Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust

Woollam Park, St Albans

Flood Risk Assessment and Drainage Strategy

October 2025

Project Code: 05920

Document Ref: 05920-FRA-002

PJA
Park Point
17 High Street
Longbridge
B31 2UQ
UK
pja.co.uk

Version Control and Approval

Version	Date	Main Contributor	Issued by	Approved by
P0	08 November 2024	Charlotte Turner	Samantha Furey	Greg Dobbins
P1	28th November 2024	Samantha Furey	Samantha Furey	Greg Dobbins
P2	5th December 2024	James Greenwood	Samantha Furey	Samantha Furey
P3	11th December 2024	Samantha Furey	Samantha Furey	Samantha Furey
P4	7th February 2025	James Greenwood	Samantha Furey	Samantha Furey
P5	10th October 2025	Amy Bennett / Samantha Furey	Alison Caldwell	Alison Caldwell
P6	21st October 2025	Samantha Furey	Samantha Furey	Samantha Furey
P7	29th October 2025	Samantha Furey	Samantha Furey	Samantha Furey
P8	31st October 2025	Samantha Furey	Samantha Furey	Samantha Furey

Purpose

This document has been prepared for Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust.

PJA Civil Engineering Limited accepts no responsibility or liability for any use that is made of this document other than by the Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust for the purposes for which it was originally commissioned and prepared.

The conclusions and recommendations contained herein are limited by the availability of background information and the planned use for the Site.

Third party information has been used in the preparation of this report, which PJA Civil Engineering Ltd, by necessity assumes is correct at the time of writing. Whilst all reasonable checks have been made on data sources and the accuracy of the data, PJA Civil Engineering Ltd accepts no liability for same.

PJA Civil Engineering Ltd. has no liability regarding the use of this report except to Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust.

CDM

The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force in April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust, is made aware of their duties under the CDM Regulations.

Copyright

© PJA Civil Engineering Ltd 2025.

Contents

Section		Page
1	Executive Summary	1
2	Introduction	3
3	Site Details	5
4	Planning Context	15
5	Assessment of Flood Risk	23
6	Surface Water Drainage Strategy	36
7	Foul Water Drainage Strategy	50
8	Operation & Management	51
9	Conclusion & Recommendations	55

Appendices

Appendix A Topographic Survey
Appendix B Infiltration Testing and Groundwater Monitoring
Appendix C Thames Water Asset Mapping
Appendix D Green and Blue Infrastructure Parameter Plan
Appendix E Pre-Application Correspondence
Appendix F Sitewide Drainage Strategy Drawings
Appendix G Sitewide Surface Water Drainage Calculations
Appendix H Sports Pitch and Pavillion Drainage Strategy Drawings
Appendix I Sports Pitch and Pavillion Drainage Calculations
Appendix J Thames Water Developer Enquiry
Appendix K Flow Exceedance Plan
Appendix L Hydraulic Modelling Report

1 Executive Summary

1.1.1 PJA has been commissioned by Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust to prepare a Flood Risk Assessment (FRA) and Drainage Strategy to support a planning permission to be sought for the following development:

(1) Relocation and replacement of existing playing fields and erection of pavilion annex; and

(2) Construction of up to 1000 new homes (Use Class C3) to include a mix of market housing, affordable housing, age restricted specialist accommodation for the elderly, adult disability service units; a care home (Use Class C2); a local centre (Use Classes E and F); a primary school (Use Class F); the laying out of green infrastructure including habitat creation; drainage infrastructure; earthworks; pedestrian and cycle routes; new means of access and alterations to existing accesses.

1.1.2 The application is submitted as a "hybrid" application. Part (1) is submitted as a full application. Part (2) is submitted as an outline application with approval of means of access sought at the present time, and all other reserved matters to be approved at a later date.

1.1.3 This revision of the FRA and Drainage Strategy has been updated as part of the planning application, due to the following:

- Updates to the publicly available flood risk mapping from the Environment Agency
- Inclusion of the site-specific hydraulic modelling of the surface water flood risk at the proposed development
- Response to the Lead Local Flood Authority comments received in response to the planning application (dated: March 2025)

1.1.4 Table 1-1 provides an executive summary of the findings of this Report.

Table 1-1: Executive Summary Table

Overview	
Site Location	Woollam Park, Land off Harpenden Road, St Albans
Development Proposal	Residential-led development
Environment Agency Flood Zone(s)	Flood Zone 1
Vulnerability Classifications(s)	More Vulnerable and Less Vulnerable
Fluvial Flood Risk	Very Low
Tidal Flood Risk	Very Low
Surface Water Flood Risk	Low A site-specific hydraulic model has been constructed to enhance understanding of the potential risk from surface water. This modelling demonstrates that the proposed development will be safe for its lifetime and will not exacerbate existing flood risk off Site.
Groundwater Flood Risk	Low to Medium
Sewer Flood Risk	Low
Canal Flood Risk	Very Low
Reservoir Flood Risk	Very Low
Surface Water Drainage	The surface water drainage strategy will sustainably manage all storm events up to and including the 1 in 100-year plus 40% climate change event. This will be achieved via a network of sustainable drainage systems (SuDS), before ultimately infiltrating with the Site.
Foul Water Drainage	Foul water flows will drain via gravity to the proposed pumping station within the Site. Foul water will then be pumped from the proposed Type 3 pumping station to the north west of the Site into Thames Water Manhole MH8702.

2 Introduction

2.1 Terms of Reference

2.1.1 PJA has been commissioned by Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust to prepare a Flood Risk Assessment (FRA) and Drainage Strategy for a proposed residential-led development at *Woollam Park, St Albans* (herein referred to as 'the Site').

2.2 Scope of works

2.2.1 This FRA and Drainage Strategy replaced the version P4 which was previously submitted with the planning application. The report has been revised to consider, the updated mapping published by the Environment Agency, site-specific hydraulic modelling and the Lead Local Flood Authority (LLFA) comments.

Flood Risk Assessment (FRA)

2.2.2 This FRA provides information on the nature of identified potential flood risk at the Site and follows government guidance regarding development and flood risk in line with the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG).

Drainage Strategy

2.2.3 The surface water drainage strategy aims to sustainably manage surface water from the Site and has been developed in accordance with current sustainable development best practices and the specific requirements of Hertfordshire County Council as LLFA and the updated National Standards for Sustainable Drainage Systems.

2.2.4 A high-level foul water drainage strategy has also been developed for the proposed development Site which aims to address the requirements of Thames Water as the sewerage undertaker.

2.3 Information Sources

2.3.1 This report comprises a review of readily available public information and other relevant information obtained from the following sources:

- Environment Agency (EA);
- British Geological Survey (BGS);
- Cranfield Soil and Agrifood Institute Soilscapes;
- DEFRA Magic Mapping;
- St Albans City & District Council;

- Hertfordshire County Council;
- Thames Water

3 Site Details

3.1 Site Description

3.1.1 The Site, which is the focus of this FRA, is mostly greenfield (undeveloped) in nature and is currently used predominantly for agricultural purposes. A small percentage of the site, adjacent to Harpenden Road, is currently used as Rugby Football playing fields.

3.1.2 The Site is bound to the A1081 (Harpenden Road) to the west, beyond which lies existing residential development. Agricultural fields bound the Site to the north of the proposed development, with an existing railway line running along the northeastern boundary of the Site. Furthermore, existing commercial development is situated to the south of the Site, beyond which lies existing residential development.

