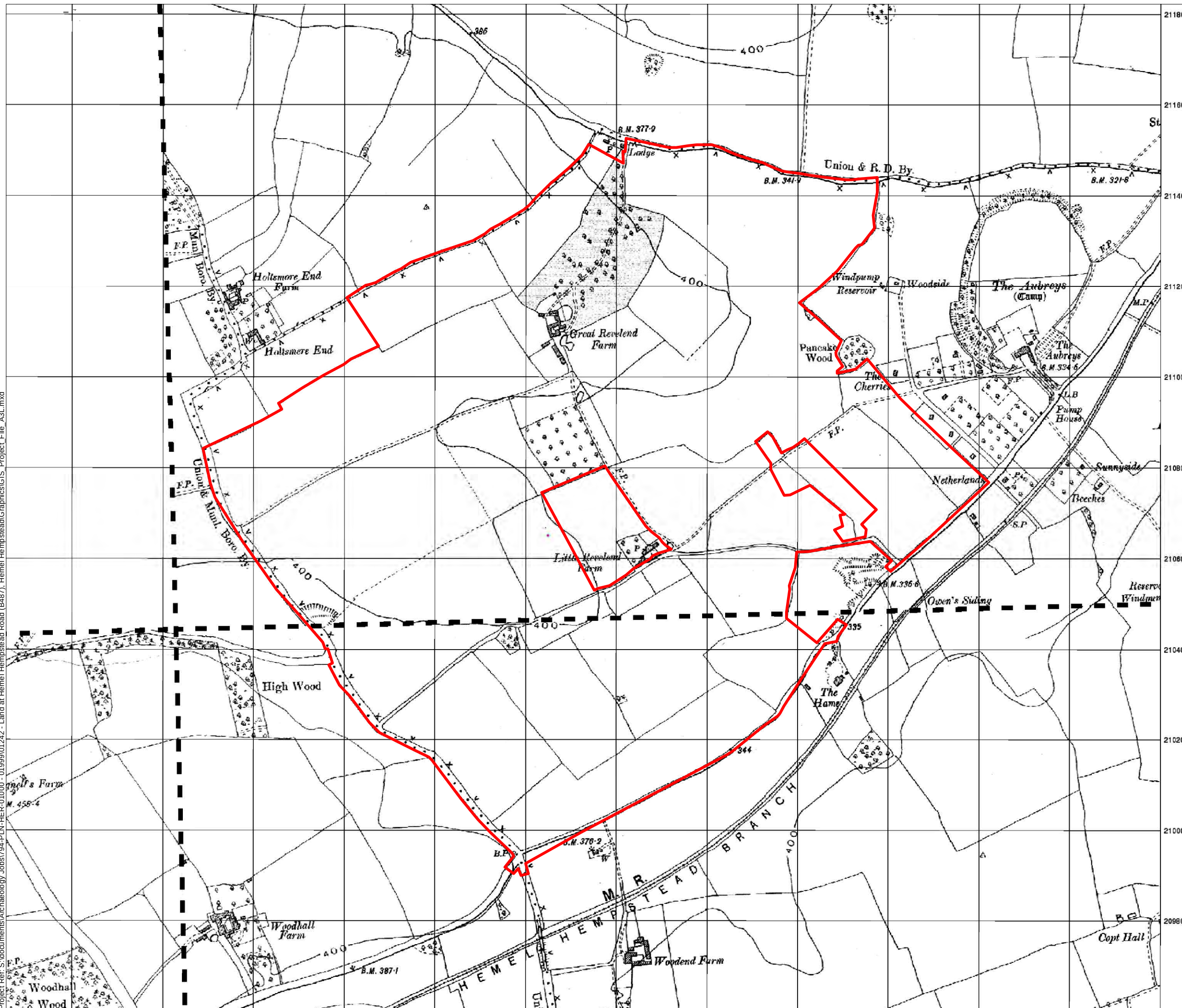


Project Ref: S:\Documents\Archaeology_Jobs\794-PLN-HER-01000 - 01999\01242 - Land at Hemel Hempstead Road (B487), Hemel Hempstead\Graphics\GIS Project File_A31.mxd



 Site Boundary

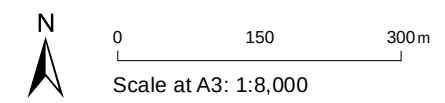


Figure 10
1925 - 1926 Ordnance Survey

Project Ref: S:\Documents\Archaeology_Jobs\704-PLN-HER-01000 - 01999\01242 - Land at Hemel Hempstead Road (B487), Hemel Hempstead\Graphics\GIS Project File_A31.mxd



