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GLADMAN DEVELOPMENTS LIMITED

CROSS ROAD, DEAL

PHASE II GROUND INVESTIGATION REPORT

MAY 2024

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CROSS ROAD, DEAL

PHASE II GROUND INVESTIGATION REPORT

MAY 2024

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DRAWINGS

1 INTRODUCTION

1.1 Instruction and Background

1.1.1 Wardell Armstrong LLP (WA) were commissioned via email on 25 October 2023 by Mr David Hough of Gladman Developments Limited, hereafter referred to as the 'Client', to undertake a ground investigation (GI) on a site off Cross Road, Deal, Kent, hereafter referred to as the 'Site'.

1.1.2 Alongside the GI, WA were also commissioned by the Client to prepare a Hydrogeological Conceptual Site Model (HCSM) as the Site is overlying a Principal Aquifer and a Southern Water operated Public Water Supply (PWS) groundwater abstraction is located approximately 300 metres north east of the Site. As part of this, WA were required to install groundwater monitoring boreholes in order to determine the seasonal variability in groundwater depth and elevation at and in the vicinity of the Site. Further information on this is contained within WA 'Hydrogeological Site Investigation Report'.

1.2 Scope and Objectives

1.2.1 The purpose of the GI is to enable a preliminary assessment of the likely ground conditions present across the Site to be carried out and to provide general geotechnical and geo-environmental information to support the identification of potential ground related development constraints.

1.2.2 The report provides information relating to the:

- Environmental setting including geology, mining, hydrogeology and hydrology.
- Potential contamination sources, pathways and receptors through the production of a preliminary Conceptual Site Model (CSM); and
- Provisional assessment of the potential geotechnical and contamination issues present on the Site.

1.3 Proposed Development

1.3.1 The proposed development is for 140 No. residential dwellings and associated gardens and infrastructure as stated with planning application reference DOV/21/01822. The Development Framework Plan (Ref: 7572-L-12_E) for the Site, dated March 2021, is attached at Appendix A.

1.4 Site Location and Description

1.4.1 The Site is located off Cross Road, Deal (Ordnance Survey National Grid Reference TR 36040E 50543N), as shown on Drawing Number GM12741-001. The Site is approximately 7.2 hectares in area and is located approximately 2.5km southwest of Deal town centre.

1.4.2 The Site comprises two fields bordered by Cross Road and residential housing off Cross Road to the east, with further residential housing off St Richard's Road to the north. Ellen's Road borders the Site to the south with agricultural fields beyond, and an area of woodland separates the Site's western border from agricultural fields and a car body parts supplier (The DIY Motorist).

1.5 Limitations

1.5.1 This report has been prepared for the exclusive benefit of the Client, for the purpose of providing geotechnical and geo-environmental recommendations for the Site. The report contents shall only be used in that context. Furthermore, new information, changes in practice or new legislation may necessitate revised interpretation of the report after the date of its production.

1.5.2 It should be noted that GI relies upon the determination of information from 'point sources' such as the trial pits, soakaways, plate load tests and boreholes and the interpretation of data between investigation points. It should be recognised that the actual conditions at and between investigation points can differ spatially and temporally. The assessments and recommendations given in this report are based upon the interpretation of the results from the GI at a specific point and time and therefore any conclusions drawn would need to be reviewed prior to their use during the development of designs for the Site.

1.5.3 WA has carried out an appropriate level of checking of third party supplied information, however WA cannot be held liable for any inaccuracies, inconsistencies or omissions in such information (should there be any).

1.5.4 The GI was restricted in places due to known services and dense vegetation. Exploratory hole locations were positioned at locations to avoid these constraints and minimise disruption to the current land uses. Trial pit locations TP31 and TP34 were not completed due to their proximity to a storm drain/sewer drain of unknown extent.

1.5.5 This report does not consider broader development constraints such as services, land drainage, detailed flood risk, ecology, invasive weeds, archaeology, acoustics or air quality.

1.5.6 WA has used reasonable skill and care in the design of the ground investigation work to comply with currently available industry guidance and to meet the requirements of the commission.

2 BASELINE CONDITIONS

2.1 Summary of the RSK Geosciences Phase 1 Preliminary Risk Assessment

2.1.1 A summary of the site history, existing land use, geology, hydrogeology, hydrology and mining is contained within the RSK Geosciences Phase 1 Preliminary Risk Assessment (Ref: 52285-R01 (00)) dated June 2021, attached at Appendix B. This report should be read in conjunction with the RSK report. The salient conclusions from the RSK report are summarised in Sections 2.1.2 – 2.1.4.

2.1.2 The following potential geotechnical constraints were identified in the RSK report:

- Karstic dissolution features in Chalk terrain;
- Evaporite dissolution;
- Ground subject to peri-glacial valley cambering;
- Silt-rich soils susceptible to rapid loss of strength in wet conditions; and
- Sudden lateral changes in ground conditions.

2.1.3 The following potential contamination sources were identified in the RSK report:

On-site

- Potential made ground associated with installation of a storm drain/water culvert/sewer drain and/or drain covers to the south east of the Site (adjacent to Cross Road); and
- Use of pesticides, herbicides and fertilisers.

Off-site

- Adjacent industrial/commercial activities; and
- Historical landfills and infilled chalk pits 82 – 93m northeast of the site.

2.1.4 The RSK report classified the site as an overall moderate to low risk for contamination linkages. Given the potential for made ground, a GI was recommended to confirm ground conditions across the site.

3 PHASE II GROUND INVESTIGATION

3.1 Description of Works

3.1.1 The GI was designed to provide a general classification and hazard demarcation of the Site.

3.1.2 Two trial pits have been positioned to undertake soakaway testing within the footprint of a proposed infiltration basin to determine the soil infiltration rate of the near surface deposits.

3.1.3 The GI comprised the following:

- A total of 37 No. trial pits (TPs) were excavated between the 9 – 12 January 2024 under the full-time supervision of a WA Geologist. Photographs of the trial pit arisings and the completed TPs (prior to backfilling) are attached at Appendix C and TP logs are attached at Appendix D. The TPs were excavated to a maximum depth of 3.60mbgl in order to:
  - Investigate the nature, distribution and thickness of the near surface deposits; and
  - Obtain samples for laboratory geochemical and geotechnical analysis.

  Three additional TPs (TPA, TPB & TPC) were excavated in the vicinity of TP20 to investigate the presence of a potential dissolution feature.
- A total of 8 No. windowless sample (WS) boreholes were drilled between the 10 – 11 January 2024 to a maximum depth of 5.00mbgl under the full-time supervision of a WA Geologist. WA borehole logs are attached at Appendix D and the Geotron (UK) Ltd drillers logs are attached at Appendix E. The boreholes were drilled in order to:
  - Investigate the nature, distribution and thickness of the near surface deposits;
  - Allow for the installation of gas and groundwater (GW) monitoring apparatus;
  - Obtain samples for laboratory geotechnical testing; and
  - Carry out in-situ geotechnical testing comprising Standard Penetration Tests (SPTs) to provide information on the in situ density of the near surface deposits.
- A total of 2 No. soakaway (SW) tests were conducted at a depth of 1.80mbgl with the pits filled with water to 0.50mbgl. These SW tests were located in the south

of the Site to further assist in the detailed design of the infiltration basin (SW record sheets are attached at Appendix F). The SW tests were undertaken on the 15 January 2024.

- A total of 5 No. Plate Load Tests (PLTs) were conducted on 15 January 2024, each at a depth of 0.30mbgl under the full-time supervision of a WA Geologist (PLT results sheets are attached at Appendix G). The PLTs were undertaken in order to derive a California Bearing Ratio (CBR) of the near surface deposits across the proposed road network as shown on the Development Framework Plan attached at Appendix A.
- A total of 3 No. Rotary Open Hole boreholes (RO) were drilled between the 9 – 18 January 2024 to a maximum depth of 31.70mbgl under the full-time supervision of a WA Hydrologist (WA borehole logs are attached at Appendix D and Geotron (UK) Ltd drillers logs are attached at Appendix E). The boreholes were drilled in order to allow the installation of apparatus to facilitate groundwater level monitoring.
- Laboratory geochemical testing was undertaken on selected samples of the near surface deposits and weathered chalk deposits collected from the TPs across the Site. The following suite of laboratory chemical testing was undertaken:
  - Heavy Metals (As, B, Cd, Cr, Cu, Hg, Ni, Pb, Se and Zn);
  - Soil Organic Matter (SOM);
  - Sulphide;
  - Water Soluble Sulphate;
  - pH;
  - USEPA 16 Polycyclic Aromatic Hydrocarbons (PAHs);
  - Speciated PCBs
  - Asbestos ID; and
  - Total Petroleum Hydrocarbons (TPHs).

  In total, 31 solid samples were subject to analysis. A summary of the laboratory geochemical testing is attached at Appendix H.
- Laboratory geotechnical testing was undertaken on representative samples of the near surface deposits and bedrock deposits collected from the TPs and WS boreholes across the Site. The following testing suite was undertaken to provide a preliminary classification of the Site:
  - 14 No. Natural Moisture Content; and
  - 14 No. Index tests.

A copy of the laboratory geotechnical results is attached at Appendix I.

- Ground gas and GW monitoring standpipes were installed within all of the WS boreholes in order to:
  - Provide a general monitoring grid across the Site;
  - Determine the depth of GW beneath the Site;
  - Obtain samples for laboratory water testing; and
  - Determine the ground gas regime beneath the site.

  Gas and GW monitoring was undertaken on 6 No. occasions between 24 January and 28 February 2024. The results of the monitoring are attached at Appendix J.

4 GROUND INVESTIGATION RESULTS

4.1 Ground Conditions – Strata Profile

4.1.1 Details of the ground conditions encountered are provided in the TP and borehole logs presented in Appendix D and are summarised in Table 4.1.

Table 4.1: Summary of Ground Conditions

Strata		Typical Description	Depth (mbgl)		Thickness (m)
			Top	Base	
Topsoil		Dark brown slightly sandy CLAY. Sand is fine to medium.	0.00	0.20 to 0.40	0.20 to 0.40
Natural Superficial Deposits		Yellow brown slightly gravelly clayey silty fine to coarse SAND. Gravel is fine to medium subrounded to subangular chalk and flint.	0.20 to 0.40	0.40 to 1.50	0.10 to 1.30
		Light yellowish brown slightly sandy slightly gravelly slightly cobbly CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular chalk and flint. Cobbles are angular flint.	1.50	2.20	0.70
Bedrock	Seaford Chalk Formation	Seaford Chalk Formation Chalk: Recovered as yellowish brown and white slightly clayey gravelly fine to coarse SAND (Grade Dm). Gravel is fine to medium subangular to angular chalk and flint.	0.20 to 1.20	0.50 to 3.90	0.20 to 2.70
		Seaford Chalk Formation Chalk: Recovered as white slightly clayey sandy cobbly fine to coarse subangular to angular GRAVEL of chalk and flint (Grade Dc). Sand is fine to medium. Cobbles are angular chalk and flint	0.30 to 3.50	2.20 to 31.70	Not proven
	Margate Chalk Member	Margate Chalk Member Chalk: Recovered as yellowish brown and white slightly clayey gravelly fine to coarse SAND (Grade Dm). Gravel is fine to medium subangular to angular chalk and flint.	0.30 to 0.45	0.70	0.25 to 0.40
		Margate Chalk Member Chalk: Recovered as white slightly clayey sandy cobbly fine to coarse subangular to angular GRAVEL of chalk and flint (Grade Dc). Sand is fine to medium. Cobbles are subangular to angular chalk and flint.	0.20 to 0.70	1.80 to 2.40	Not proven
	Newhaven Chalk	Chalk recovered as white unstained GRAVEL of chalk with occasional black specs. (PROBABLE NEWHAVEN CHALK FORMATION).	0.65	4.00	3.35

Topsoil

4.1.2 Topsoil was proven across the surface of the site at all locations. Topsoil was generally encountered from ground level to 0.30m below ground level (mbgl) with a maximum depth of 0.40m. The topsoil was primarily a dark brown slightly sandy clay.

Natural Superficial Deposits (NSDs)

4.1.3 The NSDs were proven beneath the topsoil, generally comprising yellowish brown slightly gravelly clayey silty fine to coarse sand. Gravels are fine to medium subrounded to subangular chalk and flint. The superficial sand deposits were variable in extent and depth, encountered as continuous beds across the southern half of the site (TP04 – TP06, TP09 – TP15, TP18 – TP36), and as discontinuous bands or pockets across the northern part of the site (TP01 – TP03, TP07, TP08, TP16 and TP17).

4.1.4 The superficial sand deposits were typically 0.25m thick, generally increasing in thickness towards the bottom of the northern field (TP04 – TP05), and in the centre of the southern field (TP19 – TP21).

4.1.5 Superficial deposits comprising light yellowish brown slightly sandy slightly gravelly clay with fine to coarse sand, fine to coarse subrounded to subangular gravel of chalk and flint and frequent angular cobbles of flint were observed in TP20 from 1.50-2.20mbgl.

4.1.6 Aside from topsoil, no NSDs were recorded in TP1 – TP3, TP7, TP8, TP16, TP17, WS01 and WS05.

Bedrock

4.1.7 Weathered chalk bedrock was encountered in all positions across the site. Based on published geological mapping, the Margate Chalk Member underlies the northeast of the site and the Seaford Chalk Formation underlies the remainder of the site. The deposits of the Margate Chalk Member and Seaford Chalk Formation were indistinguishable when observed in the TPs, ROs and WSs and are named on the Engineer's logs based on published geological mapping.

4.1.8 The weathered chalk bedrock was encountered initially as yellowish brown and white slightly clayey gravelly fine to coarse sand (Grade Dm) with subangular to angular fine to medium gravel of chalk and flint. The weathered chalk deposits were encountered from 0.20 – 2.20mbgl, typically from 0.50mbgl. The weathered chalk was variable in extent, encountered in all positions except TP01 – TP06, TP08 – TP10 and TP21. The

weathered chalk was typically 0.40m in thickness, with the maximum thickness observed as 1.30m in TP20.

4.1.9 Below the weathered chalk (recovered as a sand), the chalk bedrock became more competent, comprising white slightly clayey sandy subangular to angular fine to coarse gravel of chalk and flint (Grade Dc) with low cobble content, fine to medium sand and angular cobbles of chalk and flint. The gravel deposits were encountered in all positions from 0.20 – 3.50mbgl, typically 0.70mbgl. Frequent tabular seams of flint were observed within the TPs.

4.1.10 The trial pits were terminated between 1.80 – 3.60mbgl due to difficult digging through the chalk gravel.

4.1.11 The 3 No. rotary boreholes drilled as part of the hydrogeological investigation proved bedrock at depths between 0.50 – 0.65mbgl. Further information relating to the results of the rotary boreholes and the subsequent groundwater monitoring is contained within WA Hydrogeological Site Investigation Report (reference: GM12741-RPT-004) dated April 2024.

4.2 In-situ Geotechnical Testing

Standard Penetration Tests (SPTs)

4.2.1 SPTs were carried out in all WS boreholes. Following the excavation of an inspection pit to check for underground services in each borehole, the SPTs commenced at 1.00mbgl, therefore all SPT testing was undertaken within the chalk bedrock.

4.2.2 Uncorrected SPT "N Values" range from 6 to refusal with a summary of the SPT results provided in Table 4.2.

Table 4.2: Summary of SPT Results

Depth Range (mbgl)	N Value	
	Range	Average
1.00 – 1.45	6 – 15	8
2.00 – 2.45	14 – 20	17
3.00 – 3.45	10 – 22	16
4.00 – 4.45	12 – 25	17
5.00 – 5.45	15 – 28	20

4.3 Laboratory Geotechnical Testing

4.3.1 A summary of the laboratory geotechnical testing undertaken, along with the range and average test results are detailed in Sections 4.3.2 to 4.3.5 The laboratory

geotechnical test results are contained in Appendix I.

Natural Moisture Content (NMC)

4.3.2 In total, 13 No. samples of the NSDs were scheduled for NMC. The NMC ranged from 21 – 31 % with an average of 28 %. The test results are sub-divided by strata within Table 4.3.

Index Properties

4.3.3 In total, 13 No. samples of the NSDs were scheduled for index properties. A summary of the test results is shown in the Plasticity A-Line Chart (Figure 4.1) and Table 4.3.

Table 4.3: Summary of Soil classification tests

Strata	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (PI)	Volume Change Potential
Brown slightly gravelly sandy CLAY	23-25	35-37	22-24	13	Low
CHALK composed of white slightly sandy silty clay	26-31	33-36	25-30	4-8	Low

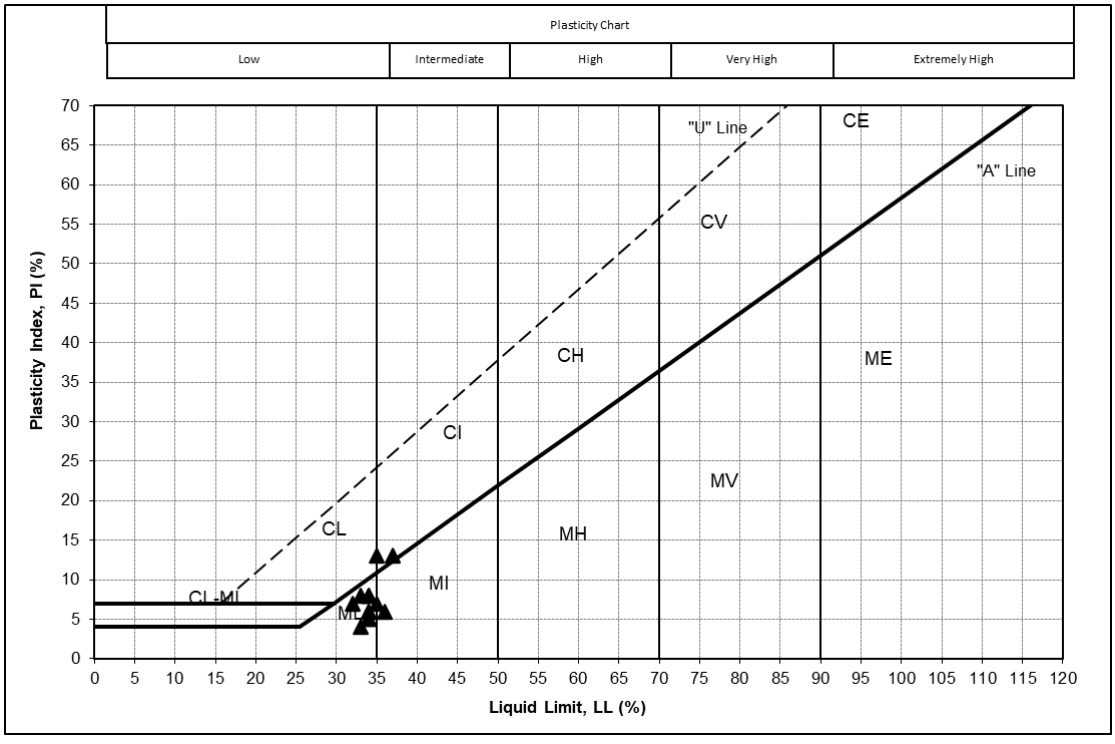

Figure 4.1: Plasticity A Line Chart

4.3.4 On the basis of the geotechnical test results summarised in Figure 4.1, the clays recorded between 1.50 – 2.20mbgl can be described as being of low to intermediate plasticity silt and clay (the clay descriptions on the Engineer's logs have been

determined on the basis of visual examination only, without the benefit of particle size distribution analyses).

