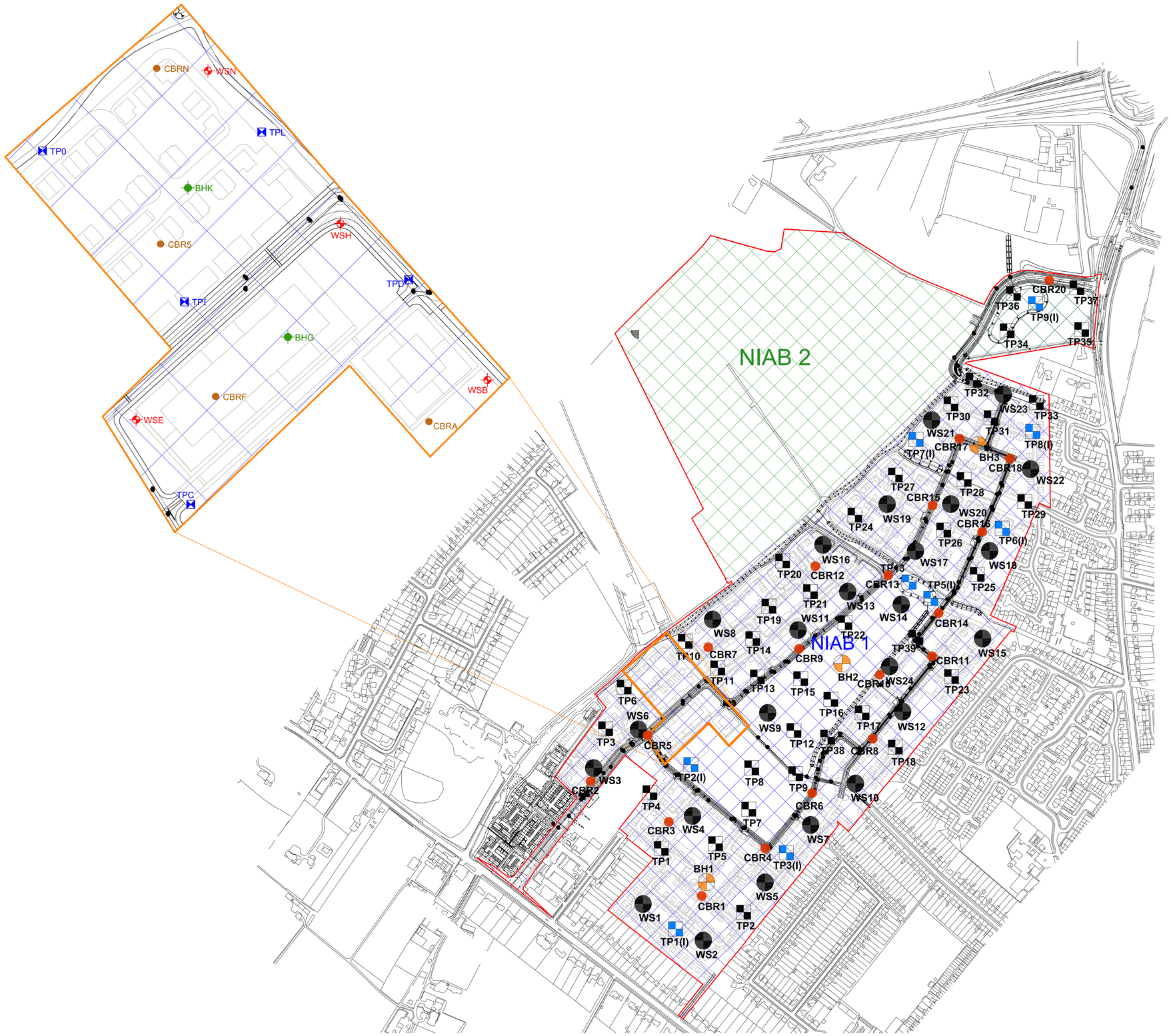
		Site:	NIAB Phase 1	Job No:	25459-01(000
		Scale:	Not to scale	Source:	Promap



Notes

Symbols on the plan are illustrative and not to scale.

Legend

- Site Boundary
- Trial pit by Machine Excavator
- Trial pit with infiltration test for soakaway design
- Borehole by Cable Percussive Drilling Methods
- Borehole by Drive-in Window Sampling Methods
- Insitu CBR Test Location
- Borehole by CP drilling method (Wilson & Bowden Specification)
- Trial Pit by machine excavation (Wilson & Bowden Specification)
- Borehole by Drive-in Window Sampling Methods (Wilson & Bowden Specification)
- Insitu CBR Test Location (Wilson & Bowden Specification)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P1	24.07.12	First Issue	WA	BC	DS

RSK

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Web: www.rsk.co.uk

Client

BDW Trading Limited

Project Title

NIAB PHASE 1 AND 2
HUNTINGDON ROAD
CAMBRIDGE

Drawing Title

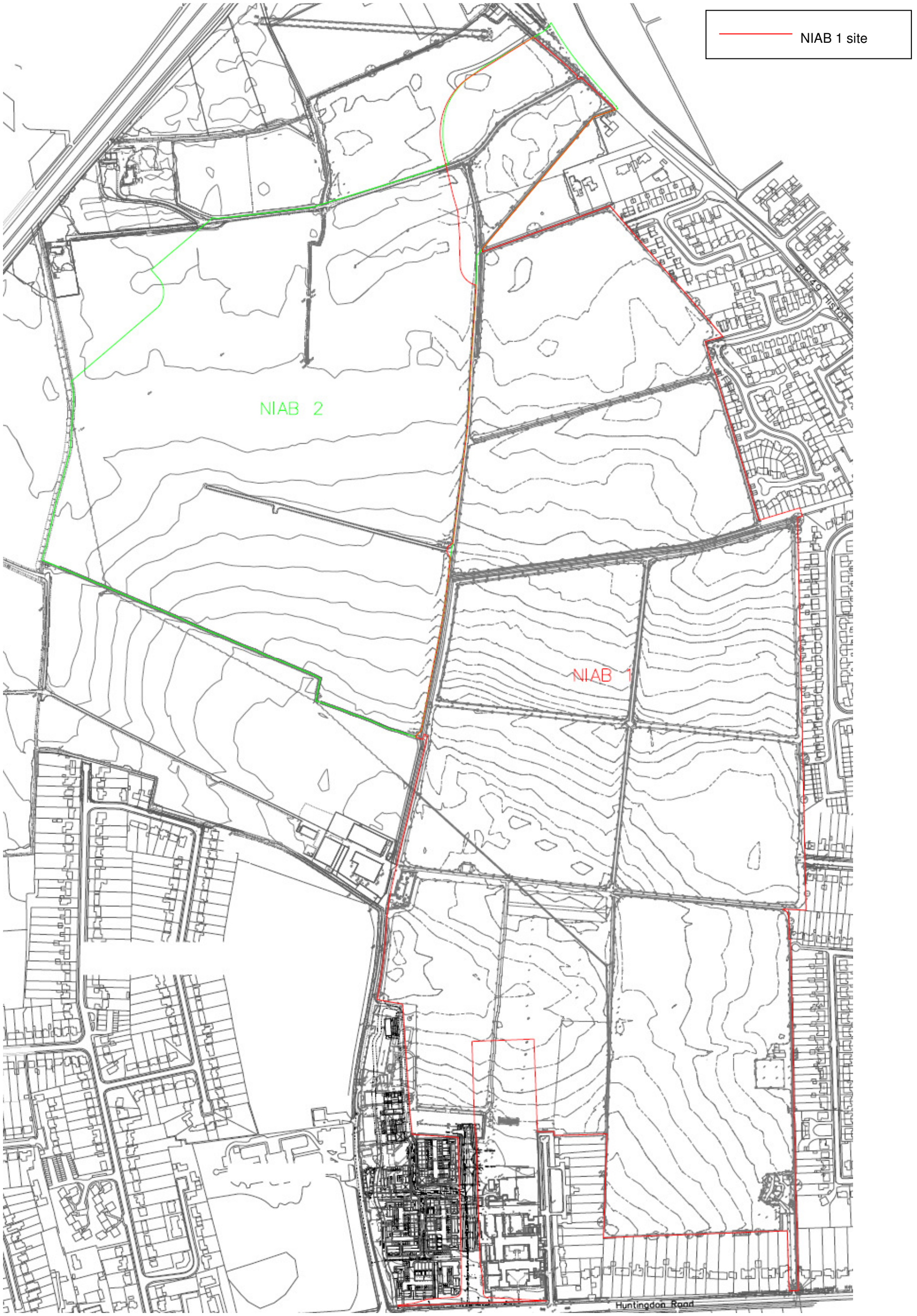
EXPLORATORY
HOLE LOCATION PLAN

Drawn	Date	Checked	Date	Approved	Date
WA	16.10.12	BC	16.08.12	DS	16.08.12

Scale	Orig Size	Dimensions
1:2500	A1	m

Project No.	Drawing File
25459-01 (00)	25459 (R02-00).dwg

Drawing No.	Rev.
FIGURE 2	P1



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		Site:	**NIAB Phases 1**	**Job No:**	**25459-01(00)**
		Scale:	**NTS**	**Source:**	**Woods Hardwick**

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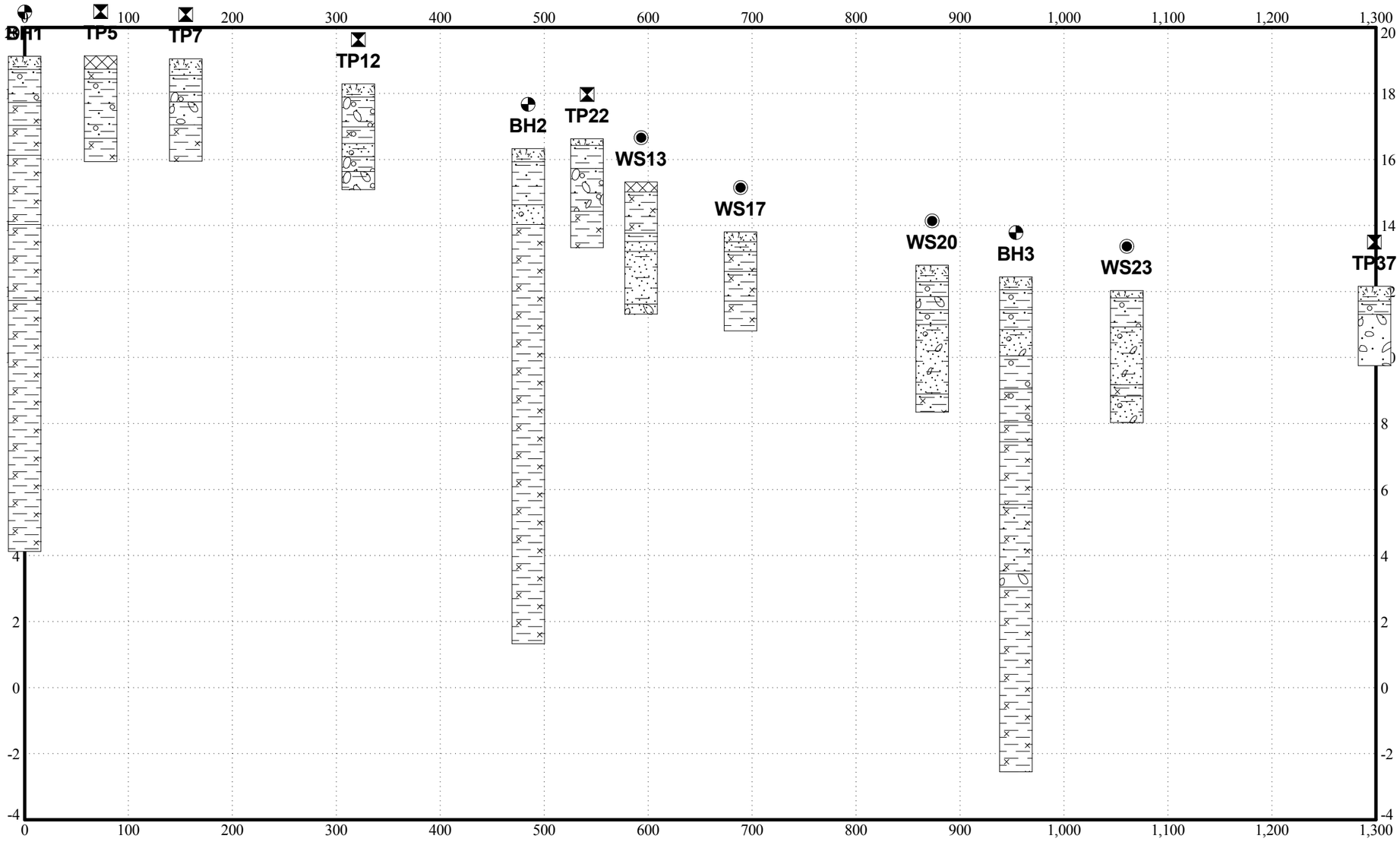

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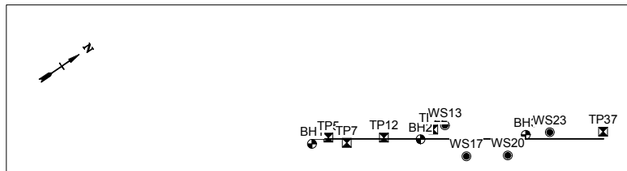

MATERIAL LEGENDS

- Clayey gravelly SAND
- Gravelly clayey SAND
- Clayey SAND
- Clayey sandy GRAVEL
- Sandy clayey GRAVEL
- Clayey sandy GRAVEL with COBBLES
- GRAVEL
- Gravelly CLAY
- Gravelly silty CLAY
- Gravelly SAND
- MADE GROUND
- SAND
- SAND & GRAVEL
- Sandy CLAY
- Sandy silty CLAY
- Silty sandy CLAY
- Sandy GRAVEL
- Gravelly sandy CLAY
- Sandy gravelly CLAY
- Sandy gravelly CLAY with COBBLES

HOLE TYPE MARKER LEGENDS:

- = Cable Percussion Borehole
- = Trial pit
- = Window sample

REV.	DATE	DESCRIPTION	BY	CHD.	APR.
	23/10/2012		BLC	BLC	BLC

Dimensions	Scale
m	Scale X = 1:4483 Scale Y = 1:141

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

CLIENT: **BDW Trading Limited**

PROJECT: **NIAB - Phase 1**

TITLE: **Geological Section 1**

CONTRACT REF:	DRAWING REF:
25459	of

DRAWING STATUS:	FIGURE
Final	4

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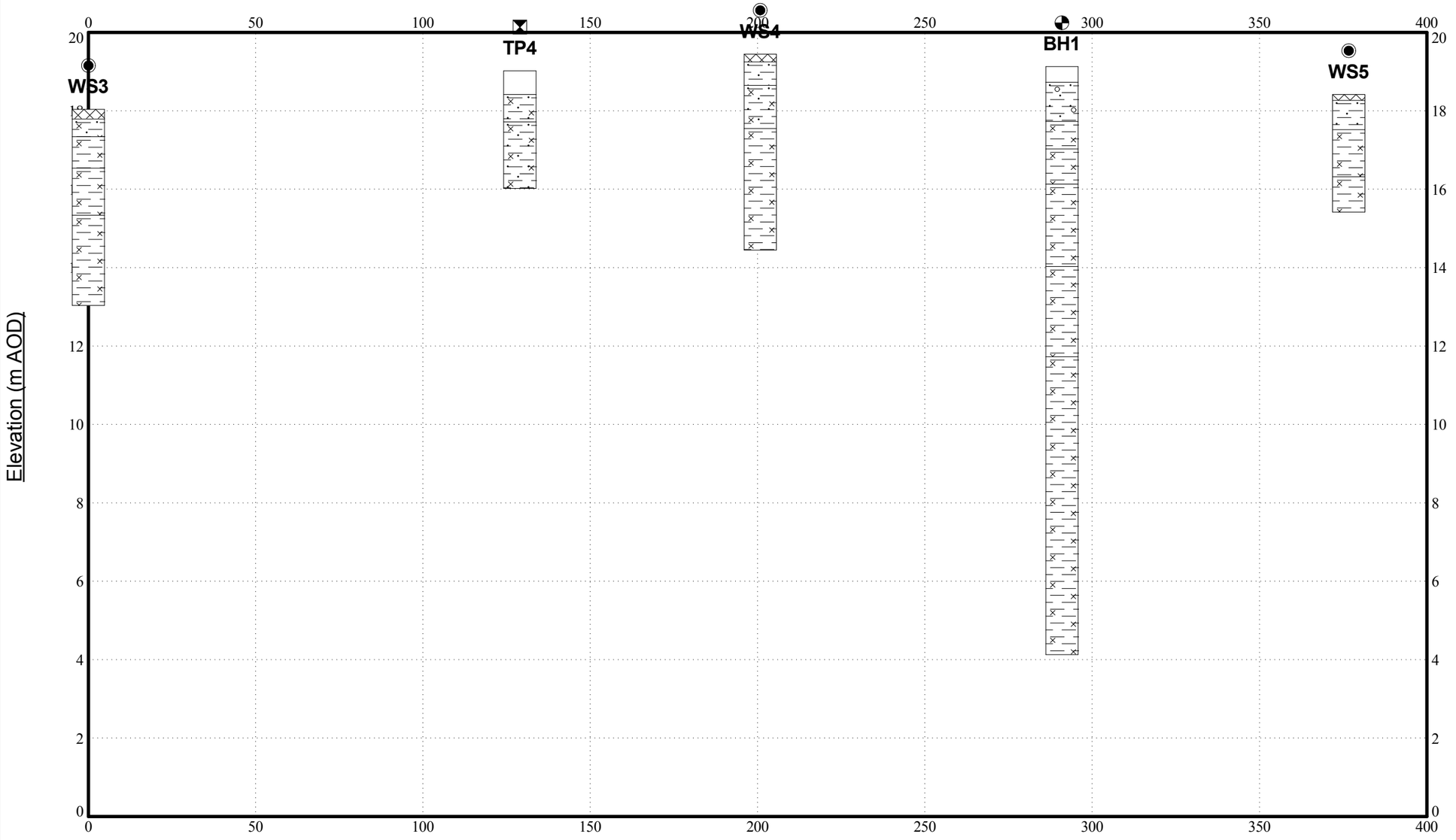
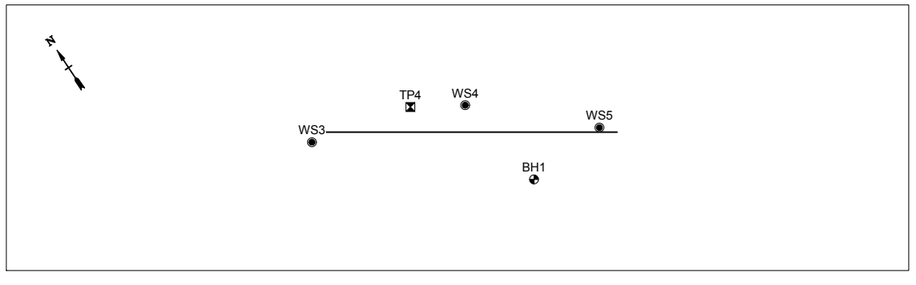


HOLE TYPE MARKER LEGENDS:

◕ = Cable Percussion Borehole
⧗ = Trial pit
◉ = Window sample

SITEMAP AND SECTION BASELINE



MATERIAL LEGENDS

- MADE GROUND
- Sandy CLAY
- Sandy silty CLAY
- Silty sandy CLAY
- Gravelly sandy CLAY
- Silty CLAY

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1	23/10/2012		BLC	BLC	BLC

Dimensions	Scale
m	Scale X = 1:1379 Scale Y = 1:118

RSK Environment Ltd
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Hertfordshire
HP3 9RT

