TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AH	Arch Head Height	ER	Earth Rod	RSD	Roller Shutter Door
AB	Air Brick	ET	EP+Transformer	RSJ	Rolled Steel Joist
AR	Assumed Route	FB	Flower Bed	SI	Sign Post
AV	Air Valve	FBD	Floor Board Direction	SP	Arch Spring Point Height
BB	Bellaire Beacon	FH	Fire Hydrant	SV	Stop Valve
BH	Bore Hole	FL	Floor Level	SW	Surface Water
BL	Bed Level	FP	Flag Pole	TB	Cable Bay
BO	Bollard	FW	Foul Water	TC	Tactile Paving
BP	Boundary Post	GG	Gas Grate	TC	Telecom Cover
BS	Bus Stop	GV	Gas Valve	TH	Trial Pit
BU	Bush	HH	Head Height	THL	Threshold Level
BW	Barbed Wire Fence	IC	Inspection Cover	TL	Traffic Light
BX	Box (Utilities)	IL	Invert Level	ToW	Top of Wall
CJB	Close Board Fence	IR	Iron Railings	TP	Telegraph Pole
CH	Cill Height	KO	Kerb Outlet	TS	Traffic Signal Cover
CL	Cover Level	LP	Lamp Post	TV	Cable TV Cover
CrL	Chain Link Fence	MH	Manhole	UB	Universal Beam
C-Lev	Ceiling Level	MP	Marker Post	UC	Unknown Cover
Col	Column	NB	Name Board	UK	Unknown Tree
CrP	Chestnut Paling Fence	OHL	Overhead Line (approx)	UMG	Unmade Ground
CR	Cable Riser	Pan	Panel Fence	USB	Under Side Beam
CW	Chicken Wire	PB	Post Box	UTL	Unable To Lift
DC	Drainage Channel	PM	Parking Meter	UTS	Unable To Survey
DH	Door Head Height	PO	Post	VP	Vent Pipe
DL	Dilapidated	P/R	Post & Rail Fence	WB	Waste Bin
DP	Down Pipe	P/W	Post & Wire Fence	WH	Weep Hole
DR	Drain	P/Wall	Partition Wall	WL	Water Level
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Survey Control Station

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ST02	553884.010	226353.369	93.845	PK Nail
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LAND SURVEYING
BUILDING SURVEYING
UNDERGROUND SURVEYING
SITE ENGINEERING
MONITORING
0845 040 5969
survey-solutions.co.uk
IPSWICH BRENTWOOD COVENTRY GLASGOW NORWICH NOTTINGHAM YEOVIL

PROJECT TITLE
HENHAM ROAD, ELSENHAM, ESSEX, CM22 6DH.

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 11 of 17

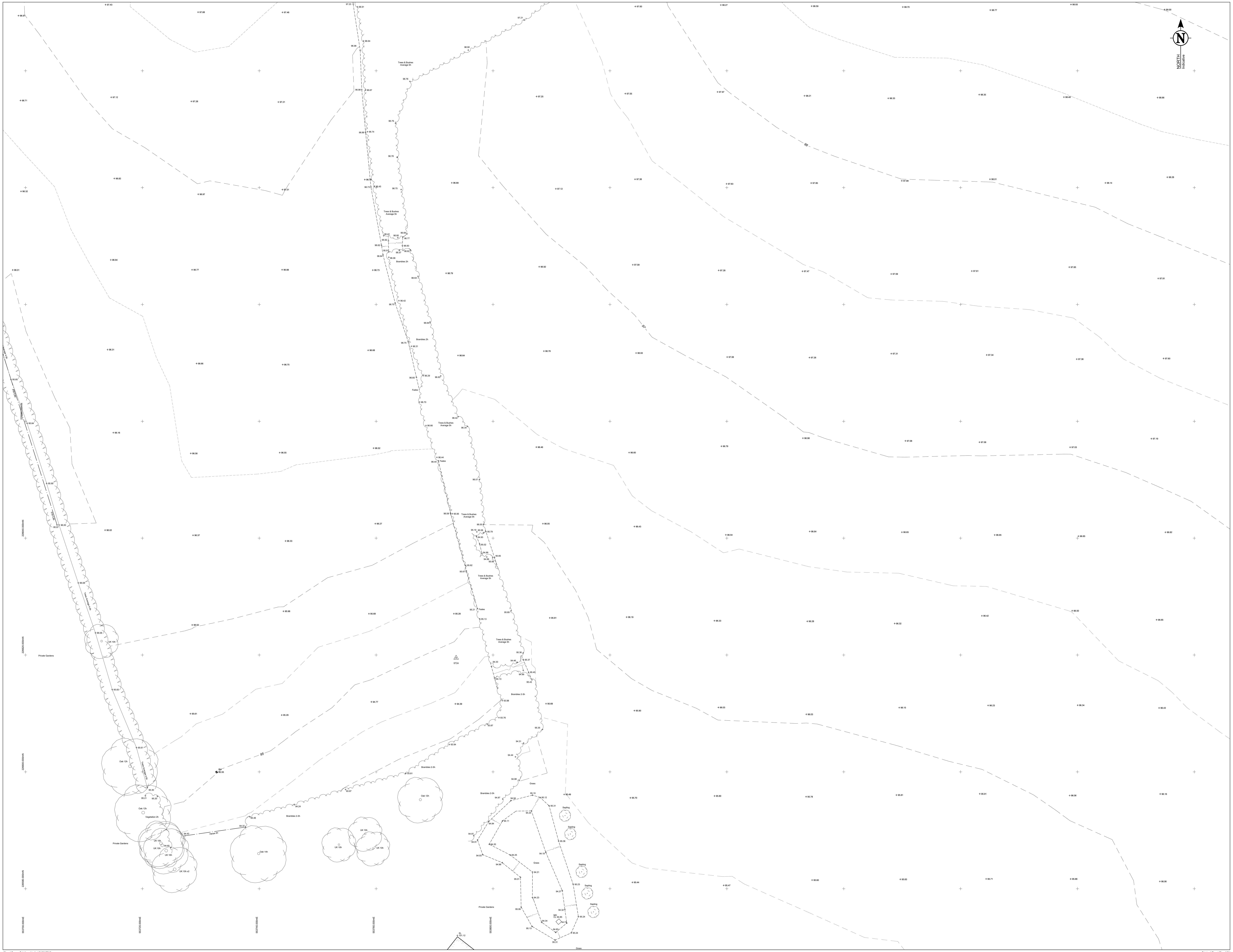
CLIENT
BLOOR HOMES EASTERN

SCALE
1:200

SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG STATUS
SB/RW	23/02/21	MB	JM	FINAL

DRAWING NUMBER	REVISION	ISSUE DATE
31268BWLS-11	C	08/03/21

Original Sheet Size A0H



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LAND SURVEYING
BUILDING SURVEYING
UNDERGROUND SURVEYING
SITE ENGINEERING
MONITORING

0845 040 5969
survey-solutions.co.uk

IPSWICH BRENTWOOD COVENTRY GLASGOW NORWICH NOTTINGHAM YEOVIL

PROJECT TITLE HENHAM ROAD, ELSENHAM, ESSEX, CM22 6DH.				
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 12 of 17				
CLIENT BLOOR HOMES EASTERN				SCALE 1:200
SURVEYOR SB/RW	SURVEY DATE 23/02/21	CHECKED BY MB	APPROVED BY JM	DWG STATUS FINAL
DRAWING NUMBER 31288BWLS-12			REVISION C	ISSUE DATE 08/03/21

ISO 9001 REGISTERED FIRM
RICS
chartered ICES
THE SURVEY ASSOCIATION

TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

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DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 13 of 17

CLIENT
BLOOR HOMES EASTERN

SCALE
1:200

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DRAWING NUMBER	REVISION	ISSUE DATE
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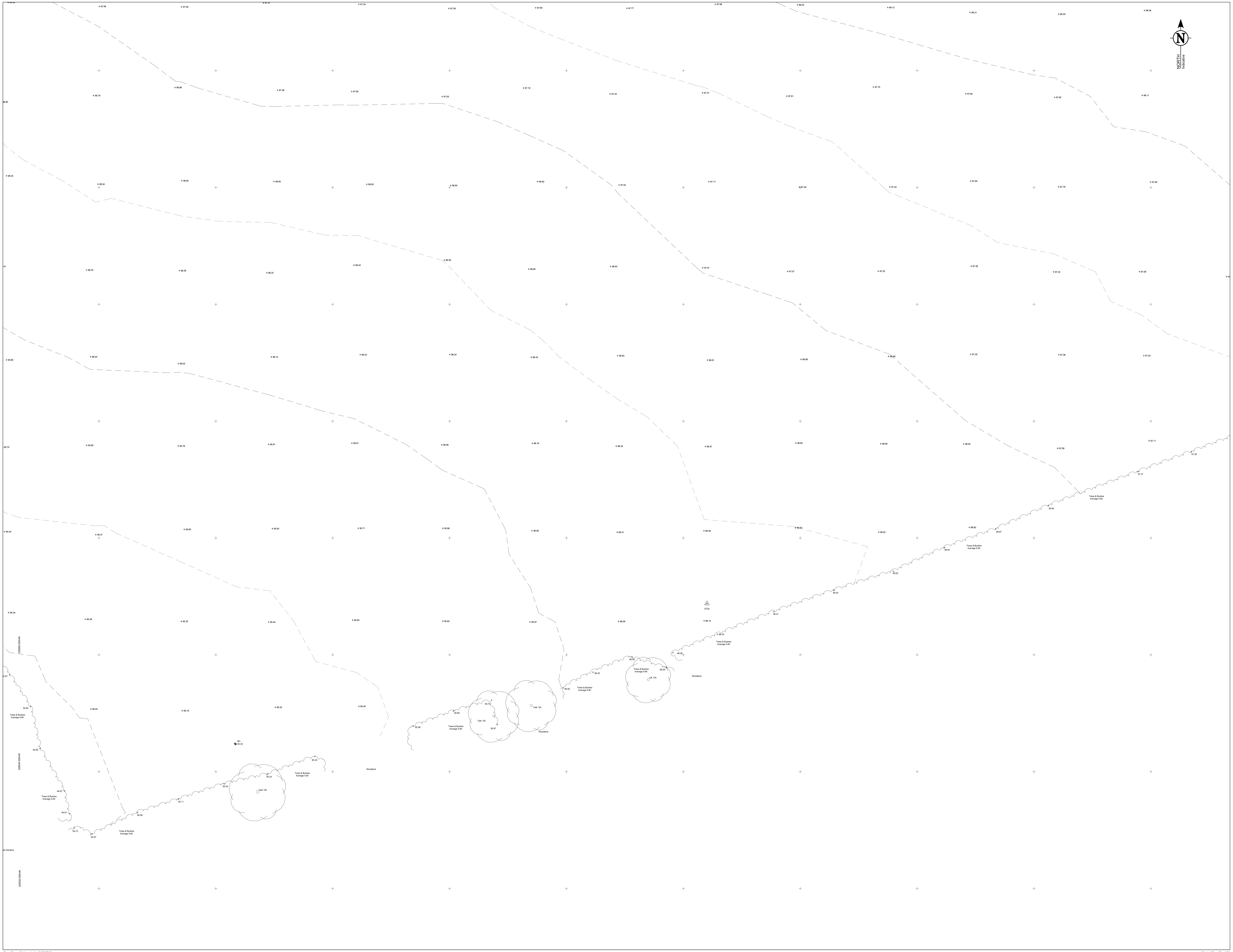

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PROJECT TITLE
HENHAM ROAD, ELSENHAM, ESSEX,
CM22 6DH.

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 14 of 17

CLIENT				SCALE
BLOOR HOMES EASTERN				1:200
SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG STATUS
SB/RW	23/02/21	MB	JM	FINAL
DRAWING NUMBER			REVISION	ISSUE DATE
31288BWLS-14			C	08/03/21

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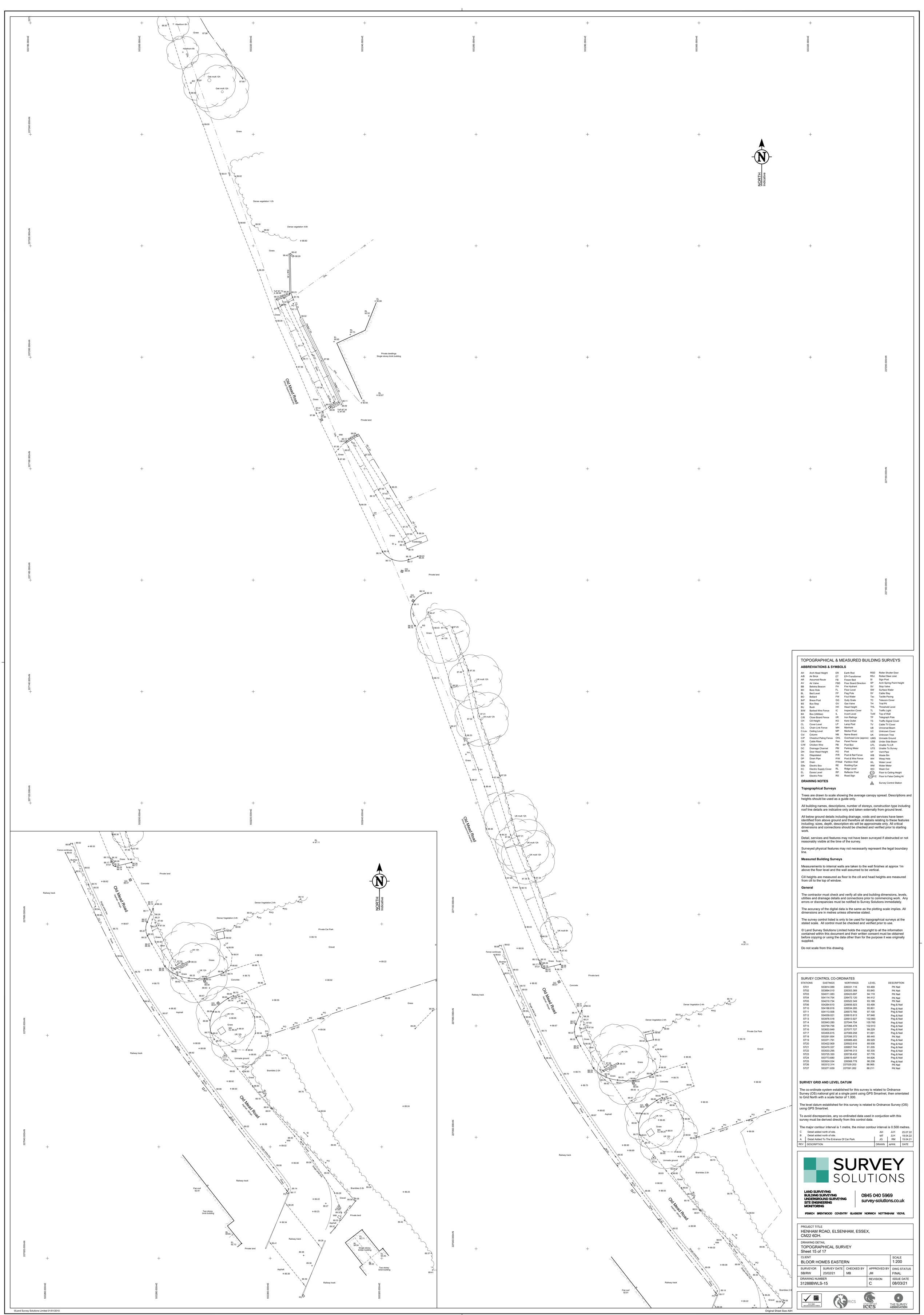

TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

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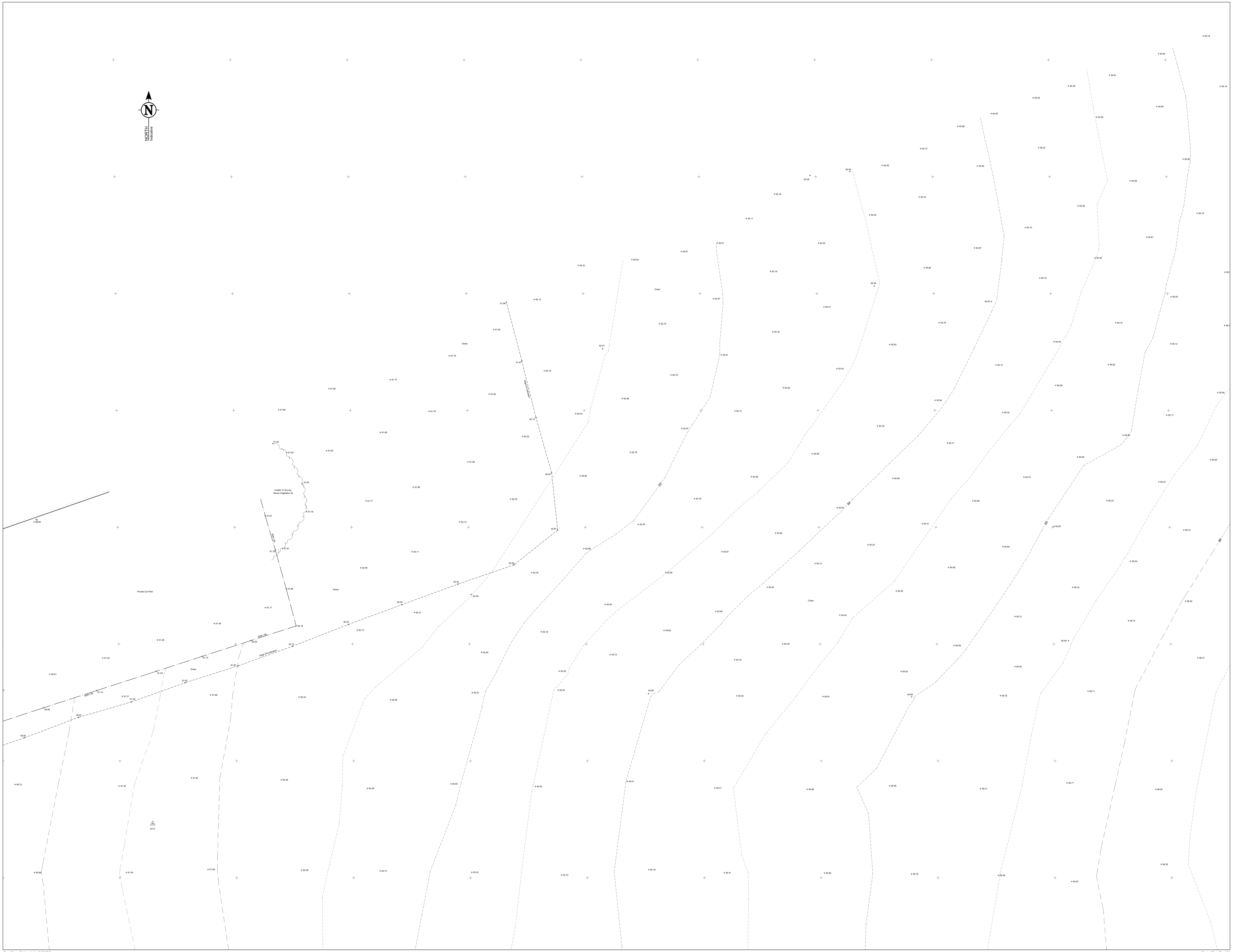
PROJECT TITLE: HENHAM ROAD, ELSENHAM, ESSEX, CM22 6DH.				
DRAWING DETAIL: TOPOGRAPHICAL SURVEY Sheet 15 of 17				
CLIENT: BLOOR HOMES EASTERN				SCALE: 1:200
SURVEYOR: SB/RW	SURVEY DATE: 23/02/21	CHECKED BY: MB	APPROVED BY: JM	DWG STATUS: FINAL
DRAWING NUMBER: 31288BWLS-15			REVISION: C	ISSUE DATE: 08/03/21



