Phase I & II Geo-Environmental Assessment

Proposed Cheshunt Sports Village
Theobalds Lane
Cheshunt
Hertfordshire
EN8 8RX

Prepared for:

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PROPOSED CHESHUNT SPORTS VILLAGE

NON TECHNICAL SUMMARY

This report presents the findings of a combined Phase I Desk Study and Phase II Intrusive Investigation undertaken to determine ground conditions, establish if there are any environmental risks associated with the site and its development and provide a geotechnical appraisal. Pertinent findings and conclusions may be summarised as follows:

- The desk study work confirmed the site was formally part of a wider gravel extraction, which subsequently became used as Grove Landfill. Plausible risks were identified associated with the potential for infill materials to be generating ground gases which could affect proposed dwellings, the general quality of shallow soils which could be used in future garden areas and also impacts to the quality of shallow groundwater within the surrounding gravels which is assumed to drain into local watercourses.
- Intrusive investigations comprised the forming of 18 boreholes to a maximum depth of 20.0m. Ground conditions were found to be variable across the site, with up to 7m of granular fill materials across the eastern half, whereas more cohesive made ground was noted to the west. Dense sands and gravels were encountered below the fill materials where it had not been extracted fully, which in turn overlay stiff grey clays at around 7m. Groundwater was noted to rest at levels ranging between 2.150m and 3.796m bgl and sampling has not identified any unacceptable risks to groundwater quality.
- No significant physical evidence of contamination was encountered during the investigation although fill materials beneath the eastern side of the site were noted to contain ash and clinker. Confirmatory soil sampling has indicated that these soils would not be suitable for gardens however it is anticipated that associated risks will be removed through site levels needing to be raised for the development, effectively capping the underlying material. Waste analysis has identified the granular fill materials in the eastern area to contain levels of heavy metals which would require them to be classed as hazardous waste if they were to be removed from site, while both the clay based fill material in the west and underlying natural ground would go as Inert.
- An initial monitoring program has not identified a significant ground gas issue, with current data indicating only basic gas protection measures would be required for new buildings (CS2), although this still needs to be confirmed through the ongoing longer term monitoring.

ENGINEERING SUMMARY

- Shallow ground conditions across the site are not considered suitable for the use of conventional spread foundations and as such, it is recommended that a piled foundation design is adopted, likely terminating in the London Clay.
- Suspended ground floor construction is recommended.
- A design sulphate class of DS-2 is considered suitable for shallow buried concrete, with an aggressive chemical environment for concrete (ACEC) of AC-2.
- Although infiltration testing has indicated that the soils may be suitable for the use of soakaways, given the nature and extent of the fill material encountered, the use of soakaways are not recommended and it is suggested that other means of surface water discharge are investigated.

The above points represent a simplified summary of the findings of this assessment and should not form the basis for key decisions for the proposed development. A thorough review of the details is contained within the following report, or alternatively get in touch and we'll talk you through it.

Project Reference:	UK16.2295	
Title:	Phase I & II Geo-Environmental Assessment Proposed Cheshunt Sports Village	
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Where ground investigations have been conducted, these have been limited to the level of detail required for the site in order to achieve the objectives of the investigation.

The report has been written, reviewed and authorised by the persons listed above. It has also undergone EPS' quality management inspection. Should you require any further assistance regarding the information provided within the report, please do not hesitate to contact us.

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1 INTRODUCTION

In June 2016, Environmental Protection Strategies Ltd (EPS) was commissioned by LW Developments Ltd to complete a Phase I and II Geo-Environmental Assessment Report at the Proposed Cheshunt Sports Village, Theobalds Lane, Cheshunt, Hertfordshire, EN8 8RX (the 'site'); see Figure 1.

The work was commissioned in order to support a planning application for the construction of a mixed commercial and residential development including the construction of a new football stadium around the existing pitch and 48 new residential properties with associated garden areas and new roadways.

This report presents the findings, conclusions, and recommendations of the Phase I Desk Study and subsequent Phase II Intrusive Investigation undertaken.

1.1 Objectives

The objectives of this investigation were as follows:

a) To compile a Conceptual Site Model (CSM) and undertake a Preliminary Risk Assessment to evaluate the potential risks the site may pose to human and environmental receptors, both currently and in future.
b) To investigate potential contaminant linkages identified through the CSM by means of investigating shallow soils.
c) To determine the potential risks posed by the site and make recommendations for further work that may be required, to ensure safe development in accordance with the *Model Procedures for the Management of Land Contamination* - Contaminated Land Report 11 and the *National Planning Policy Framework*.
d) To collect information on ground conditions and strength in order to make appropriate recommendations for geotechnical design.
e) To undertake initial ground permeability testing in order to inform recommendations for potential surface water drainage systems.

1.2 Scope of Work

To perform an exploratory assessment of the site in accordance with the principles and requirements of DEFRAs '*Contaminated Land Statutory Guidance*' (2012), BS10175 (2011) – '*Investigation of Potentially Contaminated Sites*', BS5930:2015 '*Code of Practice for Ground Investigation*' and BS EN 1997:2007 *'Geotechnical Design'*, the following tasks were undertaken:

<u>Desk Study:</u>

- Collection of site records.
- Study of existing geological, hydrogeological and historic maps of the area.
- Consultation of environmental databases, including records held by the local authority.
- Review of proposed development plans.
- Development of conceptual model and preliminary risk assessment.

Intrusive Investigation:

- Site walkover, inspection of any visual evidence of contamination at the site, obtaining photographic records.
- Health and safety briefing / site supervision.
- Forming of 12 boreholes to a maximum depth of 5.0m below ground level (bgl) using a track-mounted window sampler.
- Forming of eight boreholes to a maximum depth of 20.0m bgl using a cable-percussive shell and auger drilling rig.
- Undertaking of falling head infiltration testing at five borehole locations.
- Recording of ground conditions including inspection of samples for visual and olfactory contamination.

Reporting:

- Data collection and interpretation.
- Reporting.

The findings of these investigations and their conclusions are presented in the following sections.

1.3 Limitations and Constraints

The purpose of this report is to present the findings of a soil sampling investigation conducted at the location(s) specified. When examining the data collected from the investigations made during the assessment, Environmental Protection Strategies Ltd (EPS) makes the following statements:

No investigation method is capable of completely identifying all ground conditions that might be present in the soil or groundwater under a site. Where outlined in our report, we have examined the ground beneath a site by constructing a number of boreholes and / or trial pits to recover soil and / or groundwater samples. The locations of these excavations and sampling points are considered to be representative of the condition of the whole site subsurface however, ground conditions are naturally variable and it may be possible that the ground conditions encountered may differ to those encountered during the investigation.

No visible evidence of Japanese Knotweed was identified during the site walkover, however this plant can be difficult to identify in the early stages of growth and therefore it is not always possible to identify its presence at certain times of the year. For this reason EPS cannot confirm that Japanese Knotweed rhizomes do not exist and it is recommended that if it is suspected that this species, or other similarly invasive plants are present at the site, a specialist contractor should be commissioned to make a detailed assessment.

The investigation was carried out to assess the significance of contamination resulting from the use of the site as identified in this report. Unless EPS has otherwise indicated, no assessment of potential impact of any other previous uses has been made.

2 GEO-ENVIRONMENTAL SETTING

The following section provides a summary of the information collected in relation to the site location and history.

2.1 Site & Location Description

Detail	Description
Location	The site is located adjacent to the north of Theobald's Lane and slightly to the east of the A10, in southwest Cheshunt, approximately 950m from the town centre.
National Grid Reference	535555, 201352
Topographic Elevation	Approximately 27-30m Above Ordnance Datum (AOD).
Topographic Gradient	Levels fall slightly towards the east.
Description of Site	The site is roughly rectangular in shape and measures approximately 48,100m^2. It currently comprises Cheshunt Football Club, with the main football pitch located roughly in the centre of the site, bounded by fencing and / or barriers. Small stands are located to the east and west of the pitch, with a number of buildings located to the west of the pitch, along its length. Further to the west of this lies a gravel car park across the entire length of the site. To the south of the pitch is a stretch of grass which runs to the east, where the site opens up into playing fields which extend across the majority of the eastern half of the site and are used for further football pitches. To the north of the pitch is a mixture of concrete paths and grass verges currently used to store various construction equipment. The site slopes from west to east, with the playing fields to the east of the pitch set slightly below the rest of the site level. Vegetation mostly comprises grass with some medium sized bushes and trees lining the boundaries to the east and south.
Surrounding Land Use	The surrounding land use is mixed. To the east comprises a residential estate, whilst to the north lies further fields and pitches associated with Cheshunt Football Club. To the west lies the A10, beyond which are agricultural fields, with the land to the south mostly undeveloped.

A plan showing the site location is provided as Figure 1 and an aerial photograph is included as Figure 2. Selected site photographs are included as Appendix A, a proposed development plan is included as Appendix B and relevant extracts of a Landmark Envirocheck report are included as Appendix C.

2.2 Environmental Setting

<table>
<tr><th>Detail</th><th colspan="2">Description</th></tr>
<tr><td>Geology</td><td colspan="2">Geological maps of the area indicate the ground conditions to consist of Kempton Park Gravel Formation overlying London Clay Formation. Information on the sites' geological context is included as Appendix D.</td></tr>
<tr><td rowspan="8">Geological Hazards</td><td>Hazard</td><td>On Site Risk</td></tr>
<tr><td>Mining</td><td>Might Not Be Affected / No Hazard</td></tr>
<tr><td>Collapsible Ground</td><td>Very Low</td></tr>
<tr><td>Compressible Ground</td><td>No Hazard</td></tr>
<tr><td>Ground Dissolution</td><td>No Hazard</td></tr>
<tr><td>Running Sand</td><td>Very Low</td></tr>
<tr><td>Landslide</td><td>Very Low</td></tr>
<tr><td>Shrinking / Swelling Clay</td><td>No Hazard (Moderate 21m west)</td></tr>
<tr><td>Radon</td><td colspan="2">The BGS and Health Protection Agency (HPA) report entitled 'Indicative Atlas of Radon in England and Wales' (November 2007) shows the site to lie within a 1km grid section where the percentage of homes above the radon action level is between 0% and 1%. The joint Building Research Establishment Ltd (BRE) report entitled: 'Radon: Guidance on Protective Measures for New Buildings - 2007' reports that the site does not lie within an area where basic radon protection methods will need to be employed.</td></tr>
<tr><td>Hydrogeology</td><td colspan="2">Groundwater vulnerability maps for the area indicate the superficial deposits are classified by the Environment Agency as Secondary Aquifer and bedrock geology as Unproductive Strata. The site does not lie within, or within the catchment of, a Source Protection Zone for groundwater abstraction.

No groundwater abstractions are recorded within 1km. Groundwater vulnerability maps are included as Appendix E.</td></tr>
<tr><td>Hydrology</td><td colspan="2">The nearest surface water feature is Theobald's Brook located adjacent to the south of the site.

The site is shown to lie within Flood Zone 1, as defined by the EA flood map. Flood Zone 1 is defined in the NPPF as an area where the probability of flooding from fluvial and / or tidal sources is lowest of all designated flood zones at less than 0.1% per annum, (flood return period of 1 in 1,000 years). Flood maps are included within Appendix E.

The nearest active discharge consent lies approximately 335m southwest and pertains to the release of final/treated effluent sewage discharge to a soakaway operated by Mrs S Clayton. It has been active since December 2012.</td></tr>
<tr><td>Landfill & Waste</td><td colspan="2">Theobalds Grove is an historic landfill located within the site boundary which received Inert Waste from April 1938 and was licensed by Lea Valley Sand and Ballast Pits Ltd.</td></tr>
<tr><td>Licensed Industrial Activity</td><td colspan="2">A licensed waste management facility is located approximately 235m to the northeast and is noted to have taken special waste since April 2014. It is operated by LW Developments Ltd, at Cheshunt Football Club.</td></tr>
</table>

<table>
<tr><th>Detail</th><th colspan="3">Description</th></tr>
<tr><td rowspan="8">Industrial Land Use</td><td colspan="3">The Envirocheck report lists a number of industrial land uses in the area, these are summarised below.</td></tr>
<tr><th>Land Use</th><th>Distance & Direction</th><th>Status</th></tr>
<tr><td>Dairies</td><td>305m NW</td><td>Inactive</td></tr>
<tr><td>Car Dealers</td><td>342m NW</td><td>Inactive</td></tr>
<tr><td>Blinds, Awnings & Canopies</td><td>313m E</td><td>Inactive</td></tr>
<tr><td>Dairies</td><td>404m NW</td><td>Active</td></tr>
<tr><td>Floorcoverings – Manufacturers & Wholesalers</td><td>420m NW</td><td>Active</td></tr>
<tr><td>Garage Services</td><td>580m SE</td><td>Active</td></tr>
<tr><td>Pollution Incidents</td><td colspan="3">The Envirocheck report lists no pollution incidents to controlled waters within 500m.</td></tr>
<tr><td>Sensitive Land Use</td><td colspan="3">The site lies within an area of adopted green belt as well as a Nitrate Vulnerable Zone (NVZ) where surface waters are vulnerable to nitrates leaching from agricultural land use.</td></tr>
</table>

2.3 Site History

A summary of historical map data from 1872 to 2016 is provided below and copies of relevant historic maps and any others examined during the investigation are included in this report as Appendix F.

- Mapping displaying 1872-1883 indicates the site to have been undeveloped at this time. The site remains as such until 1914 when a gravel pit can be seen in the centre of the site, which grows to cover a large proportion of the site during the first half of the 20th century. The scale of these pits can be seen in the aerial photograph depicting 1945-47. In 1935-38, two pumps can also be seen on site. The site comes into its present layout as Cheshunt Football Club by 1967, with the football pitch in the centre of the site, playing fields to the east and a car park to the west.
- With regards to the surrounding area, it is mostly undeveloped in the late 19th century, although Aldbury and Walkers Farms located 300m northwest and southeast respectively. Cecil House lies adjacent to the southeast with a royal palace located 100m south. Further afield, a railway line and an associated station lie 550m southeast.
- By 1935-38, a nursery is located adjacent to the east. 1967 shows the first signs of widescale development with residential dwelling encompassing the land to the east, a rifle range located to the north and what is now the A10 roadway adjacent to the west. A slight expansion to Aldbury Farm can be seen along with infilled ponds adjacent to the north and southwest. More recently, a pumping station has been present adjacent to the southwest since 1999.

3 ENVIRONMENTAL CONCEPTUAL MODEL & PRELIMINARY RISK ASSESSMENT

The following section provides a review of the contaminant linkages that may be active at the site through examination of the potential sources that may be present as a result of historic and / or current site activities and where potential interaction between these sources and the identified human / environmental receptors may occur.