CLIENT: **BDW Trading Limited**

PROJECT: **NIAB - Phase 1**

TITLE: **Geological Section 2**

CONTRACT REF:	DRAWING REF:
25459	of

DRAWING STATUS:	FIGURE
Final	5

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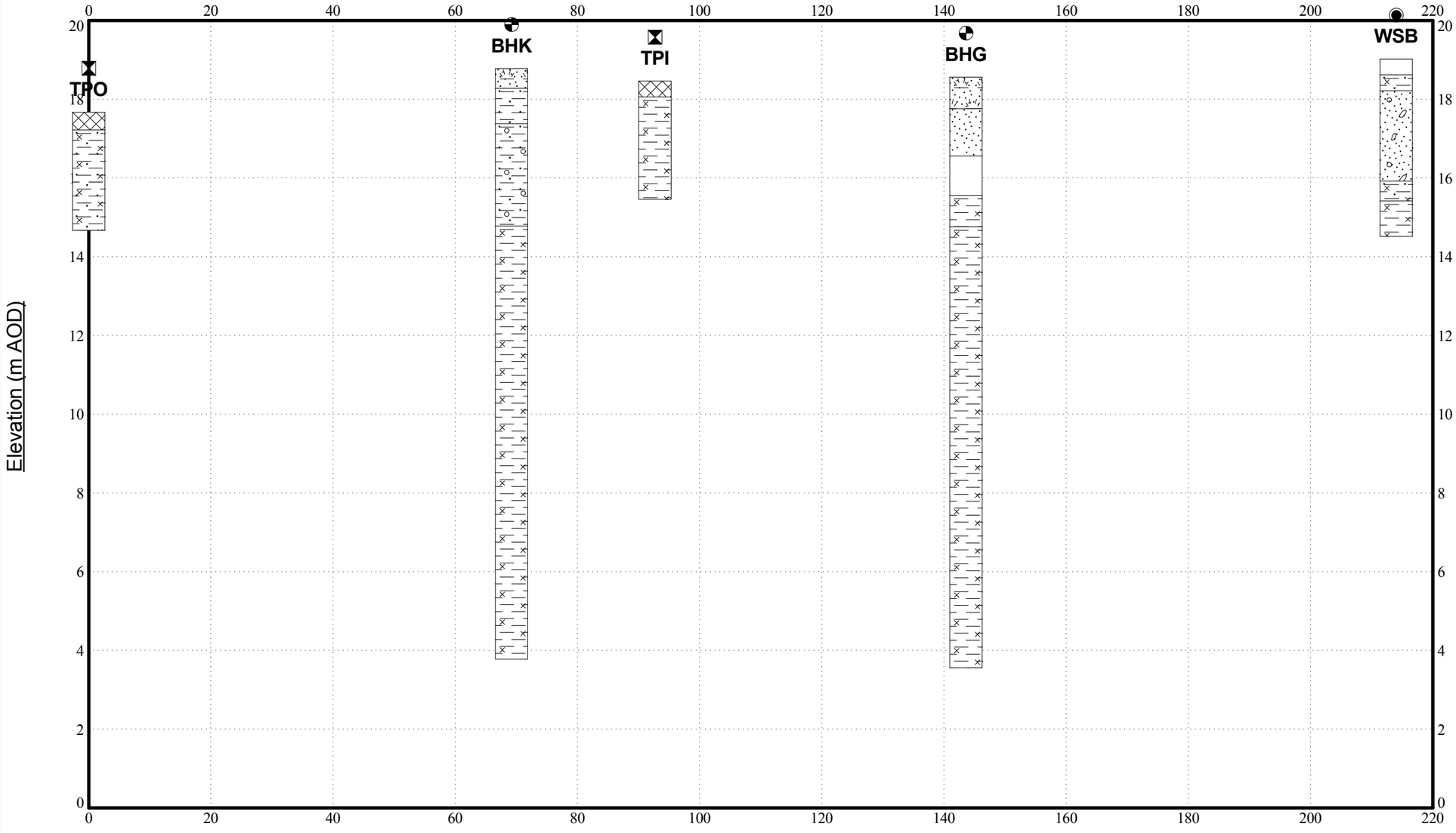

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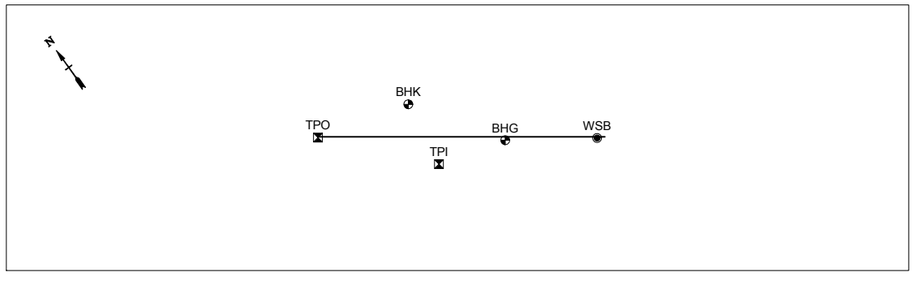

MATERIAL LEGENDS

- Gravelly SAND
- MADE GROUND
- SAND
- Sandy CLAY
- Sandy silty CLAY
- Silty sandy CLAY
- Gravelly sandy CLAY
- Topsoil
- Silty CLAY

HOLE TYPE MARKER LEGENDS:

- = Cable Percussion Borehole
- = Trial pit
- = Window sample

REV.	DATE	DESCRIPTION	BY	CHD.	APR.
	23/10/2012		BLC	BLC	BLC

Dimensions	Scale
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RSK Environment Ltd
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Hertfordshire
HP3 9RT

CLIENT: **BDW Trading Limited**

PROJECT: **NIAB - Phase 1**

TITLE: **Geological Section 3**

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25459	of

DRAWING STATUS:	FIGURE
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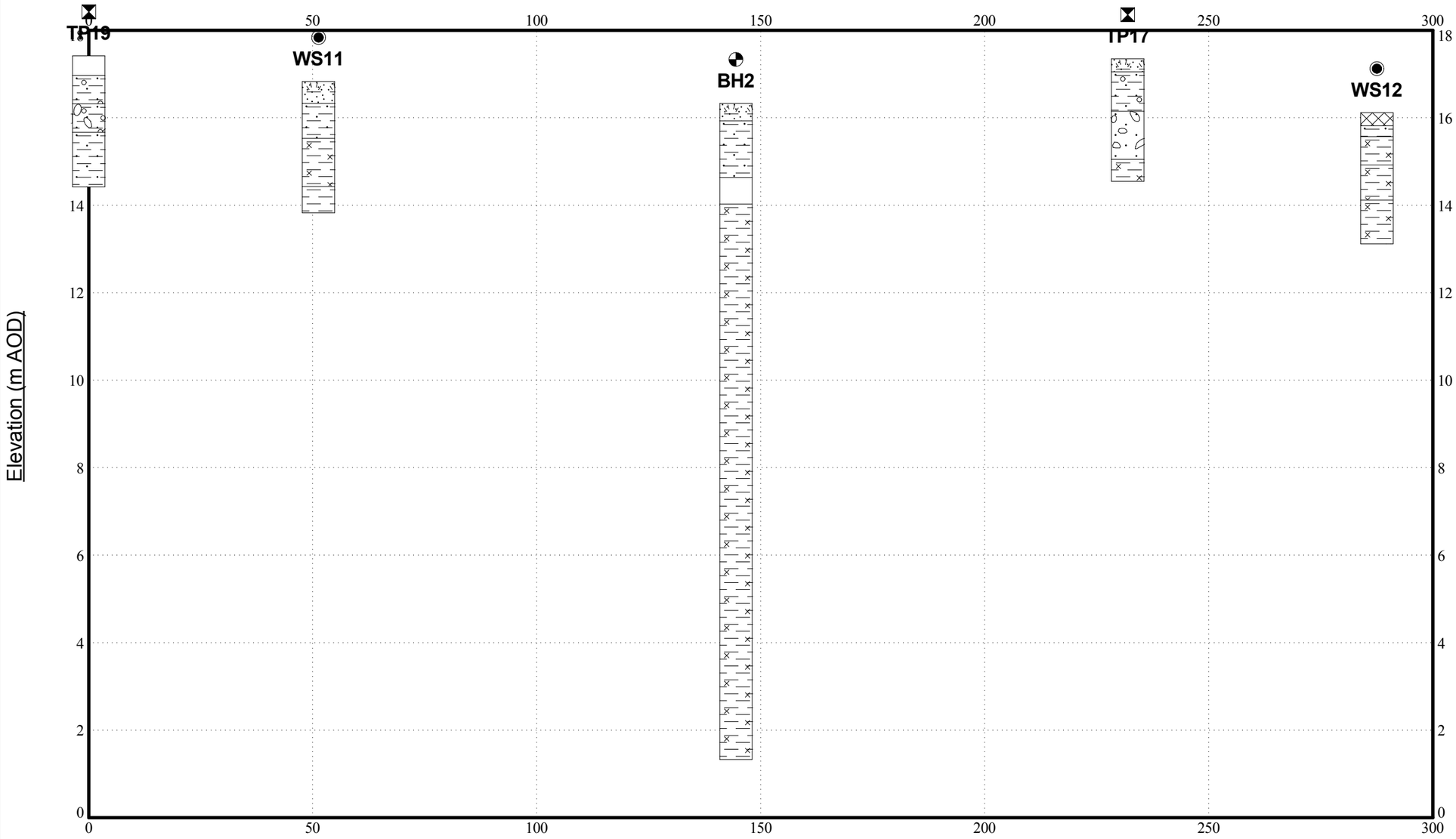

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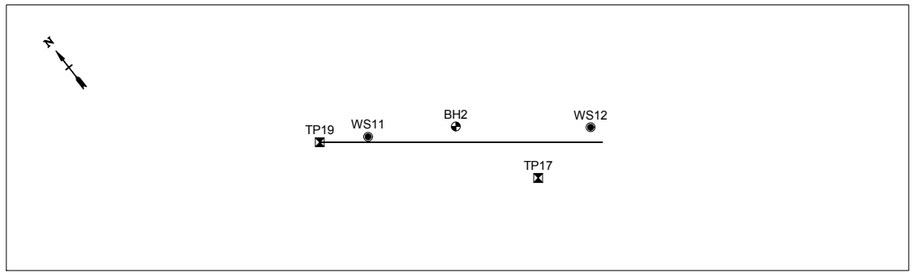

MATERIAL LEGENDS

- CLAY
- MADE GROUND
- Sandy CLAY
- Sandy GRAVEL
- Sandy gravelly CLAY
- Gravelly sandy CLAY with COBBLES
- Topsoil
- Silty CLAY

HOLE TYPE MARKER LEGENDS:

- = Cable Percussion Borehole
- = Trial pit
- = Window sample

REV.	DATE	DESCRIPTION	BY	CHD.	APR.
	23/10/2012		BLC	BLC	BLC

Dimensions	Scale
m	Scale X = 1:1034 Scale Y = 1:106

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

CLIENT: **BDW Trading Limited**

PROJECT: **NIAB - Phase 1**

TITLE: **Geological Section 4**

CONTRACT REF:	DRAWING REF:
25459	of

DRAWING STATUS:	FIGURE
Final	7

DRAWING TRACK CODE: GINT_LIBRARY_V8_04.GLB : STANDARD : A3 : LANDSCAPE : ELEV - 25459_NIAB PHASE 1.GPJ | 25/10/12 11:13 | BLC

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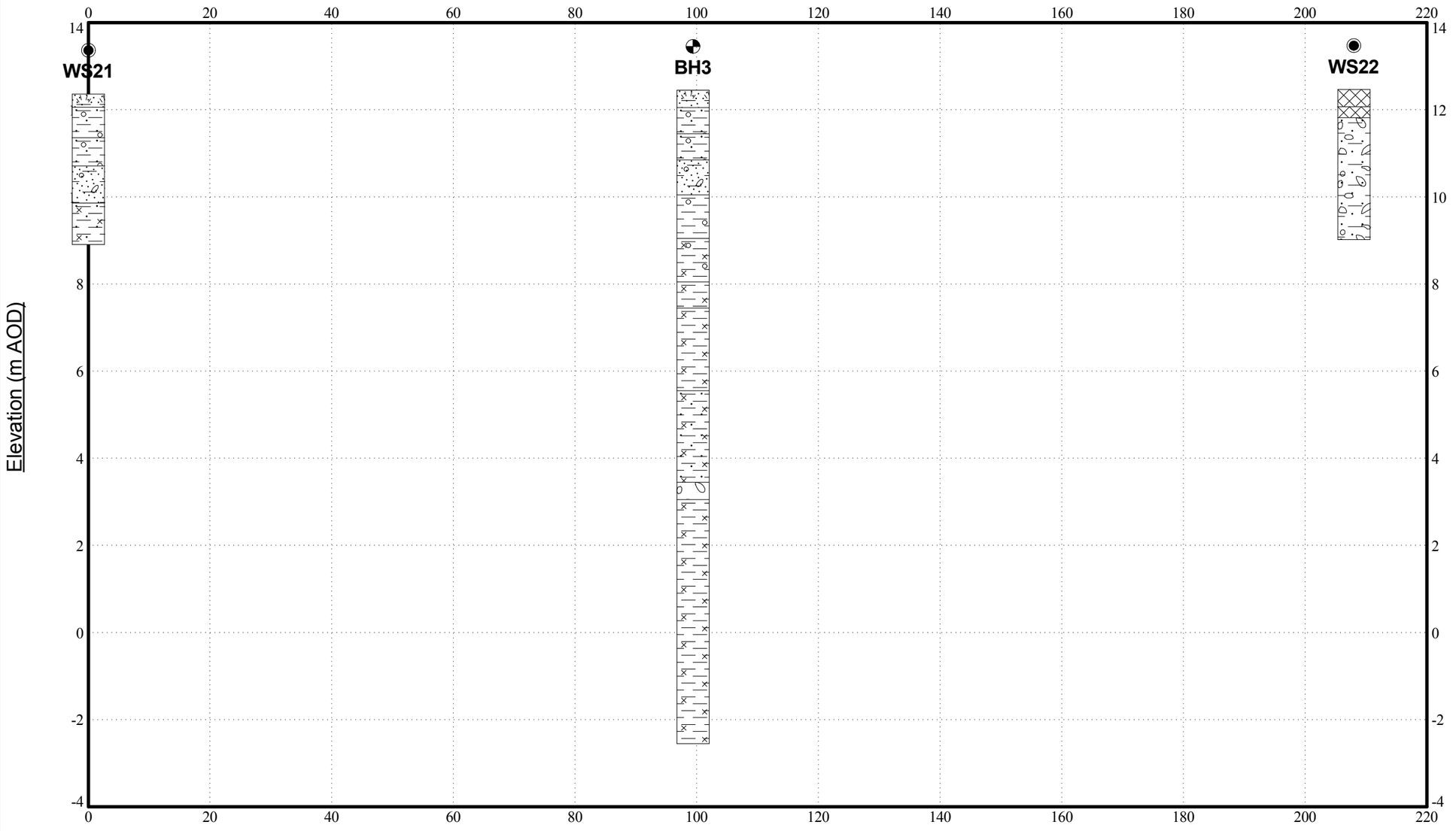

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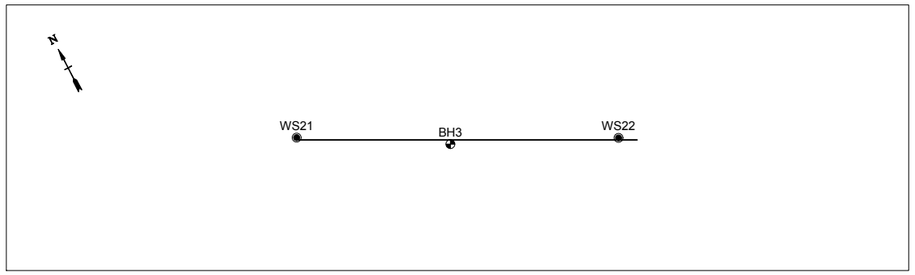

MATERIAL LEGENDS

- Clayey gravelly SAND
- Gravelly clayey SAND
- Clayey sandy GRAVEL
- GRAVEL
- Gravelly CLAY
- Gravelly silty CLAY
- MADE GROUND
- Sandy silty CLAY
- Silty sandy CLAY
- Gravelly sandy CLAY
- Sandy gravelly CLAY
- Topsoil
- Silty CLAY

HOLE TYPE MARKER LEGENDS:

◓ = Cable Percussion Borehole
◉ = Window sample

REV.	DATE	DESCRIPTION	BY	CHD.	APR.
	23/10/2012		BLC	BLC	BLC

Dimensions	Scale
m	Scale X = 1:759 Scale Y = 1:106

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

CLIENT: **BDW Trading Limited**

PROJECT: **NIAB - Phase 1**

TITLE: **Geological Section 5**

CONTRACT REF:	DRAWING REF:
25459	of

DRAWING STATUS:	FIGURE
Final	8

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APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for BDW Trading Limited (the "client") in accordance with email sent by the "client" (Mr Danny Clark), dated 22 August 2012. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.

2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be** well advised to seek independent advice from a competent environmental consultant and/or lawyer.

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date hereof, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.

7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.

8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.

APPENDIX B
SUMMARY OF LEGISLATION AND POLICY RELATING TO CONTAMINATED LAND

Part IIA of the Environmental Protection Act 1990 (EPA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, formed the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the Local Authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered all groundwater, inland waters and estuaries.

In August 2006, the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented, which extended the statutory regime to include Part IIA of the EPA as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. These have been replaced subsequently by the Contaminated Land (England) (Amendment) Regulations 2012, which now exclude land that is contaminated by virtue of radioactivity.

The intention of Part IIA of the EPA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012). This document replaces Annex III of Defra Circular 01/2006, published in September 2006 (the remainder of this document is now obsolete).

Water Framework Directive (WFD)

The Water Framework Directive 2000/60/EC is designed to:

- enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems
- promote the sustainable use of water
- reduce pollution of water, especially by 'priority' and 'priority hazardous' substances
- ensure progressive reduction of groundwater pollution.

The WFD requires a management plan for each river basin be developed every six years.

Groundwater Directive (GWD)

The 1980 Groundwater Directive 80/68/EEC and the 2006 Groundwater Daughter Directive 2006/118/EC of the WFD are the main European legislation in place to protect groundwater. The 1980 Directive is due to be repealed in December 2013. The European legislation has been transposed into national legislation by regulations and directions to the Environment Agency.

Environmental Permitting Regulations (EPR)

The Environmental Permitting (England and Wales) Regulations 2010 provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2010 states: 'the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.'

Water Resources Act (WRA)

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

Priority Substances Directive (PSD)

The Priority Substances Directive 2008/105/EC is a 'Daughter' Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of dangerous substances that are being discharged and EQS for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are used to describe where the water environment is of good quality and where it may require improvement.

Contaminated land is often dealt with through planning because of land redevelopment. This approach is documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. The overall aim of the planning and pollution control policy is to promote the sustainable and beneficial use of land (in particular, encouraging reuse of previously developed land in preference

to greenfield sites). Within this aim, polluting activities that are necessary for society and the economy should be so sited and planned, and subject to such planning conditions, that their adverse effects are minimised and contained to within acceptable limits.

APPENDIX C
SITE PHOTOGRAPHS

PHOTOGRAPHIC LOG

Photo no. 1	**Date:** 08/08/12	
Direction photo taken: NE		
Description: North-western site boundary and public right-of-way		

Photo No. 2	**Date:** 08/08/12	
Direction photo taken: N		
Description: View north from concrete hardstanding in southwest portion of the site		

Photo No.	Date:	
3	08/08/12	
Direction Photo Taken: SW		
Description: Northwest site boundary and existing off-site NIAB facilities		

Photo No.	Date:	
4	01/09/12	
Direction Photo Taken: N / NW		
Description: View to the rear of disused pavillion building		

APPENDIX D
RISK ASSESSMENT METHODOLOGY

CLR11 outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. Under CLR11, three stages of risk assessment exist: preliminary, generic quantitative and detailed quantitative. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) pollutant linkages (source–pathway–receptor) and is used as the basis for the design of the site investigation. The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk. RSK has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

- highly likely: the event appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution
- likely: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
- low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
- unlikely: circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- severe: short term (acute) risk to human health likely to result in ‘significant harm’ as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in ‘Draft Circular on Contaminated Land’, DETR 2000)
- medium: chronic damage to human health (‘significant harm’ as defined in ‘Draft Circular on Contaminated Land’, DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in ‘Draft Circular on Contaminated Land’, DETR 2000)

- mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
- minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the likelihood of an event occurring and its severity have been classified, a risk category can be assigned the table below.

		Consequences			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**Highly likely**	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

- Very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required.
- High: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term.
- Moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term.
- Low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild.
- Very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.

APPENDIX E
GROUNDSURE REPORTS (INCLUDING HISTORICAL MAPPING)

EmapSite
Masdar House,
Eversley, RG27 0RP

Report Reference:	EMS-176835_260484
Your Reference:	EMS_176835_260484
Report Date	Aug 23, 2012
Report Delivery Method:	Email - pdf

GroundSure GeoInsight

Address: NIAB 1,Huntingdon Road,Cambridge,CB3 0LE

Dear Sir/Madam,

Thank you for placing your order with GroundSure. Please find enclosed the **GroundSure GeoInsight** as requested.

If you would like further assistance regarding this report then please contact the emapsite customer services team on 0118 9736883 quoting the above report reference number.

Yours faithfully,

emapsite customer services team

Enc.
GroundSure GeoInsight

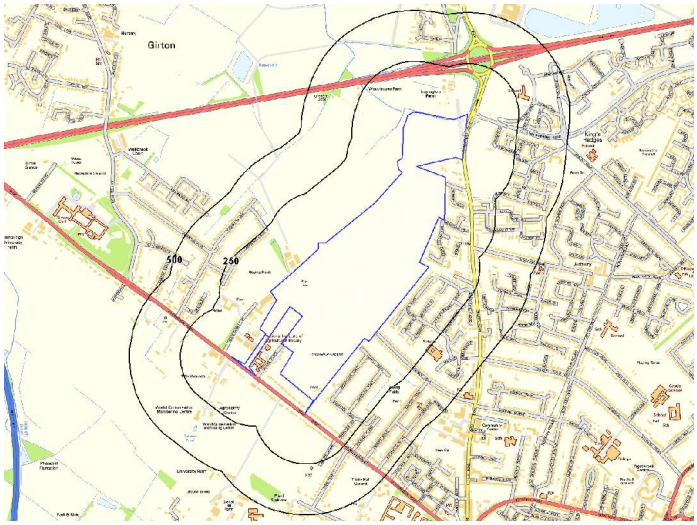
GroundSure GeoInsight

Address: NIAB 1,Huntingdon Road,Cambridge,CB3 0LE

Date: Aug 23, 2012

Report Reference: EMS-176835_260484

Your Reference: EMS_176835_260484



Brought to you by emapsite

Aerial Photograph of Study Site

NW N NE

W E

SW S SE

Site Name: NIAB 1,Huntingdon Road,Cambridge,CB3 0LE
Grid Reference: 543818,260766
Size of Site: 54.59 ha

Overview of Findings

The GroundSure GeoInsight provides high quality geo-environmental information that allows geo-environmental 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 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Shallow 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.