4.3.5 In accordance with the NHBC Standards Chapter 4.2, all 13 No. samples of clay and silt have been classified as having a low volume change potential.

4.4 Plate Load Tests (PLTs)

4.4.1 PLTs were undertaken in five locations at a depth of 0.30mbgl. The test results are attached at Appendix G. The estimated CBR range from 3% – 5%. A summary of the CBR values is presented in Table 4.4.

Table 4.4: Plate Load Equivalent CBR values

Location Number	Equivalent CBR Value (%)
CBR1	3
CBR2	4
CBR3	5
CBR4	3
CBR5	5

4.5 Buried Structures and Obstructions

4.5.1 There were no buried structures or historic foundations encountered during the ground investigation.

4.6 Soakaway (SW) Testing

4.6.1 SW Testing was carried out at two positions shown on Drawing Number GM12741-002 to provide an estimate of the soil infiltration value for a proposed infiltration basin. In both SW tests, there was an insufficient fall in water level to calculate an infiltration rate in accordance with BRE DB 365, as the water level did not drop from 75% full to 25% full in the allotted time. Notwithstanding this, SW03 recorded a reduction in water level from 0.50mbgl to 0.75mbgl over 230 minutes and SW04 recorded a reduction in water level from 0.50mbgl to 0.73mbgl over 260 minutes.

4.6.2 Based upon the above information and the calculation methodology contained within BRE DB 365, an infiltration rate of $1.7x10^{-6}$ m/s at SW03 and $1.3x10^{-6}$ m/s at SW04 has been calculated. The SW test results are attached in Appendix F.

4.7 GW Monitoring

4.7.1 During the investigation, no groundwater strikes were encountered in any of the trial pit or WS locations.

4.7.2 GW monitoring standpipes with gravel filter response zones were installed within all WS and rotary boreholes. The response zones are specified on the Engineer's logs.

4.7.3 Six visits were undertaken to measure the GW levels between the 24/01/23 – 28/02/23 in the WS boreholes. The results of these visits are detailed in Appendix J. The results of the GW monitoring were consistent during the monitoring period, recording all boreholes as dry.

4.8 Gas Monitoring

4.8.1 Gas monitoring standpipes were installed within all WS boreholes with response zones targeting the NSDs in order to investigate the potential for the presence of potentially harmful ground gases. Monitoring comprised the measurement of atmospheric pressure, methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide and gas flow rate.

4.8.2 The results of the gas monitoring visits are attached at Appendix J and summarised in Table 4.5.

Table 4.5: Gas Monitoring Summary

Determinant		Minimum	Maximum
Methane (CH_4) (%v/v)		ND	ND
Carbon Dioxide (CO_2) (%v/v)		0.1	1.2
Oxygen (O_2) (%v/v)		19.0	20.3
Carbon Monoxide (ppm)		ND	ND
Hydrogen Sulphide (ppm)		ND	ND
Flow (l/h)	Peak	<0.1	0.1
	Steady	<0.1	0.1

Notes:
ND – Not detected in excess of the instrument's detection limit.

5 CONTAMINATION RISK ASSESSMENT

5.1 Introduction

5.1.1 A primary purpose of the GI was to provide an assessment of the significance of any ground contamination that may be encountered during the development of the site.

5.1.2 In the UK, contaminated land is regulated by the planning and development control system and the contaminated land regime set out in Part 2A of the Environmental Protection Act (EPA) 1990.

5.1.3 When considering an application for development, land contamination is a material consideration, and the local planning authority should satisfy itself that any contamination is properly assessed and adequately remediated, based on a suitable for use approach.

5.1.4 Environment Agency guidance "Land Contamination: Risk Management June 2019 (LCRM)" provides advice on the approach for the investigation and assessment of contamination on a site. This approach includes the production of a CSM depicting the environmental processes that occur on and in the vicinity of the site and identifying the potential pollution linkages. The assessment of the significance of these pollution linkages can then be carried out through the risk assessment process.

5.2 Human Health

Screening Criteria

5.2.1 Laboratory geochemical analysis has been undertaken on samples of NSDs and weathered chalk deposits taken from across the site. The significance of the recorded concentrations has been determined through a comparison with published Generic Assessment Criteria (GACs).

5.2.2 GACs are derived based on generic conceptual site models for a number of land-uses and making generic assumptions about receptor type and behaviour and building and soil properties.

5.2.3 The land uses included under the GAC include residential development, with and without the consumption of homegrown produce, allotments, commercial, public open space near residential and public open space. As there is potential for re-use of materials across the site, both beneath residential dwellings and public open space, the concentrations recorded in soil samples taken from the site have been compared against the assessment criteria for the most sensitive end receptor; namely residential

with home grown produce.

5.2.4 There is no one source that publishes values for all contaminants and so the following sources have been used in the following order of preference:

Category 4 Screening Levels (C4SL)

5.2.5 In March 2014, the Department for Environment, Food and Rural Affairs published 6 Category 4 Screening Levels within their report "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination" (SP1010). These GAC's are generated using the CLEA model, although the toxicological and exposure parameters have been modified so that the values represent "a more pragmatic approach to contaminated land risk assessment (albeit still strongly precautionary)." DEFRA state that the Category 4 Screening Levels will be used as generic screening criteria.

Suitable for Use Levels (S4UL)

5.2.6 Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) have published Suitable For Use Values (S4UL's) for 82 substances. These values, contained within the publication "LQM/CIEH S4ULs for Human Health Risk Assessment" (2015) replace the previous values contained within "Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition)" dated 2009, and reflect the greater knowledge of relevant toxicology and further consideration of exposure scenarios.

5.2.7 Separate S4UL values have been published for three soil organic matter (SOM) contents (i.e. 1%, 2.5% and 6%). The average SOM for the site is 2.41%, however due to its variable nature (ranging from 0.60% to 5.70%) a value of 1% has been chosen for the initial screen as it is the most conservative approach.

5.3 Laboratory Chemical Analysis

Human Health

5.3.1 There were no exceedances of any determinants compared against the relevant GACs. Therefore, based on the samples collected and tested, the soils on site are likely to be suitable for re-use in landscaped areas.

5.3.2 During the trial pitting exercise, no visible fragments of asbestos or potential Asbestos Containing Material (ACM) were observed. Asbestos identification analysis was undertaken on 31 No. samples taken from across the site. Asbestos was not detected within any of the 31 No. samples tested. Due to no potential ACM being recorded

within the samples taken during the GI, the risk from asbestos is considered to be low, however cannot be discounted from areas of the site which were not investigated.

5.3.3 Should visible ACMs (or potential ACMs) be encountered during enabling works or construction works, the works should stop, and the material should be isolated, sampled and analysed for asbestos and the risk assessment for asbestos should be updated accordingly.

Controlled Waters

5.3.4 Due to the limited thickness of the NSDs on site they do not have an aquifer designation whilst the underlying solid geology is designated as a Principal Aquifer. The nearest surface water feature on site is a pond 700m southwest of the site.

5.3.5 There is a Southern Water operated Public Water Supply (PWS) groundwater abstraction is located approximately 300 metres north east of the Site. The Site is located within a Source Protection Zone 1. The groundwater monitoring in the WS boreholes proved groundwater to be deeper than 4.85mbgl.

5.3.6 The ground investigation has proven the site to be generally underlain up to 1.50m of NSDs generally comprising of either slightly gravelly clayey silty fine to coarse sand or slightly sandy slightly gravelly slightly cobbly clay underlain by either the Margate Chalk Member (northeast of the site) or Seaford Chalk Formation (remainder of the site).

5.3.7 The superficial sand deposits were variable in extent and depth, encountered as continuous beds across the southern half of the site (TP04 – TP06, TP09 – TP15, TP18 – TP36), and as discontinuous bands or pockets across the northern part of the site (TP01 – TP03, TP07, TP08, TP16 and TP17). In either case, these are unlikely to represent a migration pathway for any contaminants to the underlying bedrock aquifer beneath the site as they are either not continuous or not in contact with the groundwater (greater than 4.85mbgl).

5.3.8 In addition, the solid analysis has proved the presence of contaminants within the soils to be low.

5.4 Preliminary Ground Gas Risk Assessment

5.4.1 Gas monitoring apparatus was installed within all WS boreholes. No methane concentrations and only low positive gas flows were recorded above the instrument

level of detection of 0.1 % and 0.1l/h respectively. Carbon dioxide was recorded at a maximum concentration of 1.20%.

5.4.2 In order to assess the potential risk posed by the recorded gas concentrations at the site, an initial screen using the methodology presented within CIRIA C665 “Assessing risk posed by hazardous ground gases to buildings 2007” has been used.

5.4.3 BS8485 and CIRIA C665 require the calculation of a Gas Screening Value (GSV) (litres of gas per hour) using the formula below:

Borehole flow rate (l/hr) x gas concentration (%) = GSV (l/hr)

5.4.4 This calculation has been undertaken for carbon dioxide using the highest recorded concentration, therefore adopting the worst-case volume. A maximum flow of 0.1hr was measured during the monitoring process.

Carbon Dioxide GSV = (1.2/100) x 0.1l/hr = 0.0012 l/hr

5.4.5 A preliminary conservative GSV of 0.0012 l/hr has been calculated from data obtained during the monitoring programme. This places the site in a Characteristic Situation (CS) 1 i.e., a very low risk classification where no special gas protection measures are considered necessary.

5.4.6 This assessment is based on the results of the GI and the gas monitoring undertaken to date. Should, during the development of the site, observations be made such as the identification of anomalous fill material between investigations points, then the ground gas risk assessment should be reviewed.

6 GEOTECHNICAL ASSESSMENT

6.1 General

6.1.1 The GI comprised the excavation of TPs, SWs, PLTs and WS and RC boreholes to investigate the distribution and hydrogeology of the NSD's and bedrock present beneath the site and to facilitate ground gas and GW monitoring, and in-situ and laboratory testing.

6.1.2 The in-situ and laboratory geotechnical testing was conducted to investigate the general soil index and strength parameters and infiltration characteristics of the NSD and bedrock. The in-situ geotechnical test results are recorded on the TP and WS logs attached at Appendix D; the SW testing results attached at Appendix F; and the PLT results attached at Appendix G. The laboratory geotechnical testing detailed in Section 4 of this report is attached at Appendix I.

6.2 Potential Dissolution Feature

6.2.1 As stated in Section 3.1.3, a potential dissolution feature was observed in TP20, where superficial sand deposits extended to a depth of 1.50mbgl. This is in contrast to the depth of NSDs in the surrounding pits, such as TP15 (0.40mbgl), TP19 (0.40mbgl), TP24 (0.50mbgl) and TP21 (0.50mbgl).

6.2.2 Three TPs were excavated in the vicinity of TP20 (TPA, TPB and TPC) to delineate this area of deeper rockhead. The TPs pits encountered NSDs to a maximum depth of 0.50mbgl, indicating the deeper rockhead observed at TP20 may be a localised dissolution feature. No further potential dissolution features were observed throughout the works.

6.2.3 The interpretation of geology relies upon information from the investigation locations and therefore the risk of further dissolution features being encountered elsewhere on site, outside of investigation locations, cannot be discounted.

6.3 Foundations

6.3.1 Various foundation options have been considered for the site. The most appropriate solution for the development will depend on the final layout and levels, anticipated structural loadings and the tolerance of the proposed development to differential settlement.

6.3.2 The selection of foundation types will need to consider the wider development proposals and take into account the potential impact of any proposed engineering

works.

Shallow Foundation

Across the majority of the site rockhead was encountered at shallow depths (< 1.00mbgl) comprising of weathered chalk recovered as high strength clays, gravels and sands. These deposits, outside of any potential dissolution features, would generally be suitable in their current state as a founding stratum at between approximately 1.00 – 1.50mbgl with traditional shallow foundations likely being appropriate. Localised deepening using trench fill methods may be required in some areas.

Reinforced Trench Fill Foundation

6.3.3 As discussed in Section 6.2, a potential dissolution feature was identified in TP20 due to the depth of bedrock being recorded between 1.50 – 2.00m deeper in this location compared to the surrounding locations (TP15, TP19, TP21 and TP24). Due to the deeper rockhead in the vicinity of TP20, an alternative foundation solution such as a reinforced trench fill foundation founded in bedrock may be more appropriate. As there is the possibility of unrecorded dissolution features elsewhere across the site, it is possible that alternative foundation solutions may require to be considered in other locations on site.

6.3.4 The foundations designer should discuss the ground conditions with the local authority building control officer who may have local knowledge on ground conditions encountered on other developments close by and the nature of the foundation solutions adopted on these sites.

6.3.5 Proposed foundation types are shown on WA Drawing Number GM12741-005 Preliminary Foundation Zoning Plan.

Summary

6.3.6 A combination of shallow foundation solutions and reinforced trench should be appropriate for the proposed development of the site.

6.3.7 Foundations in and around areas containing potential dissolution features shall consider the presence of these features and be designed to span across any possible voiding to limit settlement to less than 25 mm.

6.3.8 Prior to any site development works and during the site preparation/enabling works the surface vegetation layers should be removed and organic soils should not be reused as engineered fill.

6.3.9 All foundations should be designed by a suitably qualified engineer to meet current design standards. Consideration of implementation of heave precautions should be made where appropriate and where there is a tree influence, or the clay is desiccated.

6.4 Heave Precautions

6.4.1 Before a final foundation solution is confirmed, consideration will need to be given to NHBC Standards Chapter 4.2 "Building Near Trees". In accordance with the NHBC Standards Chapter 4.2, the near surface natural soils have been classified as generally having a "low volume change potential" across the site, therefore, the following void dimensions will need to be implemented in accordance with Table 7 in Chapter 4.2

- Under ground beams, and suspended in-situ concrete ground floor – 50mm; and
- Under suspended precast concrete and timber floors – 200mm.

6.4.2 Further assessment will be required to determine the heave precaution requirements for individual properties in advance of construction by reference to the final building layout and confirmed levels, the NHBC standards and an appropriately detailed Arboricultural Survey.

6.5 Excavation and Dewatering

6.5.1 Based upon the conditions observed during the ground investigation and monitoring, groundwater was not encountered within the TP or WS locations and therefore should not represent a hazard to foundation and services excavations across the site.

6.5.2 The natural superficial deposits encountered in the trial pits were stable throughout excavation and therefore bearing in mind the nature of the soils and groundwater conditions encountered, excavation stability is unlikely to be a constraint during construction. The groundworks and drainage contractor should review the ground and groundwater conditions to ensure that any related temporary works are identified.

6.5.3 During construction works, should a soil stripping exercise be undertaken, then an appropriate Soil Handling Plan/Materials Management Plan will need to be prepared and adhered to in order to limit the amount of disturbance to the near surface superficial deposits. Due to the soluble nature of the chalk deposits beneath the site, care should be taken during any earthworks to minimise exposing the chalk to rainfall and surface water and initiating new dissolution features and destabilising the loose backfill of existing ones.

Infiltration

6.5.4 Generally, soakaway drainage should be avoided if at all possible in areas of soluble ground/potential dissolution features. However if this is not possible, soakaways or infiltration ponds should be sited at least 20m away from any foundations. Infiltration rates of $1.7x10^{-6}$ m/s (SW03) and $1.3x10^{-6}$ m/s (SW04) have been estimated for the shallow soils based on the test procedure in BRE DG 365.

6.5.5 Soakaways are generally considered effective when the ground infiltration rate is greater than $1.0x10^{-6}$ m/s. The infiltration rates estimated during the investigation compare well with those estimated by RSK over other parts of the site (RSK values range from $1.34x10^{-5}$ to $1.59x10^{-6}$). However, since the test procedure could not be completed to the required BRE procedure (due to the low permeability of the deposits being tested) the estimated infiltration rates should be treated with caution during design.

6.6 Buildings and Infrastructure - Sulphate Content (Buried Concrete)

6.6.1 Sulphates and acids within the ground can be destructive to concrete and result in expansion and / or softening of concrete structures. The laboratory chemical analysis along with the soil type and water levels have been used to assess the potential for chemical attack on buried concrete in new structures on the site.

6.6.2 Laboratory sulphate testing has been conducted on soil samples recovered from the various strata encountered across the site to determine the Design Sulphate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification for proposed buried concrete in accordance with BRE Special Digest 1 :2005 3rd Edition “Concrete in Aggressive Ground” document. The laboratory test results are attached at Appendix H.

6.6.3 During the intrusive works, GW was not encountered. As GW was not encountered at shallow depths, the assessment has been undertaken accounting for the presence of static groundwater.

6.6.4 The sampling and testing of the soil recovered from site has recorded the following:

- The soils pH levels across the site range from pH 7.77 to pH 9.88 (Average pH 8.33); and
- Water soluble sulphate levels are all < 10 mg/l.

6.6.5 Based upon the use of the methodology set out in BRE Special Digest 1:2005 3rd

Edition "Concrete in Aggressive Ground", the design sulphate class for this site is DS-1 and the aggressive chemical environment for concrete (ACEC) classification for the site AC-1s. However, it should be noted that further consideration should be made during the detailed design stage once the location and types of structures to be constructed have been confirmed.

6.7 Pavement and Road Design

6.7.1 PLT were undertaken in five locations at depths of 0.30mbgl with the results attached at Appendix G. The estimated CBRs ranged from 3% – 5%. The locations of the CBR tests were positioned in potential road infrastructure areas as shown on the Development Framework Plan attached at Appendix A.

6.7.2 Based on the results of the GI a design CBR value of 3% should be assumed. This should be reviewed at design stage and further testing may be required by the designer once final design layouts etc. are agreed. All road infrastructure should be designed by a suitably qualified engineer to meet current design standards.

6.7.3 In all cases, topsoil lies directly onto the NSDs. The topsoil thickness at the site ranges from 0.20 to 0.40mbgl. Topsoil beneath road / hardstanding areas should be removed prior to road construction, for retention and re-use on site within garden or landscape areas of the proposed residential development.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Geotechnical Assessment

Potential Dissolution Areas

7.1.1 A potential dissolution feature was observed in TP20, where superficial sand deposits extended to a depth of 1.50mbgl, which was in contrast to the depth of NSDs in the surrounding pits, such as TP15 (0.40mbgl), TP19 (0.40mbgl), TP24 (0.50mbgl) and TP21 (0.50mbgl). Three TPs were excavated in the vicinity of TP20 (TPA, TPB and TPC) to try and delineate this area of deeper rockhead. The additional test pits recorded NSDs to a maximum depth of 0.50mbgl. This indicates the presence of a potential localised dissolution feature in the order of 15 – 20m in size in the vicinity of TP20.

7.1.2 The interpretation of ground conditions relies upon information from the investigation locations and therefore the risk of further dissolution features being encountered elsewhere on site, outside of investigation locations, cannot be discounted.