3.1 Source Characterisation

The following potential contaminant sources have been identified at the site and in the surrounding area:

Potential Source	Source Description	Principal Contaminants of Concern
Current & Historic Site Use	Fill material of unknown origin (Made Ground) used to level areas beneath existing buildings and hardstanding.	VOC, PAH, Metals, ACM
	Historic use of the site as Grove Landfill	Landfill Gas (CO_2, CH_4), VOC
Current & Historic Surrounding Land Use	Historically Infilled Ponds adjacent to the north and southwest.	
	Rifle Range adjacent to the north of the site.	Metals (specifically antimony and lead)
	Railway line and associated station located 550m southeast.	TPH, PAH, Metals, ACM
	Current / historic industrial land use of the surrounding area including a historic car dealers 342m to the northwest.	VOC, TPH, PAH, Metals

Notes: VOC Volatile Organic Compounds; ACM Asbestos Containing Material; CH_4 Methane; PAH Polycyclic Aromatic Hydrocarbons; CO_2 Carbon Dioxide; TPH Total Petroleum Hydrocarbons

3.2 Potential Receptors

A framework for the assessment of risks arising from the presence of contamination in soils has been produced by the Environment Agency and the Department for the Environment, Food and Rural Affairs (DEFRA) and is presented with the report '*Using Science to Create A Better Place: Updated Technical Background to the CLEA Model* – Science Report SC050021/SR3'. This guidance document defines a series of standard land-uses, which form a basis for the development of a Conceptual Site Model.

The proposed development plan includes the construction of a new football stadium around the existing pitch and 48 new residential dwellings, along with associated garden areas and new roadways. Therefore the land use has been considered as:

- Residential

In view of the environmental setting, current and potential future land use of the site and surrounding sites, the potential receptors for any contaminant impact are discussed in the table below.

Receptor	Site Specific Description
Human	Future site users, site workers involved in the site redevelopment, and those working and living in the surrounding area have the potential to be at risk from exposure to potential contaminants of concern (CoCs).
Groundwater	The site is reported to be underlain by Kempton Park Gravel Formation which is defined by the EA as Secondary A Aquifer. Whilst the site does not lie within a SPZ for nearby groundwater abstraction, the underlying geology does have resource potential and therefore groundwater should be considered as a potential receptor to site derived contaminants.
Surface Water	Theobald's Brook, classified as a main river by the Environment Agency, lies adjacent to the south of the site. It is possible that site derived contaminants of concern may enter this watercourse by overland flow, migration through unsaturated soils or entering shallow surface drainage / historical land drainage which discharges to these drains, therefore surface waters must also be considered as a sensitive receptor within the conceptual site model.
Flora and Fauna	The proposed development includes the provision of domestic garden / landscaped areas. Some of the identified contaminants of concern are known to be phytotoxic and as such the potential for this impact should be considered.
Buildings & Infrastructure	Subsurface structures are likely to be present at the site that may be adversely affected by the potential presence of the identified contaminants of concern. These include concrete used in building foundations, buried potable water supply pipes and other service lines and pipes.
Adjacent Land	Adjacent properties including private residential dwellings could also be at risk from potential contaminants found at the site.

3.3 Potential Pathways

Where contaminants may be present in soil, there are a number of potential pathways that enable human receptors to come into contact with or be exposed to them. The most direct pathways, considered under current UK legislation, can be summarised as follows:

- Direct ingestion of contaminated soil
- Ingestion of household dust
- Ingestion of contaminated vegetables
- Ingestion of soil attached to vegetables
- Dermal contact with contaminated soil
- Dermal contact with household dust
- Inhalation of fugitive soil dust
- Inhalation of fugitive household dust
- Inhalation of vapours outside
- Inhalation of vapours inside

Clearly, not all of these potential pathways apply for every standard land-use; the simplest example for exclusions being a commercial / industrial site which is covered by concrete hard standing. The concrete precludes the direct exposure of humans working at the site to any contaminated soils.

However in addition to direct exposure pathways, a number of physical transport mechanisms / pathways may also exist at a site that allow remote or less accessible contaminants in soil or groundwater to reach human or environmental receptors both at a site and beyond the site boundary. These include the transport mechanisms listed on the following page.

- Downward and lateral movement of contaminants in soil either by gravity or through being 'leached' by percolating rainwater
- Lateral migration of contaminants dissolved in groundwater.
- Direct seepage or leaching of contaminants from soil into subsurface drains or supply pipework.
- Volatilisation of contaminants from groundwater or unsaturated soils into buildings or outdoor air.

Through examination of the standard land use and environmental setting at each site, the presence of pathways and transport mechanisms described above must be considered when assessing whether a contaminant linkage may plausibly be active, and therefore be included in the conceptual site model.

3.4 Summary of Contaminant Linkages

Considering the site use and environmental setting, and the proposed land use; the plausible contaminant linkages that require further investigation are summarised in the following table:

Source	Pathway	Receptor
Contaminated soil	Direct contact and inadvertent ingestion by eating or smoking with dirty hands	Construction workers during redevelopment & site users
	Inhalation of fugitive dusts	Site users
	Direct uptake and / or adherence of contaminated soil to vegetation and subsequent ingestion	Site users
	Ingress / diffusion through permeable potable water supply pipes	Site users
	Migration of ground gases to indoor and outdoor air	Site users
	Leaching of contaminants vertically through unsaturated soils	Groundwater
	Direct uptake via root systems	Plants

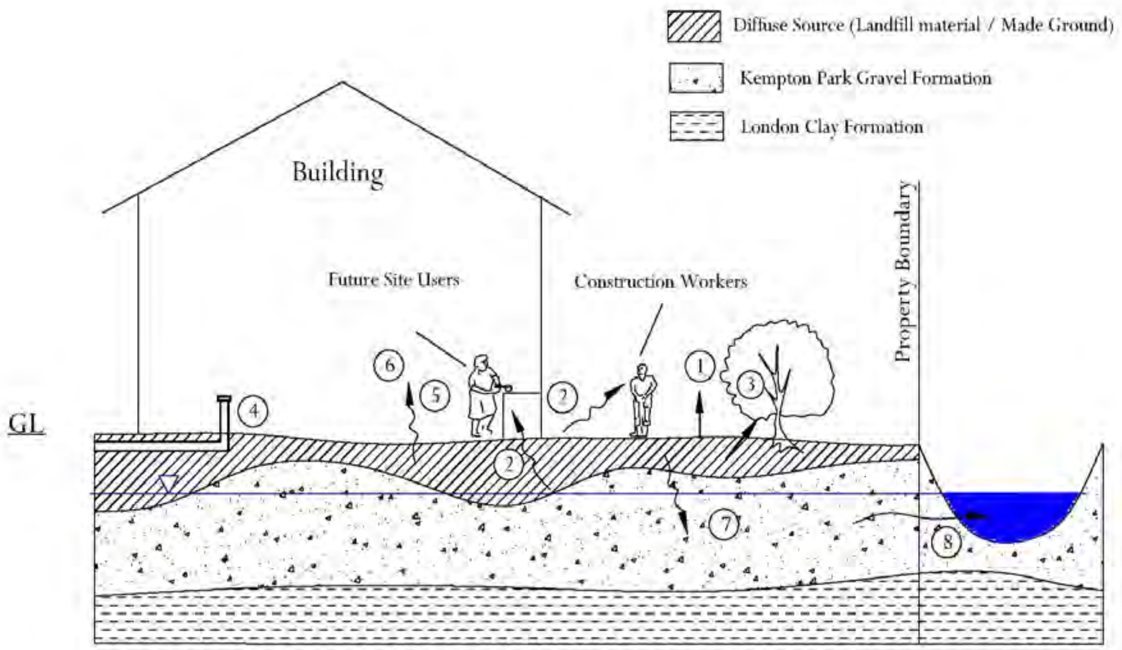
Source	Pathway	Receptor
Contaminated soil / groundwater	Direct contact	Buried infrastructure
	Lateral migration of contaminants in soil or groundwater.	Surface waters
	Volatilisation of organic compounds to indoor and outdoor air.	Site users

The following comments are made with respect to contaminant linkages which have been considered through development of the conceptual model, but have not been concluded as 'plausible' – i.e. through which a significant possibility of significant harm could occur to an identified receptor:

- A number of commercial and industrial sites are located in the surrounding area, however these are all either located down hydrological gradient of the site, or at a significant distance from it, and therefore risks are not considered to be present associated with the on-site migration of organic compounds in groundwater.
- Whilst the area to the north has historically comprised a rifle range, the associated contaminants of concern are not anticipated to be environmentally mobile and are therefore unlikely to pose a risk to future users through on-site migration.
- Contaminants of concern may be associated with the nearby railway line, located 550m southeast of the site. However, given the distance of this feature from the site, and as no goods / storage yards or sidings have been present close to the site, a plausible contaminant linkage has not been identified associated with this source.

The following diagram provides an illustration of the plausible contaminant linkages that may be active at the site and which may need further investigation or control to ensure safe development:

Proposed Cheshunt Sports Village – Illustrative Conceptual Site Model



1 Direct Contact with Soil

2 Inadvertant Contact with / Ingestion of Fugitive Soil Dust / Inhalation of volatile contaminants

3 Direct uptake via root systems

4 Infiltration to sub-surface utility pipes

5 Migration of organic vapours and volatisation to indoor and outdoor air

6 Migration of ground gas to indoor and outdoor air

7 Leaching of contaminants vertically through unsaturated soils

8 Lateral migration of contaminants in soil or groundwater

4 SUMMARY OF INTRUSIVE INVESTIGATIONS

The intrusive ground investigation was undertaken from the 27th June to 4th July in accordance with EPS standard operating procedures, copies of which will be made available on request. A summary of all site activities are presented in the following sections:

4.1 Borehole Locations

Borehole locations were selected through consideration of the proposed development layout, the location of below ground utilities as well as operational and health & safety considerations.

Twelve small diameter window sampler boreholes (WS01-WS12) were formed to a maximum depth of 5m using a track-mounted window sampler rig.

A further Eight boreholes (BH1-BH8) were formed to a maximum depth of 20m using a cable percussive shell and auger-drilling rig.

Falling Head Infiltration Testing was undertaken at five locations in order to assess the infiltration rates of the underlying soils.

The overall objective in terms of borehole locations was to provide an appropriate lateral and vertical coverage of the soils underlying the area with regard to the proposed development in order to provide information relating to the nature and quality of ground conditions as well as their strength.

A borehole location plan is presented as Figure 3.

4.2 Soil Sampling and In Situ Testing

Each borehole was logged for ground conditions encountered and inspected for any physical evidence of contamination such as soil staining, odour and the presence of separate phase liquids.

Where potentially volatile organic compounds are suspected, EPS carries a Photoionisation Detector (PID), which can be used to measure the relative concentrations of vapour associated with soil samples collected from different depths and locations at the site. Headspace testing by PID was not undertaken during the investigation given the absence of any palpable evidence of volatile organic compounds encountered during the investigation.

Standard or Cone penetration tests (SPT / CPT's) were carried out at roughly 1m intervals within all soils, to provide information on the in-situ strength of the soils. The number of blows required to advance a solid 60° nose cone over the final 300mm of a 450mm total drive was recorded, and is shown on the borehole records at the penetration resistance ("N" value).

4.3 Laboratory Testing

Samples obtained for analysis of identified contaminants of concern were submitted to Jones Environmental Forensics Ltd of Deeside, who hold appropriate UKAS / MCERT accreditation for the required testing. Samples were transported in laboratory supplied containers and delivered to the laboratory by approved courier.

Geotechnical testing was undertaken by Soil Property Testing, Huntingdon, a UKAS accredited laboratory. Copies of chain of custody documentation are held by EPS and will be made available on request. A laboratory testing schedule is included as Table 1.

4.4 Groundwater Sampling

Groundwater samples were obtained from nine boreholes from across the site on 6^{th} & 7^{th} July 2016.

All groundwater samples were obtained using the 'low flow' sampling technique in accordance with EPS standard operating procedures, with dissolved oxygen, redox, pH and temperature being monitored prior to sampling. A summary of the field measurements recorded during the sampling process are summarised in Table 2 of this report.

4.5 Ground Gas and Vapour Monitoring

EPS have undertaken eight weekly gas monitoring visits following the site works to measure the presence and concentration of ground gas (including carbon dioxide, oxygen and methane) and organic volatiles using a GFM 435 gas analyser, flow meter and PID, respectively to provide indicative information on any gassing regime. Further monitoring is currently scheduled to be undertaken on a monthly basis for a further nine months.

5 FINDINGS OF THE INVESTIGATION

This section of the report provides a summary of the findings of the various aspects of the ground investigation.

5.1 Ground Conditions

The ground conditions encountered, from ground level, were found to comprise:

- Topsoil
- Made Ground
- Kempton Park Gravel Formation
- London Clay Formation

Site specific Borehole logs are included as Appendix G and give descriptions and depths of strata encountered. A summary of the general strata encountered across the site is provided in the table below, with more detailed description given in the following sub sections.

Geological Strata	Maximum Depth to Base of Strata (m bgl)	Strata Thickness (m)
Topsoil	0.2	0.05-0.2
Made Ground	7.2	0.9-7.2
Kempton Park Gravel	6.8	0.8-4.4
London Clay	>20.0	Not Proven

5.1.1 Topsoil

A very thin layer of medium brown, silty, sandy, clayey Topsoil was identified at the surface within WS1-WS5 and WS8-WS12.

5.1.2 Made Ground

Made ground was identified within all boreholes, to varying depth and in varying nature. In the eastern half of the site, where the existing playing fields are present, significant depths of fill material were encountered, likely associated with the historic landfill that was located on site. This predominantly comprised a brown and brown-black silty gravelly sandy material with various landfill materials such as brick, concrete, glass, ash, clinker, plastic and metal and was noted to depths of up to approximately 5.5m. This material was interspersed with some bands of more cohesive material with a silt and gravel fill noted within BH6 to a maximum depth of 7.2m.

Towards the western half of the site, the made ground was more limited in nature, particularly to the southwest where as little as 0.9m was identified. Also across the western half, it was evident that the made ground had a slightly differing composition, with the soils mostly cohesive in nature and only predominantly containing brick as opposed to the wide variety of fill materials noted across the eastern half. Brick and concrete fill was noted within BH7 to a depth of 3.5m.

5.1.3 Kempton Park Gravel Formation

Beneath the made ground within WS4-WS6 and BH1-3 and BH7-8, lay material interpreted as Kempton Park Gravel Formation. It predominantly comprised dense brown sandy gravel and gravelly sand.

Superficial deposits of soft to firm clays were found to either mantel the underlying Kempton Park Gravels or to be present directly beneath the Made Ground in WS01, WS02, WS03, WS04, WS07, WS09 and WS10. It is possible that these soils also represent reworked ground, but have currently been interpreted as natural soils.

5.1.4 London Clay Formation

Below the made ground or Kempton Park Gravel Formation within all boreholes except WS4-WS6 and WS8, lay material interpreted as London Clay Formation. It generally comprised of a stiff grey silty clay and extended to the base of all the boreholes..

5.2 Groundwater

Groundwater was identified within all boreholes except WS5 and WS6, with rest levels ranging between 2.150m and 3.796m.

5.3 Gas and Organic Vapour Monitoring

EPS has undertaken eight weekly rounds of gas monitoring following the site works to measure the presence and concentration of ground gas (including carbon dioxide, oxygen and methane) and organic volatiles using a GFM 435 gas analyser, flow meter and Photoionisation Detector (PID), respectively to provide indicative information on any gassing regime.