Report Section	Number of records found within (X) m of the study site boundary
1. Geology	**Description**
1.1 Artificial Ground,	
1.1.1 Is there any Artificial Ground /Made Ground present beneath the study site?*	No
1.1.2 Are there any records relating to permeability of artificial ground within the study site* boundary?	No
1.2 Superficial Geology & Landslips	
1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes
1.2.2 Are there any records relating to permeability of superficial geology within the study site* boundary?	Yes
1.2.3 Are there any records of landslip within 500m of the study site boundary?	No
1.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No
1.3 Bedrock, Solid Geology & 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 relating to permeability of bedrock within the study site* boundary?	Yes
1.3.3 Are there any records of faults within 500m of the study site boundary?	No
1.3.4 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 not in a Radon Affected Area, as less than 1% of properties are above the Action Level
1.3.5 Is the property in an area where Radon Protection Measures are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary

* This includes an automatically generated 50m buffer zone around the site

Source:Scale 1:50,000 BGS Sheet No:188

2. Ground Workings	on-site	0-50	51-250	251-500	501-1000
2.1 Historical Surface Ground Working Features from Small Scale Mapping	0	0	10	-	-
2.2 Historical Underground Workings Features from Small Scale Mapping	0	0	0	0	0
2.3 Current Ground Workings	0	0	0	3	2

3. Mining, Extraction & Natural Cavities	on-site	0-50	51-250	251-500	501-1000
3.1 Historical Mining	0	0	0	0	0
3.2 Coal Mining	0	0	0	0	0
3.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
3.4 Non-Coal Mining*	0	0	1	1	0
3.5 Non–Coal Mining Cavities	0	0	0	1	3
3.6 Natural Cavities	0	0	0	0	0
3.7 Brine Extraction	0	0	0	0	0
3.8 Gypsum Extraction	0	0	0	0	0
3.9 Tin Mining	0	0	0	0	0
3.10 Clay Mining	0	0	0	0	0

*This includes an automatically generated 50m buffer zone around the site

4. Natural Ground Subsidence	on-site*	0-50	51-250	251-500	501-1000
4.1 Shrink-Swell Clay	Moderate	-	-	-	-
4.2 Landslides	Very Low	-	-	-	-
4.3 Ground Dissolution of Soluble Rocks	Null	-	-	-	-
4.4 Compressible Deposits	Negligible	-	-	-	-
4.5 Collapsible Deposits	Very Low	-	-	-	-
4.6 Running Sand	Very Low	-	-	-	-

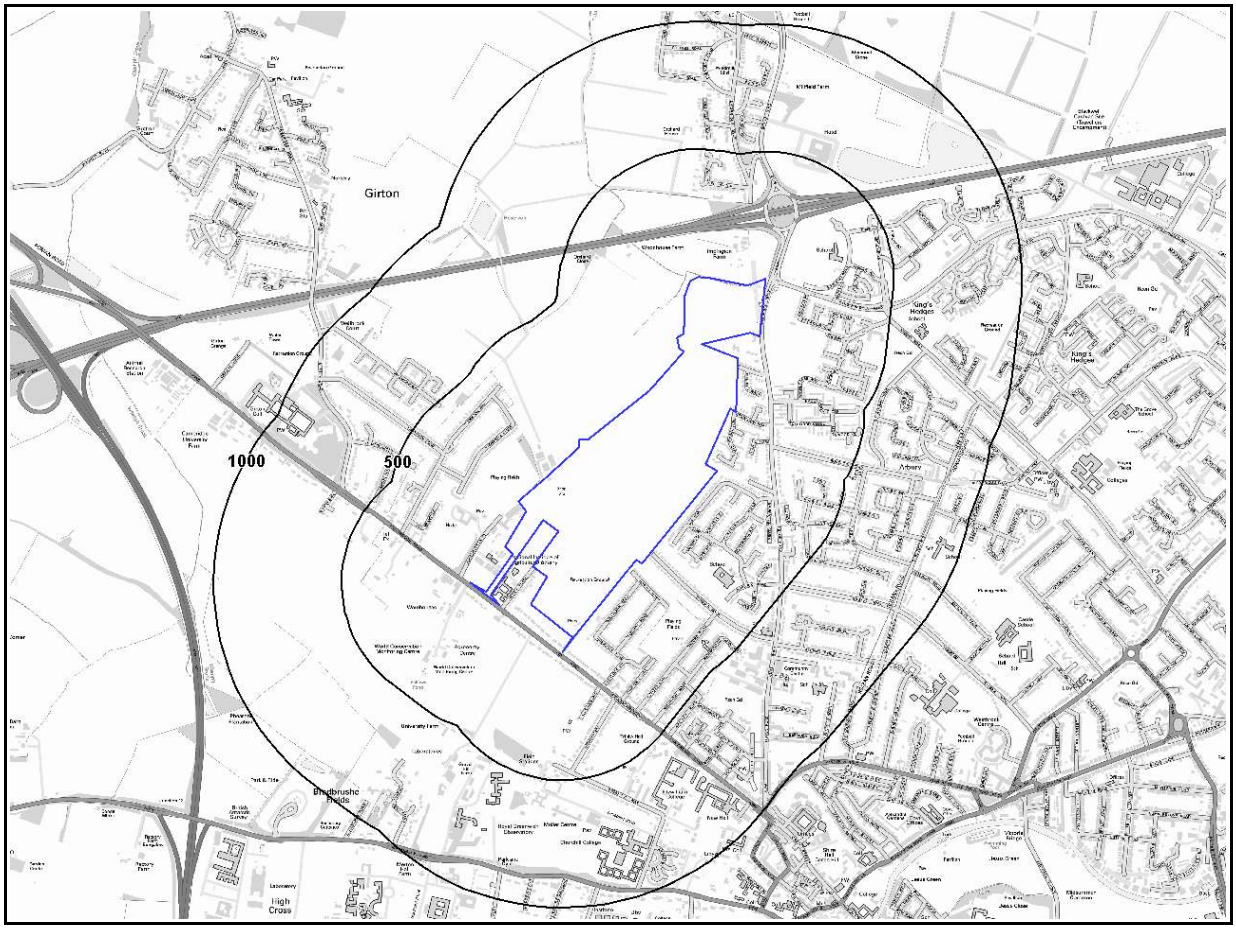
* This includes an automatically generated 50m buffer zone around the site

5. Borehole Records	on-site	0-50	51-250	251-500	501-1000
5.1 BGS Recorded Boreholes	2	1	10	-	-

6. Estimated Background Soil Chemistry	on-site	0-50	51-250	251-500	501-1000
6.1 Records of Background Soil Chemistry	10	2	0	-	-

1.1 Artificial Ground Map

NW N NE



W E

SW S SE

Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Disturbed Ground (undivided)

Worked Ground (undivided)

Landscaped Ground (undivided)

Infilled Ground

Reclaimed Ground

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:188

1.1.1 Artificial/Made Ground

Are there any records of Artificial/Made Ground within 500m of the study site boundary? **No**

Database searched and no data found.

1.1.2 Permeability of Artificial Ground

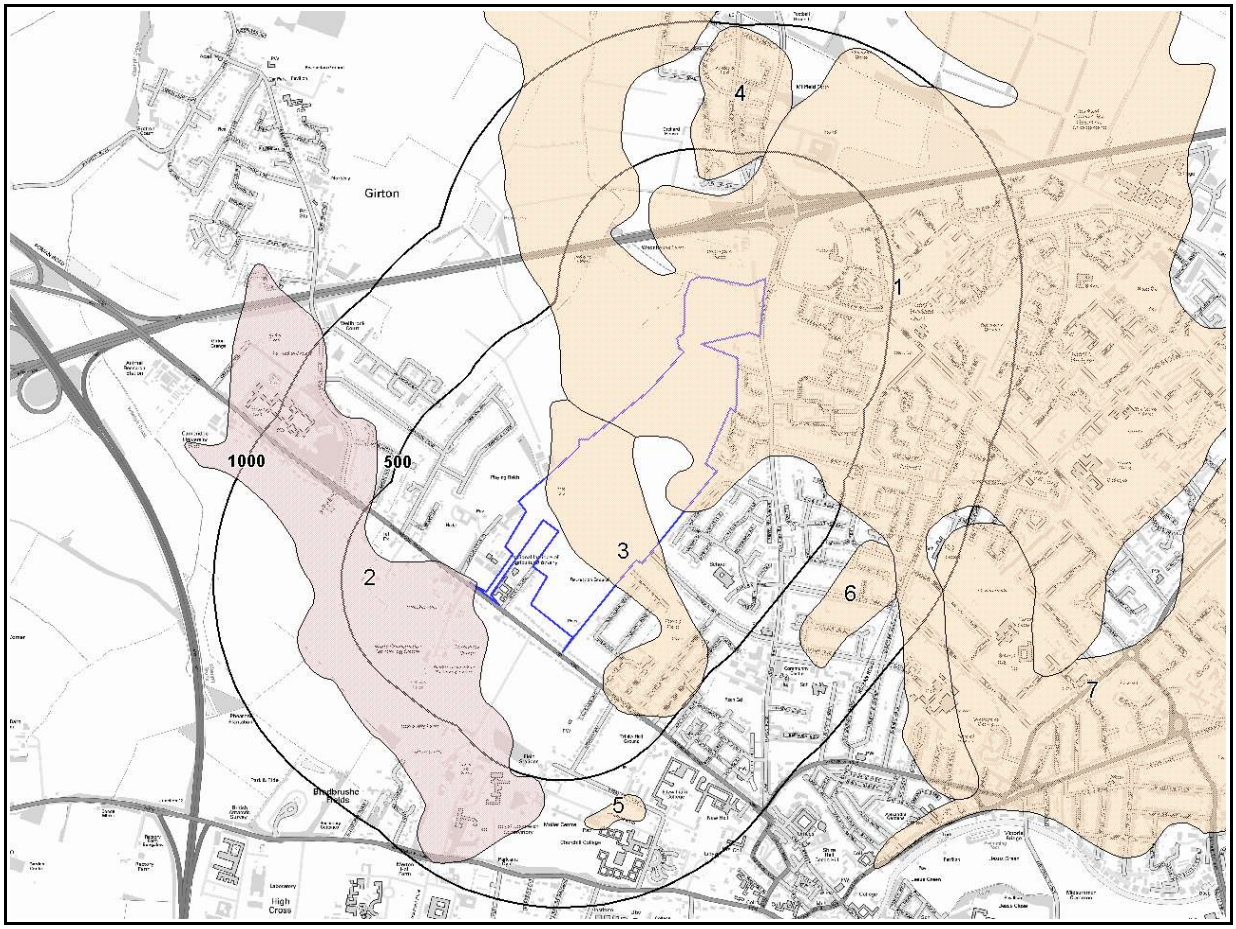
Are there any records relating to permeability of artificial ground within the study site* boundary? **No**

Database searched and no data found.

* This includes an automatically generated 50m buffer zone around the site.

1.2 Superficial Deposits and Landslips Map

NW N NE



W E

SW S SE

Superficial and Landslips Legend

Site Outline

500
1000

Search Buffers (m)

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

1.2 Superficial Deposits and Landslips

1.2.1 Superficial Deposits/Drift Geology

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

ID	Distance (m)	Direction	Lex Code	Description	Rock Description
1	0.0	On Site	RTD3-SAGR	RIVER TERRACE DEPOSITS, 3	SAND AND GRAVEL
2	0.0	On Site	HEAD-CSSG	HEAD	CLAY, SILT, SAND AND GRAVEL
3	0.0	On Site	RTD4-SAGR	RIVER TERRACE DEPOSITS, 4	SAND AND GRAVEL
4	382.0	N	RTD4-SAGR	RIVER TERRACE DEPOSITS, 4	SAND AND GRAVEL

1.2.2 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	Mixed	High	Very Low
0.0	On Site	Intergranular	Very High	High
0.0	On Site	Intergranular	Very High	High

1.2.3 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, 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.

1.2.4 Landslip Permeability

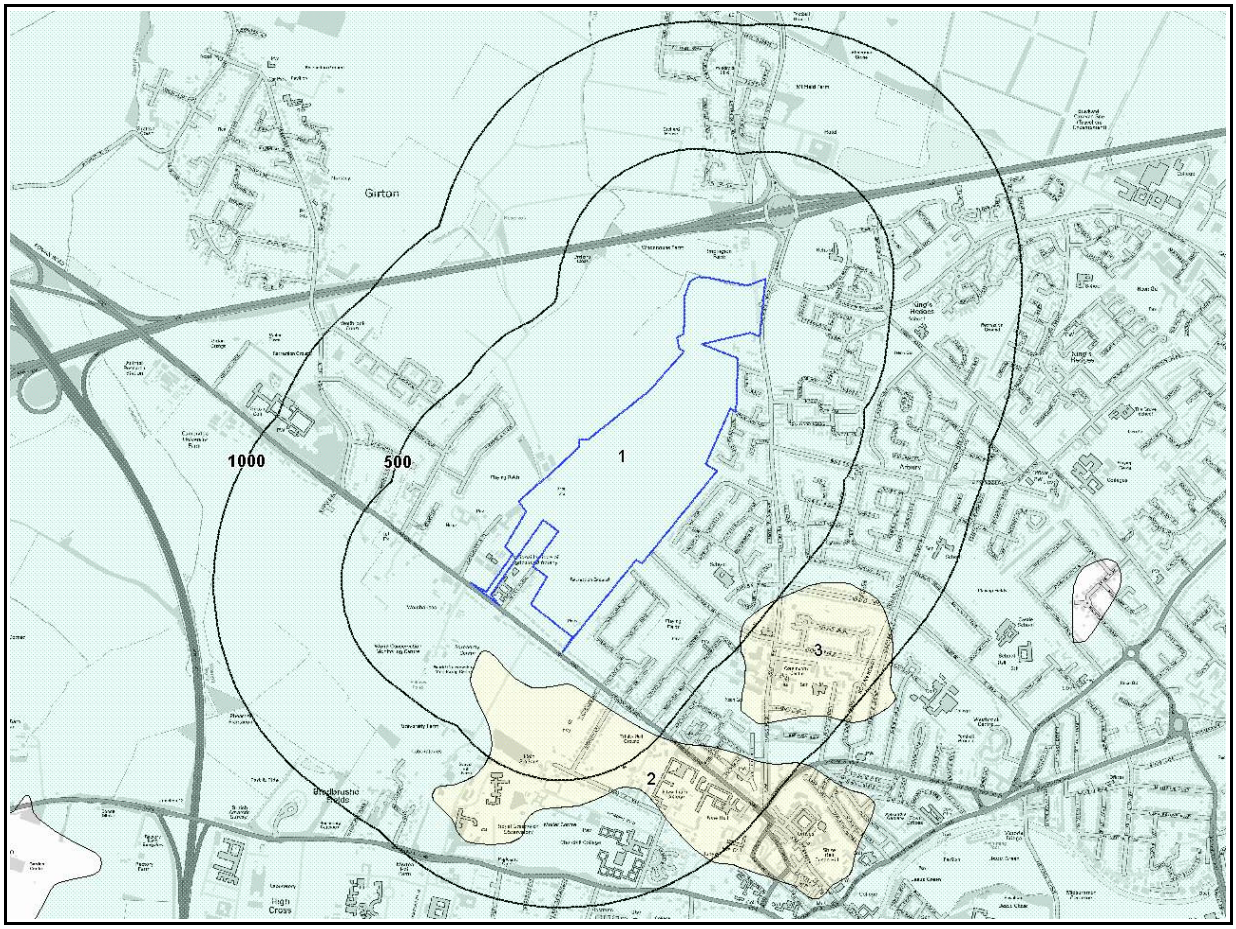
Are there any records relating to permeability of landslips within the study site* boundary? No

Database searched and no data found.

*This includes an automatically generated 50m buffer zone around the site.

1.3 Bedrock and Faults Map

NW N NE



W E

SW S SE

Bedrock & Faults Deposits Legend

Site Outline

500
1000
Search Buffers (m)

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

1.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:188

1.3.1 Bedrock/Solid Geology

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

ID	Distance (m)	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	GLT-MDST	Gault Formation - Mudstone	Albian
2	122.0	S	WMCH-CHLK	West Melbury Marly Chalk Formation - Chalk	Cenomanian
3	457.0	SE	WMCH-CHLK	West Melbury Marly Chalk Formation - Chalk	Cenomanian

1.3.2 Permeability of Bedrock Ground

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

Distance (m)	Direction	Flow type	Maximum Permeability	Minimum Permeability
0.0	On Site	Fracture	Low	Very Low
26.0	S	Fracture	Low	Very Low

1.3.3 Faults

Are there any records of Faults 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, 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.

1.3.4 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 not in a Radon Affected Area, as less than 1% of properties are above the Action Level

1.3.5 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?

No radon protective measures are necessary

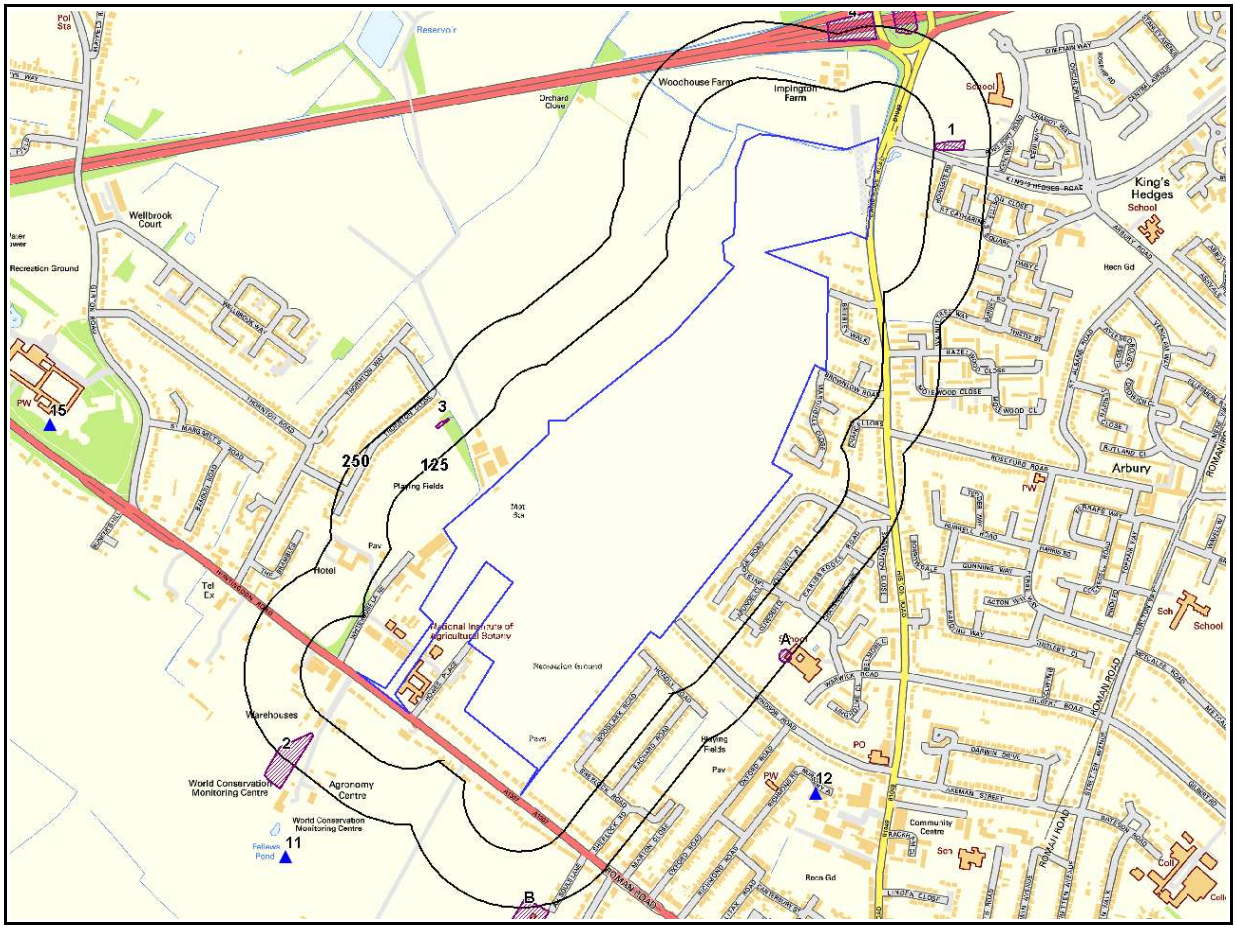
* This includes an automatically generated 50m buffer zone around the site.