3.1.3 The Site's OS co-ordinates are 515676, 210075.

3.1.4 A Site location plan is available in Figure 3-1 and Table 3-1.

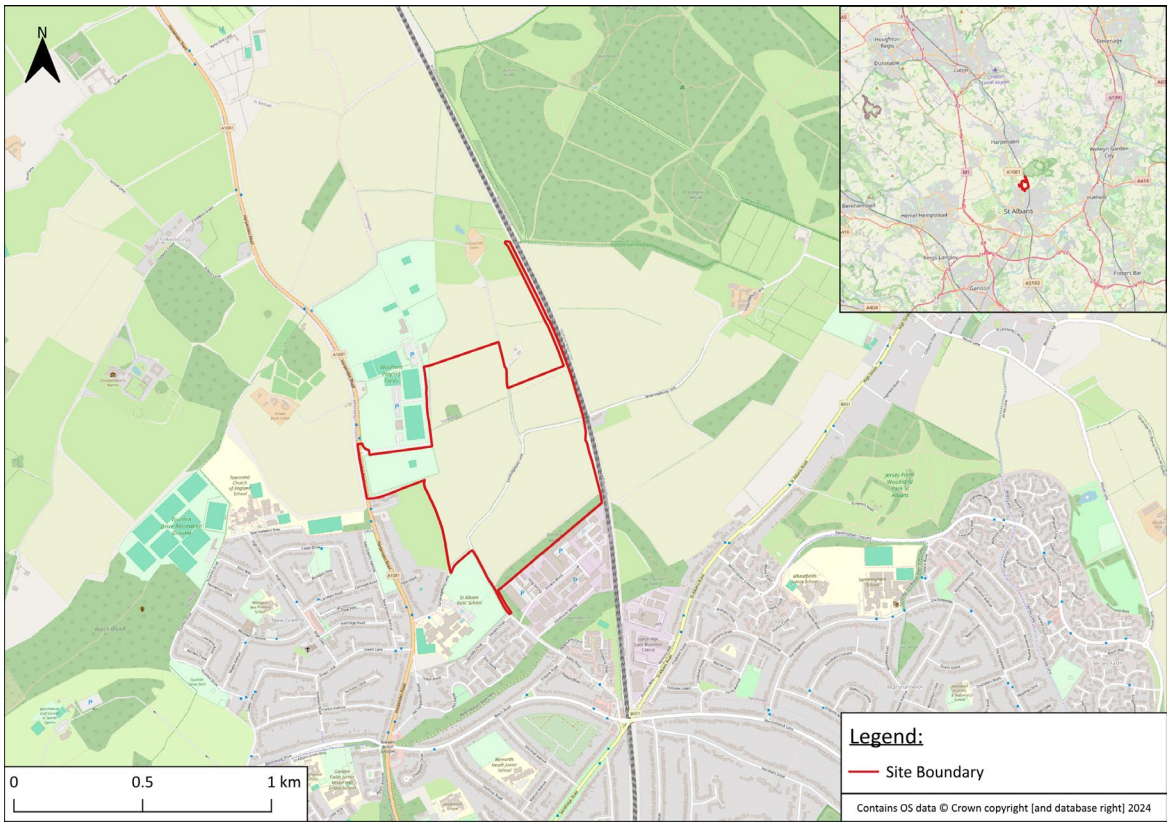


Figure 3-1:Site Location

Table 3-1: Summary of Site

Site Address	Woollam Park, St Albans
Existing Land use	Greenfield
Proposed Development Type	Residential-led Development
Site Area	50.17ha
OS Co-ordinates	515676, 210075
County	Hertfordshire
Local Planning Authority	St Albans City and District Council
Lead Local Flood Authority	Hertfordshire County Council
Local Water Authority	Thames Water

3.2 Site Topography

3.2.1 From a review of publicly available Site Topographic Survey, the Site generally falls from north west to south east, ponding in a localised depression. The highest elevation within the Site is approximately 124.9mAOD and is situated to the north west of the development. The lowest elevation within the Site is approximately 102.45mAOD and is situated to the southeast of the development.

3.2.2 The Site Topographic Survey is available in Appendix A.

3.2.3 A representation of the Site topography is illustrated in Figure 3-2, utilising the publicly available 1m DTM LiDAR.

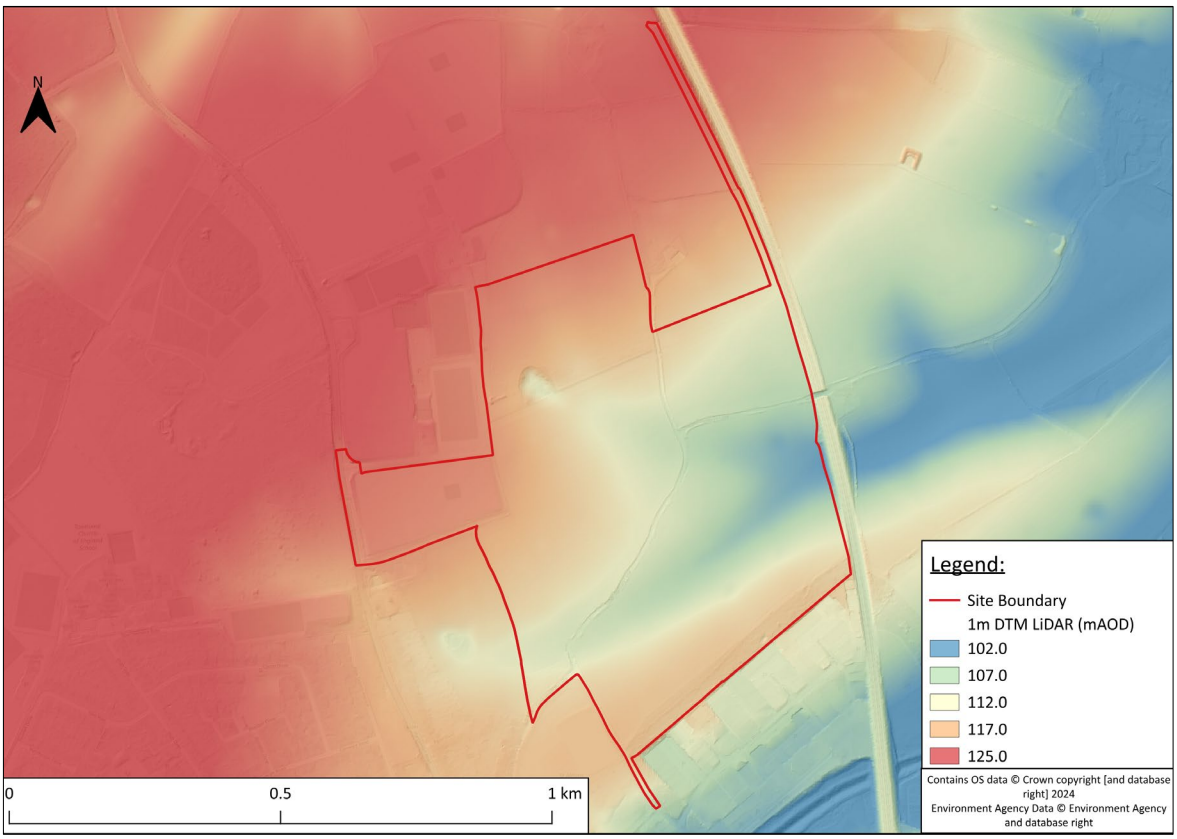


Figure 3-2: 1m DTM LiDAR

3.3 Ground Conditions

BGS Mapping

3.3.1 From a review of the publicly available Geological Survey (BGS) Geology of Britain Viewer [1], the Site is identified to be underlain by a bedrock geology of Lewes Nodular Chalk Formation and Seaford Chalk Formation (Undifferentiated) – Chalk.

3.3.2 Furthermore, the Site is underlain by two types of superficial deposits. Kesgrave Catchment Subgroup – Sand and Gravel is situated to the north, west and south of the Site, with Clay with Flints Formation - Clay, Silt, Sand and Gravel situated to the north west.