5.4 Infiltration Testing

Infiltration testing in the form of falling head permeability tests was undertaken at five locations (WS4, WS6, WS8, WS10, WS11), the results and assessment of which are provided within section 9.4 below.

5.5 Physical Evidence of Contamination

Within the boreholes which covered the playing fields to the east of the site, namely WS1-WS4, WS9-WS12 and BH2-BH5, fill materials were noted within the granular made ground which comprised ash, coal, brick, concrete, glass, plastic and metal to depths of up to 5.4m.

5.6 Laboratory Analysis

5.6.1 Chemical Analysis-Soils

A laboratory analysis testing schedule is presented as Table 1 and all environmental sample results obtained from the laboratory are included as Appendix H. The key results of laboratory testing on environmental soil samples are summarised below.

Contaminant	No. of Samples	No of Detections	Range of Detections (mg/kg)		Highest Location & Depth (m bgl)
			Min	Max	
Arsenic	9	9	5.6	97.5	WS11 (1.4-1.7)
Cadmium	9	3	0.3	2.6	WS11 (1.4-1.7)
Chromium	9	9	38.5	129.4	WS1 (0.1-0.4)
Copper	9	9	5	1053	WS1 (0.1-0.4)
Lead	9	9	5	3759	WS2 (1.4-1.7)
Mercury	9	5	0.3	1.8	WS1 (0.1-0.4)
Nickel	9	10	16	138.3	WS11 (1.4-1.7)
Selenium	9	3	1	2	WS7 (2.2-2.4),
Zinc	9	9	36	1155	WS1 (0.1-0.4)
Benzo[a]pyrene	9	6	0.13	0.95	WS11 (1.4-1.7)
Dibenz(ah)anthracene	9	3	0.05	0.19	WS11 (1.4-1.7)
PAH (Total of 16)	9	6	1.0	10.3	WS11 (1.4-1.7)
TPH	7	3	38	307	WS2 (1.4-1.7)
BTEX	7	0	-	-	-
MTBE	7	0	-	-	-
PCB	4	0	-	-	-
Asbestos	9	0	-	-	-

Notes:
- \- Contaminant not found above laboratory detection limits
- PAH Polycyclic Aromatic Hydrocarbons; TPH Total Petroleum Hydrocarbons
- BTEX Benzene, Toluene, Ethylbenzene, Xylene; PCB Polychlorinated Byphenols

5.6.2 *Chemical Analysis - Groundwater*

Contaminant	No. of Samples	No of Detections	Range of Detections (ug/kg)		Highest Location & Depth (m bgl)
			Min	Max	
Arsenic	9	9	3.5	33.0	WS1
Cadmium	9	0	-	-	-
Chromium	9	1	-	2.3	WS7
Copper	9	3	9	13	WS1
Lead	9	0	-	-	-
Mercury	9	0	-	-	-
Nickel	9	9	4	30	WS11
Selenium	9	0	-	-	-
Zinc	9	8	37	2345	WS11
Benzo[a]pyrene	9	5	0.020	0.060	WS4
Naphthalene	9	8	0.1	13.7	WS11
PAH (Total of 16)	9	9	0.270	14.380	WS11
TPH	9	0	-	-	-
BTEX	9	0	-	-	-
MTBE	9	0	-	-	-

5.6.3 *Waste Analysis*

Waste classification (i.e. hazardous or non-hazardous) was undertaken on samples of both made ground and natural soils which included total concentrations of metals and hydrocarbons, using computer software provided by HazWaste OnlineTM. The outputs from the HazWaste OnlineTM software are included in a Waste Classification Report in Appendix H.

Waste Acceptance Criteria was subsequently undertaken on two samples of made ground and two of natural soils. The results of the WAC analysis are included within Appendix G. These results, together with those of the waste classification above are summarised in the table below.

Strata	Is it Hazardous? (number of hazardous samples)	Location of Hazardous Samples	Reason for Hazardous Classification	Waste Acceptance Criteria	Waste Classification
Made Ground / Fill: Brown-black silty gravelly SAND with ash, coal, brick, glass, metal and plastic.	Yes (4)	WS1-WS2, WS9, WS11	Elevated Levels of Copper, Lead and Zinc	Will require Pre-Treatment	**HAZARDOUS (pre-treatment required)**
Made Ground: Brown silty sandy gravelly CLAY	No	N/A	N/A	Passed Criteria for Inert Landfill*	**INERT**
Kempton Park Gravel Formation	No	N/A	N/A	Passed Criteria for Inert Landfill	**INERT**
London Clay	No	N/A	N/A	Passed Criteria for Inert Landfill	**INERT**

* Waste analysis on the sample taken from WS7 (made ground - clay) did identify a concentration of Sulphate as SO4 above the acceptance threshold for inert waste within a permitted landfill site. However, *'Waste Sampling and Testing for Disposal to Landfill' (2013)* states that the values for total dissolved solids (tds) can be used instead of the values for SO4. Given that the result for TDS (2869mg/kg) falls comfortably below the threshold of 4000mg/kg, it is considered acceptable that this passes the waste acceptance criteria and can be classified as INERT for the purposes of offsite disposal.

On the basis of these results, both the Made Ground: Clay and all underlying Natural Soils can be classified as **INERT** for the purposes of off-site disposal. However, the silty gravelly sandy made ground comprising fill materials such as ash, coal, brick, glass, metal and plastic located towards the east of the site must be classified as **HAZARDOUS** and will likely require pre-treatment.

5.6.4 *Geotechnical Testing*

The results of geotechnical laboratory testing are summarised in the table below.

Strata	Range of Parameters					
	Moisture Content (%)		Plasticity Index (%)		Modified Plasticity Index (%)	
	Min	Max	Min	Max	Min	Max
London Clay Formation	25	59	36	49	30	49

The natural moisture content was established for eight samples of cohesive soil in accordance with BS1377 Part 1:7.3 and BS1377: Part 2:3.2.

Atterberg limit tests were undertaken on eight samples of cohesive soils in accordance with BS1377: Part 1:7.4 and BS1377: Part 2:3.2&4.2.

Particle Size Distribution was undertaken on two samples of granular material in accordance with BS1377: Part 2: 1990: 9.2.

Sulphate contents and pH values determinations were also carried out by the analytical laboratory, the results of which are summarised in section 8.5 below.

A laboratory analysis testing schedule is presented as Table 1 and all geotechnical sample results obtained from the laboratory are included as Appendix I.

6 GENERIC QUANTITATIVE RISK ASSESSMENT

The following section summarises the method used to assess the risks posed to human health and controlled waters then identifies any sample results found by this investigation which warrant further consideration.

6.1 Generic Screening

In order to screen laboratory data for concentrations of contaminant in soil with potential to cause harm to human health in a residential land-use setting, relevant generic screening values for contaminants in soil have been used. The technical framework used to derive the assessment criteria and the documents in which they are published are summarised as follows:

- *EA Science Reports* (SC050021/SR2, SC050021/SR3, and SC050021/SR7)
- *EA Soil Guideline Value Science Reports*
- *Suitable For Use Levels (S4ULs) for Human Health Risk Assessment* – LQM and CIEH (2015)
- *Soil Generic Assessment Criteria for Human Health Risk Assessment* - EIC/AGS/CL:AIRE (2010)

Category 4 Screening Levels (C4SLs) released in December 2013 by The Department for the Environment, Food and Rural Affairs (DEFRA), (*Development of Category 4 Screening Levels for assessment of land affected by contamination - SP1010*) provide generic suitable for use screening values for common contaminants in a variety of land uses and are utilised as appropriate 'low risk' generic screening criteria.

In addition to screening the concentrations of contaminants in soil for risks to human health, EPS has also screened the concentrations for potential to cause harm to water resources. The criteria used for this process were derived by EPS using the following technical guidance:

- *Environment Agency Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination.*

Resource Sensitivity of Area	Screening Criteria
High Groundwater Resource Potential (HGwRP) - Principal aquifers	UK Drinking Water Standards (UKDWS)
Low Groundwater Resource Potential (LGwRP) - Secondary aquifers not being abstracted and Un-productive groundwater strata	UK Environmental Quality Standards (EQS)

The underlying geology is classified as a Secondary A Aquifer and as such screening criteria for Low Groundwater Resource Potential (LGwRP) have been adopted. A summary of the screening criteria and the methodology used to derive them is included in Appendix J.

6.2 Assessment of Soil Results – Human Health

The results of the screening process for risks to human health from contaminants in soils show that screening values, representative of minimal risk levels have been exceeded for the metals arsenic, lead and mercury. A summary of the exceedances is presented in the table below.

Contaminant	Screening Criteria (mg/kg)	No. of Exceedances	Volume of largest exceedance (mg/kg)(location)
Arsenic	37	4	97.5 (WS11 1.4-1.7)
Lead	200	5	3759 (WS2 1.4-1.7)
Mercury	1.2	1	1.8 (WS1 0.1-0.4)

Whilst the table above indicates a complete list of exceedances, it should be noted that many of these exceedances were identified in soils at depths of approximately 1.5m bgl where the worst of the visible contamination was noted. However, soils at this depth are not likely to pose a significant risk to human health, as there will not be interaction with soils at this depth. Therefore, it is considered reasonable to assess the risks posed to human health through interaction with shallow soils based on those samples taken from the upper 600mm of soil. A summary of exceedances on this basis is presented below:

Contaminant	Screening Criteria (mg/kg)	No. of Exceedances	Volume of largest exceedance (mg/kg)(location)
Arsenic	37	1	40.2 (WS1 0.1-0.4)
Lead	200	2	812 (WS1 0.1-0.4)
Mercury	1.2	1	1.8 (WS1 0.1-0.4)

6.3 Assessment of Soil Results – Controlled Waters

The results of the screening process for potential risks to controlled waters from contaminants in soils show that screening values for Low Groundwater Resource Potential (LGwRP), representative of minimal risk values for controlled waters have not been exceeded at any location.

6.4 Assessment of Groundwater Results

The results of the screening process for risks to controlled waters from contaminants in groundwater show that screening values for LGwRP, representative of minimal risk levels have been exceeded for zinc and naphthalene. A summary of the exceedances is presented in the table below.

Contaminant	Screening Criteria (mg/kg)	No. of Exceedances (highest location)
Zinc	500	1 (WS11)
Naphthalene	10	3 (WS11)

6.5 Initial Ground Gas Risk Assessment

The results of soil gas monitoring are presented as Table 2 along with calculated gas screening values, set out in CIRIA guidance '*Assessing Risks Posed by Hazardous Ground Gases to Buildings*'.

Results of the ground gas monitoring show that no flow has been encountered above instrument detection limits across the entire monitoring period. Methane has only been identified within one borehole, namely WS8, albeit consistently, with a maximum reading of 1.4%. Moderate to high carbon dioxide concentrations were consistently identified within each of the monitoring wells with the maximum concentration observed being 15.7% within WS11.

Due to the nature of the proposed development, the Wilson and Card classification system has been used to initially assess the risks from ground gases, (in accordance with CIRIA C665). The worst case gas screening value for carbon dioxide was calculated at <0.0157, which would fall into the 'very low risk' category and characteristic situation 1. Similarly the worst case gas screening value for methane was calculated at <0.0014, which would again fall into the 'very low risk' category and characteristic situation 1. However, due to the presence of methane being detected above 1% and carbon dioxide above 5%, the site would currently need to be classed as Characteristic Situation 2 (CS2).

This situation will need to be confirmed through the ongoing longer term monitoring program to obtain data over a range of atmospheric conditions and seasonal variations (including higher groundwater elevations)

Finally, although one concentration of organic vapour was identified at 143ppmV during the first round of monitoring, no concentrations of organic vapours have been identified above 10.0ppmV in the subsequent rounds and this result is likely to be an isolated result or an equipment malfunction. On this basis, no risks are considered associated with the migration of volatile organic compounds to indoor air, although this is dependent on the results of continued monitoring.

7 ENVIRONMENTAL CONCLUSIONS

The Phase I Desk Study identified a limited number of plausible contaminant linkages associated with the historic use of the site as a landfill. These risks relate to future site users through interaction with shallow soils and migration of ground gases to indoor air, as well as risks to controlled waters.

The Phase II Intrusive Investigation included the drilling of 20 boreholes to a maximum depth of 20.0m. Ground conditions were identified to comprise significant thicknesses of variable made ground / fill material which to the east of the site mostly comprised loose black-brown silty gravelly sand with various fill material such as ash, brick, concrete, glass, metal and plastic; whilst to the west the made ground was thinner and more cohesive in nature. The fill material was noted to a maximum depth of 7.2m bgl. Underlying the fill material was sporadic areas of sand and gravel, predominantly located towards the southwest of the site. Below either the fill or the sand/gravel lay stiff grey clay to depths exceeding 20m. Groundwater was identified within all boreholes except WS5 and WS6, with rest levels ranging between 2.150m and 3.796m bgl.

Laboratory analysis of the soil samples found concentrations of the metals arsenic, lead and mercury to exceed relevant screening criteria. Contaminants of concern therefore must be considered to have the potential to pose an unacceptable risk to future users / residents of the site, primarily through linkages associated with physical interaction, (e.g. direct contact, inadvertent ingestion, inhalation of dusts etc.), and therefore would not be suitable for use within garden areas without appropriate control measures. However, it is understood that ground levels will need to be raised by at least 600mm across the eastern area as part of the proposed development which will provide an appropriate cap to the underlying material, thereby removing the potential for physical interaction. Confirmation of the thickness and nature of material to be used for the ground raise will need to be confirmed once final development designs have been produced.

All construction workers operating at the site should be advised of the potential for contact with made ground in the subsurface at the site. Appropriate health and safety precautions should also be adopted during any excavation works to avoid exposure to soils. Reference should be made to relevant health & safety guidance including the following CIRIA document, *R132 Guide to Safe Working on Contaminated Sites*. A method statement for encountering unexpected contamination is included as Appendix H.

In order to reduce potential risks associated with ingress of contaminants to underground water supply pipework, for any new pipework installed as part of the proposed redevelopment, aluminium barrier pipework meeting Water Industry Standard 4-32-19 and associated fittings should be used subject to agreement with the local water company. If other pipework is preferable, more detailed testing may be required in accordance with UK Water Industry Research Report 10/WM/03/21 – *'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'* (2010).

Should any palpable evidence of unexpected contamination be encountered during the redevelopment work, it should be reported to EPS so that an inspection can be made and appropriate sampling and assessment work carried out. A method statement for encountering any unexpected contamination is included as Appendix K of this report.

Although relevant screening criteria protective of controlled waters resources have been exceeded for zinc and naphthalene in groundwater samples, the fact that some values exceed those of the screening values does not necessarily indicate that an unacceptable risk to controlled waters resources exists. The generic screening values are by their very nature, extremely conservative and in the first instance an exceedance should lead to qualitative consideration of the risks that may be posed given the context of a specific site / proposed development.

However, the underlying geology is classified as a secondary aquifer and the site is not located within a source protection zone for groundwater abstraction and as such is unlikely to be a regional groundwater source given the nearest source protection zone borehole lies approximately 1.5km to the southwest. Moreover, given the relatively low exceedances and the limited number noted across the site, these concentrations are not considered to pose an unacceptable risk to regional groundwater resources.