2. Ground Workings Map

NW N NE

W E

SW S SE



Ground Workings Legend

Enabled by Ordnance Survey

Site Outline

125
250
Search Buffers (m)

Historic Surface Ground Workings

Historic Underground Workings

Current Ground Workings

2. Ground Workings

2.1 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

The following Historical Surface Ground Working Features are provided by GroundSure:

ID	Distance (m)	Direction	NGR	Use	Date
1	128.0	E	544476,261475	Unspecified Heap	1950
2	170.0	SW	543010,260103	Unspecified Pit	1950
3	175.0	NW	543351,260856	Pond	1950
4	221.0	N	544259,261743	Cuttings	1981
5A	228.0	SE	544111,260337	Unspecified Heap	1973
6A	228.0	SE	544111,260337	Unspecified Heap	1981
7B	229.0	S	543534,259740	Cemetery	1981
8B	229.0	S	543534,259740	Cemetery	1971
9B	229.0	S	543534,259740	Cemetery	1950
10	241.0	N	544376,261762	Cuttings	1981

2.2 Historical Underground Workings 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.

2.3 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 Society:

ID	Distance (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
11	427.0	SW	5430 00,25 9885	Sand & Gravel	Gravel Hill Farm	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased

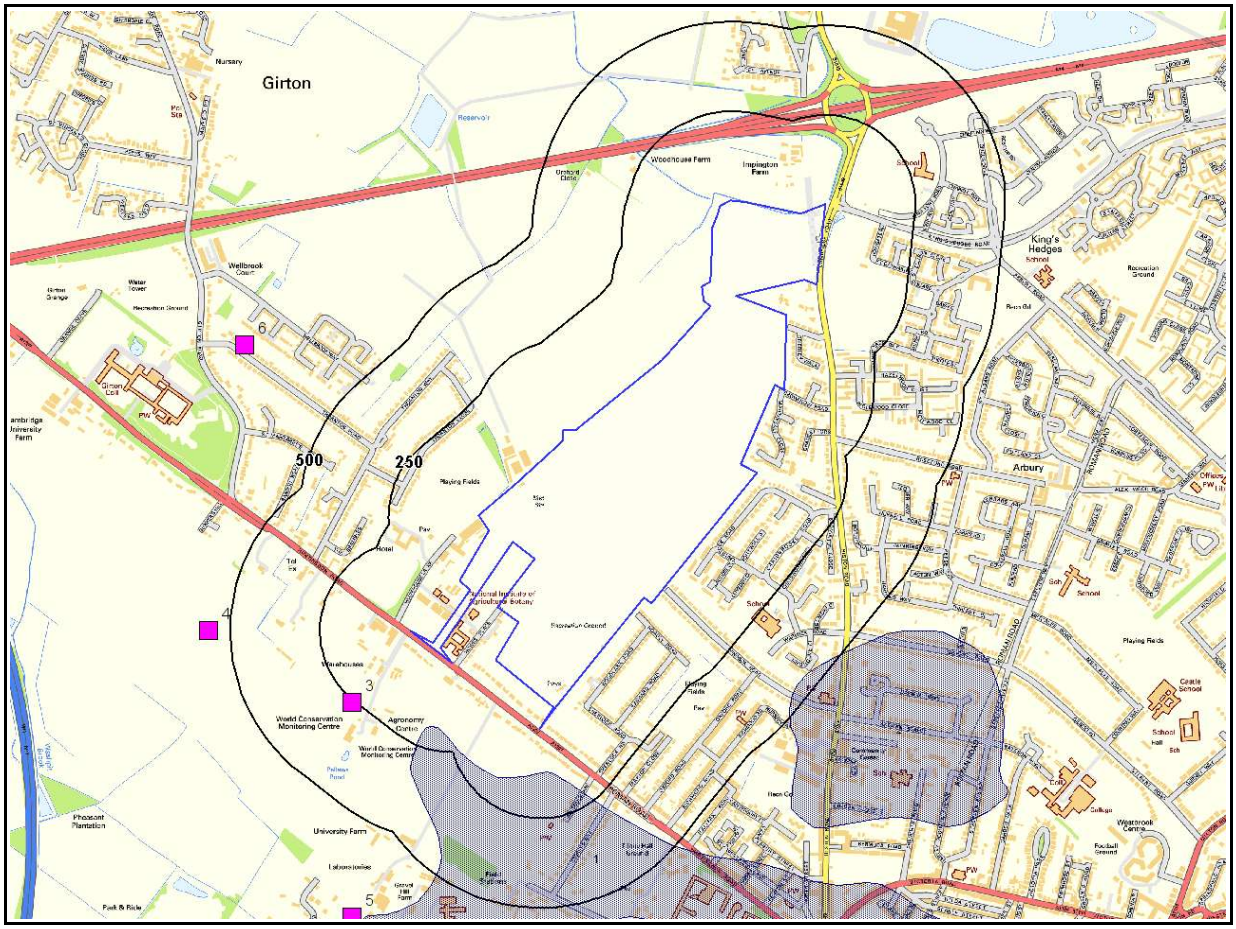
12	491.0	SE	5441 78,26 0027	Clay & Shale	Arbury Brick Works	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	499.0	SW	5432 27,25 9624	Sand & Gravel	Gravel Hill Farm Gravel Pits	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	607.0	S	5433 66,25 9439	Sand & Gravel	University Observatory Gravel Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
15	876.0	NW	5424 78,26 0848	Sand & Gravel	Bunker's Hill Gravel Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased

3. Mining, Extraction & Natural Cavities Map

NW N NE

W E

SW S SE



Mining, Extraction & Natural Cavities Legend

Site Outline

250
500
Search Buffers (m)

Historical Mining

Non-Coal Mining Cavities

Natural Cavities

Non-Coal Mining

Highly likely

Likely

Unlikely

Highly unlikely

Rare

3.Mining, Extraction & Natural Cavities

3.1 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? **No**

Database searched and no data found.

3.2 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.

3.3 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? **No**

The following information provided by JPB is not represented on Mapping:

Database searched. No results found.

3.4 Non – Coal Mining

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	122.0	S	Not available	Chalk	Rare - Infrequent minor mining may have occurred but restricted in extent.
2	457.0	SE	Not available	Chalk	Rare - Infrequent minor mining may have occurred but restricted in extent.

3.5 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	Distance (m)	Direction	NGR	Address	Superficial Deposits	Bedrock Deposits	Extracted Mineral
3	257.0	SW	543000, 260100	Cambridge, Cambridgeshire	River Terrace Deposits	Gault, Lower Greensand, Kimmeridge Clay, Ampthill Clay	Coprolite
4	561.0	W	542600, 260300	Cambridge, Cambridgeshire	Head Gravel	Gault, Lower Greensand, Kimmeridge Clay Ampthill Clay	Coprolite
5	741.0	SW	543000, 259500	Cambridge, Cambridgeshire	River Terrace Deposits	Gault, Lower Greensand, Kimmeridge Clay, Ampthill Clay	Coprolite
6	809.0	NW	542700, 261100	Cambridge, Cambridgeshire	-	Gault , Lower Greensand, Kimmeridge Clay, Ampthill Clay	Coprolite

3.6 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.

3.7 Brine Extraction

This dataset provides information from the Brine Compensation Board which has been discontinued and is now covered by the Coal Authority.

Are there any Brine Extraction areas within 1000m of the study site boundary? **No**

Database searched and no data found.

3.8 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**

Database searched and no data found.

3.9 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. More detailed information on potential Tin Mining may be found in Section 3.4 – Non-Coal Mining Hazards.

Are there any Tin Mining areas within 1000m of the study site boundary? **No**

Database searched and no data found.

3.10 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**

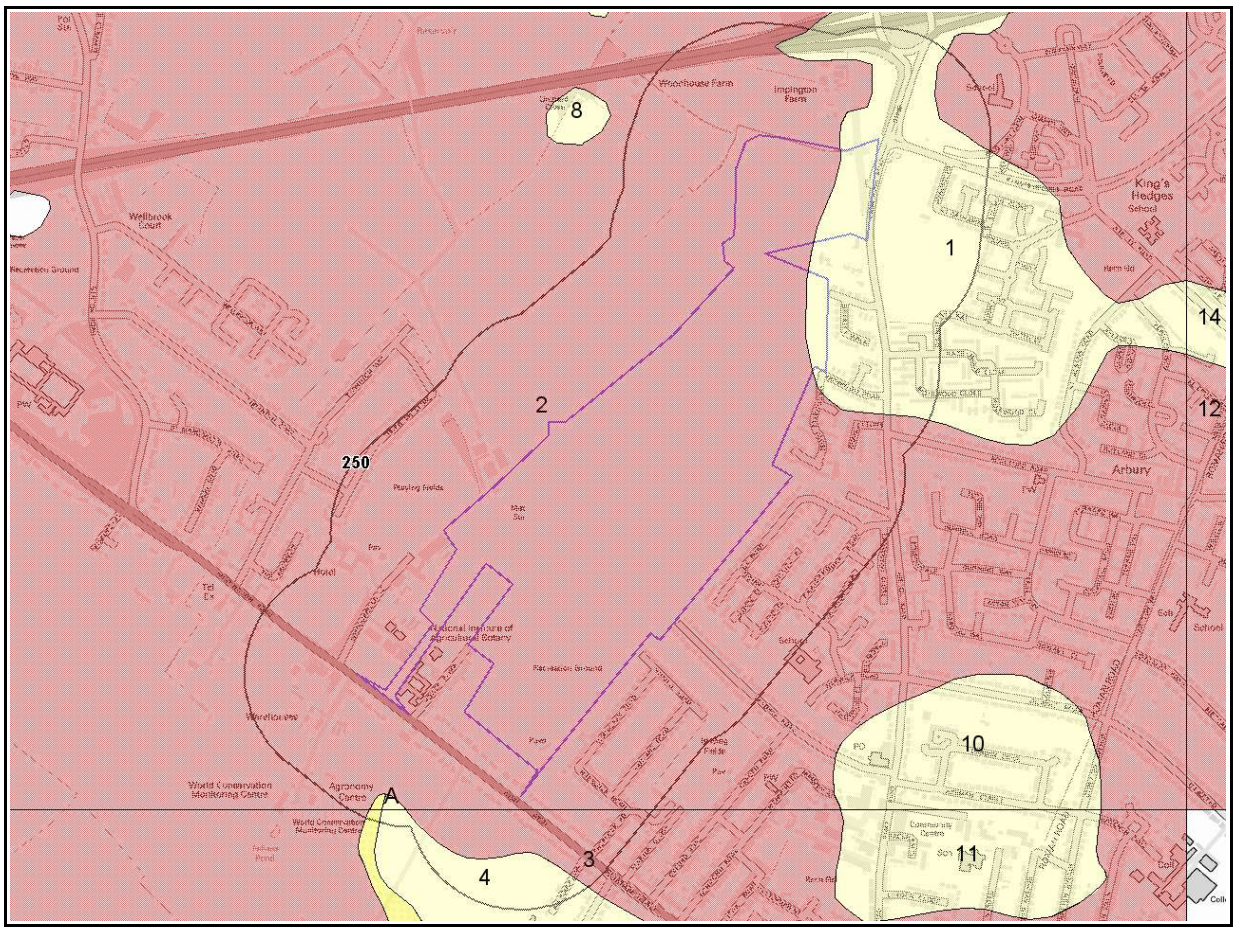
Database searched and no data found.