3.3.3 An extract of the BGS Superficial Geology is illustrated within Figure 3-3.

[1]British Geological Survey. Geology of Britain Viewer.
https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html

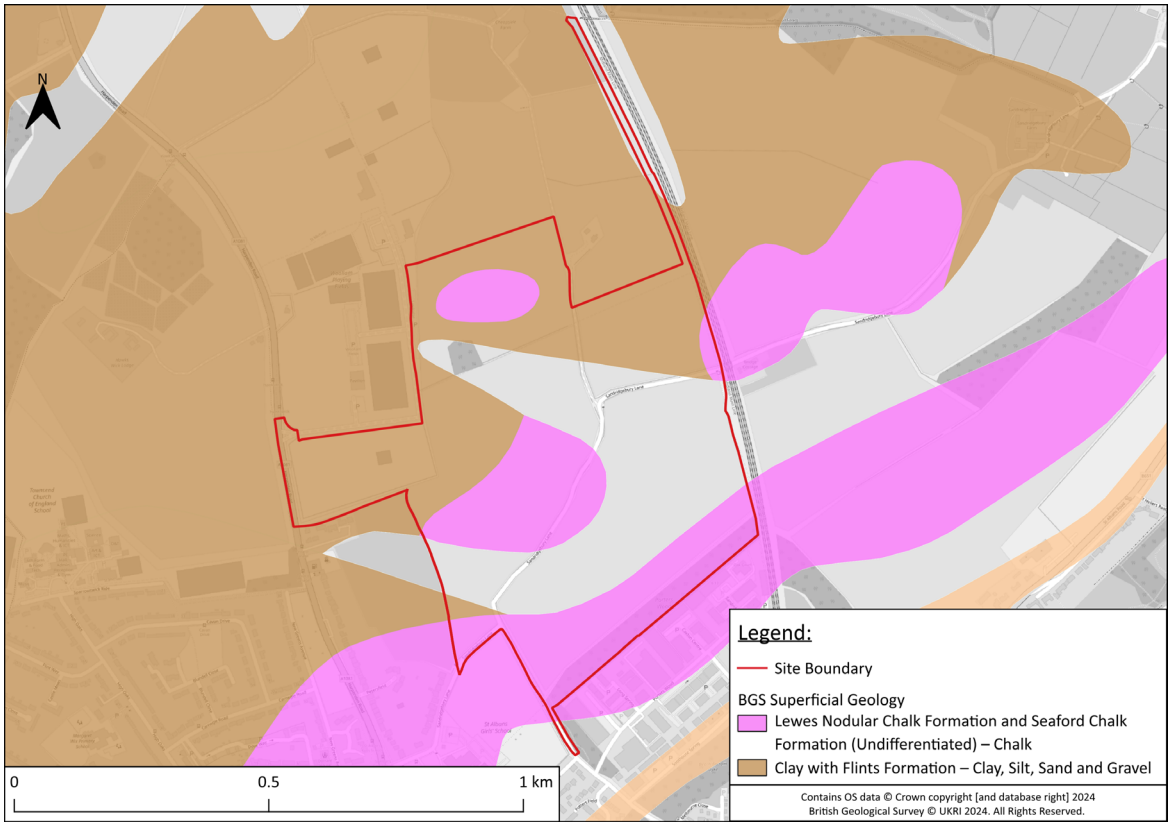


Figure 3-3: BGS Superficial Geology

Cranfield Soilscape Viewer

3.3.4 The Cranfield University Soilscape viewer [2] describes the soils as *'Slightly acid loamy and clayey soils with impeded drainage.'*

Hydrogeology

3.3.5 The publicly available DEFRA Magic Mapping [3], Bedrock Aquifer Designation Map shows that the Site is underlain by a Principal Aquifer which is defined as *"Aquifers which provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands."*

3.3.6 The publicly available DEFRA Magic Mapping, Superficial Aquifer Designation Map shows that the Site is underlain by a Secondary A Aquifer which is defined as *"Aquifers comprising of permeable layers that can support local water supplies, and may form an important source of base flow to rivers."*

[2]Cranfield Soil and Agrifood Institute. Soilscape Viewer. http://www.landis.org.uk/soilscapes/
[3] DEFRA Magic Map https://magic.defra.gov.uk/MagicMap.aspx

3.3.7 The Site is situated within a 'Total Catchment, Groundwater Source Protection Zone (III)', denoting that the groundwater underlying the Site supports a nearby abstraction point. Given this, the Environment Agency may apply certain conditions on the water quality of surface water discharge to ground.

Site Specific Ground Investigation

3.3.8 Infiltration testing at the Site was undertaken in accordance with BRE Digest 365 by WSP (2018) and Geo Environmental Group in 2024 and 2025 to understand whether an infiltration-led surface water drainage strategy could be utilised.

3.3.9 Trial pits were located across the Site to understand the potential infiltration rates. The preliminary infiltration results at IT01 to IT08 are shown in Table 3-2 and are available in Appendix B.

Table 3-2: Summary of Preliminary Infiltration Test Results

Location	Depth Range of Test (m)	Time (Mins)	Infiltration Rate (m/s)
IT01	1.30-2.40	115	$2.96X10^{-5}$
	1.05-2.08	132	$2.63X10^{-5}$
	1.01-1.82	119	$2.97X10^{-5}$
IT02	1.00-2.00	217	N/A
IT03	1.45-2.75	194	N/A
IT04	1.20-2.00	105	$2.60X10^{-5}$
	1.00-1.75	165	$1.88X10^{-5}$
IT05	1.40-2.40	201	N/A
IT06	1.80-2.80	195	N/A
IT07	1.40-2.50	183	N/A
IT08B	2.00-3.00	20	$1.50 x10^{-4}$
	1.90-2.80	25	$2.62x10^{-3}$
	1.75-2.70	25	$2.67x10^{-3}$

3.3.10 After a review of the preliminary infiltration results recorded by Geo Environmental Group, no infiltration results could be recorded at trial pits IT02, IT03, IT05, IT06 and IT07. It was noted that infiltration was viable on-Site at test locations IT01, IT04 and IT08B.

3.3.11 Additional testing was undertaken at IT08B in 2025, located adjacent to IT04, which produced three positive infiltration results. Given that the proposed infiltration basin is located between IT04 and IT08B, a conservative 'worst case' rate of $1.88x10^{-5}$ m/s has been utilised in the surface water drainage strategy.

3.3.12 As such, the use of traditional soakaways is considered to be a feasible means of surface water drainage at the Site at locations IT01, IT04 and IT08B. This may be subject to any underlying restrictions due to the presence of the aquifer referred to previously.

3.3.13 There has been extensive groundwater monitoring which has been undertaken across the Site as detailed in Section 5.6. Particular consideration should be given to groundwater monitoring which has been undertaken at WS01 and WS07/WS07A which are in close proximity to IT01, IT04 and IT08B respectively, which demonstrate that both boreholes were dry up to a depth of 5.0m during the monitoring which took place between May 2024 – April 2025. The groundwater monitoring demonstrates that the minimum distance of 1m between the base of the proposed infiltration basins and the groundwater is greater than 1m.

Site Specific Ground Investigation – Sports Pitch & Pavillion

3.3.14 The Phase II Ground Investigation demonstrates that the sports pitch area has minimal infiltration capacity across the proposed sports pitches, due to the varying depths of chalk.

3.3.15 No groundwater was identified during the monitoring, which is consistent with the testing which has been undertaken by Geo Environmental Group, as outlined in the section above.

3.3.16 The Geo Environmental Group report for the Phase II Ground Investigation (October 2025) is included in Appendix B.

3.4 Existing Hydrological Regime

3.4.1 From a review of the existing hydrological regime at St Albans, no hydrological features have been recorded within the Site. It is understood that existing surface water runoff is discharged via infiltration to the east, via the underlying chalk geology.

3.4.2 The River Ver is located approximately 2.80km west of the Site.

3.4.3 The existing hydrological regime is illustrated in Figure 3-4.

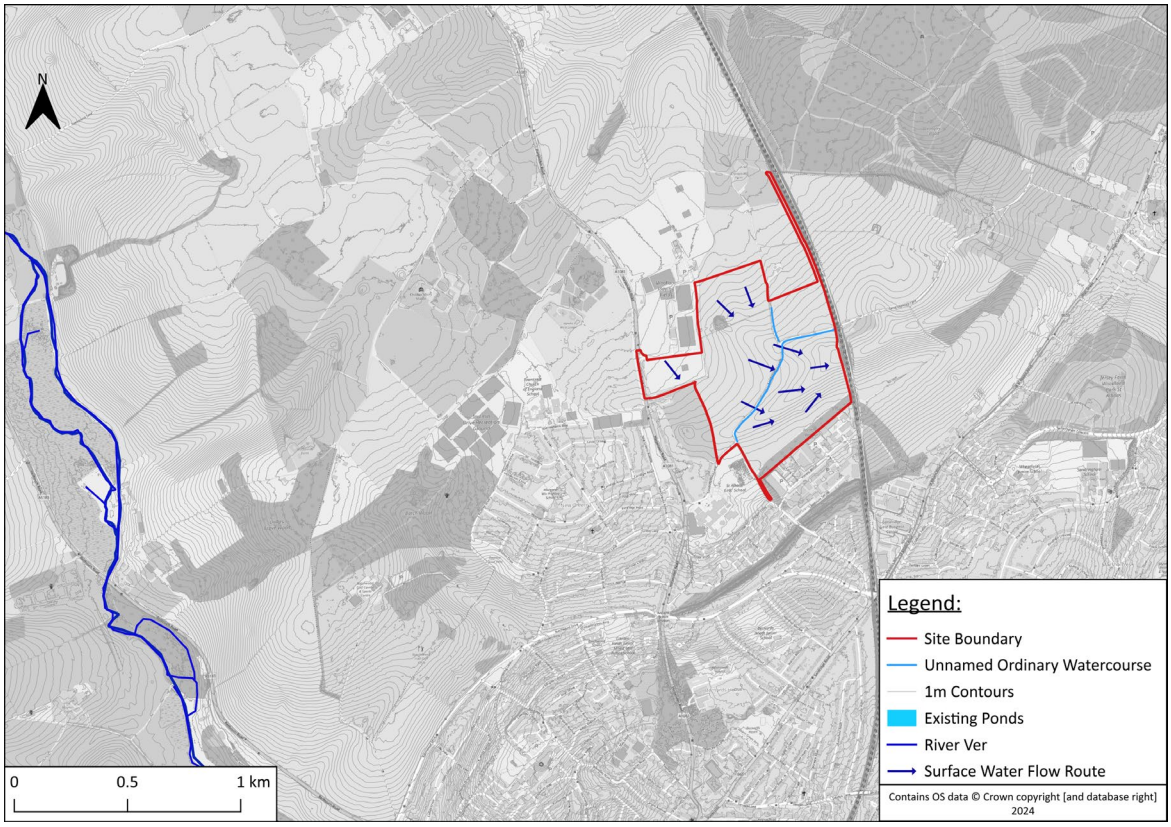


Figure 3-4: Existing Hydrological Regime

3.5 Existing Drainage Assets

3.5.1 From a review of the existing Thames Water sewer asset mapping, a 225mm diameter combined sewer bisects the Site to the north west before flowing south westerly along Harpenden Road see Figure 3-5 overleaf.

3.5.2 Furthermore, an existing 300mm diameter surface water sewer is situated to the west of the Site, along Harpenden Road.

3.5.3 Further utilities surveys have been undertaken to understand any additional existing utilities present on-Site and are included in the Brookbanks report which forms part of the planning submission pack.

3.5.4 Existing Thames Water sewer asset mapping is available within Appendix C and an extract is included within Figure 3-5.

Figure 3-5: Thames Water Asset Mapping Extract

3.6 Site Proposals

3.6.1 The Site proposal consists of a planning application for the following development:

1 Relocation and replacement of existing playing fields and erection of pavilion annex; and

2 Construction of up to 1000 new homes (Use Class C3) to include a mix of market housing, affordable housing, age restricted specialist accommodation for the elderly, adult disability service units; a care home (Use Class C2); a local centre (Use Classes E and F); a primary school (Use Class F); the laying out of green infrastructure including habitat creation; drainage infrastructure; earthworks; pedestrian and cycle routes; new means of access and alterations to existing accesses.

3.6.2 The application is submitted as a "hybrid" application. Part (1) is submitted as a full application. Part (2) is submitted as an outline application with approval of means of access sought at the present time, and all other reserved matters to be approved at a later date.

3.6.3 It is noted that the Site has been allocated within the Draft St Albans City & District Council (Regulation 19) Local Plan 2041 under Strategic Policy SP1-B1.

3.6.4 The Proposed Green and Blue Infrastructure Parameter Plan is available in Appendix D and an extract is shown in Figure 3-6.

Figure 3-6: Woollam Park, North St Albans Parameter Plan – Green and Blue Infrastructure

4 Planning Context

4.1 National Planning Policy Framework

4.1.1 The revised National Planning Policy Framework (NPPF) was published by the Ministry of Housing, Communities and Local Government, published in December 2024 and most recently updated in February 2025. The NPPF's Planning Practice Guidance (PPG) supports the Framework and is an online resource that is frequently updated.

4.1.2 Paragraph 181 of the NPPF identifies that Local Planning Authorities should ensure that flood risk is not increased elsewhere by development and where appropriate, applications should be supported by a Site-specific Flood Risk Assessment. Development should only be allowed where it can be demonstrated that:

a within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

c it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d any residual risk can be safely managed; and

e safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

4.1.3 Further to this, paragraph 182 of the NPPF sets out that applications which could affect drainage on or around the site should incorporate sustainable drainage systems to control flow rates and reduce volumes of runoff, and which are proportionate to the nature and scale of the proposal. These should provide multifunctional benefits wherever possible, through facilitating improvements in water quality and biodiversity, as well as benefits for amenity. Sustainable drainage systems provided as part of proposals for major development should:

a take account of advice from the lead local flood authority;

b have appropriate proposed minimum operational standards;

c have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development.

4.1.4 The PPG was updated in September 2025 and provided more information on the sequential approach to the location of development. Paragraph 23 sets out how the sequential approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This includes avoiding, as much as possible, development in

current and future flood risk areas, considering all sources of flooding including areas at risk of surface water flooding. Other forms of flooding should be considered consistently with river and tidal flooding so that the sequential approach can be applied across all areas of flood risk.

4.1.5 Paragraph 27 of the PPG also relates to sequential tests and requires that sequential tests are applied to 'Major' and 'Non-major' development proposed in areas at risk of flooding, as set out in paragraphs 173 to 174 of the NPPF. Paragraphs 175, 176 and 180 set out exemptions from the sequential test. In applying paragraph 175 a proportionate approach should be taken. This means that, where a site-specific FRA clearly sets out that the Proposed Development would remain safe from current and future surface water flood risk for the lifetime of the development without increasing flood risk elsewhere, then the sequential test need not be applied.

4.1.6 A sequential approach has been taken to the proposed development in relation to flood risk which is set out in Section 5.11 of this report. Flood risk from all sources is reviewed in Section 5 and the approach to surface water management in Section 6.

4.2 Local Policy & Guidance

St Albans City District Council Plan 1994

4.2.1 The St Albans City District Council Local Plan was adopted in 1994 and includes strategic policies and proposals on where new development will be provided by the district.

4.2.2 A revised Local Plan is currently being developed by the council to replace the adopted 1994 Plan for St Albans City. It should be noted that Local Plans "expired" after 27th September 2007 unless "saved", in whole or in part. As such, St Albans City District Council saved specific policies from the existing 1994 Adopted Local Plan, to ensure development was saved across the council boundary.

4.2.3 Policy 84 details the requirements for Flooding and River Catchment Management, stating new development should be steered towards low risk areas and not increase the risk of flooding to third-party land. A protective strip should be provided along the watercourse to ensure maintenance of the hydrological feature can be undertaken. Furthermore, it should be noted that if works to a watercourse need to be undertaken due to the proposed development, culverting of the hydrological feature should be avoided as far as possible.

4.2.4 Policy 84A details the requirements of Drainage Infrastructure, stating new development will not be permitted in areas which are considered to be at risk of flooding from sewers or may increase the risk of sewerage flooding to third-party land. A detailed drainage strategy should be provided as part of the planning submission.

4.2.5 To demonstrate compliance with the requirements set out in local policy, new development will be situated outside of high flood risk areas, ensuring a suitable surface water drainage strategy has been developed alongside the masterplan.

St Albans City & District Council Draft Local Plan (Regulation 19) 2041

4.2.6 The St Albans City & District Council Draft Local Plan (Regulation 19) was published in September 2024 and sets out requirements for development within the district up to 2041.

4.2.7 The assessment of Site B1 in local plan policy outlines site-specific criteria relating to the consideration of environmental constraints including groundwater in the development requirements.

4.2.8 Policy NEB8 details the requirements of Managing Flood Risk within the district. New development needs to meet the requirements of the Sequential and Exception Tests in accordance with national policy, with a Flood Risk Assessment undertaken in accordance with advice from the Environment Agency (if applicable) or Lead Local Flood Authority.

4.2.9 Where the Sequential and Exception Tests have been applied, proposals located within areas identified as being at risk of flooding will not be permitted unless the following is demonstrated:

- That the most vulnerable development within the site is located in areas of lowest risk;
- That all sources of flood risk are considered, including fluvial and surface water flood risk;
- The development is appropriately flood resistant and resilient and incorporates appropriate infrastructure to address the increasing potential for flood events due to Climate Change;
- The flood risk will not be increased elsewhere and, where possible, reduce flood risk offsite;
- How the proposal incorporates sustainable drainage systems;
- How any residual risk can be safely managed; and
- That safe access and egress routes are included where appropriate and have an agreed emergency plan.

4.2.10 Furthermore, the policy states that all major new development should incorporate sustainable drainage systems (SuDS) and manage surface water runoff to achieve greenfield runoff rates. Management and maintenance plans for the proposed SuDS, with appropriate contributions sought where necessary will need to be provided.

4.2.11 Given this, a detailed review of flood risk and drainage at the Site is set out in Section 5 and 6 of this report.

South West Hertfordshire Level 1 Strategic Flood Risk Assessment (October 2018)

4.2.12 A Level 1 Strategic Flood Risk Assessment (SFRA) was published in October 2018 by South West Hertfordshire Councils (Dacorum Borough Council, St Albans City and District Council, Three Rivers District Council and Watford Borough Council) and was created with the purpose of providing a comprehensive and robust evidence to support the production of Local Plans for the four councils.

4.2.13 Appendix A of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east.

4.2.14 The Level 1 SFRA states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode.

4.2.15 Given this, a detailed review of flood risk at the Site is set out in Section 5 of this report.

South West Hertfordshire Level 1 Strategic Flood Risk Assessment Addendum (July 2024)

4.2.16 A Level 1 Strategic Flood Riks Assessment Addendum was published by South West Hertfordshire Councils (Dacorum Borough Council, St Albans City and District Council, Three Rivers District Council and Watford Borough Council) in July 2024 to support the revised St Albans City & District Council Local Plan and associated Planning Policy documents.

4.2.17 The Level 1 SFRA Addendum states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode.

4.2.18 Appendix K of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east.

4.2.19 Given this, a detailed review of flood risk at the Site is set out in Section 5 of this report.

St Albans Level 2 Strategic Flood Risk Assessment (July 2024)

4.2.20 A Level 2 Strategic Flood Risk Assessment (SFRA) was published in July 2024 by St Albans City and District Council and was created with the purpose of supporting the production of the St Albans City and District Local Plan.

4.2.21 The Site is not identified within the Level 2 Strategic Flood Risk Assessment even though the Site has been draft allocated under the St Albans City & District Council Draft Local Plan (Regulation 19) 2041.

4.2.22 As such, a detailed review of flood risk at the Site is set out in Section 5 of this report.

Hertfordshire County Council Local Flood Risk Management Strategy 2 (LFRMS2)

4.2.23 The Hertfordshire County Council Local Flood Risk Management Strategy was approved by the county council in February 2013 following the establishment of the Lead Local Flood Authority in May 2010. As such, the LLFA have published the Hertfordshire Local Flood Risk Management Strategy 2 to include updated information in relation to flood risk.

4.2.24 The Hertfordshire Local Flood Risk Management Strategy 2 states that 3,667 properties are at high flood risk (1 in 30-year even) from surface water flooding in St Albans, with 7,661 properties being at medium risk (1 in 100-year event). It should be noted that the exact location of these properties is unknown.

4.2.25 To further understand flood risk to the Site, a detailed assessment is available in Section 5 of this report.

Stage 2 Matter 1 - Statement of Common Ground (SADC/ED86)

4.2.26 St Albans City & District Council and Hertfordshire County Council issued a Statement of Common Ground in October 2025, which outlines that in principle there are no concerns with the Site and the associated surface water flood risk flow path.

4.3 Consultation

4.3.1 Pre-application consultation has been undertaken with key stakeholders in relation to flood risk and drainage. A summary of their responses has been provided below and full responses included within Appendix E

Hertfordshire County Council Lead Local Flood Authority

4.3.2 Hertfordshire County Council were consulted in their role as the Lead Local Flood Authority (LLFA) to determine if there was any flood risk information available for the Site.

4.3.3 Pre-Application advice was received on the 20th August 2024, detailing historic flood risk information and Site-specific comments for the draft allocation of North St Albans. The key points from this response are summarised below:

- *'The Site is at high flood risk from surface water in the high-risk scenario (more than 3.33% chance of flooding each year) As such, a sequential test will be needed at the Site to consider all sources of flood risk.'*
- *Surface water flow route modelling should be undertaken.*
- *The drainage from the railway line should be considered at the Site as whilst on an embankment, a drainage channel may exist along the toe of it.*
- *Access roads will need to be located outside any flood extent and where this is not possible, it will need to be demonstrated in accordance with the flood risk assessment guidance for new developments and the hazard calculations in FD2320. (NPPF PPG Paragraph 005).*
- *The type and location of SuDS should be considered at an early stage of the planning process.*
- *The proposed surface water drainage strategy should comply with the four pillars of sustainable urban drainage systems (SuDS) of Water Quality, Water Quantity, Amenity and Biodiversity.*
- *The regulations of the Source Protection Zone (SPZ III) is required to be considered in the proposed drainage for the Site and additional treatment steps be implemented where necessary (refer to the EA guidance if required).*
- *An investigation into infiltration to be undertaken in accordance with the BRE 365 methods (or equivalent).*
- *Groundwater monitoring (at least covering February, March and April) will be required to demonstrate the seasonally high groundwater level in the area and at least 1m of unsaturated zone be provided to the base of the infiltration structure.*
- *Management and Maintenance easements should be included for all SuDS .*

4.3.4 Following the submission of the planning application, a request for further information was received from Hertfordshire County Council LLFA dated the 27th March 2025 (ref. 5/2024/2271). The key points from the response to the full application is summarised below (please refer to 05920-TN-01-P0 Planning response to the LLFA, for further information):

- *'We note that information has been submitted for the entire site but at this stage, the LLFAis unable to clearly differentiate between the outline application and the full application. Therefore, we request the applicant submits separate documentation for this section of the proposed development that highlights the proposed drainage strategy. This information would be suitable in Technical Note form'.*

4.3.5 In terms of the outline application the LLFA raised the following:

- *FRA and drainage strategy utilising old flood map for planning data.*
- *Residual Risks and Mitigating Flood Risk- mitigating the flow path on Site and clarifying FFL.*
- *Site specific hydraulic modelling recommended.*
- *Evidence of greenfield run off rates.*
- *High surface water discharge rates within the drainage strategy.*

- *Further information on how water quality has been assessed and considered.*
- *Full network calculations to be provided.*
- *Further detail on the surface water drainage strategy requested to confirm surface water flood risk to properties and proposed basins.*
- *Demonstration that exceedance floes are diverted away from vulnerable infrastructure.*
- *Site constraints- further clarification requested regarding the amount and distribution of SuDS.*
- *Phasing documentation to be submitted alongside a constriction management plan.*

Environment Agency

4.3.6 The Environment Agency were consulted regarding flood risk to the Site via a Product 4, 5, 6 and 7 request. A response was received in January 2024, with the Environment Agency stating that no detailed hydraulic modelling information was available due to the Site not being situated within an area at risk from fluvial flooding.

4.3.7 Furthermore, the Environment Agency were contacted in May 2024 in regard to the Site being situated within Groundwater Source Protection Zone III. The provided guidance suggested that rainfall draining from roofs and areas of hardstanding could discharge via infiltration, assuming the following:

- Infiltration sustainable drainage systems (SuDS) are suitably designed.
- Infiltration SuDS meet the Government's non-statutory technical guidance for SuDS Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (publishing.service.gov.uk). The CIRIA SuDS manual is (C753) is also a useful resource and is available via the CIRIA website (ciria.org);
- The surface water drainage scheme incorporates a SuDS management treatment train – that is, use drainage components in series to achieve a robust surface water management system that does not pose an unacceptable risk of pollution to groundwater;
- The surface water originates from areas where no potentially contaminative activities have occurred and is free from hazardous substances as per the current list of confirmed hazardous substances to groundwater (2018 01 31 Confirmed hazardous substances list_0.pdf (wfduk.org)). Please note that surface water discharges from heavily trafficked areas and areas where vehicles are stored may contain hazardous substances and the expectation is that the SuDS scheme for the site will incorporate pollution control features that would prevent hazardous contaminants entering the infiltration point (see bullet point above).
- The discharge point cannot be direct to groundwater (i.e. via a borehole that penetrates to water table). The applicant will need to provide confidence that the infiltration point has been designed to be as shallow as possible to retain the beneficial filtration effects of soils in the unsaturated zone above the permanent water table and present no risk to aquifers.

4.3.8 Given that the above can be satisfied, the Environment Agency do not feel that an environmental permit for infiltration of surface water would be required at the Site.

Affinity Water

4.3.9 Affinity Water are the local water supplier and as such were consulted in regard to the Site being situated within Groundwater Source Protection Zone III. A response was received on the 19th June 2024, confirming that the location of the Site is situated outside of Source Protection Zone 2, and therefore no particular requirements on water abstraction and supply will be provided specifically. It is recommended that best practice is undertaken to protect the water quality in the environment and the Environment Agency are contacted.

Thames Water

4.3.10 Thames Water were consulted in regard in foul water drainage at the Site. A response was received via a pre-planning enquiry dated 5th April 2024 stating that the existing sewerage network will not have enough capacity for full development at the Site. As such, sewerage hydraulic modelling will need to be undertaken to understand the existing capacity available and the upgrades required to facilitate the development.

4.3.11 Thames Water have been reconsulted using revised discharge rates for an update on the capacity of the existing sewerage network. A response was received on the 8th October 2025, which stated that the sewerage network will not have enough capacity for a full development at the Site. Following receipt of planning permission, Thames Water will be required to undertake modelling of their existing network to understand the upgrades required to facilitate the development.

5 Assessment of Flood Risk

5.1.1 The flood risk to and from the Site has been assessed based on a review of publicly available information (e.g., Environment Agency flood data). A summary of the flood risk at the Site is provided in Table 5-1 and discussed in more detail in the chapter below.

Table 5-1: Potential Sources of Flood Risk

Source of Flooding	On Site Presence
Fluvial	×
Surface Water	✓ *(section 5.5)*
Tidal	×
Groundwater	×
Sewers	×
Reservoirs	×
Canal	×

5.2 Historic Flooding

5.2.1 Appendix A of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east.

5.2.2 The Level 1 SFRA states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode.

5.2.3 The Environment Agency's Historic Flood Mapping shows no historical flood events recorded within the vicinity of the Site.

5.3 Fluvial Sources

5.3.1 The Environment Agency, through the publicly available Flood Map for Planning service, categorises potential fluvial flood risk into Flood Zones, assuming no flood defences (updated March 2025).

5.3.2 The Site is identified in the publicly available Flood Map for Planning as located wholly within Flood Zone 1, demonstrating that the fluvial flood risk is considered to have a less than 0.1% Annual Exceedance Probability (AEP) (1 in 1,000-Year Event).

5.3.3 An extract of the Flood Map for Planning is contained in Figure 5-1.

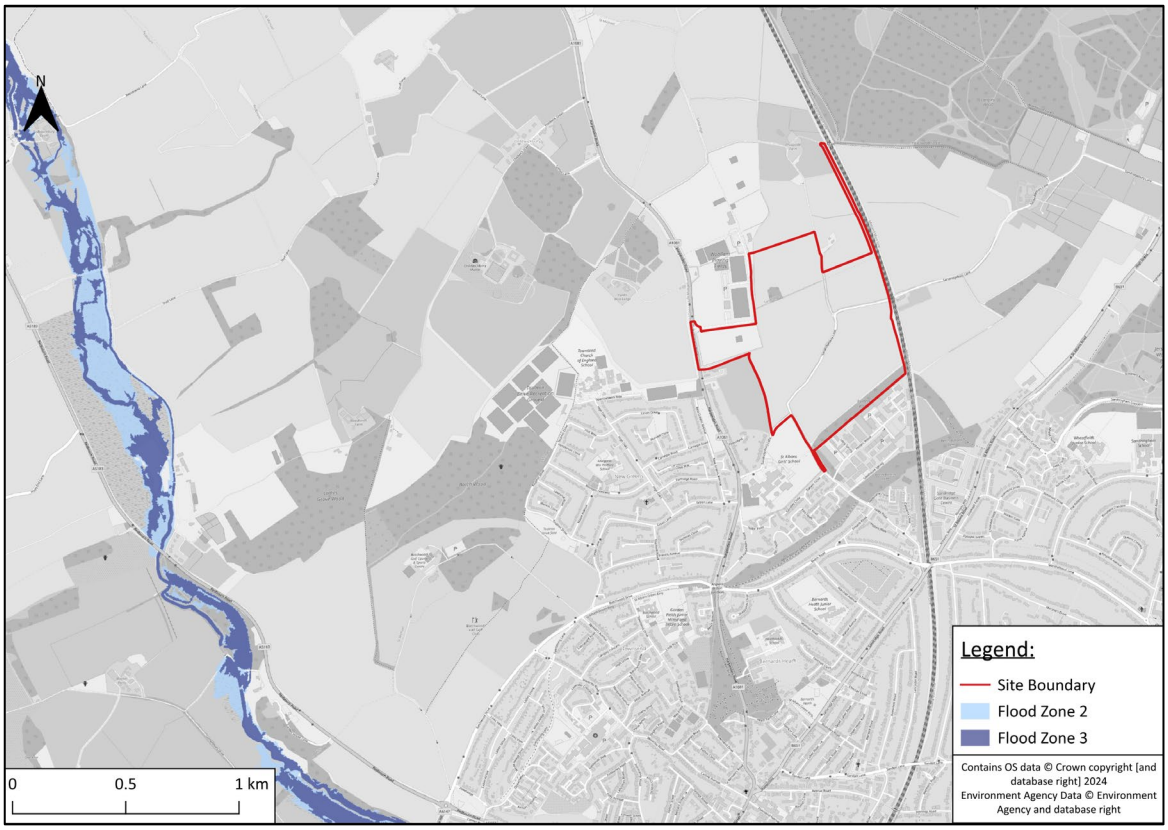


Figure 5-1: Publicly Available Flood Map for Planning Extract

5.4 Tidal Sources

5.4.1 Given the in-land location of the Site, flood risk from this source is considered very low.

5.5 Surface Water Sources

5.5.1 Surface water runoff is likely to occur after heavy rainfall. Currently, there is no formal means of surface water drainage that has been identified to positively drain the Site and as such, water will runoff with the natural topography in a south easterly direction towards the boundary of the Site where it is understood that it infiltrates.

5.5.2 The Long-Term Flood Risk Information, Flood Risk from Surface Water Map identifies that majority of the Site is at very low risk of surface water flooding. It is noted that low, medium and high surface water flow routes bisect the Site centrally, before ponding along the eastern boundary.

5.5.3 An extract of the Long-Term Flood Risk, Flood Risk from Surface Water mapping is provided in Figure 5-2.

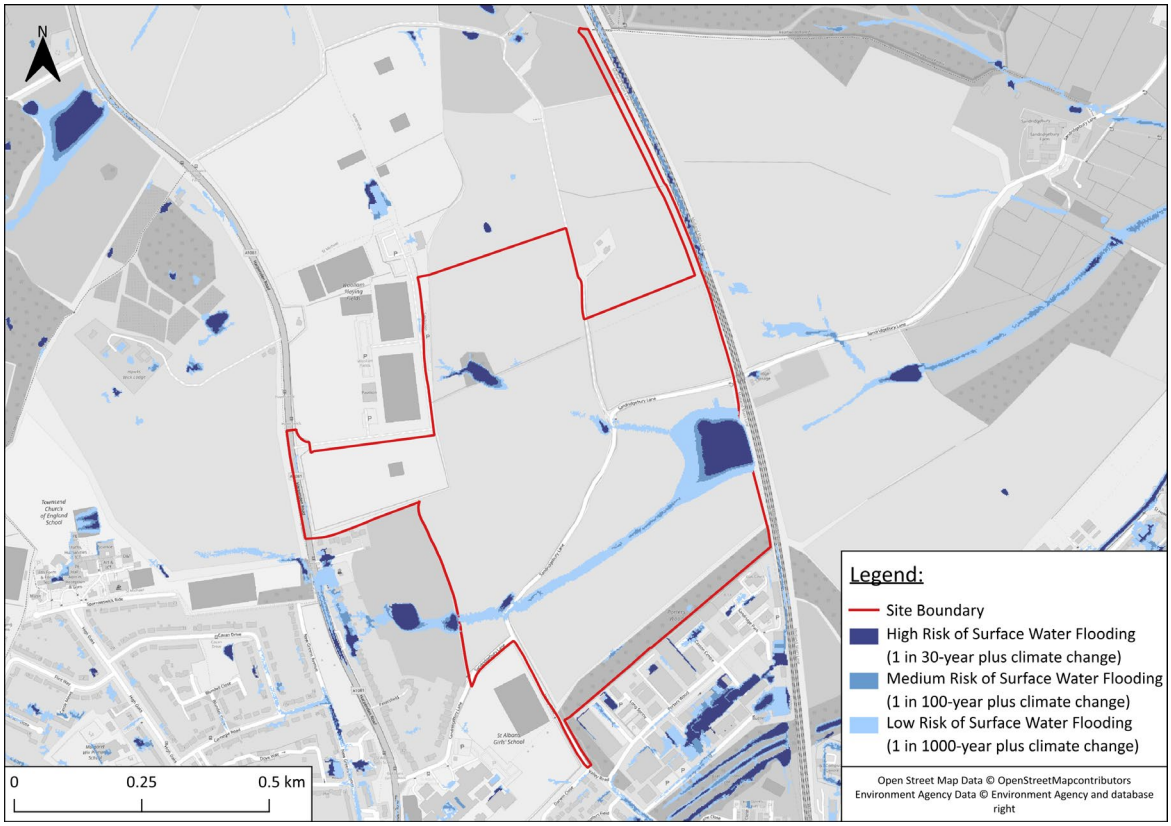


Figure 5-2: Long Term Flood Risk – Surface Water Mapping Extract

5.5.4 The production of this mapping has been undertaken using national scale modelling and enhanced using compatible locally produced modelling from LLFAs (where available) to provide the generation of surface water flood risk mapping. The previous generations were primarily developed for regulator use as the approach and risk was refined. For example, the first did not include any allowance for sewers, whilst the second incorporated a national loss coefficient.

5.5.5 The current dataset presents the risk which takes account of the climate change allowances based on the latest UK Climate Projections (UKCP18) from the Met Office, using the Representative Concentration Pathway (RCP) 8.5

5.5.6 Although through the production of this mapping, LLFAs were approached for culvert asset datasets to be incorporated within the national scale model, these data sets may not be fully comprehensive. A 2m DTM has also been utilised in the national scale model, whilst this better represents topography in comparison to previous versions of the mapping, there is still opportunity for refinement on a local scale where finer DTM LiDAR data is available coupled with site-specific topographic data.

5.5.7 As part of the final Site design, measures will be implemented to ensure there is negligible increase in surface water flood risk on- and off-Site and ensure that exceedance flows will be directed away for property.

Hydraulic Modelling

5.5.8 A site-specific baseline hydraulic model has been constructed to refine the surface water flow path identified within the Site. Since the last iteration of this FRA (P4), the baseline hydraulic modelling has been revised to utilise the latest methodology adopted by the EA following updates to the long-term flood risk mapping, released in January 2025.

5.5.9 Post-development hydraulic modelling has also been undertaken to incorporate a representation of the proposed development levels, surface water drainage strategy, and the proposed hydraulic structures within the Site.

5.5.10 Through the Site-specific post-development hydraulic modelling, in all modelled events, a significant reduction to the peak water levels in the east of the Site adjacent to the existing railway embankment is demonstrated.

5.5.11 The post-development hydraulic model is a highly conservative representation of the potential surface water flood risk in the current and future rainfall events. It provides a conservative and robust representation of the potential surface water flow route through the development, and ultimate potential surface water flood risk to the proposed development.

5.5.12 The key findings of the site-specific hydraulic modelling comprise:

- The site-specific hydraulic modelling demonstrates that the proposed development will be safe for its lifetime during current and future rainfall events.
- The proposed development will not exacerbate the existing identified surface water flood risk.
- The proposed development generates offsite betterment in multiple locations along Sandridgebury Lane and adjacent to the railway embankment in the East of the Site.
- The proposed development will manage and mitigate potential surface water flooding in any event up to and including the 1 in 1,000-year.
- The proposed surface water drainage strategy and proposed development levels redirect and manage surface water runoff within the Site via blue-green corridors, which incorporate attenuation basins and conveyance features.
- The proposed development will generate a reduction in maximum peak water levels adjacent to the existing railway embankment, as compared to existing conditions, in all events up to and including the 1 in 1,000-year.

- The proposed development will generate a reduction in maximum peak water depths within three locations on Sandridgebury Lane, as compared to existing conditions, in all events up to and including the 1 in 1,000-year.

5.5.13 The Hydraulic Modelling Report in Appendix Lcontains further information on the hydraulic modelling undertaken for the Site.

5.6 Groundwater Sources

5.6.1 Groundwater flooding is typically caused by high groundwater levels. It occurs where excess water emerges at the ground surface via springs or within manmade structures such as basements. The risk of groundwater flooding depends on the nature of the geological strata underlying the Site, as well as on the local topography.

5.6.2 Appendix A of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east.

5.6.3 From a review of the BGS Geoindex, there are no public borehole records identified within the Site at St Albans. The nearest trial pit (TL10NW38) is situated approximately 1.3km to the west of the Site and was dug to approximately 2.0m below ground level (bgl). The records demonstrate that no groundwater was encountered at this location as part of the exploration.