In terms of risks to surface waters, the nearest watercourse comprises Theobald's Brook, which runs alongside the site to the south. Although a minor exceedance of Zinc (1156mg/kg) was noted within WS2, no further exceedances were noted within any of the boreholes located closest to the brook with the highest concentrations located further away from the brook to the north. Again, given this factor and the limited nature of the exceedances, the concentrations are not considered to pose a significant risk to Theobald's Brook or any other nearby surface watercourses.

Waste analysis has identified the granular fill materials in the eastern area to contain levels of heavy metals (notably lead, copper and zinc) which would require them to be classed as hazardous waste if they were to be removed from site. This finding will need to be considered within appraisal and design of shallow workings (such as surface drainage attenuation tanks) in the eastern area. The clay based fill material in the west and underlying natural ground can be classed as Inert.

An initial monitoring program has not identified a significant ground gas issue. Methane has been recorded marginally above 1% at one location and carbon dioxide levels up to 15%, but notably there have been no measurable flow rates. Current data indicates only basic gas protection measures would be required for new buildings, in line with Characteristic Situation 2 (CS2), although this still needs to be confirmed through the ongoing longer term monitoring.

In accordance with the *Model Procedures for Management of Land Contamination, (Contaminated Land Report 11),* risks have been identified by this work that will require further assessment. A summary of the approach outlined in CLR11, marking the work already completed under the risk assessment phase, is presented as a flow diagram in Figure 4 of this report.

8 GEOTECHNICAL APPRAISAL

The ground conditions have been found to predominantly comprise a significant thickness of made ground / fill, underlain by superficial geology of brown-yellow sandy gravel in places and bedrock comprising firm-stiff grey silty clay.

8.1 Structural Foundations

The ground conditions are not considered suitable for the use of conventional spread foundations due to the thickness of made ground / fill materials identified at the surface.

Therefore it is recommended that piles are adopted, which will likely terminate in the London Clay, and carry their loads in a combination of end bearing and skin friction. It would be unwise to assume any positive contribution to skin friction within the Made Ground and Kempton Park Gravels. If levels are raised, the effects of negative skin friction will also need to be considered. Furthermore, it should be noted that the groundwater was recorded at between roughly 2m and 4m and care must therefore be taken to ensure that the piling method provides sound piles below groundwater.

A preliminary assessment of potential pile capacities has been provided in the table below, although in view of the wide variety of piles sizes available, and the range of installation plant and techniques, the design of the piles should be carried out by, and should remain the responsibility of the specialist piling contractor, who will reflect their own methods, experience and design procedures within their proposals.

	Allowable Working Load (kN)		
Depth of pile below ground level (m bgl)	**300mm Diameter Pile**	**400mm Diameter Pile**	**600mm Diameter Pile**
15	350	710	1010
18	580	790	1240

Note: A Factor of Safety of 2.5 has been adopted

8.2 Ground Floor Construction

Given the depth of made ground / fill materials encountered, suspended ground floor construction is recommended.

8.3 Groundworks

The stability of unsupported excavations in all soils should not be relied upon.

Heavy plant and stockpiles of materials should not be permitted close to the edges of unsupported excavations.

Further reference may be made to CIRIA Report No. 97 '*Trenching Practice*' 1992.

Groundwater was encountered within all boreholes except WS5 and WS6, with rest levels ranging between 2.150m and 3.796m and it is therefore possible that some degree of groundwater control may be required during excavations

8.4 Drainage

Infiltration testing was undertaken at five locations across the site (WS4, WS6, WS8, WS10, WS11). The results of the testing are presented in the table below.

Location	Infiltration Rate (m/s)
WS4	7.7701E-06
WS6	2.27533E-05
WS8	N/A*
WS10	6.23534E-06
WS11	N/A*

*Within WS8 and WS11 an infiltration rate could not be calculated because drainage was instant upon pouring the water into the well.

Regarding drainage strategy at the site, although the above results indicate that the use of soakaways would be feasible, their use to dispose of surface water will lead to concentration of water in the fill materials. As these soils are not natural and have not been subject to any form of compaction/treatment this will lead to inundation/collapse settlement of these soils and resultant damage to structures/pavements.

It is appreciated that shallow soils at the site are variable, with less made ground / fill materials identified towards the southwest, underlain by natural sand/gravel; and where shallow natural soils are present these might be suitable for soakaways, however the response zone should not be allowed in any made ground due to the points above.

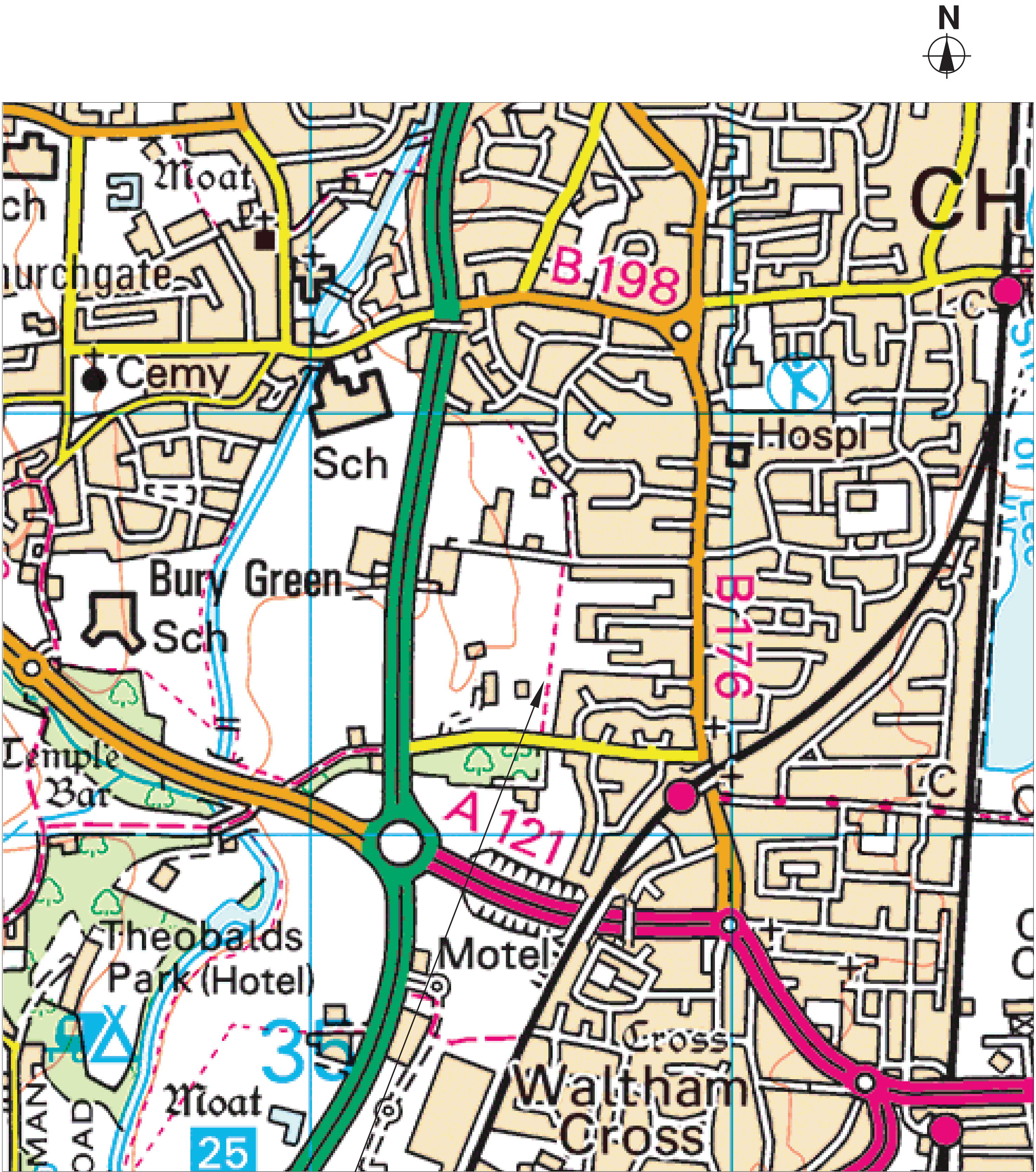
Nevertheless, where fill materials / significant quantities of made ground are present, it is not recommended that soakaways are used as a means to discharge surface water.

8.5 Concrete Grade

Sulphate contents and pH value determinations were carried out by the analytical laboratory on natural soils. Sulphate contents were recorded between 0.0134g/l and 1.7056g/l. The pH values ranged from 6.49 to 10.57.

In accordance with Part 1 of the BRE Special Digest 1 '*Concrete in Aggressive Ground*' 2005, in a data set where there are more than ten results available for the location, the mean of the highest 20% of sulphate test results should be taken as the characteristic value for water-soluble sulphate. Therefore, a design sulphate class of DS-2 is considered suitable for shallow buried concrete, with an aggressive chemical environment for concrete (ACEC) of AC-2.

FIGURES



Approximate Site Boundary

Title:	Site Location Plan		
Project:	Proposed Cheshunt Sports Village Theobalds Lane, Hertfordshire, EN8 8RX	Scale:	NTS
		Drawn By: TP	Approved By: WE
		Job No:	UK16.2295
		Dwg No:	Cheshunt/0916/01
Fig No:	1	Date:	September 2016

Approximate Site Boundary

eps

Title:	Aerial Photograph
Project:	Proposed Cheshunt Sports Village Theobalds Lane, Hertfordshire, EN8 8RX
Fig No:	2
Scale:	NTS
Drawn By:	TP
Approved By:	WE
Job No:	UK16.2295
Dwg No:	Cheshunt/0916/02
Date:	September 2016

EPS Window Sample Location Location

EPS Shell & Auger Location

Approximate Site Boundary

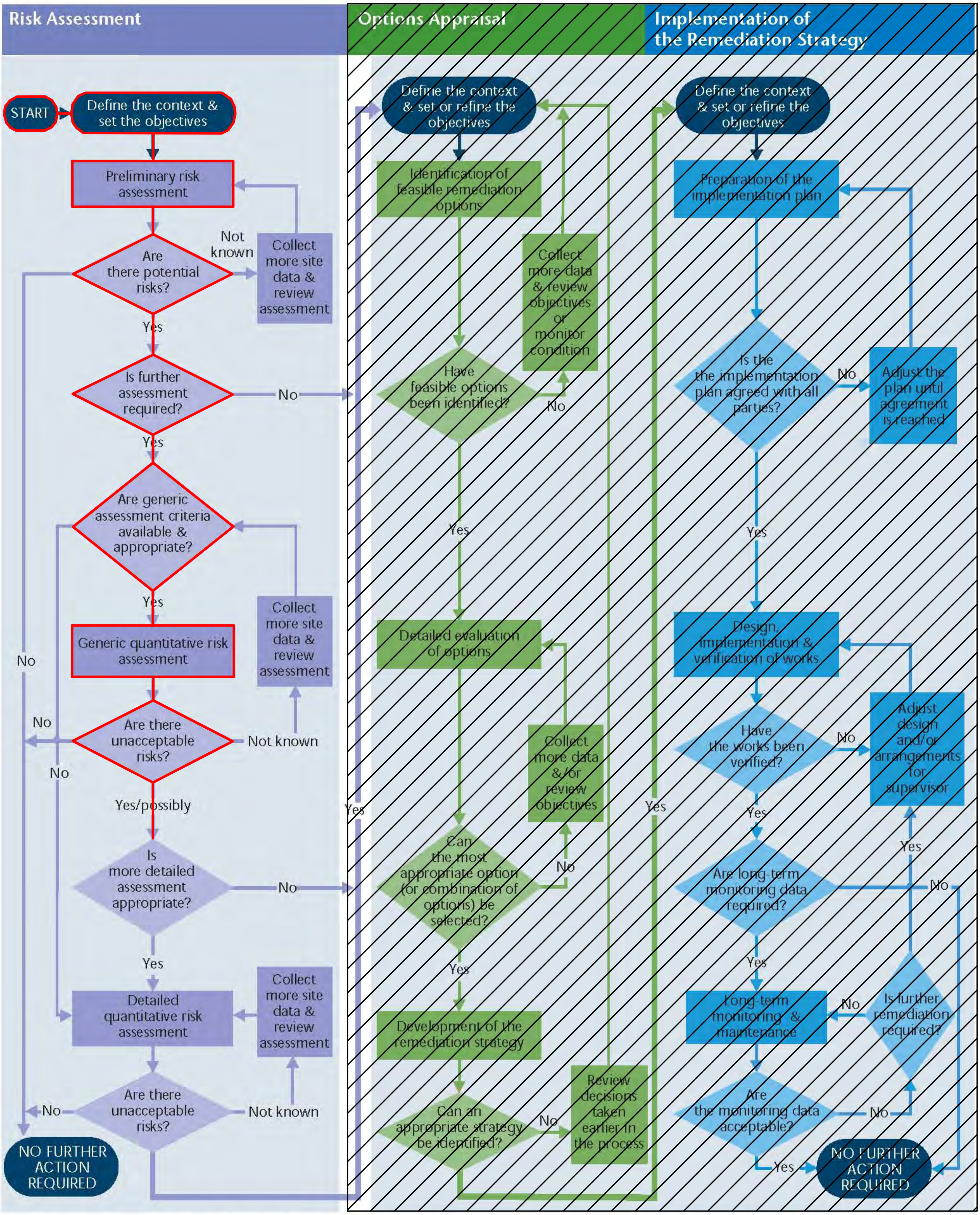
eps

Title: Borehole Location Plan

Project: Proposed Cheshunt Sports Village, Theobalds Lane, Cheshunt, EN8 8RX

Fig No: 4

Scale:	As Shown
Drawn By:	MJ
Approved By:	WE
Job No:	UK16.2295
Dwg No:	Cheshunt/0716/04
Date:	June 2016



Assessment Pathway for Site

Title:	**Site Context - CLR11**
Project:	Proposed Cheshunt Sports Village Theobalds Lane, Hertfordshire, EN8 8RX
Fig No:	4
Scale:	n/a
Drawn By:	TP
Approved By:	WE
Job No:	UK16.2295
Dwg No:	Cheshunt/0716/04
Revision Date:	August 2016