4. Natural Ground Subsidence
4.1 Shrink-Swell Clay Map

NW N NE

W E

SW S SE



Shrink-Swell Clay Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

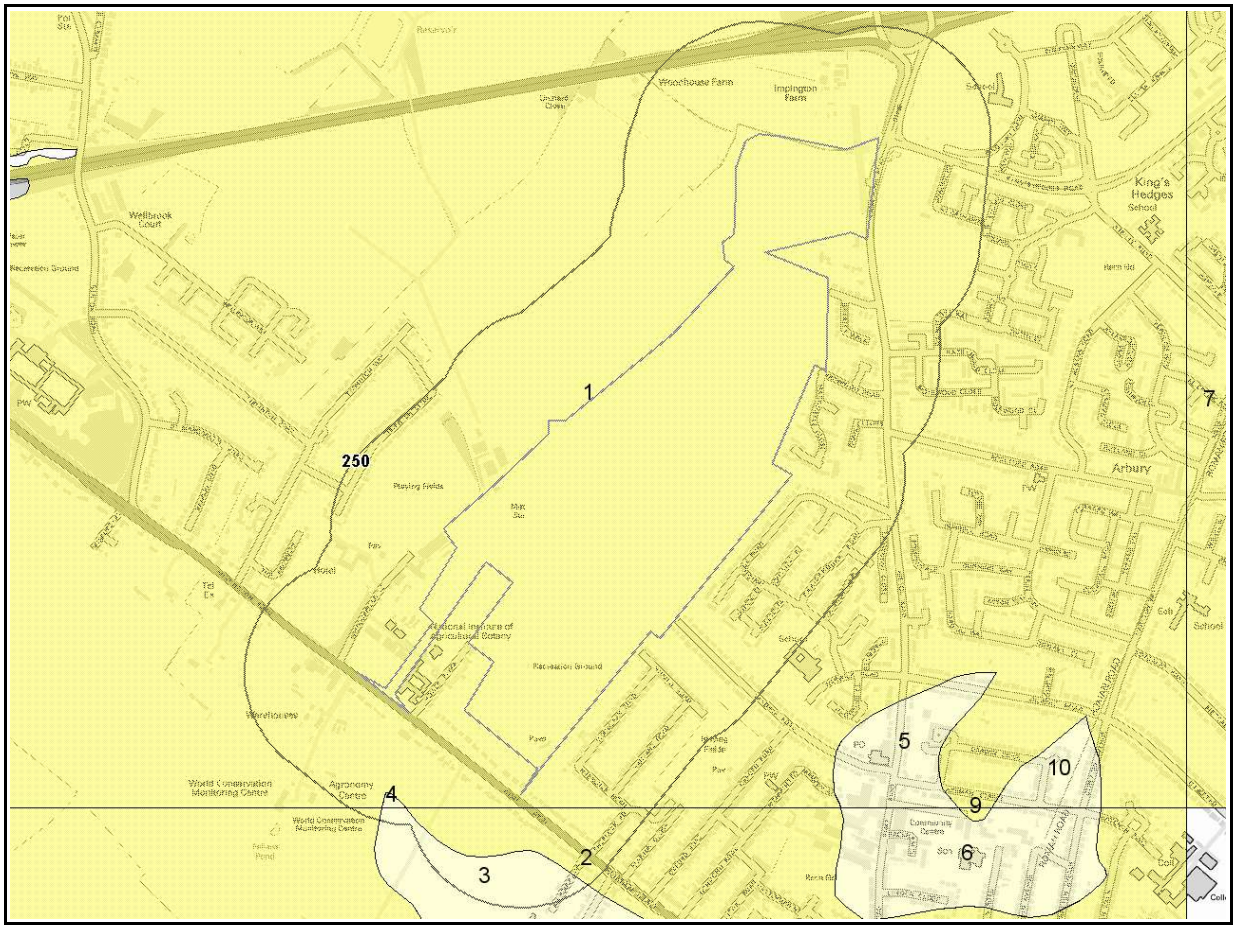
Low
Moderate
High

4.2 Landslides Map

NW N NE

W E

SW S SE



Landslides Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

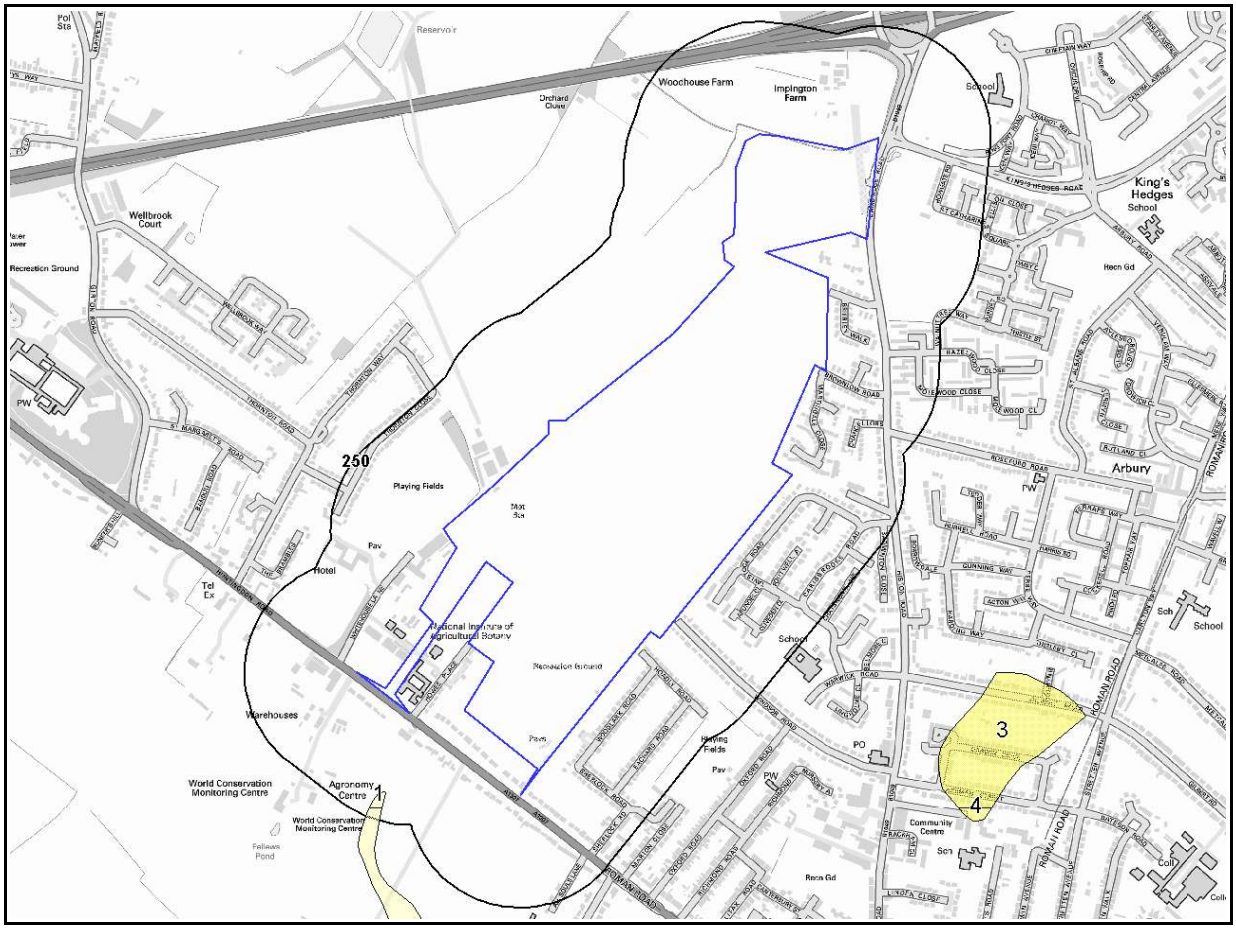
Low
Moderate
High

4.3 Ground Dissolution Soluble Rocks Map

NW N NE

W E

SW S SE



Ground Dissolution Soluble Rocks Legend

Enabled by Ordnance Survey

Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

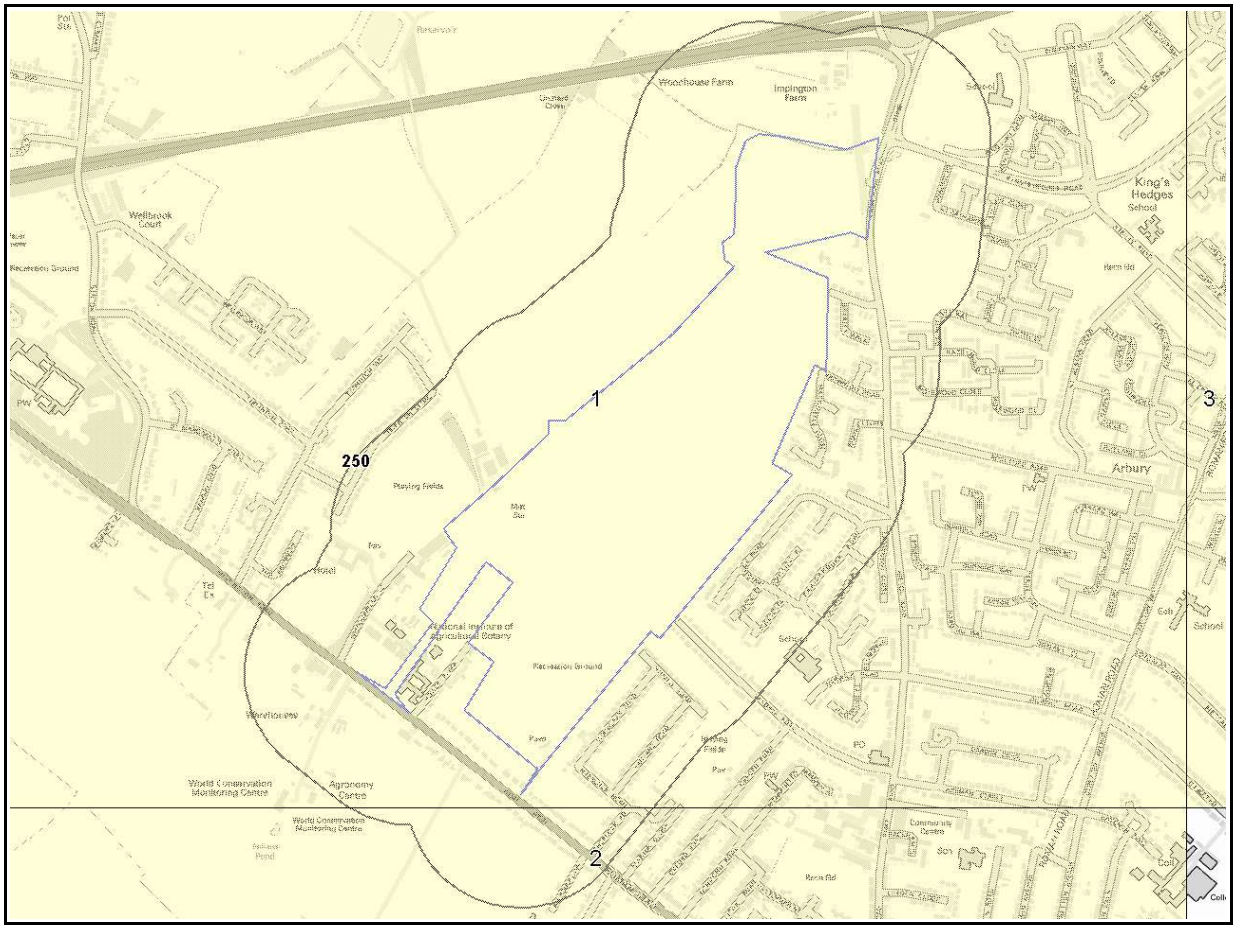
High

4.4 Compressible Deposits Map

NW N NE

W E

SW S SE



Compressible Deposits Legend

Enabled by Ordnance Survey

Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

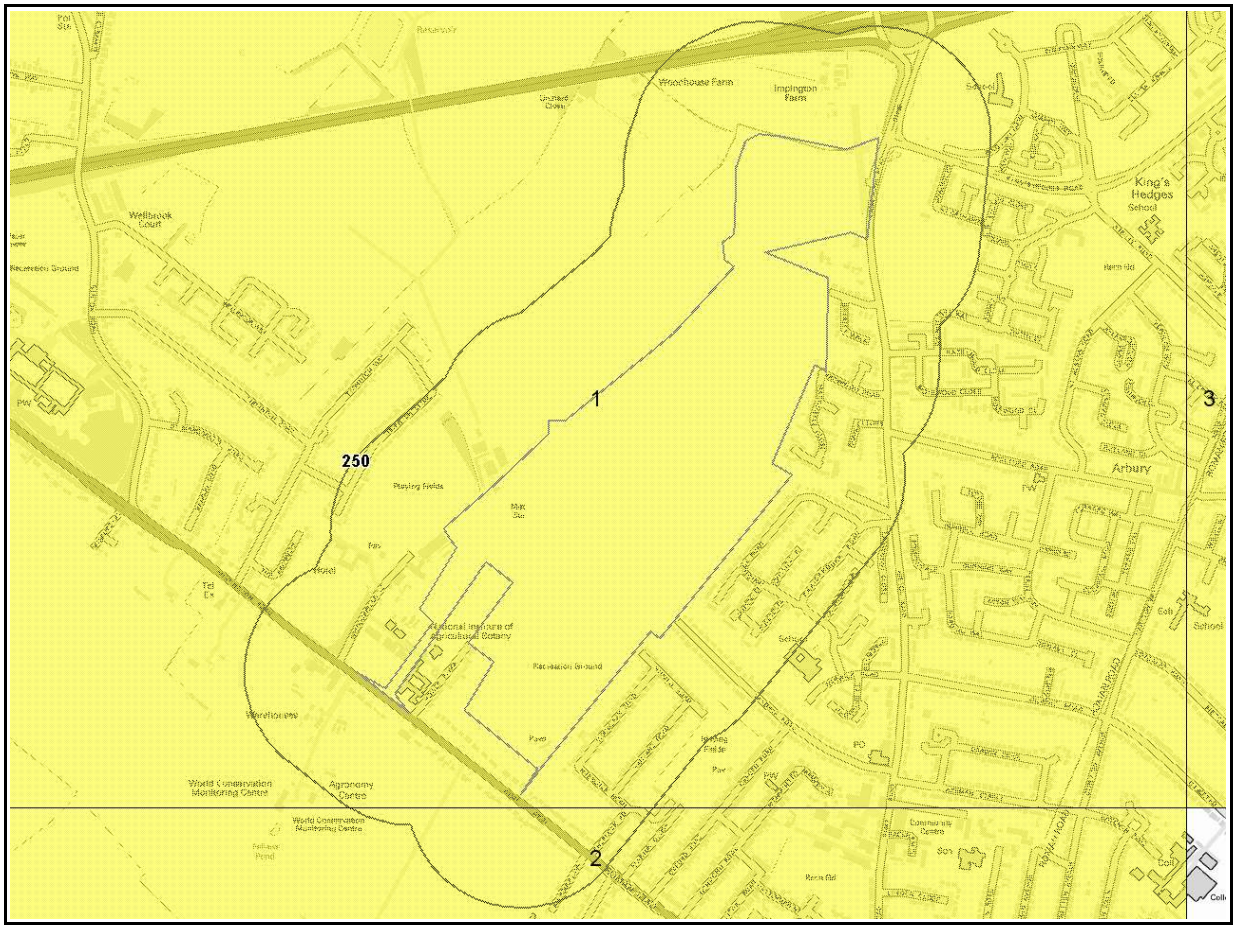
High

4.5 Collapsible Deposits Map

NW N NE

W E

SW S SE



Collapsible Deposits Legend

Enabled by Ordnance Survey

Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

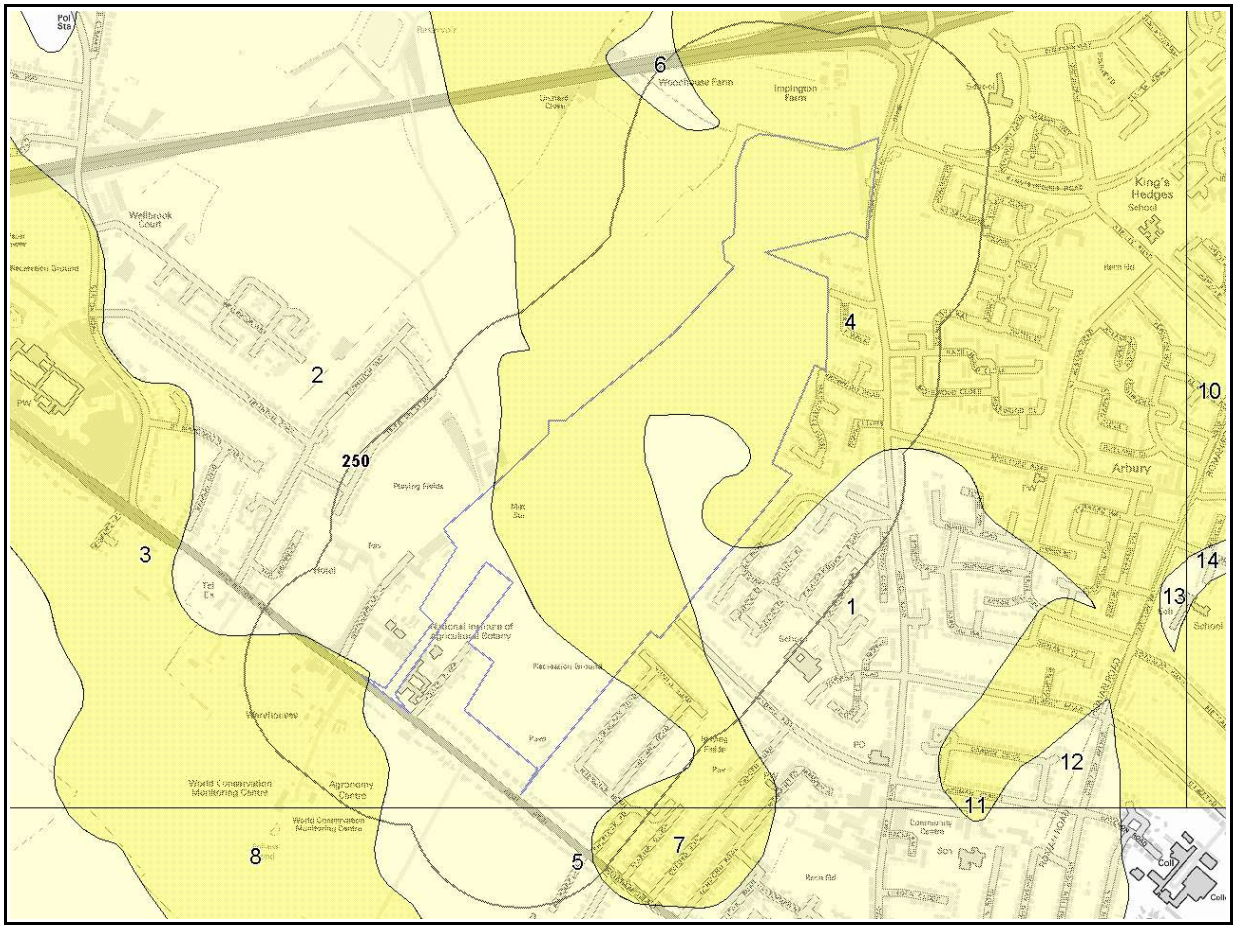
High

4.6 Running Sand Map

NW N NE

W E

SW S SE



Running Sand Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

4.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

4.1 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	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.
2	0.0	On Site	Moderate	Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. 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 probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.
3	26.0	S	Moderate	Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. 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 probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.

4.2 Landslides

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	26.0	S	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.

*This includes an automatically generated 50m buffer zone around the study site boundary.

4.3 Ground Dissolution of Soluble Rocks

The following Soluble Rocks information provided by the British Geological Survey:

Distance (m)*	Direction	Hazard Rating	Details
0.0	On site	Null-Negligible	Soluble rocks are not present in the search area. 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.

4.4 Compressible Deposits

The following Compressible Ground 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	26.0	S	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.

4.5 Collapsible Deposits

The following Collapsible Rocks information is provided by the British Geological Survey:

ID	Distance (m)*	Direction	Hazard Rating	Details
1	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.
2	26.0	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.

4.6 Running Sands

The following Running Sands information is 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.
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	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.

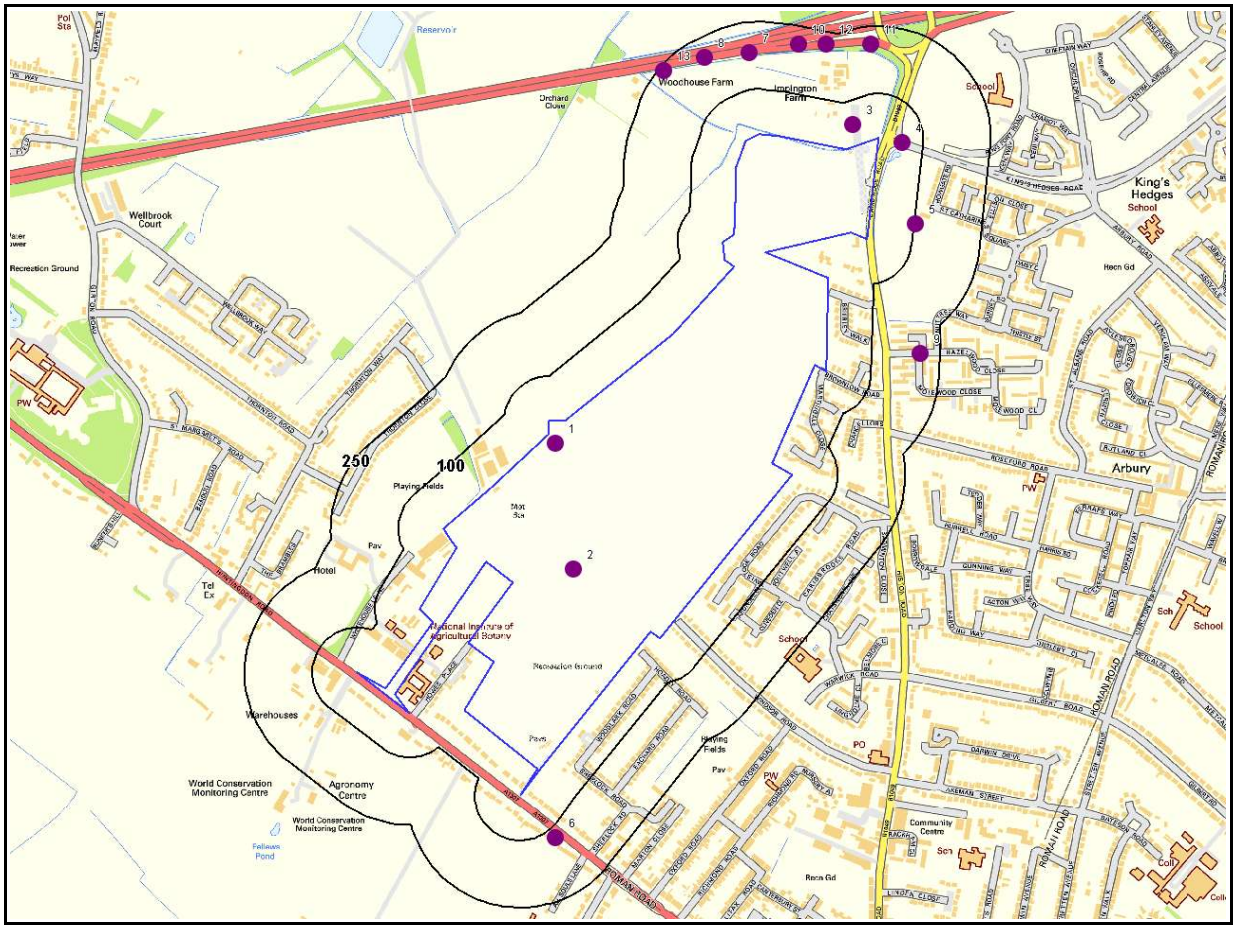
4	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
5	26.0	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.

5. Borehole Records Map

NW N NE

W E

SW S SE



Borehole Records Legend

Site Outline

Borehole Locations

125
250
Search Buffers (m)

5.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: **13**

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length (m)	Borehole Name
1	0.0	On Site	543600,260810	TL46SW168	42.67	HUNTINGDON ROAD, CAMBRIDGE
2	0.0	On Site	543640,260530	TL46SW144	5.0	WHITE HOUSE, HISTON
3	46.0	N	544260,261520	TL46SW126	1.0	CAMBRIDGE NORTHERN BY-PASS B5107
4	54.0	E	544370,261480	TL46SW127	2.0	CAMBRIDGE NORTHERN BY-PASS A5107A
5	104.0	E	544400,261300	TL46SW190	5.18	CAMBRIDGE ROAD IMPINGTON
6	124.0	SE	543600,259930	TL45NW176	3.0	CAMBRIDGE 1
7	180.0	N	544030,261680	TL46SW119	4.0	CAMBRIDGE NORTHERN BY-PASS A5098
8	206.0	NW	543930,261670	TL46SW118	3.0	CAMBRIDGE NORTHERN BY-PASS A5097
9	207.0	E	544410,261010	TL46SW165	11.0	SEWAGE PUMPING STATION, CHESTERTON
10	208.0	N	544140,261700	TL46SW120	5.5	CAMBRIDGE NORTHERN BY-PASS A5099
11	210.0	N	544300,261700	TL46SW122	18.0	CAMBRIDGE NORTHERN BY-PASS B5105-A
12	220.0	N	544200,261700	TL46SW121	24.0	CAMBRIDGE NORTHERN BY-PASS B5100-5104
13	238.0	NW	543840,261640	TL46SW117	2.0	CAMBRIDGE NORTHERN BY-PASS A5096

Additional online information is available for the following boreholes listed above:

#1: http://scans.bgs.ac.uk/sobi_scans/boreholes/543268
#2: http://scans.bgs.ac.uk/sobi_scans/boreholes/543244
#3: http://scans.bgs.ac.uk/sobi_scans/boreholes/543226
#4: http://scans.bgs.ac.uk/sobi_scans/boreholes/543227
#5: http://scans.bgs.ac.uk/sobi_scans/boreholes/543290
#6: http://scans.bgs.ac.uk/sobi_scans/boreholes/542517
#7: http://scans.bgs.ac.uk/sobi_scans/boreholes/543219
#8: http://scans.bgs.ac.uk/sobi_scans/boreholes/543218
#9: http://scans.bgs.ac.uk/sobi_scans/boreholes/543265
#10: http://scans.bgs.ac.uk/sobi_scans/boreholes/543220
#11: http://scans.bgs.ac.uk/sobi_scans/boreholes/543222
#12: http://scans.bgs.ac.uk/sobi_scans/boreholes/543221
#13: http://scans.bgs.ac.uk/sobi_scans/boreholes/543217

6.Estimated Background Soil Chemistry

Records of background estimated soil chemistry within 250m of the study site boundary: 12

For further information on how this data is calculated and limitations upon its use, please see the GroundSure GeoInsight User Guide, available on request.

			Estimated Geometric Mean Soil Concentrations (mg/kg)				
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 - 30 mg/kg	<150 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<150 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<150 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<150 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<150 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<150 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<150 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	45 - 60 mg/kg	<150 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	45 - 60 mg/kg	<150 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<150 mg/kg
2.0	SE	RuralSoil	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<150 mg/kg
26.0	S	RuralSoil	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<150 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.

7. Contacts

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sales@emapsite.com

British Geological Survey Enquiries
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Email: enquiries@bgs.ac.uk
Web: www.bgs.ac.uk
BGS Geological Hazards Reports and general geological enquiries

British Gypsum
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Tel: 0845 762 6848
DX 716176 Mansfield 5 www.coal.gov.uk

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Email: enquiries.gs@jpb.co.uk
Website: www.jpb.co.uk

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Acknowledgements

Standard Terms and Conditions

1 Definitions

In these conditions unless the context otherwise requires:

"Beneficiary" means the Client or the customer of the Client for whom the Client has procured the Services.

"Commercial" means any building which is not Residential.

"Commission" means an order for Consultancy Services submitted by a Client.

"Consultancy Services" mean consultancy services provided by GroundSure including, without limitation, carrying out interpretation of third party and in-house environmental data, provision of environmental consultancy advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.

"Contract" means the contract between GroundSure and the Client for the performance of the Services which arises upon GroundSure's acceptance of an Order or Commission and which shall incorporate these conditions, the relevant GroundSure User Guide, proposal by GroundSure and the content of any subsequent report, and any agreed amendments in accordance with clause 11.

"Client" means the party that submits an Order or Commission.

"Data Provider" means any third party providing Third Party Content to GroundSure.

"Data Report" means reports comprising factual data with no professional interpretation in respect of the level of likely risk and/or liability available from GroundSure.

"GroundSure" means GroundSure Limited, a company registered in England and Wales under number 03421028 and whose registered office is at Greater London House, Hampstead Road, London NW1 7EJ.

"GroundSure Materials" means all materials prepared by GroundSure as a result of the provision of the Services, including but not limited to Data Reports, Mapping and Risk Screening Reports.

"Intellectual Property" means any patent, copyright, design rights, service marks, moral rights, data protection rights, know-how, trade mark or any other intellectual property rights.

"Mapping" an historical map or a combination of historical maps of various ages, time periods and scales available from GroundSure.

"Order" means an order form submitted by the Client requiring Services from GroundSure in respect of a specified Site.

"Order Website" means online platform via which Orders may be placed.

"Report" means a Risk Screening Report or Data Report for commercial or residential property available from GroundSure relating to the Site prepared in accordance with the specifications set out in the relevant User Guide.

"Residential" means any building used as or suitable for use as an individual dwelling.

"Risk Screening Report" means one of GroundSure's risk screening reports, comprising factual data with interpretation in respect of the level of likely risk and/or liability, excluding **"Consultancy Services"**.

"Services" means the provision of any Report, Mapping or Consultancy Services which GroundSure has agreed to carry out for the Client/Beneficiary on these terms and conditions in respect of the Site.

"Site" means the landsite in respect of which GroundSure provides the Services.

"Third Party Content" means any data, database or other information contained in a Report or Mapping which is provided to GroundSure by a Data Provider.

"User Guide" means the relevant current version of the user guide, available upon request from GroundSure.

2 Scope of Services

2.1 GroundSure agrees to carry out the Services in accordance with the Contract and to the extent set out therein.

2.2 GroundSure shall exercise all the reasonable skill, care and diligence to be expected of experienced environmental consultants in the performance of the Services.

2.3 The Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in the Contract.

2.4 Terms and conditions appearing on a Client's order form, printed stationery or other communication, including invoices, to GroundSure, its employees, servants, agents or other representatives or any terms implied by custom, practice or course of dealing shall be of no effect and these terms and conditions shall prevail over all others.

2.5 If a Client/Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to procure such insurance, but makes no warranty that such insurance shall be available from insurers or offered on reasonable terms. GroundSure does not endorse or recommend any particular insurance product, policy or insurer. Any insurance purchased shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. The Client/Beneficiary should take independent advice to ensure that the insurance policy requested and/or offered is suitable for its requirements.

2.6 GroundSure's quotations/proposals are valid for a period of 30 days only. GroundSure reserves the right to withdraw any quotation at any time before GroundSure accepts an Order or Commission. GroundSure's acceptance of an Order or Commission shall be effective only where such acceptance is in writing and signed by GroundSure's authorised representative or where accepted via GroundSure's Order Website.

3 The Client's obligations

3.1 The Client shall ensure the Beneficiary complies with and is bound by the terms and conditions set out in the Contract and shall provide that Groundsure may in its own right enforce such terms and conditions against the Beneficiary pursuant to the Contracts (Rights of Third parties) Act 1999. The Client shall be liable for all breaches of the Contract by the Beneficiary as if they were breaches by the Client. The Client shall be solely responsible for ensuring that the Report/Mapping ordered is appropriate and suitable for the Beneficiary's needs.