 Site Boundary

N
0 150 300m
Scale at A3: 1:8,000



Figure 11
1964 - 1965 Ordnance Survey

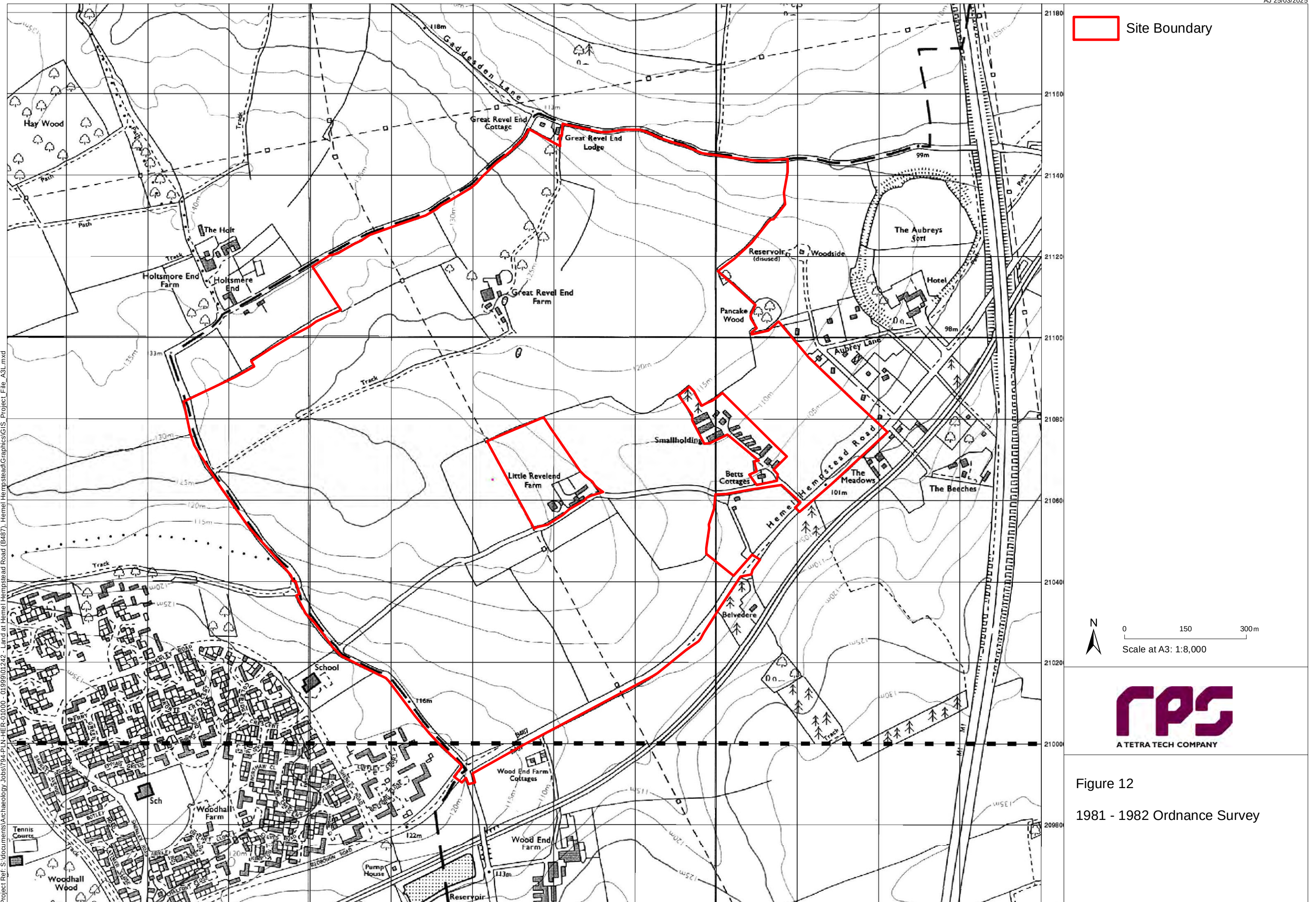


Figure 12

1981 - 1982 Ordnance Survey

Project Ref: S:\documents\Archaeology_Jobs\794-PLN-HER-01000 - 01999\01242 - Land at Hemel Hempstead Road (B487), Hemel Hempstead\Graphics\GIS Project File_A31.mxd



 Site Boundary

 N
0 150 300m
Scale at A3: 1:8,000



Figure 13
2009 Google Earth Image

Project Ref: S:\documents\Archaeology_Jobs\794-PLN-HER-01000 - 01999\01242 - Land at Hemel Hempstead Road (B487), Hemel Hempstead\Graphics\GIS Project_Files_A31.mxd



 Site Boundary


0 150 300m
Scale at A3: 1:8,000



Figure 14
2020 Google Earth Image

Project Ref: S:\documents\Archaeology_Jobs\704-PLN-HER-01000 - 01999\01242 - Land at Hemel Hempstead\Graphics\GIS Project_Files_A31.mxd



 Site Boundary

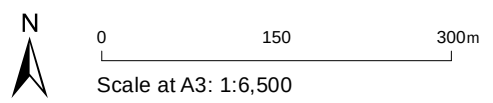
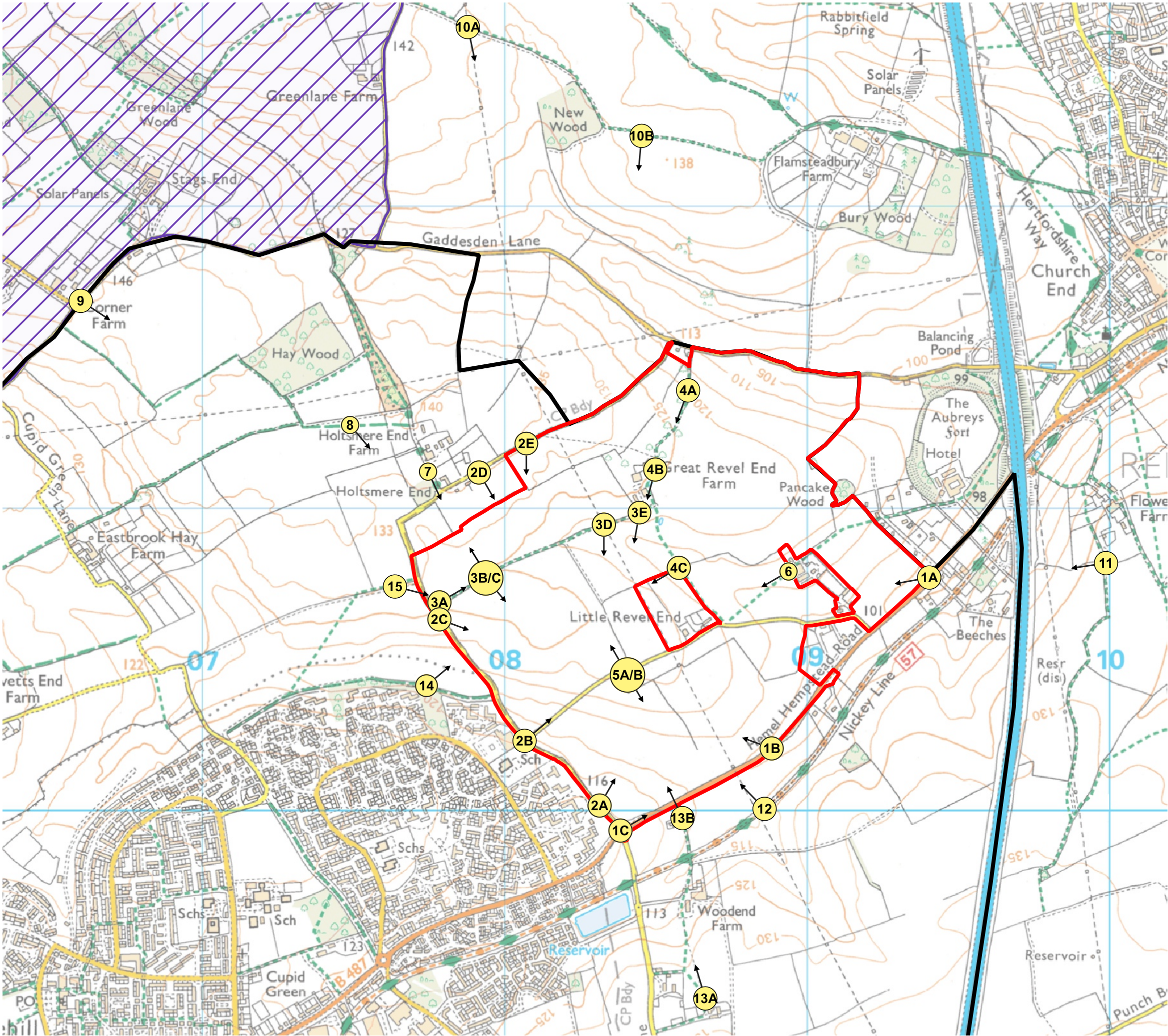


Figure 15
Site Photographs

Contact

Sherwood House, Sherwood Avenue
Newark, Nottinghamshire NG24 1QQ
T +44 1636 642 707

Appendix 14.1 – Viewpoint Location Plans



This drawing is the property of FPCR Environment and Design Ltd and is issued on the condition it is not reproduced, retained or disclosed to any unauthorised person, either wholly or in part without written consent of FPCR Environment and Design Ltd

Ordnance Survey material - Crown Copyright. All rights reserved. Licence Number: 100019980 (Centremapslive.com)



- KEY
- Site Boundary
 - Hemel Hempstead Growth Area Boundary
 - Chilterns National Landscape
 - Viewpoint Locations

date	10/03/25	drwn/chkd	DY/EAF
client	Pigeon and Bloor Homes		
project	Hemel Hempstead		
title	VISUAL APPRAISAL	scale	1:12,500 @ A3
number	FIGURE 6	rev	A

Appendix 16.1 – Phase 1 Geo-Environmental Study



Phase I Geo-Environmental Desk Study

Land at Holtsmere End Lane

Hemel Hempstead
St Albans
Hertfordshire
AL3 7AW

Prepared for:

Pigeon (Hemel Hempstead) Limited
Salisbury House
Station Road
Cambridge
CB1 2LA

&

Bloor Homes South Midlands
Bewick House
6 Cygnet Drive
Swan Valley
Northampton
NN4 9BS

EPS Project Reference: UK24.7212

Date Issued: 7th March 2025

Report Status: Issue 1



LAND AT HOLTSMEER END LANE, HEMEL HEMPSTEAD

NON-TECHNICAL CLIENT SUMMARY

This report presents the findings of a Phase I Geo-Environmental Desk Study which was carried out to assess risks posed by contaminated land and to provide an initial assessment of geological/ geotechnical hazards, and how the proposed scheme might be affected.