TABLES

Table 1 – Laboratory Testing Schedule

Sample ID	Sample Depth (m bgl)	Moisture Content & Atterberg Limits	PSD	Undrained Triaxial	pH and Sulphate	EPS Mini Suite	EPS TPH Suite	EPS Waste Suite	SVOC
WS1	0.1-0.4	-	-	-	-	1	1	-	-
WS1	1.3-1.5	-	-	-	1	-	-	-	-
WS1	3.2-3.4	-	-	-	-	-	-	1	-
WS1	N/A	-	-	-	-	1	1	-	1
WS2	1.4-1.7	-	-	-	-	-	-	1	-
WS2	2.6-2.8	-	-	-	1	-	-	-	-
WS2	N/A	-	-	-	-	1	1	-	1
WS3	0.3-0.5	-	-	-	-	1	-	-	-
WS3	0.9-1	-	-	-	1	-	-	-	-
WS4	1.1-1.3	-	-	-	1	-	-	-	-
WS4	3.3-3.5	-	-	-	-	-	-	1	-
WS4	3.5-3.7	-	1	-	-	-	-	-	-
WS4	N/A	-	-	-	-	1	1	-	1
WS5	0.5-0.6	-	-	-	-	1	-	-	-
WS5	1.7-1.8	-	-	-	1	-	-	-	-
WS6	1.1-1.3	-	-	-	1	-	-	-	-
WS7	0.8-1	-	-	-	1	-	-	-	-
WS7	2.2-2.4	-	-	-	-	1	1	-	-
WS7	N/A	-	-	-	-	1	1	-	1
WS8	2.4-2.5	-	-	-	-	-	-	1	-
WS8	2.8-3	-	-	-	1	-	-	-	-
WS8	N/A	-	-	-	-	1	1	-	1
WS9	1.3-1.5	-	-	-	-	1	1	-	-

Sample ID	Sample Depth (m bgl)	Moisture Content & Atterberg Limits	PSD	Undrained Triaxial	pH and Sulphate	EPS Mini Suite	EPS TPH Suite	EPS Waste Suite	SVOC
WS9	1.4-1.6	-	-	-	1	-	-	-	-
WS9	N/A	-	-	-	-	1	1	-	1
WS10	1.7-1.8	-	-	-	1	-	-	-	-
WS10	N/A	-	-	-	-	1	1	-	1
WS11	1.4-1.7	-	-	-	-	1	1	-	-
WS11	N/A	-	-	-	-	1	1	-	1
BH1	8	1	-	-	-	-	-	-	-
BH1	9.5	-	-	1	-	-	-	-	-
BH1	15.5	-	-	1	-	-	-	-	-
BH2	9	-	-	1	-	-	-	-	-
BH2	10	1	-	-	-	-	-	-	-
BH2	12	-	-	1	-	-	-	-	-
BH3	6.5	-	-	1	-	-	-	-	-
BH3	15	1	-	-	-	-	-	-	-
BH3	18.5	-	-	1	-	-	-	-	-
BH4	4.6	1	-	-	-	-	-	-	-
BH4	9.5	-	-	1	-	-	-	-	-
BH4	12.5	-	-	1	-	-	-	-	-
BH5	6.5	1	-	-	-	-	-	-	-
BH5	8	-	-	1	-	-	-	-	-
BH5	14	-	-	1	-	-	-	-	-
BH6	11	1	-	-	-	-	-	-	-
BH6	12.5	-	-	1	-	-	-	-	-
BH6	15.5	-	-	1	-	-	-	-	-

Sample ID	Sample Depth (m bgl)	Moisture Content & Atterberg Limits	PSD	Undrained Triaxial	pH and Sulphate	EPS Mini Suite	EPS TPH Suite	EPS Waste Suite	SVOC
BH7	7.5	-	-	1	-	-	-	-	-
BH7	15	1	-	-	-	-	-	-	-
BH7	16.5	-	-	1	-	-	-	-	-
BH8	5	-	1	-	-	-	-	-	-
BH8	7.5	1	-	-	-	-	-	-	-
BH8	8	-	-	1	-	-	-	-	-
BH8	14	-	-	1	-	-	-	-	-
BH8	N/A	-	-	-	-	1	1	-	1

Notes:

Notes:	mbgl	meters below ground level
	1	Sample Taken
	-	Sample Not Analysed
	EPS Mini Suite	Organic Matter, Cyanide, Metals, PAH's, Phenols, Asbestos
	EPS Waste Suite	Metals, PAH, TPH, Asbestos Screen, Inert WAC
	SVOC	Semi Volatile Organic Compounds
	EPS TPH Suite	Total Petroleum Hydrocarbons (including BTEX & MTBE)
	PSD	Particle Size Distribution

Table 2 – Groundwater Monitoring Data

Location	Depth to water (m bgl)	pH	Dissolved Oxygen (ppm)	Temperature (°C)	Product Thickness
WS1	2.577	6.83	0.29	15.8	n/a
WS2	2.454	6.82	0.31	16.4	n/a
WS4	2.861	6.95	0.31	15.6	n/a
WS7	3.796	7.00	0.59	17.1	n/a
WS8	3.711	7.15	0.39	15.1	n/a
WS9	2.635	6.78	0.35	15.5	n/a
WS10	2.305	6.98	0.92	14.6	n/a
WS11	2.964	6.67	0.34	16.3	n/a
BH8	3.935	7.07	0.38	16.1	n/a

Notes
n/a – not any
m bgl – metres below ground level
ppm – parts per million

Table 3 – Gas Monitoring Well Analysis (06/07/2016)

Sample ID	WS1	WS2	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	BH8
CH_4 (%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.1	<0.1	<0.1	<0.1	<0.1
CO_2 (%)	8.7	7.9	11.8	6.9	6.8	9.8	6.3	10.2	1.5	15.7	11.5
O_2 (%)	11.6	13.9	7.4	11.5	10.0	6.6	5.0	10.1	19.5	4.8	4.0
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gas Screening Value (l/hr) (CH_4)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0011	<0.0001	<0.0001	<0.0001	<0.0001
Gas Screening Value (l/hr) (CO_2)	<0.0087	<0.0079	<0.0118	<0.0069	<0.0068	<0.0098	<0.0063	<0.0102	<0.0015	<0.0157	<0.0115

Readings collected on 06/07/2016 at an atmospheric pressure of 1020mbar (Falling).

Table 3 (continued) – Gas Monitoring Well Analysis (13/07/2016)

Sample ID	WS1	WS2	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	BH8
CH_4 (%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.3	<0.1	<0.1	<0.1	<0.1
CO_2 (%)	6.8	7.0	8.8	7.3	6.0	10.4	8.1	8.0	2.2	4.6	12.2
O_2 (%)	14.3	15.1	11.1	11.3	11.4	7.3	1.0	12.9	19.0	18.1	3.7
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gas Screening Value (l/hr) (CH_4)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0013	<0.0001	<0.0001	<0.0001	<0.0001
Gas Screening Value (l/hr) (CO_2)	<0.0068	<0.0070	<0.0088	<0.0073	<0.0060	<0.0104	<0.0081	<0.0080	<0.0022	<0.0046	<0.0122

Readings collected on 13/07/2016 at an atmospheric pressure of 1023mbar (falling).

Table 3 (continued) – Gas Monitoring Well Analysis 19/07/2016)

Sample ID	WS1	WS2	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	BH8
CH_4 (%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.4	<0.1	<0.1	<0.1	<0.1
CO_2 (%)	9.4	7.0	9.8	6.9	12.5	8.6	8.0	6.7	1.9	15.5	6.6
O_2 (%)	11.7	14.8	10.3	12.3	3.4	9.7	0.2	14.1	19.1	5.8	10.2
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gas Screening Value (l/hr) (CH_4)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0014	<0.0001	<0.0001	<0.0001	<0.0001
Gas Screening Value (l/hr) (CO_2)	<0.0094	<0.0070	<0.0098	<0.0069	<0.0125	<0.0086	<0.0080	<0.0067	<0.0019	<0.0155	<0.0066

Readings collected on 19/07/2015 at an atmospheric pressure of 1014mbar (falling).

Table 3 (continued) – Gas Monitoring Well Analysis (26/07/2016)

Sample ID	WS1	WS2	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	BH8
CH_4 (%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.4	<0.1	<0.1	<0.1	<0.1
CO_2 (%)	10.6	4.1	11.1	6.8	7.1	11.1	6.6	9.0	1.4	15.3	12.8
O_2 (%)	10.7	17.1	10.3	13.7	10.8	7.1	0.1	12.7	19.7	6.2	5.5
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gas Screening Value (l/hr) (CH_4)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0014	<0.0001	<0.0001	<0.0001	<0.0001
Gas Screening Value (l/hr) (CO_2)	<0.0106	<0.0041	<0.0111	<0.0068	<0.0071	<0.0111	<0.0066	<0.0090	<0.0014	<0.0153	<0.0128

Readings collected on 26/07/2016 at an atmospheric pressure of 1018mbar (falling).

Table 3 (continued) – Gas Monitoring Well Analysis (04/08/2016)

Sample ID	WS1	WS2	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	BH8
CH_4 (%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.2	<0.1	<0.1	<0.1	<0.1
CO_2 (%)	13.0	6.4	10.5	6.8	1.5	11.4	8.9	8.0	1.6	13.4	12.1
O_2 (%)	8.4	15.4	10.8	13.1	17.7	5.8	0.3	13.4	19.2	8.3	4.6
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gas Screening Value (l/hr) (CH_4)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0012	<0.0001	<0.0001	<0.0001	<0.0001
Gas Screening Value (l/hr) (CO_2)	<0.0130	<0.0064	<0.0105	<0.0068	<0.0015	<0.0114	<0.0089	<0.0080	<0.0016	<0.0134	<0.0121

Readings collected on 04/08/2016 at an atmospheric pressure of 1003mbar (falling).

Table 3 (continued) – Gas Monitoring Well Analysis (16/08/2016)

Sample ID	WS1	WS2	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	BH8
CH_4 (%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1
CO_2 (%)	8.9	4.7	9.5	7.4	6.2	8.3	7.1	7.7	1.2	14.1	6.8
O_2 (%)	13.0	16.4	12.2	13.6	11.9	10.0	5.2	13.6	19.5	8.3	12.0
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gas Screening Value (l/hr) (CH_4)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001
Gas Screening Value (l/hr) (CO_2)	<0.0089	<0.0047	<0.0095	<0.0074	<0.0062	<0.0083	<0.0071	<0.0077	<0.0012	<0.0141	<0.0068

Readings collected on 16/08/2016 at an atmospheric pressure of 1016mbar (falling).

Table 3 (continued) – Gas Monitoring Well Analysis (25/08/2016)

Sample ID	WS1	WS2	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	BH8
CH_4 (%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CO_2 (%)	8.6	2.9	9.8	7.7	8.8	9.9	9.3	0.8	0.9	13.3	12.5
O_2 (%)	12.7	17.7	11.7	13.0	9.6	7.3	2.4	14.6	20.1	8.6	4.7
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gas Screening Value (l/hr) (CH_4)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Gas Screening Value (l/hr) (CO_2)	<0.0086	<0.0029	<0.0098	<0.0077	<0.0088	<0.0099	<0.0093	<0.0008	<0.0009	<0.0133	<0.0125

Readings collected on 25/08/2016 at an atmospheric pressure of 1010mbar (falling).

Table 3 (continued) – Gas Monitoring Well Analysis (30/08/2016)

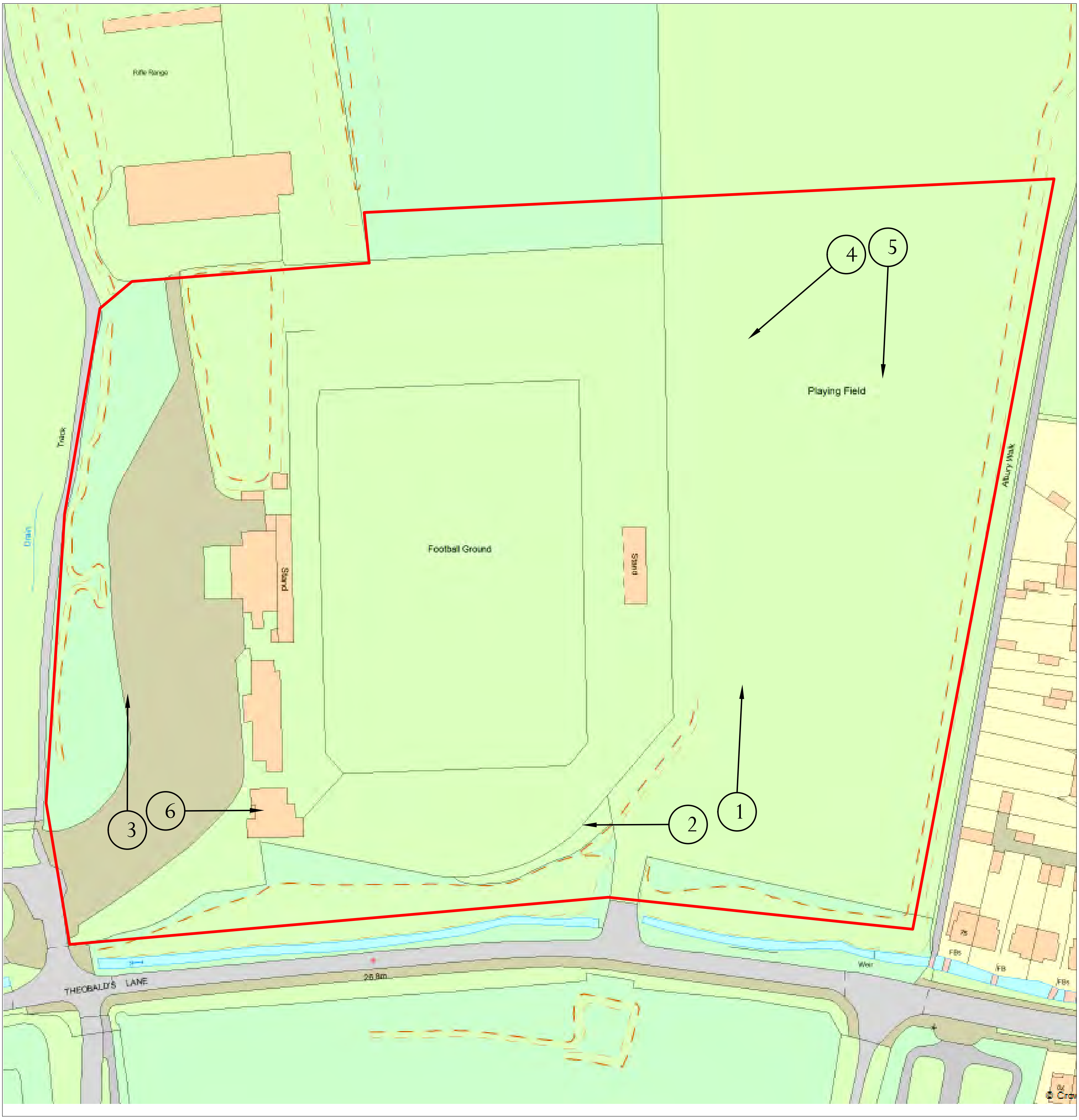
Sample ID	WS1	WS2	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	BH8
CH_4 (%)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CO_2 (%)	9.2	6.1	9.7	7.7	10.1	11.8	10.8	7.6	1.4	13.9	11.5
O_2 (%)	12.1	15.1	12.3	14.0	7.7	5.7	0.3	13.5	19.7	8.1	6.4
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gas Screening Value (l/hr) (CH_4)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Gas Screening Value (l/hr) (CO_2)	<0.0092	<0.0061	<0.0097	<0.0077	<0.0101	<0.0118	<0.0108	<0.0076	<0.0014	<0.0139	<0.0115

Readings collected on 30/08/2016 at an atmospheric pressure of 1021mbar (falling).

APPENDICES

APPENDIX A

Selected Site Photographs



Key:

1 Approximate Photo Location

Approximate Site Boundary

eps

Title: **Photo Location Plan**

Project: Proposed Cheshunt Sports Village, Theobalds Lane, Cheshunt, EN8 8RX

Appendix: A

Scale:	As Shown
Drawn By: MJ	Approved By: WE
Job No:	UK16.2295
Dwg No:	Cheshunt/0816/04
Date:	August 2016

Photo 1: View looking north across the eastern playing fields.

Photo 2: View looking west along the south of the site.

Photo 3: View looking north across the car park to the west.

Photo 4: View looking southwest from the northeast corner of the site.

Photo 5: View looking south across the eastern playing fields.

Photo 6: View looking east towards the site buildings.

APPENDIX B

Proposed Development Plan

1:50	1	2.5	5m
1:100	2	5	10m
1:200	4	10	20m
1:500	10	25	50m

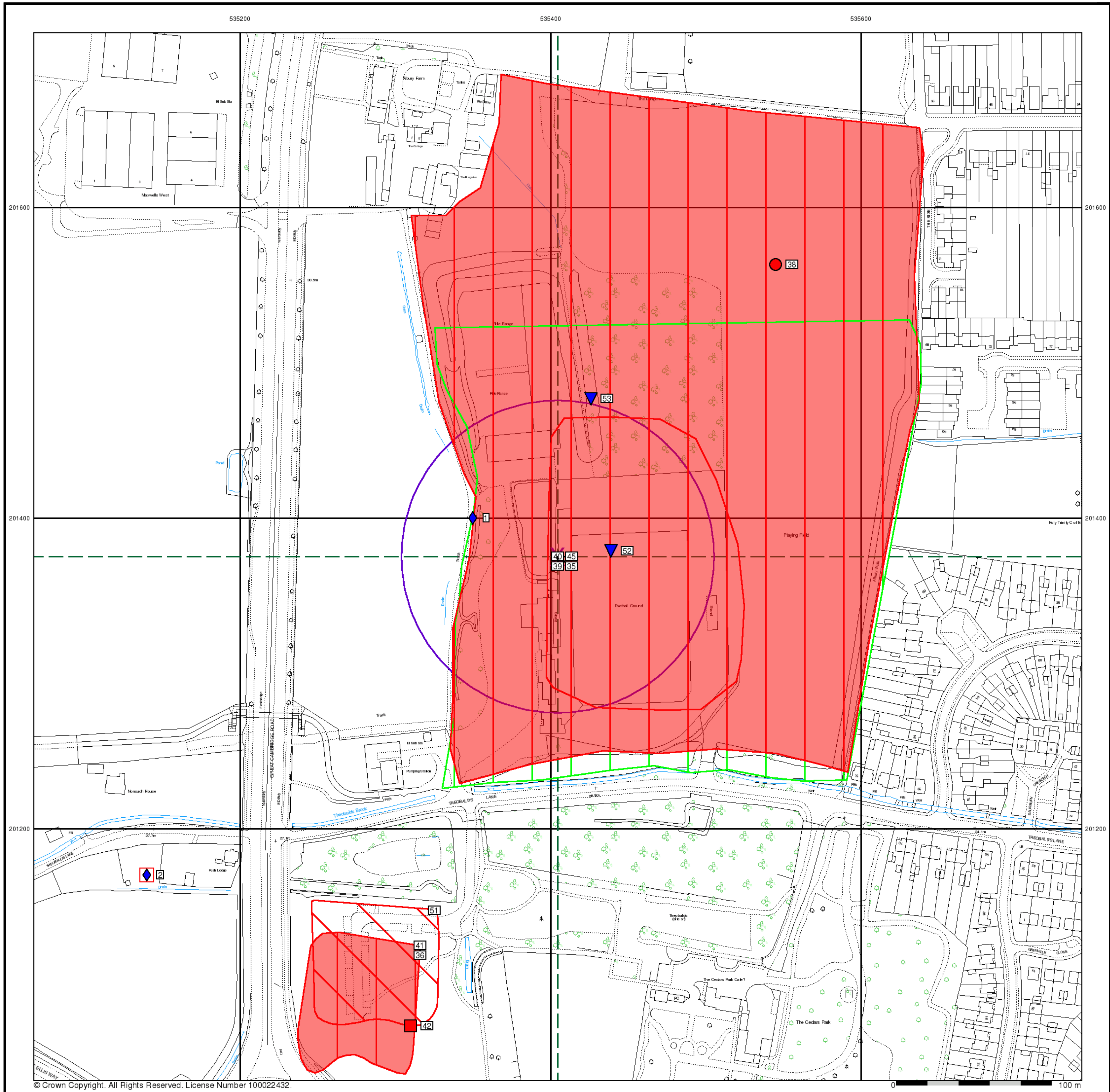
bryant + moore
ARCHITECTS
19–25 Salisbury Square, Old Hatfield, Herts AL9 5BT
Tel: 01707 251428 Fax: 01707 251429 Email: mb@bryantandmoore.co.uk

PROPOSED DEVELOPMENT AT:
CHESTHUNT FC

EXISTING TOPOGRAPHICAL 1:500@A1 MAY 2014 15_238_FS03

APPENDIX C

Surrounding Land Use



eps

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location
- Pylon
- Overhead Transmission Line

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

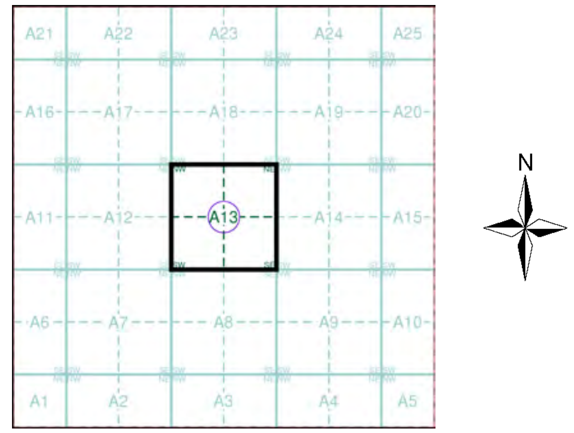
Geological

- BGS Recorded Mineral Site

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Segment A13



Order Details

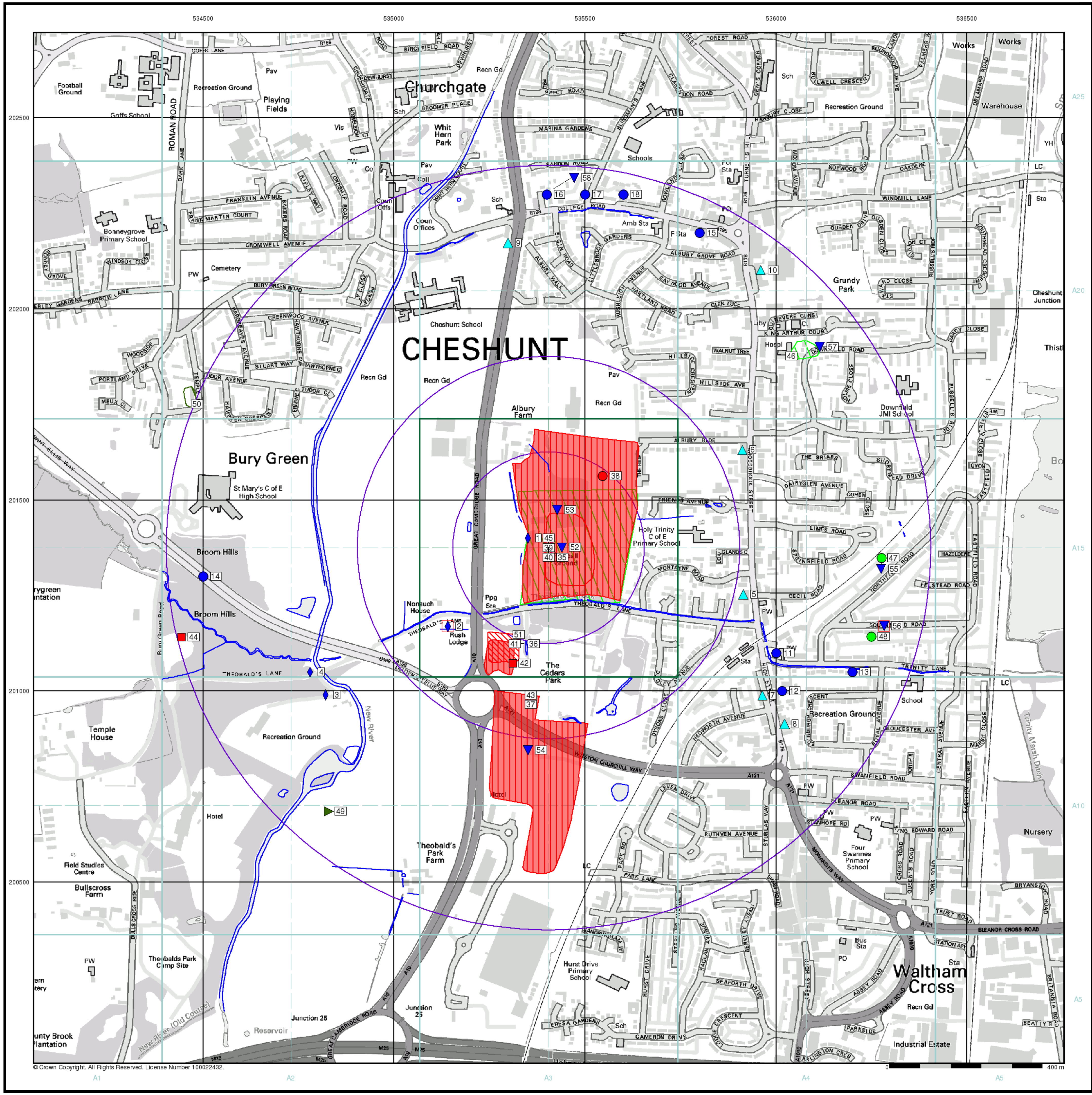
Order Number: 88157315_1_1
Customer Ref: UK16.2295
National Grid Reference: 535400, 201380
Slice: A
Site Area (Ha): 0.01
Plot Buffer (m): 100

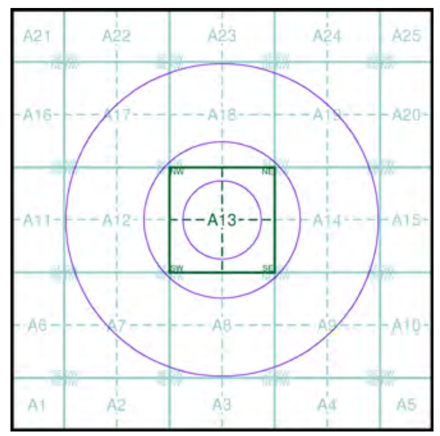
Site Details

Proposed Cheshunt Sports Village, Cheshunt, Herts, EN8 8RX

Landmark Information Group

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





General

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- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

Agency and Hydrological

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- Contaminated Land Register Entry or Notice
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- Enforcement or Prohibition Notice
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- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
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- Prosecution Relating to Authorised Processes
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Hazardous Substances

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- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
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- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Slice A

Order Details

Order Number:	88157315_1_1
Customer Ref:	UK16.2295
National Grid Reference:	535400, 201380
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Proposed Cheshunt Sports Village, Cheshunt, Herts, EN8 8RX

Landmark Information Group

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

APPENDIX D

Geological Context

Geology 1:50,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	WMGR	Infilled Ground	Artificial Deposit	Cenozoic - Cenozoic
	MGR	Made Ground (Undivided)	Artificial Deposit	Holocene - Holocene
	LSGR	Landscaped Ground (Undivided)	Artificially Modified Ground	Holocene - Holocene

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Flandrian
	KPGR	Kempton Park Gravel Formation	Sand and Gravel	Devensian - Devensian
	ESI	Enfield Silt Member	Clay and Silt	Flandrian - Devensian
	KPGR	Kempton Park Gravel Formation	Clay and Silt	Devensian - Devensian
	TPGR	Taplow Gravel Formation	Sand and Gravel	Wolstonian - Wolstonian
	LOFT	Lowestoft Formation	Diamicton	Anglian - Anglian
	DHGR	Dollis Hill Gravel Member	Sand and Gravel	Anglian - Cromerian
	RTDU	River Terrace Deposits (Undifferentiated)	Sand and Gravel	Quaternary - Quaternary

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	LC	London Clay Formation	Clay, Silt and Sand	Eocene - Eocene

Geology 1:50,000 Maps

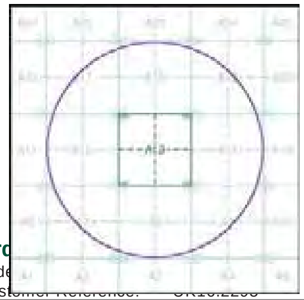
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.

The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID:	1
Map Sheet No:	239
Map Name:	Hertford
Map Date:	1978
Bedrock Geology:	Available
Superficial Geology:	Available
Artificial Geology:	Not Available
Faults:	Not Supplied
Landslip:	Not Available
Rock Segments:	Not Supplied

Geology 1:50,000 Maps - Slice A



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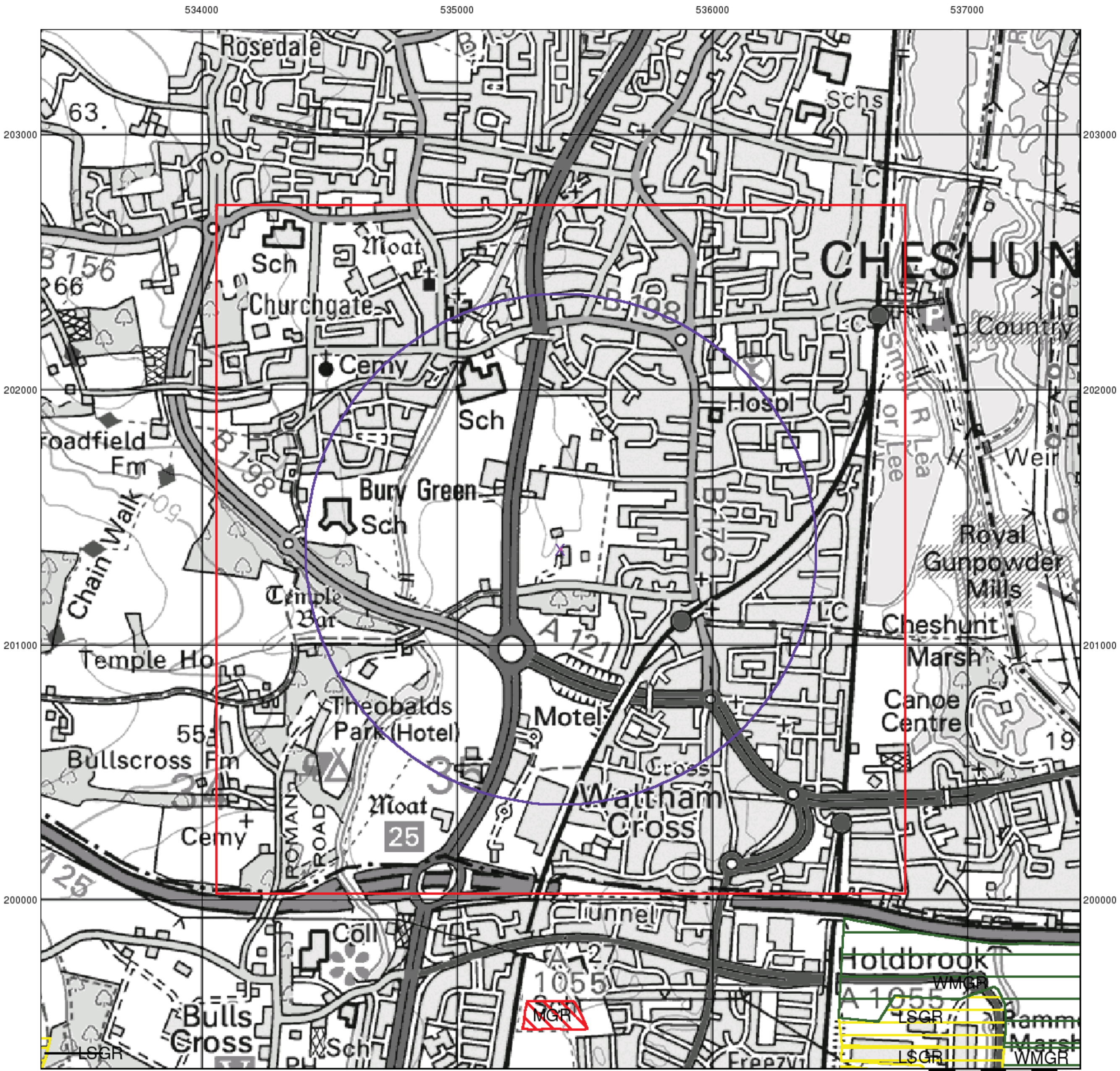
National Grid Reference: 535400, 201380
Slice: A
Site Area (Ha): 0.01
Search Buffer (m): 1000

Site Details:

Proposed Cheshunt Sports Village, Cheshunt, Herts, EN8 8RX

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



Artificial Ground and Landslip

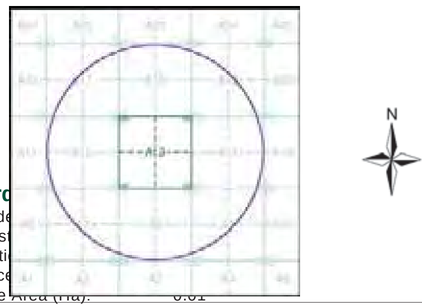
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



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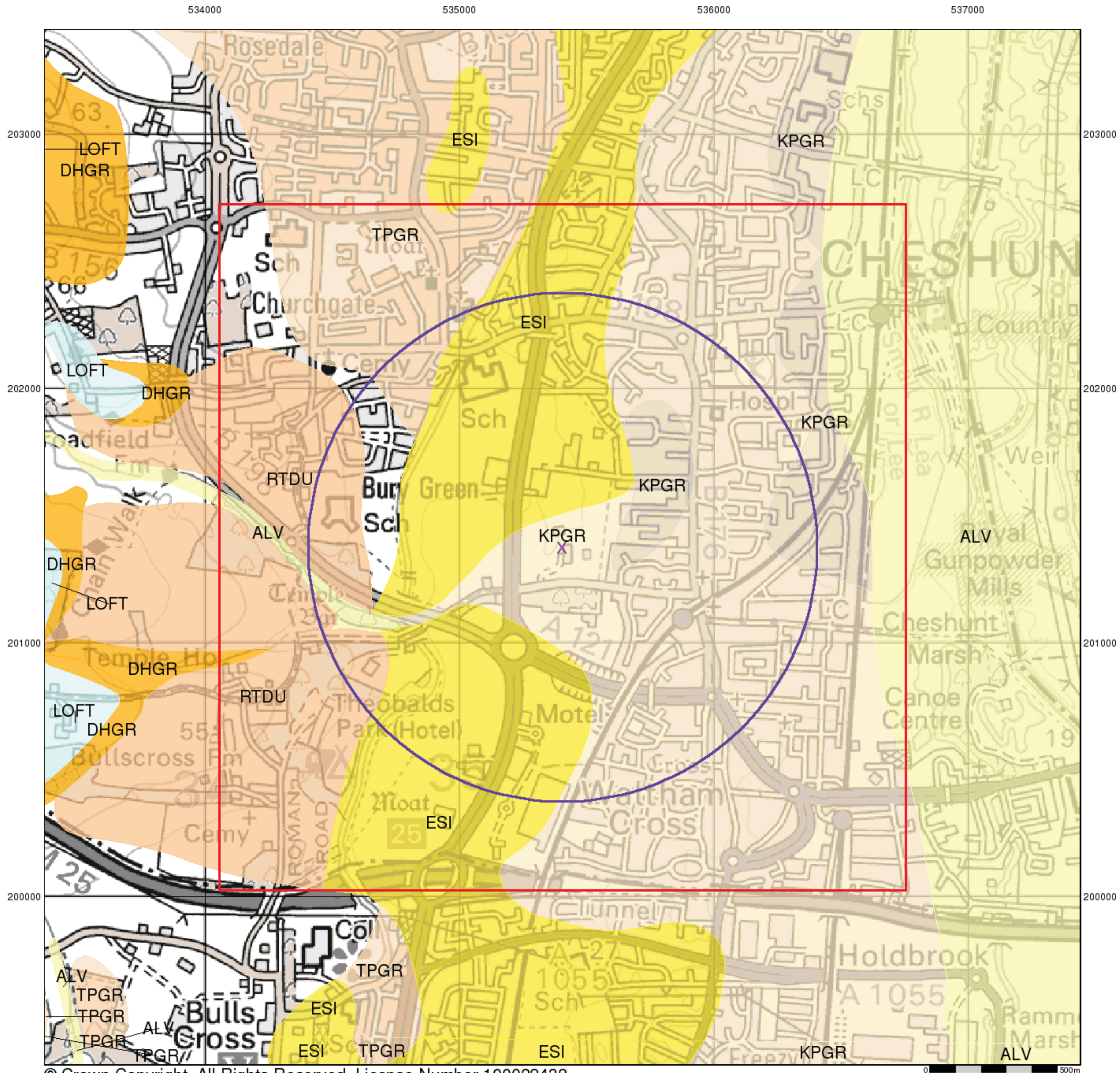
Slice
Site Area (ha):
Search Buffer (m): 1000

Site Details:

Proposed Cheshunt Sports Village, Cheshunt, Herts, EN8 8RX

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



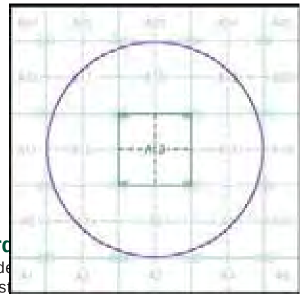
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



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National Grid Reference: 535400, 201380
Slice: A
Site Area (Ha): 0.01
Search Buffer (m): 1000

Site Details:

Proposed Cheshunt Sports Village, Cheshunt, Herts, EN8 8RX

Tel: 0844 844 9952
Fax: 0844 844 9951
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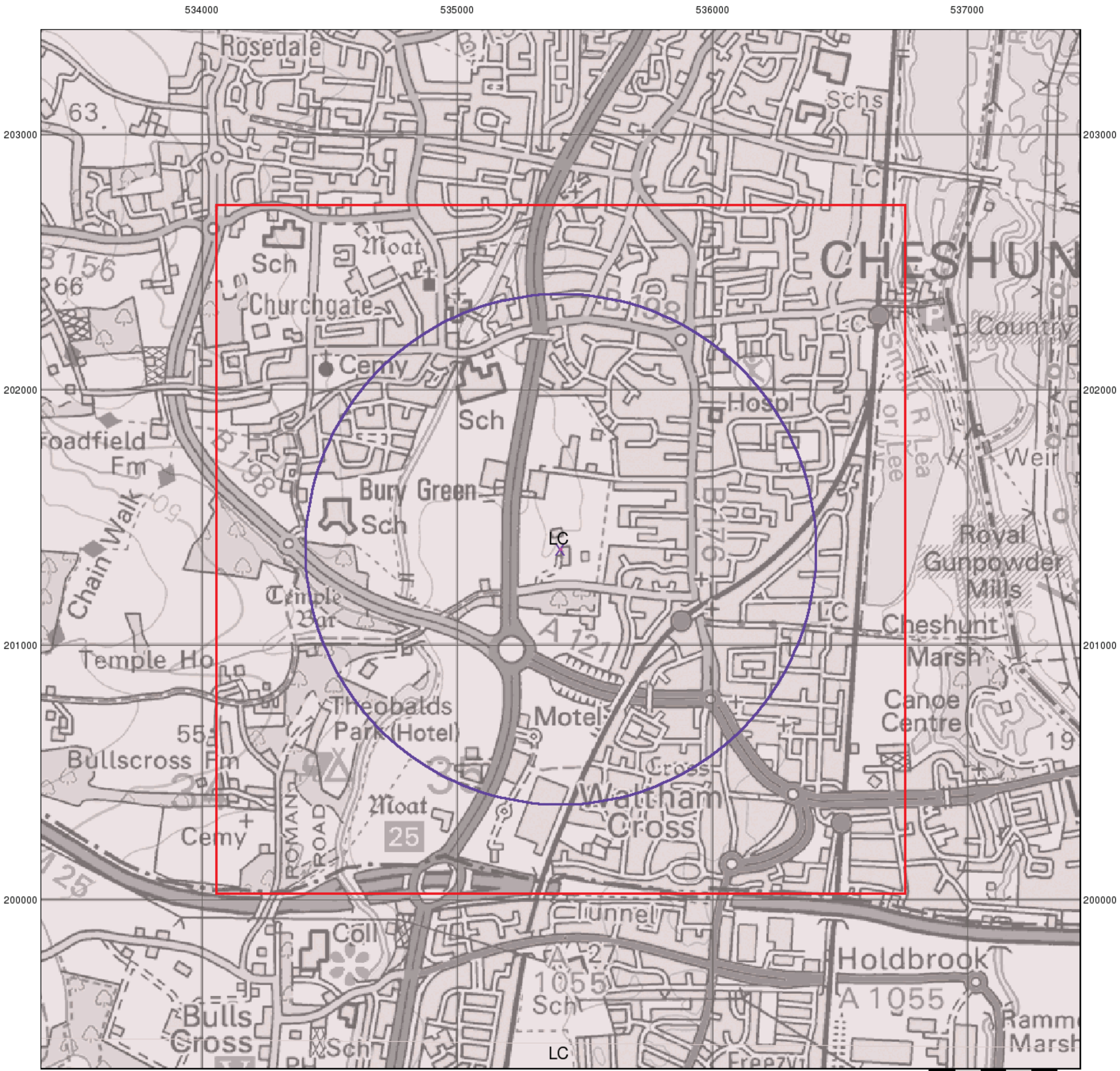


Bedrock and Faults

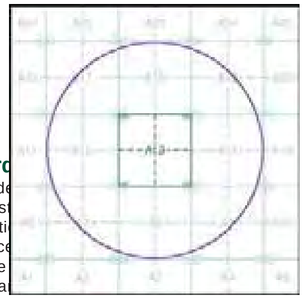
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



N

Ord
Orde
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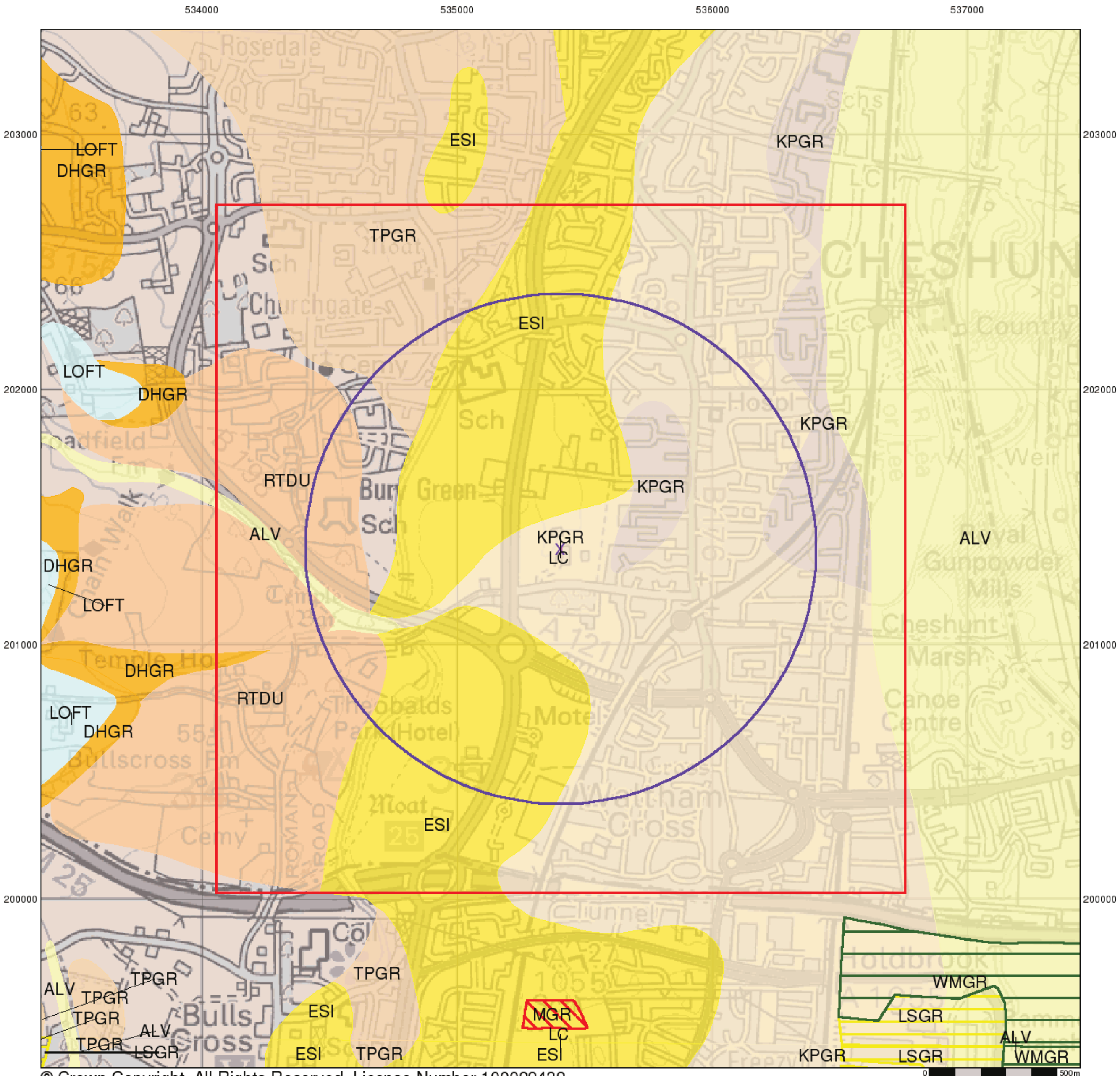
Nati
Slice
Site
Sea

Site Details:

Proposed Cheshunt Sports Village, Cheshunt, Herts, EN8 8RX

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



Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

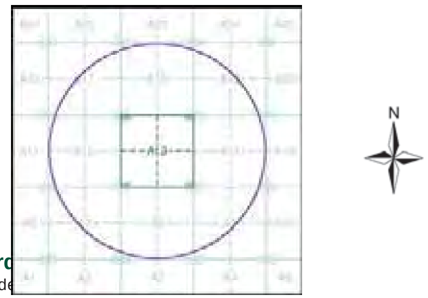
Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Telephone: 0115 936 3143
Fax: 0115 936 3276
email: enquiries@bgs.ac.uk
website: www.bgs.ac.uk

Combined Geology Map - Slice A



Ord

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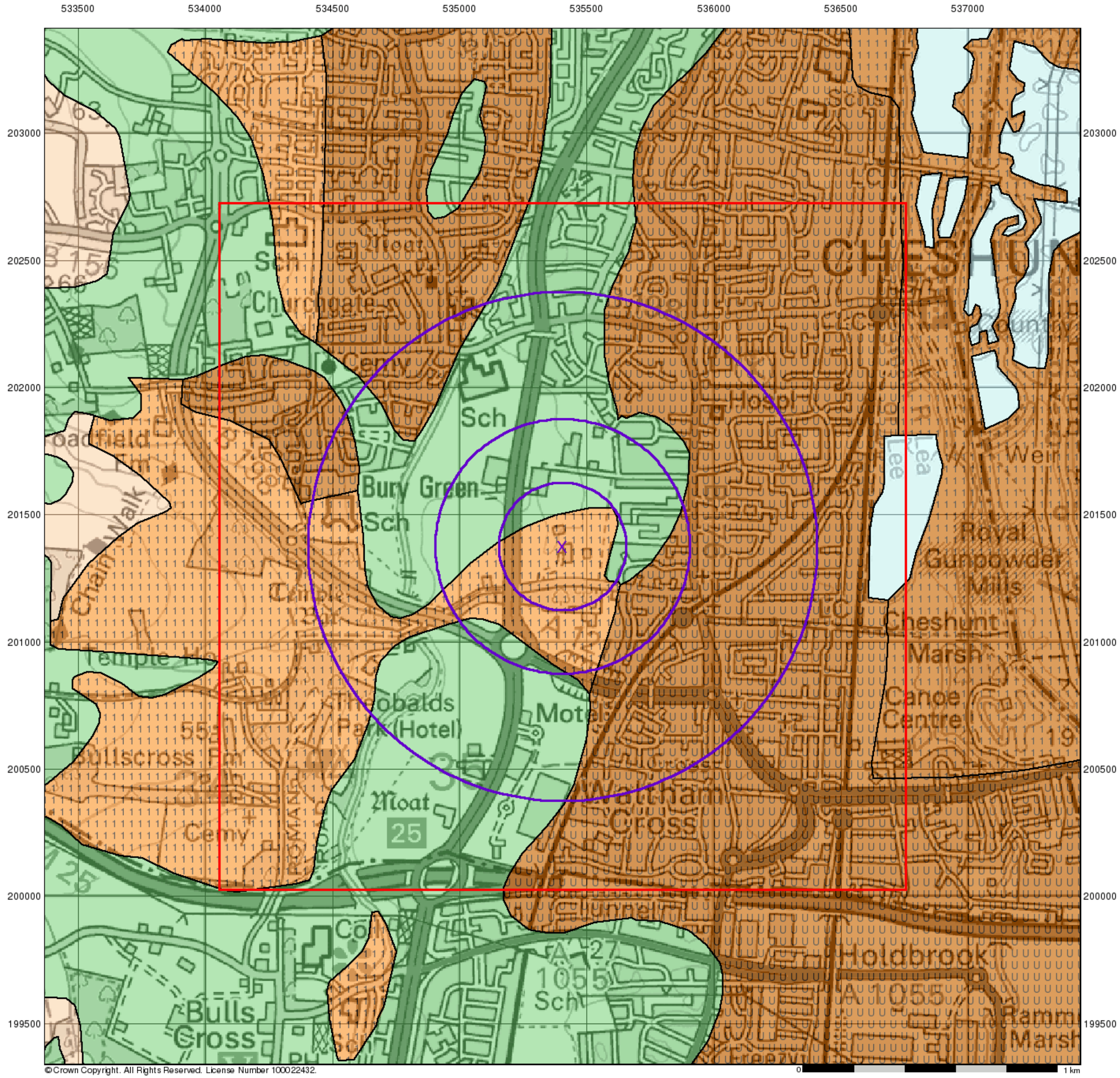
Customer Reference: UK16.2295
National Grid Reference: 535400, 201380
Slice: A
Site Area (Ha): 0.01
Search Buffer (m): 1000

Site Details:

Proposed Cheshunt Sports Village, Cheshunt, Herts, EN8 8RX

APPENDIX E

Groundwater Vulnerability and Flood Maps



Groundwater Vulnerability

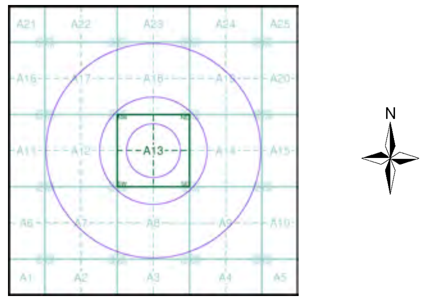
General

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

Agency and Hydrological

Geological Classes	Soil Classes
Major Aquifer (Highly Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Minor Aquifer (Variably Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Non Aquifer (Negligibly Permeable)	
Water or Sea	
Drift Deposit	

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 88157315_1_1
Customer Ref: UK16.2295
National Grid Reference: 535400, 201380
Slice: A
Site Area (Ha): 0.01
Search Buffer (m): 1000

Site Details

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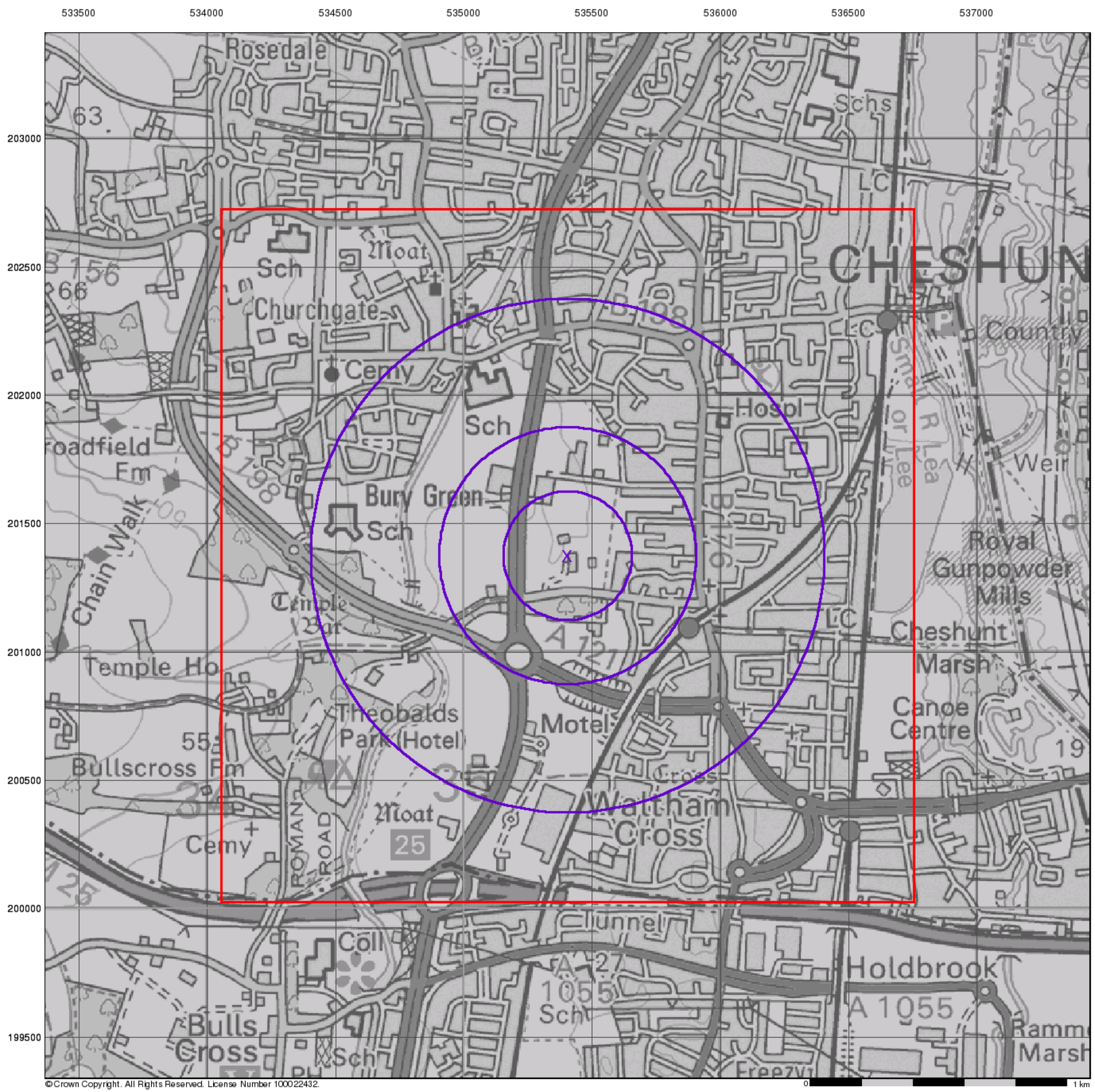


Bedrock Aquifer Designation

General

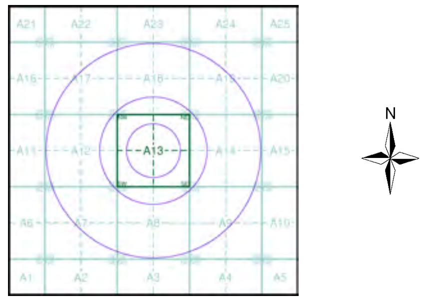
Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice
Map ID

Agency and Hydrological

Geological Classes

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

Site Sensitivity Context Map - Slice A



Order Details

Order Number:	88157315_1_1
Customer Ref:	UK16.2295
National Grid Reference:	535400, 201380
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

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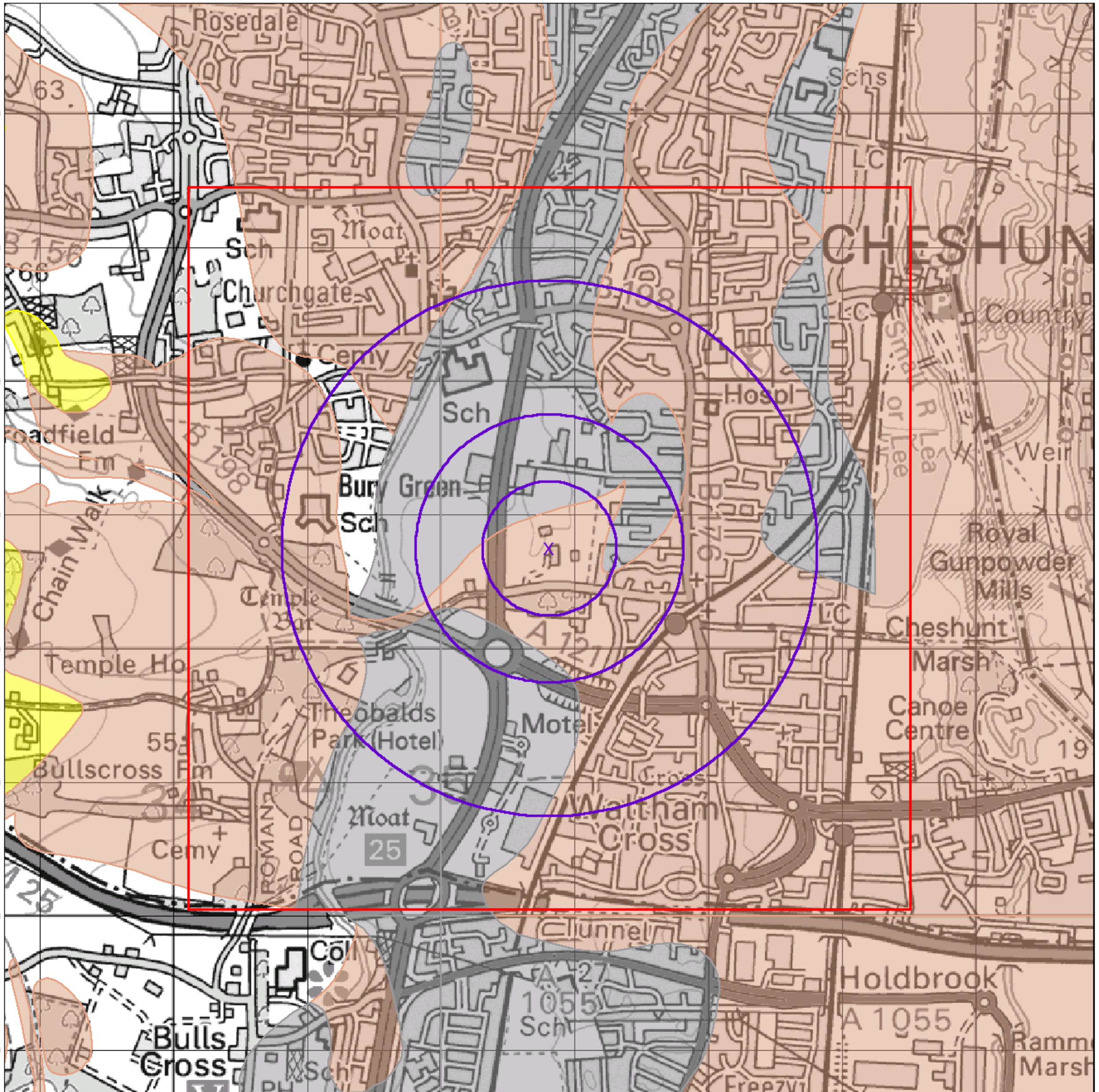


Superficial Aquifer Designation

General

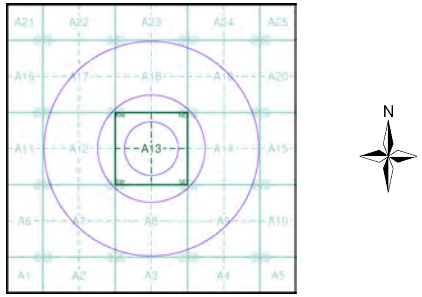
Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice
Map ID

Agency and Hydrological

Geological Classes

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

Site Sensitivity Context Map - Slice A



Order Details

Order Number:	88157315_1_1
Customer Ref:	UK16.2295
National Grid Reference:	535400, 201380
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

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