3.2 The Client shall (or shall procure that the Beneficiary shall) supply to GroundSure as soon as practicable and without charge all information necessary and accurate relevant data including any specific and/or unusual environmental information relating to the Site known to the Client/Beneficiary which may pertain to the Services and shall give such assistance as GroundSure shall reasonably require in the performance of the Services (including, without limitation, access to a Site, facilities and equipment as agreed in the Contract).

3.3 Where Client/Beneficiary approval or decision is required, such approval or decision shall be given or procured in reasonable time as not to delay or disrupt the performance of any other part of the Services.

3.4 The Client shall not and shall not knowingly permit the Beneficiary to, save as expressly permitted by these terms and conditions, re-sell, alter, add to, amend or use out of context the content of any Report, Mapping or, in respect of any Services, information given by GroundSure. For the avoidance of doubt, the Client and Beneficiary may make the Report, Mapping or GroundSure's findings available to a third party who is considering acquiring the whole or part of the Site, or providing funding in relation to the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.

3.5 The Client is responsible for maintaining the confidentiality of its user name and password if using GroundSure's internet ordering service and accepts responsibility for all activity that occurs under such account and password.

4 Reliance

4.1 Upon full payment of all relevant fees and subject to the provisions of these terms and conditions, the Client and Beneficiary are granted an irrevocable royalty-free licence to access the information contained in a Report, Mapping or in a report prepared by GroundSure in respect of or arising out of Consultancy Services. The Services may only be used for the benefit of the Client and those persons listed in clauses 4.2 and 4.3.

4.2 In relation to Data Reports, Mapping and Risk Screening Reports, the Client shall be entitled to make Reports available to (i) the Beneficiary, (ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate), (iv) the first purchaser or first tenant of the Site (v) the professional advisers and lenders of the first purchaser or tenant of the Site. Accordingly GroundSure shall have the same duties and obligations to those persons in respect of the Services as it has to the Client and those persons shall have the benefit of any of the Client's rights under the Contract as if those persons were parties to the Contract. For the avoidance of doubt, the limitations of GroundSure's liability as set out in clauses 7 and 11.6 shall apply.

4.3 In relation to Consultancy Services, reliance shall be limited to the Client, Beneficiary and named parties on the Report.

4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise agreed in writing with GroundSure, any other party considering the information supplied by GroundSure as part of the Services, including (but not limited to) insurance underwriters, does so at their own risk and GroundSure has no legal obligations to such party unless otherwise agreed in writing.

4.5 The Client shall not and shall not knowingly permit any person (including the Beneficiary) who is provided with a copy of any Report, (except as permitted herein or by separate agreement with GroundSure) to,: (a) remove, suppress or modify any trade mark, copyright or other proprietary marking from the Report or Mapping; (b) create any product which is derived directly or indirectly from the data contained in the Report or Mapping; (c) combine the Report or Mapping with, or incorporate the Report or Mapping into any other information data or service; or (d) re-format or otherwise change (whether by modification, addition or enhancement) data or images contained in the Report or Mapping.

4.6 Notwithstanding clause 4.5, if the Client acts in a professional capacity, it may make reasonable use of a Report and/or findings made as a result of Consultancy Services to advise Beneficiaries. However, GroundSure shall have no liability in respect of any opinion or report given to such Beneficiaries by the Client or a third party.

5 Fees and Disbursements

5.1 GroundSure shall charge the Client fees at the rate and frequency specified in the Contract together, in the case of Consultancy Services, with all proper disbursements incurred by GroundSure in performing the Services. For the avoidance of doubt, the fees payable for the Services are as set out in GroundSure's written proposal, Order Website or Order acknowledgement form. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services.

5.2 Unless GroundSure requires prepayment, the Client shall promptly pay all fees disbursements and other monies due to GroundSure in full without deduction, counterclaim or set off together with such value added tax or other tax as may be required within 30 days from the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client (**"Payment Date"**). GroundSure reserves the right to charge interest which shall accrue on a daily basis from 30 days after the date of Payment Date until the date of payment (whether before or after judgment) at the rate of five per cent per annum above the Bank of England base rate from time to time.

5.3 In the event that the Client disputes the amount payable in respect of GroundSure's invoice it shall notify GroundSure no later than 28 days after the date thereof that it is in dispute. In default of such notification the Client shall be deemed to have agreed the amount thereof. As soon as reasonably practicable following receipt of a notification in respect of any disputed invoice, a member of the management team at GroundSure shall contact the Client and the parties shall use all reasonable endeavours to resolve the dispute.

6 Intellectual Property and Confidentiality

6.1 Subject to the provisions of clause 4.1, the Client and the Beneficiary hereby acknowledge that all Intellectual Property in the Services and Content are and shall remain owned by either GroundSure or the Data Providers and nothing in these terms purports to transfer or assign any rights to the Client or the Beneficiary in respect of the Intellectual Property.

6.2 The Client shall acknowledge the ownership of the **Third Party** Content where such **Third Party** Content is incorporated or used in the Client's own documents, reports, systems or services whether or not these are supplied to a third party.

6.3 Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.

6.4 The Client acknowledges that the proprietary rights subsisting in copyright, database rights and any other intellectual property rights in respect of any data and information contained in any Report are and shall remain (subject to clause 11.1) the property of GroundSure and/or any third party that has supplied data or information used to create a Report, and that these conditions do not purport to grant, assign or transfer any such rights in respect thereof to a Client and/or a Beneficiary.

6.5 The Client shall (and shall procure that any recipients of the Report as permitted under clause 4.2 shall):

(i) not remove, suppress or modify any trademark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;

(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;
(iii) not create any product or report which is derived directly or indirectly from the data contained in the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);
(iv) not combine the Services with or incorporate such Services into any other information data or service; and
(v) not reformat or otherwise change (whether by modification, addition or enhancement), data contained in the Services (save that those acting in a professional capacity to the Beneficiary shall not be in breach of this clause 6.5(v) where such reformatting is in the normal course of providing advice based upon the Services),
in each case of parts (iii) to (v) inclusive, whether or not such product or report is produced for commercial profit or not.

6.6 The Client and/or Beneficiary shall and shall procure that any party to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.

6.8 Save as otherwise set out in these terms and conditions, any information provided by one party ("**Disclosing Party**") to the other party ("**Receiving Party**") shall be treated as confidential and only used for the purposes of these terms and conditions, except in so far as the Receiving Party is authorised by the Disclosing Party to provide such information in whole or in part to a third party.

7 Liability

THE CLIENT'S ATTENTION IS DRAWN TO THIS PROVISION

7.1Subject to the provisions of this clause 7, GroundSure shall be liable to the Beneficiary only in relation to any direct losses or damages caused by any negligent act or omission of GroundSure in preparing the GroundSure Materials and provided that the Beneficiary has used all reasonable endeavours to mitigate any such losses.

7.2GroundSure shall not be liable for any other losses or damages incurred by the Beneficiary, including but not limited to:
(i) loss of profit, revenue, business or goodwill, losses relating to business interruption, loss of anticipated savings, loss of or corruption to data or for any special, indirect or consequential loss or damage which arise out of or in connection with the GroundSure Materials or otherwise in relation to a Contract;
(ii) any losses or damages that arise as a result of the use of all or part of the GroundSure Materials in breach of these terms and conditions or contrary to the terms of the relevant User Guide;
(iii) any losses or damages that arise as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such part is based on any Third Party Content or any reasonable interpretation of Third Party Content. The Client accepts, and shall procure that any other Beneficiary shall accept, that it has no claim or recourse to any Data Provider in relation to Third Party Content; and/or
(iv) any loss or damage to a Client's computer, software, modem, telephone or other property caused by a delay or loss of use of GroundSure's internet ordering service.

7.3 GroudSure's total liability in contract, tort (including negligence or breach of statutory duty), misrepresentation, restitution or otherwise, arising in connection with the GroundSure Materials or otherwise in relation to the Contract shall be limited to £10 million in total (i) for any one claim or (ii) for a series of connected claims brought by one or more parties.

7.4 For the duration of the liability periods set out in clauses 7.5 and 7.6 below, GroundSure shall maintain professional indemnity insurance in respect of its liability under these terms and conditions provided such insurance is readily available at commercially viable rates. GroundSure shall produce evidence of such insurance if reasonably requested by the Client. A level of cover greater than GroundSure's current level of cover may be available upon request and agreement with the Client.

7.5 Any claim under the Contract in relation to Data Reports, Mapping and Risk Screening Reports, must be brought within six years from the date when the Beneficiary became aware that it may have a claim and in no event may a claim be brought twelve years or more after completion of such a Contract. For the avoidance of doubt, any claim in respect of which proceedings are notified to GroundSure in writing prior to the expiry of the time periods referred to in this clause 7.5 shall survive the expiry of those time periods provided the claim is actually commenced within six months of notification.

7.6 Any claim under the Contract in relation to Consultancy Services, must be brought within six years from the date the Consultancy Services were completed.

7.7 he Client accepts and shall procure that any other Beneficiary shall accept that it has no claim or recourse to any Data Provider or to GroundSure in respect of the acts or omissions of any Data Provider and/or any Third Party Content provided by a Data Provider.

7.8 Nothing in these terms and conditions:
(i) excludes or limits the liability of GroundSure for death or personal injury caused by GroundSure's negligence, or for fraudulent misrepresentation; or
(ii) shall affect the statutory rights of a consumer under the applicable legislation.

8 GroundSure right to suspend or terminate

8.1 In the event that GroundSure reasonably believes that the Client or Beneficiary as applicable has not provided the information or assistance required to enable the proper performance of the Services, GroundSure shall be entitled on fourteen days written notice to suspend all further performance of the Services until such time as any such deficiency has been made good.

8.2 GroundSure may additionally terminate the Contract immediately on written notice in the event that:
(i)the Client shall fail to pay any sum due to GroundSure within 28 days of the Payment Date; or
(ii)the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an Administration Order made against it or if a Receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or
(iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or
(iv)the Client or the Beneficiary breaches any material term of the Contract (including, but not limited to, the obligations in clause 4) incapable of remedy or if remediable, is not remedied within 14 days of notice of the breach.

9 Client's Right to Terminate and Suspend

9.1 Subject to clause 10.2, the Client may at any time after commencement of the Services by notice in writing to GroundSure require GroundSure to terminate or suspend immediately performance of all or any of the Services.

9.2 The Client waives all and any right of cancellation it may have under the Consumer Protection (Distance Selling) Regulations 2000 (as amended) in respect of the Order of a Report/Mapping. This does not affect the Beneficiary's statutory rights.

10 Consequences of Withdrawal, Termination or Suspension

10.1 Upon termination or any suspension of the Services, GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client/Beneficiary any property of the Client/ Beneficiary in GroundSure's possession or control.

10.2 In the event of termination/suspension of the Contract under clauses 8 or 9, the Client shall pay to GroundSure all and any fees payable in respect of the performance of the Services up to the date of termination/suspension. In respect of any Consultancy Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination/suspension of the Contract.

11 General

11.1 The mapping contained in the Services is protected by Crown copyright and must not be used for any purpose outside the context of the Services or as specifically provided in these terms.

11.2 GroundSure reserves the right to amend these terms and conditions. No variation to these terms shall be valid unless signed by an authorised representative of GroundSure.

11.3 No failure on the part of GroundSure to exercise and no delay in exercising, any right, power or provision under these terms and conditions shall operate as a waiver thereof.

11.4 Save as expressly provided in clauses 4.2, 4.3, 6.3 and 11.5, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.

11.5 The Secretary of State for Communities and Local Government acting through Ordnance Survey may enforce breach of clause 6.1 of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.

11.6 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:
(i) the Client or Beneficiary's failure to provide facilities, access or information;
(ii) fire, storm, flood, tempest or epidemic;
(iii) Acts of God or the public enemy;
(iv) riot, civil commotion or war;
(v) strikes, labour disputes or industrial action;
(vi) acts or regulations of any governmental or other agency;
(vii) suspension or delay of services at public registries by Data Providers; or
(viii) changes in law.

11.7 Any notice provided shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.

11.8 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email and on the second working day after the day of posting if sent by first class post.

11.9 The Contract constitutes the entire contract between the parties and shall supersede all previous arrangements between the parties.

11.10 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.

11.11 These terms and conditions shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with these terms and conditions shall be subject to the exclusive jurisdiction of the English courts.

11.12 If the Client or Beneficiary has a complaint about the Services, notice can be given in any format eg writing, phone, email to the Compliance Officer at GroundSure who will respond in a timely manner.

EmapSite
Masdar House, ,
Eversley, RG27 0RP

GroundSure Reference:	EMS-176835_260485
Your Reference:	EMS_176835_260485
Report Date:	Aug 23, 2012
Report Delivery Method:	**Email - pdf**
Client Email:	sales@emapsite.com

GroundSure EnviroInsight

Address: NIAB 1,Huntingdon Road,Cambridge,CB3 0LE

Dear Sir/Madam,

Thank you for placing your order with emapsite. Please find enclosed the GroundSure EnviroInsight as requested

If you would like further assistance regarding this report then please contact the emapsite customer services team on 0118 9736883 quoting the above report reference number.

Yours faithfully,

emapsite customer services team

Enc.
GroundSure EnviroInsight

GroundSure EnviroInsight

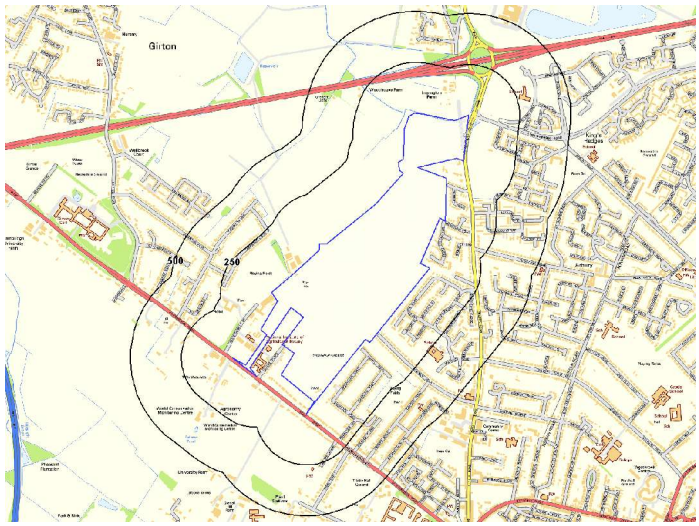
Address: NIAB 1,Huntingdon Road,Cambridge,CB3 0LE

Date: Aug 23, 2012

GroundSure Reference: EMS-176835_260485

Your Reference: EMS_176835_260485

Client: EmapSite



Brought to you by emapsite

Aerial Photograph of Study Site

NW ▲ N NE

◄W E►

SW ▼ S SE

Site Name: NIAB 1,Huntingdon Road,Cambridge,CB3 0LE
Grid Reference: 543818,260766
Size of Site: 54.59 ha

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.

Report Section	Number of records found within (X) m of the study site boundary					
1. Environmental Permits, Incidents and Registers	on-site	0-50	51-250	251-500	501-1000	1000-1500
1.1 Industrial Sites Holding Environmental Permits and/or Authorisations						
Records of historic IPC Authorisations	0	0	0	0	-	-
Records of Part A(1) and IPPC Authorised Activities	0	0	0	0	-	-
Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	0	0	0	0	-	-
Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	0	0	0	0	-	-
Records of List 1 Dangerous Substances Inventory sites	0	0	0	0	-	-
Records of List 2 Dangerous Substances Inventory sites	0	1	0	1	-	-
Records of Part A(2) and Part B Activities and Enforcements	0	0	0	1	-	-
Records of Category 3 or 4 Radioactive Substances Authorisations	0	4	1	0	-	-
Records of Licensed Discharge Consents	0	0	0	2	-	-
Records of Planning Hazardous Substance Consents and Enforcements	0	0	0	0		
1.2 Records of COMAH and NIHHS sites	0	0	0	0	-	-
1.3 Environment Agency Recorded Pollution Incidents						
National Incidents Recording System, List 2	0	0	0	-	-	-
National Incidents Recording System, List 1	0	0	0	-	-	-
1.4 Sites Determined as Contaminated Land under Part IIA EPA 1990	0	0	0	0	-	-

2. Landfill and Other Waste Sites	on-site	0-50	51-250	251-500	501-1000	1000-1500
2.1 Landfill Sites						
Environment Agency Registered Landfill Sites	0	0	0	0	0	-
Landfill Data – Operational Landfill Sites	0	0	0	0	0	-
Environment Agency Historic Landfill Sites	0	0	0	1	0	0
Landfill Data – Non-Operational Landfill Sites	0	0	0	1	0	-
BGS/DoE Landfill Site Survey	0	0	0	0	0	0
GroundSure Local Authority Landfill Sites Data	0	0	0	0	0	1
2.2 Landfill and Other Waste Sites Findings						
Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Environment Agency Licensed Waste Sites	0	0	0	0	0	0

3. Current Land Uses

	on-site	0-50	51-250	251-500	501-1000	1000-1500
3.1 Current Industrial Sites Data	2	4	23	-	-	-
3.2 Records of Petrol and Fuel Sites	0	0	0	1	-	-
3.3 Underground High Pressure Oil and Gas Pipelines	0	0	0	0	-	-

4. Geology

	Description
4.1 Are there any records of Artificial Ground and Made Ground present beneath the study site? *	No
4.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site? *	Yes
4.3 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	

Source: Scale: 1:50,000 BGS Sheet 188

* This includes an automatically generated 50m buffer zone around the site.

5. Hydrogeology and Hydrology

	on-site	0-50	51-250	251-500	501-1000	1001-2000
5.1 Are there any records of Productive Strata in the Superficial Geology within 500m of the study site?				Yes		
5.2 Are there any records of Productive Strata in the Bedrock Geology within 500m of the study site?				Yes		
5.3 Groundwater Abstraction Licences (within 2000m of the study site).	2	1	7	7	2	9
5.4 Surface Water Abstraction Licences (within 2000m of the study site).	0	0	0	0	0	1
5.5 Potable Water Abstraction Licences (within 2000m of the study site).	0	0	0	0	0	0
5.6 Are there any Source Protection Zones within 500m of the study site?					No	

5.7 River Quality	on-site	0-50	51-250	251-500	501-1000	1001-1500
Is there any Environment Agency information on river quality within 1500m of the study site?	No	No	No	No	No	No
5.8 Detailed River Network entries within 500m of the site	0	1	5	12	-	-
5.9 Surface water features within 250m of the study site	Yes	Yes	Yes	-	-	-

6. Flooding

6.1 Are there any Environment Agency indicative Zone 2 floodplains within 250m of the study site?	No
6.2 Are there any Environment Agency indicative Zone 3 floodplains within 250m of the study site?	No
6.3 Are there any Flood Defences within 250m of the study site?	No
6.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
6.5 Are there any areas used for Flood Storage within 250m of the study site?	No
6.6 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Very High
6.7 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Moderate

7. Designated Environmentally Sensitive Sites

	on-site	0-50	51-250	251-500	501-1000	1001-2000
7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	1	1	0	0
7.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0

7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	1	1	0	0
7.3 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
7.4 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
7.5 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
7.6 Records of Ramsar sites	0	0	0	0	0	0
7.7 Records of World Heritage Sites	0	0	0	0	0	0
7.8 Records of Environmentally Sensitive Areas	0	0	0	0	0	0
7.9 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
7.10 Records of National Parks	0	0	0	0	0	0
7.11 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
7.12 Records of Nitrate Vulnerable Zones	1	1	0	0	0	0

8. Natural Hazards

8.1 What is the maximum risk of natural ground subsidence?	Moderate

9. Mining

9.1 Are there any coal mining areas within 75m of the study site?	No
9.2 What is the risk of subsidence relating to shallow mining within 150m of the study site?	Negligible
9.3 Are there any brine affected areas within 75m of the study site?	No

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. 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.

2. 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.

3. 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 underground oil and gas pipelines.

4. Geology

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

5. 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.

6. Flooding

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

7. 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. These searches are conducted using radii of up to 500m.

8. 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.

9. Mining

Provides information on areas of coal and shallow mining.