- The land at Holtsmere End Lane is currently occupied by fields used as arable farmland and has remained largely undeveloped throughout its history, with the exception of some suspected infilled chalk pits, and other minor areas of infilling where made ground could be present. It is understood that outline development proposals are for a notable residential scheme.
- Geological mapping suggests the ground conditions consist of Clay-with-Flints or superficial Head Deposits over chalk bedrock. Some previous intrusive investigations carried out by EPS in 2019 and 2020 in the southern parcel found the superficial Clay-with-Flints to extend to a maximum depth of 6.7m, with chalk below.
- The main risk identified with respect to the proposed development is the potential for the interaction between groundworkers and future site users (residents) with potentially contaminated shallow soils. Therefore, further assessment is recommended to assess soil quality across the site, with particular focus given to areas where infilled features or made ground might be expected based on historical mapping and geophysical surveys completed by third party consultants.
- Risks to future site users from the generation and accumulation of ground gases have also been highlighted, primarily associated with the historic chalk pits recorded onsite, but also a nearby landfill. Therefore, additional ground gas monitoring to complement the existing data has also been recommended. Furthermore, some of the site lies within an area where basic radon protective measures will likely be required in the construction of new buildings, and it is recommended that a detailed radon report is obtained and compared against future development proposals once this has been made available.
- A moderate risk of the presence of chalk dissolution has also been identified. This must be given full consideration in future design, albeit current indications suggest that this will not represent a significant constraint to development; based on the findings of initial ground investigation works conducted by EPS, although it is recognised that further detail and coverage is required for this to be conclusive.

By their very nature, the above bullet points represent a simplified summary of our work and **must not** be relied upon to form the basis for key decisions for the proposed development. A full picture is provided in the following report, or alternatively give us a call and we'll talk you through it.



Project Reference:	UK24.7212	
Title:	Phase I Geo–Environmental Desk Study – Land at Holstmere End Lane, Hemel Hempstead	
Client:	Pigeon (Hemel Hempstead) Limited & Bloor Homes South Midlands	
Date:	7 th March 2025	
EPS Contact Details:	7B Caxton House Broad Street Cambourne Cambridge CB23 6JN	T: 01954 710666 E: info@epstrategies.co.uk W: www.epstrategies.co.uk
Status:	Issue 1	

Author:	Reviewed:	Authorised:
		
Tom Androsiuk	Ben Virtue	Ben Virtue
Principal Consultant	Associate Director	Associate Director

This report has been prepared for the client(s) listed on the report title page. EPS accepts no liability or responsibility for use of, or reliance upon, this report and / or the information contained within it by third parties.

If third parties have been contracted / consulted during compilation of this report, the validity of any data they may have supplied, and which are included in the report, have been assessed as far as possible by EPS however, EPS cannot guarantee the validity of these data.

No part of this report, or references to it, may be included in published documents of any kind without approval from EPS. This report and its contents, together with any supporting correspondence or other documentation, remain the property of Environmental Protection Strategies Ltd until paid for in full.

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

The National Planning Policy Framework requires a competent person to prepare site investigation information, which is defined as a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation. EPS considers that it fulfils these criteria and would welcome any request for staff CVs or case studies to demonstrate it.

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Objectives	1
1.2	Project Limitations and Constraints.....	1
2	SITE CHARACTERISATION	3
2.1	Site Location and Description	3
2.2	Geo-Environmental Setting	4
2.3	Summary of Previous Reports	8
2.4	Site History.....	11
3	PRELIMINARY RISK ASSESSMENT & CONCEPTUAL SITE MODEL.....	13
3.1	Background	13
3.2	Source Characterisation.....	13
3.3	Potential Receptors.....	14
3.4	Potential Pathways	16
3.5	Summary of Contaminant Linkages.....	17
3.6	Key Areas of Potential Concern & Uncertainty.....	19
4	GEOTECHNICAL GROUND MODEL	20
5	CONCLUSIONS & RECOMMENDATIONS.....	22
5.1	Conclusions	22
5.2	Recommendations.....	22

Figures

Figure 1 Site Location Plan

Appendices

Appendix A	Selected Site Photographs & Walkover Notes
Appendix B	Surrounding Land Use
Appendix C	Geological Context
Appendix D	Groundwater Vulnerability and Flood Maps
Appendix E	A Selection of Historic Maps

1 INTRODUCTION

In December 2024, Environmental Protection Strategies Ltd (EPS) was commissioned by Pigeon (Hemel Hempstead) Limited & Bloor Homes South Midlands to complete a Phase I Geo-Environmental Desk Study for Land at Holstmere End Lane, Hemel Hempstead, St Albans, Hertfordshire, AL3 7AW ('the site'); see Figure 1.

The work was commissioned to support outline planning proposals for a residential scheme comprising significant provision for new dwellings as well as recreational, amenity and public open spaces together with associated access and infrastructure works.

This report presents the findings, conclusions, and recommendations of the Phase I Desk Study undertaken for the site as instructed, and also summaries a number of previous documents produced for portions of the same study area by both EPS and third parties.

1.1 Objectives

The purpose of this desk study is to evaluate the potential contaminant linkages which may be active at the site in its current condition, or could become active in future, and to determine if any action is required to investigate them further or to break them.

This is achieved by carrying out the following activities:

- a) Examining the site history - late 1800s to present day, through collection of historical maps of the area, site records, records held by relevant local authorities, the Environment Agency and review of other information databases.
- b) Characterising the site's environmental and geological sensitivity through examination of existing geological, hydrogeological, topographical, and historical maps and aerial photographs of the area.
- c) Identifying Potential Areas of Concern (PAOC's) through a combination of historical map and data review.
- d) Consideration of any future plans for the site and the effects any proposed changes may have on contaminant linkages over time.
- e) Development of a Conceptual Site Model through a Preliminary Risk Assessment to evaluate the potential risks posed by the site and make recommendations for any further work that may be required to ensure suitability for use and safe development. In accordance with the Environment Agency's *Land Contamination: Risk Management* guidance and the *National Planning Policy Framework*.

1.2 Project Limitations and Constraints

The purpose of this report is to present the findings of a Phase I Geo-Environmental Desk Study conducted at the location(s) specified. When examining the data collected from the investigations made during the assessment, EPS makes the following statements:



This report does not include specific investigation for the presence of either Potential Asbestos Containing Material (PACM) or Japanese Knotweed at the subject site however, if obvious evidence of either is observed during EPS site walkover, details will be provided in this report. Specialist contractors should be commissioned to make detailed assessments and recommendations if these materials are suspected.

2 SITE CHARACTERISATION

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

2.1 Site Location and Description

Detail	Description
Location	The site covers an area in the region of 130 hectares of largely undeveloped land situated northeast of Hemel Hempstead, between Hemel Hempstead Road (south), Holstmere End Lane (west) and Gaddesden Lane (north).
Grid Reference	508471, 210766 (approximately central)
Topographic Elevation	Ground levels vary throughout the area with the highest elevation of approximately 132m Above Ordnance Datum (AOD) present in the northwest and the lowest elevation of approximately 106m in the southeast.
Description of Site	The study area is an irregularly shaped parcel of land characterised by a number of agricultural fields located adjacent to one another and bound by country lanes and local roads as well as field boundaries marked with mature hedgerows. Approximately a third of the way along the western boundary, from the southwestern corner, an unnamed road extends northeast from Holstmere End Lane, towards Little Revelend Farm (albeit the holding itself is not part of the study area); which is situated just to the southeast of centre. This road extends further east (past the farmyard) and eventually joins a short lane known as Little Revelend and then onto Hemel Hempstead Road (B487). A caravan park, some larger agricultural stores, poultry houses and a few residential dwellings are located just off site in this area. Another unnamed road provides access to Great Revel End Farm (which is also excluded from the study area), from Gaddesden Lane in the northeast corner, and routing southwest. A number of small tracks link between the fields and these two farmyards. No buildings or structures appear to be present within any of the fields, with the nearby farms and properties outlined above not forming part of the study area itself. During a site walkover in February 2025, the fields were planted with a range of different crops with the ground surface soft and 'boggy' in selected areas. Surface water features in the form of small ponds are present within the bounds of the site and these is located in and amongst some trees immediately south of Great Revel End Farm.

Detail	Description
Description of Site (cont.)	Occasional instances of 'fly tipped' waste were also noted during the site walkover, these appeared to be confined to the tracks/ roads between some of the fields and bordering the area of investigation (particularly adjacent to Holtsmere End Lane).
Surrounding Land Use	To the northwest, northeast and south the land appears to be agricultural/ arable farmland with some limited residential and agricultural buildings. To the west the land use is predominantly residential properties with some retail shops and schools. To the east is further arable farmland interspersed with agricultural buildings along with a few dwellings, a hotel and the M1 motorway. Further afield, approximately 1.4km south of the study area is the Buncefield Oil Terminal.

A plan showing the site location is provided as Figure 1. Selected Site Photographs are included as Appendix A along with the Walkover Notes, and relevant extracts of a Landmark Envirocheck report are included as Appendix B.

2.2 Geo-Environmental Setting

Detail	Description
Geology	Geological maps show that superficial clay, silt, sand and gravel of the Clay-with-Flints Formation are mapped across central and eastern sections, with a few narrow outcrops spanning from east to west. Superficial clay, silt, sand and gravel of the Head Deposits are also mapped encroaching the northeastern and southeastern corners of the site respectively. The bedrock geology is mapped as chalk of the Lewes Nodular Chalk & Seaford Chalk Formations (undifferentiated). No artificial geology is mapped on site or in the surrounding area. Information on the site's geological context is included as Appendix C.
British Geological Survey (BGS) & Site Specific Geology	A number of historic borehole records hosted by the BGS are present in the surrounding area including one drilled within the grounds of Great Revel End Farm. This borehole reports the Clay-with-Flints to be present to approximately 30.5m, with chalk then recorded to the base of the borehole at approximately 60.4m. This borehole was drilled in 1947 and resting groundwater was recorded at a depth of approximately 24.7m. A copy of the historic borehole is also included within Appendix C. Having undertaken some limited intrusive investigation in select parts of the site, EPS also have some information on the site-specific geology and this is referenced in greater detail in Section 2.3.

Detail	Description	
Geological Hazards	Hazard	On Site Risk
	Mining (non-coal)	Rare
	Collapsible Ground	Very Low
	Compressible Ground	No Hazard
	Ground Dissolution	Moderate
	Running Sand	Very Low
	Landslide	Very Low
	Shrinking / Swelling Clay	Low
	Several chalk pits are present in the local area, including Flamsteadbury Farm Chalk Pit approximately 150m north and 330m north. Additionally, a sand and gravel pit is recorded within the grounds of Little Revelend Farm around 105m east of the southeastern corner of the study area. A man-made mining cavity is recorded within the northern area, approximately 80m south of Great Revel End Farm, with a further, similar feature also reported approximately 500m south. A single natural cavity is recorded in the surrounding area, this is located approximately 470m south of the southwestern corner of the study area and relates to a chalk solution pipe.	
Radon	Since EPS' previous phases of work at this site (see Section 2.3 for further detail), radon maps have been updated, and therefore, so have the protection requirements. At the time of writing, the Envirocheck report indicates that the majority of the site appears to lie within an area where the percentage of homes above the radon action level is 3% - 5%. As such, basic radon protection will likely be required for a significant portion of the proposed dwellings / buildings. It is recommended that once development plans are finalised that a site-specific radon report is obtained from the BGS to determine which specific plots will require basic or even full radon protection measures to be incorporated; and this should be agreed with the building control department of the Local Authority.	
Hydrogeology	Groundwater vulnerability maps for the area show that the superficial Clay-with-Flints Formation is classified as Unproductive Strata while the superficial Head Deposits are mapped as a Secondary (undifferentiated) Aquifer. The bedrock Lewes Nodular Chalk & Seaford Chalk Formations (undifferentiated) are classified as a sensitive Principal Aquifer. The entire site area lies within a Total Catchment (Zone 3) Source Protection Zone for local groundwater abstraction.	

Detail	Description
Hydrogeology (cont.)	Two groundwater abstractions are reported within approximately 150m east of the southeastern corner of the study area where groundwater is reported to be abstracted from a borehole for general farming and agricultural use. Two groundwater abstractions are also located approximately 250m north of the northeastern corner, where groundwater is abstracted for general agriculture and for private household use. Groundwater vulnerability maps are included as Appendix D.
Hydrology & Flood Risk	On-site surface water features are known to be present in the form of small ponds in and amongst some trees immediately south of Great Revel End Farm. Some further ponds or basins are located adjacent to the M1, approximately 500m east. It is also possible that small scale drainage ditches are present within the hedgerows that separate the fields within the area of investigation. A number of discharge consents are held within the surrounding area, with the closest of these being located adjacent to the sites northern corner, within approximately 100m of the eastern limit and within approximately 400m of the sites southern corner. The nearest entry relates to final/ treated effluent being released to land via a soakaway. No surface water abstractions are recorded within 1km. Review of the EA Flood Zone Map for the area indicates that the entire site area lies within Flood Zone 1, which is defined as the area with a low potential risk of flooding from fluvial or tidal sources. It should be noted that the EA maps do not take into account flooding from poor drainage, or groundwater. A copy of the flood maps for the site and surrounding area is also included within Appendix D.
Known Site Drainage & Utilities	An oil pipeline is known to run beneath the site on a northwest/ southeast trend with marker posts located on at the edge of each field where the pipeline runs through. Additionally, overhead power lines held up by wooden pylons follow the same approximate route through the southern area, but then divert towards the southwestern corner in the northern parcel. Given a few farms are present within the wider site, albeit the holdings themselves are excluded from the study area, it is likely that below ground services such as potable water supply and drainage as well as other utilities will feed into and away from these properties, and should be considered through future development proposals.

Detail	Description		
Landfill & Waste	A landfill recorded by the local authority is located approximately 290m southeast of the sites southern corner, while no additional information about this landfill is provided, this area now appears to be occupied by residential housing.		
	A relatively small and historic landfill is located adjacent to the eastern corner of the site (at the junction of Hempstead Road and Little Revelend). This facility is recorded to have accepted inert waste between August 1962 and December 1963.		
	One small area of potentially infilled land (possible pit or pond) is recorded just inside the western boundary of the site (around the midpoint). Additional entries are highlighted within 200m of the eastern border and approximately 150m/ 330m north (coinciding with the aforementioned Flamsteadbury Farm Chalk Pits).		
	No licensed waste management facilities or registered waste transfer, treatment or disposal sites are recorded within 500m.		
Permitted Industrial Activity	Two sites are licensed by the local authority for industrial activity within the surrounding area. These include 'Flint To Cell Limited' approximately 930m southwest, where the use of generators is authorised and 'Itab Uk Ltd', based in a similar location, where metal decontamination processes are permitted.		
Industrial Land Use & Points of Interest	The Envirocheck report lists a number of industrial land uses within the surrounding area and the closest/ most pertinent of these are summarised below.		
	Land Use	Approximate Distance & Direction	Status
	C Brown & Sons (Car Breakers & Dismantlers)	50m southeast	Inactive
	Apple Tree Dry Cleaners (Dry Cleaners)	40m west	Inactive
	Woodhall Hardware & DIY (Hardware)	40m west	Inactive
	C Brown & Sons (Car Breakers & Dismantlers)	50m southeast	Inactive
	There are no records of any fuel station entries within 1km.		

Detail	Description		
Pollution Incidents	Several pollution incidents are also recorded within 1km and these are summarised in the below.		
	Pollutant, Receiving Water & Date of Pollution Incident	Approximate Distance & Direction	Incident Severity / Category
	Oils (unknown), unknown/ not given, April 1990	250m south	Category 3 (minor) Incident
	Oils (unknown), unknown/ not given, October 1992	520m east	Category 3 (minor) Incident
	Chemicals (unknown), unknown/ not given, October 1995	780m southwest	Category 3 (minor) Incident
	There are no records on the substantiated pollution incident register within the surrounding 1km and similarly there are no records of any prosecutions relating to controlled waters or authorised processes within the same radius.		
Previous Investigation or Remediation	EPS have undertaken several phases of work for a range of different purposes in select parts of the site. A summary of the assessments completed by EPS and third parties is presented in Section 2.3 below.		
Sensitive Land Use	The site lies within a Nitrate Vulnerable Zone where surface water is identified as being at risk from nitrates leaching from agricultural land. The area of investigation is also within an area of adopted Green Belt.		

2.3 Summary of Previous Reports

A number of previous assessments have been completed (by EPS and third parties), that relate to selected parts of the study area. For background information, it is recommended that the reader review the following reports in full, with any pertinent points which may impact the findings of this risk assessment summarised below.

- *Phase 1 Geo-Environmental Desk Study – Redbourn Road / Hemel Hempstead Road, Hemel Hempstead (Ref: 19-0138) – Rolton Group, (February 2018)*

This Phase 1 Geo-Environmental Desk Study covered the southern parcel of the wider area and did not identify any likely sources of significant contamination. However, due to the presence of an old chalk pit in the north and the oil pipeline running through the centre, some made ground used to fill/ level areas was noted to potentially be present, but the associated contaminants were deemed to be relatively stable and not high risk.

Additionally, there was deemed to be a 'significant possibility' of below ground cavities existing from natural dissolution or physical removal associated with the old chalk pits on and neighbouring the site.

Additional investigation into the site was recommended including a geophysical survey to assess for the presence of cavities and a subsequent intrusive ground investigation to identify any anomalies.

- *PBA Natural and Mining Cavities Databases Search with Cavities Occurrence Assessment for the Site at Land Adjacent to Holtsmere End Lane, Hemel Hempstead, AL3 7AW (Ref: 45635//CBH/JW/HG) – Peter Brett Associates, (February 2019)*

This correspondence includes a review of natural and mining cavity records for the local area along with a cavity occurrence assessment for the site (southern area only). The database search identified two natural cavity locations within 2km of southern parcel. The closest is located 160m south-southeast and relates to a solution pipe while the other cavity is approximately 1.5km south-southwest and relates to 10 solution pipes. One mining cavity was also recorded within the surrounding area at 710m north and is referred to as a chalkwell.

The cavity occurrence assessment provided a rating of 'moderately high' due to the superficial Clay-with-Flints Formation that could under-drain into the chalk below, creating the potential for solution features to occur. The assessment also suggests that the local area is well known for historic chalk mining, and two old chalk pits on the northern and eastern boundaries of the site are highlighted in historic mapping.

Recommendations were made to prepare a hazard zoning map to assist in undertaking a ground investigation and a geophysical survey was also recommended.

- *Geophysical Survey Report, Land adjacent to Holtsmere End Lane Hemel Hempstead, Hertfordshire, Survey Report Reference MSTL461 – Magnitude Surveys, (April 2019)*

Two geophysical surveys have been carried out within the southern area, the first of these had the objective to assess the subsurface archaeological potential and involved a fluxgate magnetometer survey. The key results of the survey are summarised below;

- The survey identified anomalies forming an open sided footing for a structure surrounded by rubble, which is possibly linked to the demolition of a building in the north-western area. If these anomalies are to be interpreted as a former on-site structure, this would pre-date historical mapping.

- In the northern area of the southern parcel, evidence of chalk extraction was recorded as anomalies coinciding with the historic chalk pit shown on maps from 1878. This area was defined by a copse of trees on subsequent historic records. A smaller extraction feature (chalk pit) was also interpreted approximately 100m south of the mapped chalk pit which seemingly coincides with a potential un-mapped chalk pit evidenced on an aerial photograph from the 1940's.
- *Geophysical Survey Report, Holtsmere End Lane, Hemel Hempstead, Survey Report Reference SOR14814 – Sumo Geophysics Ltd, (April 2019)*

The second geophysical survey involved completing an electromagnetic field to search for evidence of solution features and possible mine workings. The results are summarised below;

- In total, sixteen anomalies were identified from the conductivity data. Of those, six conductivity highs (C4, C6, C7, C8, C9 and C10) and six conductivity lows (C1, C2, C3, C5, C14 and C15) were interpreted to be associated with potential dissolution features. It should be noted that these anomalies can be produced by changes in the ground conditions and not just solely dissolution features.
- Four discrete conductivity anomalies (C11, C12, C13 and C16) were deemed small enough to be potentially associated with mineshafts.
- Recommendations were made to target the anomalies by follow up intrusive investigations.

Following the completion of these geophysical surveys, a preliminary ground investigation was completed by EPS in the southern parcel, in order to initially assess the ground conditions across this portion of the site.

- *Preliminary Ground Investigation Report, Holtsmere End Lane (South), Report Reference: UK19.4388 – EPS Ltd, (June 2019)*

The preliminary ground investigation involved the formation of twenty boreholes, drilled throughout the southern site area with dynamic probing also completed at each borehole location in order to assess the potential risks associated with chalk dissolution features and historic chalk mining. From the preliminary ground investigation, the risks associated with chalk dissolution were considered to be low, however further detailed investigation was recommended at a later stage.

- *Ground Investigation Report, Land Adjacent to Holtsmere End Lane (South), Report Reference: UK19.4388b – EPS Ltd, (September 2019)*

This ground investigation focused on initially assessing the infiltration and drainage characteristics of the soils in the southern site area. The intrusive investigations involved the drilling of four deep boreholes to a maximum depth of 18.37m below ground level (bgl) and excavating four trial pits to 2.9m.

Ground conditions were found to comprise a thin layer of topsoil underlain by a varying thickness (0.45m to 1.8m) of Clay-with-Flints overlying chalk. Groundwater was struck within one borehole when drilling, at a depth of 14.8m.

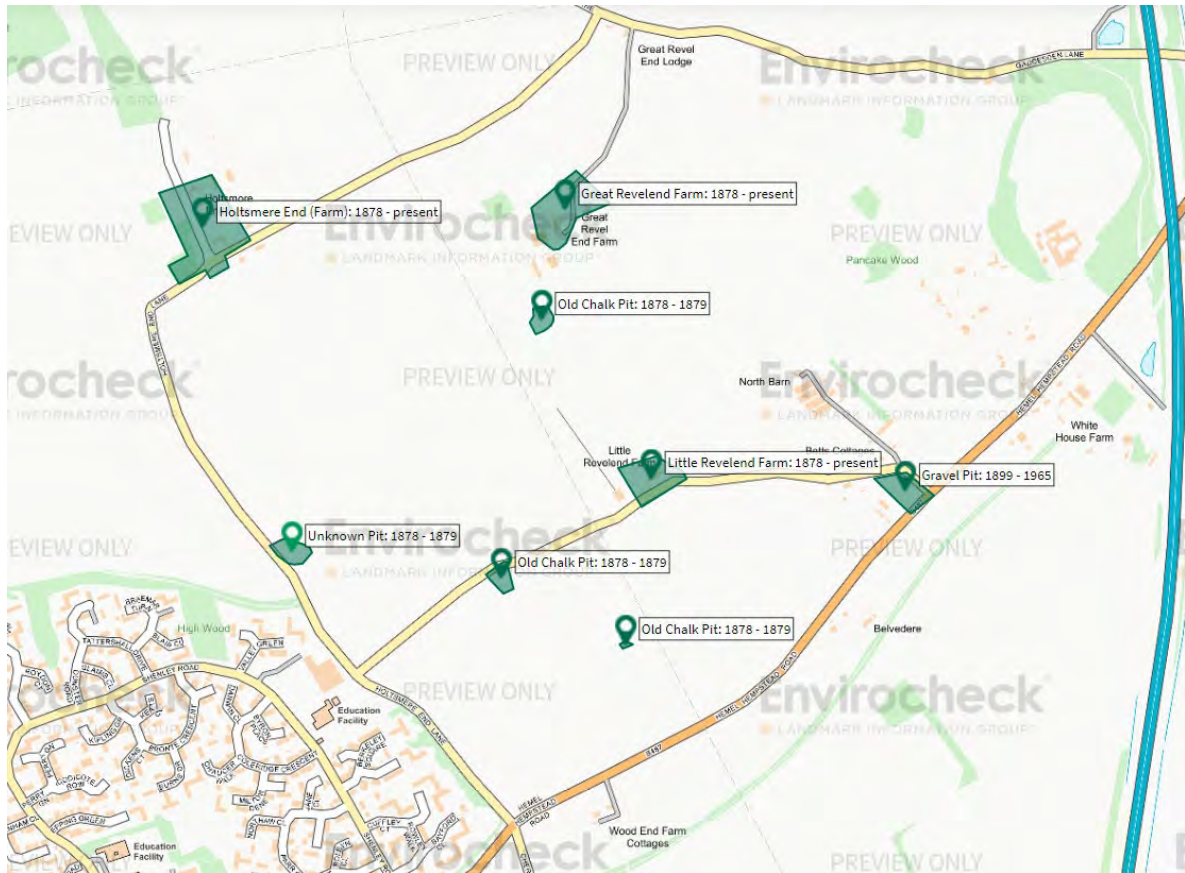
A ground gas monitoring programme and initial ground gas risk assessment was also undertaken as part of this ground investigation and the results from the four monitoring visits indicate that the southern site area falls within a Characteristic Situation 1 'very low risk' scenario, whereby no ground gas protection measures are considered necessary.

- *Email Summary of Groundwater Levels, Holstmere End Lane (South), Hemel Hempstead, Project Reference: UK19.4388b – EPS Ltd, (March 2020)*

Following the issue of EPS' Ground Investigation Report for the southern site area in September 2019, EPS continued to monitor groundwater levels in the boreholes drilled as part of the initial ground investigation. The programme took place to March 2020 and the results were provided in a summary email to the client. As expected, groundwater levels were found to have rose throughout the monitoring period over the autumn/winter which was suggested to have been a result of seasonal changes influenced by rainfall and other factors. The shallowest level at which groundwater was recorded was ~10.9m bgl at BH202 on 6th March 2020.

2.4 Site History

A summary of historical map data from 1878 to 2025 is provided below. Key points are highlighted and copies of relevant historic maps examined during the investigation are included in this report as Appendix E.



- Historical mapping shows that Holstmere End Farm, Great Revel End Farm and Little Revelend Farm have all been present from the late 1800's, with these holdings still present and active at the time of writing. Both Great Revel End Farm and Little Revelend Farm are excluded from the proposed development area.
- Three old chalk pits (two towards the south and one the north) are mapped from the 1870s, additionally an unspecified (unknown) pit is also mapped in the west of the northern area over the same time period, and this feature also coincides with an area of potentially infilled land.
- A gravel pit is annotated approximately 130m east of the southern site area, on maps from 1899 to 1965, this gravel pit appears to have been redeveloped into the current buildings and associated caravan park (annotated as Tullochside on some maps) including an electricity substation sometime between 1981 and 1999 and it also broadly aligns with the historic landfill that accepted inert waste between August 1962 and December 1963 in this area.
- The only other potentially contaminative features that appear on historical maps is a fireworks factory mapped within the now residential housing estate to the west from 1938 to 1982. The other major historical changes of the surrounding area relate to the gradual and continued development of the residential housing estate to the west and southwest throughout the mid to late 1900's and the construction of the M1 motorway to the east sometime between 1960 and 1964.

3 PRELIMINARY RISK ASSESSMENT & CONCEPTUAL SITE MODEL

In accordance with the Environment Agency's *Land Contamination: Risk Management* guidance, there are three stages to managing contaminated land (Risk Assessment, Remedial Options Appraisal / Remediation and Verification). This section outlines the first tier of Stage 1, the Preliminary Risk Assessment.