Foundations

7.1.3 The most appropriate solution for the development will depend on the final layout, anticipated structural loadings and the tolerance of the proposed development to potential differential settlement. All foundations should be designed by a suitably qualified engineer to meet current design standards, using additional targeted ground investigation to supplement this general characterisation of the site. A combination of traditional shallow foundation solutions (strip and reinforced trench fill) should be appropriate for the proposed development of the site.

7.1.4 Foundations in and around areas containing potential dissolution features shall consider the presence of these features and be designed to span across any potential voiding to limit any settlement to less than 25 mm.

7.1.5 Proposed foundation types are shown on WA Drawing Number GM12741-005 Preliminary Foundation Zoning Plan.

Heave Precautions

7.1.6 In accordance with NHBC Standards Chapter 4.2 Building near trees, the soils on site are classified as having a low volume change potential.

Excavation and De-watering

7.1.7 The GI generally indicates that construction related excavations will not require de-watering or stability measures being implemented.

Infiltration

7.1.8 Infiltration rates of $1.7x10^{-6}$ m/s (SW03) and $1.3x10^{-6}$ m/s (SW04) have been estimated for the shallow soils based on the test procedure in BRE DG 365. These infiltration rates compare well with those estimated by RSK over other parts of the site (RSK values range from $1.34x10^{-5}$ to $1.59x10^{-6}$ m/s).

7.1.9 Since the test procedure could not be completed to the required BRE procedure (due to the low permeability of the deposits being tested) the estimated infiltration rates should be treated with caution during design.

Buildings and Infrastructure - Sulphate Content (Buried Concrete)

7.1.10 Based on guidance on BRE Special Digest 1:2005 Third Edition, the soils can be classified as Design Sulphate Class for DS-1 and aggressive chemical environment for concrete (ACEC) class AC-1d.

Pavement and Road Design

7.1.11 Based on the results of the GI a design CBR value of 3% should be assumed. This should be reviewed at design stage and further testing may be required by the designer once final design layouts etc. are agreed. All road infrastructure should be designed by a suitably qualified engineer to meet current design standards.

Earthworks

7.1.12 Where any earthworks cut and fill is required to prepare the site for development, a geotechnical design and specification should be prepared to ensure proper management and re-use of soils. The Specification should conform to BS 6031 and an accepted earthworks specification such as the current version of the Specification for Highway Works, Series 600 Earthworks.

7.1.13 Due to the soluble nature of the chalk deposits beneath the site, care should be taken during any earthworks to minimise exposing the chalk to rainfall and surface water and initiating new dissolution features and destabilising the loose backfill of existing ones.

7.2 Contamination Assessment

Human Health

7.2.1 The results of the GI and risk assessment suggest that the overall risk associated with soil contamination is low. The results of this investigation suggest that the topsoil and NSDs are suitable to remain at the surface following residential development. There were no exceedances of any determinants compared against the relevant GACs.

Controlled Waters

7.2.2 Due to the solid analysis recording the presence of contaminants within the soils to be low and the depth of groundwater, the risk of contamination to controlled waters is low. In addition, it is likely that as part of the proposed development, surface water will be controlled on site and discharged into the on-site infiltration basin and therefore not allowed to pass freely through the NSDs, consequently reducing water infiltrating through the soil and further lowering the risk to controlled waters.

Preliminary Gas Risk Assessment

7.2.3 The preliminary gas risk assessment indicates that the site lies within a CS 1 i.e., a very low risk classification where no special gas protection measures are considered necessary. This assessment is based on the limited assessment undertaken and further consideration of the risks should be made once the final location and nature of the development is known.

Re-use of Site-Won Materials and Materials Management Plan

7.2.4 It is expected that site enabling works will involve the stripping of the surface vegetation layers and topsoil/subsoil and any made ground materials encountered.

7.2.5 Testing has proven the potential suitability for topsoil and subsoil to be reused within garden and landscape areas. Consequently, it is recommended that the remediation strategy makes provision for the sustainable re-use of site-won material under the appropriate soil management controls.

7.3 Additional Comments

7.3.1 It is recommended that during the detailed design and future development works, further targeted GI works should be undertaken by the developer specifically in accordance with their development layout. Should a void or dissolution feature be suspected, such as in the area of TP20, further trial pits/boreholes should be

undertaken to establish its size and depth, and whether there are other voids in the area as dissolution features are commonly found grouped together.

APPENDICES

Appendix A

Development Framework Plan 7572-L-12_E

Dover District Council Reg 18 Draft Local Plan - Open Space Requirements (DM Policy 31)

Typology	Standard Required per 1000 pop. (Ha)	Required (Ha)	Onsite required?	Proposed (Ha)	
Accessible greenspace - Parks & Gardens	0.45	**0.1566**	-	-	
Accessible greenspace - Amenity Greenspace	1.46	**0.508**	**Yes**	**4.19**	✓
Provision for children & young people	0.06	**0.04**	**Yes**	**0.04**	✓
Allotments	0.21	**0.073**	-	-	

Calculations based on 2.4 persons per household based on a density of 35 DPH (giving an estimated population of

Application Boundary **[8.71 Ha]**

BUILT DEVELOPMENT

Residential Area **[4.23Ha]**
(Up to 140 dwellings at 33 DPH)

ACCESS

Proposed Vehicular Access

Proposed Indicative Roads

Proposed Pedestrian Connections

Proposed Footpaths

GREEN INFRASTRUCTURE [4.48 Ha]

Existing Woodland and Trees to be Retained and Enhanced [2.0 ha]

Public Open Space [1.72 ha]

Proposed Woodland Planting [0.15 Ha]

Proposed Shrub and Tree Planting

Proposed Hedgerow Planting

Proposed Play Area (LEAP) [0.04 Ha]

Proposed Habitat Area - Mown Route with Information Boards and Reptile Hibernacula [0.16ha]

Proposed Attenuation Basin [0.16 ha]

Proposed Drainage Swales [0.15ha]

Proposed Community Orchard [0.10ha]

N

Gladman Developments Ltd
Cross Road
Walmer, Kent

DEVELOPMENT FRAMEWORK PLAN

1:2500@A3
24 March 2021 JES / CEH
7572-L-12 rev **E**

Appendix B

RSK Geosciences Phase I Preliminary Risk Assessment

Gladman Developments Ltd

Land West of Cross Road, Deal

Preliminary Risk Assessment

52285-R01 (00)

RSK GEOSCIENCES

June 2021

RSK GENERAL NOTES

Project No.: 52285

Title: Preliminary Risk Assessment: Land West of Cross Road, Cross Road, Deal CT14 9LA

Client: Gladman Develpoements Ltd, Gladman House, Alexandria Way, Congleton, Cheshire CW12 1LP

Date: 28th June 2021

Office: RSK Environment Limited, Anerley Court, Half Moon Lane, Hildenborough, Tonbridge, TN11 9HU. Tel 01732 833111

Status: Rev 00

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Signature		Signature	

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

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FIGURES

APPENDICES

1 INTRODUCTION

1.1 Commissioning

RSK Environment Limited (RSK) was commissioned by Gladman Developments Ltd to carry out a Preliminary Risk Assessment of the land west of Cross Road, Deal, CT14 9LA. The project was carried out to an agreed brief as set out in RSK's proposal (Ref. 52285-T01(00), dated 19th April 2021).

RSK's service constraints are shown in **Appendix A**.

The site in question is being considered for development for residential use.

1.2 Objectives

The objective of the work is:

- to provisionally identify any land contamination and/or geotechnical constraints to the proposed development and to support discharge of relevant planning conditions and relevant building control requirements; and
- to identify the need for 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.

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

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

- review of the history of development on the site and surroundings, including a study of historical ordnance Survey mapping and other sources of historical information via an environmental database report;
- assessment of local geology, hydrogeology and surface water setting, including the identification of potential geological hazards including mining etc;
- review of relevant information held by appropriate statutory authorities, e.g. local authority Environmental Health Departments and Environment Agency, obtained from the environmental database report;
- completion of a site reconnaissance survey to assess the visual condition of the site;

- development of an initial conceptual site model (CSM) identifying potential contaminant linkages for potential contaminants, completion of a preliminary risk assessment (PRA) and identification of key uncertainties and assumptions in the CSM;
- preliminary consideration of geotechnical constraints and hazards; and
- identification of the need for further action, e.g. intrusive investigations, where applicable.

1.4 Existing reports

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

- RSK, Preliminary Risk Assessment – Land off Cross Road, Deal, Ref: 28926, April 2017.

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

1.5 Limitations

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.

The study was designed generally to meet the objectives of a preliminary (phase 1) investigation, as defined by BS 10175:2011 (BSI, 2017).

This report should be considered in the light of any changes in legislation, statutory requirement or industry practices that have occurred subsequent to the date of issue.

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 opinions expressed in this report, and the comments and recommendations given, are based on the information obtained from the desk assessment and the site reconnaissance survey. No intrusive investigations have been undertaken to confirm the actual ground conditions and hence the environmental status of the site.

While asbestos-containing materials are not suspected to be present at the site, asbestos may well be present in soils in discrete areas and may be encountered during future ground investigation.

A detailed survey of invasive plant species is outside the scope of this investigation therefore detailed comments with regards to such species have been omitted from this report.

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	Land West of Cross Road
Full site address and postcode	Land west of Cross Road, Deal, CT14 9LA
National Grid reference (centre of site)	TR 36027 50534

2.2 Site description

The site covers an area of c. 8.2 hectares, divided approximately into two parcels; the larger of the parcels located on the central portion of the site is currently occupied by agricultural (arable) land. The smaller parcel is located on the northern portion of the site and is currently fallow land.

The southern boundary and southwestern corner is covered by dense semi-mature and mature shrubs and trees. In addition, semi-mature and mature hedgerows are generally present around the perimeter for the site. The site slopes generally from north-northeast to south-southwest.

Access can be obtained at the southeast corner (intersection of Cross Road and Ellens Road) and the northeast corner on Cross Road. The smaller, fallow land parcel is accessed via a gate, which is located on the south side of the parcel.

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

2.3 Surrounding land uses

The site is located on the southwestern outskirts of Deal, within a predominantly agricultural and residential setting. Immediate surrounding land uses are described in **Table 2**.

Table 2 Surrounding land uses

North	Residential dwellings, fallow and agricultural land and a commercial business/facility (GA Vehicle Repairs)
East	Residential dwellings and agricultural land
South	Agricultural land
West	Agricultural land and a commercial business/facility (The DIY Motorist)

2.4 Development plans

It is understood that the site will be developed for residential end-use. Plans for the development have not yet been provided to RSK as part of this preliminary risk assessment

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 (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
1872	1938	Undeveloped and/or vacant land, or agricultural use (use not depicted on maps)	entire site
1947	1999	Agricultural use (arable)	entire site
2021		Agricultural use (arable) and vacant/fallow land	entire site
Date from	**Date to**	**Historical Land Use (off-site)**	**Distance (m) and orientation**
1872	2021	Undeveloped and/or vacant land, or agricultural use (use not depicted on maps)	immediately north
1872	1908	Developed/used as a chalk pit. Lime kilns also depicted. A second chalk pit is depicted in 1898	c. 75-100 m northeast
1872	1938	Undeveloped and/or vacant land, or agricultural use (use not depicted on maps)	immediately east, south, and west
1877	1973	Developed with a water works	c. 100 m north
1898	1908	Developed/used as a chalk pit. Lime kilns also depicted	c. 250 m north

1898	1908	Developed with what appears to be several residential dwellings	c. 200 m northeast
1898	2021	Residential dwellings, followed by a railway line	c. 200-250 m east
1906	1938	Developed with a brick works; several kilns depicted	c.250-300 m south
1907	1948	Developed with a residential dwelling or a small commercial building	c. 125 m west
1907	1973	Reservoir depicted. By 1973 it was depicted as 'covered'	c. 200 m northeast
1908	2021	Developed with what appears to be multiple residences	0-400 m north and northeast
1938	1987	All formerly detailed chalk pits depicted as 'old chalk pits'	c. 75-250 m north and northeast
1938	1987	Developed with several residential dwellings and/or small commercial building	0 – 400 m west
1947	Present	Agricultural land	immediately east, south and west
1957	2021	Developed with what appears to be several residences and/or commercial buildings (use not depicted)	immediately north/ northwest
1993	2021	Commercial building, with a scrap yard / recycling site depicted	immediately west
Relevant information sources: Historical OS maps ☒ Aerial photography ☒ 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.			

3.1.2 Unexploded ordnance

A review of publicly available unexploded ordnance (UXO) risk maps (**Appendix D**) indicates that the site is located in an area with high potential for wartime bombs to be present (Zetica, 2021).

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	0	-
Enforcement and prohibition notices	0	0	0	-
Pollution incidents to controlled waters, Prosecutions relating to controlled waters, Substantiated pollution incident register, Water Industry Act referrals	0	0	3	Off-site (Pollution incidents to controlled waters): 318 m north. Scrapyard. Pollutant: waste oils. Note: fire in scrap yard. Ref: 296195. Incident severity: Category 2 – significant incident. Date: 20th May 1996 Off-site (Substantiated pollution incident register): 251 m northeast. Incident ref: 1041091. Water impact: category 1 – major incident. Air and land impact: category 4 – no impact. Pollutant: microbiological. Date: 25th September 2012

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
Discharge consents	0	2	2	23 m south (x2). Southern Water Services. Discharge type: public sewer - storm sewage overflow (Ellens Road/Cross Road). Discharge to controlled sea. Ref: A00470, Dates: 15th April 1991 (Revocation date: 15th April 1996) and 15th April 1996, (Revocation date: 26th April 2002)
Registered radioactive substances	0	0	0	-
Landfill and waste				
Active landfills	0	1	0	82 m northeast. Hand tip. No threat to ground or surface water.

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
Historic / closed landfills	0	2	0	82 m northeast. St. Richards Road (Mill Hill). Deposited waste included inert and household waste. Provider Ref: EAHLD19633. WRC Ref: 2200/7249. First input date: 1st January 1976; last input date: 31st December 1987 93 m northeast. St. Richards Road (Mill Hill). Deposited waste included inert waste. Provider Ref: EAHLD19630. First input date: 1st January 1976; last input date: 31st December 1987

Other waste management licences	0	2	2	<u>Off-site (Licensed Waste Management Facilities):</u> 25 m west. The DIY Motorist. Category: metal recycling site (vehicle dismantlers). License issued 29th September 1995 493 m north. The Chalk Pit, Mill Hill. Category: metal recycling site. Licence issued: 29th May 2007. Licence status: surrendered <u>Off-site (Registered Waste Treatment & Disposal Sites):</u> 71 m west. The DIY Motorist. Category: scrapyard. Max input rate: very small (less than 10,000-tonnes per year). Authorised waste: cars/ lorries/ vehicle. License issued: 29th September 1995 300 m north. Sandwich Metal Company, The Chalk Pit. Max input rate: small (10,000-25,000-tonnes per year). Authorised waste: Kent cat B2 - scrap metal, lead/ acid batteries, tyres from vehicles, waste oil in engines /vehicles. Dated:

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
				30th September 1994
Potentially in-filled land (pit, quarry, pond, marsh, river, stream, dock etc)	0	2	5	Off-site (non-water): 104 m northeast. Unknown filled ground (pit, quarry etc.). Date of mapping: 1987 166 m south. Unknown filled ground (pit, quarry etc.). Date of mapping: 1987 286 m north. Unknown filled ground (pit, quarry etc.). Date of mapping: 1987 The remaining two listings are >500 m from the subject site. Off-site (water): The two listings are >500 m from the subject site.
Hazardous substances/ industrial land uses				
Control of Major Accident Hazards (COMAH) sites	0	0	0	-
Explosives sites, Notification of Installations Handling Hazardous Substances (NIHHS), Planning hazardous substance consents/ enforcements	0	0	0	-
Contaminated land Part 2A register entries and notices	0	0	0	-

Contemporary trade directory entries	0	10	39	<u>Off-site <250 m:</u> 22 m west. The DIY Motorist: salvage dealers (inactive) 71 m north. GA Vehicle Repairs: garage services (active) 127 m north. Downs Joinery: joinery manufacturers (inactive) 171 m northeast. Maylands: ornamental metalwork (inactive) 190 m north. J Gifford: road haulage services (inactive) 191 m northeast. Compass Joinery: joinery manufacturers (inactive) 199 m northeast. Deans Carpet Cleaning Services; carpet, curtain and upholstery cleaners (active) 217 m east. Maurice Gill Blacksmith; blacksmiths and foragemasters (active) 241 m east. Rubino Building and Timber Preservation Contractors; damp

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
				and dry rot control (inactive) 245 m southeast. Kingsdown Kleaning: cleaning services, domestic (inactive) The remaining listings are >250 m from the subject property site
Fuel station entries	0	0	1	815 m northeast. Dirk Dunkley Commercial Car Repairs – petrol station. Status: closed.
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.				

In summary, items that have been identified to represent an on-going potential source of contamination that could affect the site comprise:

Off-site

- Historical closed landfill, c. 82 and 93 m northeast (St Richards Road/Mill Hill); and
- Trade directory entries: the western adjacent site comprises of a vehicle servicing/repair and vehicle dismantler type business (DIY Motorist).

These entries have been carried forward for consideration within the initial conceptual site model contained in **Section 6**.

3.3 Information from regulatory authorities

3.3.1 Planning records

No planning records are held by the Local Authority Planning Department pertaining to the site and relevant to the current assessment.

3.3.2 Local Authority environmental health department information

A response from the local authority environmental health department (Kent County Council and/or Dover District Council) has been requested, however, their response has not been received as of this report date.

3.3.3 Petroleum licensing information

A response from the Petroleum Officer at Kent County Council and/or Dover District Council has been requested, however, their response has not been received as of this report date.

3.3.4 Site services

Buried utility services and their backfill can provide preferential pathways for gas, vapour or groundwater to migrate along to another part of the site or to a receptor. They can also represent significant constraints to development. However, obtaining a full set of service plans was outside the scope of this report.

3.4 Summary of previous investigations

A summary of pertinent information from previous investigations is included below in **Table 5**. Relevant information relating to the identified ground and groundwater conditions has not been included within the table below but has been incorporated into the relevant parts of Sections 3.5 - Geology and 3.6 – Mining and quarrying.

Table 5 Summary of previous investigation reports

Report Details	**1. Preliminary Risk Assessment, RSK, April 2017**
Site coverage	The assessment/report included the entire subject site footprint and also a parcel of land to the east of Cross Road
Summary scope of works	- A review of existing reports, geological, hydrogeological and hydrological information, a commercial available environmental database and historical plans - A site walkover - Consideration of the potential risk from UXO - Preliminary comment where the prevailing gradient is 1 in 12 or steeper, and the implications for possible migration of groundwater in the event that SUDS infiltration drainage systems are possible or proposed - Recommendations for intrusive investigations
Does the client have reliance upon the report?	Yes

Key factual findings	Environmental: the conceptual site model (CSM) identified the below linkages with a risk classification of moderate/low or above: - Chemicals associated with the potential made ground at the site relating to the development of Cross Road - Ground gas from on and off-site sources Foundations: subject to site investigations to confirm the condition of the shallow chalk and degree of near surface weathering, it was concluded that the ground conditions may be suitable for the design and construction of relatively shallow spread foundations. The risk associated with natural dissolution features beneath the site is considered to be very low Drainage: It was concluded that the adoption of soakaway drainage or some other form of sustainable urban drainage systems (SUDS) into the Chalk should be assessed by a drainage engineer, together with consultation with the environment agency Recommendations for further work included: - An exploratory subsurface investigation allowing for sample collection and in-situ geotechnical testing. Targeted exploratory holes close to Cross Road and the land adjacent to 'The DIY Motorist' to allow for targeted environmental sampling - Geotechnical and chemical soil analyses, including speciated petroleum hydrocarbons in the vicinity of 'The DIY Motorist' - Installation of ground gas monitoring wells - Discussion with any warranty providers and the local authority to determine their requirements of the site with regards to radon protection

3.5 Site geology

3.5.1 Anticipated geological sequence

Published records (British Geological Survey, 2021) for the area and available historical borehole logs indicate the geology of the site to be characterised by the succession recorded in **Table 6**. There are numerous publicly available BGS historical boreholes located on or within 250 m of the site, a selection of which are presented in **Appendix D**.

Table 6 Site geology

Strata	Description	Estimated thickness	Permeability
Seaford Chalk Formation (across the majority of the site)	Firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardground and thin marls are known from the lowest beds. Some flints nodules are large to very large	50 – 80 m	Intermediate – high permeability
Margate Chalk Member (northern/ north-eastern corner of the site)	Marl-free smooth white chalk with little flint, weakly developed indurated iron-stained sponge beds. There are no formal subdivisions, but informally the member includes a number of laterally persistent flint and marl beds named in Robinson (1986), which can be traced outside Kent in the Southern and "Transitional" provinces where they are correlated with the named beds of Mortimore (1986) within the Newhaven Chalk Formation.	Up to 24 m in the north Foreland to Foreness Point and Palm Bay sections on the isle of Thanet in north Kent	Intermediate – high permeability
Relevant information sources: BGS Geoindex ☒ BGS borehole logs ☒ Previous PRA report ☒			

Whilst not shown on the subject site, superficial head deposits are shown directly to the south. The BGS describes head deposits as comprising ‘gravel and cay depending on the upslope source and distance from the source’

3.5.2 Radon

The environmental database report provides an assessment of site-specific radon risk. In addition, the UK Radon interactive maps was also reviewed. It is indicated that the subject site is located in an area of intermediate to highest radon potential. The maximum radon potential is 1 – 5%.

Note the site-specific assessment within the environmental database report is at a higher resolution and therefore provides greater detail than that publicly available in the indicative radon atlas at www.ukradon.org.

Further assessment may be required, in line with the guidance provided in BRE publication 211 “Radon: Guidance on Protective Measures for New Dwellings (2015)”.

3.6 Mining and quarrying

Evidence has been sought to identify any mining, quarrying, landfilling and land reclamation operations, past and present, which have taken place within 500 m of the site.

3.6.1 Coal mining area

The environmental database report indicates that the subject site is located in an area which may be affected by coal mining activity. Based on a review of The Coal Authority interactive map, the site is located within the Coal Mining Reporting Area, also known as CON29M Coal and Brine Consultation Areas

A CON29M non-residential mining report (Ref: 51001303745001; dated 30 November 2016; appendix D) confirms that:

- Past underground coal mining - The property is not within a surface area that could be affected by past underground mining;
- Present underground coal mining - The property is not within a surface area that could be affected by present underground mining;
- Future underground coal mining - The property is not in an area where the Coal Authority has plans to grant a licence to remove coal using underground methods. The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods. The property is not in an area likely to be affected from any planned future underground coal mining. However, reserves of coal exist in the local area which could be worked at some time in the future. No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence;
- Mine entries - There are no known coal mine entries within, or within 20 metres of, the boundary of the property;
- Coal mining geology - The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining; and
- Past opencast coal mining - The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

3.6.2 Areas of other (rock or mineral) mining and landfilling

Evidence has been sought to identify any mining, quarrying, landfilling and land reclamation operations, past and present, which have taken place within 500 m of the site.

Envirocheck report data identified several chalk pits to the north and northeast of the subject site, these are detailed as c. 100 m northeast on the 1872 to 1908 maps; c. 250 m north on the 1898 to 1908 maps; and c. 75-100 m northeast on the 1898 to 1908 maps.

A reservoir was depicted c. 200 m northeast on the 1907 to 1973 maps.

A brickwork was depicted c. 250-300 m south on the 1906 to 1938 maps; it appears that this area was identified in the Envirocheck report as potentially infilled land (non-water), listed as c. 166 m to the south.

In addition, Envirocheck report data identified two historical landfill sites c. 82 and 93 m to the northeast. The landfills were used to deposit inert and household wastes, and both

appear to have been closed in 1987. The location of these landfills appears to coincide with the location of two former chalk pits detailed above.

No further significant information is listed.

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 a principal aquifer relating to the Seaford Chalk Formation and/or Margate Chalk Member. Groundwater quality beneath the site may be affected by saline intrusion and groundwater levels at the site may be affected by tidal variations due to the proximity of the coast to the east.
Depth to groundwater and flow	The anticipated depth to the groundwater table is in the order of 45 m below ground level estimated from BGS logs (TR34/NE22). The depth of any groundwater is likely to be deeper towards the north of the site with increased site elevation. Shallow groundwater in the site area is anticipated to flow in a south-southwest direction, in line with the local topography.
Rising groundwater levels	Not applicable.
Groundwater recharge/ attenuation	The site is entirely soft landscaping. Unsurfaced and will therefore drain to the ground.
Historical implications for hydrogeology	Three historical chalk pits were located c. 75 to 250 m north and northeast of the site boundary; a historical reservoir was located c. 200 m northeast of the site; and potentially infilled land (non-water) was listed c. 166 m to the south of the site.
Licensed groundwater abstractions	The environmental database report indicates that there are two (2no.). current licensed groundwater abstractions of which both are public water supply boreholes within a 1 km radius of the site.
Source protection zones	Information available in the Envirocheck report indicates that the site lies within Zone 1 (inner protection zone) of the groundwater Source Protection Zone (SPZ). Details of the SPZ designation are contained in **Appendix F**.

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	There are no ponds, streams or drainage ditches on or adjacent to the site. The nearest identified surface watercourse/feature to the site is an unnamed pond located approximately 680m to the west-southwest of the site (Church Farm). In addition, the English Channel is located approximately 1.78 km to the east of the site. This watercourse is tidal.
Surface water abstractions	There are no surface water abstractions identified by the environmental database, within a 1 km radius of the site.
Site drainage	The site is covered by soft landscaping, therefore surface drainage from the site would infiltrate into the underlying soils. It should be noted that a storm drain line/ water culvert or sewer drain line dissects the eastern portion of the site in a north-south direction; the exact nature of this drain is unknown, however site observations indicate this does not emanate or discharge on the subject property.
Preliminary flood risk assessment	The indicative floodplain map for the area, shows that the site does not lie within 100 m of a Zone 2 or Zone 3 flood zone. A flood risk assessment (FRA) is outside the scope of this report.

3.9 Sensitive land uses

There are no recorded sensitive land uses (SSSI's, ancient woodland, Ramsar sites etc.) within 1 km of the subject site.

4 SITE RECONNAISSANCE FINDINGS

A site reconnaissance survey was completed on 9th June 2021 by RSK. The characteristics of the site observed during the walkover and from current ordnance Survey maps are summarised in **Table 9**. RSK was unaccompanied during the site walkover. Due to dense vegetation present (mature shrubs and trees), the western corner/boundary and southern boundary were not accessible.

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 9 Site reconnaissance findings

Feature	Description
Physical characteristics	
Access constraints	Vehicular and pedestrian access from the corner of Cross Road and Ellens Road (southeast corner of the site). Pedestrian access only from Cross Road (at the northeast corner of the site).
Site topography	Site topography falls gently from the north-northeast to the south-southwest.
Surface cover	Soft landscaped – open greenfield throughout: arable land occupies much of the site. The northern portion (field) is fallow. Thick vegetation (mature trees and shrubs) is present on the western boundary/corner and southern boundary.
Site drainage	None identified, therefore assumed surface drainage from the site would infiltrate directly into the ground and/or via field land drains leading off-site. It should be noted that a storm drain line/water culvert/sewer drain line dissects the eastern portion of the site in a north-south direction; the exact nature of this drain is unknown, however site observations indicate this does not emanate or discharge on the subject property.
Surface water	None identified on site.
Trees and hedges	A mature wooded area (a mix of trees and shrubs) is present along the western boundary/corner and southern boundary. Semi-mature and mature hedgerows are present along the majority of the site boundaries.
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.

Feature	Description
Retaining walls and adjacent buildings on or close to site boundary	There are no such structures on or close to the site boundary.
Basements on-site	No evidence of existing or infilled basements was observed.
Made ground, earthworks and quarrying	None observed. Assumed limited localised reworking associated with the storm drain line/water culvert/sewer drain line that dissects the eastern portion of the site in a north-south direction.
Potentially unstable slopes on or close to site	None observed.
Buried and overhead services present	There are several manhole covers on-site associated with the aforementioned storm drain line/water culvert/sewer drain line. Overhead services were noted along the eastern boundary of the site, along Cross Road.
Environmental characteristics	
Underground/ above ground storage tanks and pipework	None observed.
Potentially hazardous materials storage and use	None observed.
Asbestos-containing materials	None observed. Albeit potential within localised reworked soils associated with the storm drain line/water culvert/sewer drain line.
Waste storage	None observed.
Fly-tipping	None observed.
Electricity sub-stations/ transformers	None observed on or close to site.
Evidence of possible land contamination on-site	None observed.
Potential off-site sources of ground contamination	The DIY Motorist (a vehicle servicing/repair and dismantler business) is located adjacent to the west.

In summary, items that have been identified to represent environmental and/or geotechnical hazards that could affect the site comprise:

- On-site: localised reworked soil associated with the storm drain line/water culvert /sewer drain line that dissects the eastern portion of the site in a north-south direction.

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; and
- 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 Category 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 10** together with an assessment of whether the site may be affected by each of the stated hazards.

Table 10 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	☒	☐	Likely to affect ground engineering and foundation design and construction
Shrinkable clay soils	☐	☒	Design to NHBC Standards Chapter 4 or similar

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	
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	☒	☐	Likely to affect ground engineering and foundation design and construction
Running sand at and below water 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)	☐	☒	May affect temporary and permanent works
Rising groundwater table due to diminishing abstraction in urban area	☐	☒	May affect deep foundations, basements and tunnels
Geological faults, fissures and break lines	☐	☒	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

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	
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)	☐	☒	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	☐	☒	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.			

5.2.1 Environmental database report

The environmental database report indicates:

- Potential for collapsible ground stability hazards: very low;
- Potential for compressible ground stability hazards: no hazard;
- Potential for ground dissolution stability hazards: low to very low;
- Potential for landslide ground stability hazards: no hazard to very low;
- Potential for running sand ground stability hazard: no hazard; and
- Potential for shrinking or swelling or clay ground stability hazard: no hazard.

5.2.2 Chalk

In view of the prevailing ground conditions, with Chalk at shallow depth beneath the site, it is normal practice to consider the potential risk of ground subsidence related to the presence of swallow holes and other natural chalk solution features or man-made cavities.

Based on the Edmund's risk assessment model for natural dissolution features referred to in CIRIA Report C574 (Lord et al. 2002), the site falls into the 'very low anticipated subsidence risk' category. With reference to Edmund's database of known natural and man-made chalk solution features there are no such features in the immediate vicinity of the site.

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 11**. Ground gas sources are addressed in the next section.

Table 11 Potential sources of soil and groundwater contamination

Potential sources	Contaminants of concern
On-site	
Possible Made ground – associated with the installation of the storm drain line/water culvert/sewer drain line and/or drain covers, which dissects the eastern portion of the site in a north-south direction.	Unknown fill material but potentially including brick, ash and clinker and containing toxic and phytotoxic metals, inorganics, polycyclic aromatic hydrocarbons (PAHs), asbestos
Pesticides, herbicides, fertilisers	Organochlorines, organophosphorus
Off-site	
Adjacent industrial/commercial activities: the western adjacent site (DIY Motorist) comprises vehicle servicing/repair and vehicle dismantler type operations	Unknown but potentially including petroleum hydrocarbons, fuel additives, PAHs, chlorinated solvents, asbestos
Historical landfills/ infilled former chalk pits (c. 82 and 93m northeast)	Inert/household waste. Landfill leachate including ammoniacal nitrogen, chloride

Potential sources of contamination on-site are anticipated to be largely restricted to any discrete areas of made ground (if any) associated with the storm drain line/water culvert /sewer drain line and/or drain covers, which dissects the eastern portion of the site in a north-south direction, any potential migration of contaminants from the adjacent 'The DIY Motorist' on the western adjacent property, and any potential contaminants associated with the use of pesticides, herbicides, and fertilisers from the agricultural uses onsite.

Off-site sources from historical pollution incidents, discharge consents, other contemporary trades (other than those listed above) and fuel stations have been omitted owing either to the absence of incident/significant incident and/or proximity of each entry recorded within the environmental database.

Given the anticipated ground conditions (Seaford Chalk Formation and/or Margate Chalk Member of intermediate-high permeability), and the proximity of the historic landfills (c. 82 – 93 m northeast) to the subject site, potential sources of ground gas generation have been identified and are further discussed in Section 6.2.

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];
- current adjacent site users – residential, commercial, and agricultural end-use [migration of contamination via dust/fibre deposition, vapour or groundwater migration combined with inhalation];
- 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
- controlled waters: groundwater in principal aquifer and source protection zone 1 of the Seaford Chalk Formation and/or Margate Chalk Member bedrock deposits [percolation through permeable strata to aquifer/ lateral migration of dissolved phase/ NAPL etc.*].

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.

Ecological receptors are only considered within the conceptual model in the context of statutory protected sites.

6.2 Potential ground gas linkages

6.2.1 Ground gas generation potential

Potential ground gas sources identified for the site and surrounding are shown in **Table 12**.

Table 12 Potential ground gas sources

Potential sources	Indicative ground gas generation potential (CIEH, 2008)	Additional information
On-site		
Natural carbonate soil and strata such as chalk and limestone	Very low	Carbon dioxide likely to have a very low ground gas generation potential
Off-site		
Former St Richards Road landfill site (c. 82m northeast of the site) accepting inert and household waste	High	Carbon dioxide, methane and trace gases. Potentially high ground gas generation potential based on the acceptance of household waste

Given the anticipated ground conditions set out above, significant potential sources of ground gas generation have been identified associated with the historical St Richards Road landfill site (c. 82 m northeast), which accepted household waste (and also inert waste). While there is residential development both on and surrounding this former landfill site, it remains a potential unknown source of ground gas.

6.2.2 Preferential pathways for ground gas migration

Credible preferential pathways potentially connecting the source and receptor through vertical and lateral migration are:

- geology of the Seaford Chalk Formation and/or Margate Chalk Member which is likely to be permeable;
- Possible made ground;
- faults/ fissures/ fractures in the underlying geology;
- building foundations;
- construction joints and cracks within building structures; and
- utility routes and service penetrations into buildings.

6.2.3 Sensitive receptors and linking pathways

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

- future site users – residential users [migration and ingress of ground gases into buildings, build-up in confined spaces and explosion/ asphyxiation]; and
- future buildings and services [migration and ingress of ground gases into buildings, build-up in confined spaces and explosion].

The assessment has identified receptors to include building structures and proposed end-users.

Construction workers have not been identified as receptors for the purposes of this assessment. Risks may still be present to construction workers especially where works include the entry into excavations within the ground. Construction workers should undertake appropriate risk assessments and risks should be managed through health and safety procedures and the use of PPE.

6.3 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 F**. 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
Possible made ground/reworked soils associated with storm drain line/water culvert /sewer drain line that dissects the eastern portion of the site in a north-south direction	Future site users	Direct contact (oral, dermal, inhalation)	Low likelihood	Medium	**Moderate/low**	*Low likelihood* of future contact given anticipated localised nature of any potential impacted Made Ground soils (if any) and, anticipated free-draining nature of underlying soils with respect to the potential application of any pesticides, herbicides and fertilisers. *Medium* severity conservatively assigned given unknown extent and chemical composition of any impacted Made Ground soils and unknown use/concentrations of any potential pesticides, herbicides, and fertilisers.
Possible use of pesticides, herbicides and fertilisers	Current adjacent site users		Unlikely	Medium	Low	Future contact *Unlikely* assuming construction best practice adopted and adhered to. *Medium* severity conservatively assigned given unknown extent and chemical composition of any impacted Made Ground soils and unknown use/concentrations of any potential pesticides, herbicides, and fertilisers.
Off-site/adjacent vehicle servicing/repair and vehicle dismantler type	Future buildings and services	Direct contact (chemical attack on infrastructure and buildings)	Unlikely	Medium	Low	Future contact *Unlikely* given anticipated localised nature of any potential impacted Made Ground soils (if any) and, limited impact of contaminant of concern with regards to pesticides, herbicides, and fertilisers. *Medium* severity conservatively assigned given unknown extent and chemical composition of any impacted soils

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
business (The DIY Motorist)	Future vegetation	Direct contact (root uptake)	Low likelihood	Mild	Low	*Low Likelihood* given anticipated localised nature of any potential impacted Made Ground soils (if any) and given the absence of any obvious signs of gross vegetative stress. *Mild* severity assigned given reduced sensitivity of receptor (vegetation)
	Controlled waters: Principal aquifer and SPZ 1 of the Seaford Chalk Formation and/or Margate Chalk Member bedrock deposits	Vertical and lateral migration including leaching	Unlikely	Medium	Low	*Unlikely* given anticipated localised nature of any potential impacted Made Ground soils (if any) and, limited impact of contaminant of concern with regards to pesticides, herbicides, and fertilisers. *Medium* severity conservatively assigned given unknown extent and chemical composition of any impacted soils
Hazardous ground gases –	Future site users	Inhalation – via migration	Unlikely	Severe	**Moderate/Low**	*Unlikely* assigned based on the anticipated 'low' ground gas generation potential of off-site sources.

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
including carbon dioxide, methane and trace gases	Future buildings and services	through the geology/possible made ground, faults/ fissures/ fractures in the underlying geology building foundations, construction joints/cracks, services				*Severe* severity assigned given the potential for explosive atmosphere and/or asphyxiation

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:

- Direct contact with potentially impacted localised Made Ground (eastern portion of the site in the vicinity of the drain line/water culvert/sewer drain line) by future site users;
- Direct contact with potential site-wide pesticides, herbicides, and fertilisers by future site users; and
- Inhalation of potentially hazardous ground gases/soil vapours from off-site sources (north-northeast) by future site users.

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.

6.4 Data gaps and uncertainties

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

- due to dense vegetation present (mature shrubs and trees), the western corner/boundary and southern boundary were not accessible;
- presence/absence of invasive species (Japanese knotweed or otherwise) at the western corner/boundary and western boundary;
- depth to and soil parameters of the underlying natural geology;
- use (historical/current) of any pesticides, herbicides, and fertilisers;
- presence/absence and chemical composition of localised Made Ground (if any) along the eastern portion of the site;
- presence/absence of unexploded ordnance; ‘high‘ potential assigned; and
- groundwater depth and flow direction are conceptual at this stage.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Geo-environmental assessment

The potential for significant and widespread contaminative impact is considered 'low' however, there remains a potential for localised impact, most notably on the eastern portion of the site in the vicinity of the drain line/water culvert/sewer drain line.

Whilst similar considered of 'low' risk, there remains a potential for site-wide historical/current use of pesticides, herbicides and fertilisers.

Whilst the likelihood of hazardous ground gases associated with the former 'inert and household waste' landfill are considered 'unlikely', based on a assumed 'low' ground gas generation potential associated with 'inert and household waste' deposits, a 'moderate-low' risk valuation has been assigned in lieu of any confirmatory ground gas monitoring data.

On this basis, the Conceptual Site Model indicates an overall 'moderate/low' risk for the subject. A conservative approach to the potential pollutant linkages has been adopted given the proposed end-use (residential).

Given there is a potential for localised Made Ground of unknown chemical composition and/or remnant concentrations of pesticides, herbicides and fertilisers, intrusive exploratory works with supplementary laboratory testing, monitoring and subsequent risk assessment is recommended. Confirmatory ground gas monitoring will be required as part of any future exploratory works and assessment.

In addition, exploratory holes advanced in the southwest corner of the site, as access allows (adjacent to 'The DIY Motorist') for targeted environmental sampling (including speciated petroleum hydrocarbons) would be prudent given the location of the business to the site and nature of operations, and proposed residential end-use.

Intrusive exploratory works will allow quantitative evaluation of the potentially complete pollutant linkages identified in Section 6.2 and allow subsequent refinement of the initial conceptual site model.

In addition, intrusive exploratory works will also enable many of the data gaps and uncertainties highlighted within Section 6.3 to be addressed.

7.2 Geotechnical assessment

The subject site is underlain by the Seaford Chalk Formation and/or Margate Chalk Member bedrock geology, which are likely present at shallow depth.

Subject to site investigation to confirm the condition of the shallow chalk and the degree of near surface weathering, the ground conditions may be suitable for the design and construction of relatively shallow spread foundations for the proposed residential development.

In the absence of any soil parameters to inform future foundation design intrusive exploratory works with in-situ and laboratory testing is recommended.

The intrusive exploratory works will allow the underlying geology to be determined including the establishing the presence/absence and thickness of any Made Ground, and potentially unsuitable superficial deposits.

Prior to any intrusive works, it is recommended that a preliminary unexploded ordnance (UXO) risk assessment is commissioned.

It is recommended that any intrusive exploratory works are undertaken as part of a combine geo-environmental and geotechnical site investigation.

REFERENCES

Previous SI reports and other site related information

Preliminary Risk Assessment, RSK, April 2017

Standards and guidance

British Standards Institution (BSI) (2020), 'BS 5930:2015+A1:2020. Code of practice for ground investigations'.

British Standard Institution (BSI) (2019), 'BS 8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

British Standards Institution (BSI) (2011), 'BS 10175:2011 + A2:2017. Investigation of potentially contaminated sites: Code of practice'.

British Standards Institution (BSI) (2013), BS8576:2013. Guidance on investigations for ground gas – permanent gases and volatile organic compounds (VOCs).

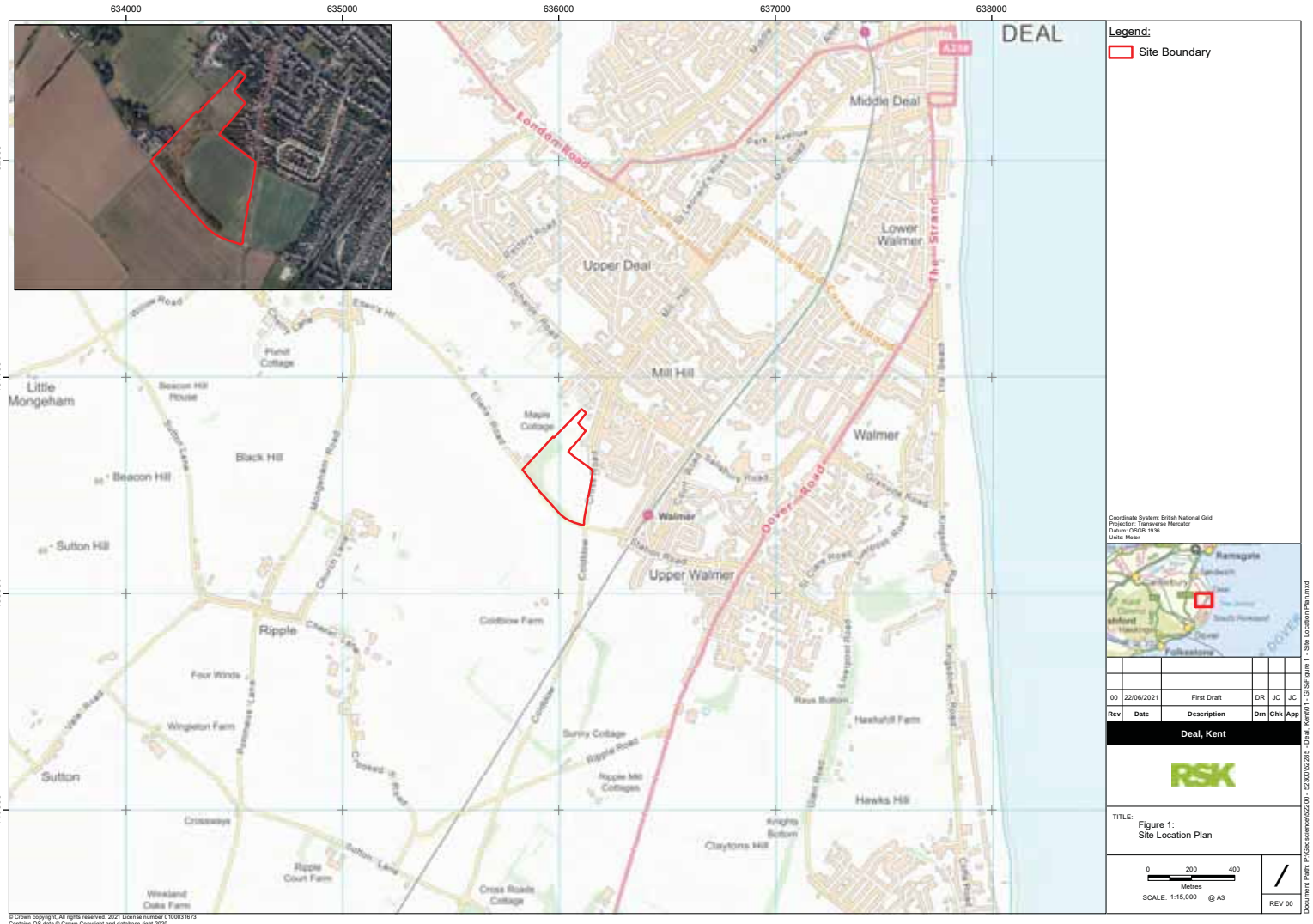
Environment Agency (2020), Land contamination risk management, https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm, April 2021

Part IIA of the Environmental Protection Act (Contaminated Land Regulations (England)) 2002.

Rudland, D. J., Lancefield, R. M. and Mayell, P. N. (2001), CIRIA C552. Contaminated Land Risk Assessment: A Guide to Good Practice.

Stone, K., Murray, A., Cooke, S., Foran, J., Gooderham, L., (2009) CIRIA C681, Unexploded Ordnance (UXO). A guide or the construction industry.

FIGURES



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Site Boundary

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/06/2021	First Draft	DR	JC	JC

Deal, Kent

RSK

TITLE:
Figure 1:
Site Location Plan

0 200 400
Metres
SCALE: 1:15,000 @ A3

REV 00

Document Path: P:\Geoscience\52200\ - 52300\52385 - Deal, Kent\01 - GIS\Figure 1 - Site Location Plan.mxd

Legend:

Site Boundary

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/06/2021	First Draft	DR	JC	JC

Deal, Kent

RSK

TITLE:
Figure 2:
Site Layout Plan

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Metres
SCALE: 1:2,500 @ A3

REV 00

Document Path: P:\Geoscience\522\00\52285 -Deal, Kent\01 - GIS\Figure 2 - Site Layout Plan.mxd

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 Gladman Developments Ltd (the "Client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and the Client, dated 19th April 2021..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*

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

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Not Supplied - Holocene
	HEAD	Head	Silt and Gravel	Not Supplied - Quaternary
	HEAD	Head	Clay and Silt	Not Supplied - Quaternary
	HEAD	Head	Clay, Silt, Sand and Gravel	Not Supplied - Quaternary
	BTFU	Beach and Tidal Flat Deposits (Undifferentiated)	Sand and Gravel	Not Supplied - Quaternary
	STOB	Storm Beach Deposits	Sand and Gravel	Not Supplied - Quaternary
	BTFU	Beach and Tidal Flat Deposits (Undifferentiated)	Sand, Silt and Clay	Not Supplied - Quaternary
	CWF	Clay-with-flints Formation	Clay, Silt, Sand and Gravel	Not Supplied - MIOCENE

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MACK	Margate Chalk Member	Chalk	Not Supplied - Santonian
	SECK	Seaford Chalk Formation	Chalk	Not Supplied - Coniacian
		Faults		

RSK

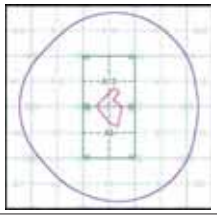
Geology 1:50,000 Maps

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:	290
Map Name:	Dover
Map Date:	1966
Bedrock Geology:	Available
Superficial Geology:	Available
Artificial Geology:	Not Available
Faults:	Not Supplied
Landslip:	Available
Rock Segments:	Not Supplied

Geology 1:50,000 Maps - Slice A



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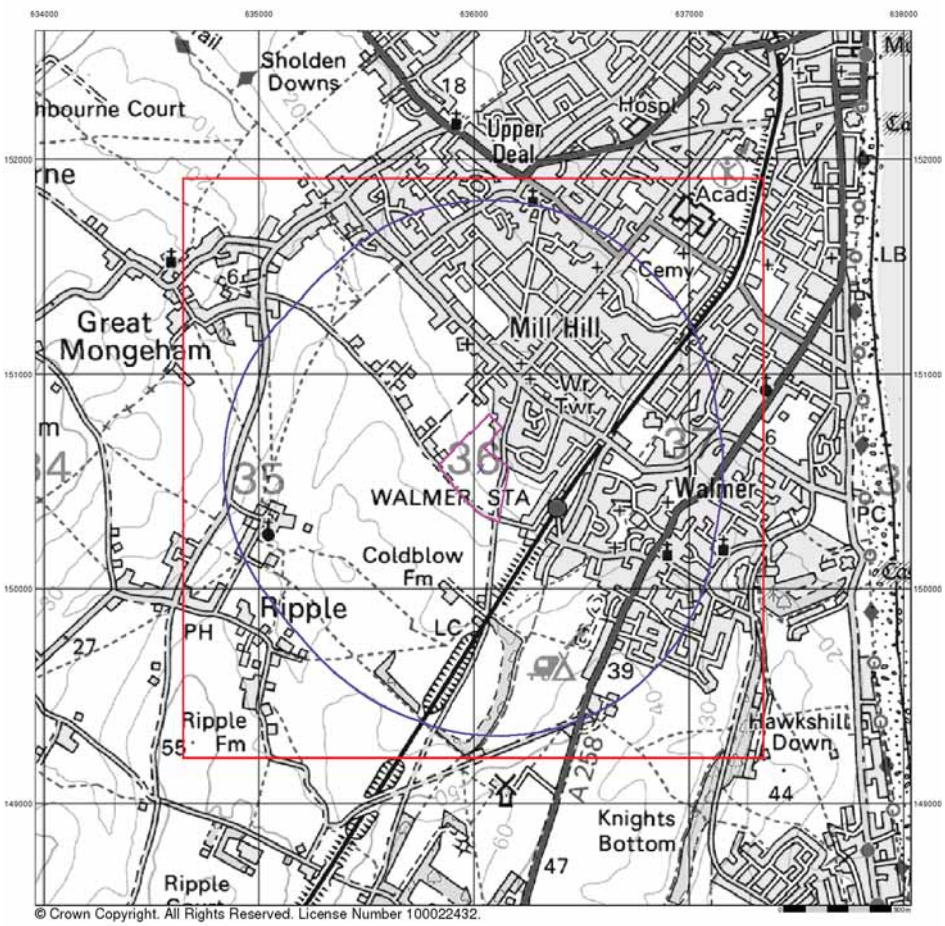
Site Area (Ha):	8.53
Search Buffer (m):	1000

Site Details:

April Cottage, Ellens Road, DEAL, CT14 9JJ

Landmark INFORMATION GROUP

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



Artificial Ground and Landslip

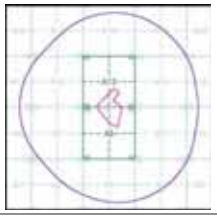
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions 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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Slice:	A
Site Area (Ha):	8.53
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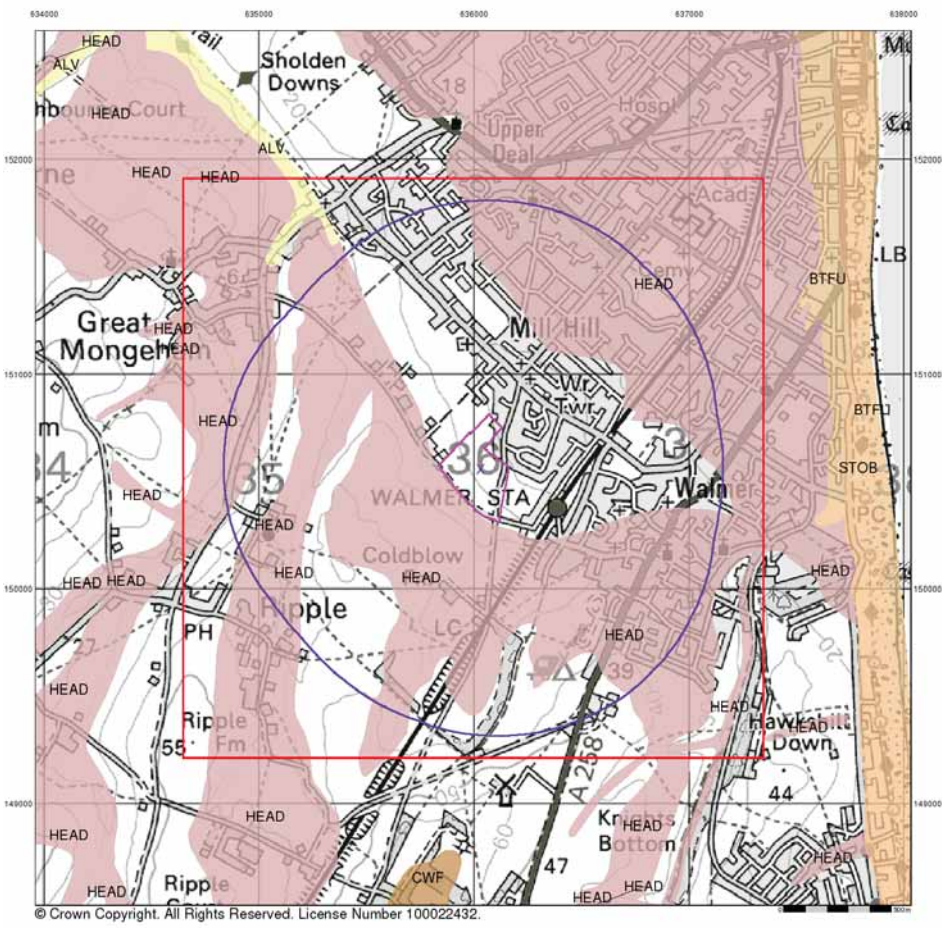


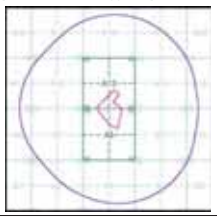
Superficial Geology

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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Site Details:

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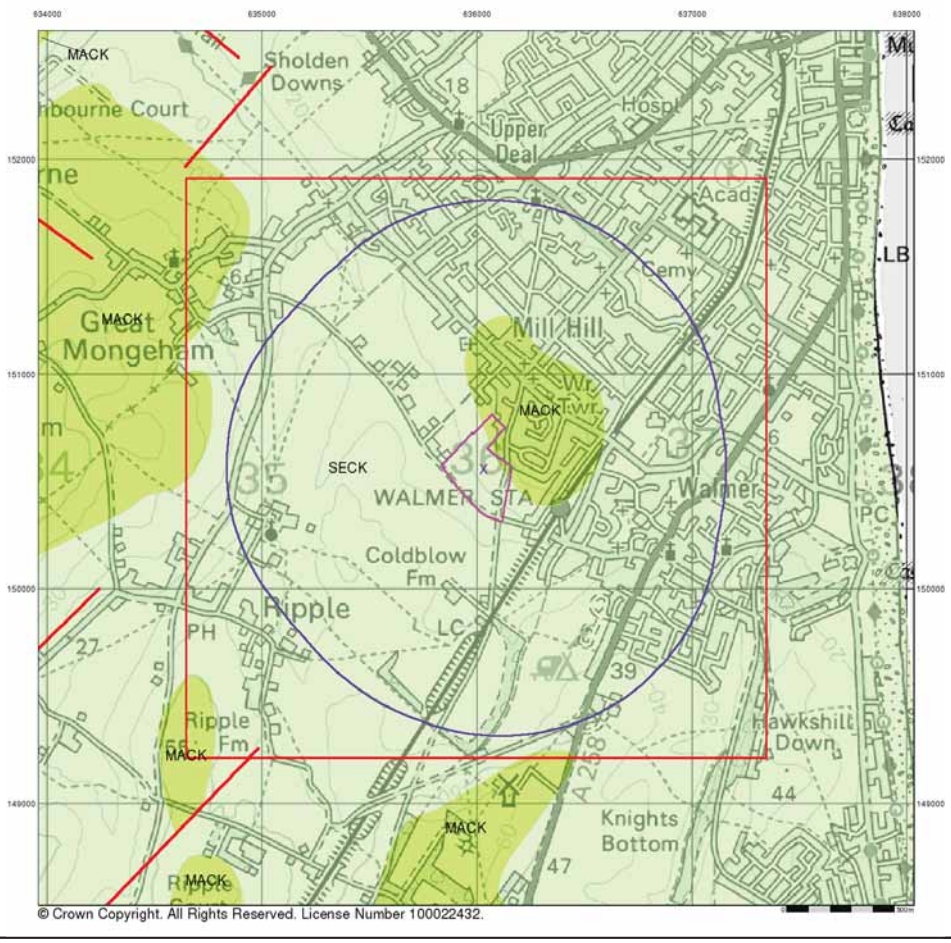


Bedrock and Faults

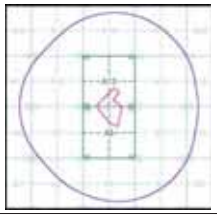
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

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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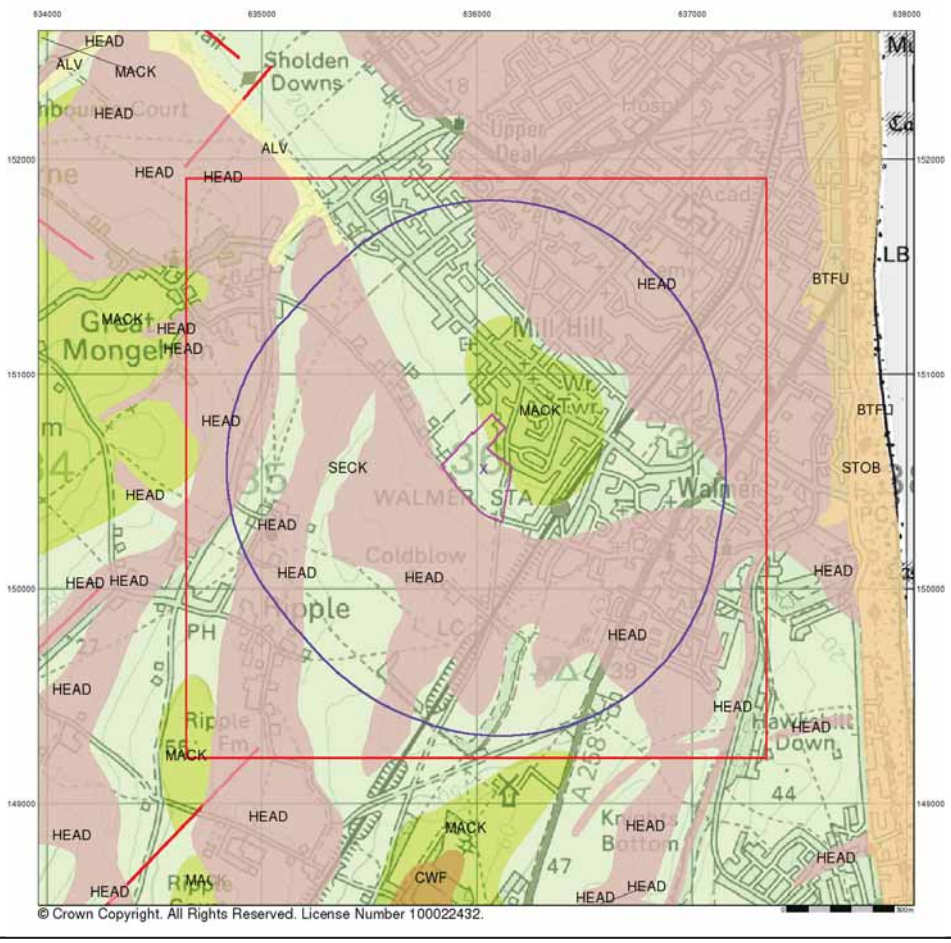


Combined Surface Geology

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.

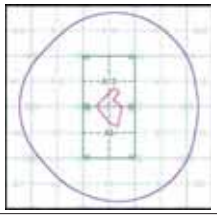
Additional Information

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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Slice:	A
Site Area (Ha):	8.53
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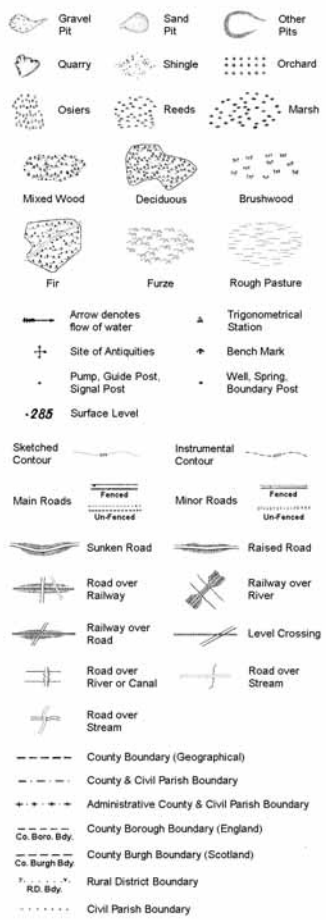
Site Details:

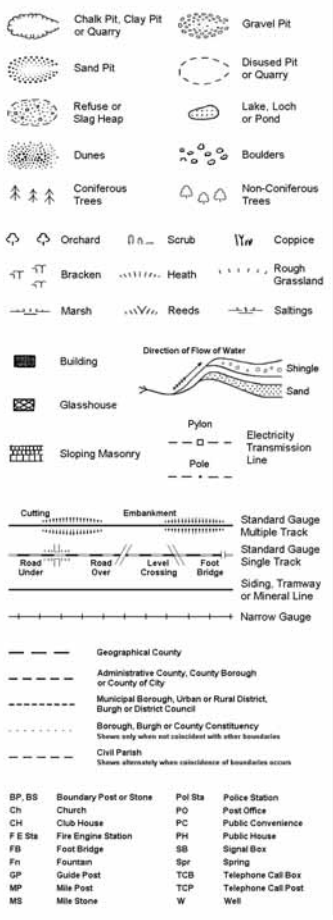
April Cottage, Ellens Road, DEAL, CT14 9JJ

Historical Mapping Legends

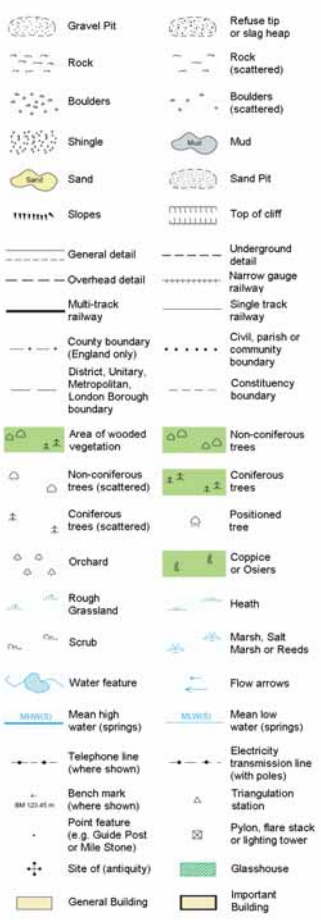
Ordnance Survey County Series 1:10,560



Ordnance Survey Plan 1:10,000



1:10,000 Raster Mapping



RSK

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
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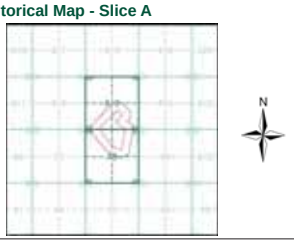
Kent	1:10,560	1907 - 1908	4
Kent	1:10,560	1907 - 1908	5
Kent	1:10,560	1907 - 1908	6
Kent	1:10,560	1938	7
Kent	1:10,560	1938	8
Historical Aerial Photography	1:10,560	1947 - 1948	9
Ordnance Survey Plan	1:10,000	1960 - 1961	10
Ordnance Survey Plan	1:10,000	1970 - 1973	11
Ordnance Survey Plan	1:10,000	1981 - 1987	12
Ordnance Survey Plan	1:10,000	1991 - 1993	13
10K Raster Mapping	1:10,000	1999	14
10K Raster Mapping	1:10,000	2006	15
VectorMap Local	1:10,000	2021	16

Historical Map - Slice A

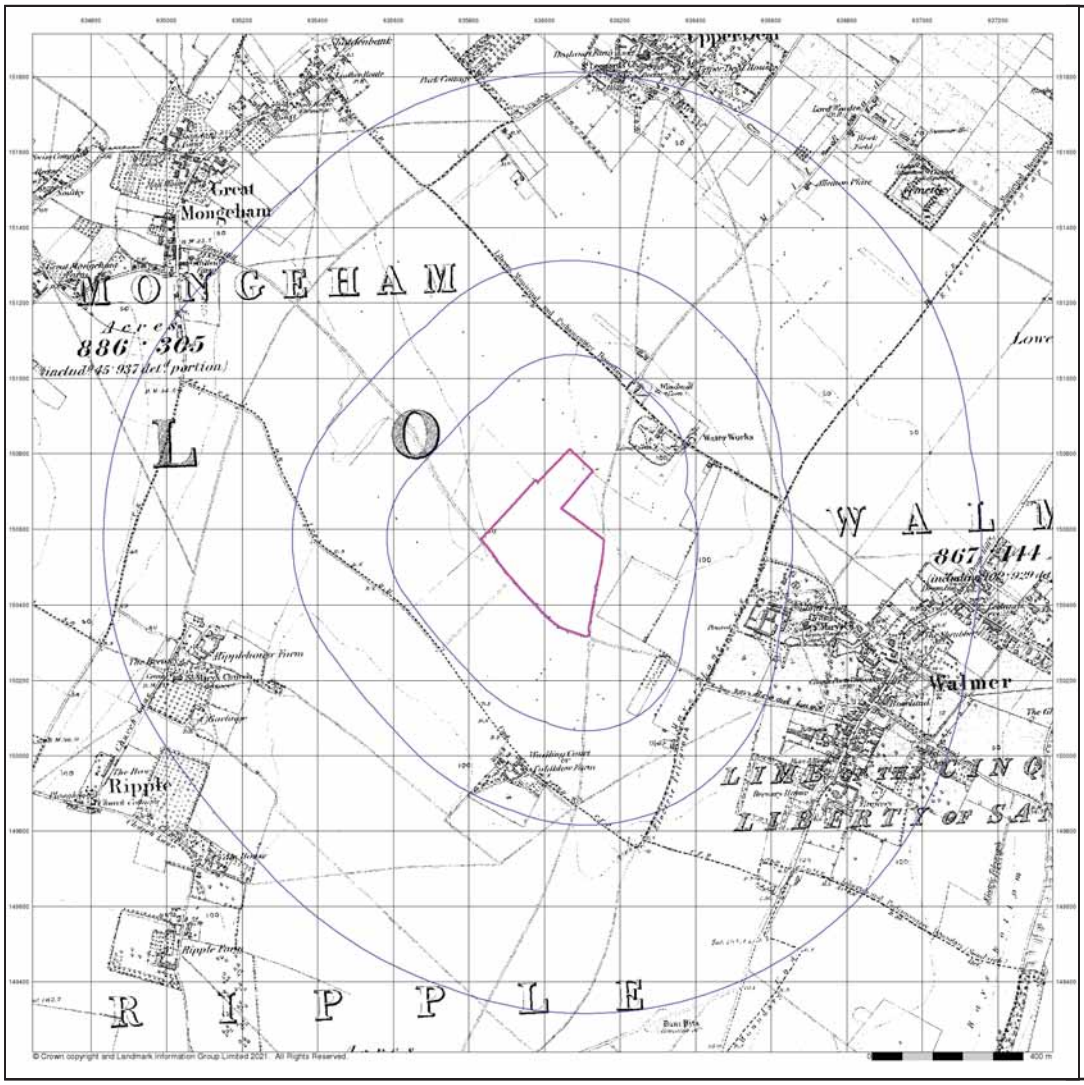


Order Details

Order Number: 279891064_1_1
Customer Ref: P02114644
National Grid Reference: 636030, 150560
Slice: A
Site Area (Ha): 8.53
Search Buffer (m): 1000

Site Details

April Cottage, Ellens Road, DEAL, CT14 9JJ



RSK

Kent

Published 1877

Source map scale - 1:10,560

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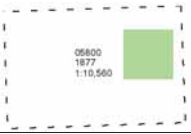
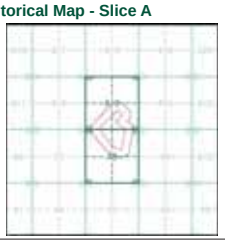
Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	279891064_1_1
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Tel: 0844 844 9952
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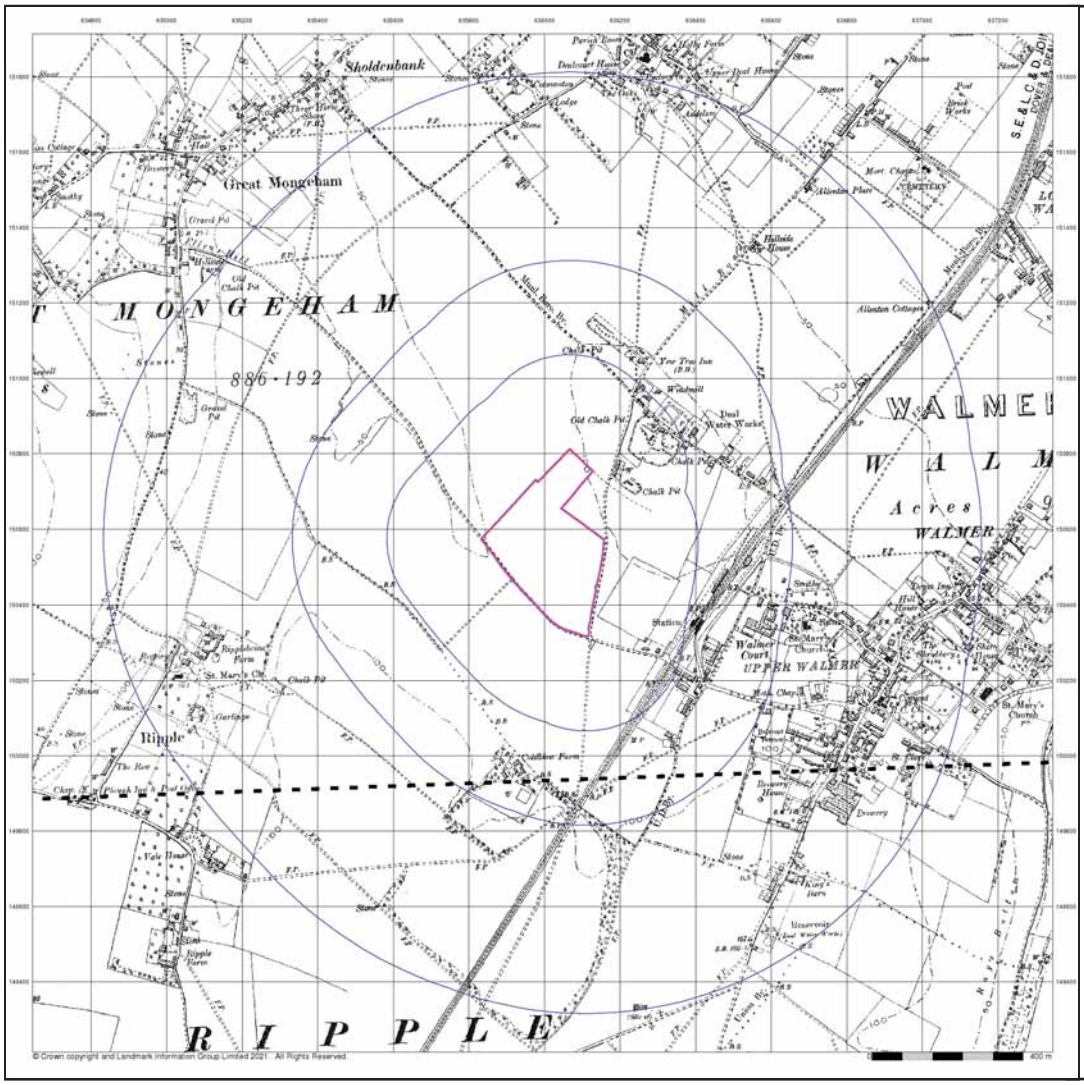
Web: www.envirocheck.co.uk



Kent

Published 1898 - 1899

Source map scale - 1:10,560

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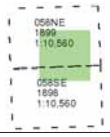
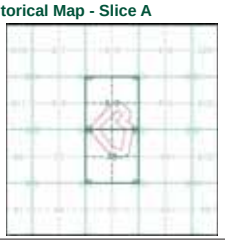


Historical Map - Slice A



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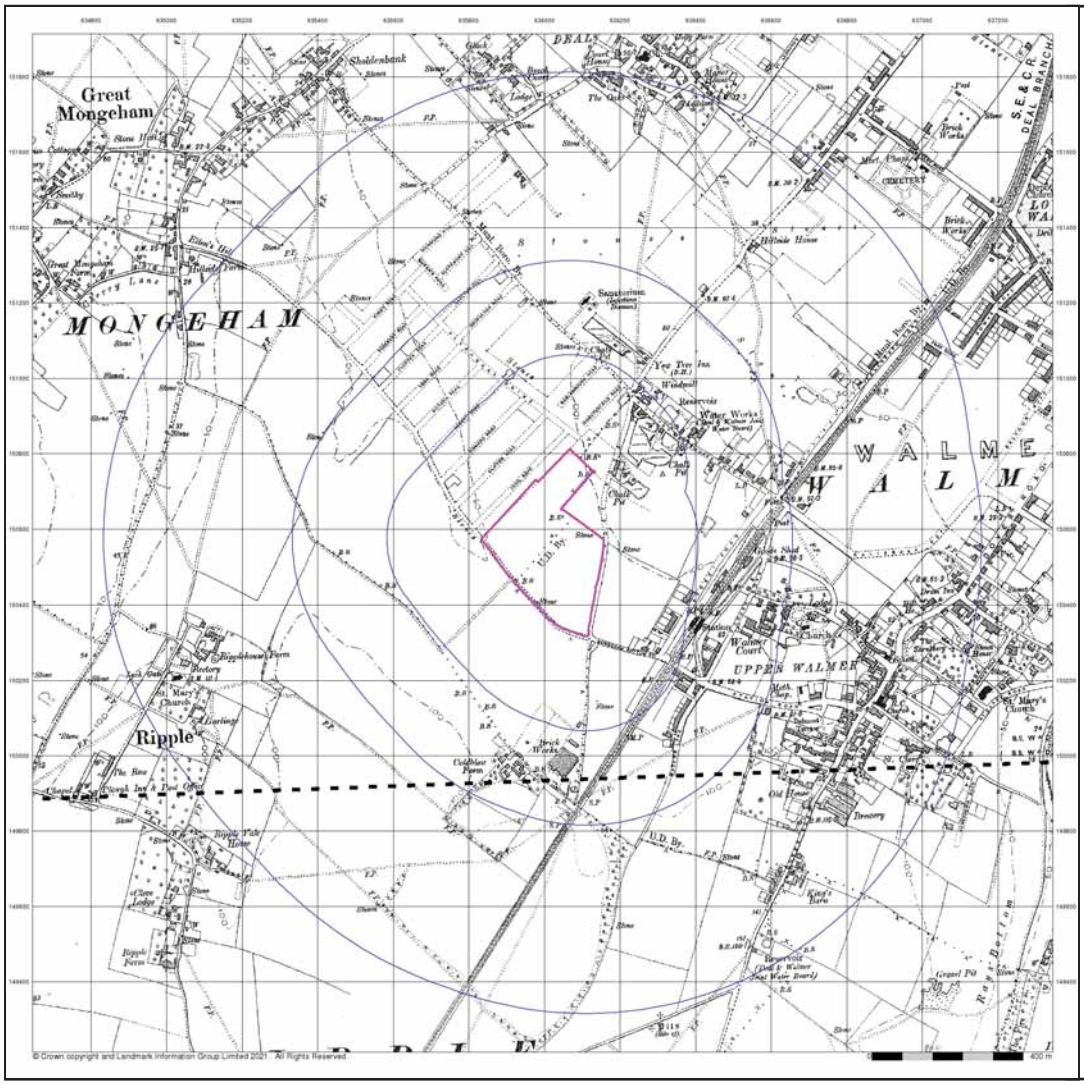

RSK

Kent

Published 1907 - 1908

Source map scale - 1:10,560

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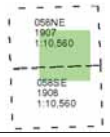
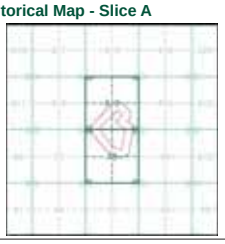
Map Name(s) and Date(s)



Historical Map - Slice A



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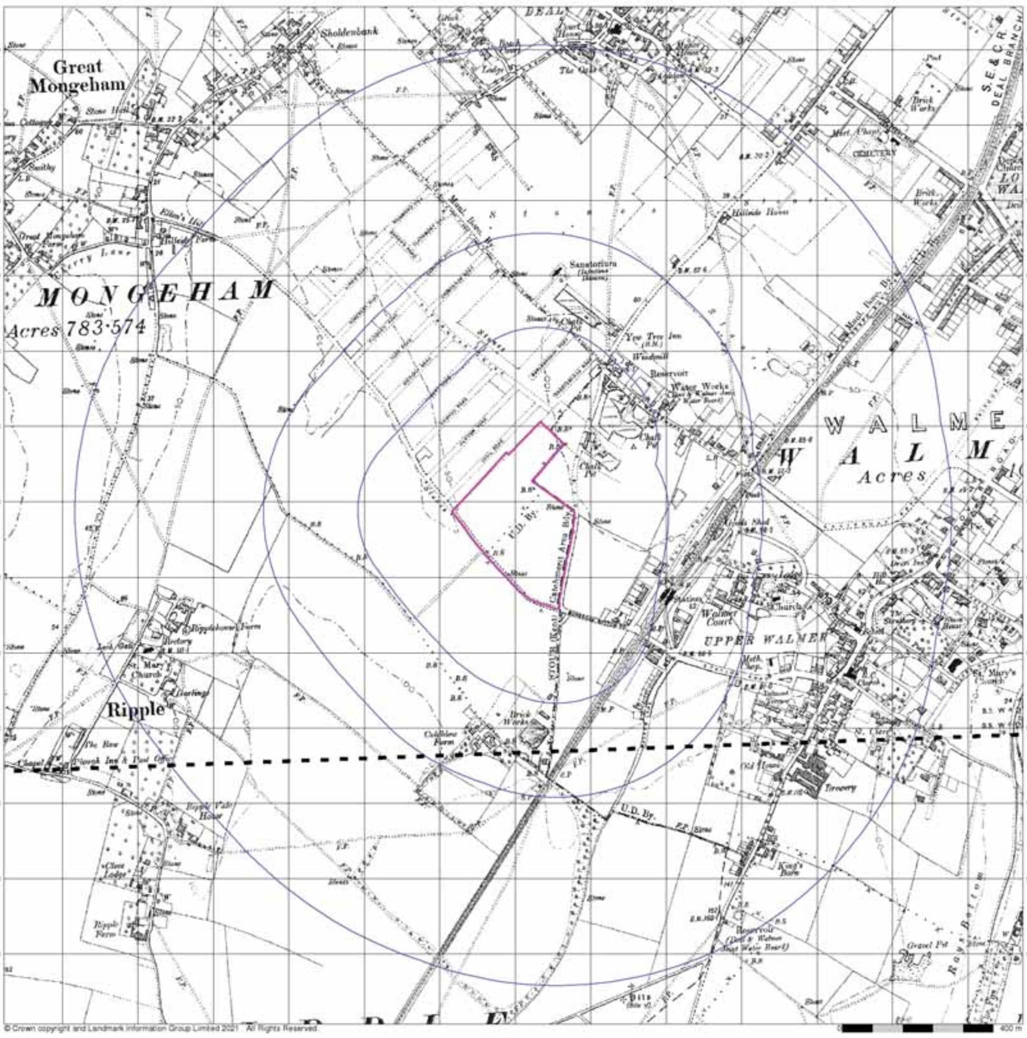

400 m

RSK

Kent

Published 1907 - 1908

Source map scale - 1:10,560

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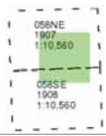
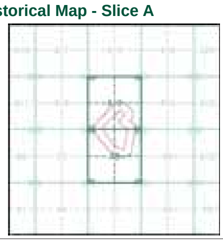


Historical Map - Slice A



N

Order Details

Order Number: 279891064_1_1
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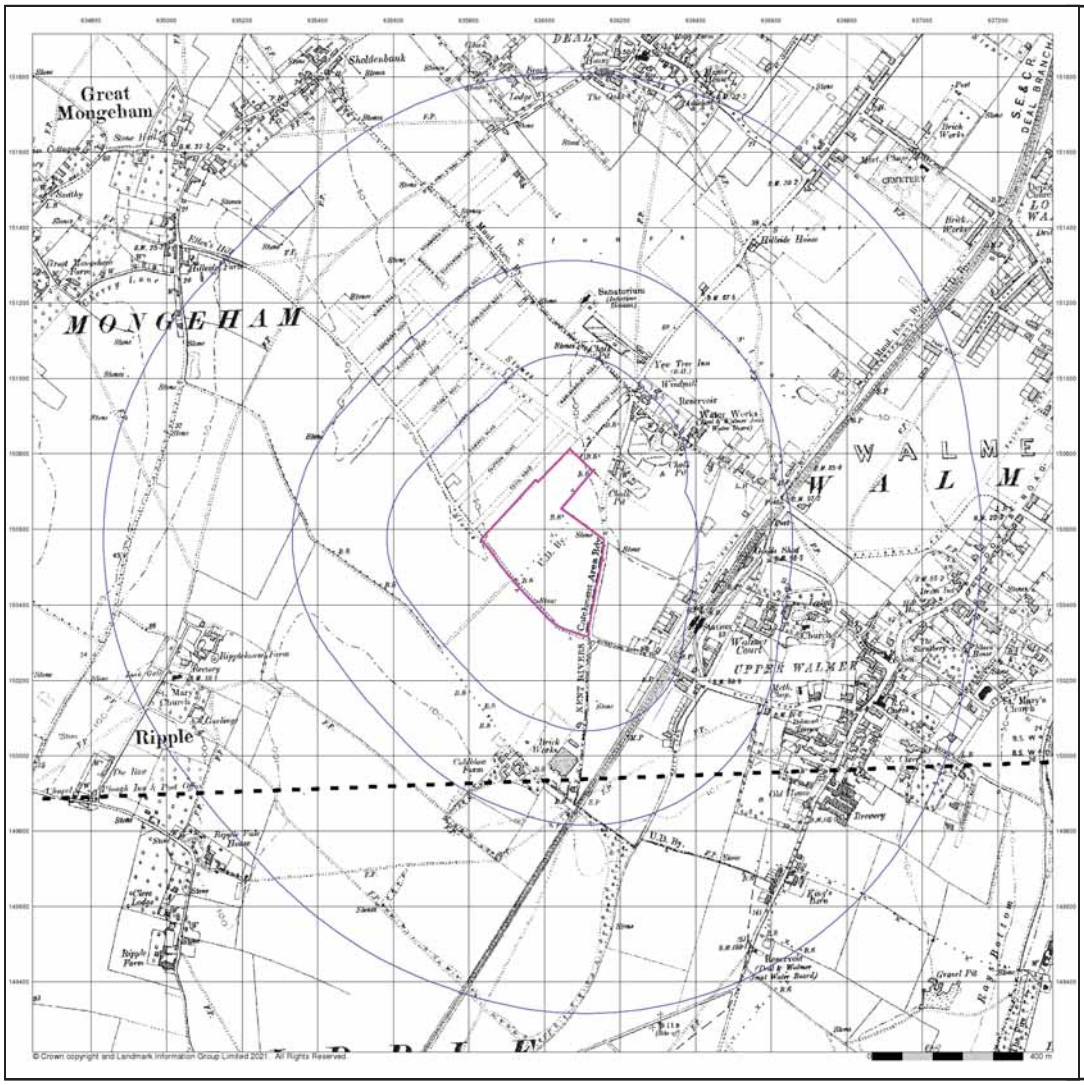

Kent

Published 1907 - 1908

Source map scale - 1:10,560

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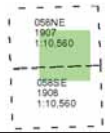
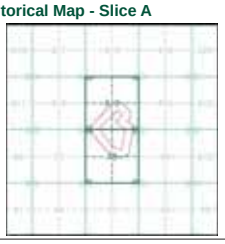


Historical Map - Slice A



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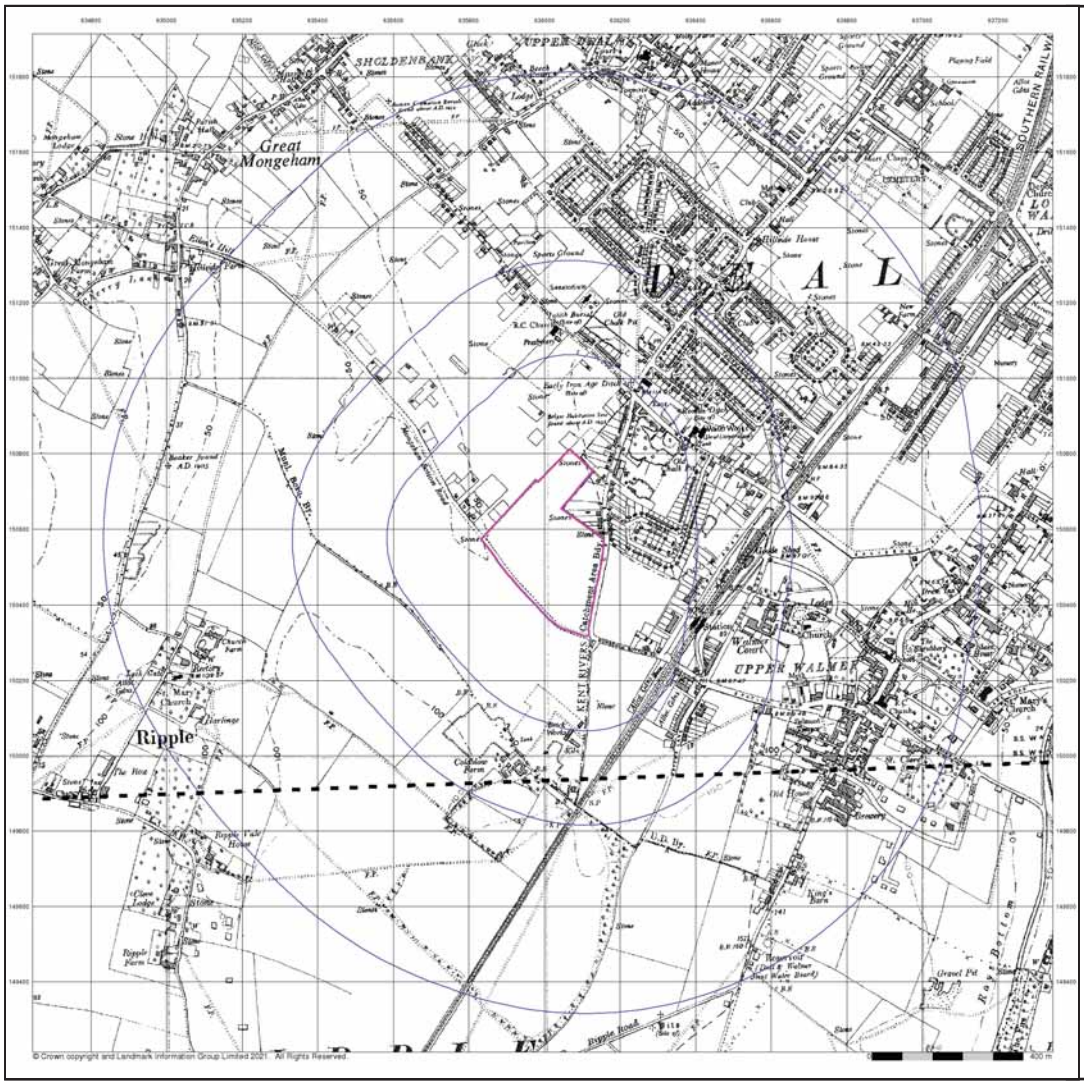

RSK

Kent

Published 1938

Source map scale - 1:10,560

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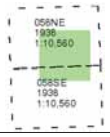
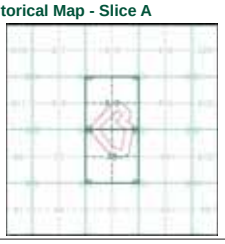


Historical Map - Slice A



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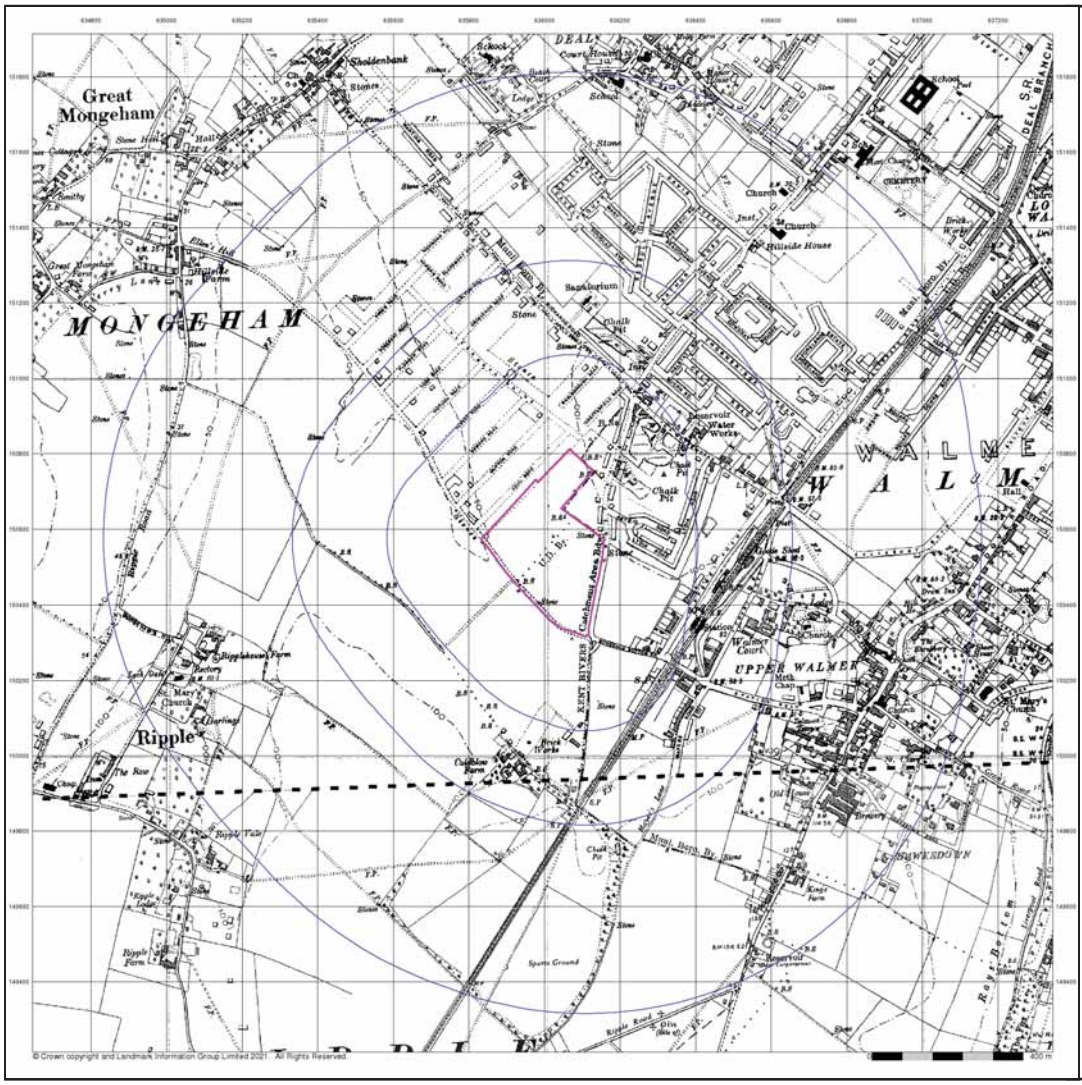

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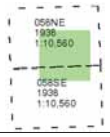
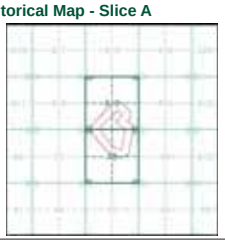


Historical Map - Slice A



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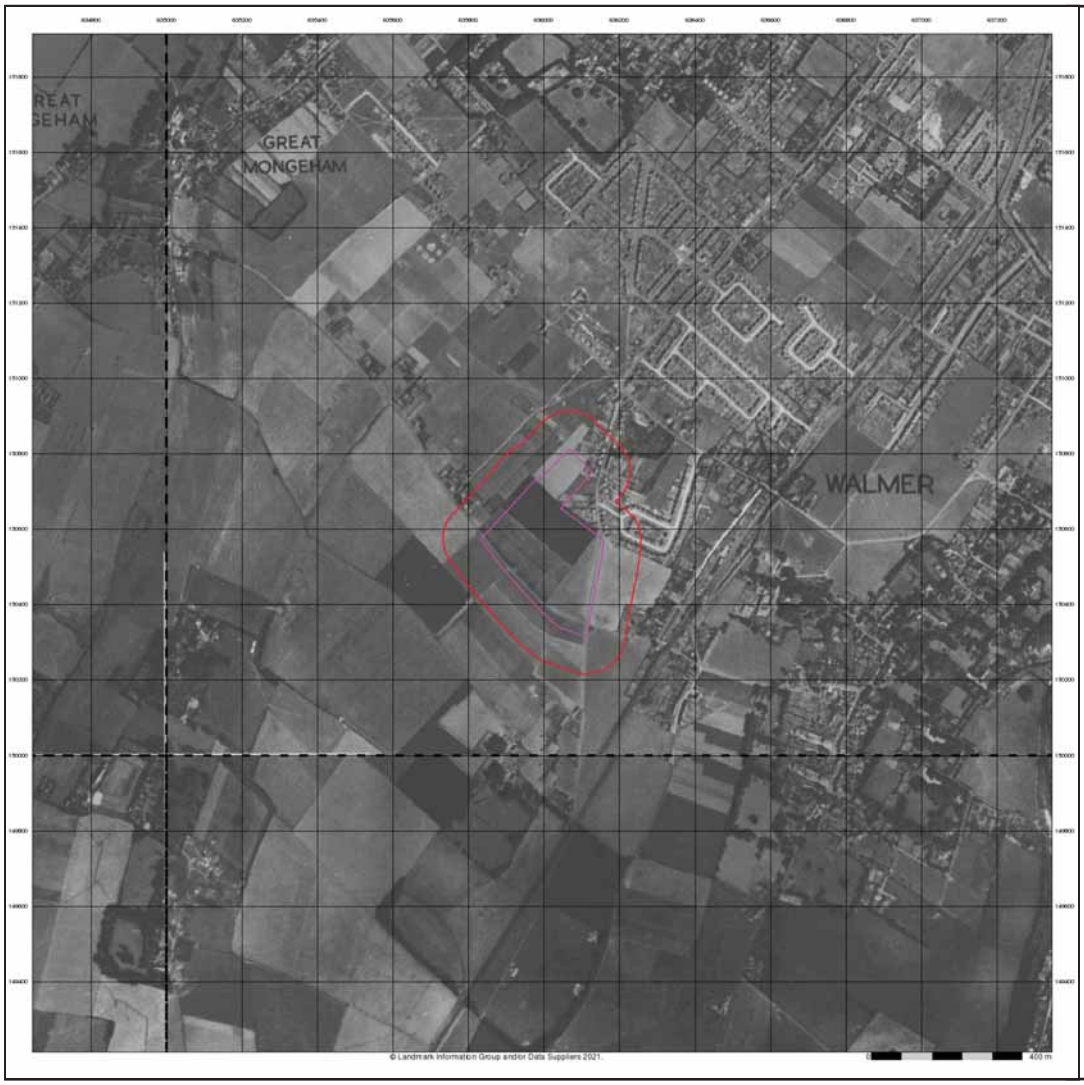


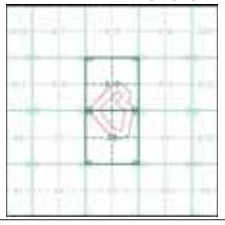
Historical Aerial Photography
Published 1947 - 1948
Source map scale - 1:10,560

The Historical Aerial Photos were produced by the Ordnance Survey at a scale of 1:1,250 and 1:10,560 from Air Force photography. They were produced between 1944 and 1951 as an interim measure, pending preparation of conventional mapping, due to post war resource shortages. New security measures in the 1950's meant that every photograph was re-checked for potentially unsafe information with security sites replaced by fake fields or clouds. The original editions were withdrawn and only later made available after a period of fifty years although due to the accuracy of the editing, without viewing both revisions it is not easy to spot the edits. Where available Landmark have included both revisions.

Map Name(s) and Date(s)

TR35SW 1947 1:10,560	TR35SE 1947 1:10,560
TR34NW 1947 1:10,560	TR34NE 1948 1:10,560

Historical Aerial Photography - Slice A



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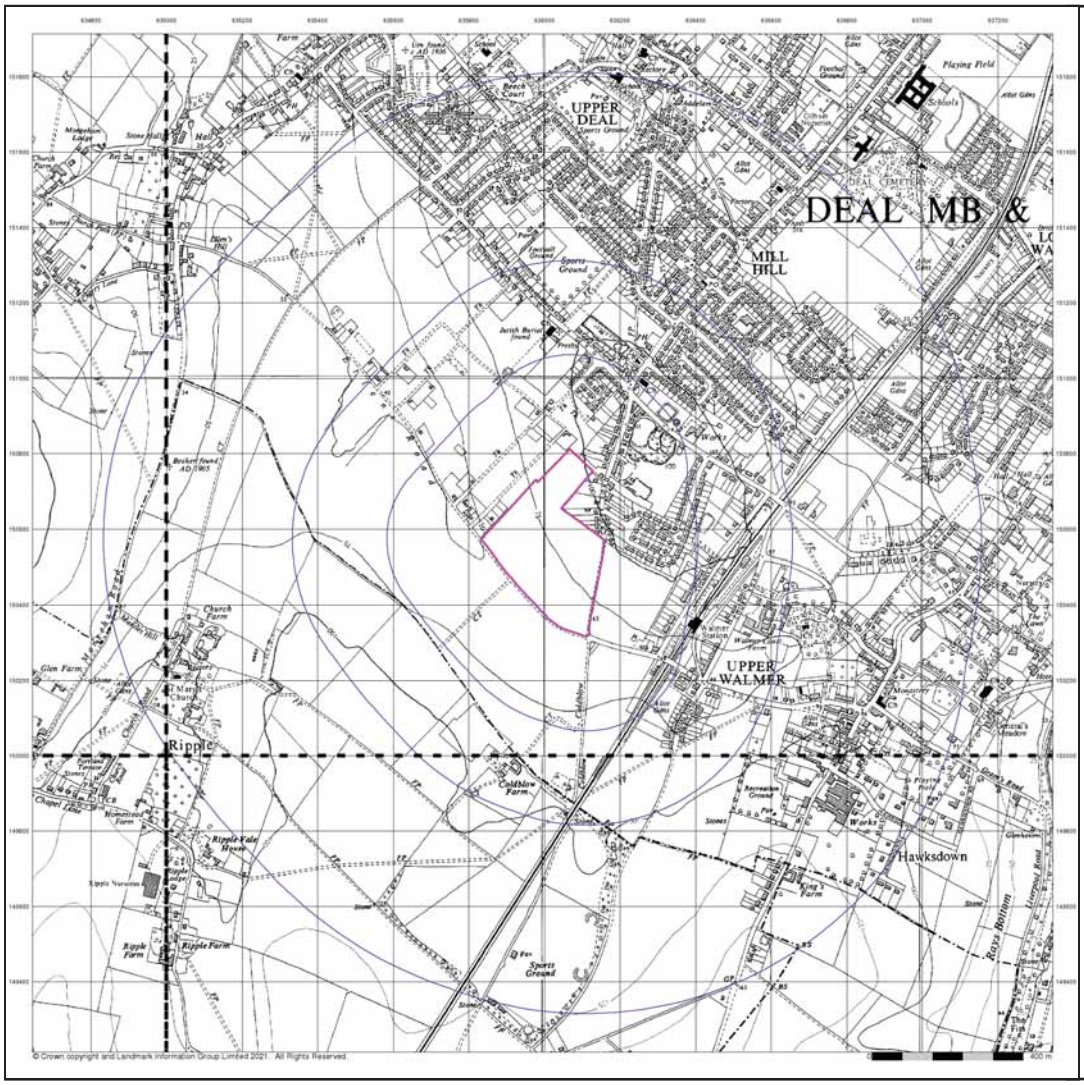

RSK

Ordnance Survey Plan
Published 1960 - 1961
Source map scale - 1:10,000

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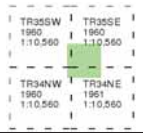
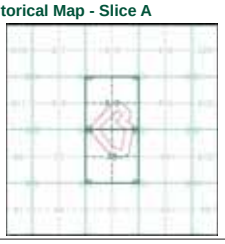
Map Name(s) and Date(s)



Historical Map - Slice A



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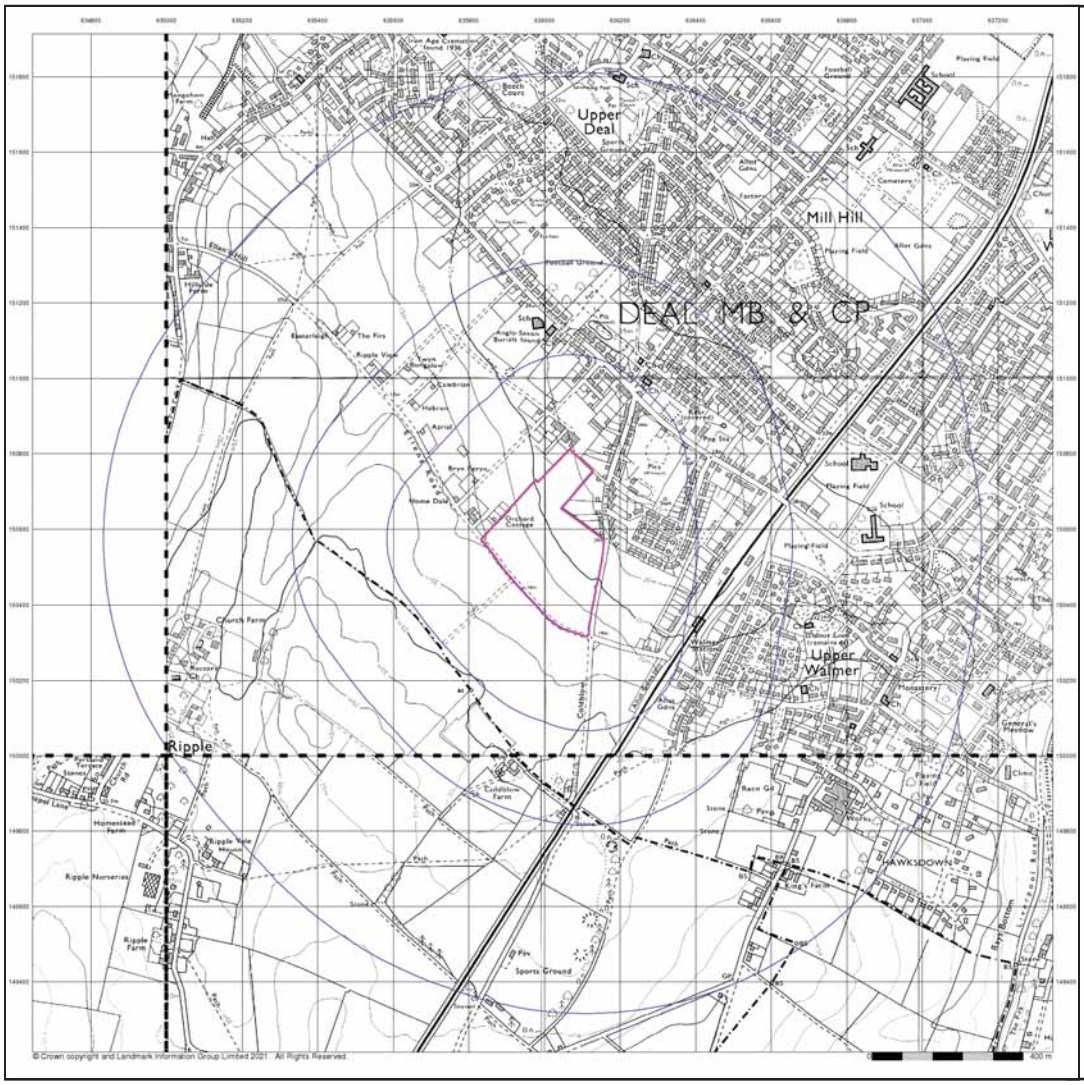

RSK

Ordnance Survey Plan
Published 1970 - 1973
Source map scale - 1:10,000

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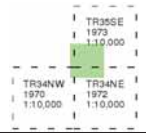
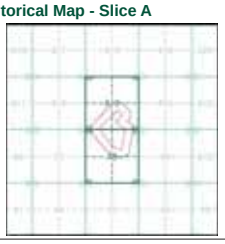
Map Name(s) and Date(s)



Historical Map - Slice A



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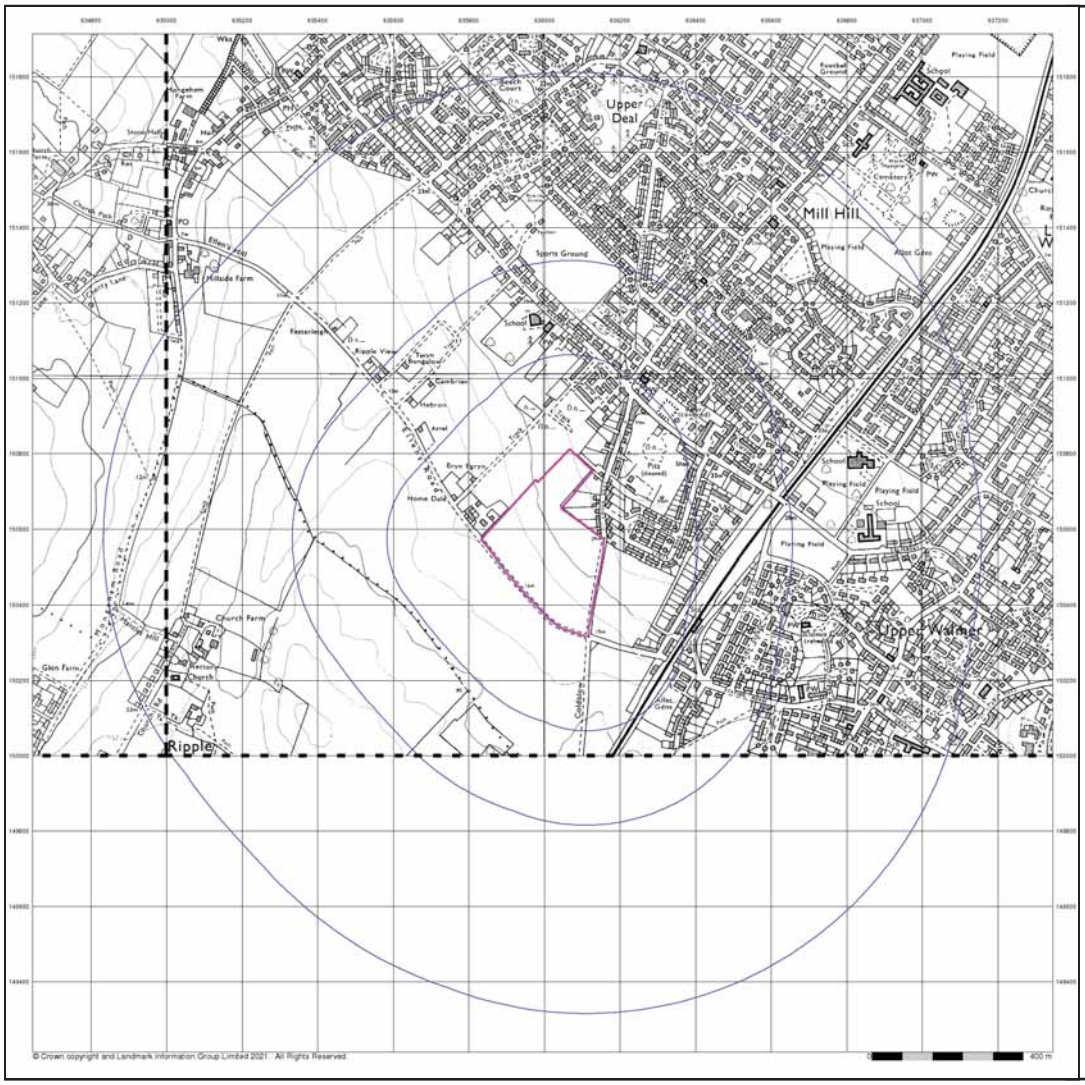

RSK

Ordnance Survey Plan
Published 1981 - 1987
Source map scale - 1:10,000

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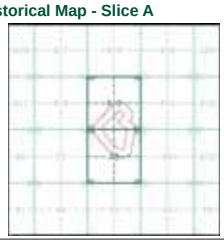
Map Name(s) and Date(s)

Historical Map - Slice A



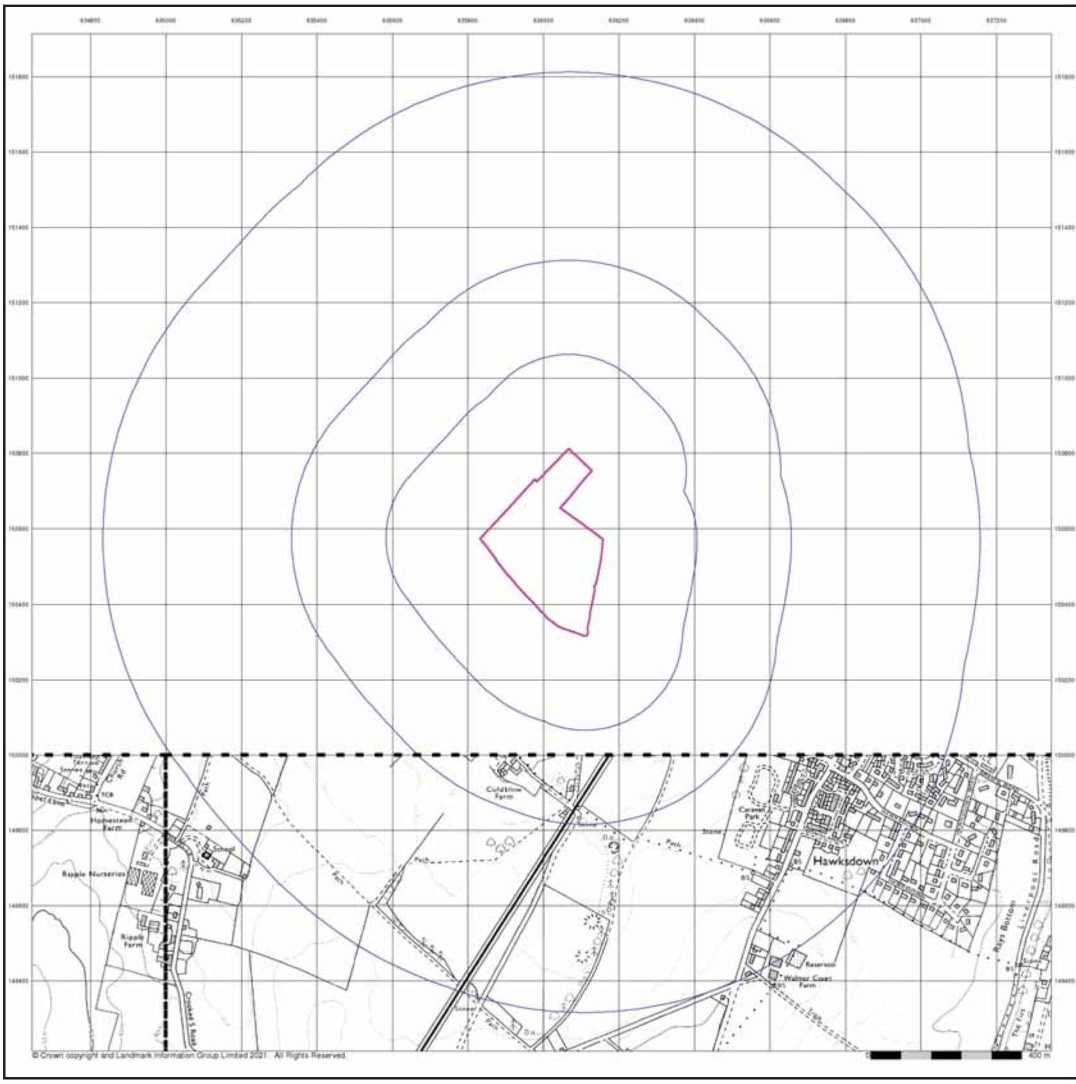
Order Details

Order Number:	279891064_1_1
Customer Ref:	P02114644
National Grid Reference:	636030, 150560
Slice:	A
Site Area (Ha):	8.53
Search Buffer (m):	1000

Site Details

April Cottage, Ellens Road, DEAL, CT14 9JJ

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



RSK

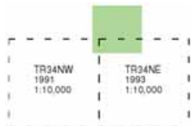
Ordnance Survey Plan

Published 1991 - 1993

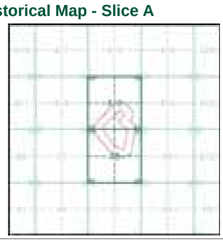
Source map scale - 1:10,000

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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10k Raster Mapping

Published 1999

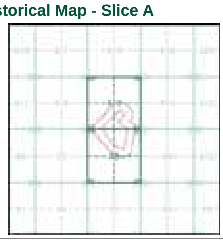
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

TR35SW 1999 1:10,000	TR35SE 1999 1:10,000
TR34NW 1999 1:10,000	TR34NE 1999 1:10,000

Historical Map - Slice A



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