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PROJECT TITLE HENHAM ROAD, ELSENHAM, ESSEX, CM22 6DH.				
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 16 of 17				
CLIENT BLOOR HOMES EASTERN				SCALE 1:200
SURVEYOR SB/RW	SURVEY DATE 23/02/21	CHECKED BY MB	APPROVED BY JM	DWG STATUS FINAL
DRAWING NUMBER 31288BWLS-12			REVISION C	ISSUE DATE 08/03/21

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PROJECT TITLE HENHAM ROAD, ELSENHAM, ESSEX, CM22 6DH.				
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 17 of 17				
CLIENT BLOOR HOMES EASTERN				SCALE 1:200
SURVEYOR SB/RW	SURVEY DATE 23/02/21	CHECKED BY MB	APPROVED BY JM	DWG STATUS FINAL
DRAWING NUMBER 31288BWLS-12			REVISION C	ISSUE DATE 08/03/21

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Appendix B

GROUND INVESTIGATION

Bloor Homes Eastern Limited

Phase II, Land North of Henham Road, Elsenham

Geo-environmental and Geotechnical Site Investigation

1921748-R02 (00)

RSK GEOSCIENCES

DECEMBER 2021

RSK GENERAL NOTES

Project No.: 1921748

Title: Geo-environmental and Geotechnical Site Investigation: Phase II, Land North of Henham Road, Elsenahm

Client: Bloor Homes Eastern Limited

Date: December 2021

Office: RSK Environment Limited, 18 Frogmore Road, Hemel Hempstead, Herts, HP3 9RT. Tel 01442 437500

Status: Rev 00

Author(s)	Tim Costello / Andrew Tranter	**Technical reviewer**	Duncan Sharp
Signature	[redacted]	Signature	[redacted]
Project manager	Andrew Tranter	**Quality reviewer**	Ellie Sanders
Signature	[redacted]	Signature	[redacted]

Revision control sheet				
Revision ref.	**Date**	**Reason for revision**	**Amended by:**	**Approved by:**
Rev 00	Dec 2021	First issue	n/a	see above

CONTENTS

FIGURES

APPENDICES

1 INTRODUCTION

1.1 Commissioning

RSK Environment Limited (RSK) was commissioned by Bloor Homes to carry out a Geo-environmental and Geotechnical Site Investigation of the Phase II development area located north of Henham Road, Elsenham CM22 6DH. The project was carried out to an agreed brief as set out in RSK's proposal (Ref. T1921748, dated September 2021).

The site in question is being considered for development with low-rise residential properties.

RSK's service constraints are shown in Appendix A.

1.2 Objectives

The objective of the work is:

- to identify any land contamination and/or geotechnical constraints to the proposed development; and
- to identify the need for any additional investigation or remediation works to demonstrate that the site is suitable for its proposed use.

1.3 Scope of works

The scope of this assessment has been developed in accordance with relevant British Standards and authoritative technical guidance as referenced through the report. The assessment of the contamination status of the site is in line with the technical approach presented in Land Contamination Risk Management (LCRM) (Environment Agency, 2021) – which supersedes CLR11 Model Procedures for Land Contamination – and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017). It is also compliant with relevant planning policy and guidance.

The scope of the intrusive investigation has been designed in line with the recommendations of BS5930:2015+A1:2020 Code of practice for ground investigations (BSI, 2020), which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. It has also been developed in general accordance with BS 10175: 2011 + A2 2017. Ground gas assessment has been undertaken in general accordance with BS8576: 2013 and BS 8485:2015+A1:2019.

A brief summary of relevant legislation and policy relating to land contamination is given in Appendix C.

The scope of works for the assessment has included the following:

- Site reconnaissance survey to assess the visual condition of the site;
- purchase of an environmental data base report to enable review historical development, local geology and hydrology;
- review of any previous site investigation reports made available;

- development of initial conceptual site model of the site (CSM);
- preliminary consideration of geotechnical constraints and hazards;
- intrusive investigation comprising nine window sample borehole with gas installations, ten trial pits, in situ testing (including soakaway tests and plate load tests), soil sampling for geo-environmental and geotechnical purposes;
- three return visits to carry out ground gas and groundwater monitoring;
- interpretation of data to develop a refined conceptual site model (CSM);
- generic quantitative risk assessment (GQRA) of relevant contaminant linkages;
- interpretation of ground conditions and geotechnical data to provide preliminary recommendations with respect to foundations and infrastructure design;
- preliminary assessment of the potential waste classification; and

- preparation of this factual and/or interpretative report.

1.4 Existing reports

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

- WSP, Preliminary risk assessment East of Elsenham, ref 11500852, dated November 2017;
- Tetra Tech, Factual and interpretive Geo-Environmental Report, ref 784-B025589, dated February 2021; and
- Geo-environmental and Geotechnical Site investigation Report, ref 1921748-R01(00) dated August 2021.

Pertinent information from these reports has been summarised in Section 2.

1.5 Limitations

This report is subject to the RSK service constraints given in Appendix A and limitations that may be described through this document.

2 SITE DETAILS

2.1 Site location

Site location details are presented in **Table 1** and a site location plan is provided on Figure 1.

Table 1 Site location details

Site name	Elsenham
Full site address and Post Code	Henman Road, Elsenham CM22 6DH
National Grid reference (centre of site)	TL 53616 27101

2.2 Site description

The site boundary and current site layout are shown on Figure 2.

The site covers an area of c. 18 hectares and comprises arable farmland. Land directly to the south of the site has been previously investigated by RSK and is referred to as the Phase I development area.

2.3 Surrounding land uses

The site is located to the east of the village of Elsenham within a mixed agricultural and residential setting. Immediate surrounding land uses are described in **Table 2**.

Table 2 Surrounding land uses

North	Agricultural fields surround the site to the north, with Elsenham station carpark, and a commercial premises ~20 m to the northwest.
East	Agricultural fields are directly east with a former sand and gravel quarry located ~200 m to the south east of the site, and comprises grassland/woodland.
South	Agricultural land exists to the south that makes up the Phase I development area
West	The West Anglian mainline and Elsenham Station along with residential properties.

2.4 Development plans

It is understood that the site will be developed with low-rise residential properties, however the layout of the site has not been determined.

3 DESK-BASED ASSESSMENT

The desktop study was designed generally to meet the objectives of a preliminary (phase 1) investigation, as defined by BS 10175:2011 + A2 2017 (BSI, 2017) and this assessment relates to LCRM Stage 1, Tier 1 preliminary risk assessment. The "vicinity" of the site for the purposes of this report is defined as locations situated within an approximate 250 m radius of the site, although certain sources and/ or sensitive targets further than 250 m may also have been considered.

The study aims principally to identify and assess the potential risks and liabilities associated with contamination of the ground, on and in the vicinity of the site. While this includes consideration of current operations and housekeeping on the site, the report does not constitute a comprehensive environmental audit of the site, as covered under ISO 14001.

3.1 Site history

3.1.1 Historical development record

The development history of the site and surrounding area based upon assessment of historical plans and records is detailed in **Table 3**. The historical maps reviewed are shown within the environmental database report in Appendix C.

Table 3 Summary of historical development

Date from	Date to	Historical Land Use (on-site)	Area of site
1881	1951	Agricultural land. A rail spur for the Elsenham/Thaxted light rail appears after 1913 across the north western corner and running along the northern edge of the site	North west.
1951	1970	Agricultural land. The rail line was closed in 1953 and dismantled.	East
1970	1999	Agricultural land.	East and south
1999	2021	Agricultural land.	South
Date from	**Date to**	**Historical Land Use (off-site)**	**Distance (m) and orientation**
1881	1951	The site is largely surrounded by agricultural land with the existing railway line to the west and residential properties to the south. A pond is located ~100 m to the south of the site, and still exists.	All
1923	1970	Cattle pens are present directly to the northwest of the site within the spur of the light railway.	All

		A large nursery is also located ~120 m to the northwest of the site boundary. A military camp was located directly to the north of the site during the Second World War and was used to train service personal in survival skills. During the 1950s and 1960s sand and gravel were extracted ~200 m to the southeast of the site boundary. The pit has not been backfilled and comprises open scrub land.	
1970	2021	A small sand / gravel pit is shown ~190 m east of the site boundary. The cattle pens are replaced by a depot during the 1980s which is redeveloped ~2006.	All
Relevant information sources: Historical OS maps ☒ Town plans ☐ Information from the Local Planning Authority ☐ Aerial photography ☒ Additional information ☐ Previous reports ☒			
Note: Reference to published historical maps provides invaluable information regarding the land use history of the site, but historical evidence may be incomplete for the period pre-dating the first edition and between successive maps.			

The historical records show that the site has been used predominately for agricultural purposes. A rail spur for the Elsenham/Thaxted light railway was constructed along the sites north-north western boundary in the early 20th century, however was dismantled during the 1950s.

Offsite, during the 19th Century the site was surrounded by agricultural land with the existing railway line directly to the west. During the Second World War a military training camp was constructed directly to the north of the site. A sand and gravel quarry was located ~200 m to the south east from the 1950s to the 1970s, and a much smaller pit was situated ~190 m to the east. There is no evidence to suggest that either were backfilled or used as landfills.

A depot was constructed directly northwest of the site during the 1980s and was redeveloped with a new warehouse type building ~2006.

3.1.2 Unexploded ordnance

A detailed unexploded ordnance risk assessment of the site (ref DA12536a-00) was carried out by 1st Line Defence during April 21 in relation to the Phase I development area to the south. The assessment indicated that due to the proximity of the former military camp the following mitigate measures are required including,

- site specific UXO awareness briefing;
- non-intrusive magnetometer survey for site investigation;
- watching brief by UXO technician during site works and construction works; and
- deeper magnetometer survey is recommended for piled foundations.

Given that the Phase II development is located closer to the former camp it is considered that the same mitigation measures will apply.

3.2 Information from environmental database report

Relevant environmental permits and incidents detailed within the environmental database report (see Appendix C) are summarised below in **Table 4**.

Table 4 Summary of environmental permits, landfills and incidents

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
Agency and hydrological				
Environmental permits – incorporating Integrated Pollution Prevention and Control, Integrated Pollution Controls, Local Authority Integrated Pollution Prevention and Control	0	0	1	Vridor Waste Management Ltd – Landfill >500 m east of the site.
Enforcement and prohibition notices	0	0	0	None
Pollution incidents to controlled waters, Prosecutions relating to controlled waters, Substantiated pollution incident register, Water Industry Act referrals	0	0	1	1 historic incident offsite in 1989. >800 m to the south east.
Discharge consents	0	0	26	26 points located within 1000 m
Registered radioactive substances	0	0	0	None
Landfill and waste				
Active landfills	0	0	1	Off-site ~950 m east, Elsenham Quarry operated by Viridor Waste Management Limited, landfilling >25,000 tonnes excluding inert waste.

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
Historic / closed landfills	0	0	2	Off-site ~850 m east relates to landfilling of industrial and commercial waste at former sand pit off Henham Road.
Other waste management licences	0	0	1	Off site ~950 m east recycling centre operated by Ingrebourne Valley Ltd.
Potentially in-filled land (pit, quarry, pond, marsh, river, stream, dock etc)	0	0	3	Off-site: Former sand and gravel quarry directly to the east.
Hazardous substances/ industrial land uses				
Control of Major Accident Hazards (COMAH) sites	0	0	0	None
Explosives sites, Notification of Installations Handling Hazardous Substances (NIHHS), Planning hazardous substance consents/ enforcements	0	0	0	None
Contaminated land Part 2A register entries and notices	0	0	0	None
Contemporary trade directory entries	0	0	-	No active entries that are likely to impact the site.
Fuel station entries	0	0	1	The Garage High Street which has been decommissioned and is unlikely to impact the site.
Note: Entries have only been included within the table where they are located within a 250 m radius of the site or, where they fall outside of this radius but are considered to comprise a significant entry.				

3.3 Information from regulatory authorities

3.3.1 Local Authority environmental health department information

The Environmental Health Department of Uttlesford District Council has no records of contamination in connection with the site. Furthermore, no Part 2A designations or contamination complaints have been noted on site.

The Council have highlighted the rail spur on-site and sand and gravel pit ~200 m to the southwest as points of interest.

No private abstraction licences exist within 1 km of the site.

A copy of the response is included in Appendix D.

3.4 Summary of previous investigations

A summary of pertinent information from previous investigations is included below in **Table 5**.

Table 5 Summary of pertinent information from previous investigations

Report Details	WSP, Preliminary risk assessment East of Elsenham, ref 11500852, dated November 2017
Site coverage	Covers the phase I development area to the south of the site, and part of the existing site along the western boundary.
Summary scope of works	Desk based study.
Does the client have reliance upon the report?	Yes.
Key factual findings	The report concluded that there is the potential for made ground to exist on the site associated with the former sand and gravel quarry to the east (~200 m SE of the site), existing railway line to the west, and former light railway to the north (located on the site) existing site boundary. The made ground may contain potentially deleterious materials that pose a risk to future site users, and further investigation was recommended. Further investigation was also recommended in order to facilitate foundation and infrastructure design.
Report Details	Tetra Tech, Factual and interpretive Geo-Environmental Report, ref 784-B025589, dated February 2021
Site coverage	Covers the phase I development area to the south of the site, and part of the existing site along the western boundary.
Summary scope of works	Three cable percussive boreholes to a maximum of 11 m depth and 24 window sample boreholes to a maximum of 5 m depth. Four round of ground gas and groundwater monitoring were carried out following the investigation. Falling head test were carried out in three window sample boreholes.

Does the client have reliance upon the report?	Yes.
Key factual findings – Ground Conditions	The ground conditions beneath the site comprised topsoil over a slightly gravelly clay across the western margin of the site (Head Deposits, and a very sandy very gravelly Clay (Lowestoft Formation) over the central and north-eastern portions of the site. The remainder of the site was directly underlain by the Kesgrave Catchment Subgroup consisting of gravelly sand and sand deposits. The Kesgrave Catchment Subgroup was also present beneath the Lowestoft/head deposits across the central, western and northern portions of the site. The Lambeth Group was encountered at one location in the south eastern corner of the site at 8.2 mbgl. Groundwater was recorded variable standing depths, ranging between 0.78 mbgl and 8.59 mbgl.
Key factual findings – Geo-environmental	• No made ground was recorded on the site. The results of chemical testing recorded one elevated concentration of pH, however the soils were not considered to pose a risk to human health; • In regards to the risk to groundwater leachate testing was carried out on 10 topsoil samples. Elevated zinc was recorded above the initial DWS screening values, however no elevated concentration of zinc were recorded in the underlying groundwater; • Groundwater samples were taken from three borehole from across the site. No elevated concentrations of contaminants were recorded with the exception of petroleum hydrocarbons and PAHs at one locality CP04. Given the absence of a source the exceedance was attributed to possible cross contamination from drilling or the use of farm machinery. Further testing was recommended; and • Low concentration of methane and carbon dioxide were recorded which were assessed as Characteristic Situation 1, whereby no gas protection measures are required for new buildings.
Key factual findings – Geotechnical	• Shallow strip or trench fill foundations placed within the firm clays (Head deposits or Lowestoft Formation till deposits) or medium dense to dense sands (Kesgrave Catchment Subgroup) should be feasible for the proposed houses; • Foundations for the proposed school will depend on proposed loads and number of stories. Shallow strip or trench fill foundations placed within the Lowestoft

	Formation till deposits may be feasible or a piled foundation solution may be required; • Appropriate foundation precautions will be needed when building within influencing distance of existing or proposed trees. Where applicable a proprietary compressible material should be incorporated into foundation design to protect against heave and shrinkage of cohesive soils; • De-watering may be locally required during excavations; • Falling head permeability testing indicates that the Head Deposits are of low permeability with a calculated soil infiltration rate of 7.63E-09 m/s. The Kesgrave gravelly sand deposits are relatively permeable with calculated soil infiltration rates of 1.99E-06 and 3.54E-05m/s; and • Results for water soluble sulphate indicate no requirement for protection of concrete from sulphate attack. The Design Sulphate class was assessed as DS-1, ACEC Class AC-1.
Conclusions/ recommendations	The following recommendations were made for additional investigation. • Further groundwater monitoring at CP04; • Addition site investigation for piled foundation design; • A slope stability analysis in relation to the former sand and gravel quarry to the east; and • Additional infiltration tests in accordance with BRE365.
Report Details	RSK, Geo-Environmental and Geotechnical Site Investigation, ref 1921748-R02, dated August 2021
Site coverage	Covers the phase I development area only located directly south of the site.
Summary scope of works	To address the recommendations of the Tetra Tech Report a site investigation was carried out comprising three cable percussive boreholes to 20 m depth, ten machine dug trial pits to 2 m depth, six window sample boreholes to 4 m depth, plate load testing, infiltration testing, and three return visits for gas and groundwater monitoring.
Does the client have reliance upon the report?	Yes.
Key factual findings – Ground Conditions	The ground conditions were consistent with the previous site investigation. The Kesgrave Catchment Subgroup was encountered across the area of investigation which was generally granular but found to be locally cohesive along the western boundary. This formation was locally overlain by the cohesive deposits of the Lowestoft Formation in the northeast portion of the site which ranged from 0.6 to 3.2 m in thickness. The

	Lambeth Group was encountered from 7 m bg along the western boundary to 15 m bgl in the north eastern comer (directly south of the Phase II development area). Groundwater depth range from 1.8 m to 9.2 m bgl. No visual or olfactory evidence of contamination was noted.
Key factual findings – Geo-environmental	• No elevated concentrations of potential contaminants were recorded in the soil samples taken from across the site. It was concluded that there was no risk to future site users, vegetation or water supply pipes, and no remedial measures are required; • No elevated concentrations of contamination were recorded above EQS values in the groundwater at CP04. The previous results may be due to a sampling error; • No ground gas protection measures are required for new properties; and • Further investigation of a former well noted on the historical maps should be investigated to determine whether it still exists.
Key factual findings – Geotechnical	• Traditional spread footings would be suitable for low-rise residential properties. Design parameters for piled foundation were provided in the report for more heavily loaded structures; • The recommended sub-grade soil CBR value for road pavement design is 4.5 %; • Assuming that the disturbance to ground will be minimised by the use of piled foundations, the recommended ACEC Classification is therefore AC-2 with a Design Sulphate Class of DS-2; and • The results of infiltration testing show that the granular Kesgrave Catchment Subgroup would be suitable for the use of pit soakaways across the central and southern portions of the site. Deeper trench or ring soakaways may need to be adopted where this formation is overlain by the Lowestoft Formation in the north eastern portion of the site.