10. 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

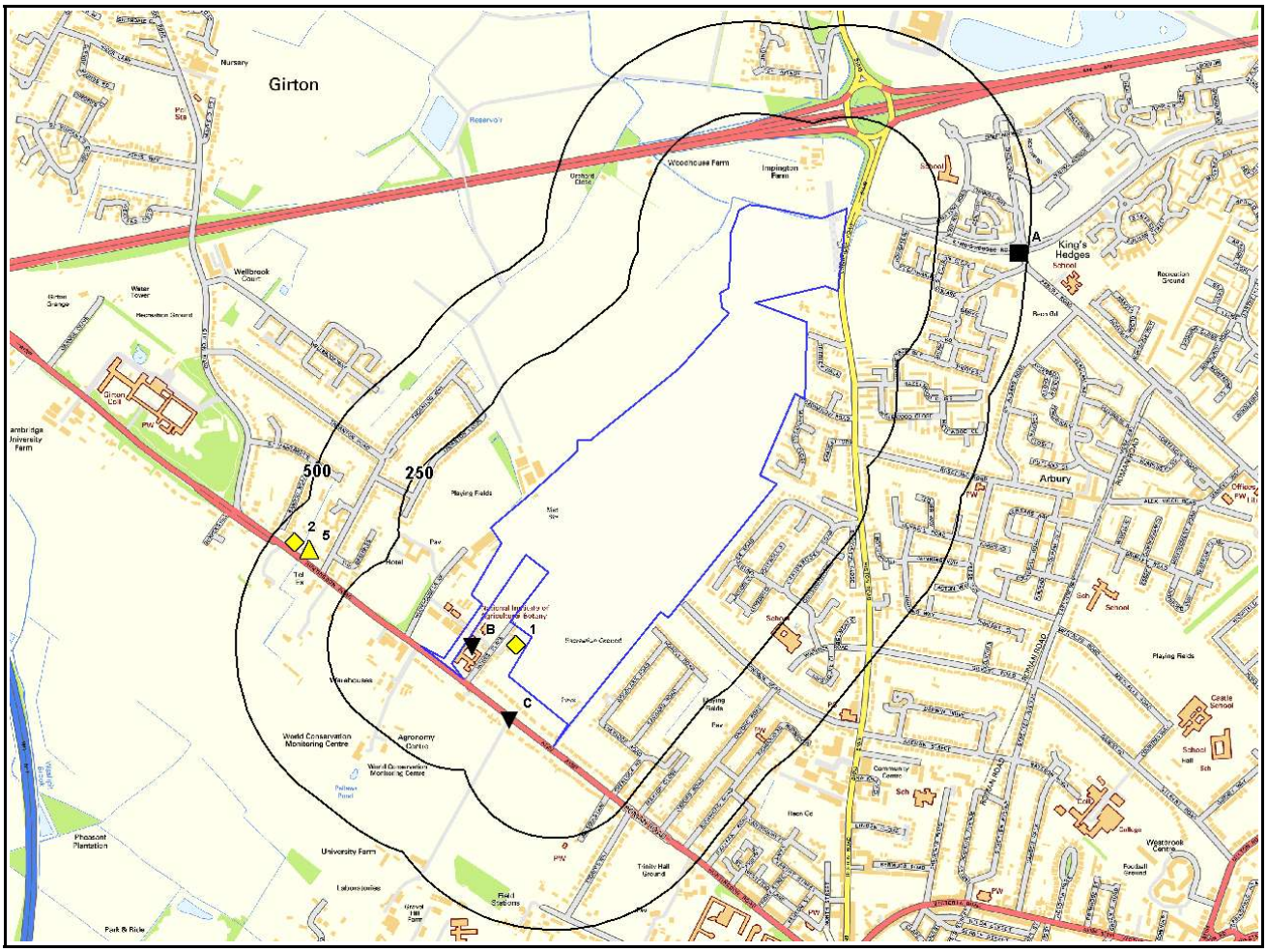
Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes 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.

1. Environmental Permits, Incidents and Registers Map

NW N NE



W E

SW S SE

Authorisations,Incidents and Registers Legend

Enabled by Ordnance Survey

- Site Outline
- Search Buffers (m) — 250 / 500
- Recorded Pollution Incident
- Dangerous Substances (List 1)
- Dangerous Substances (List 2)
- Water Industry Referrals
- Licenced Discharge Consents
- Red List Discharge Consents
- RAS 3 & 4 Authorisations
- Part A(1) Authorised Processes and Historic IPC Authorisations
- Part A(2) and Part B Authorised Processes
- COMAH / NIHHS Sites
- Sites Determined as Contaminated Land
- Hazardous Substance Consents and Enforcements

1.Environmental Permits, Incidents and Registers

1.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency and Local Authorities reveal the following information:

Records of historic IPC Authorisations within 500m of the study site: **0**

Database searched and no data found.

Records of Part A(1) and IPPC Authorised Activities within 500m of the study site: **0**

Database searched and no data found.

Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site: **0**

Database searched and no data found.

Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site: **0**

Database searched and no data found.

Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site: **0**

Database searched and no data found.

Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site: **2**

The following List 2 Dangerous Substance Inventory Site records are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance	Direction	NGR	Details	
1	25.0	NW	543420, 260300	Name: Niab Status: Not Active Receiving Water: Na	Authorised Substances: pH
2	441.0	NW	542820, 260580	Name: Pace Petroleum (girton) Status: Not Active Receiving Water: Na	Authorised Substances: pH

Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site: **1**

The following Part A(2) and Part B Activities are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance	Direction	NGR	Details

5	398.0	NW	542858, 260558	Address: Q8 Girton, Huntingdon Road Girton Cambridge CB3 0LQ Process: Unloading of Petrol Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified

Records of Category 3 or 4 Radioactive Substance Licences within 500m of the study site: 5

The following RAS Licence (3 or 4) records are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance [m]	Direction	Address	Operator	Type	Permission Number	Dates	Status
11B	19.0	SE	Niab, Huntingdon Road, Cambridge, Cambridgeshire, CB3 0LE	Niab	Disposal Of Radioactive Waste (was Rsa60 Section 6).	AC9203	Date of Approval:31/3/1991 Effective from:31/3/1991 Last date of update:2012-05-16	Revoked/ cancelled
12B	19.0	SE	National Inst Of Agricultural Botany, Plant Pathology Department,molecular Biology + Diagnostics Section,huntingdon Road, Cambridge, Cambridgeshire, CB3 0LE	National Inst Of Agricultural Botany	Keeping And Use Of Radioactive Materials (was Rsa60 Section 1).	AI1264	Date of Approval:18/6/1993 Effective from:18/6/1993 Last date of update:2012-05-16	Revoked/ cancelled
13B	19.0	SE	Niab, Huntingdon Road, Cambridge, Cambridgeshire, CB3 0LE	Niab	Keeping And Use Of Radioactive Materials (was Rsa60 Section 1).	AC9211	Date of Approval:31-3-1991 Effective from:31-3-1991 Last date of update:2003-12-01	Revoked/ cancelled
14B	19.0	SE	National Inst Of Agricultural Botany, Plant Pathology Department,molecular Biology + Diagnostics Section,huntingdon Road, Cambridge, Cambridgeshire, CB3 0LE	National Inst Of Agricultural Botany	Keeping And Use Of Radioactive Materials (was Rsa60 Section 1).	AI1264	Date of Approval:31-3-1991 Effective from:31-3-1991 Last date of update:2003-12-01	Superseded By Variation
15C	90.0	SW	Quadrant Holdings Cambridge Ltd, 181a Huntingdon Road, Cambridge, Cambridgeshire, CB3 0DJ	Quadrant Holdings Cambridge Ltd	Keeping And Use Of Radioactive Materials (was Rsa60 Section 1).	AE0193	Date of Approval:31-3-1991 Effective from:31-3-1991 Last date of update:2003-12-01	Revoked/ cancelled

Records of Licensed Discharge Consents within 500m of the study site: 2

The following Licensed Discharge Consents records are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance	Direction	NGR	Details

3A	474.0	E	544780, 261370	Address: Depot Kings Hedges Rd, Cambridge, CB4 9PQ Effluent Type: Trade Discharges - Site Drainage (contam Surface Water, Not Waste Sit Permit Number: PR1NF2419 Permit Version: 2	Receiving Water: No 1 Public Drain Status: Modified - (wra 91 Sched 10 - As Amended By Env Act 1995) Issue date: 4/4/2002 Effective Date: 4/4/2002 Revocation Date: 28/7/2003
4A	474.0	E	544780, 261370	Address: Depot Kings Hedges Rd, Cambridge, CB4 9PQ Effluent Type: Trade Discharges - Process Effluent - Not Water Company Permit Number: PR1NF2419 Permit Version: 1	Receiving Water: No 1 Public Drain Status: Pre Nra Legislation Where Issue Date < 01-sep-89 (historic Only) Issue date: 1/11/1986 Effective Date: 1/11/1986 Revocation Date: 3/4/2002

Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site: 0

Database searched and no data found.

1.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site: 0

Database searched and no data found.

1.3 Environment Agency Recorded Pollution Incidents

Records of National Incidents Recording System, List 2 within 250m of the study site: 0

Database searched and no data found.

Records of National Incidents Recording System, List 1 within 250m of the study site: 0

Database searched and no data found.

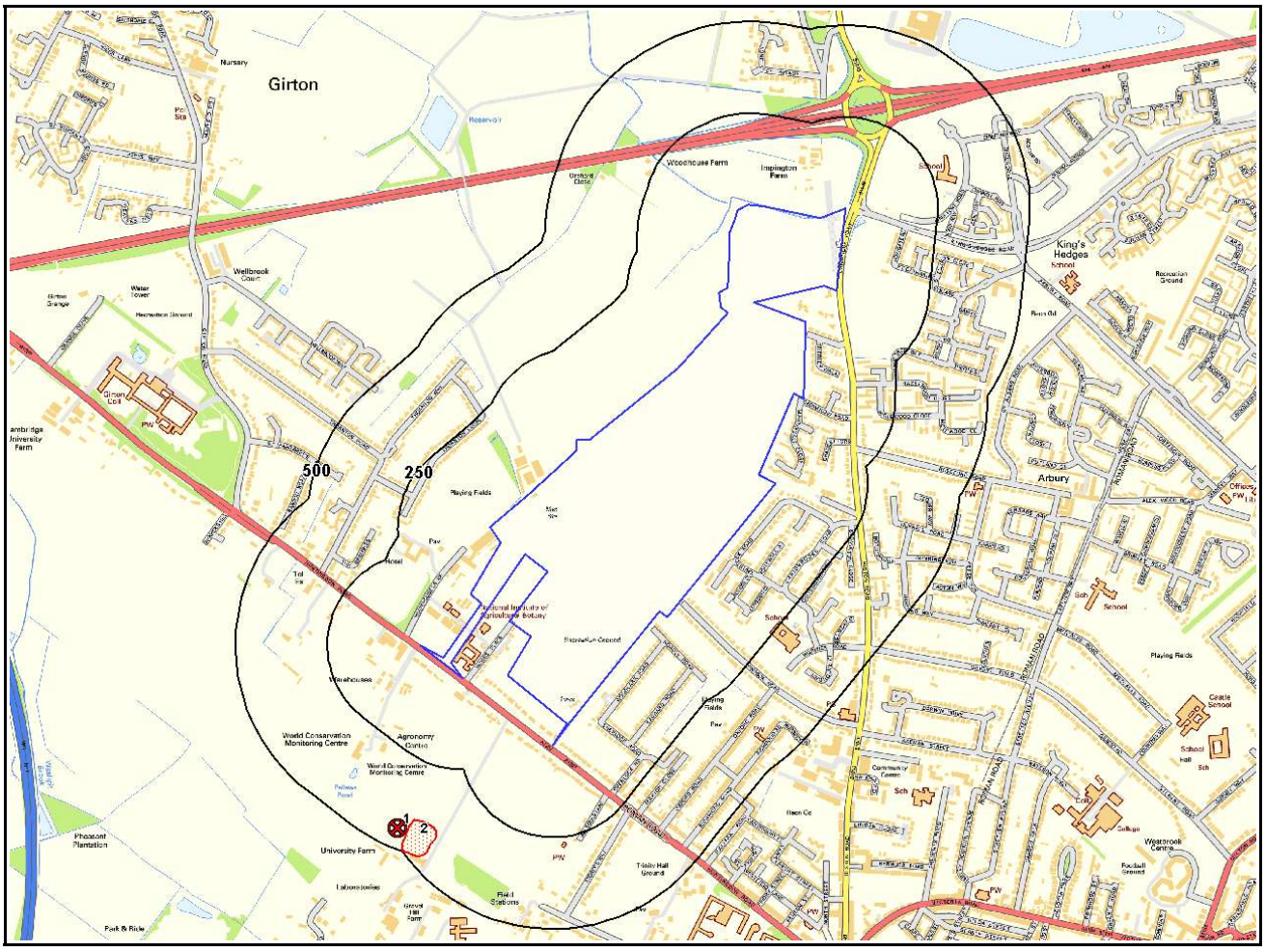
1.4 Sites Determined as Contaminated Land under Part IIA EPA 1990

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

Database searched and no data found.

2. Landfill and Other Waste Sites Map

NW ▲ N NE



◄W E►

SW ▼ S SE

Landfill & Other Waste Sites Legend

Enabled by Ordnance Survey

Site Outline

250
500
Search Buffers (m)

E.A. Active Landfill
E.A. Historic Landfill (Area Data)
E.A. Historic Landfill (Point Data)
BGS / DoE Survey Landfill
Local Authority Landfill (Area Data)
Local Authority Landfill (Point Data)

Operational Waste Treatment Licence
Closed Waste Treatment Licence
REGIS Waste Licence
Operational Landfill
Closed Landfill

2. Landfill and Other Waste Sites

2.1 Landfill Sites

Records from Environment Agency landfill data within 1000m of the study site: 0

Database searched and no data found.

Records of operational landfill sites sourced from Landmark within 1000m of the study site: 0

Database searched and no data found.

Records of Environment Agency historic landfill sites within 1500m of the study site: 1

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

ID	Distance	Direction	NGR	Details	
2	393.0	SW	543100, 259700	Site Address: Cambridge University Farm, Huntingdon Road, Cambridgeshire Waste Licence: Yes Site Reference: LS 62 Waste Type: Inert Regis Reference: -	Licence Issue: 10-Jul-1984 Licence Surrendered: 01-Oct-1987 Licence Hold Address: Ely Road, Waterbeach, Cambridge Operator: -

Records of non-operational landfill sites sourced from Landmark within 1000m of the study site: 1

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

ID	Distance	Direction	NGR	Details	
1	447.0	SW	543100, 259800	Site Address: Cambridge Univ. Farm, Huntingdon Road, CAMBRIDGE, Cambridgeshire Landfill Licence: 050ADVAL Agency Reference: Waste Type: Inert Waste Description: Inert Landfill Known Restrictions: No known restriction on source of waste	Record Date: 01-Jul-1984 Transfer Date: Modification Date: Status: Licence lapsed/cancelled/defunct/not applicable/surrendered Category: LANDFILL Regulator: EA - Anglian Region - Central Area (Ely - south) Size: Undefined

Records of BGS/DoE non-operational landfill sites within 1500m of the study site: 0

Database searched and no data found.

Records of Local Authority landfill sites within 1500m of the study site: 1

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

ID	Distance	Direction	Site Address	Source	Data Type
Not shown	1246.0	N	Refuse Tip	1968 mapping	Polygon

2.2 Other Waste Sites

Records of operational waste treatment, transfer or disposal sites within 500m of the study site: **0**

Database searched and no data found.

Records of non-operational waste treatment, transfer or disposal sites within 500m of the study site: **0**

Database searched and no data found.

Records of Environment Agency licensed waste sites within 1500m of the study site: **0**

Database searched and no data found.

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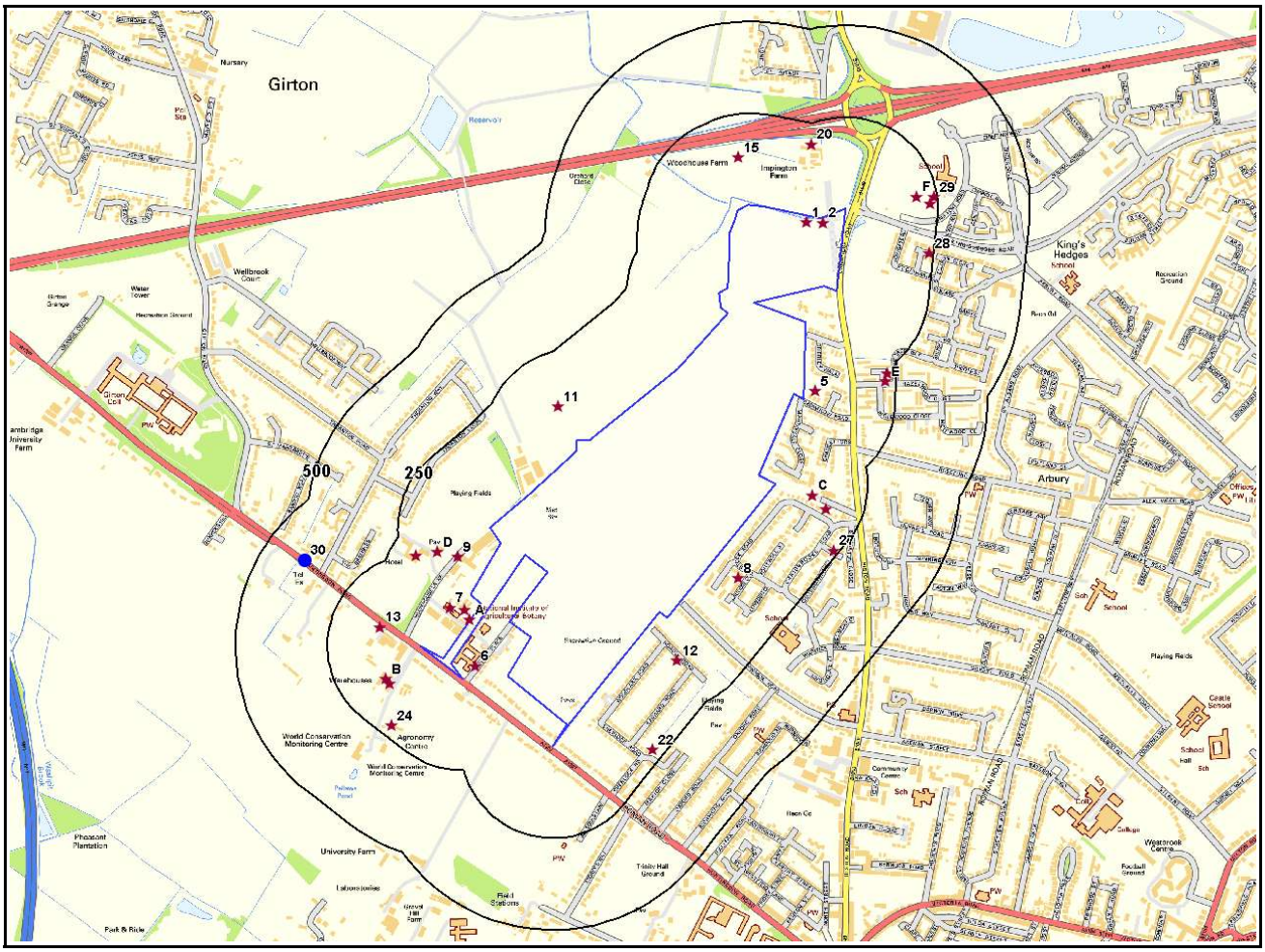
3. Current Land Use Map

NW N NE



◄W E►

SW S SE

Current Land Use Legend

Enabled by Ordnance Survey

Site Outline

250
500
Search Buffers (m)

Current Industrial Sites

Petrol & Fuel Sites

Underground High Pressure Oil & Fuel Pipelines

3. Current Land Uses

3.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 29

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

ID	Distance	Direction	Company	Address	Activity	Category
1	0.0	On Site	Pylon	CB24	Electrical Features	Infrastructure and Facilities
2	0.0	On Site	Gas Governor	CB24	Gas Features	Infrastructure and Facilities
3A	3.0	NW	Tanks	CB3	Tanks (Generic)	Industrial Features
4A	29.0	NW	Tank	CB3	Tanks (Generic)	Industrial Features
5	30.0	E	Electricity Sub Station	CB4	Electrical Features	Infrastructure and Facilities
6	48.0	NE	Electricity Sub Station	CB3	Electrical Features	Infrastructure and Facilities
7	64.0	NW	Tank	CB3	Tanks (Generic)	Industrial Features
8	82.0	SE	Electricity Sub Station	CB4	Electrical Features	Infrastructure and Facilities
9	83.0	NW	Electricity Sub Station	CB3	Electrical Features	Infrastructure and Facilities
10 C	104.0	E	Electricity Sub Station	CB4	Electrical Features	Infrastructure and Facilities
11	105.0	NW	Electricity Poles	CB24	Electrical Features	Infrastructure and Facilities
12	119.0	SE	Electricity Sub Station	CB3	Electrical Features	Infrastructure and Facilities
13	121.0	NW	Electricity Sub Station	CB3	Electrical Features	Infrastructure and Facilities
14 B	129.0	SW	Warehouses	CB3	Container and Storage	Transport, Storage and Delivery
15	132.0	N	Pylon	CB24	Electrical Features	Infrastructure and Facilities
16 B	134.0	SW	Cambridge Mobile Communications Ltd	Gusto Mills, Huntingdon Road, Cambridge, CB3 0DL	Radar and Telecommunications Equipment	Industrial Products
17 D	137.0	NW	Tank	CB3	Tanks (Generic)	Industrial Features
18 C	151.0	SE	Liz Attmore	7, Tavistock Road, Cambridge, CB4 3NB	Clothing, Components and Accessories	Consumer Products
19 D	183.0	NW	Tank	CB3	Tanks (Generic)	Industrial Features
20	192.0	N	Electricity Sub Station	CB24	Electrical Features	Infrastructure and Facilities
21F	193.0	E	Pylon	CB4	Electrical Features	Infrastructure and Facilities
22	219.0	SE	Electricity Sub Station	CB3	Electrical Features	Infrastructure and Facilities
23E	220.0	E	Pumping Station	CB4	Water Pumping Stations	Industrial Features
24	220.0	SW	Tank	CB3	Tanks (Generic)	Industrial Features
25E	224.0	E	Electricity Sub Station	CB4	Electrical Features	Infrastructure and Facilities
26F	227.0	E	Bus Depot	CB4	Bus and Coach Stations, Depots and Companies	Public Transport, Stations and Infrastructure
27	235.0	SE	Electricity Sub Station	CB4	Electrical Features	Infrastructure and Facilities
28	237.0	E	Electricity Sub Station	CB4	Electrical Features	Infrastructure and Facilities
29	241.0	E	Tank	CB4	Tanks (Generic)	Industrial Features

3.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: **1**

The following petrol or fuel site records provided by Catalist are represented as points on the Current Land Use map:

ID	Distance	Direction	NGR	Company	Address	LPG	Status
30	389.0	NW	542849, 260533	BP	Mrh Girton Spar, Huntingdon Road, Huntingdon Road, Girton, Cambridge, Cambridgeshire, CB3 0LQ	No	Open

3.3 Underground High Pressure Oil and Gas Pipelines

Records of high pressure underground pipelines within 500m of the study site: **0**

Database searched and no data found.