The following section provides a review of the contaminant linkages that may be active at the site, whereby EPS have examined 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 Background

A Desk Study comprises the first stage of any geo-environmental assessment, the purpose of which is to determine what potentially contaminative activities may have occurred at the property or the surrounding area which may pose an environmental or geological risk to site users, the surrounding environment or proposed development, either at present or in the future.

The method used in this investigation to assess the environmental risk posed is based on the concept of 'contaminant linkage', which considers the following three factors:

Source	The location from which an environmentally hazardous / contaminative substance is, (or was,) derived.
Pathway	A route or mechanism via which a source could come into contact with a receptor to cause significant harm.
Receptor	An environmentally sensitive object or condition e.g. person, property, controlled water, or ecological system, which may be present now or in future.

If all three factors are identified, there is the potential for a 'contaminant linkage' to be active, which could result in significant harm being caused to the environment or human health.

3.2 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
Natural Geology	Radioactive decay of Natural Geology	Radon Gas
Current & Historic Site Use	Potentially infilled chalk pits/ land entries within the site boundaries and the possibility of infill material of unknown origin (made ground). This includes an anomaly interpreted as a former on-site structure during a third party geophysical survey in April 2019, as well as beneath current roads, which may be adjusted to align with future layout.	PAH, Metals, ACM, Ground Gas (CO ₂ , CH ₄)
	Active BPA oil pipeline running through the study area.	TPH
	Current and historic use of the site as arable farmland.	Pesticides & Herbicides
Current and Historical Surrounding Land Use	Evidence of fly-tipped waste adjacent to Holstmere End Lane and surrounding local area, with the potential for asbestos containing materials to be present.	ACM
	Current / historical industrial land use of the surrounding area including a dry cleaners and historic car breakers/ dismantlers as well as an electricity sub-station.	PAH, Metals, TPH (incl. MTBE & BTEX), VOC's/ SVOC's & PCB's
	Current and historic farms surrounded by the area of investigation (Great Revel End Farm & Little Revelend Farm) and in the surrounding area (Holstmere End Farm and poultry houses adjacent to the east).	
	Historic gravel pit/ landfill approximately 130m east.	Ground / landfill Gas (CO ₂ , CH ₄)

Notes:	PAH	Polycyclic Aromatic Hydrocarbons	ACM	Asbestos Containing Materials
	CO ₂	Carbon Dioxide	CH ₄	Methane
	TPH	Total Petroleum Hydrocarbons	MTBE	Methyl Tertiary Butyl Ether
	BTEX	Benzene, Toluene, Ethylbenzene & Xylenes	VOC's	Volatile Organic Compounds
	SVOC's	Semi Volatile Organic Compounds	PCB's	Polychlorinated Biphenyls

3.3 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 have been further developed into six generic landuses in the Category 4 Screening Levels project for Land Affected by Contamination (DEFRA/Contaminated Land: Applications in Real Environments (CL:AIRE) Project Report SP1010, 2014) which form a basis for the development of the Conceptual Site Model.

Risks posed to controlled waters have been considered in line with the *Environment Agency's approach to groundwater protection (v1.2, 2018)* and associated position statements.

It is understood that outline planning proposals are for a residential scheme comprising significant provision for new dwellings as well as recreational, amenity and public open spaces together with associated access and infrastructure works. While some commercial spaces may also be incorporated into the proposed scheme, the most sensitive land use has been considered (on a precautionary basis), and is as follows:

- Residential (with home-grown produce)

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 below:

Receptor	Site Specific Description
Human	Future site users, construction 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 underlying geology comprises superficial Clay-with-Flints Formation, which is defined as an Unproductive Aquifer along with superficial Head Deposits classified as a Secondary Aquifer. Furthermore, the chalk bedrock is classified as a sensitive Principal Aquifer. The entire site area also lies within a Total Catchment (Zone 3) SPZ for local groundwater abstraction and hence with all due consideration given to the above, groundwater should be considered as a sensitive receptor to site derived contaminants.
Surface Water	The nearest surface watercourses appear to be small ponds within the northern section and within the grounds of Great Revel End Farm. It is possible that site derived contaminants of concern may enter these and other nearby watercourses (such as any field drains) by overland flow, migration through unsaturated soils or entering shallow surface drainage / historical land drainage which discharges to such features. Therefore, surface waters must also be considered as a sensitive receptor within the conceptual site model.

Receptor	Site Specific Description
Flora and Fauna	The proposed development will likely include the provision of domestic garden areas as well as recreational, amenity and public open space. 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 which may be adversely affected by the potential presence of the identified contaminants of concern (primarily from off-site sources). These include concrete used in building foundations, buried potable water supply pipes and other service lines and pipes.
Adjacent Land	Adjacent properties including the residential land use to the west and the farms surrounded by the site could also be at risk from potential contaminants found at the site.

3.4 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 outdoors
- Inhalation of vapours indoors

Clearly, not all of these potential pathways apply for every standard land-use. For example, ingestion of contaminated vegetables will not apply to land uses other than residential with plant uptake and allotments.

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 following:

- 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.

3.5 Summary of Contaminant Linkages

Considering the site use and environmental setting, and the proposed land use; the plausible contaminant linkages that have been identified through the Preliminary Risk Assessment which require further investigation are summarised in the following table:

Source	Pathway	Receptor
Natural Geology	Migration of radon gas to indoor air	Site users
Contaminated Soil (incl. potentially infilled chalk pit and infilled land entries)	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	
	Migration of ground gas to indoor & outdoor air	
	Direct uptake via root systems	Plants

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:

- Pesticides and herbicides have been identified as potential contaminants of concern associated with the use of the study area as arable farmland. The application of modern pesticides and herbicides follows strict guidelines which aim to minimise their effects on the environment and human health. Additionally, as no storage of pesticide and herbicides appears to have taken place, a plausible contaminant linkage has not been recognised.

- PAH's and metals have been identified as contaminants of concern associated with the historic onsite infilled pits and other potential features. However, these contaminants are considered to be relatively immobile in the environment by virtue of their very low solubility and volatility. On this basis, plausible pathways by which these potential contaminants could pose a significant risk to the underlying groundwater or nearby surface waters are not considered to be active.
- It is possible that inadvertent damage could occur to the oil pipeline during the proposed development phase but it is anticipated that all works will be carried out by competent professional contractors provided with appropriate plans of buried plant and adhering to BPA's exclusion zone/ easement around the pipeline. Therefore, this infrastructure is not considered to be a significant source of contamination at this stage, particularly given the modern leak detection systems in place to ensure the integrity of the pipeline.
- Several commercial and industrial land uses are located in the surrounding area, the most significant of which are considered to be a dry cleaners, vehicle dismantlers and a number of small farm holdings (including Great Revel End & Little Revelend Farm), which are surrounded by land being considered for future development. However, given the nature and status of these land uses and the low likelihood of any significant fuel or chemical storage associated with them (including the farm holdings which are only of limited scale), together with the absence of shallow groundwater, these sources are not considered to pose a significant risk to the proposed development.
- Given the likely shallow nature of impacts to surface soils, as well as the contaminants of concern associated with the established on-site sources, no significant risk to the foundations of any on-site buildings or infrastructure such as new services is recognised.
- Occasional fly tipped waste was observed adjacent to Holtsmere End Lane (but not within the formal boundaries of the area of investigation). Whilst there is the potential for this waste to contain ACM, given that this material is located off-site, it is unlikely to pose a significant risk to future site users post completion of the redevelopment works.

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:

Land Holtsmere End Lane, Hemel Hempstead – Illustrative Conceptual Site Model

Proposed Residential Scheme



Potential Pathways:

1. Migration of radon gas to indoor & outdoor air
2. Direct / inadvertent contact with ingestion of soil & inhalation of fugitive dusts
3. Direct uptake and / or adherence of contaminated soil to vegetation and subsequent ingestion
4. Migration of ground gas to indoor & outdoor air (from on and off-site sources)

3.6 Key Areas of Potential Concern & Uncertainty

Overall, the majority of the site is considered to have a low risk in terms of the potential for future site users and environmental receptors being exposed to contamination. The key areas of concern are the potentially infilled chalk pits and localised sections where made ground could be present such as an anomaly picked up on a third party geophysical survey or areas where existing roads and pavements are present.

Some of these features, which are likely to be very discrete in scale in the context of the overall parcel of land, also have the potential to generate ground gas (although this is also considered to be limited), and the infilled soils may also not meet the quality standards required for a modern residential gardens. As such, future phases of intrusive investigation and assessment should target these features to assess the identified risks and confirm the assertions made in this and other phases of work.

4 GEOTECHNICAL GROUND MODEL

Geological records indicate the ground conditions to comprise superficial Clay-with-Flints and Head Deposits with the bedrock geology mapped as chalk of the Lewes Nodular Chalk & Seaford Chalk Formations. The presence of the Clay-with-Flints has been confirmed within the southern area via EPS's ground investigation work, as has the presence of chalk at depth. Made ground materials associated with potentially infilled land entries and isolated sections of current or historic development are also anticipated.

A preliminary geotechnical ground model commenting on individual design aspects is presented below. This is not intended to inform geotechnical design, but give an indication of the constraints which might be anticipated.

Element	Anticipated Strata	Parameter(s)	Anticipated Conditions
Foundations	Clay-with-Flints Formation & Head Deposits	Allowable Bearing Pressure	50kN/m ² to 125kN/ m ²
		Settlement	Low to medium sensitivity depending on soil composition
		Volume Change	Low to medium volume change potential depending on soil composition
	Chalk	Allowable Bearing Pressure	75kN/m ² to 150kN/m ²
		Settlement	Low risk
		Volume Change	Low volume change potential
Drainage	Clay-with-Flints Formation & Head Deposits	Permeability	Might be suitable for infiltration drainage depending on soil composition
	Chalk	Permeability	Likely to be suitable for infiltration drainage
Concrete grade	Clay-with-Flints Formation & Head Deposits	Grade	Low to moderate risk of high sulphate levels
	Chalk	Grade	Low risk of high sulphate levels

Potential Hazard	Comment
Trees & Vegetation	Trees and hedgerows are present throughout the area particularly along the borders of the fields. Depending on final development proposals, the proximity of buildings/ infrastructure to trees and hedgerows and the specific heave potential of the underlying superficial deposits or shallow chalk, this could lead to the localised deepening of foundations.
Chalk Dissolution & Historic Chalk Mining	Risks associated with chalk dissolution and historic chalk mining are considered to be relatively low based on the ground investigation works completed to date. However, this should be confirmed through additional phases of intrusive works, completed in greater detail and across areas/ features which haven't been covered to date.
Subsurface Structures & Existing Overground Cables	An underground BPA oil pipeline runs through the site, this feature along with the overhead cables and pylons that are also present throughout the site should be considered during any upcoming design and redevelopment work.

5 CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

This Phase I Desk Study has established the site as relatively low risk in terms of plausible contaminant linkages that have the potential to become active if and when the land is to be developed into a residential housing scheme.

The main area of concern identified with respect to the proposed development is the potential for the interaction between groundworkers and future site users (residents) with potentially contaminated shallow soils. This could be either during the construction works and post-development, mainly relating to the possible presence of made ground on site, associated with localised infill from former chalk pits/ infilled ground, as well as existing roadways/ infrastructure; the construction of which might have encroached within the study area.

Risks to future site users from the generation and accumulation of ground gases (CO₂, CH₄) have also been identified, primarily associated with the historic chalk pits recorded onsite, but also a nearby historic landfill.

Some of the site lies within an area where the percentage of homes above the radon action level is between 3% and 5%. As such, basic radon protective measures will likely be required in the construction of selected new buildings, and it is recommended that a detailed radon report is obtained and compared against future development proposals.

A moderate risk of the presence of chalk dissolution has also been identified. This must be given full consideration in future design, albeit current indications suggest that this will not represent a significant constraint to development; based on the findings of initial ground investigation works conducted by EPS, although it is recognised that further detail and coverage is required for this to be conclusive.

It should be appreciated that due to the size of the proposed development site, not all of the potential contamination linkages which have been identified through the risk assessment process apply across the wider plot. The layout of proposed infrastructure and consequently the distance from potential sources should be given all due consideration through further stages of risk assessment.

5.2 Recommendations

The scope of future phases of intrusive investigation (ideally informed by a formal development proposal/ layout), should include the following:

- a) Sampling of shallow soils on a regularly spaced grid throughout the area to confirm the quality of the materials present, but also with focus given to targeting specific features such as the potentially infilled chalk pits, and any areas where made ground might be expected. Subsequent environmental (chemical) laboratory analysis of the recovered soil samples should then be undertaken to confirm their suitability in a residential setting.
- b) Additional monitoring wells should be installed in boreholes drilled in close proximity to the potential sources of ground gas (infilled chalk pits and areas of potentially infilled land/ adjacent landfilling) so that ground gas monitoring can be undertaken. This should include and focus towards potential sources that have not been investigated to date (i.e. those in the northern parcel). The results of additional ground gas monitoring should then be used to supplement the existing dataset and determine/ confirm if ground gas protection measures will be required for future buildings.
- c) Furthermore, to address risks from potential generation of radon gas migrating into the proposed buildings and structures, basic radon protection will likely need to be installed within selected proposed buildings including any ancillary structures. Consultation should be undertaken with the building control department of the Local Authority to confirm the specifics of the radon protection measures and the installation and verification of such measures should be undertaken by a qualified contractor. It is also recommended that a detailed radon report is obtained and compared against future development proposals to support this process.
- d) Due to the notable potential for dissolution features, further site investigation is considered necessary to target any potential areas where voids or low strength/ infilled ground might be present. Areas targeted should be identified through review of the historic mapping and geophysical surveys, and should be conducted via a fixed grid of boreholes or dynamic probes completed to a sufficient depth and spacing across these potential areas of concern, to confirm or discount the presence of such features. Such work could also be combined with a wider geotechnical assessment, to support design and construction of the proposed buildings and infrastructure.

A copy of this report should be provided to the Environmental Health department of St Albans City & District Council and Dacorum Borough Council so that the information may be used to support planning proposals for the site. This report should satisfy the outline requirements of the planning process relating to contamination and the issue of contaminated land does not appear to present a barrier to a viable redevelopment. Additional phases of intrusive investigation required can likely be carried out under a conditional planning consent.

FIGURES