3.5 Site geology

3.5.1 Anticipated geological sequence

Published records available on-line from the British Geology Survey shows that the western half of the site is underlain by superficial despots comprising Kesgrave Catchment Subgroup. This formation is overlain by the Lowestoft Formation across the eastern half, and the north-western tip of the site.

The superficial deposits are underlain by solid geology comprising the London Clay Formation, Lambeth Group with White Chalk at depth. However, the findings of the previous investigations indicate that the London Clay Formation may be absent locally.

Based on the published records, nearby BGS borehole logs, and the findings of the previous investigation the geology of the site to be characterised by the succession recorded in **Table 6**.

Table 6 Site geology

Strata	Description	Estimated thickness	Permeability
Lowestoft Formation (eastern half of the site)	Brown mottled grey very sandy, very gravelly clay with sub angular to sub rounded flint and chalk.	absent to over 5 m depth	Low (based on infiltration testing carried out by RSK).
Kesgrave Catchment Subgroup Cohesive (western half of the site, and below Lowestoft Formation)	Brown sandy slightly gravelly clay.	3 to 4 m depth	Low (based on infiltration testing carried out by RSK).
Kesgrave Catchment Subgroup Granular (western half of the site, and below Lowestoft Formation)	Brow to grey sand and gravelly sand.	~8 m	High (based on infiltration testing carried out by Tetra Tech)
Lambeth Group	Brown very sandy clay over layer of sand and clay.	~15 m*	Variable
Lewis Nodular and Seaford Chalk Formation	Chalk with flints	50 m+	High
Relevant information sources: BGS Geoindex ☒ BGS borehole logs ☒ Previous SI reports ☒ *Based on BGS borehole logs TL 52/69 and TL 52 NW/66			

Made ground may also be present along the northern boundary of the site associated with a disused railway line.

3.5.2 Radon

The environmental database report indicates that the site is not located within an 'Affected Area'. An 'Affected Area' is one with 1% or more homes above the radon Action Level of 200 Bq m^{-3}, and therefore the risk of significant ingress of radon into structures on-site is considered low and protection measures are not necessary in the construction of non-domestic buildings.

3.6 Mining and quarrying

The historical information shows the presence of a sand and gravel pit located ~200m to the south east of the site boundary, which was active from the 1950s until the 1970s. Three trial pits were excavated in the pit as part of the previous investigation conducted by RSK across the Phase I development area. The trial pits confirmed that it had not been backfilled / used as a landfill and therefore is not a source of ground gas or leachate.

A smaller sand / gravel pit was also present ~190m to the east of the site during the early 20th Century. The historical records also show that the pit has not been infilled.

3.7 Hydrogeology

A summary of the hydrogeological setting of the site, with respect to the anticipated geological sequence set out in Section 3.5 is presented below in **Table 7**.

Table 7 Summary of hydrogeological setting

Condition	Description
Aquifer characteristics	The site is underlain by the following aquifers: Superficial Deposits Lowestoft Formation – Secondary undifferentiated aquifer; Kesgrave Catchment Subgroup – Secondary A aquifer; Solid Geology London Clay – Unproductive Stratum (not proven beneath the site); Lambeth Group – Secondary A aquifer; Lewis Nodular and Seaford Chalk Formations – Principal aquifer; The ground conditions suggest that where low permeability clays are encountered at the surface this would restrict any vertical migration of contamination. Conversely, the granular deposits would allow the movement of any contaminants in the soil pore/groundwater.
Depth to groundwater and flow	Groundwater was recorded at variable depths of between 1.0 m depth along the western boundary to 15 m in the southeast corner during previous site investigations. The variable groundwater levels may reflect the variable topography across the site. Shallow groundwater within the superficial deposits is expected to flow to the south towards Stanstead Brook.

Condition	Description
	A second deeper aquifer comprising the Lewis Nodular and Seaford Chalk Formations is also present beneath the site. The anticipated groundwater table in this aquifer is in the order of 25 m to 30 mbgl. The hydrogeological map for the area shows that the regional direction of flow within the chalk aquifer is to the south. Groundwater within the chalk and overlying superficial deposits are not expected to be in hydraulic continuity with each other.
Groundwater recharge/ attenuation	Most of the site is currently unsurfaced and will hence drain to ground or enter drainage ditches along the field boundaries.
Licensed groundwater abstractions	The environmental database report indicates that there are no groundwater abstractions within a 1 km radius of the site.
Source protection zones	Information available in the Envirocheck report indicates that the site does not lie within a currently designated groundwater Source Protection Zone (SPZ).

3.8 Hydrology

A summary of the hydrology within the site area is summarised in **Table 8**.

Table 8 Summary of hydrology in site area

Condition	Description
Surface watercourses/features	The nearest identified surface water feature is a pond located ~150 m to the south of the site. The nearest watercourse is the Stanstead Brook – located ~1 km to the south of the site.
Surface water abstractions	The environmental database report indicates that there are three. current licensed surface water abstractions within a 1000 m radius of the site. These licensed are issued to Viridor Waste Management Limited to extract surface water from a tributary of Stanstead Brook for use in processing and dust suppression.
Site drainage	There is no existing drainage system located on site, however drainage ditch is located along the north boundary of the site.
Preliminary flood risk assessment	The indicative floodplain map for the area, shows that the site does not lie within a designated floodplain. The risk of flooding each year has been assessed by the EA as very low –i.e. 0.1% A flood risk assessment (FRA) is outside the scope of this report.

3.9 Sensitive land uses

Table 9 provides a summary of any environmentally sensitive areas identified within 250 m of the site based on the environmental database report

Table 9 Environmentally sensitive areas

Feature	Present within 250 m of site?	Details	Likely pathways from site?
International designations – Ramsar wetland, Special Area of Conservation (SAC), Special Protection Area (SPA)	No		
National designations – Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), ancient woodland	No		
Local designations – Local Nature Reserve, Site of Importance for Nature Conservation (SINC)	No		
Nearest high sensitivity development, e.g. residential	Yes	Residential ~50 m to the west.	No – given distance and railway located in cutting between site and the residential properties.

4 SITE RECONNAISSANCE FINDINGS

A site reconnaissance survey was completed on 24th September 2021 by RSK. The characteristics of the site observed during the walkover and from current ordnance Survey maps are summarised in **Table 10**.

A site plan is provided in Figure 2 with photographic records included in Appendix E detailing the main features identified below.

Whilst the walkover summary includes consideration of current operations and housekeeping on the site as potential sources of contamination, it does not constitute a comprehensive environmental audit of the site, as covered under ISO 14001.

Table 10 Site reconnaissance findings

Feature	Description
Physical characteristics	
Access constraints	Access via a locked gate off Henham Road via Phase I. A second point of entry via Old Mead Road is not suitable for heavy vehicles.
Site topography	The site slopes towards the west and south from a high of 104 mAOD to 89 mAOD.
Surface cover	The majority of the site is covered by active arable land with public walking trails along field margins.
Site drainage	Site surface water will drain to ground
Surface water	No surface water features exist on site.
Trees and hedges	The site is bounded by trees and hedgerow.
Invasive species	Based upon the walkover survey obvious evidence of Japanese Knotweed or other invasive species has not been identified on-site. However, it should be noted that a detailed survey of the possible presence or absence of invasive species is outside of the scope of investigation and consideration should be given to commissioning a specialist survey, as necessary.
Existing buildings on-site	No buildings are present on-site
Retaining walls and adjacent buildings on or close to site boundary	The Tuplin packaging company has a commercial / warehouse premises ~25 m of the north west corner of the site.
Basements on-site	No evidence of existing or infilled basements was observed
Made ground, earthworks and quarrying	Made ground may be present associated with a historic railway line located in the northeast corner and along the northern boundary of the site.

Feature	Description
Potentially unstable slopes on or close to site	None observed
Buried and overhead services present	None observed
Environmental characteristics	
Underground/ above ground storage tanks and pipework	None observed
Potentially hazardous materials storage and use	None observed
Asbestos-containing materials	None observed
Waste storage	None observed
Fly-tipping	None observed
Electricity sub-stations/ transformers	The trainline adjacent to the western boundary is electrified. Low voltage overhead wires are present along the northern boundary of site
Evidence of possible land contamination on-site	Possible pesticides associated with farming, and historical railway line.
Potential off-site sources of ground contamination	Existing railway line to the west. No obvious signs of potentially contaminative activities were noted with the commercial premise / warehouse located to the northwest of the site.

Possible sources of contamination on site were

- The use of pesticides for agricultural purposes; and
- Made ground associated with former railway line.

Off site sources noted were

- Railway line to the west.

The following geotechnical issues were identified

- Changes in site level and associated changes of surface lithologies (cohesive to granular).

5 PRELIMINARY GEOTECHNICAL CONSTRAINTS

5.1 Design class

BS EN 1997-1 defines three different Geotechnical Categories that structures may fall into, which are summarised as follows:

- Category 1: Small and relatively simple structures for which it is possible to ensure that the fundamental requirements will be satisfied on the basis of experience and qualitative geotechnical investigations; with negligible risk;
- Category 2: Conventional types of structure and foundation with no exceptional risk or difficult ground or loading conditions; or
- Category 3: Structures or part of structures, which fall outside limits of Geotechnical Categories 1 and 2. Examples include very large or unusual structures; structures involving abnormal risks, or unusual or exceptionally difficult ground or loading conditions; structures in highly seismic areas; structures in areas of probable site instability or persistent ground movements that require separate investigation or special measures.

Based on the information provided above on the proposed development and in view of the anticipated ground conditions, a Geotechnical Category of 2 has been assumed for the purposes of designing the geotechnical investigation. This should be reviewed at all stages of the investigation and revised where necessary.

5.2 Preliminary geotechnical hazards assessment

A summary of commonly occurring geotechnical hazards associated with the anticipated geology outlined in Section 3.5 above is given in **Table 11** together with an assessment of whether the site may be affected by each of the stated hazards.

Table 11 Summary of preliminary geotechnical risks that may affect site

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Sudden lateral changes in ground conditions	☒	Cohesive and granular soils located on site	Likely to affect ground engineering and foundation design and construction in the form of cohesive and granular soils located on the site.

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Shrinkable clay soils	☒	Lowestoft Formation present along site boundaries	Design to NHBC Standards Chapter 4 or similar.
Highly compressible and low bearing capacity soils, (including peat and soft clay)	☐	☒	Likely to affect ground engineering and foundation design and construction
Silt-rich soils susceptible to rapid loss of strength in wet conditions	☒	variable silt levels within cohesive material across site	Likely to affect ground engineering and foundation design and construction
Running sand at and below water table	☒	Fine sands recorded on site may become mobile below groundwater table	Likely to affect ground engineering and foundation design and construction
Karstic dissolution features (including ‘swallow holes’ in Chalk terrain)	☐	☒	May affect ground engineering and foundation design and construction – refer to Section 4.1.2
Evaporite dissolution features and/or subsidence	☐	☒	May affect ground engineering and foundation design and construction
Ground subject to or at risk from landslides	☐	☒	Likely to require special stabilisation measures
Ground subject to peri-glacial valley cambering with gulls possibly present	☐	☒	Likely to affect ground engineering and foundation design and construction
Ground subject to or at risk from coastal or river erosion	☐	☒	Likely to require special protection/stabilisation measures
High groundwater table (including waterlogged ground)	☒	Shallow groundwater recorded on site	May affect temporary and permanent works

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Rising groundwater table due to diminishing abstraction in urban area	☐	☒	May affect deep foundations, basements and tunnels
Geological faults, fissures and break lines	☒	Boundary of Head Deposits, Lowestoft and Kesgrave Sands Subgroup	May affect ground engineering and foundation design and construction
Underground mining including shafts and adits (e.g. coal, mineral)	☐	☒	Likely to require further assessment including potentially special stabilisation measures
Effects of extreme temperature (e.g. cold stores or brick kilns/furnaces)	☐	☒	Likely to affect ground engineering and foundation design and construction
Existing sub-structures (e.g. tunnels, foundations, basements, and adjacent sub-structures)	☐	☒	Likely to affect ground engineering and foundation design and construction
Filled and made ground (including embankments, infilled ponds and quarries)	☒	Former sand and gravel quarry to the south east, previous made ground noted in north west corner and historic rail spur along north western corner of site	Likely to affect ground engineering and foundation design and construction
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	☐	☒	May affect ground engineering and foundation design and construction
Site topography	☒	Ground levels fall to the south and west.	May affect ground engineering and foundation design and construction
Note: Seismicity is not included in the above table as this is not normally a design consideration in the UK.			

6 INITIAL CONCEPTUAL SITE MODEL

In the UK land contamination is assessed using a risk-based approach taking account of the magnitude (severity of the hazard) and likelihood (probability) of occurrence. A 'receptor' is something that could be adversely affected by contamination (e.g. people, an ecological system, property or a water body). A 'pathway' is a route or means by which a receptor is or could be exposed to or affected by a contaminant. A 'contaminant source' is a hazard but it can only pose a risk to a receptor where a pathway is present. The relationship between sources, pathways and receptors are referred to as a conceptual site model. A risk can only be released where a contaminant source, pathway and receptor are all in place, referred to as a 'pollutant linkage'.

In line with LCRM (Environment Agency, 2021) and BS 10175: 2011 + A2 2017 (BSI, 2017), RSK has used information in the preceding sections to identify hazards (sources of contaminants), receptors that may be impacted and plausible linking pathways. Where all three are present this is termed a potentially complete contaminant linkage and a qualitative risk estimation is made.

6.1 Potential soil, soil vapour and groundwater linkages

6.1.1 Potential sources of contamination

Potential sources of soil and groundwater contamination identified from current activities and the history of the site and surrounding area are presented in **Table 12**.

Table 12 Potential sources of soil and groundwater contamination

Potential sources	Contaminants of concern
On-site	
Made ground (associated with historic rail line and associated structures)	Unknown fill material but potentially including brick, ash and clinker. (heavy metals, and polycyclic aromatic hydrocarbons).
Agricultural use of pesticides	Pesticides.
Off-site	
Existing railway and station on western boundary	Petroleum hydrocarbons, inorganics, PAHs, ethanol glycol, and asbestos.

Potential on-site sources of contamination identified on-site was the possible use of pesticides associated with the on-going agricultural land use. There is also the potential for made ground along the north western and northern boundaries of the site associated with a historic railway line.

In regard to pesticides, these are controlled by the Control of Pesticides Regulations 1986, and if used appropriately are unlikely to pose a risk to future site users or the environment.

Any contamination associated with the railway is likely to be limited to sporadic de-icing and possibly minor oil leaks.

6.1.2 Sensitive receptors and linking exposure/ migration pathways

Sensitive receptors identified at or in the vicinity of the site that could be affected by the potential sources identified above comprise:

- future site users – residential users [oral, dermal and inhalation exposure with impacted soil, soil vapour and dust/fibres, ingestion of home-grown produce];
- future buildings and services [direct contact with contaminated soils or groundwater and chemical attack];
- future vegetation [direct contact with contaminated soils or groundwater and root uptake leading to phytotoxicity]; and
- groundwater in secondary A aquifer within Kesgrave Catchment Subgroup superficial deposits [leaching from soils/ percolation to aquifer/ lateral migration of dissolved phase].

Potential linking pathways are show in brackets for each item above.

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

6.2 Preliminary risk assessment

The preliminary risk assessment findings and potentially complete contaminant linkages are shown in **Table 13** overleaf. The risk classification based on the combination of hazard consequence and probability using a risk matrix from CIRIA C552 (Rudland et al., 2001), a summary of which is included in Appendix H. This relates to Tier 1 preliminary risk assessment in LCRM (Environment Agency, 2021).

Table 13 Risk estimation for potentially complete contaminant linkages

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
On -site, Existing agricultural use	Future site users Water supply pipes	Direct contact Vertical/lateral migration in the groundwater	Low	Medium	Moderate to Low	If used appropriately the use of pesticides is not likely to impact receptors.
	Groundwater	Vertical/lateral migration in the groundwater	Unlikely	Medium	Low	Any pesticides are likely to be concentrated within the surface soils.
On site, made ground associated with former railway	Future site users	Direct contact	Low	Medium	Moderate to Low	There is the possibility made ground existing along the route of the former railway that may contain deleterious materials, but this is not certain until further investigation is carried out.
	Vegetation Water supply pipes	Direct contact	Unlikely	Mild	Very Low	Any contamination is likely to be localised. There was no sign of any vegetation stress during the walkover survey.
	Groundwater	Vertical/lateral migration in the groundwater	Unlikely	Medium	Low	The railway was dismantled over 50 years ago, and therefore any potentially mobile contaminants is likely to have degraded.

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
Off-site – railway line to the west.	Groundwater	Vertical/lateral migration in the groundwater	Low	minor	Very Low	Railway line is located in cutting so ground levels are lower than the site. Mobile contaminants may impact groundwater locally but are considered unlikely to pose a direct risk to the site.

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

Potentially complete contaminant linkages with a potential risk of moderate to low or higher identified in in **Table 13** comprise:

- Potential risk to future site users from contaminants associated with agricultural use of the site, and locally made ground within the area of the historic railway.

These potentially complete contaminant linkages need to be assessed further through appropriate site investigation to target the identified sources of potential contamination and assess the feasibility of identified pathways.

6.3 Data gaps and uncertainties

Key data gaps and uncertainties identified in the CSM at desk study stage include:

- Variability of groundwater depth and flow direction; and
- Presence of any made ground associate with the former railway.

7 SITE INVESTIGATION STRATEGY & METHODOLOGY

7.1 Introduction

RSK carried out intrusive investigation works and subsequent monitoring of boreholes between 6th November 2021 and 13th November 2021.

7.2 Objectives

The specific objectives of the investigation were as follows:

- to further characterise the ground conditions underlying the site;
- to investigate specific potential sources of contamination identified in initial CSM;
- to determine groundwater depth and;
- to assess geotechnical properties of soils.

7.3 Investigation strategy

The techniques adopted for the investigation were chosen with consideration of the objectives and site constraints.

The ground investigation was carried out using intrusive ground investigation techniques in general accordance with the recommendations of BS5930:2015+A1:2020, which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. Whilst every attempt was made to record full details of the strata encountered in the boreholes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils.

Details of the investigation locations, installations and rationale are presented in **Table 14**. Ten machine excavated trial pits were dug to between 2 to 3 mbgl, four of these trial pits were used for infiltration tests. Nine window sample boreholes were drilled to 5 m depth, two of which were installed with a combined gas and groundwater monitoring wells.

An exploratory hole location plan is shown on Figure 3.

Table 14 Exploratory hole and monitoring well location rationale

Investigation type	Number	Designation	Monitoring well installation	Rationale examples below
Boreholes by dynamic sampling methods	9	WS101 to WS109	Gas monitoring at WS101 and WS105	To characterise the ground conditions across the site for contamination and geotechnical purposes. Ground gas and water monitoring wells were installed WS101 and WS105. These were positioned at the edge of the field so that they would not be damaged by ploughing. WS101 was also positing in the area of the former railway spur.
Trial-pits excavated by mechanical excavator	6	TP101 to TP106	None	To characterise the shallow ground conditions across the site. TP101 and TP102 were positioned to target the historical railway along the northern boundary. The remainder of the trial pits were non-targeted.
Trial-pits excavated by mechanical excavator	4	SA101 to SA104	None	Trial pits positioned across site to assess infiltration rates.
Trial-pits excavated by mechanical excavator	6	CBR101 to CBR106	None	Shallow trial pits to <0.50 m depth to allow plate load tests to be undertaken to determine in-situ CBR value

7.3.1 Implementation of investigation works

The exploratory holes were logged by an engineer in general accordance with the recommendations of BS5930:2015+A1:2020 (which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1).

The monitoring well construction and associated response zones are detailed on the exploratory hole records in Appendix G.

The soil sampling and analysis strategy was designed to characterise each encountered soil strata, permit an assessment of the potential contaminant linkages identified and

investigate the geotechnical characteristics. In addition, samples were taken to allow for geo-environmental and geotechnical testing to be undertaken.

Soils collected for laboratory analysis were placed in a variety of containers appropriate to the anticipated testing suite required. They were dispatched to the laboratory in cool boxes under chain of custody documentation. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination.

7.4 Monitoring programme

7.4.1 Ground gas monitoring

In line with the initial CSM, response zones were installed within the underlying Kesgrave Catchment Subgroup as this would act as a pathway for migration of possible gas associated with the historic railway line to Thaxted along the west/north west portion of the site.

Three monitoring rounds carried out on the 22nd October, 26th October and 1st November have been undertaken to provide data to support refining of the CSM. A calibrated infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million.

The atmospheric pressure before and during monitoring, together with the weather conditions, were recorded. The monitoring included periods of falling atmospheric pressures and after/during rainfall.

All ground gas monitoring results together with the temporal conditions are contained within Appendix H.

7.5 Laboratory testing

Laboratory testing was undertaken at a UKAS accredited laboratory with ISO17025 and MCERTS accredited test methods were specified where applicable for contamination testing and as shown in the laboratory test certificates appended.

7.5.1 Chemical analysis of soil samples

The soil sampling strategy was designed to characterise the near surface soils (top metre) across the site. The programme of chemical tests undertaken on soil samples obtained from the intrusive investigation is presented in **Table 15** with the laboratory testing results contained in Appendix I.

Table 15 Summary of chemical testing of soil samples

Stratum	Tests undertaken	No. of tests
Made ground	Heavy metals, PAHs and asbestos screen	5
Natural soils	Heavy metals, PAH's and pesticides	3

7.5.2 Geotechnical analysis of soils

Where appropriate disturbed, bulk and undisturbed soil samples were taken for geotechnical classification testing with the depth and nature of samples detailed within the exploratory hole records.

Where appropriate, testing was undertaken in accordance with BS 1377:1990 Method of Tests for Soils for Civil Engineering Purposes or, where superseded, by the relevant part of BS EN ISO 17892:2014 Geotechnical investigation and testing - Laboratory Testing of Soil. Tests carried out in order to classify the concrete class required on-site have been undertaken following the procedures within BRE SD1:2005.

The programme of geotechnical tests undertaken on samples obtained from the intrusive investigation is presented in **Table 16**. The results and UKAS accreditation of tests methods are shown in Appendix J.

Table 16 Summary of geotechnical testing undertaken

Strata	Tests undertaken	No. of tests
Head Deposits	Liquid/ plastic limits	3
	WS sulphate and PH	2
Kesgrave Catchment Subgroup granular	WS sulphate and PH	2
	Sieve analysis	3
Lowestoft Formation	Liquid/plastic limits	3
	WS sulphate and PH	3

7.5.3 Infiltration testing

Infiltration tests were carried out in the following trial pits and strata:

- SA101 – Head Deposits;
- SA102 - Granular deposit of the Kesgrave Catchment Subgroup;
- SA103 – Granular deposit of the Kesgrave Catchment Subgroup; and
- SA104 – Cohesive deposit of the Lowestoft Formation.

The tests were carried out generally in accordance with the method described in BRE Digest 365 (BRE, 2016). This involved filling the pits with water from a tanker and recording the drop in water level with time as the water soaked into the ground.

Copies of the testing records are included in Appendix K.

8 SITE INVESTIGATION FACTUAL FINDINGS

The results of the intrusive investigation and subsequent geo-environmental and geotechnical laboratory analysis undertaken are detailed below.

8.1 Ground conditions encountered

The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, list of samples taken, field observations of soil and groundwater, in-situ testing and details of monitoring well installations are included on the exploratory hole records presented in Appendix G.

Th exploratory holes encountered made ground locally along the northern and western boundaries of the site. Topsoil mantled the majority of the site, with the Head Deposits and Lowestoft Formation sub cropping beneath the western and eastern flanks of the site. The Kesgrave Catchment Sub Group sub cropped directly beneath the Head Deposits, topsoil and Lowestoft Formation in the western, central and eastern areas, respectively. The findings of the investigation broadly confirm the stratigraphic success described within the CSM, however the Lowestoft Formation is further east than originally anticipated.

For the purpose of discussion, the ground conditions encountered during the fieldworks are summarised in **Table 17** with the strata discussed in subsequent subsections.

Table 17 General succession of strata encountered

Stratum	Exploratory holes encountered	Depth to top of stratum m bgl	Proven thickness (m)
Made ground	WS101, WS105 & WS107	Ground level	0.61 to 1.20
Topsoil	All except WS101, WS105 and WS107	Ground level	0.30 to 0.40
Subsoil	All except WS101, WS105, WS106 WS107, SA02, SA03	0.3 to 0.4	0.2-0.85
Lowestoft Formation	WS103, WS107, WS109, SA104, TP104, SA03	0.3 to 1.15	0.85 to 4.50+
Head Deposits	SA01, WS101, WS106, TP01	0.3 to 0.85	0.55 to 4.7+
Kesgrave Catchment Subgroup	TP105, WS101, WS102, WS104, TP102, TP103, TP105, TP106, WS105, SA02, SA03,	0.35 to 2.3	1.85 to 3.8+
+ = Base of stratum not proven			

8.1.1 Made ground

Made ground was recorded locally at three exploratory points, two of which (WS101 and WS107) were located just outside of the boundary of the site to the northwest and north

east. Made ground was also encountered along the western boundary of the site at WS105. This stratum was described as,

- WS101 (0.75 m depth) - brown silty gravelly sand with flint brick and concrete;
- WS105 (1.2 m depth) – brown organic gravelly fine to coarse sand with flint, sandstone and rare slag; and
- WS107 (0.6 m depth) – brown sandy gravelly silt over a dark brown ash silty gravelly sand with flint, charcoal and pottery.

The made ground may be associated with the construction of the historical / existing railway to the west or possibly the commercial / warehouse unit located to the northwest of the site boundary.

8.1.2 Topsoil / Subsoil

Topsoil was encountered across the remainder of site and comprised a dark brown gravelly organic SILT or SAND with roots, which was underlain by a subsoil consisting of brown gravelly silty CLAY or SAND.

8.1.3 Lowestoft Formation

This stratum was encountered beneath the eastern boundary of the site and comprised a stiff sandy gravelly clay with fine to cobble sized fragments of flint and chalk. The base of this stratum was beyond the limit of investigation, 5 m below ground level.

A summary of the in-situ and laboratory test results recorded in the stratum are presented in **Table 18**.

Table 18 Summary of in-situ and laboratory test results for Lowestoft Formation

Soil parameters	Min. Value	Max. Value	Reference
Moisture content (%)	18	19	Appendix J
Liquid limit (%)	35	54	Appendix J
Plasticity limit (%)	21	29	Appendix J
Plasticity index (%)	13	25	Appendix J
Modified plasticity index (%)	13	25	Appendix J
Plasticity term	Intermediate	High	Appendix J
Volume change potential	Low	Medium	-
SPT 'N' values	24	Refusal	Appendix G
Undrained shear strength inferred from SPT 'N' values (kN/m^2)*	242	291	Appendix G
Consistency term from field description	Firm	Very Stiff	Appendix G
Notes: *derived using a Stroud Factor of 5.0			

8.1.4 Head Deposits

This stratum was encountered beneath the topsoil / made ground beneath the western boundary and northwest corner of the site, and comprised a firm to stiff brown sandy slightly gravelly to gravelly CLAY with flint.

A summary of the in-situ and laboratory test results recorded in the stratum are presented in **Table 19**.

Table 19 Summary of in-situ and laboratory test results for Head Deposits

Soil parameters	Min. Value	Max. Value	Reference
Moisture content (%)	15	23	Appendix J
Modified moisture content (%)	20	26	Appendix J
Liquid limit (%)	45	55	Appendix J
Plasticity limit (%)	10	26	Appendix J
Plasticity index (%)	21	35	Appendix J
Modified plasticity index (%)	15	30	Appendix J
Plasticity term	Intermediate	High	Appendix J
Volume change potential	Low	Medium	Appendix J
SPT 'N' values	7	18	Appendix G
Undrained shear strength inferred from SPT 'N' values (kN/m^2)*	35	90	Appendix G
Undrained shear strength measured by shear vane testing (kN/m^2)	68		Appendix G
Consistency term from field description	Firm	Stiff	Appendix G
Strength term (inferred from Hand shear vane test)	Medium		-
Notes: *derived using a Stroud Factor of 5.			

8.1.5 Kesgrave Catchment Subgroup

The central and southern areas were directly underlain by granular deposits of the Kesgrave Catchment Subgroup comprising a medium dense to very dense brown / yellow brown silty to slightly silty SAND with varying proportions of flint gravel.

A high proportion of flint gravel was recorded initially at SA102 and TP106 which are possibly indicative of naturally reworked material from the Lowestoft Formation.

The base of the stratum was not proven during this investigation. However, the top of the Lambeth Group was encountered between 7 m and 15.8 m bgl during the previous investigation of the Phase I development area directly to the south.

A summary of the in-situ and laboratory test results recorded in the stratum are presented in **Table 20**.

Table 20 Summary of in-situ and laboratory test results for Kesgrave Catchment Sub Group

Soil parameters	Min. Value	Max. Value	Reference
SPT 'N' values	12	51	Appendix G
Density term	Medium dense	Very dense	Appendix G

8.1.6 Visual/olfactory evidence of soil contamination

Rare fragments of slag were encountered at WS105, and charcoal was noted within WS107 during the investigation. No other visual evidence of possible contamination was noted.

8.2 Groundwater

No groundwater was recorded within any of the exploratory points during the ground investigation. During the three subsequent monitoring visits groundwater was recorded at between 0.55 m and 1.22 m bgl in WS101. The source of the water is unclear, but is unlikely to represent a continuous body of water otherwise flooding would have been observed further west and down-gradient of the boreholes. It is considered more likely that the observations represent either perched water and / or lateral movement of water during periods of rainfall into the void created by the well. Additional investigation would need to be carried out fully characterise the groundwater regime in this area.

Groundwater was also recorded between 9.75 m and 9.8 m bgl at BH3 which was installed during the previous investigation to the southeast of the site. It is considered that the water levels in this borehole do reflect the groundwater table in the Kesgrave Catchment Subgroup.

It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal variations. On-going monitoring would be required to establish both the full range of conditions and any trends in groundwater levels.

8.3 Chemical laboratory results

The soil results are presented in Appendix I.

8.4 Geotechnical laboratory results

The results of the geotechnical testing are discussed in Section 11 and presented in Appendix J.

8.5 Ground gas monitoring

The results of the ground gas monitoring and testing carried out are given in Appendix H and discussed in section 9.

9 GEO-ENVIRONMENTAL ASSESSMENT

9.1 Refinement of initial CSM

The investigation has identified the localised presence of made ground off-site to the northeast and northwest of the site boundary which possibly could be associated with the former disused railway or construction of the nearby commercial / warehouse unit. Made ground was only identified at one locality within the site boundary, WS105, situated along the western boundary. Given its limited extent, the potential that made ground would pose any significant risks to the identified receptors is very low, but testing has been carried out to confirm the absence of potentially deleterious materials.

The only other source of contamination identified was the possible use of agricultural pesticides. Testing has also been carried out to confirm the presence or absence of pesticides.

No linkages have been discounted at this stage.

9.2 Linkages for assessment

As described in LCRM (Environment Agency, 2021), there are two stages of quantitative risk assessment (QRA), Tier 2 generic (GQRA) and Tier 3 detailed (DQRA). The GQRA comprises the comparison of soil, groundwater, soil gas and / or ground gas results with generic assessment criteria (GAC) that are appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory results or following statistical analysis depending upon the sampling procedure that was adopted. This assessment relates to LCRM Stage 1, Tier 2 generic quantitative risk assessment

Following the refinement of the CSM, the potentially complete contaminant linkages that require further assessment and the methodology of assessment are presented in **Table 21**.

Table 21 Contaminant linkages

Potentially relevant contaminant linkage	Assessment method
Soil data	
1. Oral, dermal and inhalation exposure with impacted soil, soil vapour and dust by future residents	Human health GAC in Appendix L for a proposed residential end use with home-grown produce since the proposed end use includes residential gardens.
2. Uptake of contaminants by vegetation potentially impacting plant growth (phytotoxicity)	Comparison of soil data to GAC in Appendix M for phytotoxicity.
3. Contaminants permeating potable water supply pipes	Comparison of soil data to GAC in Appendix N for plastic water supply pipes using UKWIR (2010) guidance.
4. Leaching of soil contaminants and dissolved phase migration	Since no leachate data is available the potential for leaching has been considered qualitatively using soil and results.

Potentially relevant contaminant linkage	Assessment method
Ground Gas	
5. Concentrations of methane and carbon dioxide in ground gas entering and accumulating in enclosed spaces or small rooms in new buildings, which could affect future site users. For methane this could create a potentially explosive atmosphere, while death by asphyxiation could result from carbon dioxide.	Consideration of the risk in line with the CSM, and assessment of concentrations in accordance with BS8485.

9.3 Methodology and assessment of soil results

The analysis of laboratory results relating to soil samples submitted for testing, including leachate analysis, is included in the following sections.

9.3.1 Oral, dermal and inhalation exposure with impacted soil by future occupants/site users

The results of the assessment show that no elevated concentration of heavy metals, PAH or asbestos were recorded in the samples taken from the made ground above the human health GACs. Furthermore, no elevated concentrations of pesticides were recorded above the analytical detect limit for samples taken from the natural soils.

No further assessment or remedial measures are considered necessary for this linkage.

9.3.2 Uptake of contaminants by vegetation potentially inhibiting plant growth (phytotoxicity)

The results have been compared with the GAC presented in Appendix M for this linkage (pH above 7). No elevated concentrations have been recorded above the GAC and therefore it is considered that this linkage does not exist.

9.3.3 Impact of organic contaminants on potable water supply pipes

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

The results indicate that a relevant linkage is unlikely to exist associated with organic contaminants and therefore pollutant polyethylene (PE) and/or polyvinyl chloride (PVC) water supply pipes are expected to be suitable for use on the development.

It should be noted that at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling/analytical strategy may be required at a later date once the route(s) of the supply pipe(s) are known. In addition, it is recommended that the relevant water

supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

9.3.4 Leaching of contaminants into the underlying groundwater in the Secondary A aquifer

The results of the soil testing have not recorded any elevated concentrations of contaminants that would pose a risk to the underlying groundwater.

9.4 Ground gas risk assessment – bulk gases

The following line of evidence have been used to assess the risk from ground gas,

- The results of the desk study have not identified any sources of ground gas on or off-site that could impact the site;
- The findings of the intrusive investigation confirmed that the majority of the site is underlain by natural soils. Made ground was only recorded on the western boundary (on-site) and did not contain any potentially biodegradable materials. In accordance with BS8576:2013, made ground with low quantities of degradable organic matter are classified as having a very low ground gas generation potential;
- The findings of the previous investigation conducted by RSK to the south confirmed that the former sand / gravel pit located ~200m to the southeast had not been infilled with waste material;
- Three rounds of gas monitoring were carried out by RSK at two from wells located on the site (WS101 and WS105), and a well previously installed near the south east corner (BH3). Very low methane concentrations of methane (0.2% v/v), and low concentration of carbon dioxide of up to 6.9% v/v was recorded. No flow was recorded in any of the wells. The concentrations are typical of natural soils; and
- The results have been assessed using the methodology set out in BS8485:2015+A1:2019 for low rise housing (NHBC traffic light system) and all other developments (Wilson and Card method). The calculated gas screening values for carbon dioxide is 0.069l/hr. The GSV's falls under Green for low rise housing, and Characteristic Situation 1 for all other developments, whereby no gas protection measures are necessary for new properties.

The results of the ground gas assessment indicates that no gas protection measures are required for the proposed development and no further monitoring is considered to be necessary.

9.5 Uncertainties and implications in refined CSM and GQRA

In accordance with good practice, data gaps and uncertainties in the refined CSM have been identified at this stage. These are summarised in **Table 22** along with the likely implications.

Table 22 Data gaps and uncertainties

Data gap/ uncertainty	Details	Implications
Lateral extent of made ground where encountered.	Made ground was encountered at three locations WS101, WS105, and WS107	The chemical testing has indicated that the made ground does not pose any risk to human health, however a watching brief should be observed by groundworkers for any suspect contamination not identified during the investigation.
Groundwater levels	Groundwater regime has not been fully characterised.	May impact drainage design.
Deep Strata	Only investigation of the shallow soils has been carried out.	Deeper investigation would be needed if piled foundations solution is required for structures.

10 PRELIMINARY WASTE ASSESSMENT

In accordance with the definition provided in the Waste Framework Directive (WFD), materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Naturally occurring soils are not considered waste if reused on the site of origin for the purposes of development. Soils such as made ground that are not of clean and natural origin (irrespective of whether they are contaminated or not) and other materials such as recycled aggregate, do not become waste until the criteria above are met.

Excavation arisings from the development may therefore be classified as waste if surplus to requirements or unsuitable for reuse. The following assessments assume the material tested is classified subsequently as waste.

10.1 Hazardous waste assessment

Technical Guidance WM3 (EA, 2018) sets out in its Appendix D requirements for waste sampling. It is a legal requirement to correctly assess and classify waste. The level of sampling should be proportionate to the volume of waste and its heterogeneity. The preliminary assessment provided below is based only upon the available sample results and may not be sufficient to adequately classify the waste.

10.1.1 Chemical contaminants

Envirolab, an RSK company, has developed a waste soils characterisation assessment tool (HASWASTE), which follows the guidance within Technical Guidance WM3. The analytical results have been assessed using this tool to assess the hazardous properties to support potential off-site disposal of materials in the future. Note that it is ultimately for landfills to confirm what wastes they are able to accept within the constraints of their permit.

No samples of made ground were found to have hazardous properties based on this assessment. This suggests that if applicable the waste would require disposal at a suitably permitted non-hazardous waste landfill. Further waste acceptance criteria testing (WAC) would be required to further classify made ground into inert or contaminated non-hazardous.

The natural soil would be classified as inert in accordance with WM3.

RSK recommends that if any soils are destined for off-site disposal to landfill the prospective landfill operator(s) should be contracted at an early stage to confirm the classification and requirements for further testing if necessary.

11 GEOTECHNICAL ASSESSMENT

11.1 Proposed development

It is understood that the proposed development is to involve the construction of low-rise residential properties and associated infrastructure and private gardens. At this stage, no specific information relating to the building loads has been provided.

11.2 Key geotechnical hazards / development constraints

The key risks identified from the available ground investigation data are discussed below:

- Sudden changes in ground conditions at shallow depths (Head Deposits, Lowestoft Formation and Kesgrave Catchment Sub Group);
- Shrinkable and silt-rich clay soils (Lowestoft Formation and Head Deposits);
- Potential for instability and running sands within the saturated granular deposits of the Kesgrave Catchment Sub Group;
- Localised made ground (north eastern and south western corners); and
- Topography falling towards the south west.

11.3 Foundations

11.3.1 Foundation options

The native undisturbed soils beneath the site are anticipated to provide acceptable bearing resistance for traditional spread foundations to support the structural loads associated with the proposed low-rise residential dwellings.

Foundations will, however, need to be designed to accommodate the variability between the natural strata, which sub crop beneath the site.

In addition, where the founding stratum comprises a shrinkable soil (Head Deposits and / or Lowestoft Formation sup cropping within the western and eastern flanks of the site, respectively) foundations will need to extend to a moisture stable horizon, the depths to which could be significant within the influence of trees and hedgerows.

11.3.2 Spread foundations

The recommendations for the design and construction of spread foundations in relation to the ground conditions are set out in **Table 23**.

Table 23 Design and construction of spread foundations

Design/construction considerations	Design/construction recommendations
Founding stratum	Medium strength cohesive soils of the Head Deposits (sub cropping from surface beneath the western flank of the site). High strength cohesive soils of the Lowestoft Formation (sub cropping from surface beneath the eastern flank of the site). Medium dense granular soils of the Kesgrave Catchment Sub Group (sub cropping beneath the Head Deposits and Lowestoft Formation and from surface beneath the centre of the site).
Depth	Foundations constructed within the cohesive soils (Head Deposits and / or Lowestoft Formation) should be taken to a minimum depth of 0.90 m below the final or existing ground level, whichever is lower, and at least 0.2 m into the founding stratum below any overlying made ground or to any greater depth required in respect of the special design considerations given below. Foundations constructed within the granular soils (Kesgrave Catchment Sub Group) should be taken to a minimum depth of 0.60 m below the final or existing ground level, whichever is lower, and at least 0.2 m into the founding stratum below any overlying made ground or to any greater depth required in respect of the special design considerations given below.
Special design considerations	
Shrinkable soils	Owing to the presence of shrinkable clay soils within the Head Deposits and Lowestoft Formation, foundations bearing within these strata should be designed taking into account all the normal precautions, including minimum founding depths, to minimise the risk of future foundation movements in accordance with NHBC standards or similar. The findings of the ground investigation indicate that foundations should be designed for shrinkable soils of medium volume change potential.
Variable founding soils	Where foundations span differing strata, consideration should be given to incorporating appropriate reinforcement into the strip foundations to minimise the risk of future differential foundation movements.
Presumed bearing capacity – Head Deposits	Strip foundations with a width of up to 1.0 m and constructed on the medium strength cohesive soils of the normally consolidated Head Deposits at a minimum depth of 0.90 m may be designed using a presumed bearing capacity of 85 kN/m^2.
Presumed bearing capacity – Lowestoft Formation	Strip foundations with a width of up to 1.0 m and constructed on the high strength cohesive soils of the over consolidated Lowestoft Formation at a minimum depth of 0.90 m may be designed using a presumed bearing capacity of 125 kN/m^2.
Presumed bearing capacity – Kesgrave Catchment Sub Group	Strip foundations with a width of up to 1.0 m and constructed on the medium dense granular soils of the Kesgrave Catchment Subgroup at a minimum depth of 0.60 m may be designed using a presumed bearing capacity of 150 kN/m^2.

Design/construction considerations	Design/construction recommendations
Construction considerations	All foundation excavations should be inspected, and any made ground and soft, organic, or otherwise unsuitable materials removed and replaced with mass concrete. The proposed founding stratum is a relatively silt-rich soil, hence susceptible to rapid softening once exposed. Hence all foundation excavations should immediately be blinded with concrete or the full foundation constructed.

11.3.3 Floor slabs

The nature of the soils encountered during the investigation indicates that ground bearing floor-slabs may be adopted with a suitable sub-base layer for the low-rise residential dwellings across the majority of the site. However, floor slabs should be suspended within areas of made ground soils (recorded locally within WS105 and WS107 in the south western and north eastern corners of the site) and cohesive soils located within areas of tree influence, which have the potential to heave. Alternatively, these unsuitable soils should be removed and replaced with well-compacted, suitable granular fill.

11.4 Roads and hardstanding

In the 1 m to 1.5 m below the proposed finished ground level the exploratory holes have revealed a soil profile comprising cohesive soils of the Head Deposits and Lowestoft Formation beneath the western and eastern flanks of the site, respectively and granular soils of the Kesgrave Catchment Sub Group beneath the central areas.

In pavement design terms, the groundwater conditions are anticipated to comprise a low water table, i.e. at least 1 m below the pavement formation level, beneath the entirety of the site.

Based on a similar range of plasticity results, the estimated minimum, equilibrium soil-suction, California bearing ratio (CBR) value for Head Deposits and Lowestoft Formation is 2.5% and for Kesgrave Catchment Sub Group is 10% based upon Table C1 in TRRL (1984) Report LR1132.

The results of in-situ testing are summarised in **Table 24**.

Table 24 Summary of CBR values derived from in-situ DCP tests

Test location	Material type	Minimum CBR value determined at or just below anticipated formation level
CBR101	Lowestoft Formation (cohesive)	CBR 2.0% at 0.50 m
CBR102	Kesgrave Catchment Sub Group (granular)	CBR 7.9% at 0.50 m
CBR103	Kesgrave Catchment Sub Group (granular)	CBR 1.8% at 0.50 m
CBR104	Lowestoft Formation (cohesive)	CBR 1.9% at 0.50 m

Test location	Material type	Minimum CBR value determined at or just below anticipated formation level
CBR105	Head Deposits (cohesive)	CBR 2.4% at 0.50 m
CBR106	Head Deposits (cohesive)	CBR 2.4% at 0.50 m

The sub-grade soils in the vicinity of all test locations will be susceptible to improvement by rolling with conventional compaction plant.

The recommended sub-grade soil CBR value for road pavement design is therefore 2.5% for the cohesive soils and 10% for the granular soils following improvement by rolling with conventional plant. This value assumes that during construction the formation level will be carefully compacted and any soft spots removed and replaced with well-compacted granular fill.

The sub-grade condition at the time of construction should be confirmed by testing at the final formation level by in situ CBR testing.

The cohesive sub-grade soils can be regarded as frost-susceptible and the granular soils non-frost-suspectible, based upon the criteria given in Appendix 1 of TRRL (1970) Report Road Note 29. When the sub-grade is frost-susceptible the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450 mm.

11.5 Excavations for foundations and services

Some of the trial pits became unstable during excavation. It is therefore recommended that excavation support systems are made available during the groundwork stage of the development.

Man entry into any excavations should not be undertaken without provision of suitable shoring and support and dewatering or suitable regrading and battering of side slopes to safe angles. Confined spaces protocols for the Health and Safety of personnel should always be used where man entry into excavations is to be undertaken as low oxygen conditions may be present.

Groundwater was encountered in some of the trial pits. Dewatering may therefore be required to facilitate foundation excavation.

11.6 Chemical attack on buried concrete

This assessment of the potential for chemical attack on buried concrete at the site is based on BRE Special Digest 1: Concrete in aggressive ground, which represents the most up-to-date guidance on this topic currently available in the UK.

The desk study and site reconnaissance indicate that, for the purposes of assessing the aggressive chemical environment of the site, the site should be considered as comprising natural ground unlikely to contain pyrite.

Based on testing results, **Table 25** gives the characteristic pH, water-soluble and total sulphate content values for soils from each of the geological units and groundwater encountered on-site.

Table 25 Characteristic pH, water soluble sulphate and total sulphate values

Stratum	pH	Water Soluble Sulphate (mg/l)
Lowestoft Formation	8.53 to 8.57	<10
Head Deposits	8.09 to 8.32	<10 to 19
Kesgrave Catchment Subgroup	8.19 to 8.37	<10

Based on the results above and following the steps outlined in the BRE guidance, the Design Sulphate Classes and Aggressive Chemical Environment for Concrete classifications are summarised in **Table 26**, on the basis of water soluble.

Table 26 Concrete design class

Stratum	Groundwater	Water Soluble Sulphate	
		DS Class	AC Class
Lowestoft Formation	Mobile	DS-1	AC-1
Head Deposits	Mobile	DS-1	AC-1
Kesgrave Catchment Subgroup Granular	Mobile	DS-1	AC-1

Assuming generally mobilise ground conditions and that disturbed clay do not come into contact with concrete, the recommended ACEC Classification is therefore AC-1 with a Design Sulphate Class of DS-1.

11.7 Infiltration drainage

The results of soakaway testing are summarised in **Table 27**.

Table 27 Infiltration test results

Trial pit	Geological unit	Test result (m/s)
SA101	Head Deposits	Not determined
SA102	Kesgrave Catchment Subgroup	Not determined
SA103	Kesgrave Catchment Subgroup	Test 1: 8.02 E-05 Test 2: 5.47 E-05 Test 3: 5.41 E-05
SA104	Lowestoft Formation	Not determined

The results show that where more cohesive deposits were encountered beneath the eastern and western portions of the site, an infiltration rate could not be calculated as the

water levels did not reach the 25% of the test area over the monitoring period (24 hours). It is therefore considered that the use of shallow soakaways across these areas are unlikely to be suitable. However, reasonable infiltration rates were recorded beneath the central / southern portion of the site, where granular (sand) deposits of the Kesgrave Catchment Subgroup are present. The use of shallow soakaways may therefore be suitable for these areas.

Due to the recorded variability in ground conditions across the site, it is recommended that additional testing be carried out when the location of any soakaway are known.

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

12 CONCLUSIONS AND RECOMMENDATIONS

12.1 Ground model

The ground investigation encountered a superficial layer of made ground just beyond the site boundary to the northwest and northeast, and locally along the western boundary of the site. Rare fragments of slag were noted in the made ground at WS105 located on the western boundary, and ash at WS107 situated off-site to the northeast. No other visual or olfactory evidence of contamination was noted.

The majority of the site is mantled by a superficial veneer of topsoil. Normally consolidated clays of the Head Deposits sub crop beneath the western flank of the site and stiff over consolidated clays of the Lowestoft Formation to the east. The granular Kesgrave Catchment Sub Group sub crops beneath the latter soils and directly below the topsoil beneath the central areas of the site.

Localised incoherent pockets of water were encountered within the superficial soils and groundwater was recorded at ~9 m depth in the Kesgrave Catchment Subgroup in BH3 located near the southwest boundary of the site.

12.2 Geo-environmental assessment

The historical records show that a spur of a railway was located across the northwest corner of the site and a railway was located along the northern boundary until it was dismantled during the 1950s. The made ground noted on the site may be associated with the construction of this or the existing railway line to the west.

The remainder of the site has not been developed and is currently used for arable farming.

Chemical testing of soil samples from the made ground and natural soils have not identified any elevated concentrations of contaminants that would pose a risk to future site users, groundwater, water supply pipes or vegetation. No further assessment or remedial measures are considered to be necessary in relation to the proposed residential development. However, it is recommended due to the presence of a historical railway on parts of the site a watching brief is maintained by groundworker during construction works for any suspect materials (asbestos, hydrocarbon staining), and if identified further advice should be sought from an environmental consultant.

No sources of ground gas have been identified on or within proximity of the site, therefore no ground gas protection measures will be required for the new properties.

The preliminary waste assessment indicates that the made ground would be classified as non-hazardous waste, and natural soils as inert. If any material is destined for off-site disposal advice should be sought at any early stage from any waste operators to confirm the preliminary assessment and whether any additional testing would be required.

12.3 Geotechnical assessment

The key risks identified from the available ground investigation data are discussed below:

- Sudden changes in ground conditions at shallow depths (Head Deposits, Lowestoft Formation and Kesgrave Catchment Sub Group);
- Shrinkable and silt-rich clay soils (Lowestoft Formation and Head Deposits);
- Potential for instability and running sands within the saturated granular deposits of the Kesgrave Catchment Sub Group;
- Localised made ground (north eastern and south western corners); and
- Topography falling towards the south west.

The native undisturbed soils beneath the site are anticipated to provide acceptable bearing resistance for traditional spread foundations to support the structural loads associated with the proposed low-rise residential dwellings.

Foundations will, however, need to be designed to accommodate the variability between the natural strata, which sub crop beneath the site.

In addition, where the founding stratum comprises a shrinkable soil (Head Deposits and / or Lowestoft Formation sup cropping within the western and eastern flanks of the site, respectively) foundations will need to extend to a moisture stable horizon, the depths to which could be significant within the influence of trees and hedgerows.

The nature of the soils encountered during the investigation indicates that ground bearing floor-slabs may be adopted with a suitable sub-base layer for the low-rise residential dwellings across the majority of the site.

The recommended sub-grade soil CBR value for road pavement design is 2.5% for the cohesive soils and 10% for the granular soils, following improvement by rolling with conventional plant. The cohesive sub-grade soils can be regarded as frost-susceptible and the granular soils non-frost-susceptible.

Assuming generally mobilise ground conditions, the recommended ACEC Classification is AC-1 with a Design Sulphate Class of DS-1.

Infiltration results show that where more cohesive deposits were encountered beneath the eastern and western portions of the site, an infiltration rate could not be calculated However, reasonable infiltration rates were recorded beneath the central / southern portion of the site, where granular (sand) deposits of the Kesgrave Catchment Subgroup are present. The use of shallow soakaways may therefore be suitable for these areas.

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FIGURES

FIGURE 1 SITE LOCATION PLAN

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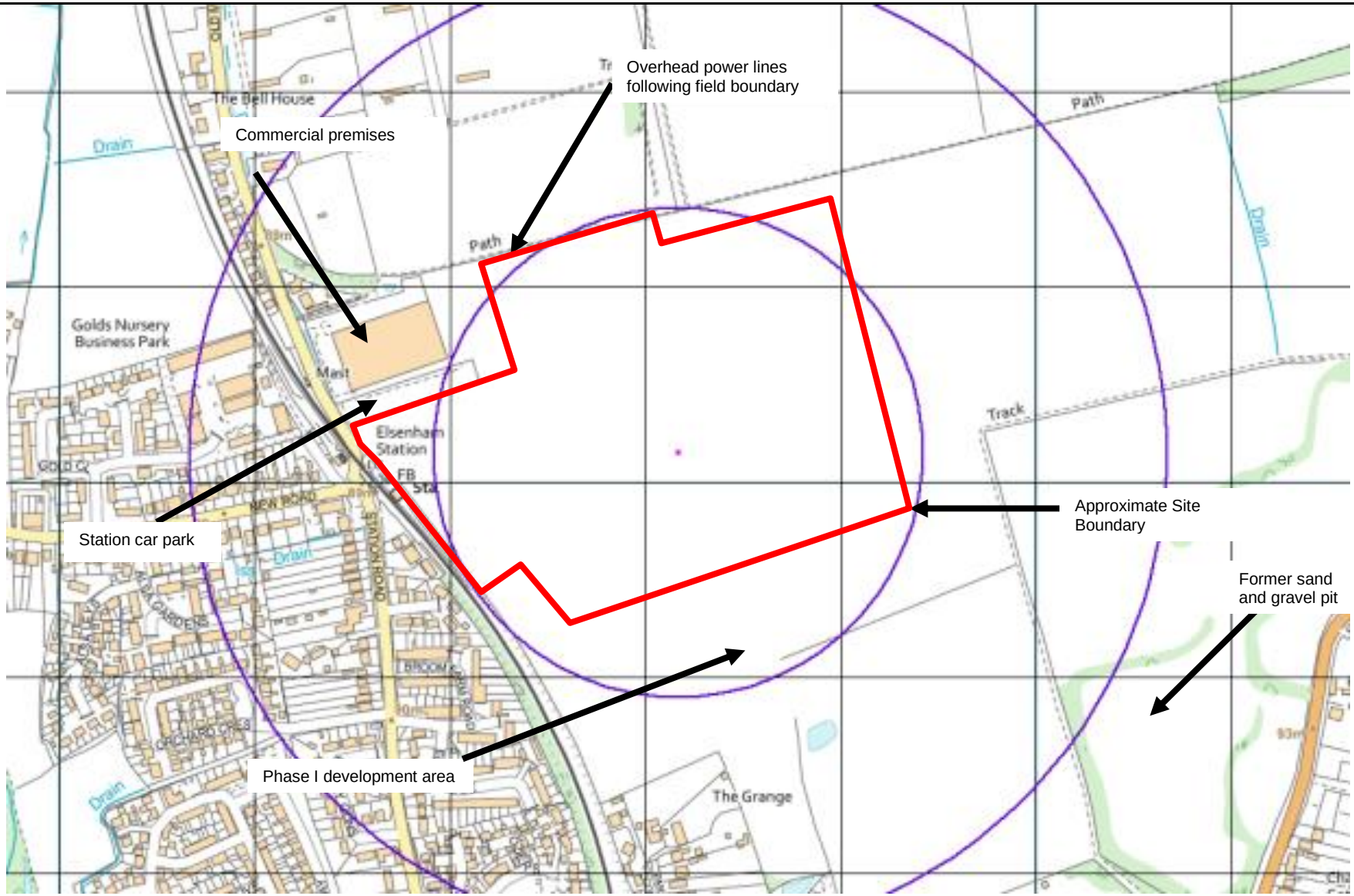
RSK Group Limited, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT.

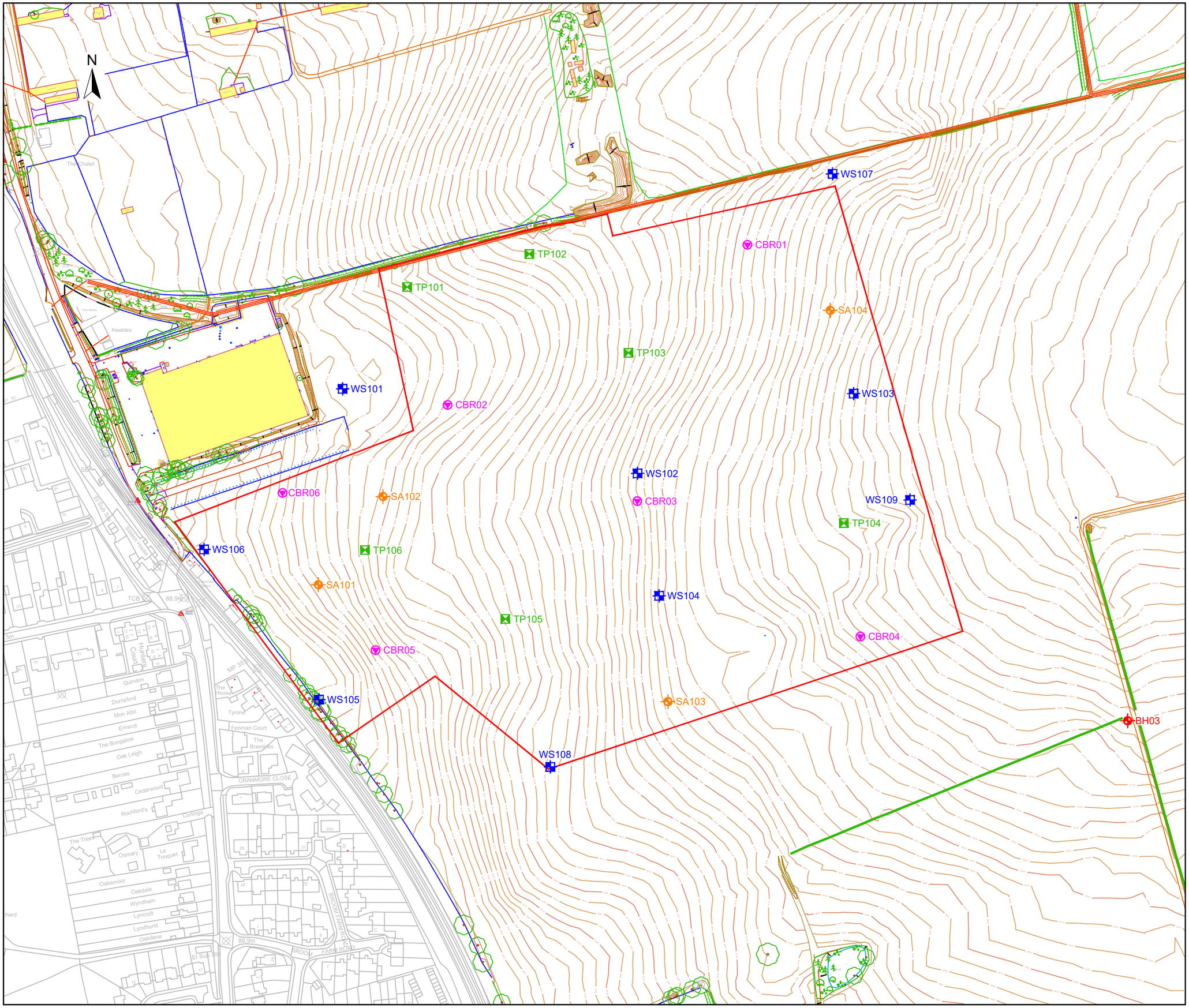
SITE LOCATION PLAN	**Client: Bloor Homes Eastern**	**Figure No: 1**
RSK GEOSCIENCES	**Site: Elsenham**	**Job No: 1921748**
	Scale: N.T.S	**Source: OS**

FIGURE 2 SITE LAYOUT PLAN



RSK GEOSCIENCES	**Site Layout**	**Client:**	Bloor Homes Eastern	**Figure No:**	2
		Site:	Elsenham	**Job No:**	1921748
		Scale:	N.T.S	**Source:**	n/a

FIGURE 3 EXPLORATORY HOLE LOCATION PLAN



LEGEND

- Site Boundary
- Window Sample Location
- Trial Pit Location
- California Bearing Ratio Test
- Sampling Location
- Borehole Location (Phase 1 Site Investigation)

Rev	Date	Amendment	Drawn	Chkd	Appd
01	06.12.21	FIRST ISSUE	AE	TC	AT

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Client: Bloor Homes

Project Name: Elsenham Phase II

Description: Exploratory Hole Location Plan

Project ID	Figure	Revision
1921748	02	01

File name: 1921748-Site Exploratory Hole Location

Dimensions	Scale	Size
m	1:2500	A3

Scale bar: 0 20 40 60 80 100m

APPENDICES

APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Bloor Homes (the "Client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and Bloor Homes. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.
2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas, persistent, bioaccumulative or toxic chemicals (including PFAS/ PFOS) or other radioactive or hazardous materials, unless specifically identified in the Services.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):
    a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.

b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.

12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

APPENDIX B
SUMMARY OF LEGISLATION AND POLICY RELATING TO LAND CONTAMINATION

Part IIA of the Environmental Protection Act 1990

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

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

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

Planning Policy

Contaminated land is often dealt with through planning because of land redevelopment. This approach was documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. PPS23 was withdrawn early in 2012 and has been replaced by much reduced guidance within the National Planning Policy Framework (NPPF), reference ISBN: 978-1-5286-1033-9, February 2019.

The new framework has only limited guidance on contaminated land, as follows:

Chapter 11. Making effective use of land

117 Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.

118. Planning policies and decisions should:

c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.

Chapter 15. Conserving and enhancing the natural environment

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Ground conditions and pollution

178. Planning policies and decisions should ensure that:

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

179. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

Water Resources Act (WRA)

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

Water Framework Directive (WFD)

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

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

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

Groundwater Directive (GWD)

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

Priority Substances Directive (PSD)

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

Environmental Permitting Regulations (EPR)

The Environmental Permitting (England and Wales) Regulations 2016 (as amended) provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2016 states: 'the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.'

Notes:

1. *The above information is provided for background but does not constitute site-specific advice*
2. *The above summary applies to England only. Variations exist within other countries of the United Kingdom*

APPENDIX C
ENVIRONMENTAL DATABASE REPORT

Geology 1:50,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	WGR	Worked Ground (Undivided)	Void	Not Supplied - Holocene
	WMGR	Infilled Ground	Artificial Deposit	Not Supplied - Holocene
	MGR	Made Ground (Undivided)	Artificial Deposit	Not Supplied - Holocene

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Not Supplied - Holocene
	LOFT	Lowestoft Formation	Diamicton	Not Supplied - Anglian
	GFDMP	Glaciofluvial Deposits, Mid Pleistocene	Sand and Gravel	Not Supplied - Cromerian
	GLLMP	Glaciolacustrine Deposits, Mid Pleistocene	Clay and Silt	Not Supplied - Cromerian
	KGCA	Kesgrave Catchment Subgroup	Sand and Gravel	Not Supplied - Pleistocene
	HEAD	Head	Clay, Silt, Sand and Gravel	Not Supplied - Quaternary

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	LC	London Clay Formation	Clay, Silt and Sand	Not Supplied - Ypresian
	TALM	Thanet Formation And Lambeth Group (Undifferentiated)	Clay, Silt and Sand	Not Supplied - Paleocene
	LESE	Lewes Nodular Chalk Formation and Seaford Chalk Formation (Undifferentiated)	Chalk	Not Supplied - Turonian

RSK

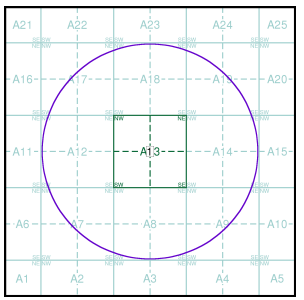
Geology 1:50,000 Maps

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:	**222**
Map Name:	**Great Dunmow**
Map Date:	**1990**
Bedrock Geology:	**Available**
Superficial Geology:	**Available**
Artificial Geology:	**Available**
Faults:	**Not Supplied**
Landslip:	**Not Available**
Rock Segments:	**Not Supplied**

Geology 1:50,000 Maps - Slice A



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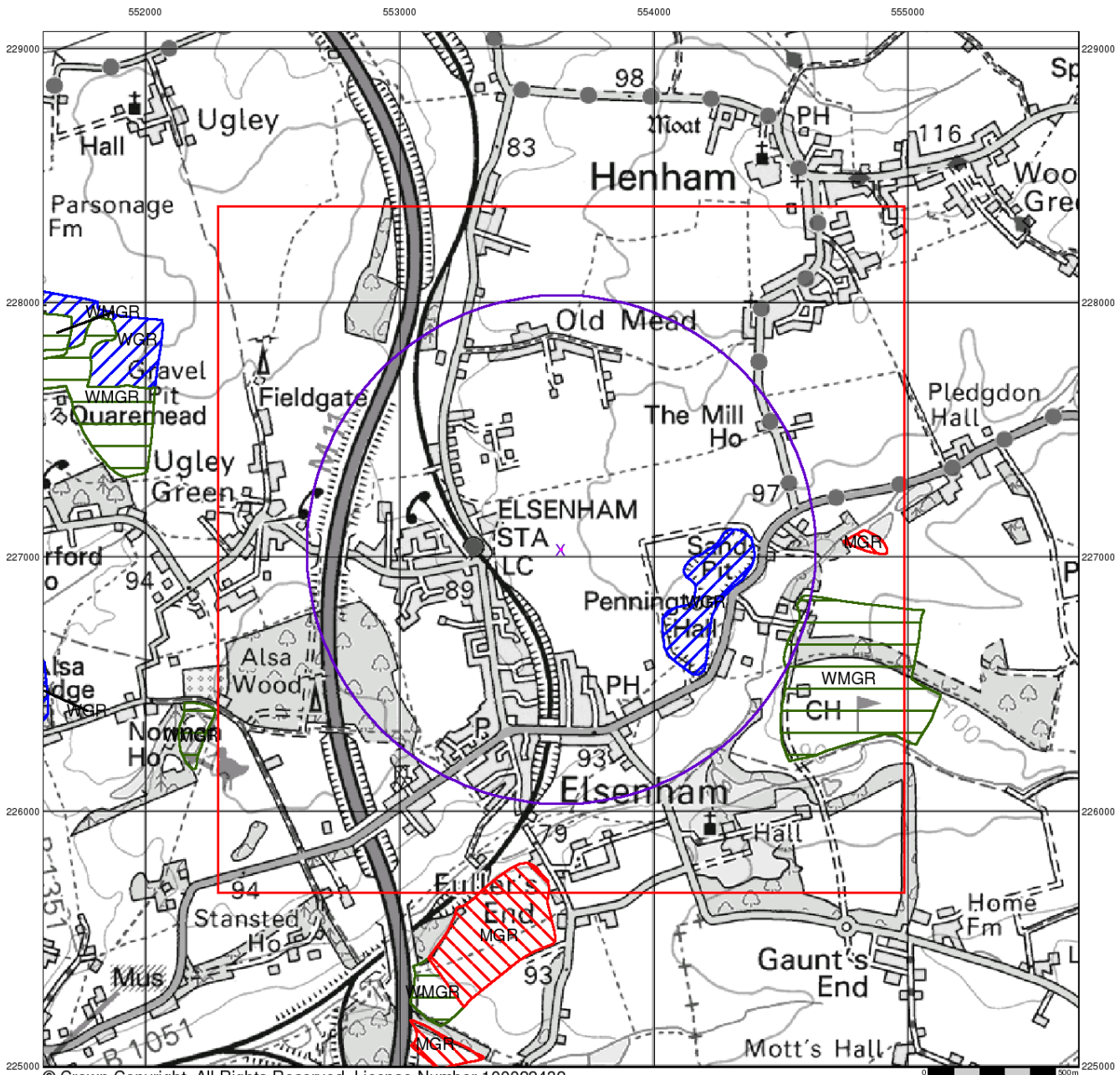
Customer Reference:	P02119042
National Grid Reference:	553630, 227030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details:

Site at 553400, 227100

Landmark INFORMATION GROUP

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



Artificial Ground and Landslip

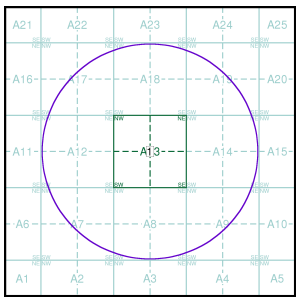
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions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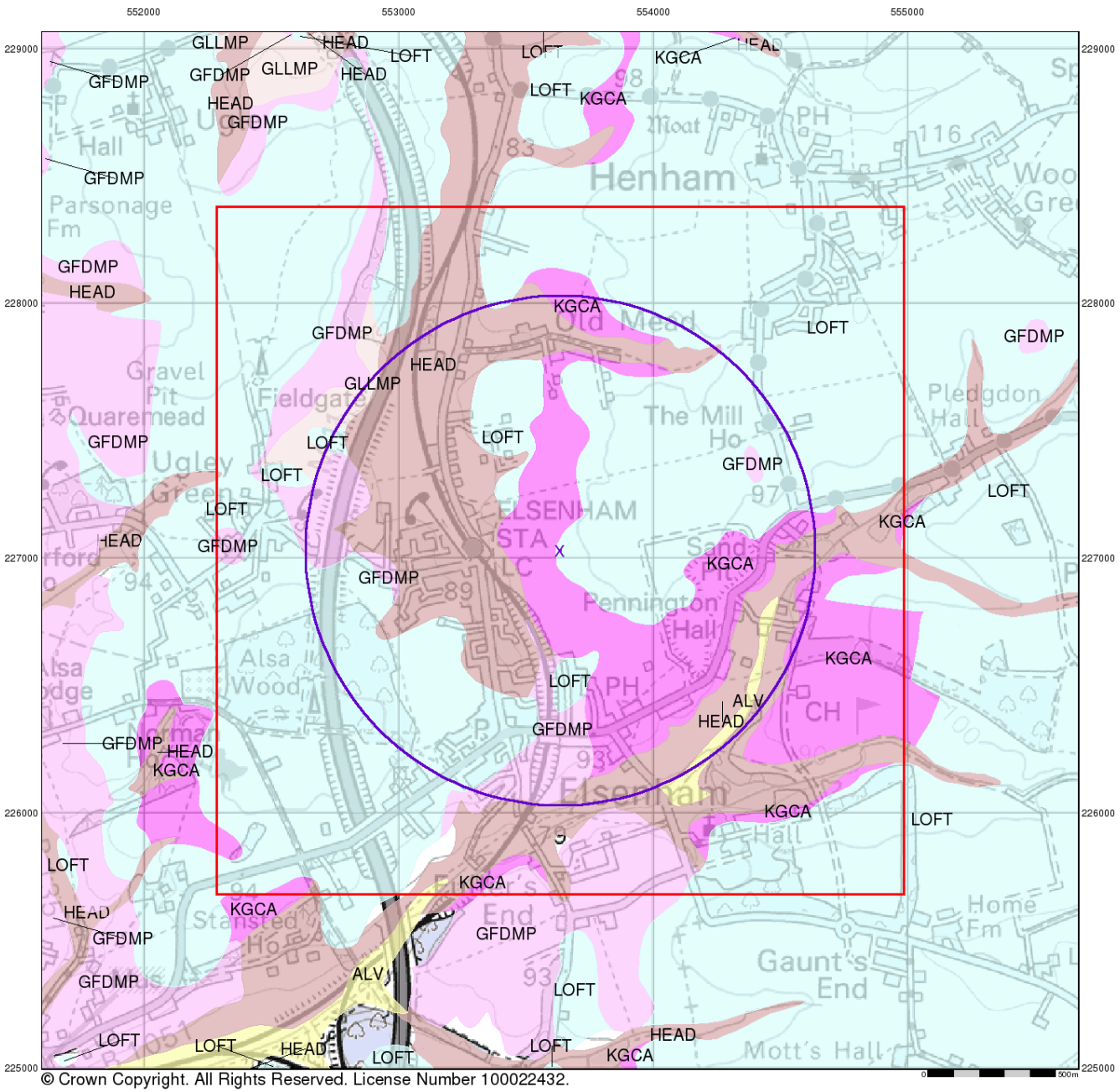


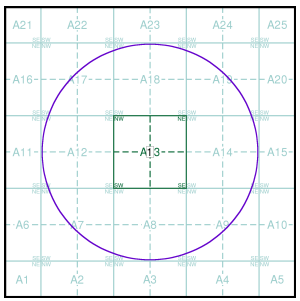
Superficial Geology

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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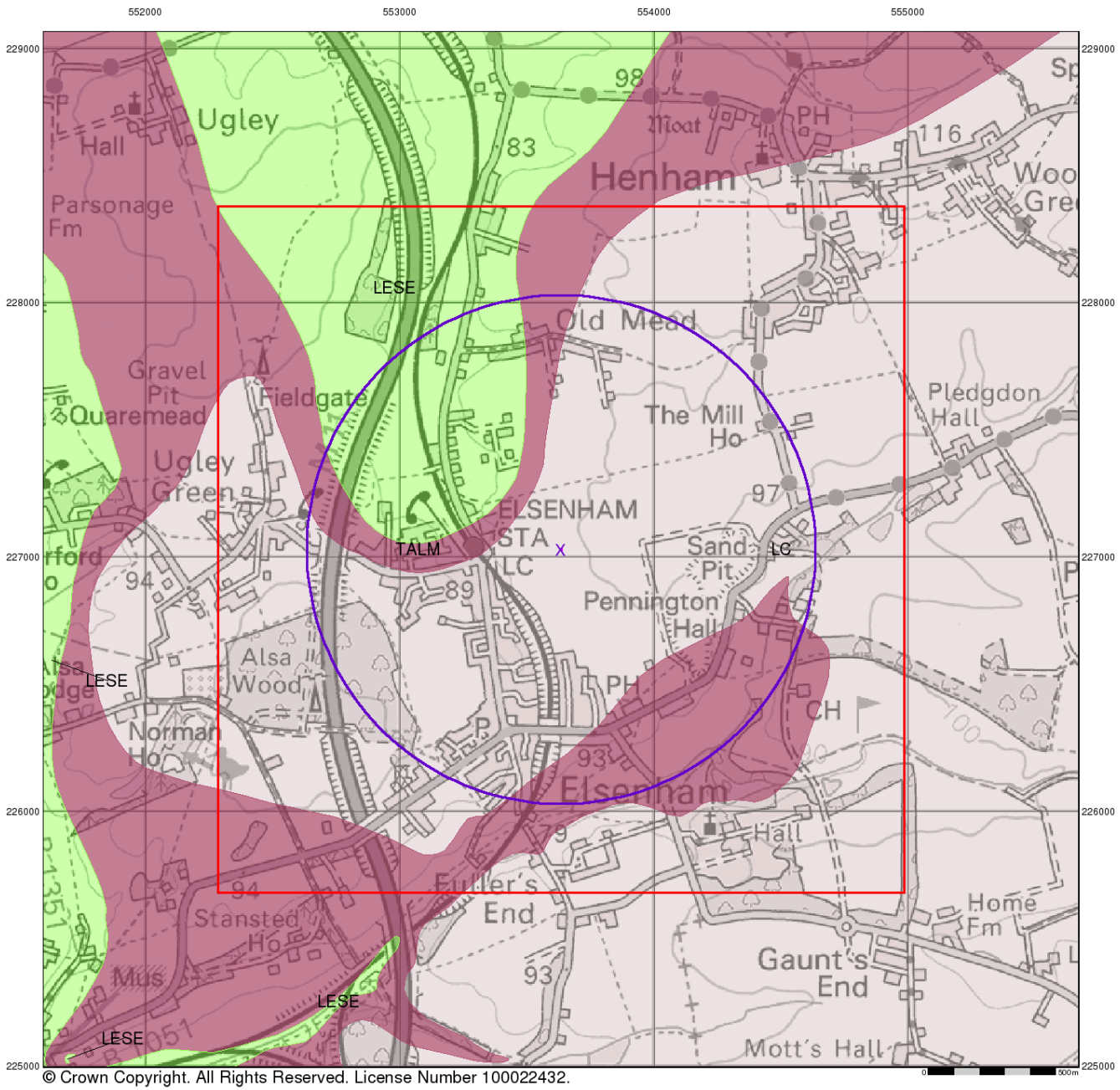


Bedrock and Faults

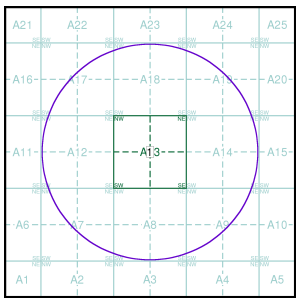
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

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



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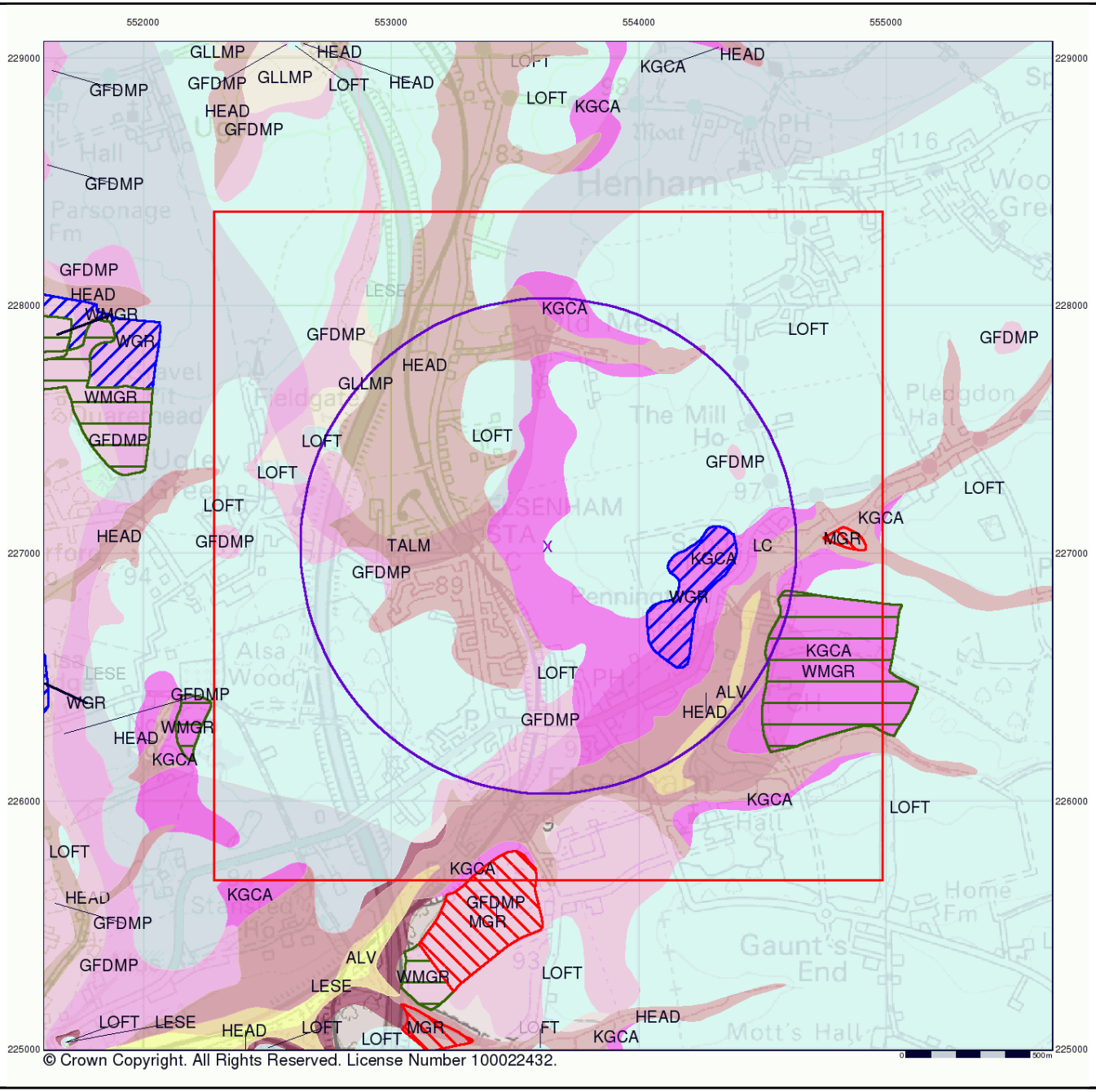


Combined Surface Geology

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.

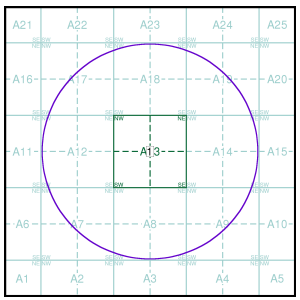
Additional Information

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



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Historical Mapping Legends

Ordnance Survey County Series 1:10,560

Gravel Pit
Sand Pit
Other Pits
Quarry
Shingle
Orchard
Osiers
Reeds
Marsh
Mixed Wood
Deciduous
Brushwood
Fir
Furze
Rough Pasture
Arrow denotes flow of water
Trigonometrical Station
Site of Antiquities
Bench Mark
Pump, Guide Post, Signal Post
Well, Spring, Boundary Post
·285 Surface Level
Sketched Contour
Instrumental Contour
Main Roads
Fenced
Un-Fenced
Minor Roads
Fenced
Un-Fenced
Sunken Road
Raised Road
Road over Railway
Railway over River
Railway over Road
Level Crossing
Road over River or Canal
Road over Stream
Road over Stream
County Boundary (Geographical)
County & Civil Parish Boundary
Administrative County & Civil Parish Boundary
Co. Boro. Bdy. County Borough Boundary (England)
Co. Burgh Bdy. County Burgh Boundary (Scotland)
R.D. Bdy. Rural District Boundary
Civil Parish Boundary

Ordnance Survey Plan 1:10,000

Chalk Pit, Clay Pit or Quarry
Gravel Pit
Sand Pit
Disused Pit or Quarry
Refuse or Slag Heap
Lake, Loch or Pond
Dunes
Boulders
Coniferous Trees
Non-Coniferous Trees
Orchard
Scrub
Coppice
Bracken
Heath
Rough Grassland
Marsh
Reeds
Saltings
Building
Direction of Flow of Water
Shingle
Sand
Glasshouse
Pylon
Electricity Transmission Line
Pole
Sloping Masonry
Cutting
Embankment
Standard Gauge Multiple Track
Road Under
Road Over
Level Crossing
Foot Bridge
Standard Gauge Single Track
Siding, Tramway or Mineral Line
Narrow Gauge
Geographical County
Administrative County, County Borough or County of City
Municipal Borough, Urban or Rural District, Burgh or District Council
Borough, Burgh or County Constituency
Shown only when not coincident with other boundaries
Civil Parish
Shown alternately when coincidence of boundaries occurs

BP, BS	Boundary Post or Stone	Pol Sta	Police Station
Ch	Church	PO	Post Office
CH	Club House	PC	Public Convenience
F E Sta	Fire Engine Station	PH	Public House
FB	Foot Bridge	SB	Signal Box
Fn	Fountain	Spr	Spring
GP	Guide Post	TCB	Telephone Call Box
MP	Mile Post	TCP	Telephone Call Post
MS	Mile Stone	W	Well

1:10,000 Raster Mapping

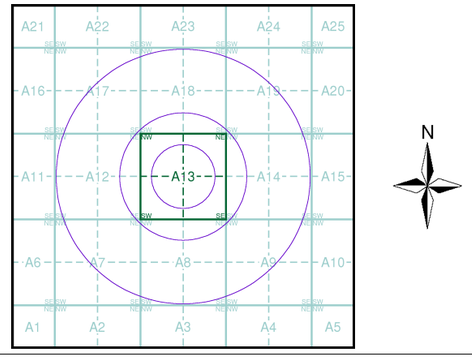
Gravel Pit
Refuse tip or slag heap
Rock
Rock (scattered)
Boulders
Boulders (scattered)
Shingle
Mud
Sand
Sand Pit
Slopes
Top of cliff
General detail
Underground detail
Overhead detail
Narrow gauge railway
Multi-track railway
Single track railway
County boundary (England only)
Civil, parish or community boundary
District, Unitary, Metropolitan, London Borough boundary
Constituency boundary
Area of wooded vegetation
Non-coniferous trees
Non-coniferous trees (scattered)
Coniferous trees
Coniferous trees (scattered)
Positioned tree
Orchard
Coppice or Osiers
Rough Grassland
Heath
Scrub
Marsh, Salt Marsh or Reeds
Water feature
Flow arrows
MHW(S) Mean high water (springs)
MLW(S) Mean low water (springs)
Telephone line (where shown)
Electricity transmission line (with poles)
BM 123.45 m Bench mark (where shown)
Triangulation station
Point feature (e.g. Guide Post or Mile Stone)
Pylon, flare stack or lighting tower
Site of (antiquity)
Glasshouse
General Building
Important Building

RSK

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Essex	1:10,560	1881	2
Hertfordshire	1:10,560	1883	3
Essex	1:10,560	1898	4
Essex	1:10,560	1923	5
Essex	1:10,560	1951	6
Ordnance Survey Plan	1:10,000	1960	7
Ordnance Survey Plan	1:10,000	1966	8
Ordnance Survey Plan	1:10,000	1983	9
Ordnance Survey Plan	1:10,000	1994	10
10K Raster Mapping	1:10,000	1999	11
10K Raster Mapping	1:10,000	2006	12
VectorMap Local	1:10,000	2021	13

Historical Map - Slice A



Order Details

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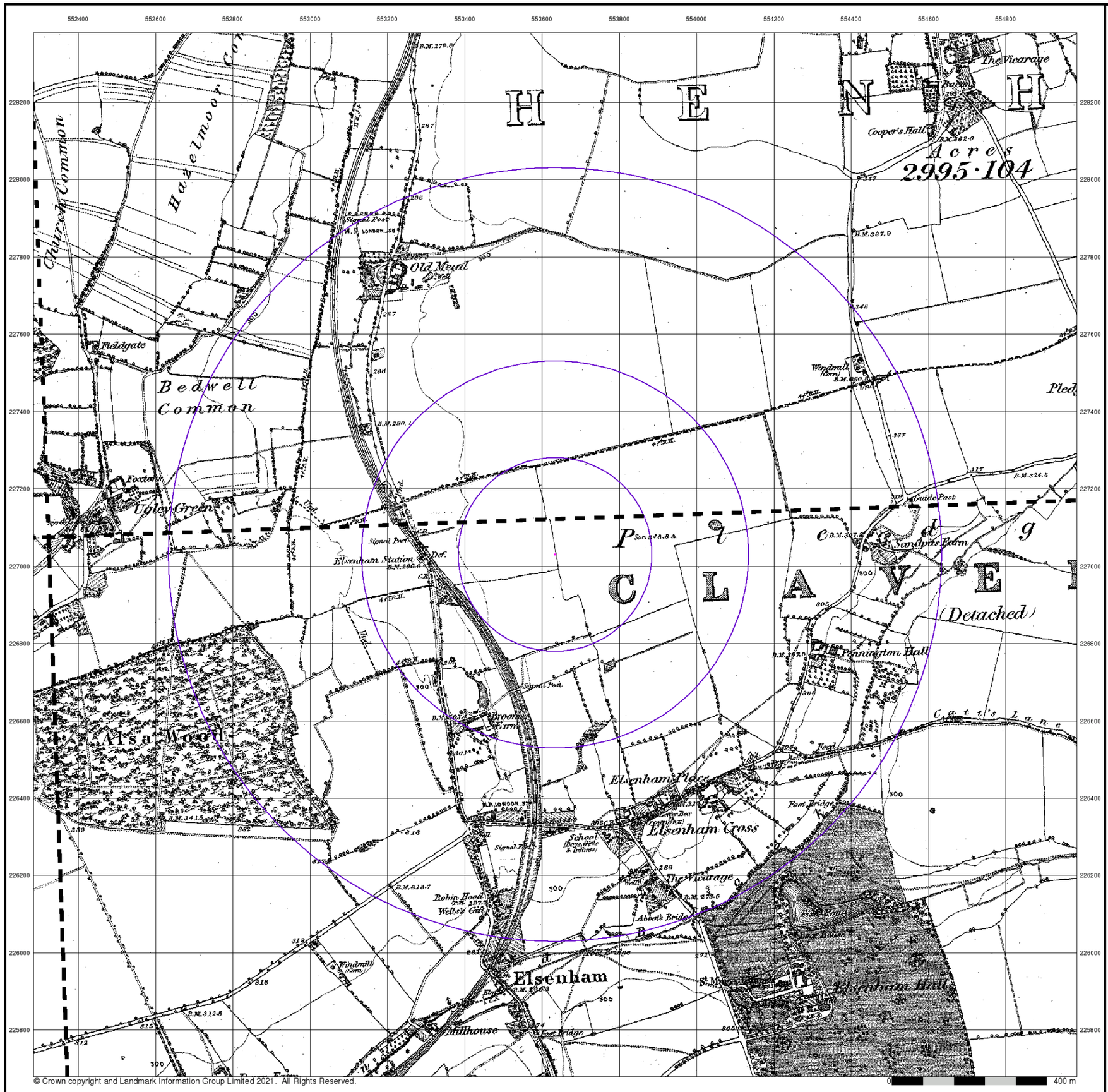


RSK

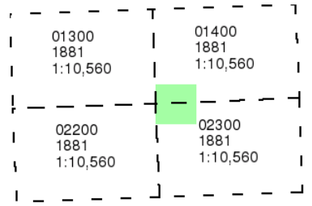
Essex

Published 1881

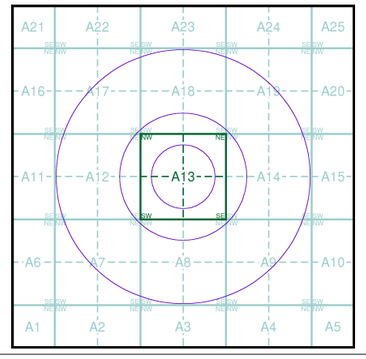
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



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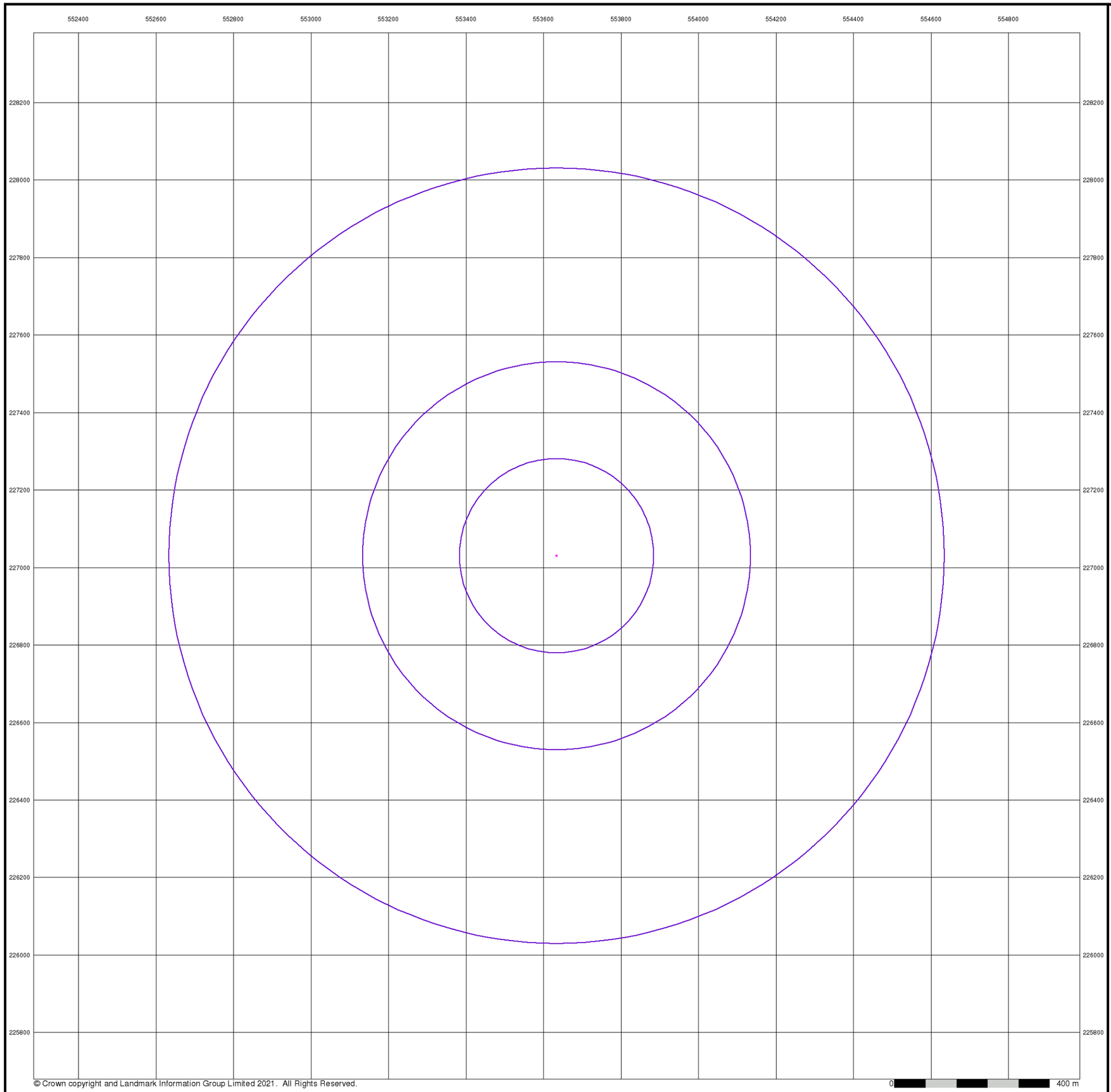

RSK

Hertfordshire

Published 1883

Source map scale - 1:10,560

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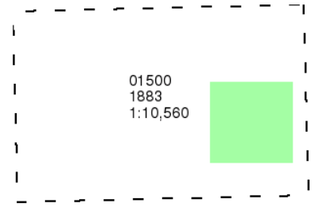

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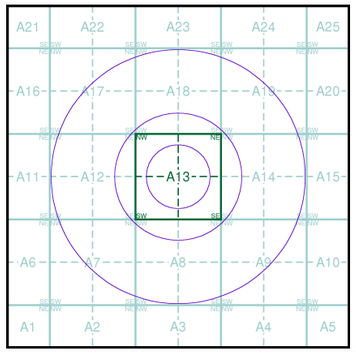

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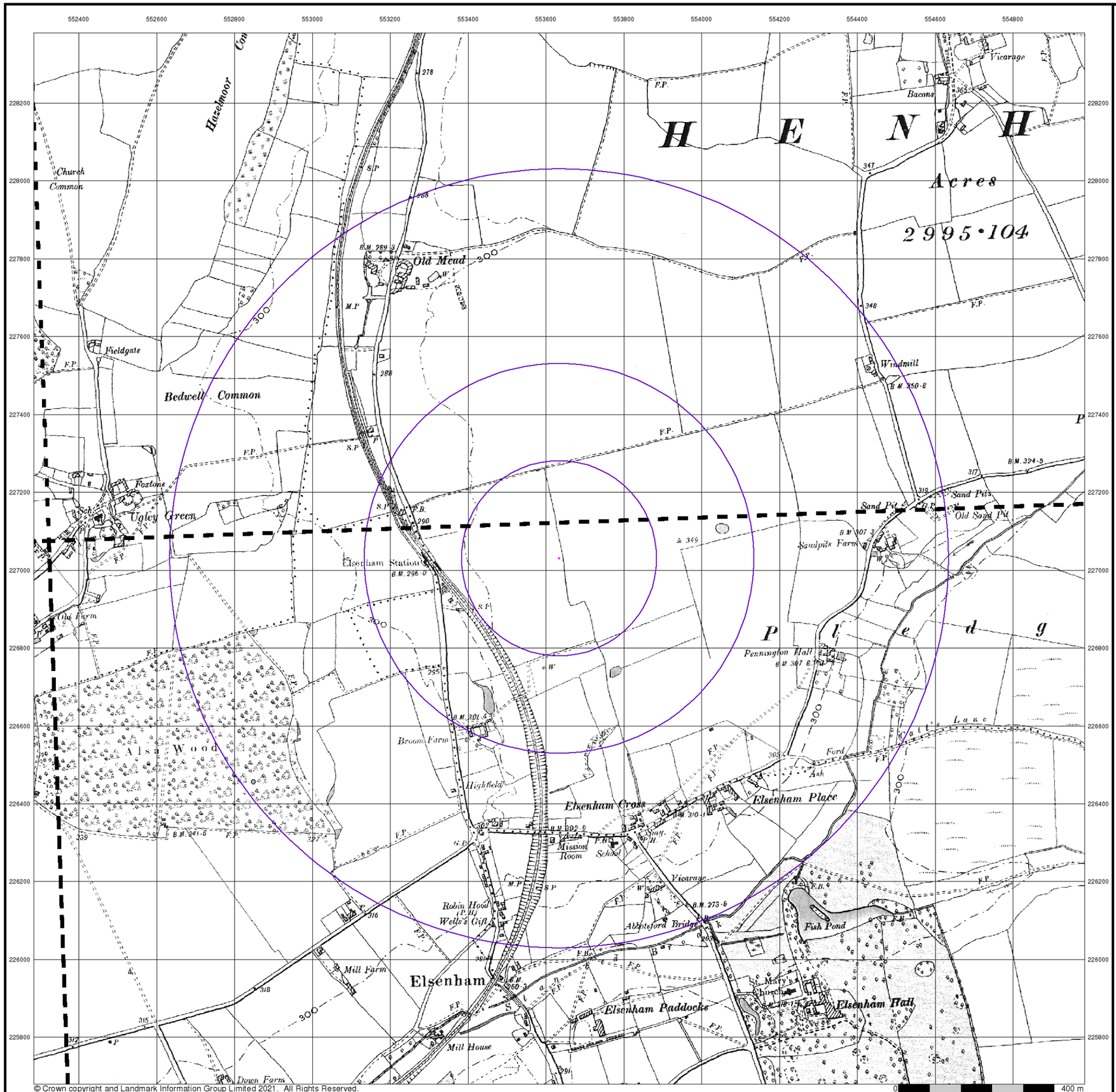

RSK

Essex

Published 1898

Source map scale - 1:10,560

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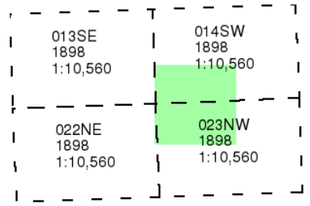
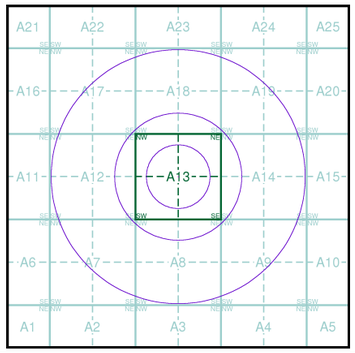


Historical Map - Slice A



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Essex

Published 1923

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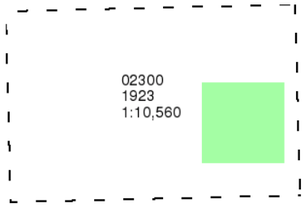

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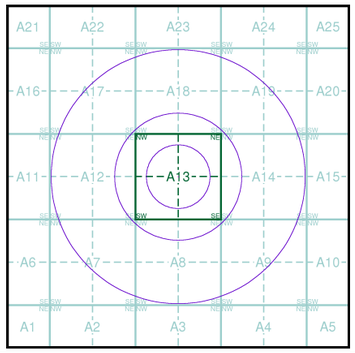

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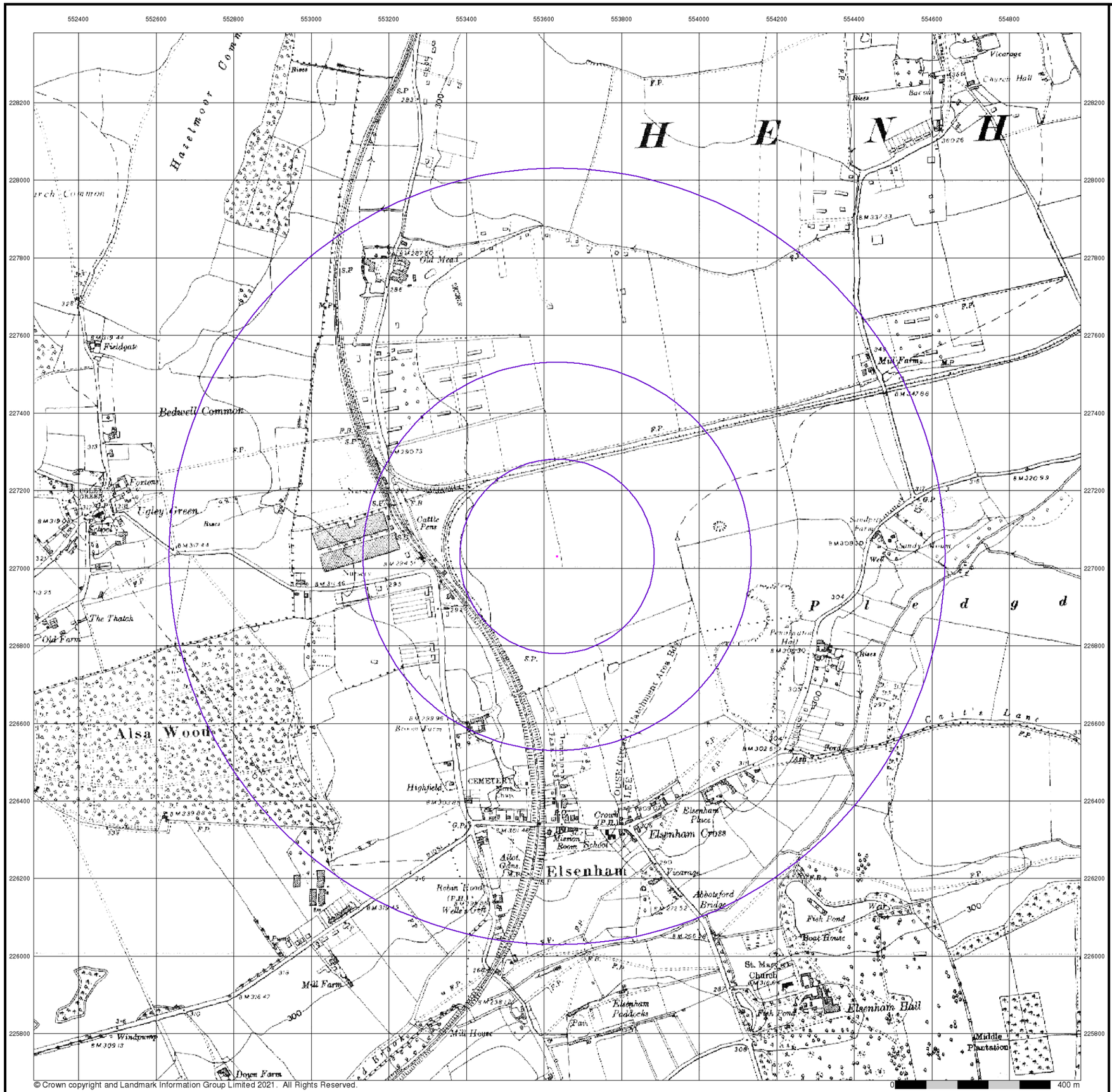

RSK

Essex

Published 1951

Source map scale - 1:10,560

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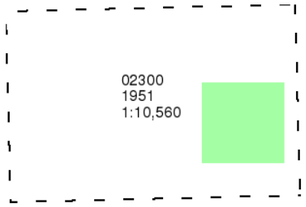
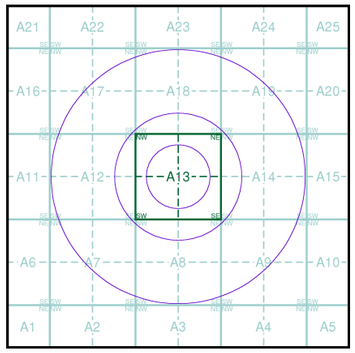


Historical Map - Slice A



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RSK

Ordnance Survey Plan

Published 1960

Source map scale - 1:10,000

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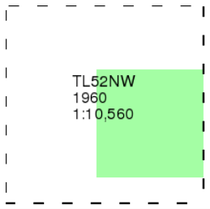
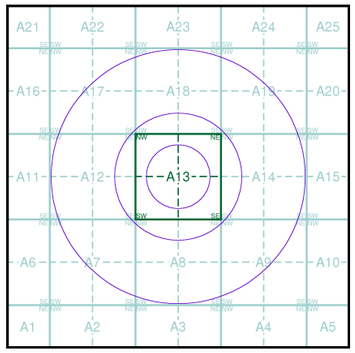
Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	286742639_1_1
Customer Ref:	P02119042
National Grid Reference:	553630, 227030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 553400, 227100

Landmark INFORMATION GROUP

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

RSK

Ordnance Survey Plan

Published 1966

Source map scale - 1:10,000

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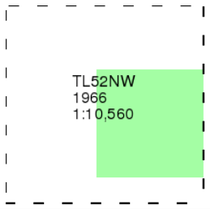
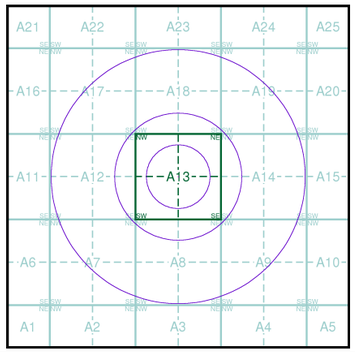


Historical Map - Slice A



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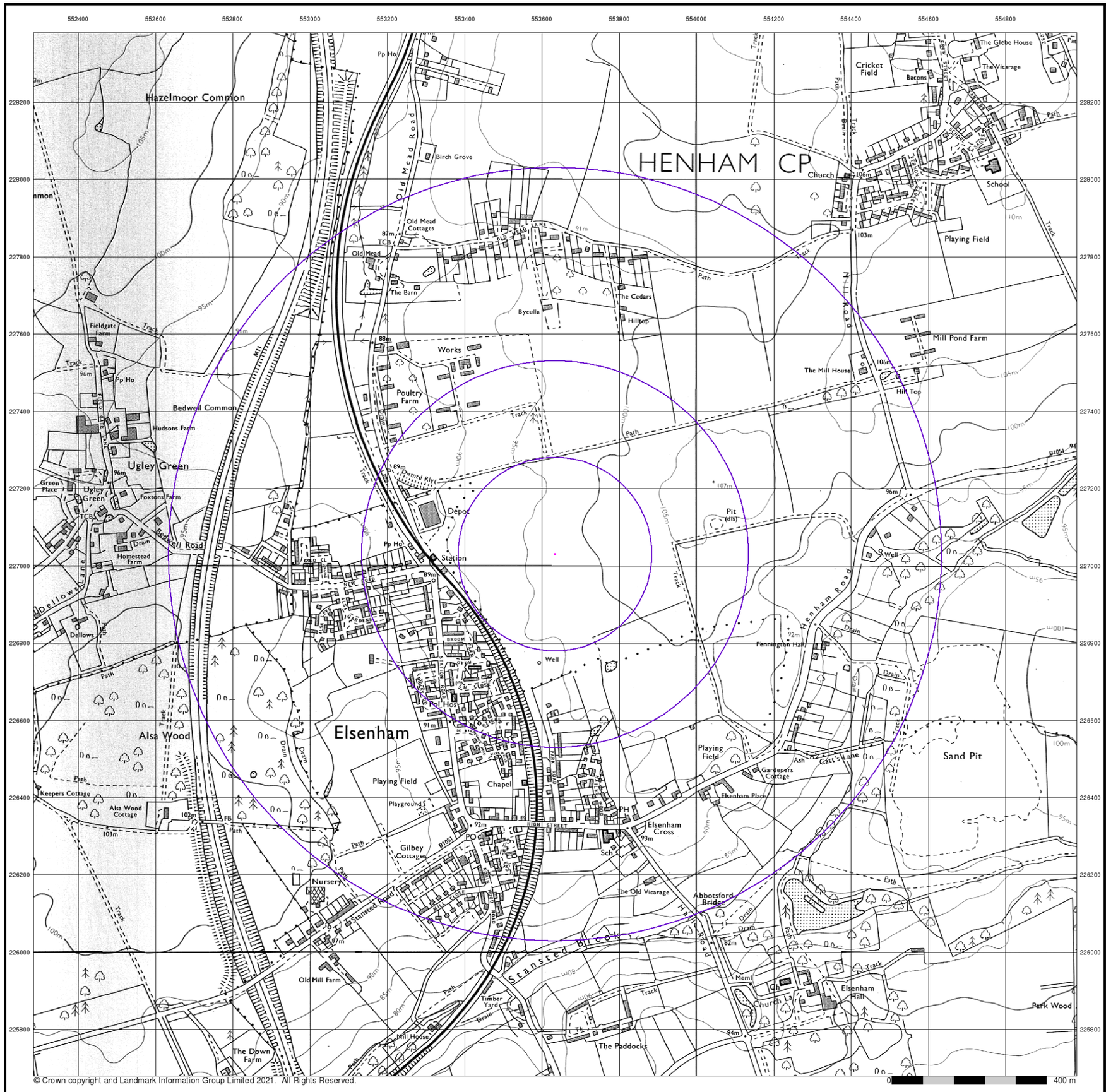

RSK

Ordnance Survey Plan

Published 1983

Source map scale - 1:10,000

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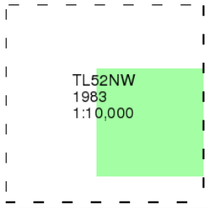
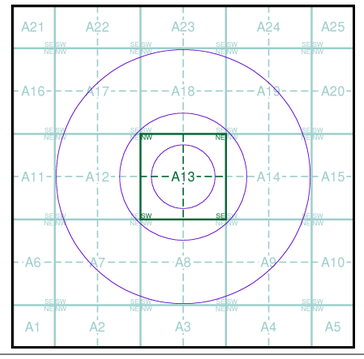


Historical Map - Slice A



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