4. Geology

4.1 Artificial Ground and Made Ground

Database searched and no data found.

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

4.2 Superficial Ground and Drift Geology

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

Lex Code	Description	Rock Type
RTD3-SAGR	RIVER TERRACE DEPOSITS, 3	SAND AND GRAVEL
HEAD-CSSG	HEAD	CLAY, SILT, SAND AND GRAVEL
RTD4-SAGR	RIVER TERRACE DEPOSITS, 4	SAND AND GRAVEL

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

4.3 Bedrock and Solid Geology

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

LEX Code	Description	Rock Type
GLT-MDST	GAULT FORMATION	MUDSTONE

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

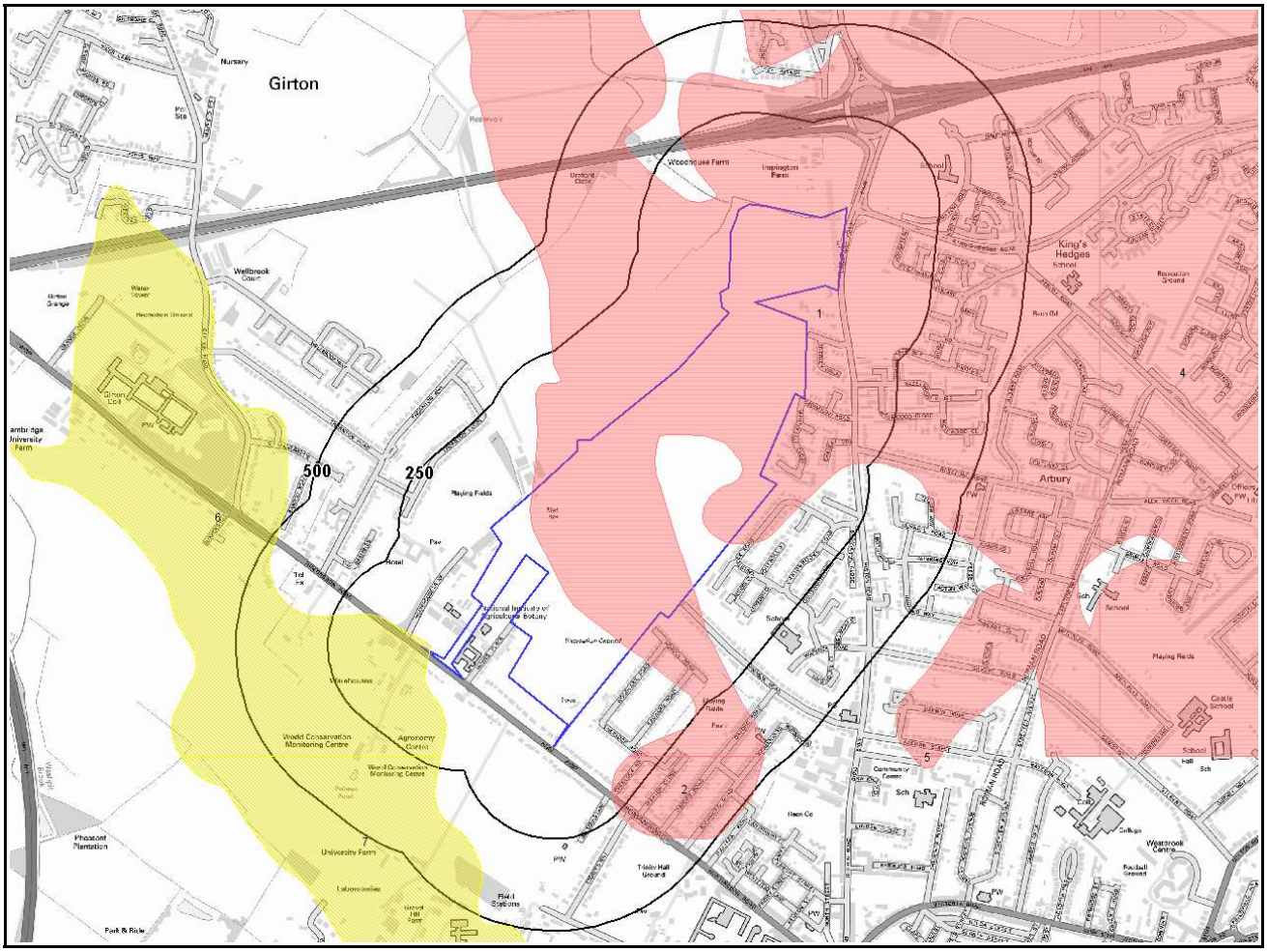
For more detailed geological and ground stability data please refer to the "GroundSure GeoInsight". Available from our website.

5a. Hydrogeology - Aquifer Within Superficial Geology

NW N NE

W E

SW S SE



Aquifer Within Superficial Geology Legend

Site Outline

250
500
Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

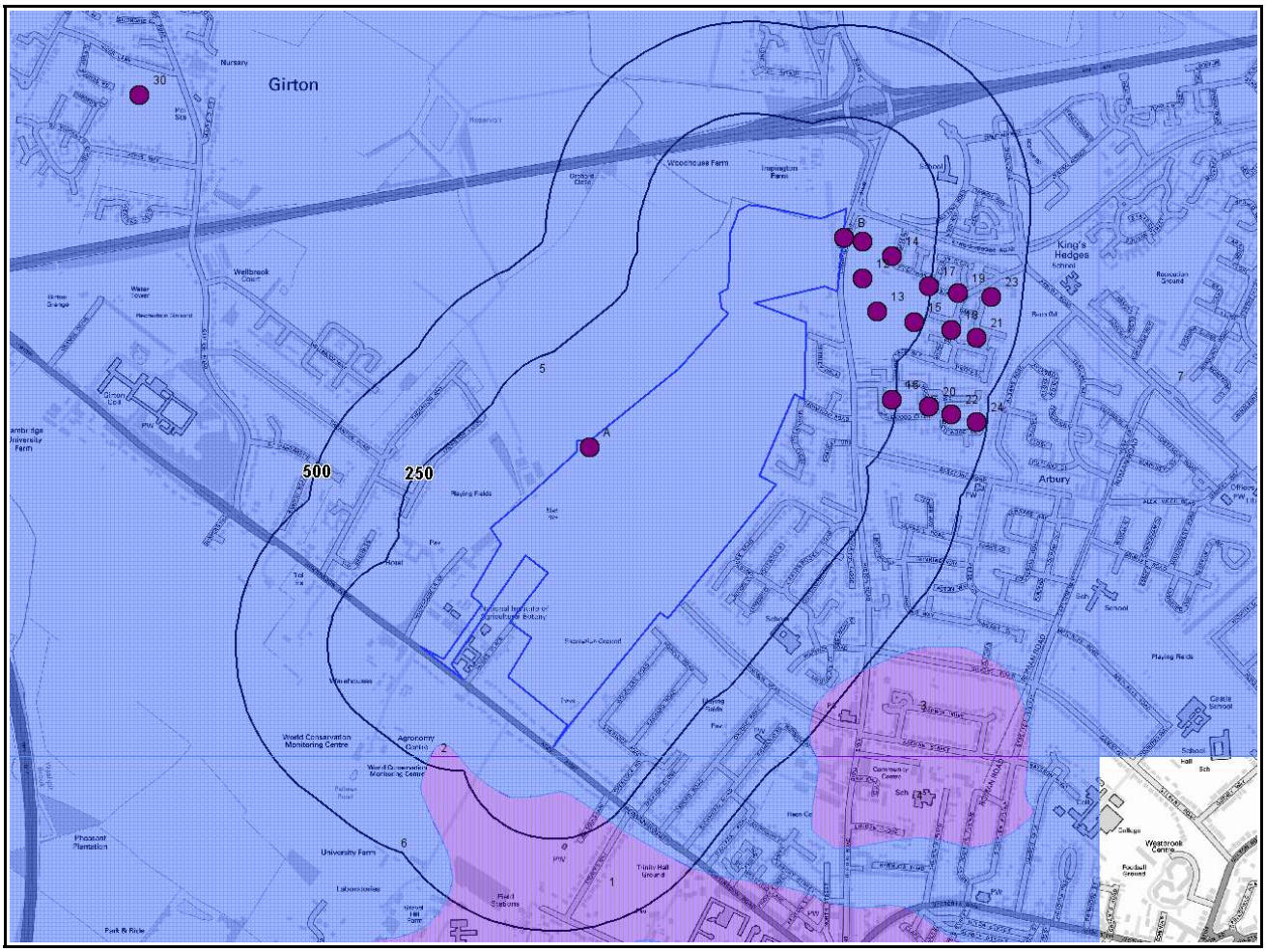
Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

5b. Hydrogeology - Aquifer Within Bedrock Geology and Abstraction Licenses

NW N NE



W E

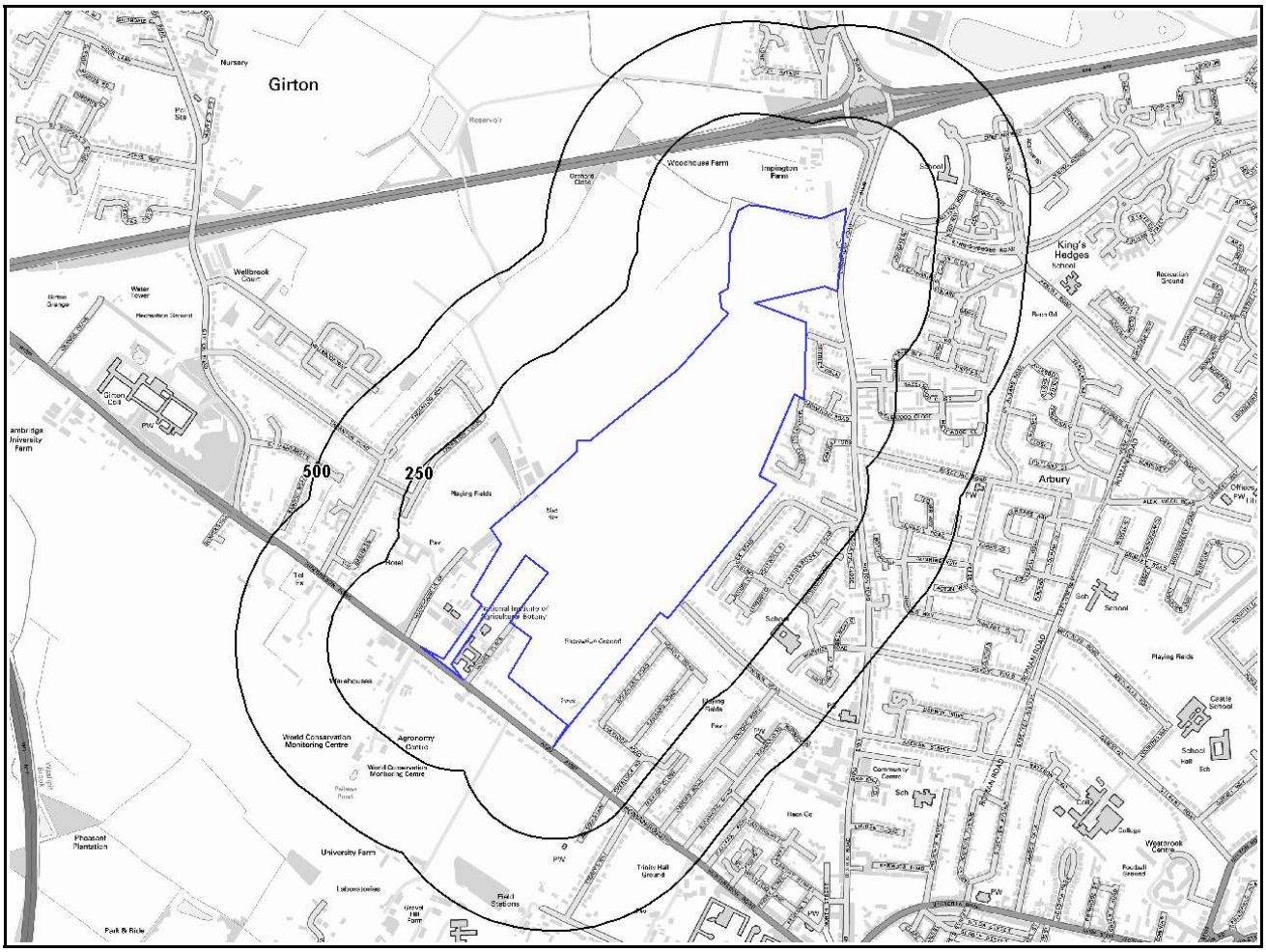
SW S SE

Aquifer Within Bedrock Geology Legend

- Site Outline
- Search Buffers (m): 250, 500
- Principal Aquifer
- Secondary (A) Aquifer - Permeable Layers
- Secondary (B) Aquifer - Lower Permeability Layers
- Groundwater Abstraction Licence
- Secondary Aquifer - Undifferentiated Layers
- Unproductive
- Unknown (lakes and landslip)
- Surface Water Abstraction Licence

5c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses

NW N NE



W E

SW S SE

SPZ and Potable Water Abstraction Licenses
Legend

Enabled by Ordnance Survey

Site Outline

250
500
Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

Source Protection Zone 2 - Outer Catchment

Source Protection Zone 3 - Total Catchment

Source Protection Zone 4 - Zone of Special Interest

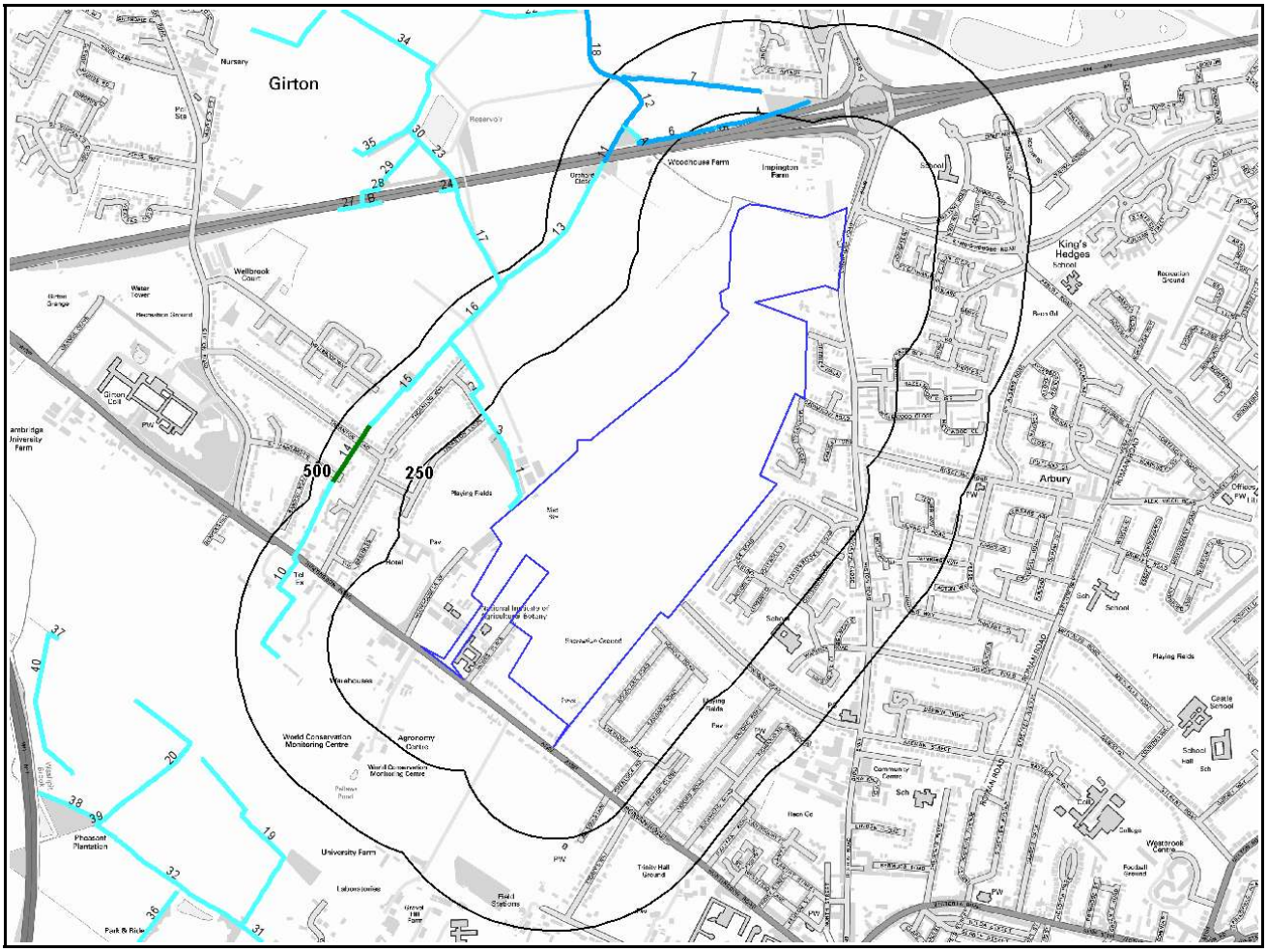
Potable Water Abstraction Licence

5d. Hydrology – Detailed River Network and River Quality

NW N NE

W E

SW S SE



Hydrology Legend

Enabled by Ordnance Survey

- Site Outline
- 250 / 500 Search Buffers (m)
- Primary River
- Secondary River
- Tertiary River
- Lake/Reservoir
- Underground River (inferred)
- General Quality Assessment: Chemistry
- Canal
- Canal Tunnel
- Extended Culvert (greater than 50m)
- D/S of High Water Mark
- D/S seaward extension
- General Quality Assessment: Biology

5.Hydrogeology and Hydrology

5.1 Aquifer within Superficial Deposits

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

From 1 April 2010, the Environment Agency'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 Enviroinsight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (5a):

ID	Distance [m]	Direction	Designation	Description
1	0.0	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	0.0	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
2	172.0	SE	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	220.0	S	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

5.2 Aquifer within Bedrock Deposits

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

From 1 April 2010, the Environment Agency'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 Enviroinsight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (5b):

ID	Distance [m]	Direction	Designation	Description
5	0.0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
6	26.0	S	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
1	122.0	S	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	185.0	S	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
3	457.0	SE	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

5.3 Groundwater Abstraction Licences

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

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (5b):

ID	Distance	Direction	NGR	Details	
8A	0.0	On Site	543620, 260840	Licence No: 6/33/35/*G/0285 Details: Spray Irrigation - Direct Direct Source: Ground Water Source Of Supply Point: Borehole No.1 At Cambridge Data Type: Point	Annual Volume (m³): 45440 Max Daily Volume (m³): 616.8 Original Application No: - Original Start Date: 1/4/1998 Expiry Date: 31/12/2007 Issue No: 100 Version Start Date: 1/4/1998 Version End Date:
9A	0.0	On Site	543620, 260840	Licence No: 6/33/35/*G/0285 Details: Spray Irrigation - Storage Direct Source: Ground Water Source Of Supply Point: Borehole No.1 At Cambridge Data Type: Point	Annual Volume (m³): 45440 Max Daily Volume (m³): 616.8 Original Application No: - Original Start Date: 1/4/1998 Expiry Date: 31/12/2007 Issue No: 100 Version Start Date: 1/4/1998 Version End Date:
10B	2.0	E	544310, 261410	Licence No: 6/33/33/*G/0030 Details: General Farming & Domestic Direct Source: Ground Water Source Of Supply Point: Borehole S Of Impington Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 1/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1966 Version End Date:
11B	53.0	E	544360, 261400	Licence No: 6/33/33/*G/0030 Details: General Farming & Domestic Direct Source: Ground Water Source Of Supply Point: Borehole S Of Impington Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 1/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1966 Version End Date:
12	64.0	E	544360, 261300	Licence No: 6/33/33/*G/0030 Details: General Farming & Domestic Direct Source: Ground Water Source Of Supply Point: Borehole S Of Impington Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 1/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1966 Version End Date:
13	122.0	SE	544400, 261210	Licence No: 6/33/33/*G/0030 Details: General Farming & Domestic Direct Source: Ground Water Source Of Supply Point: Borehole S Of Impington Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 1/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1966 Version End Date:
14	137.0	E	544440, 261360	Licence No: 6/33/33/*G/0030 Details: General Farming & Domestic Direct Source: Ground Water Source Of Supply Point: Borehole S Of Impington Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 1/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1966 Version End Date:
15	225.0	E	544500, 261180	Licence No: 6/33/33/*G/0030 Details: General Farming & Domestic Direct Source: Ground Water Source Of Supply Point: Borehole S Of Impington Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 1/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1966 Version End Date: