



Hawridge Strategic Land Ltd

LAND OFF COWARDS LANE, CODICOTE

Flood Risk Assessment and Drainage Strategy

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CONTENTS

- 1.0 INTRODUCTION**
- 2.0 SOURCES OF INFORMATION**
- 3.0 SITE SETTING AND PROPOSED SCHEME**
- 4.0 FLOOD RISK ASSESSMENT**
- 5.0 CONCLUSIONS AND RECOMMENDATIONS**

FIGURES

- 1.1 Site Location
- 4.1 Flood Map for Planning Source: Defra Data Services Platform
- 4.2 EA Risk of Flooding from Surface Water – Extent
- 4.3 EA Risk of Flooding from Surface Water – Extent CC
- 4.4 British Geological Survey Bedrock Geology Mapping Extract (1:50,000 scale)
- 4.5 British Geological Survey Superficial Geology Mapping Extract (1:50,000 scale)
- 4.6 EA Risk of Flooding from Reservoirs

APPENDICES

- A Thames Water – Wastewater Plans
- B CK Rail Borehole and Soakage Testing Results
- C Greenfield Runoff Calculation
- D FLOW Hydraulic Calculations

PLANS

- | | |
|--------------------------|---|
| CMP-01 R3 | Concept Masterplan |
| PPL-01 | Parameter Plan |
| SLP-01 | Site Location Plan |
| TVG830-01 | Topographical Survey |
| 3473-CCE-XX-XX-DR-D-0001 | Outline Surface Water Drainage Strategy |

1.0 INTRODUCTION

- 1.1 Create Consulting Engineers Ltd were instructed by Hawridge Strategic Land Limited to undertake a Flood Risk Assessment (FRA) and Sustainable Surface Water Drainage Strategy (SuDS) for a proposed development at the land off Cowards Lane, in Codicote. The proposed development is south of Cowards Lane and east of St Albans Road. The site is located to the south of Codicote.
- 1.2 The Site measures 1.38 ha and is located at Ordnance Survey grid reference 521595E, 217805N, with the red-line boundary shown in Figure 1.1.
- 1.3 The Site falls under the jurisdiction of both Hertfordshire County Council (HCC) and North Hertfordshire District Council (NHDC), with the former acting as the Lead Local Flood Authority (LLFA). HCC is responsible for flood water on the road network or pavement. NHDC manages flood risks from surface water, groundwater and smaller streams.
- 1.4 The Site is located in Flood Zone 1, as indicated on the Flood Map for Planning, however the proposed Site area exceeds 1 ha, as such, any planning application for a site which is in excess of 1 ha must include an FRA as part of the planning process. Likewise, a SuDS solution must be presented at this stage planning as the site is over 1 ha. This report presents the FRA for the site and the proposed development, with a suitable SuDS solution.

Objectives

- 1.5 The following objectives for this report are to:
- Provide a Flood Risk Assessment (FRA) of the site, in compliance with the guidelines set out in the National Planning Policy Framework (NPPF)¹ and associated Planning Practice Guidance (PPG)²
 - Assess the risk and implications of flooding on the site, including flooding from tidal, fluvial, groundwater, surface water runoff, and artificial sources.
 - Provide advice on the site layout and design to ensure the safe operation of the site during any flood event.
 - To develop a suitable SuDS network for the development, and
 - Consider the potential future impacts of climate change over the lifetime of the proposed development.

Planning Policy Requirements

National Policy

- 1.6 The National Planning Policy Framework (NPPF) is the primary planning policy for England. It outlines the government's planning policies and provides guidance on their application by developers and assessment by Local Planning Authorities (LPAs).
- 1.7 The NPPF¹ requires that developments must consider flood risk and that:

¹ Ministry of Housing, Communities & Local Government, 2025. *National Planning Policy Framework (NPPF)*. [Online]. Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2> [Accessed July 2025].

² Ministry of Housing, Communities & Local Government, 2021. *Planning Practice Guidance (PPG) – Flood Risk and Coastal Change*. [Online]. Available at: <http://planningguidance.planningportal.gov.uk/> [Accessed July 2025].

Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

- 1.8 The supporting documents to the NPPF are the Planning Practice Guidance (PPG)² and recent case law³ which state that the PPG holds the same legal status as the NPPF. As such, developers must adhere to both the NPPF and the PPG during the planning stage. The PPG on flood risk and coastal change specifies when an appropriate FRA must be undertaken to demonstrate how flood risk from all sources, both to the development and to others, will be managed now and in the future.
- 1.9 The NPPF and PPG^{Error! Bookmark not defined.} state that an FRA should be appropriate to the scale, nature, and location of the development. It must identify and assess the risk of flooding from all sources, both to and from the development, and demonstrate how these risks will be managed throughout the development's lifetime.

Regional Policy

- 1.10 The North Hertfordshire Local Plan⁴ provides a broad development strategy for the Region up to 2031.
- 1.11 Relevant policy is ENV4, which states:
- 'Mitigate the effects of climate change by encouraging the use of sustainable construction techniques, the appropriate use of renewable energy technologies and reducing the risk of flooding.'*
- 1.12 Policy SP11: Natural resources and sustainability – This Plan seeks to meet the challenges of climate change and flooding.
- b) Take a risk based approach to development and flood risk, directing development to areas at lowest risk in accordance with the NPPF and ensuring the provision of Sustainable Drainage Systems (SuDS) and other appropriate measures;*
- c) Support the principles of the Water Environment (Water Framework Directive) Regulations 2017 and seek to protect, enhance and manage the water environment;*
- 1.13 Policy D1: Sustainable design – Planning permission will be granted provided that development proposals:
- ii. optimise the potential of the site by incorporating Sustainable Drainage Systems (SuDS);*
- 1.14 Policy NE7: Reducing flood risk – Planning permission for development proposals will be granted provided that (as applicable):
- a) Development is located outside of medium and high-risk flood areas (flood zone 2 and 3) and other areas affected by other sources of flooding where possible;*

³ Judgement Ruling R (Mead and Redrow) v SoS LUHC [2024] EWHC 279 (Admin)

⁴ North Hertfordshire, 2011 – 2031. Local Plan. [Online]. Available at: <https://www.north-herts.gov.uk/sites/default/files/2022-12/North%20Hertfordshire%20Local%20Plan%202011-2031.pdf> (Accessed July 2025).

- b) Where (a) is not possible, application of the sequential and exception tests is demonstrated where development is proposed in areas of flood risk using the Strategic Flood Risk Assessment (SFRA) and Environment Agency flood maps;*
- c) A FRA has been prepared in accordance with national guidance that considers the lifetime of the development, climate change impacts and safe access and egress;*
- d) It will be located, designed and laid out to ensure the risk of flooding is reduced whilst not increasing flood risk elsewhere;*
- e) The impact of any residual flood risk will be minimised through flood resistant, resilient design and construction;*
- f) Any flood protection and mitigation measures necessary will not cause harm to nature conservation, heritage assets, and/ or landscape and recreation and, where possible, will have a positive impact in these respects; and*
- g) Overland flow routes and functional floodplain areas are protected from all development other than that which is "water compatible" and this must be designed and constructed to remain operational and safe for users during flood events, resulting in no net loss of flood plain storage and not impeding water flows or increasing flood risk elsewhere.*

1.15 Policy NE8: Sustainable drainage systems – Planning permission for development will be granted provided that:

- a) The most appropriate sustainable drainage solution is used taking into account technical, viability and design issues to reduce the risk of surface water flooding, enhance biodiversity, water quality and provide amenity benefits;*
- b) It aims to mimic the natural drainage patterns and processes as far as possible; and*
- c) Drainage solutions follow the SuDS hierarchy.*

1.16 Policy NE9: Water quality and environment: Planning permission for development proposals will be granted provided that they make appropriate space for water, including (as applicable):

- a) Maintaining a minimum 8 metre wide undeveloped buffer zone from all designated main rivers;*
- b) Maintaining a minimum 5m wide undeveloped buffer zone for ordinary watercourses; and*
- c) River restoration and resilience improvements where proposals are situated close to a river or considered to affect nearby watercourses.*

All development proposals will be required to manage surface water through Sustainable Drainage Systems (SuDS) or techniques to limit run-off and reduce the existing rate of run-off on previously developed sites⁵.

Surface water runoff should be managed as close to its source as possible, in line with the following drainage hierarchy:

- a) store rainwater for later use; then:*
- b) discharge into the ground (infiltration); then:*
- c) discharge to a surface water body; then:*
- d) discharge to a surface water sewer, highway drain or other drainage system; and finally.*
- e) discharge to a combined sewer.*

⁵ McCloy Consulting & Robert Bray Associates., 2018. Oxford City Council SuDS Design and Evaluation Guide. [Online]. <https://www.oxford.gov.uk/downloads/file/996/cover-pages-and-overview> (Accessed April 2025)

Constraints and Limitations

- 1.17 The copyright of this report is vested in Create Consulting Engineers Ltd and the client, Hawridge Strategic Land Limited. The client, or their appointed representatives, may copy the report in connection with the development described herein. It may not be copied by any other party or used for any other purpose without the written consent of Create Consulting Engineers Ltd or the client.
- 1.18 Create Consulting Engineers Ltd accepts no responsibility whatsoever to any other parties to whom this report, or any part thereof, is made known. Any such parties rely on the report at their own risk.
- 1.19 The Flood Risk Assessment addresses the flood risk posed to and from the proposed development, the extent of which is shown by the site boundary, as indicated on the attached drawings.
- 1.20 This report has been undertaken assuming that the site will be developed according to the proposals outlined above, without significant change. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.
- 1.21 Create Consulting Engineers Ltd has endeavoured to assess all information provided during this appraisal. The report summarises information from several external sources and cannot offer any guarantees or warranties regarding the completeness or accuracy of the information relied upon. Information from third parties has not been verified by Create Consulting Engineers Ltd unless otherwise stated in this report.
- 1.22 The revised Construction (Design and Management) Regulations 2015⁶ (CDM Regulations) came into force in April 2015 to update certain duties for all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities is to ensure that the client organisation, in this case, Hawridge Strategic Land Limited, is made aware of their duties under the CDM Regulations. Further information on the CDM Regulations is provided in the client guide and is available online. It is assumed for this assessment that the lead designer will be responsible for advising the client.
- 1.23 The approach to this FRA and SuDS Report follows the ethos of the CDM Regulations. During the assessment process, the development is considered, and any foreseeable associated health and safety flood risks are identified. It is then considered how these flood risks can be eliminated or mitigated to reduce or control them. The outcome of this assessment process is presented in this report. While preparing this FRA, no other noteworthy or significant health and safety risks have been identified.

⁶ Health and Safety Executive., 2015. *Construction (Design and Management) Regulations*. [Online]. Available at: <http://www.hse.gov.uk/pubns/indg411.pdf> [Accessed July 2025].

2.0 SOURCES OF INFORMATION

- 2.1 The information contained in this report is based on a review of existing information and consultation with interested parties.
- 2.2 Key reports and websites reviewed as part of this study are listed in Table 2.1 below.

Document/Website	Author/Publisher	Date
Flood Map for Planning - https://flood-map-for-planning.service.gov.uk/	GOV.UK	Accessed July 2025
Long Term Flood Risk Maps - https://flood-warning-information.service.gov.uk/long-term-flood-risk/map	GOV.UK	Accessed July 2025
BGS GeoIndex – Geology and borehole records - https://mapapps.bgs.ac.uk/geologyofbritain/home.html	British Geological Survey	Accessed July 2025
Topographic survey: TVG830-01	Thames Valley Geomatics	April 2025
Concept masterplan: CMP-01-R3	Insitu DESIGN	June 2025
Deep borehole Log and soakage testing	CK Consulting and Geotechnical	June 2025
Phase 1 Preliminary Risk Assessment	CK Consulting and Geotechnical	May 2025
North Hertfordshire Local Plan	North Hertfordshire District Council	2011 - 2031
SuDS Design Guidance for Hertfordshire	Hertfordshire County Council	March 2015
North Hertfordshire District Surface Water Management Plan	WSP	March 2017
North Hertfordshire District Council Strategic Flood Risk Assessment Level 1	North Hertfordshire District Council	September 2016
Hertfordshire County Council Local Flood Risk Management Strategy	Hertfordshire County Council	February 2019
Foul Water Asset Plans	Anglian Water	April 2025
Clean Water Asset Plans	Affinity Water	April 2025

Table 2.1: Key Information Sources

3.0 SITE SETTING AND PROPOSED SCHEME

Site Location and Description

- 3.1 The Site is 1.38 ha and is located on the southern side of Cowards Lane, which is to the south of Codicote, a large village, which is northwest of Welwyn. The red-line boundary is shown in Figure 1.1.
- 3.2 The Site is located at Ordnance Survey grid reference 517973E, 231258N as shown in Figure 1.1 and in drawings in the Appendix.
- 3.3 The proposed Site is predominantly greenfield in nature expect for some hard standing at the north of the Site, and the current equestrian stables in the eastern corner of the Site.
- 3.4 A public rights of way (PROW) is located on the Site, which runs north to south, which is accessed via the main entrance to the Site from Cowards Lane.
- 3.5 The nearest Environment Agency Main River to the site is the River Mimram, located approximately 620 m southwest of the Site's southern boundary.
- 3.6 There is no formal drainage on the Site and is free draining.

The Proposed Scheme

- 3.7 This report accompanies an outline planning application for residential development with means of access for consideration and all other matters reserved for subsequent approval; demolition of all existing structures; associated landscaping, drainage, car parking; infrastructure and all ancillary and enabling works.
- 3.8 The main entrance to the Site is to be retained from Cowards Lane, and the public right of way is also incorporated into the proposed scheme.
- 3.9 The indicative proposed scheme is shown in the Appendix.

Site Levels

- 3.10 A topographic survey of the Site has been undertaken by Thames Valley Geomatics in April 2025. The survey covers the Site and access arrangements from Cowards Lane. It has been undertaken to Ordnance Survey Datum Newlyn (m AOD) and it is appended to this report.
- 3.11 The survey shows a steady and consistent fall from northwest to southeast with a slight valley profile trending towards the middle. The maximum ground level at the Site is shown to be 100.01 m AOD, which is located at the northwest corner of the Site and minimum ground level is 92.82 m AOD located along the centre of the southern boundary.

4.0 FLOOD RISK ASSESSMENT

Scope of Work

- 4.1 The scope of this FRA was refined to meet the brief outlined in Chapter 1 of this report and considers the following:
- Flood risk to the development from all sources over the lifetime of the development.
 - The potential for the design, construction, and operation of the site to increase the risk of flooding to neighbouring properties.
 - Any necessary mitigation measures to address identified potential flood risks.
- 4.2 This FRA has reviewed data from the HCC Strategic Flood Risk Assessment, HCC Local Flood Risk Management Strategy⁷ and HCC Preliminary Flood Risk Assessment⁸ (PFRA).
- 4.3 The design flood event is the 1% Annual Exceedance Probability (AEP) in any given year, plus an allowance for climate change. Climate change uplifts vary depending on the source of flooding. This is outlined in the PPG and explained in this report.
- 4.4 The approach is consistent with the NPPF¹ and its associated PPG², as well as the requirements of local planning policy.

Flood History

- 4.5 The level 1 SFRA⁹ provides limited information on historical flood events in the area. Two events have mentioned for the local area, the 1947 (March) event in Codicote which was caused by heavy rainfall and snow melt affecting the River Mimram. The other is the 1996 event where out of bank flooding occurred from the River Mimram. No floodplain extents were provided and it is unknown if the Site was affected by either event.

Flood Risk from Fluvial and Tidal Sources

- 4.6 The closest EA Main River to the site is the River Mimram, which is located approximately 620 m to the southwest of the Site.
- 4.7 The Flood Map for Planning shows the risk of fluvial flooding from EA Main River in an undefended situation. The Site is shown to be located within Flood Zone 1, in Figure 4.1, which equates to the Site having a low risk of fluvial and tidal flooding.
- 4.8 For context within the Flood Map for Planning, Flood Zone 1 is land assessed as having less than a 0.1% AEP (Annual Exceedance Probability) risk of flooding from rivers or the sea in any given year. Flood Zone 2 comprises land assessed as having a 1% AEP (1 in 100 years) to 0.1% AEP (1 in 1000 years) chance of flooding from rivers, or between a 0.5% AEP (1 in 200 years) and 0.1% AEP chance of flooding from

⁷ Oxfordshire County Council. [Online]. Available at: <https://www.oxfordshirefloodtoolkit.com/wp-content/uploads/2016/04/OxfordshireFloodRiskManagementStrategy.pdf> [Accessed July 2025].

⁸ Oxfordshire County Council. Preliminary Flood Risk Assessment. [Online]. Available at: https://mycouncil.oxfordshire.gov.uk/documents/s5786/2010s4568%20Oxfordshire%20PFRA_v1.2_Apr1 [Accessed July 2025].

⁹ North Hertfordshire District Council. [Online]. Strategic Flood Risk Assessment Level 1 Available at: <https://www.north-herts.gov.uk/sites/default/files/NHE13a%20-%20North%20Hertfordshire%20District%20Council%20SFRA%20Report%202008%20%28p1-83%29.pdf> [Accessed July 2025].

the sea in any given year. Flood Zone 3 is land with a 1% AEP or greater chance of flooding from rivers or a 0.5% AEP or greater risk of flooding from the sea in any given year. These zones are often referred to contextually as 'High,' 'Medium,' and 'Low' flood risk, respectively.

- 4.9 The design fluvial flood event is the 1% AEP event, plus an allowance for climate change, in accordance with the NPPF. Climate change allowances are determined by the type of development proposed, the longevity of the development, and the catchment in which the development is located for fluvial sources. This is outlined within the 'Flood Risk Assessments: Climate Change Allowances'¹⁰ document published on GOV.UK.
- 4.10 The climate change allowances are based on the GOV.UK 'Flood Risk Assessment: Climate Change Allowances' document. The document states that a residential development has a lifetime of 100 years, placing it within the 2080s epoch for climate change allowances.
- 4.11 The Site is located within the 'Upper and Bedford Ouse Management Catchment peak river flow allowances,' within which the 2080s central epoch has a 19% climate change allowance.
- 4.12 As the Site is located in Flood Zone 1, which is defined as land which could be affected by a fluvial or tidal events greater than the 0.1% AEP event, the Site can be concluded that it would not experience flooding in the design event (1% AEP+ CC). The Site and the proposed development is not at risk from fluvial or tidal flooding in the design event.

Flood Risk from Surface Water (Rainfall)

- 4.13 Flooding from surface water can occur during intense local rainfall events when floodwaters cannot infiltrate into the ground or discharge into natural or artificial drainage systems. As a result, the floodwater follows the topography of the local area. In an urban environment, the risk of flooding from surface water and overloaded sewers is closely related, and both are included in the relevant surface water flooding datasets. Flooding events are typically of short duration (unless there is a blockage in the drainage system) but can be severe.
- 4.14 The EA has recently updated (January 2025) the Risk of Flooding from Surface Water (RoFSW) mapping dataset. This data assesses where surface water flooding may occur when the volume of rainwater exceeds the capacity of the existing drainage network (with a default loss rate of 18 mm/hr to model and replicate on-site drainage systems) or exceeds the infiltration capacity of the receiving soils, causing water to flow overland instead. The data includes information about flood extents and depths, produced using national-scale modelling, enhanced with locally produced modelling from some LLFAs.
- 4.15 The recently updated RoFSW now includes a climate change representation based on the latest UK Climate Projections (UKCP18) from the MET Office, using the Representative Concentration Pathway (RCP) 8.5. The RoFSW shows a near-term epoch (2040–2060, the "2050s" epoch), with central allowances used to support short- and medium-term decisions informed by the highest flood likelihood projections.
- 4.16 The current scenario RoFSW Extent Map (Figure 4.2) suggests that the site is subject to a 'very low' risk of flooding from surface water with a small pocket of 'low' risk occurring in the highway, Cowards Lane, outside of the Site boundary.

¹⁰GOV.UK., 2021. Climate change allowances. [Online]. Available at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>[Accessed July 2025].

- 4.17 The future-plus-climate-change scenario RoFSW mapping (Figure 4.3) closely follows the present-day scenario. However, the extent of surface water in the highway is marginally increased due to the impact of climate change.
- 4.18 The new RoFSW dataset includes the predicted risk of flooding for a series of depths in incremental steps of 0.2 m, 0.3 m, 0.6 m, 0.9 m, and 1.2 m. This data uses the same 'high,' 'medium,' and 'low' risk categories as set out in the above extent mapping for each return period.
- 4.19 The depth mapping shows the risk of a specific depth of flooding in either the current or future event. We have reviewed these maps, and as the Site is not shown to be at risk of surface water flooding within the current or future modelling
- 4.20 Given the surface water flooding extent in Cowards Lane (to the north of the Site), it is recommended that the ground levels for the proposed development access should be retained in their current position. Ground levels should not be lowered as this could alter the surface water pattern and could encourage surface water onto the Site and into the proposed development.
- 4.21 The risk from surface water flooding to the Site and the proposed development is considered very low when ground levels around the access are being maintained.
- 4.22 It should be noted that flooding from surface water remains a residual risk due to the potential for rainfall to exceed the design standard of the proposed surface water drainage system for the proposed development and the effects of climate change on the frequency and severity of rainfall events.

Geology and Flood Risk from Groundwater

- 4.23 Groundwater flooding occurs when groundwater rises through permeable strata to reach the surface.
- 4.24 The Department for Environment, Food, and Rural Affairs (DEFRA) Magic Maps¹¹ defines the site's underlying bedrock as a principle aquifer. These aquifers are classified by the Environment Agency as having:

'These are layers of rock or drift deposits that have high intergranular and/or fracture permeability – meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer'

- 4.25 The Site also lies within a 'Secondary Undifferentiated' superficial deposit aquifer, as defined by the Environment Agency¹² as:

'assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'

¹¹ DEFRA., 2024. Magic Map. [Online]. Available at: <https://magic.defra.gov.uk/MagicMap.aspx> [Accessed July 2025].

¹² Department for Environment and Rural Affairs (DEFRA) Magic Website., 20224. [Online]. *Environment Agency Aquifer Designation Data*. Available at: <https://magic.defra.gov.uk/MagicMap.aspx> [Accessed July 2025].

- 4.26 British Geological Survey (BGS) mapping (1:50,000 scale)¹³ identifies the bedrock geology (Figure 4.4) at the site as Lewes Nodular Chalk Formation and Seaford Chalk Formation – Chalk.
- 4.27 The BGS mapping shows that the superficial deposits on the site (Figure 4.5) are composed of Lowestoft Formation (Diamicton).
- 4.28 BGS borehole (BH) records¹⁴ indicate that the closest borehole record (TL21NW/4), located within the Site, reveals the geological sequence: 0.30 m of Made Ground, underlain by Glacial sands and gravels from 0.30 to 10.30 m below ground level (bgl), initially pale brown clay with flint and quartz pebbles, turning into pebbly sand at a depth of 1.80 m bgl. This is followed by Upper Chalk from 10.30 to 10.60 m bgl where the borehole log terminates. The scan stated that no water was struck.
- 4.29 CK Consulting and Geotechnical undertook site investigation on the Site which included a deep borehole (BH) infiltration test on the Site in June 2025. This survey included a single BH to a depth of 30 m below ground level (bgl) with a falling head infiltration test undertaken at 20 m bgl.
- 4.30 Following the soakage testing CK Consulting have provided an infiltration rate of 4.1 l/s (3.6849 m/hr). The supporting geotechnical testing logs are appended to this report.
- 4.31 Groundwater was encountered in the BH at a depth of 25 m bgl. This level remained steady from throughout the investigation.
- 4.32 Groundwater monitoring is being undertaken and will be checked at regular intervals. This is to understand the seasonal variability of the groundwater at the Site and will be updated in due course.
- 4.33 Based on the available information, the general ground conditions of the Site are anticipated to be as shown in Table 3.1:

Stratum	Approximate Thickness (m)	Generalised Description	EA hydrogeological classification
Made Ground	0.00 – 0.35	Made Ground/Topsoil	Unproductive Strata (Non-Aquifer)
Lowestoft Formation	0.35 – 11.80	CLAY with sands and gravels	Unproductive Strata (Non-Aquifer)
Lewes Nodular Chalk Formation	11.80 – 30.00 (end)	Weathered off white/white CHALK	Principle Aquifer

Table 4.1: Recorded Stratigraphy

- 4.34 The groundwater was recorded on the Site, as being over 25 m bgl and this depth of groundwater is unlikely to emerge at the surface, even during winter months. Groundwater does vary between the season and there can be several metres differences between summer and winter groundwater readings (Building Regulation H suggest 1 m variance). As the groundwater position is 25 m bgl, it is highly unlikely that the groundwater will rise 25 m in the winter and emerge at the surface.
- 4.35 Although the risk of groundwater emergence is low, it is still recommended that finished floor levels and threshold levels are set in accordance with CIRIA Design for Urban Exceedance. This suggests that

¹³ British Geological Survey (BGS) Onshore GeoIndex., 2021. *DiGMapGB-50 Bedrock Geology and Superficial Deposits*. [Online]. Available at: <https://mapapps.bgs.ac.uk/geologyofbritain/home.html> [Accessed July 2025].

¹⁴ British Geological Survey (BGS) Onshore GeoIndex., 2021. *Borehole records*. [Online]. Available at: <https://mapapps.bgs.ac.uk/geologyofbritain/home.html> [Accessed July 2025].

entry points are set 75–150mm above surrounding ground levels to provide some resilience for any unforeseen flooding.

- 4.36 There is a presence of groundwater on the Site, and suitable geology to allow the free movement of groundwater. However, the groundwater position is relatively deep and unlikely to reach the surface during the winter season. As such, the risk of flooding from groundwater emergence at the Site and with the mitigation proposed in this section, it can be deemed that the risk to the proposed development is also low.

Flood Risk from Sewers and Water Mains

- 4.37 Sewer flooding occurs when sewers surcharge due to reaching capacity within the network. This typically happens during intense rainfall events that exceed the capacity of the sewers (whether private, adopted, or highway sewers). Flooding from sewers and highways is closely linked to surface water in urban areas, with the source of flooding being the same: surface water/rainfall events.
- 4.38 Anglian Water is the statutory sewerage undertaker for the area and is responsible for the operation and maintenance of the public sewers serving the site.
- 4.39 According to the asset plans (Appendix A), there is a 225 mm foul water sewer running west to east along Cowards Lane (just north of the north site boundary).
- 4.40 The nearest surface water sewer to the Site is approximately 360 m northeast of the Site within the High Street. This surface water sewer is shown to be 300 mm increasing to 400 mm in diameter.
- 4.41 If any adopted sewers were to surcharge, the floodwater would follow the local topography and likely remain within the highways surrounding the site.
- 4.42 The proposed development on the Site, will result in the creation of new surface water and foul network on the Site. It is not expected that the new, supporting sewer infrastructure to fail or surcharge, but if it was, the flood water would follow the local topography.
- 4.43 It is recommended that the development follows CIRIA Designing for Urban Exceedance and that all finished floor levels and threshold levels are set 75–150 mm above the surrounding ground levels to prevent the ingress of flooding source.
- 4.44 Therefore, the Site and proposed development are at low risk from sewer flooding.

Flood Risk from Artificial Water Bodies

- 4.45 The Long-Term Flood Risk maps for Reservoirs (Figure 4.6) indicates the Site is not within an area at risk of flooding in the event of a reservoir embankment failure.
- 4.46 All reservoirs are regularly inspected, and essential maintenance is carried out in accordance with the Reservoirs Act 1975. The Environment Agency (EA) is the governing body responsible for ensuring the safety of reservoirs in Wales. Specialist engineers, known as Panel Engineers, must carry out these surveys. Due to these procedures, there have been no fatalities from reservoir failures in the UK since 1925.
- 4.47 The Site is not at risk of reservoir failure and subsequent flooding.

Flood Risk Sequential and Exception Test

4.48 As per the NPPF legislation;

"...the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test."

And

"The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk)."

4.49 Following the NPPF Annex 3 and the PPG, the proposed development is for dwellings which is classed as "More Vulnerable" and the Flood Zone classification for the Site is Flood Zone 1, as per Table 1 of the PPG.

4.50 Following Diagram 2 of the PPG, the proposed development can be allocated to areas of low risk of flooding from all sources of flooding; now and in the future. This has been outlined in the above FRA.

4.51 Table 2 of the PPG states that for the More Vulnerable development in Flood Zone 1, that the Exception Test is not required.

4.52 Following the guidance on the Sequential and Exception Test, outlined in the NPPF, PPG and the LPA SFRA, the development is deemed to have been sequentially designed in relation to flood risk and is passed.

5.0 OUTLINE SURFACE WATER DRAINAGE STRATEGY

Surface Water Drainage

Drainage Discharge Hierarchy

5.1 Analysis has been undertaken to propose an outline SuDS strategy, in accordance with sustainable drainage principles, which limits the surface water runoff from the proposed development and includes climate change.

5.2 The discharge hierarchy should be considered and the relevant PPG states:

“Generally the aim should be to discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:

- 1. Into the ground (infiltration);*
- 2. To a surface water body;*
- 3. To a surface water sewer, highway drain or another drainage system;*
- 4. To a combined sewer.”*

5.3 As discussed in Chapter 4 the surface geology at the Site is not overly conducive to infiltration techniques, unsuccessful BRE365 testing has been undertaken. The bedrock geology has been shown with on site testing to have the potential to provide deep infiltration.

5.4 There are no ditches, watercourses, surface water or combined sewers within the vicinity of the Site which surface water could discharge to.

5.5 Therefore, in line with the drainage hierarchy it is proposed to discharge surface water from the Site to deep bore soakaways.

SuDS Potential Summary

5.6 The aim of SuDS is to mimic the natural drainage process and reduce the impact of urbanisation on the frequency and size of floods. SuDS should also protect and enhance the environment.

5.7 A summary of the potential SUDS options which led to the above drainage strategy is included in Table 5.1.

	SuDS Techniques	Practicable	Proposed	Site and Development Specific Notes
Most Sustainable	Rainwater Harvesting	Y	TBC	TBC, to be incorporated if possible.
	Green Roof	N	N	No flat roofs proposed.
	Rain gardens	N	N	Rain gardens are not viable due nature of the layout of the Site.
	Basins and Ponds	Y	Y	Detention basin proposed.
	- Constructed wetlands - Balancing ponds - Detention basins - Retention ponds			
	Filter Strips and Swales	N	N	Not suitable on the site due to space requirements for these SuDS features and the proposed scheme.
	Infiltration Devices - Soakaways - Infiltration trenches and basins	Y	Y	Deep bore soakaways proposed.
	Permeable Surfaces - Gravelled areas - Permeable pavers	N	N	Not required.
Least Sustainable	Tanked Systems	N	N	Not required.
	- Oversized pipes - Crated storage			

Table 5.1: SuDS Techniques and Application to the Development

- 5.8 Rainwater harvesting techniques such as rainwater butts (for watering gardens etc.) and rain gardens are encouraged within the final SuDS design, however these have not been included within any calculations as a conservative measure because it cannot be guaranteed these will be empty during a storm event. If they were to be empty at the time of a storm, they would be able to contain storm water.
- 5.9 The proposed outlined SuDS strategy has been determined following the SuDS hierarchy which helps to steer developers to ensure surface water is managed as close to its source as possible. There should be a preference for green over grey features, in line with the SuDS hierarchy.

Discharge Rates

- 5.10 The peak greenfield run-off rate (Q_{bar}) has been calculated to be 2.4 l/s for the Site.

- 5.11 As the proposed means of surface water disposal is via infiltration, these calculations are for information only. This calculation can be found in the Appendix.
- 5.12 The PPG requires the climate change uplift to be dependent on the longevity of the development, type of development proposed and the catchment it is located within. According to the GOV.UK 'Peak Rainfall allowances Map' tool for the Combined Upper Bedford and Ouse Management Catchment a residential development which has a design life of 100 years, therefore should use the 'upper end allowance' for rainfall and 2080s epoch. This is in accordance with NPPF, PPG requirements, and the 'Flood Risk Assessments: Climate Change Allowances'. The climate change allowances for rainfall for the Site are:
- Rainfall uplift for 1 in 30 year event: 35 %
 - Rainfall uplift for 1 in 100 year event: 40 %

Proposed SuDS Strategy

- 5.13 Analysis has been undertaken to propose an outline SuDS strategy, in accordance with sustainable drainage principles, which limits the surface water runoff from the proposed development and includes climate change.
- 5.14 The proposed highway area is 0.221 ha and the proposed roof area is 0.153 ha, which increases to 0.168 ha with the addition of urban creep, making a total impermeable area of 0.389 ha.
- 5.15 It is proposed that the SuDS solution to accommodate and store all flows below ground up to and including the 1 % AEP +CC event would include:
- Detention basin.
- 5.16 The proposed SuDS scheme will discharge water via 2no deep bore soakaways. The rates of discharge have been calculated by CK Rail, and the design of the borehole follows Building Regulations H and Kent's LLFA Soakaway Guide.
- 5.17 The proposed strategy can be seen on Drawing 3473-CCE-XX-XX-DR-D-0001 within the Appendix.
- 5.18 The schedule for the respective storage areas can be seen below:

Storage ID	Area (m²)	Depth/Subbase Depth (m)	Maximum Gradient
Basin	860	1.20	-

Table 5.2: SuDS Storage Design Schedule as shown on Drawing 3473-CCE-XX-XX-DR-D-0001

- 5.19 The preliminary calculation for the proposed SuDS features to control surface water on the Site for the development are included in Appendix and an indicative SuDS schematic plan is also included in the appendix of this report.
- 5.20 Table 5.3 shows the top water level (TWL) and storage volume for the 1 % AEP +CC event. The proposed storage does not meet the required half drain down time as the basin will half drain down from within 3485 minutes post 33 % AEP +CC event. However, the basin is able to retain a 10 % AEP follow on storm.

Storage ID	Depth (m)	Volume (m³)	Post 1in100+CC Event Time to Half Empty (mins)
Basin	0.79	348	3485

Table 5.3: Summary of FLOW results

- 5.21 The FLOW calculations have used some conservative design decisions. These include:
- The default Cv values have been altered to a value of 1.0 which ensures all the storm water is assessed i.e. 100% of the water is modelled.
 - MADD factor has been altered from its default of 20 m³ to zero, to ensure there is no over estimation in the drainage model capacity to attenuate water.
 - FEH 22 (Flood Estimation Handbook 2022) point data was also used for the storm event rather than FSR (Flood Studies Report). FEH is more up to date than FSR data and provides a better representation of an actual events.
- 5.22 Detail design of the deep borehole soakaways, basin and details of the connections are all part of the detailed design stage of the development. This level of detail can be conditioned as part of the planning permission, if required.

Borehole Soakaway Failure

- 5.23 A soakaway failure scenario has been modelled based on the following inputs:
- Infiltration rate set to 0.00001 m/hr;
 - 33 % and 1 % AEP events simulated;
- 5.24 The results of this model can be found in the appendix, in summary the basin shown to be able to fully contain a 1 % AEP +CC event with no flooding predicted.

Surface Water Quality

- 5.25 Pollution control requirements are determined by the using the Simple Index Approach as detailed in the CIRIA SuDS Manual. The pollution indices for this Site as per table 26.2 of the CIRIA SuDS Manual can be seen below:

Land Use	Total Suspended Solids	Metals	Hydrocarbons
Roof area	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads i.e., <300 traffic movements a day	0.5	0.4	0.4

Table 5.4: Calculated SuDS pollution mitigation indexes for the Site

- 5.26 The worst-case pollution run-off from the proposed Site is from the adoptable highways this run-off will be treated by the detention basin with permanent water level (Pond), prior to discharge. Based on table 26.3 from the CIRIA SuDS Manual, the worst-case area for the Site will provide treatment indices of:

SuDS Component	Total Suspended Solids	Metals	Hydrocarbons
Pond	0.70	0.70	0.50

Table 5.5: Indicative SuDS mitigation indices

- 5.27 It can be seen above that the proposed treatment provides the required level of treatment for this Site prior to discharge.
- 5.28 It should be noted that SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the CIRIA SuDS Manual.

Exceedance Flow Routes

- 5.29 Exceedance flow routes may be adapted to suit any proposed changes to the Site layout as the design progresses in line with the following principles:
- Surcharged flows from roads and roof areas will be retained within kerb lines and channelled towards the basin to the southeast.
 - External ground levels will be profiled such that no ponding occurs against buildings, with flows directed as above.

Four Pillars of SuDS

- 5.30 For the purposes of this assessment, it must be demonstrated how the drainage strategy design provided above adheres to the four pillars of SuDS. It is defined that the approaches to manage surface water should take into account water quantity (flooding), water quality (pollution), amenity and biodiversity issues.
- 5.31 The proposed drainage strategy provides mitigation of water quantity, water quality, amenity and biodiversity all in the forms of the detention basin / pond and permeable paving for all proposed paved and external parking areas.
- 5.32 The above SuDS features will control the rate of stormwater overflow and provide sufficient water treatment prior to discharge as per the SUDS indices outlined above.

Management and Maintenance of Drainage Assets

- 5.33 The party or persons ultimately responsible for the management and maintenance of drainage assets will be the freeholder for the site, the shared spaces will be maintained by a private management company (or their successor in title) as part of the wider Site management regime.
- 5.34 Further detail regarding the exact management and maintenance procedures required will be provided as part of detailed design of the drainage networks, any reserved matters submission once a management company has been instructed and a scope agreed. This will, however, follow the principles set out in Table 5.6 below and any flow control devices would follow manufacturer instructions:

Maintenance Schedule	Required Actions	Typical Frequency
Detention Basin		
Regular Maintenance	Inspect inlets and outlets for blockages and clear as required.	Monthly for first year then annually thereafter
	Remove litter and debris. Carry out periodic mowing of grassed surface and inspect for silt accumulation to determine appropriate removal frequency.	Monthly or as required (and through growing season for swales)
Occasional maintenance	Remove sediment from any affected articles including silt traps (most likely via jetting).	As required
	Clear any pipe blockages with appropriate equipment	As required
Remedial Actions	Repair any damage arising from various inspections (by approved engineer where required)	As required
Deep Bore Soakaways		
Regular Maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional Maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial Actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually
Other General:		
Regular Maintenance	Inspect rainwater gutter channels, inlets and outlets for blockages and clear as required.	Monthly for first year then annually thereafter
	Inspect gully drains, channel drains and inspection chambers (including silt traps) for siltation/blockage.	Monthly for first year then annually thereafter
	Inspect for sediment and debris in manhole bases and any blockage of soakaway chamber and geocellular storage.	Bimonthly for first six months then every six months thereafter
	Remove litter and debris from swale. Carry out periodic mowing of grassed surface and inspect for silt accumulation to determine appropriate removal frequency.	Monthly or as required (and through growing season for swales)

Maintenance Schedule	Required Actions	Typical Frequency
Occasional Maintenance Remedial Actions	Remove any sediment and debris from base of chambers and cellular storage.	As required, based on inspections
	Remove sediment from any affected articles including silt traps (most likely via jetting).	As required
	Clear any pipe blockages with appropriate equipment	As required
	Repair any damage arising from various inspections (by approved engineer where required)	As required
	Replacement of permeable surfacing, manhole components.	As required

Table 5.6: Outline SUDS Management and Maintenance Requirements

Foul Water Drainage

- 5.35 The proposed foul water discharge generated by the site is proposed to connect to the existing Thames Water infrastructure north the site, MH6901 within Cowards Lane.
- 5.36 A foul water pumping station and rising main will be required for the development at this Site. A predevelopment enquiry with Thames Water has been submitted and is currently awaiting a reply at the time of writing.
- 5.37 All domestic foul drainage will be designed in accordance with Part H of the Building Regulations.

Flood Risk from the Development

- 5.38 The inclusion of SuDS would not increase the risk of surface water flooding but result in reduction of peak flow rates from the Site. The development would not result in the exacerbation of the current situation as the existing Site discharges unrestricted.
- 5.39 The proposed development has been shown it can incorporate SuDS to ensure there will not be an increase current surface water runoff rates from the Site post-development. The inclusion of SuDS as outlined in this report will manage and contain surface water onsite.

6.0 CONCLUSIONS AND RECOMMENDATIONS

- 6.1 Based on our understanding of the Site setting and the development proposals, it is considered that the risk of flooding is generally low from most sources with mitigation measures.
- 6.2 The Flood Map for Planning indicates that the Site area is located within Flood Zone 1, and therefore at low risk of flooding from fluvial and tidal sources. It has been noted that the wider area has experienced historical fluvial flood events, though precise impact details are not provided, and there is no SFRA commentary specific to the Site boundary.
- 6.3 The Site is not shown to be at risk of surface water flooding but the entrance along Coward's Lane is shown at risk. It has been advised that the development does not lower these ground levels, as this could alter the surface water floodplain and allow flood water onto the Site.
- 6.4 Groundwater was recorded at being 25 m bgl and the risk of groundwater emergence is deemed low.
- 6.5 The FRA has concluded that the development should follow the CIRIA Designing for Urban Exceedance with finished floor levels and threshold levels set 75–150 mm above the surrounding ground level. This is to prevent the ingress for an unforeseen flooding from sewers etc.
- 6.6 Early engineering designs have allowed for sustainable urban drainage systems to be integrated into the design from an early stage. On site ground investigation confirms suitable infiltration rates and that the groundwater position can be located in line with Building Regulations H and Kent's LLFA Soakaway Design Guide.
- 6.7 It has been demonstrated through FLOW calculations that that the proposed development can include several SuDS measures to manage and discharge surface water via filtration.
- 6.8 The proposed SuDS solution for the development includes permeable paving with lined gravel subbase, open basins, and deep borehole soakaways.
- 6.9 In the event of a soakaway failure, no flooding is predicted up to and including a 1 % AEP + CC year event.
- 6.10 Additional SuDS measures such as rainwater harvesting for irrigating landscaped areas and biorientation areas has been excluded from the calculations. These can also provide additional attenuation on the Site and can be used as additional storage in exceedance events but have been assumed to be at capacity, at the time of storm for the design work. This means the presented design can fully contain the 1% AEP + CC event on the Site, when these devices are full.
- 6.11 The freeholder will appoint a management company to be responsible for the upkeep and maintenance of the SuDS network for the private areas and a maintenance company will be responsible for the shared areas. The appropriate drainage and highway features will be offered for adoption where applicable.
- 6.12 The inclusion of SuDS reduces flood risk to others by attenuating and managing surface water on the Site. Currently the site would have uncontrolled free discharge of surface water and anything over greenfield rates would flow naturally overland and could cause flooding to others.

- 6.13 The proposed development is compliant with the NPPF, PPG, and local planning policy with regards to surface water management and flood risk. It is therefore considered appropriate development in this location.

FIGURES

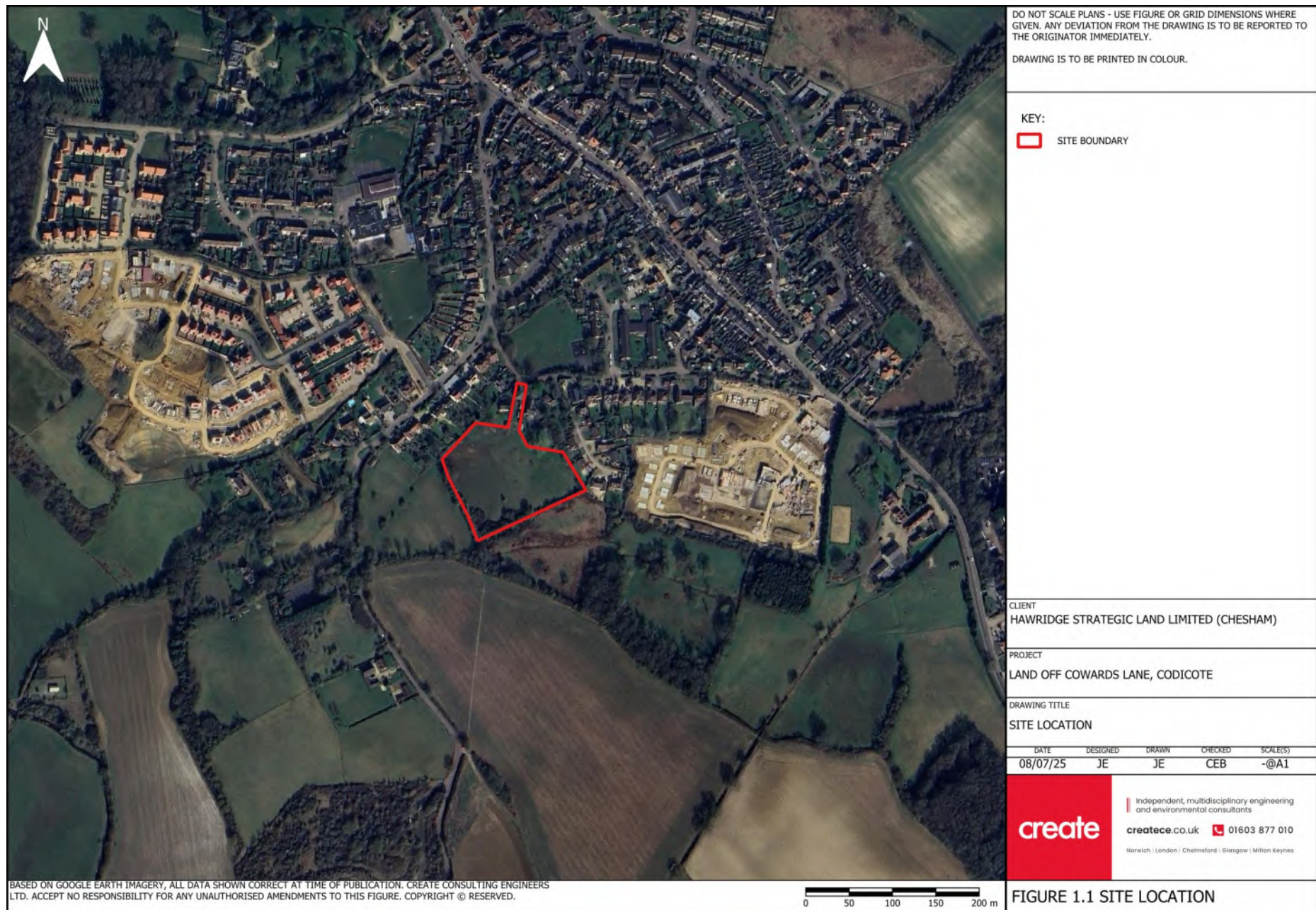


Figure 1.1: Site Location Source: Google Earth Mapping (2025)

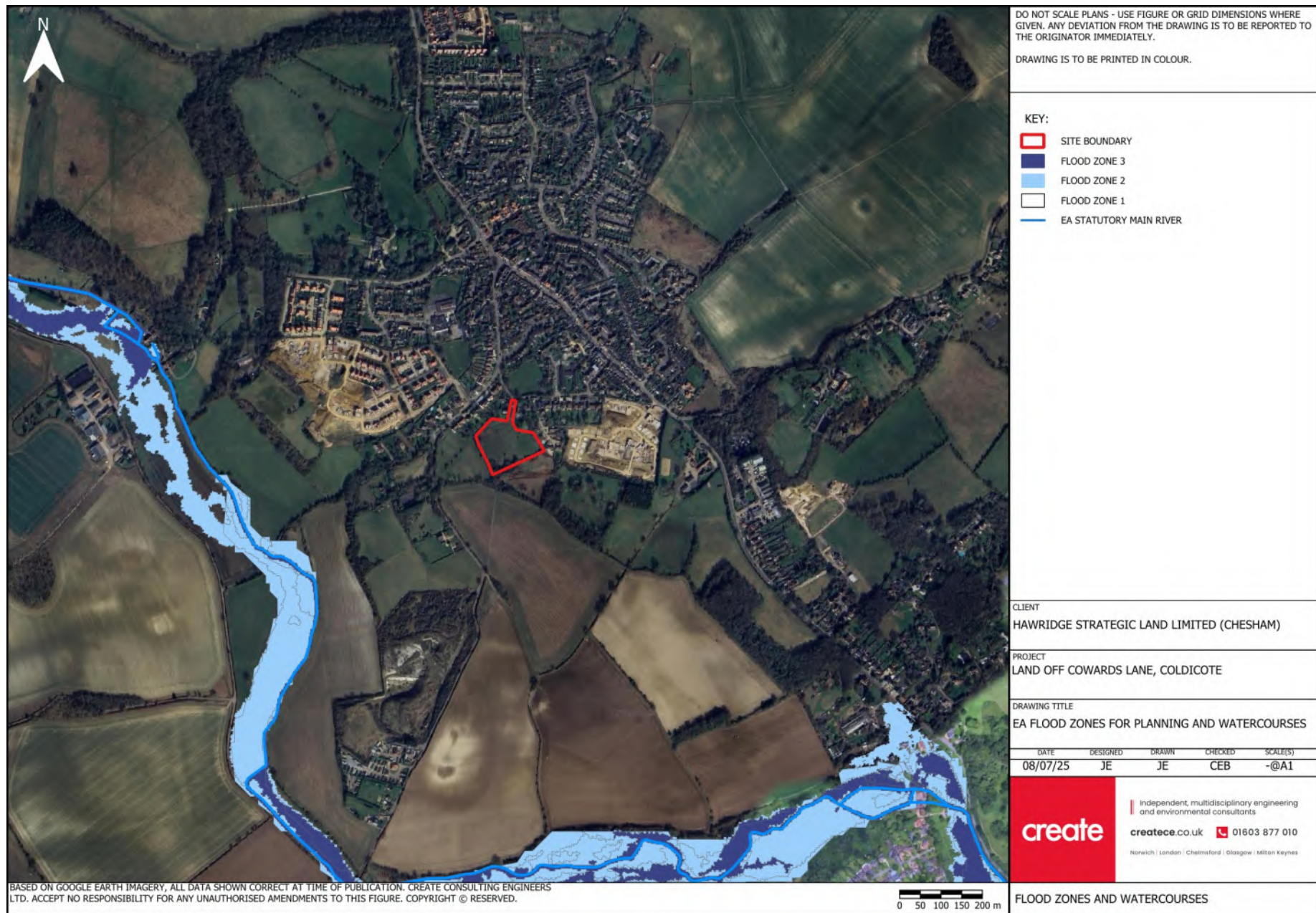


Figure 4.1: Flood Map for Planning

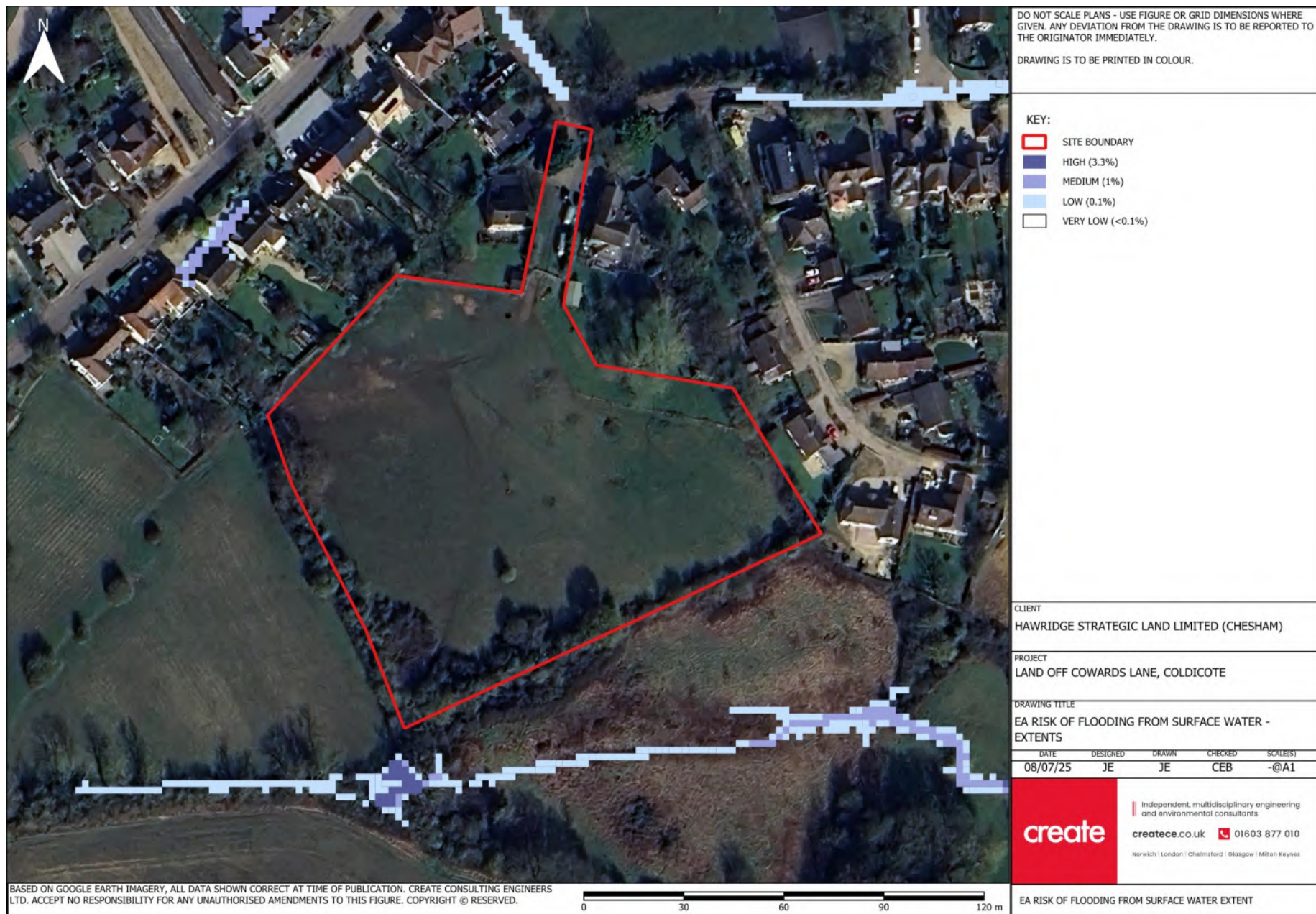


Figure 4.2: EA Risk of Flooding from Surface Water - Extent

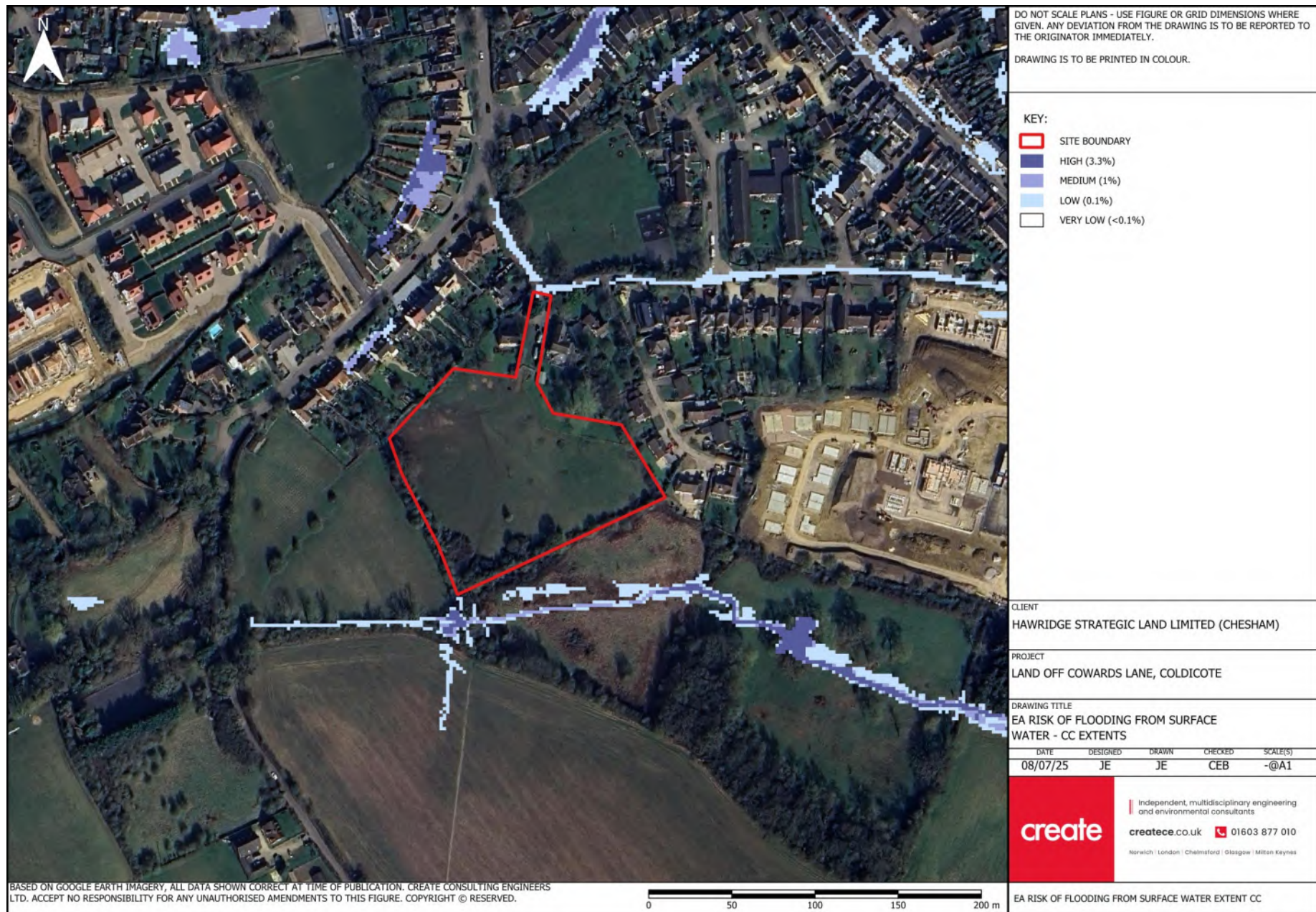


Figure 4.3: EA Risk of Flooding from Surface Water – Extent CC

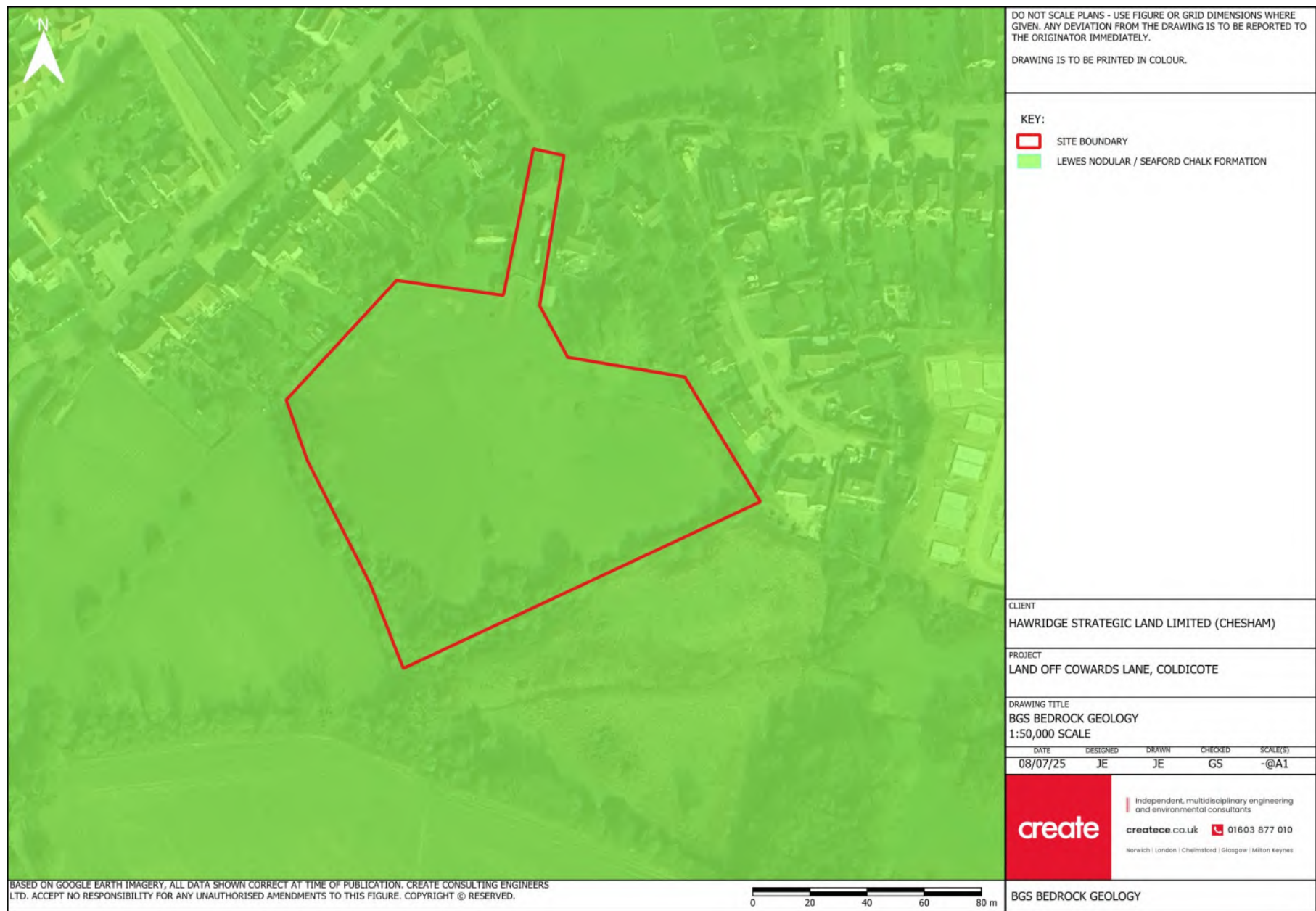


Figure 4.4: British Geological Survey Bedrock Geology Mapping Extract (1:50,000 scale)



Figure 4.5: British Geological Survey Superficial Geology Mapping Extract (1:50,000 scale)

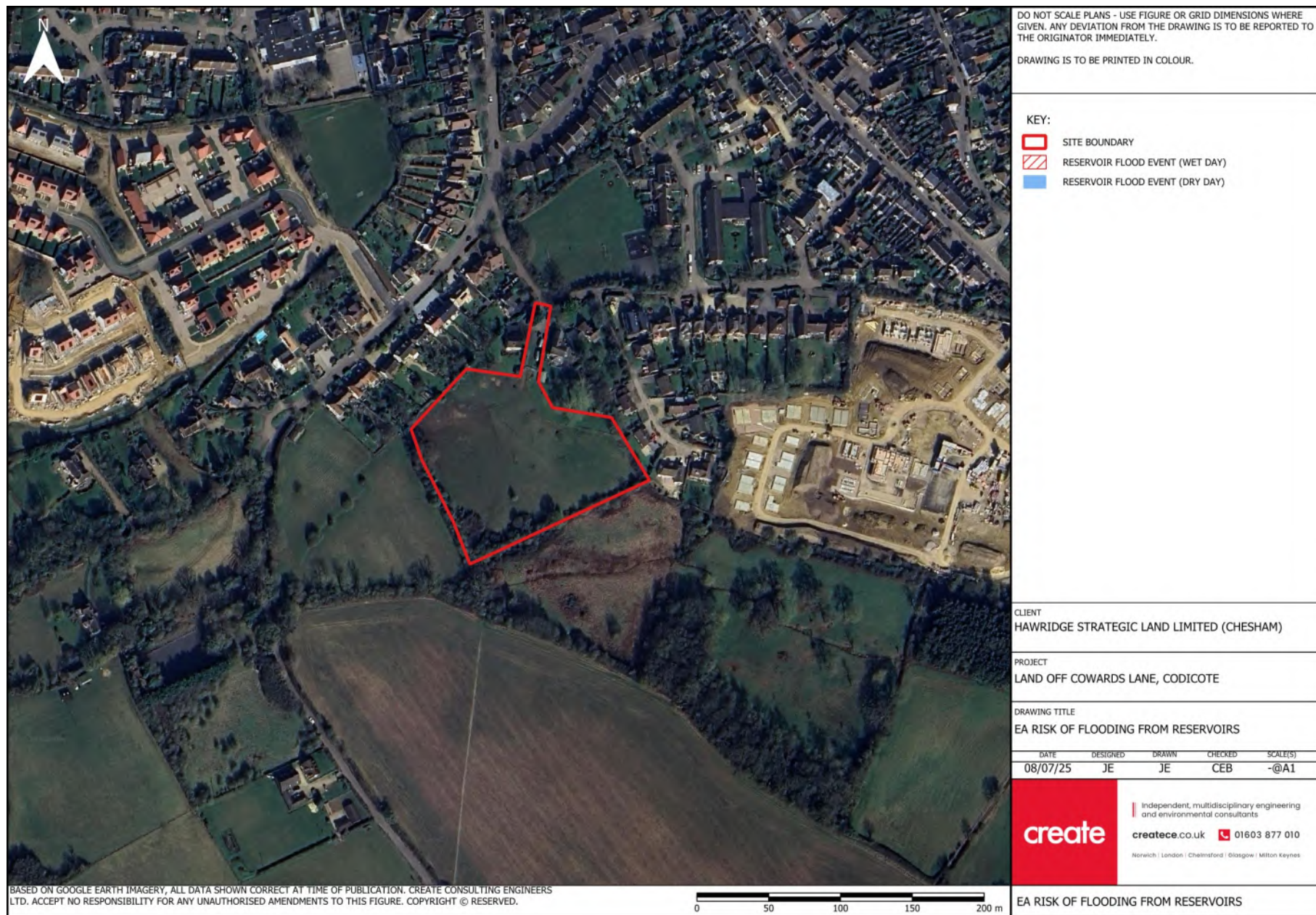


Figure 4.6: EA Risk of Flooding from Reservoirs

APPENDIX A

Asset Plans



0m 250m 500m 750m

Scale: 1:1250

Map Centre: 521596, 217826

Data updated: 24/03/25

Our Ref: 1743370-1

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Field Sewer	Other Sewer	Field Works
Surface Sewer	Proposed Sewer	Surface Works
Combined Sewer	Water Area	Combined Works
Abandoned Sewer	Water Area	Abandoned Works
Pressure Main	Water Area	Other Works
	Water Area	Field Works
	Water Area	Field Works
	Water Area	Field Works

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Wastewater Plan A0
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NAVs Information

Abbreviation	Company Full Name
AWL	Albion Water Limited
CW	County Water Limited
EWL	ESP Water Limited
IWNL	Independent Water Networks Limited
IWSL	Icosa Water Services Limited
LU	Leap Utilities Limited
STS	Severn Trent Services Limited

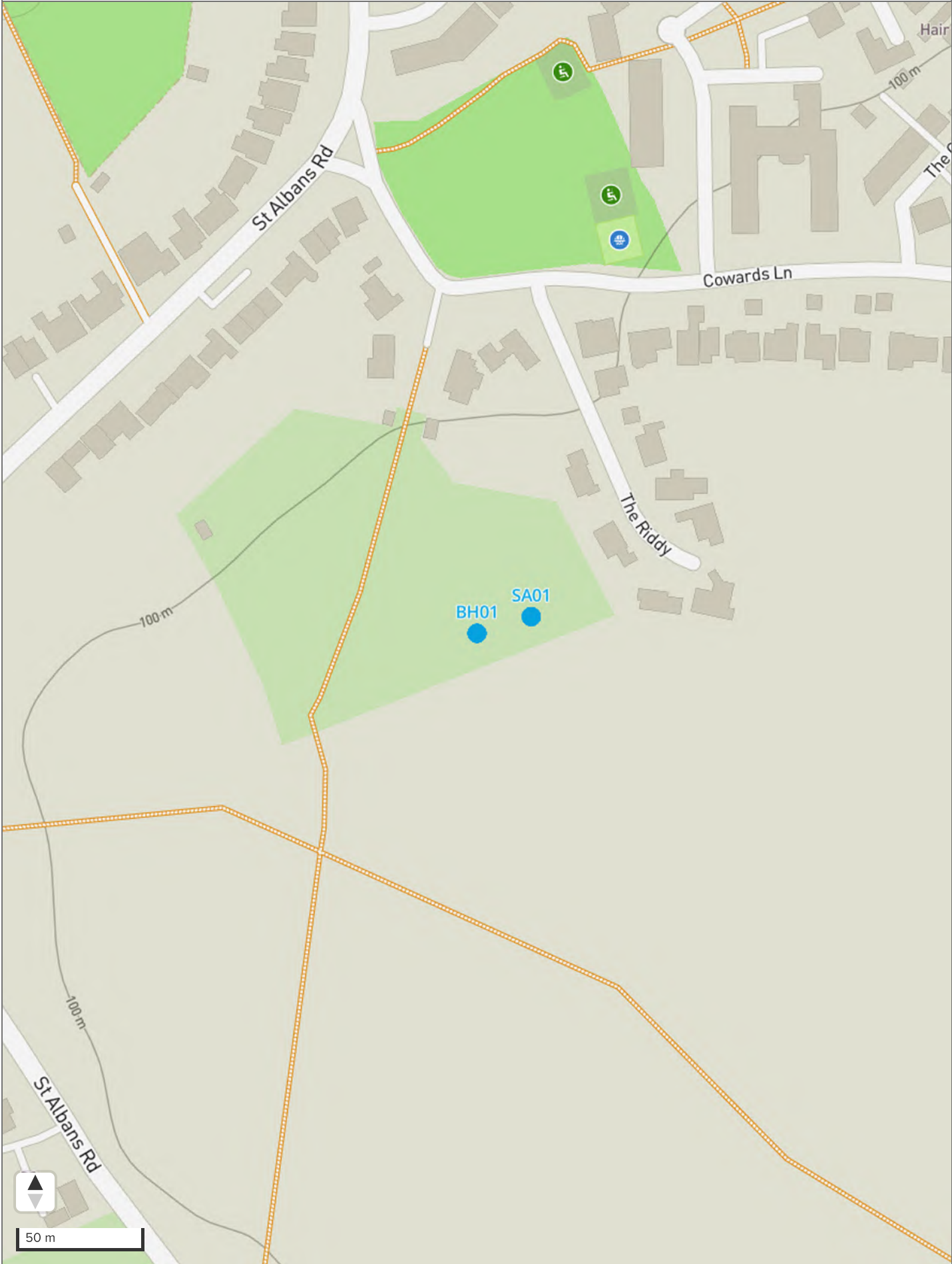
Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
0001	522070	218000	F	81.74	80.27	1.47
0002	522034	218062	F	82.56	80.62	1.94
0003	522004	218050	F	-	-	-
0004	522015	218037	F	-	-	-
0005	522019	218042	SO	-	-	-
0006	522008	218034	SO	-	-	-
0007	522026	218041	SO	-	-	-
0008	522014	218028	S	-	-	-
0009	522035	217999	S	-	-	-
001A	522067	218071	F	-	-	-
001B	522040	218052	F	-	-	-
001C	522071	218061	SO	-	-	-
001D	522077	218063	SO	-	-	-
0101	522013	218134	F	83.08	81.52	1.56
0102	522010	218136	F	82.93	81.63	1.3
0801	522011	217872	F	87.95	85.34	2.61
0802	522007	217865	S	88.03	85.89	2.14
0901	522057	217918	SO	87.87	84.8	3.07
0902	522075	217932	F	85.97	83.49	2.48
0903	522040	217997	F	-	-	-
0904	522050	217907	SO	87.79	84.8	2.99
0905	522074	217944	SO	85.94	84.71	1.23
091A	522055	217940	F	-	-	0.5
091B	522032	217963	F	-	-	0.5
091F	522023	217932	S	-	-	-
091G	522030	217926	S	-	-	-
091H	522047	217948	F	-	-	-
091I	522034	217955	F	-	-	-
091J	522052	217935	F	-	-	-
1701	522193	217708	F	77.49	75.93	1.56
1702	522160	217786	F	78.71	77.64	1.07
1801	522125	217869	F	82.23	79.56	2.67
1802	522106	217892	F	81.64	80.49	1.15
1901	522126	217911	F	82.34	79.8	2.54
1902	522100	217952	F	81.52	79.96	1.56
2001	521289	218066	F	-	-	-
2102	521275	218192	F	107.8	106.35	1.45
2103	521238	218187	F	-	-	-
2104	521240	218172	F	-	-	-
2105	521274	218186	F	-	-	-
2106	521273	218170	F	-	-	-
2107	521273	218162	F	-	-	-
2108	521286	218160	F	-	-	-
2109	521271	218134	F	-	-	-
211A	521227	218188	F	-	-	1
211B	521297	218128	F	-	-	-
2501	522265	217536	F	74.68	73.34	1.34
2601	522233	217629	F	76.64	-	-
3001	521309	218077	F	-	-	-
3002	521366	218082	F	-	-	-
3003	521365	218071	F	-	-	-
3101	521350	218197	F	106.85	105.23	1.62
3102	521355	218124	F	-	-	-
3103	521354	218109	F	-	-	-
3104	521368	218108	F	-	-	-
311A	521315	218182	F	-	-	-
311B	521311	218182	F	-	-	-
401C	521487	218059	C	-	-	-
401D	521490	218056	F	-	-	-
4201	521497	218263	F	103.14	101.09	2.05
4202	521443	218241	F	104.52	102.4	2.12
4203	521399	218210	F	105.47	103.86	1.61
4801	521459	217850	F	102.15	100.66	1.49
4802	521485	217874	F	101.85	100.21	1.64
481A	521481	217848	F	-	-	-
5001	521583	218070	F	103.14	101.78	1.36
5002	521587	218012	F	102.15	99.78	2.37
501A	521565	218043	F	-	-	-
5101	521570	218172	F	104.01	100.78	3.23
5102	521575	218137	F	103.95	101.12	2.83
5103	521597	218171	F	104.1	101.97	2.13
5201	521546	218298	F	100.87	99.16	1.71
5202	521535	218295	F	101.18	99.45	1.73
5203	521507	218275	F	102.56	100.68	1.88
5204	521577	218257	F	102.22	98.84	3.38
5205	521567	218249	F	102.59	98.99	3.6
5206	521569	218214	F	103.52	99.25	4.27
5207	521542	218202	F	103.95	102.29	1.66
5208	521517	218200	F	104.49	102.79	1.7
5209	521558	218216	F	103.61	101.88	1.73
5210	521540	218286	F	101.11	99.65	1.46
521A	521561	218219	F	-	-	-
521B	521531	218279	F	-	-	1
521C	521528	218280	F	-	-	1
521D	521526	218283	F	-	-	1
521E	521547	218300	C	100.82	99.17	1.65
531M	521560	218307	C	100.32	99.25	1.07
531Q	521563	218309	S	100.24	99.34	0.9
5901	521531	217924	F	101.86	99.57	2.29
5902	521578	217969	F	101.73	98.91	2.82
5903	521588	217960	F	100.62	98.78	1.84
591A	521565	217969	F	-	-	1
6001	521603	218013	F	102.24	100.35	1.89
6002	521606	218035	F	102.65	100.68	1.97
6003	521607	218043	F	101.98	100.73	1.25
6004	521653	218070	F	102.08	101.03	1.05
6005	521670	218087	F	102.3	101.25	1.05
6101	521669	218186	F	102.78	100.85	1.93
6102	521608	218170	F	104.1	102.14	1.96
6103	521616	218164	F	104.13	102.29	1.84
611A	521605	218151	F	-	-	1
611B	521691	218154	F	-	-	1
611C	521624	218198	F	-	-	-
611D	521684	218199	F	-	-	-
6201	521631	218210	S	103.21	102.06	1.15
6202	521613	218223	F	103.24	101.77	1.47
6203	521606	218215	F	103.62	102.77	0.85
6204	521645	218214	F	103.18	98.47	4.71
621A	521689	218218	F	-	-	-
621B	521684	218210	F	-	-	-
621C	521678	218201	F	-	-	-
621D	521628	218204	F	-	-	-
621E	521697	218229	F	-	-	-
621F	521675	218208	F	-	-	0.3
621G	521671	218223	F	-	-	-
6801	521672	217872	F	97.29	95.57	1.72
6803	521674	217867	F	97.16	95.41	1.75
681A	521649	217870	F	-	-	0.5
681B	521645	217886	F	-	-	-
681C	521601	217887	F	-	-	1
681D	521626	217896	F	-	-	-
681E	521646	217854	F	-	-	-
6901	521615	217915	F	99.07	97.75	1.32
6902	521633	217914	F	98.82	97.48	1.34
6903	521650	217917	F	98.5	97.11	1.39
7001	521785	218084	F	99.19	97.43	1.76
701A	521777	218061	F	-	-	0.5
701B	521781	218055	F	-	-	0.5
701C	521785	218050	F	-	-	0.5
701D	521792	218056	F	-	-	0.5
701E	521773	218066	F	-	-	0.5
701F	521779	218097	F	-	-	0.3
701G	521789	218083	F	10.3	8.67	1.63
701H	521784	218093	F	10.42	8.71	1.71
7101	521707	218156	S	102.02	100.46	1.56
7102	521726	218156	F	101.8	98.23	3.57
7103	521731	218144	F	101.32	98.52	2.8
7104	521789	218147	F	100.73	99.31	1.42
7105	521760	218106	F	99.99	98.4	1.59
711A	521797	218166	F	-	-	-
711B	521744	218113	F	-	-	-
711C	521700	218146	F	-	-	1
711D	521784	218101	F	-	-	0.3
711E	521736	218108	F	-	-	-
711F	521738	218167	F	-	-	1
711G	521733	218163	F	-	-	-
711H	521728	218158	F	-	-	1
7201	521772	218268	F	97.66	95.64	2.02
7202	521773	218291	F	94.56	92.61	1.95
721A	521768	218241	F	-	-	-
721B	521757	218241	F	-	-	-
7304	521776	218307	F	93.27	91.14	2.13

	Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
301		521728	217890	F	97.37	96.72	0.65
302		521734	217831	F	95.89	95.13	0.76
303		521741	217825	F	95.71	94.89	0.82
304		521745	217800	F	-	-	-
305		521699	217818	F	95.29	93.67	1.62
31A		521741	217888	F	-	-	1
31B		521729	217886	F	-	-	1
31C		521729	217886	F	-	-	1
31D		521710	217935	F	-	-	-
302		521726	217935	F	-	-	-
303		521742	217936	F	-	-	-
304		521755	217936	F	-	-	-
305		521773	217937	F	-	-	-
31A		521783	217997	F	-	-	-
31B		521805	218053	F	98.32	97.29	1.03
31C		521812	218055	F	98.05	97	1.05
31D		521807	218049	S	98.19	96.7	1.49
304		521800	218052	S	98.42	97.46	0.96
305		521895	218096	F	96.17	94.06	2.11
31B		521818	218055	F	-	-	0.9
31C		521827	218003	F	-	-	-
31D		521835	218003	F	-	-	-
31E		521841	218009	F	-	-	-
31F		521821	218009	F	-	-	-
31G		521864	218176	F	98.06	96.34	1.72
31A		521803	218168	F	-	-	-
31B		521801	218155	F	-	-	-
31C		521889	218156	F	-	-	0.5
31D		521886	218163	F	-	-	0.5
31E		521893	218149	F	-	-	0.5
31F		521890	218154	F	-	-	0.5
31G		521815	218174	F	-	-	-
31H		521819	218176	F	-	-	-
301		521894	218261	F	89.51	87.41	2.1
302		521839	218272	F	91.43	89.58	1.85
303		521807	218297	F	92.12	90.31	1.81
304		521845	218284	F	90.78	89.26	1.52
305		521817	218266	F	94	92.38	1.62
306		521811	218236	F	-	-	-
307		521840	218202	F	98.66	97.26	1.4
308		521880	218213	F	95.37	93.66	1.71
312		521890	218294	F	-	-	-
31A		521886	218237	F	-	-	-
31B		521892	218232	F	-	-	-
31A		521850	218305	F	-	-	-
301		521828	217844	F	-	-	-
302		521837	217915	F	-	-	-
30A		521802	217920	F	95.91	94.41	1.5
31A		521826	217956	F	-	-	-
31B		521832	217960	F	-	-	-
31C		521835	217965	F	-	-	-
31D		521805	217976	F	-	-	-
301		521906	218016	F	95.58	93.52	2.06
302		521907	218063	F	95.52	93.86	1.66
304		521962	218045	F	-	-	-
305		521975	218050	F	-	-	-
306		521986	218032	F	-	-	-
31A		521944	218021	F	-	-	-
31B		521941	218029	F	-	-	1.2
31C		521939	218036	F	-	-	1.2
31D		521933	218041	F	-	-	-
31E		521930	218058	F	-	-	-
31F		521938	218052	F	-	-	-
31H		521969	218048	F	-	-	-
31G		521979	218173	F	96.45	83.87	2.58
31E		521954	218178	F	89.35	85.18	4.17
301		521961	218166	F	88.44	84.97	3.47
302		521936	218208	F	90.54	85.5	5.04
303		521926	218225	F	90.01	87.15	2.86
304		521914	218240	F	89.81	87.27	2.54
301		521980	217851	F	-	-	-
303		521913	217895	F	-	-	-
302		521979	217886	S	88.78	86.81	1.97
301		521936	217965	F	94.45	92.85	1.6
302		521929	217950	F	93.46	92.4	1.06
303		521920	217943	S	93.53	91.56	1.97
305		521955	217949	F	-	-	-
31B		521960	217954	F	-	-	-
31C		521949	217967	F	-	-	-
31D		521944	217962	F	-	-	-

APPENDIX B

CK Rail Ground Investigation Results

LAYOUT MAP



Client: Hawridge Strategic Land							BH01	
Date Started: 2025-06-06		Co-ordinates X: 521,635.0 Y: 217,781.0		Ground Level (m) 93.76				
SAMPLE STATUS								
D: Small bulk disturbed								
Elevation	Depth	Lithology	Lithology	Casings	Backfill	Diameter	Status	Samples
93.61	0		Soft, brown, slightly fine sandy, slightly gravelly CLAY. Gravel is sub-angular to rounded, fine and medium flint and brick. (Made Ground) 0.15 m Soft, orange brown, slightly fine sandy, slightly gravelly CLAY. Gravel is sub-angular to rounded, fine to coarse flint. (Made Ground) 0.35 m	200	Concrete 0.2 m	200	D	0.1 m
93.41		D					0.25 m	
	1				D		0.5 m	
					D		1 m	
	2	Stiff, brown mottled grey grey, slightly gravelly CLAY. Gravel is sub-angular and sub-rounded, fine to coarse flint and chalk. (Lowestoft Formation)	D		2 m			
	3		D		3 m			
90.26		3.5 m					D	
	4		D		4 m			
	5		D		5 m			
	6	Stiff, brownish grey and brown, slightly fine sandy, slightly gravelly CLAY. Gravel is sub-angular to rounded, fine to coarse flint and chalk. (Lowestoft Formation)	D		6 m			
	7		D	7 m				
	8		D	8 m				
85.36		8.4 m						
85.16		Grey silty SAND. (Driller's Description) 8.6 m						
	9		D	9 m				
		Stiff, brownish grey and brown, slightly fine sandy, slightly gravelly CLAY. Gravel is sub-angular to rounded, fine to coarse flint and chalk. (Lowestoft Formation)						
83.76	10		D	10 m				
Remarks		1. Trial pit remained stable whilst open and during the test. 2. Excavation noted to be dry prior to commencing infiltration test.						
Driller	SM	EXPLORATORY HOLE LOG		CKConsulting and Geotechnical				
Logged	KK							
Checked	PTE	Cowards Lane, Codicote (Soakage Testing)		Ground Investigation Data				
Appr'd	PTE							

Client: Hawridge Strategic Land							BH01	
Date Started: 2025-06-06		Co-ordinates X: 521,635.0 Y: 217,781.0		Ground Level (m) 93.76				
SAMPLE STATUS								
D: Small bulk disturbed								
Elevation	Depth	Lithology	Lithology	Casings	Backfill	Diameter	Status	Samples
83.76	10		Stiff, brownish grey and brown, slightly fine sandy, slightly gravelly CLAY. Gravel is sub-angular to rounded, fine to coarse flint and chalk. (Lowestoft Formation)	200		200	D	11 m
	11			11.5 m		11.5 m		
81.96	12		CHALK described from disturbed samples as off-white and white, structureless melange comprising 30% to 40% of angular and sub-angular, fine to coarse gravel of chalk set in a 60% to 70% fine sand size and silt size chalk matrix. Occasional very angular and angular, fine to coarse flint gravel. (Grade Dm?) (Weathered Lewes Nodular Chalk Formation/Seaford Chalk Formation - Undifferentiated)	150	Bentonite	150	D	12 m
	13						D	13 m
	14						D	14 m
	15						D	15 m
	16						D	16 m
	17						D	17 m
	18						D	18 m
	19						D	19 m
73.76	20						D	20 m
Remarks		1. Trial pit remained stable whilst open and during the test. 2. Excavation noted to be dry prior to commencing infiltration test.						
Driller	SM	EXPLORATORY HOLE LOG						
Logged	KK							
Checked	PTE	Cowards Lane, Codicote (Soakage Testing)		Ground Investigation Data				
Appr'd	PTE							

Client: Hawridge Strategic Land							BH01	
Date Started: 2025-06-06		Co-ordinates X: 521,635.0 Y: 217,781.0		Ground Level (m) 93.76				
SAMPLE STATUS								
D: Small bulk disturbed								
Elevation	Depth	Lithology	Lithology	Casings	Backfill	Diameter	Status	Samples
73.76	20		CHALK described from disturbed samples as off-white and white, structureless melange comprising 30% to 40% of angular and sub-angular, fine to coarse gravel of chalk set in a 60% to 70% fine sand size and silt size chalk matrix. Occasional very angular and angular, fine to coarse flint gravel. (Grade Dm?) (Weathered Lewes Nodular Chalk Formation/Seaford Chalk Formation - Undifferentiated)	150	Gravel	150	D	21 m
	21							
	22							
71.66	22							
71.36								
	23							
	24							
	25							
	26							
	27							
	28							
	29							
63.76	30		30 m		30 m	30 m	D	30 m
Remarks								
1. Trial pit remained stable whilst open and during the test. 2. Excavation noted to be dry prior to commencing infiltration test.								
Driller	SM	EXPLORATORY HOLE LOG						
Logged	KK							
Checked	PTE	Cowards Lane, Codicote (Soakage Testing)		Ground Investigation Data				
Appr'd	PTE							

SAMPLE STATUS
D: Small bulk disturbed

Borehole

Depth	P	30.0 m
Diameter	D	63.0 mm

Water depth

Being drilled	H _w	25.0 m
After equipment	H _w	25.0 m

Tube

☒ PEHD		
Inner diameter	D _t	50.0 mm
Outer diameter	D _t	63.0 mm
Slotted	From 18.0 To 30.0 m	
Development	☒ No	
Bottom plug	☒ Yes	
Height from ground	H _t	- m

Backfill

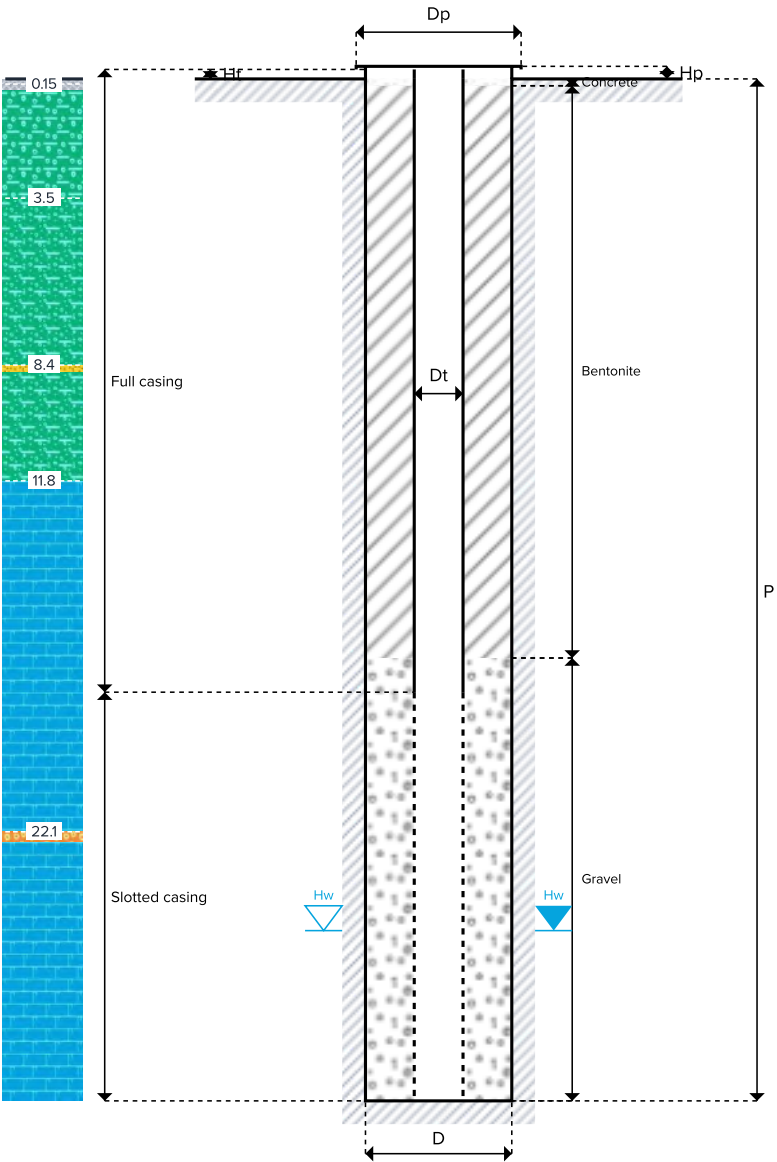
Concrete	From 0.0 To 0.2 m
Bentonite	From 0.2 To 17.0 m
Gravel	From 17.0 To 30.0 m

Protection

Metal head	☒ Yes	
Lock	☒ No	
Key hole	☒ No	
Concrete manhole	☒ No	
Protection diameter	D _p	0.15 mm
Height from ground	H _p	0.37 m

Piezometer Reception

Water Depth - Start receiving	- m
Water Depth - End receiving	- m
Reception duration	- h



BOREHOLE SOAKAGE TEST DATA

Lead Number:	GI-211	Site:	Cowards Lane, Codicote		
Borehole test depth (m):	20	Dia (m)	0.15	Dry?	Yes
					Depth if wet: N/A
Water Supply:	Bowser	Water Amount (Gallons)	250	Time to Empty (secs):	120

Depth	Ground Conditions	Time	Depth
Ground Level		0	2.01
	Turf over possible topsoil (Driller's Description)	30	8.9
0.15		60	11.5
	Made Ground (Driller's Description)	90	13
0.35		120	14.5
	Brown, silty, sandy clay with flint (Driller's Description)	150	16
3.50		180	16.5
	Grey, silty, sandy clay with chalk fragments (Driller's Description)	210	17
		240	17.6
8.40		5	18.4
	Grey, silty sand. (Driller's Description)	6	18.85
8.60		7	19.1
	Grey, silty, sandy clay with chalk and flint fragments (Driller's Description)	8	19.3
		9	19.4
11.80		10	19.5
	Putty chalk (Driller's Description)	15	Dry
30.00		20	-
	End of borehole	25	-
		30	-

1 Measurement of soakage based upon data prior to commencing test

Emptied water (litres)	<i>250 gallons x 4.546</i>	1136.5
Water in BH at time 0 secs (litres)	<i>(20 - 2.01) x (π0.075²) x 1000</i>	318
Soakage Rate (litres/sec)	$\frac{\text{Emptied water} - \text{Water at 0 secs}}{\text{Time to empty bowser}}$	6.8

2 Measurement of soakage using intial drop in water level

Water level at 0 secs	2.01	Water level at 30 secs	8.9
Volume of water (litres)	$(8.9 - 2.01) \times (\pi 0.075^2) \times 1000$		122
Soakage Rate (litres/sec)	$\frac{\text{Volume of water from 0 to 30 secs}}{\text{Change in time (30 secs)}}$		4.1

Client: Hawridge Strategic Land							SA01
Date Started: 2025-06-06		Co-ordinates X: 521,656.0 Y: 217,788.0		Ground Level (m) 94.08			
Elevation	Depth	Lithology	Lithology				Backfill
94.08	0		Soft, brown, slightly fine sandy, slightly gravelly CLAY. Gravel is sub-angular to rounded, fine and medium flint and brick.(Made Ground)				Arisings
93.83			Soft, orange brown, slightly fine sandy, slightly gravelly CLAY. Gravel is sub-angular to rounded, fine to coarse flint.(Lowestoft Formation?)				
93.33			0.75 m				
	1		Stiff, brown mottled grey grey, slightly gravelly CLAY. Gravel is sub-angular and sub-rounded, fine to coarse flint and chalk. (Lowestoft Formation)				
	2		2.1 m				2.1 m
91.98							

06/06/2025

Form completed by		
Tested By	PRINT	Oakland
	SIGN	Oakland
	DATE	07/06/2025
Calculated By	PRINT	KK
	SIGN	KK
	DATE	13/06/2025
Checked by	PRINT	PTE
	SIGN	PTE
	DATE	17/06/2025

APPENDIX C

Greenfield Runoff Calculation

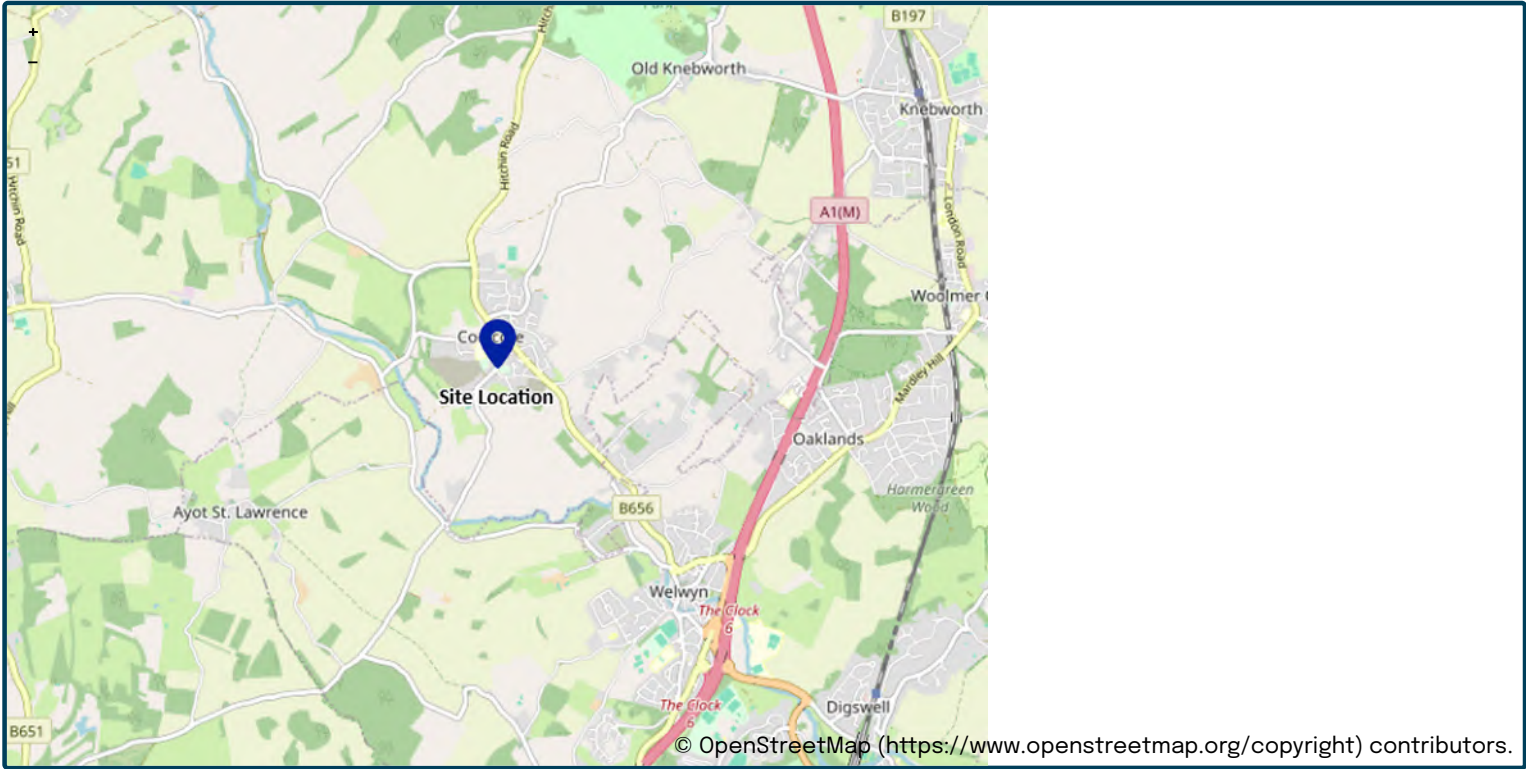
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	15/04/2025
Calculated by	J Everitt
Reference	Cowards Lane
Model version	0.6.5

Location

Site name	Cowards Lane
Site location	Codicote



Site easting	521593
Site northing	217809

Site details

Total site area (ha)	1.35	ha
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Greenfield runoff

Method

Method	FEH statistical
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FEH statistical

	<u>My value</u>		<u>Map value</u>
SAAR (mm)	655	mm	655
BFIHOST	0.598		
QMed-QBar conversion	1.136		1.136
QMed (l/s)	2.37	l/s	
QBar (FEH statistical) (l/s)	2.7	l/s	

Growth curve factors

	<u>My value</u>		<u>Map value</u>
Hydrological region	6		6
1 year growth factor	0.85		
2 year growth factor	0.88		
10 year growth factor	1.62		
30 year growth factor	2.3		
100 year growth factor	3.19		
200 year growth factor	3.74		

Results

Method	FEH statistical	
Flow rate 1 year (l/s)	2.3	l/s
Flow rate 2 year (l/s)	2.4	l/s
Flow rate 10 years (l/s)	4.4	l/s
Flow rate 30 years (l/s)	6.2	l/s
Flow rate 100 years (l/s)	8.6	l/s
Flow rate 200 years (l/s)	10.1	l/s

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (0.6.5) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>).

The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

APPENDIX D

FLOW Hydraulic Calculations

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
Outline_Basin	0.389	5.00	93.200	1200	1.200
DeepBoreSoaks			93.200	1200	1.400

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
Outline_Basin	10.000	50.0	300	Circular	93.200	92.000	0.900	93.200	91.800	1.100

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
Outline_Basin	Outline_Basin	1200	Manhole	Adoptable	DeepBoreSoaks	1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	4320	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	35	0	0
100	40	0	0

Node Outline_Basin Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	92.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	3210

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	275.0	0.0	0.600	491.0	0.0	0.601	592.0	0.0	1.200	860.0	0.0

Node DeepBoreSoaks Deep Bore Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	78.200	Borehole Diameter	0.170
Side Inf Coefficient (m/hr)	3.68490	Time to half empty (mins)	3	Borehole Depth (m)	15.000
Safety Factor	5.0	Diameter (m)	0.200	Inf Depth (m)	3.200
Porosity	0.30	Depth (m)		Number Required	2

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	105.237	29.778	30 year +35% CC 480 minute summer	34.357	9.079
2 year 15 minute winter	73.850	29.778	30 year +35% CC 480 minute winter	22.826	9.079
2 year 30 minute summer	66.950	18.945	30 year +35% CC 600 minute summer	27.500	7.522
2 year 30 minute winter	46.983	18.945	30 year +35% CC 600 minute winter	18.790	7.522
2 year 60 minute summer	43.790	11.572	30 year +35% CC 720 minute summer	24.022	6.438
2 year 60 minute winter	29.093	11.572	30 year +35% CC 720 minute winter	16.145	6.438
2 year 120 minute summer	31.596	8.350	30 year +35% CC 960 minute summer	19.078	5.024
2 year 120 minute winter	20.992	8.350	30 year +35% CC 960 minute winter	12.637	5.024
2 year 180 minute summer	25.644	6.599	30 year +35% CC 1440 minute summer	13.232	3.546
2 year 180 minute winter	16.669	6.599	30 year +35% CC 1440 minute winter	8.893	3.546
2 year 240 minute summer	20.752	5.484	30 year +35% CC 2160 minute summer	9.090	2.512
2 year 240 minute winter	13.787	5.484	30 year +35% CC 2160 minute winter	6.263	2.512
2 year 360 minute summer	16.009	4.120	30 year +35% CC 2880 minute summer	7.381	1.978
2 year 360 minute winter	10.406	4.120	30 year +35% CC 2880 minute winter	4.960	1.978
2 year 480 minute summer	12.538	3.313	100 year +40% CC 15 minute summer	500.126	141.518
2 year 480 minute winter	8.330	3.313	100 year +40% CC 15 minute winter	350.966	141.518
2 year 600 minute summer	10.177	2.784	100 year +40% CC 30 minute summer	324.189	91.734
2 year 600 minute winter	6.954	2.784	100 year +40% CC 30 minute winter	227.501	91.734
2 year 720 minute summer	8.986	2.408	100 year +40% CC 60 minute summer	214.939	56.802
2 year 720 minute winter	6.039	2.408	100 year +40% CC 60 minute winter	142.800	56.802
2 year 960 minute summer	7.254	1.910	100 year +40% CC 120 minute summer	131.186	34.669
2 year 960 minute winter	4.805	1.910	100 year +40% CC 120 minute winter	87.157	34.669
2 year 1440 minute summer	5.142	1.378	100 year +40% CC 180 minute summer	99.314	25.557
2 year 1440 minute winter	3.455	1.378	100 year +40% CC 180 minute winter	64.557	25.557
2 year 2160 minute summer	3.636	1.005	100 year +40% CC 240 minute summer	77.392	20.453
2 year 2160 minute winter	2.505	1.005	100 year +40% CC 240 minute winter	51.418	20.453
2 year 2880 minute summer	3.024	0.811	100 year +40% CC 360 minute summer	57.553	14.810
2 year 2880 minute winter	2.033	0.811	100 year +40% CC 360 minute winter	37.411	14.810
30 year +35% CC 15 minute summer	381.215	107.871	100 year +40% CC 480 minute summer	44.139	11.665
30 year +35% CC 15 minute winter	267.520	107.871	100 year +40% CC 480 minute winter	29.325	11.665
30 year +35% CC 30 minute summer	245.335	69.421	100 year +40% CC 600 minute summer	35.296	9.654
30 year +35% CC 30 minute winter	172.165	69.421	100 year +40% CC 600 minute winter	24.116	9.654
30 year +35% CC 60 minute summer	161.709	42.735	100 year +40% CC 720 minute summer	30.799	8.254
30 year +35% CC 60 minute winter	107.435	42.735	100 year +40% CC 720 minute winter	20.699	8.254
30 year +35% CC 120 minute summer	100.594	26.584	100 year +40% CC 960 minute summer	24.400	6.425
30 year +35% CC 120 minute winter	66.832	26.584	100 year +40% CC 960 minute winter	16.163	6.425
30 year +35% CC 180 minute summer	76.923	19.795	100 year +40% CC 1440 minute summer	16.856	4.518
30 year +35% CC 180 minute winter	50.002	19.795	100 year +40% CC 1440 minute winter	11.328	4.518
30 year +35% CC 240 minute summer	60.204	15.910	100 year +40% CC 2160 minute summer	11.519	3.184
30 year +35% CC 240 minute winter	39.998	15.910	100 year +40% CC 2160 minute winter	7.937	3.184
30 year +35% CC 360 minute summer	44.769	11.521	100 year +40% CC 2880 minute summer	9.300	2.493
30 year +35% CC 360 minute winter	29.101	11.521	100 year +40% CC 2880 minute winter	6.250	2.493

Results for 2 year Critical Storm Duration. Lowest mass balance: 93.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	Outline_Basin	585	92.224	0.224	7.6	70.8886	0.0000	OK
720 minute winter	DeepBoreSoaks	705	92.226	0.426	4.2	1.4362	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
600 minute winter	Outline_Basin	Outline_Basin	DeepBoreSoaks	5.3	0.948	0.034	0.6342
720 minute winter	DeepBoreSoaks	Infiltration		0.7			

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 93.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	Outline_Basin	945	92.647	0.647	13.7	258.8828	0.0000	SURCHARGED
1440 minute winter	DeepBoreSoaks	1410	92.649	0.849	2.3	1.9232	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
960 minute winter	Outline_Basin	Outline_Basin	DeepBoreSoaks	2.7	0.836	0.017	0.7042
1440 minute winter	DeepBoreSoaks	Infiltration		0.7			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 93.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Outline_Basin	1440	92.785	0.785	12.2	347.9333	0.0000	SURCHARGED
1440 minute winter	DeepBoreSoaks	1470	92.786	0.986	2.7	2.0804	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
1440 minute winter	Outline_Basin	Outline_Basin	DeepBoreSoaks	2.7	0.789	0.017	0.7042
1440 minute winter	DeepBoreSoaks	Infiltration		0.7			

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
Outline_Basin	0.389	5.00	93.200	1200	1.200
DeepBoreSoaks			93.200	1200	1.400

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
Outline_Basin	10.000	50.0	300	Circular	93.200	92.000	0.900	93.200	91.800	1.100

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
Outline_Basin	Outline_Basin	1200	Manhole	Adoptable	DeepBoreSoaks	1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	4320	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	0	0	0

Node Outline_Basin Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	92.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	480

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1.2	0.0	0.531	465.0	0.0	0.601	592.0	0.0
0.530	1.2	0.0	0.600	491.0	0.0	1.200	860.0	0.0

Node DeepBoreSoaks Deep Bore Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	78.200	Borehole Diameter	0.170
Side Inf Coefficient (m/hr)	3.68490	Time to half empty (mins)	3	Borehole Depth (m)	15.000
Safety Factor	5.0	Diameter (m)	0.200	Inf Depth (m)	3.200
Porosity	0.30	Depth (m)		Number Required	2

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
10 year 15 minute summer	215.498	60.978	10 year 480 minute summer	20.516	5.422
10 year 15 minute winter	151.226	60.978	10 year 480 minute winter	13.630	5.422
10 year 30 minute summer	137.307	38.853	10 year 600 minute summer	16.473	4.506
10 year 30 minute winter	96.356	38.853	10 year 600 minute winter	11.255	4.506
10 year 60 minute summer	90.130	23.819	10 year 720 minute summer	14.427	3.867
10 year 60 minute winter	59.880	23.819	10 year 720 minute winter	9.696	3.867
10 year 120 minute summer	57.948	15.314	10 year 960 minute summer	11.512	3.031
10 year 120 minute winter	38.499	15.314	10 year 960 minute winter	7.626	3.031
10 year 180 minute summer	45.034	11.589	10 year 1440 minute summer	8.035	2.153
10 year 180 minute winter	29.273	11.589	10 year 1440 minute winter	5.400	2.153
10 year 240 minute summer	35.552	9.395	10 year 2160 minute summer	5.562	1.537
10 year 240 minute winter	23.620	9.395	10 year 2160 minute winter	3.833	1.537
10 year 360 minute summer	26.625	6.852	10 year 2880 minute summer	4.547	1.219
10 year 360 minute winter	17.307	6.852	10 year 2880 minute winter	3.056	1.219

Results for 10 year Critical Storm Duration. Lowest mass balance: 57.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Outline_Basin	705	92.761	0.761	10.5	135.4265	0.0000	SURCHARGED
600 minute summer	DeepBoreSoaks	615	92.761	0.961	3.0	2.0518	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
720 minute winter	Outline_Basin	Outline_Basin	DeepBoreSoaks	3.3	0.846	0.021	0.7042
600 minute summer	DeepBoreSoaks	Infiltration		0.7			

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
Outline_Basin	0.389	5.00	93.200	1200	1.200
DeepBoreSoaks			93.200	1200	1.400

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
Outline_Basin	10.000	50.0	300	Circular	93.200	92.000	0.900	93.200	91.800	1.100

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
Outline_Basin	Outline_Basin	1200	Manhole	Adoptable	DeepBoreSoaks	1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	4320	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	35	0	0
100	40	0	0

Node Outline_Basin Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	92.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	275.0	0.0	0.600	491.0	0.0	0.601	592.0	0.0	1.200	860.0	0.0

Node DeepBoreSoaks Deep Bore Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	78.200	Borehole Diameter	0.170
Side Inf Coefficient (m/hr)	0.00001	Time to half empty (mins)	1215993	Borehole Depth (m)	15.000
Safety Factor	5.0	Diameter (m)	0.200	Inf Depth (m)	3.200
Porosity	0.30	Depth (m)		Number Required	2

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +35% CC 15 minute summer	381.215	107.871	100 year +40% CC 15 minute summer	500.126	141.518
30 year +35% CC 15 minute winter	267.520	107.871	100 year +40% CC 15 minute winter	350.966	141.518
30 year +35% CC 30 minute summer	245.335	69.421	100 year +40% CC 30 minute summer	324.189	91.734
30 year +35% CC 30 minute winter	172.165	69.421	100 year +40% CC 30 minute winter	227.501	91.734
30 year +35% CC 60 minute summer	161.709	42.735	100 year +40% CC 60 minute summer	214.939	56.802
30 year +35% CC 60 minute winter	107.435	42.735	100 year +40% CC 60 minute winter	142.800	56.802
30 year +35% CC 120 minute summer	100.594	26.584	100 year +40% CC 120 minute summer	131.186	34.669
30 year +35% CC 120 minute winter	66.832	26.584	100 year +40% CC 120 minute winter	87.157	34.669
30 year +35% CC 180 minute summer	76.923	19.795	100 year +40% CC 180 minute summer	99.314	25.557
30 year +35% CC 180 minute winter	50.002	19.795	100 year +40% CC 180 minute winter	64.557	25.557
30 year +35% CC 240 minute summer	60.204	15.910	100 year +40% CC 240 minute summer	77.392	20.453
30 year +35% CC 240 minute winter	39.998	15.910	100 year +40% CC 240 minute winter	51.418	20.453
30 year +35% CC 360 minute summer	44.769	11.521	100 year +40% CC 360 minute summer	57.553	14.810
30 year +35% CC 360 minute winter	29.101	11.521	100 year +40% CC 360 minute winter	37.411	14.810
30 year +35% CC 480 minute summer	34.357	9.079	100 year +40% CC 480 minute summer	44.139	11.665
30 year +35% CC 480 minute winter	22.826	9.079	100 year +40% CC 480 minute winter	29.325	11.665
30 year +35% CC 600 minute summer	27.500	7.522	100 year +40% CC 600 minute summer	35.296	9.654
30 year +35% CC 600 minute winter	18.790	7.522	100 year +40% CC 600 minute winter	24.116	9.654
30 year +35% CC 720 minute summer	24.022	6.438	100 year +40% CC 720 minute summer	30.799	8.254
30 year +35% CC 720 minute winter	16.145	6.438	100 year +40% CC 720 minute winter	20.699	8.254
30 year +35% CC 960 minute summer	19.078	5.024	100 year +40% CC 960 minute summer	24.400	6.425
30 year +35% CC 960 minute winter	12.637	5.024	100 year +40% CC 960 minute winter	16.163	6.425
30 year +35% CC 1440 minute summer	13.232	3.546	100 year +40% CC 1440 minute summer	16.856	4.518
30 year +35% CC 1440 minute winter	8.893	3.546	100 year +40% CC 1440 minute winter	11.328	4.518
30 year +35% CC 2160 minute summer	9.090	2.512	100 year +40% CC 2160 minute summer	11.519	3.184
30 year +35% CC 2160 minute winter	6.263	2.512	100 year +40% CC 2160 minute winter	7.937	3.184
30 year +35% CC 2880 minute summer	7.381	1.978	100 year +40% CC 2880 minute summer	9.300	2.493
30 year +35% CC 2880 minute winter	4.960	1.978	100 year +40% CC 2880 minute winter	6.250	2.493

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 87.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	Outline_Basin	3480	92.794	0.794	5.4	353.9341	0.0000	SURCHARGED
2880 minute winter	DeepBoreSoaks	3420	92.794	0.994	1.0	2.0901	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
2880 minute winter	Outline_Basin	Outline_Basin	DeepBoreSoaks	1.0	0.619	0.006	0.7042
2880 minute winter	DeepBoreSoaks	Infiltration		0.0			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 87.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	Outline_Basin	3480	92.928	0.928	6.8	449.1795	0.0000	FLOOD RISK
2880 minute winter	DeepBoreSoaks	3420	92.928	1.128	1.2	2.2445	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
2880 minute winter	Outline_Basin	Outline_Basin	DeepBoreSoaks	1.2	0.653	0.007	0.7042
2880 minute winter	DeepBoreSoaks	Infiltration		0.0			

PLANS





- SITE BOUNDARY
- ⬆️⬆️ PRINCIPAL ACCESS POINT
- ⬆️⬆️ FOOTPATH / PEDESTRIAN ACCESS POINT
- ⋯ PUBLIC RIGHT OF WAY (FOOTPATH 023)
- DEVELOPMENT AREA
- PUBLIC OPEN SPACE
- SuDS BASIN & DRAINAGE AREA (INDICATIVE LOCATION)
- ✳️ LOCALLY EQUIPPED AREA FOR PLAY (LEAP) (INDICATIVE LOCATION)

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Rev	Description	Date	Au
-	Issue for Planning	10.07.25	MB

Project	Cowards Lane, Codicote		
Drawing	Parameter Plan - 01	Dwg no.	PPL-01
Client	Hawridge Strategic Land	Scale	1:1000 @ A3
Project no.	HAWR.250206	Rev.	-
Date	10.07.25	Author	MB



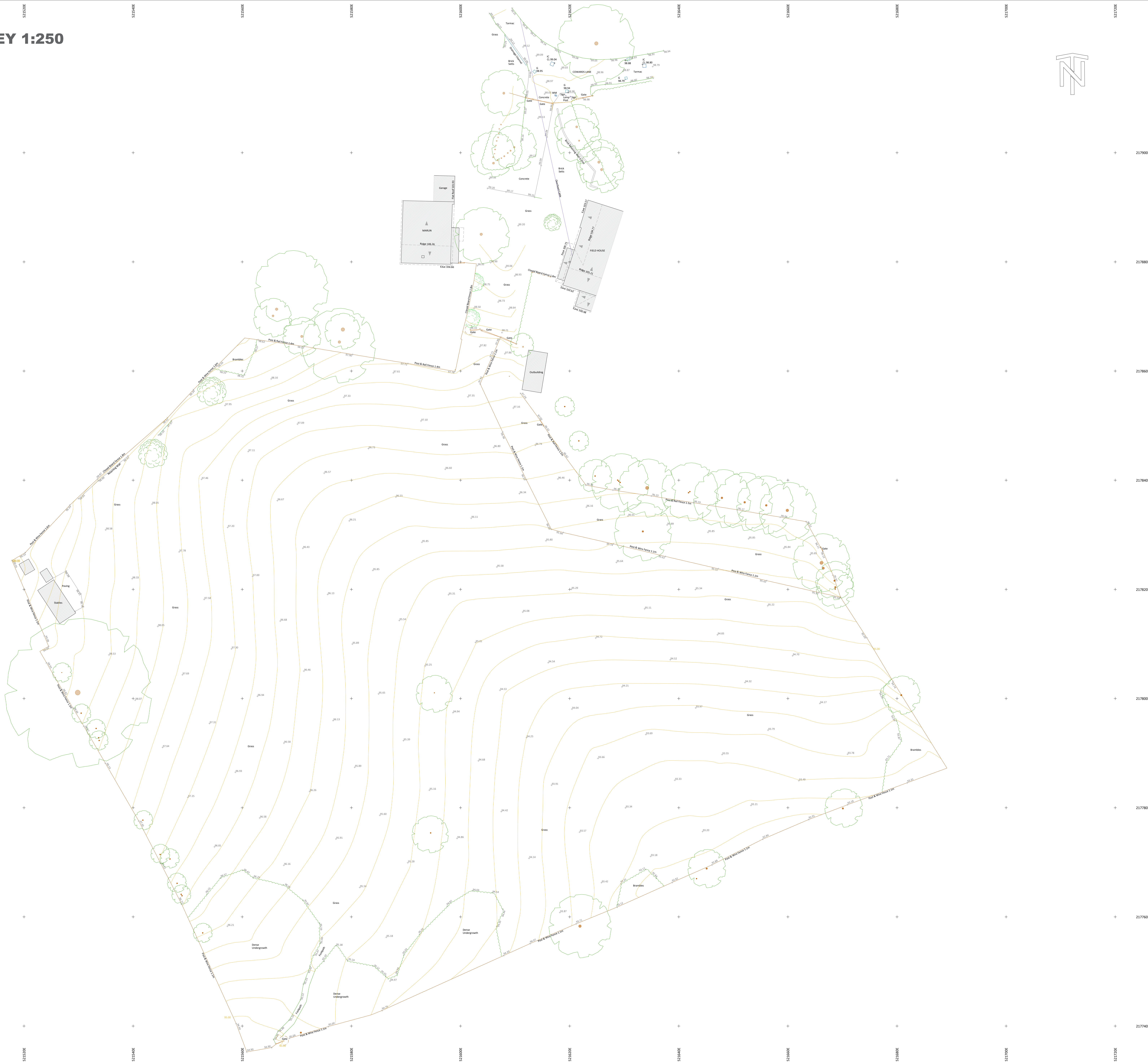


Rev	Description	Date	Au
-	Issue for Planning	10.07.25	MB

Project	Cowards Lane, Codicote		
Drawing	Site Location Plan - 01	Dwg no.	SLP-01
Client	Hawridge Strategic Land	Scale	1:1000 @ A3
Job no.	HAWR.250206	Rev.	-
Date	10.07.25	Author	MB



TOPOGRAPHICAL SURVEY 1:250



Notes:

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Scale factor has been removed.

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SURVEY ABBREVIATIONS

AV	Air Valve	Multi	Multiple cables/pipes
BL	Beam Level	PM	Parking Meter
BT	British Telecom	RE	Rodding Eye
C	Cable	RWP	Rainwater Pipe
CCTV	Closed Circuit Television	RS	Road Sign
CI	Ceiling Level	SF	Soffit Depth
Comms	Communications cable	Skw	Sink Waste
CTV	Cable Television	SL	Soffit Level
D	Door Head Level	SVP	Soil Vent Pipe
Elec	Electricity cable/apparatus	TCB	Telephone Call Box
EML	Electromagnetic Location	TFR	Taken From Records
EOT	End of Trace	THL	Threshold Level
ER	Earth Rod	TP	Telegraph Pole
FL	Floor Level	UTT	Unable to Trace
FH	Fire Hydrant	VP	Vent Pipe
G	Gully	WM	Water Meter
GPR	Ground Penetrating Radar	WO	Wash Out
GV	Gas Valve		
H	Head Level		
HV	High Voltage >1000v		
HW	Heating		
IC	Inspection Chamber		
IL	Invert Level		
LP	Lamp Post		
LV	Low Voltage <1000v		

A	Initial Issue	RM	09-04-25
REV:	DESCRIPTION:	BY:	DATE:

CLIENT:
Hawridge Strategic Land Limited
St Mary's Court
Amersham
Buckinghamshire
HP7 0UT

SITE: Land to South of Cowards Lane
Codicote
Herts
SG4 8UW

TITLE: Topographical Survey

SCALE AT A0 : 1:250	DATE: 03-04-25	DRAWN: RM	CHECKED: AT
PROJECT NO: TVG830	DRAWING NO: TVG830-01	REVISION: A	





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KEY

- PROPOSED SURFACE WATER SEWER
- EXCEEDANCE FLOW ROUTE
- APPLICATION SITE REDLINE BOUNDARY
- TANKED PERMEABLE PAVING

BASIN:
CL: 93.20 mAOD
IL: 91.00 mAOD
DEPTH: 1.20 m
AREA: 860 m²

DEEP BH
SOAKAWAY 1

DEEP BH
SOAKAWAY 2

CATCHPIT

SuDS

LEAP

Ponds

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W:\2.0 NEW PROJECTS\2025\3473 - COWARDS LANE, CODICOTE\3.0 CIVILS\3473-CCE-XX-XX-DR-D-0001 - OUTLINE SURFACE WATER DRAINAGE STRATEGY

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P01	10.07.25	INITIAL ISSUE	JE	CB
REV	DATE	DESCRIPTION	DRAWN	CHECKED
CLIENT	HAWRIDGE STRATEGIC LAND			

PROJECT
LAND OFF COWARDS LANE
CODICOTE

DRAWING TITLE
PRELIMINARY SURFACE WATER DRAINAGE STRATEGY

DATE	DESIGNED	DRAWN	CHECKED	SCALE(S)
10/07/25	JE	JE	GS	NTS

Independent, multidisciplinary
engineering and environmental
consultants
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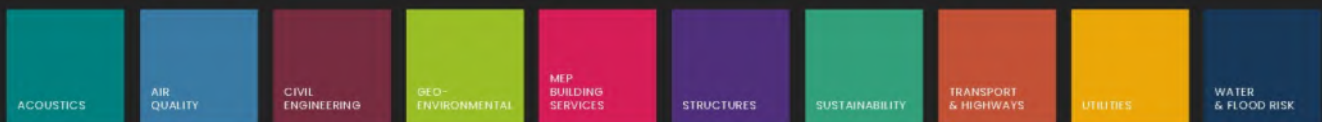
DRAWING STATUS INFORMATION						STATUS	CREATE PROJECT NUMBER
PROJ	ORIG	ZONE	LEVEL	TYPE	ROLE	NUMBER	REVISION
3473	CCE	XX	XX	DR	D	0001	P01

Hawridge Strategic Land Ltd

LAND OFF COWARDS LANE, CODICOTE

Flood Risk Assessment and Drainage Strategy

The information contained within this report and any appendices or supporting information provided are to be treated as confidential.



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