5.6.4 Groundwater monitoring has been undertaken across the Site between May 2024 and April 2025 (contained within Appendix B) to further understand groundwater flood risk and inform the proposed surface water drainage strategy.

5.6.5 The following table provides a summary of the groundwater levels which have been recorded during the ongoing groundwater monitoring:

Table 5-2: Groundwater Level Monitoring

Date	WS01	WS02	WS03	WS04	WS05	WS06	WS07	WS07A	WS11	WS12	WS13
09/05/24	Damp at 5.0	Dry	Dry	0.53	Dry	Damp at 5.0	N/A	N/A	N/A	N/A	N/A
11/06/24	Damp at 5.0	Dry	Damp at 5.0	1.34	1.20	Dry	N/A	N/A	N/A	N/A	N/A
04/07/24	Dry	Dry	5m	1.90	1.58	Dry	N/A	N/A	N/A	N/A	N/A
21/08/24	Damp at 5.0	Dry	Dry	Damp at 1.9	Damp at 1.8	Dry	Dry	N/A	N/A	N/A	N/A
25/09/24	Damp at 5.0	Dry	Dry	0.00	Dry	Damp at 5.0	N/A	N/A	N/A	N/A	N/A
23/10/24	Dry	Dry	1.01	0.52	Damp at 1.8	Dry	N/A	N/A	N/A	N/A	N/A

Date	WS01	WS02	WS03	WS04	WS05	WS06	WS07	WS07A	WS11	WS12	WS13
20/02/25	Dry	Dry	1.17	1.20	Damp at 1.8	Dry	N/A	N/A	N/A	N/A	N/A
06/03/25	Dry	Dry	1.11	N/A	Dry	Dry	N/A	Dry	Dry	Dry	Dry
15/04/25	Dry	Dry	Dry	N/A	Dry	Dry	N/A	Dry	Dry	Dry	Dry

5.6.6 The Phase II Ground Investigation for the Sports Pitch and Pavillion also demonstrates that no groundwater was encountered during monitoring.

5.6.7 Given the results from the ongoing groundwater monitoring, flood risk from groundwater may be considered to be a low risk.

5.7 Sewer Sources

5.7.1 As set out in Section 3.5, the Thames Water asset mapping indicates that an existing 225mm diameter foul water sewer bisects the Site to the north west before flowing south westerly along Harpenden Road.

5.7.2 Sewer asset mapping indicates an existing 300mm diameter surface water sewer is situated to the west of the Site along Harpenden Road.

5.7.3 The Level 1 SFRA states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode. The exact locations of these recordings is unknown due to confidentiality.

5.7.4 Thames Water were consulted in regard in foul water drainage at the Site. A response was received via a pre-planning enquiry dated 7th October 2024 stating that the existing sewerage network will not have enough capacity for full development at the Site. As such, sewerage hydraulic modelling will need to be undertaken to understand the existing capacity available and the upgrades required.

5.7.5 As a result of the review of the of the existing sewer sources currently within the area, the Site may be considered to be at low risk of sewer flooding.

5.8 Sources of Reservoir Failure

5.8.1 The publicly available Long-Term Flood Risk, Information, Flood Risk from Reservoirs Mapping identifies that the Site lies outside the maximum extent of flooding from reservoirs.

5.8.2 Given this, flood risk from reservoirs may be considered to be very low.

5.9 Canal Sources

5.9.1 Flooding from canals is a much less common occurrence than fluvial flooding due to the managed nature of water levels within the artificial waterways. the canal network is designed in such a way so as to direct all additional water beyond the navigation capacity to impounding areas or surrounding watercourses to be conveyed downstream. The risk from canal flooding becomes more of a concern where the structure is elevated on an earth embankment and if there is a rare instance of a catastrophic breach, leading to a sudden drain-down of the pound and resultant overland flow flood risk to development immediately downstream.

5.9.2 There are no canals within the vicinity of the Site.

5.9.3 Given this, flood risk from canals may be considered to be very low.

5.10 Climate Change

5.10.1 In accordance with the NPPF and supporting Planning Practice Guidance an FRA should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account. Climate change will affect peak river flows and, consequently, the extent of fluvial flooding is likely to increase in the future.

5.10.2 On 19th February 2016, the Environment Agency released updated guidance on climate change allowances [4] to support the NPPF, which was later revised for peak river flows in 2021 and for peak rainfall intensity in 2022.

5.10.3 Table 5-3 shows the peak river flows for the Colne Management Catchment Peak River Flow Allowances in which St Albans is situated.

Table 5-3: Colne Management Catchment Peak River Flow Allowances

	Central	Higher	Upper
2020s	10%	16%	30%
2050s	8%	16%	38%
2080s	21%	35%	72%

5.10.4 The peak rainfall intensity allowances for the Colne Management Catchment have also been reviewed, as detailed for the 1% annual exceedance rainfall event within Table 5-4.

[4] Flood risk assessments: climate change allowances. Environment Agency 2016. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Table 5-4: Colne Management Catchment Peak Rainfall Allowances (1% AEP)

	Central	Upper
2050s	20%	40%
2070s	25%	40%

5.10.5 The proposed development and associated surface water drainage scheme has therefore been designed to sustainably manage the run-off from the critical 1 in 100 year storm event with a 40% allowance for climate change.

5.10.6 Consideration to the potential impact of climate change has been given in the proposed development, in particular with regard to locating built development outside of the maximum flood extents in climate change scenarios and exceedance flow routing, therefore potential flood risk from climate change may be considered to be low.

5.11 Sequential and Exception Test Requirements

National Policy and Guidance

5.11.1 Paragraph 174 and 175 of the NPPF states *"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. The sequential approach 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).".*

5.11.2 The PPG sets out the principles of the Sequential and Exception Tests and what is required to pass them when proposing new development in an area at risk of flooding. Paragraph 23 of the PPG sets out how the sequential approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This includes avoiding, as much as possible, development in current and future flood risk areas, considering all sources of flooding including areas at risk of surface water flooding. Other forms of flooding should be considered consistently with river and tidal flooding so that the sequential approach can be applied across all areas of flood risk. In applying paragraph 175 of the NPPF a proportionate approach should be taken. This means that, where a site-specific FRA clearly sets out that the Proposed Development would remain safe from current and future surface water flood risk for the lifetime of the development without increasing flood risk elsewhere, then the sequential test need not be applied.

The Exception Test is triggered when development cannot be located within an area of suitably low risk flood risk.

5.11.3 The Exception Test requires a demonstration that flood risk to people and property can be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable Sites at lower risk of flooding are not available. Essentially, the Exception Test requires the proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will remain safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

Local Policy and Guidance

5.11.4 Paragraph 180 of the NPPF States *"Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the planmaking stage, or if more recent information about existing or potential flood risk should be taken into account".*

5.11.5 The Site has not been reviewed as part of a Sequential Test as part of the Local Plan Evidence Base and as such, the below provides evidence that a sequential approach has been taken to the development Site itself.

Flood Risk Vulnerability & Flood Zone Incompatibility

5.11.6 Table 5-4 summarises the flood risk vulnerability classification for different types of development. The proposed residential development at the Site is classified as More Vulnerable development with the commercial development at the Site classified as Less Vulnerable.

Table 5-5: Vulnerability Classification (Annex 3 NPPF Extract).

Class	Description
More vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • **Buildings used for dwelling houses**, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill* and Sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding.

Class	Description
	• Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place. • Car parks
Source: NPPF Annex 3: Flood Risk Vulnerability Classification	

5.11.7 An extract of PPG Table 2 is provided in Table 5-6 which identifies that an Exception Test is not required for More Vulnerable and Less Vulnerable development located within Flood Zone 1.

Table 5-6: Flood Risk Vulnerability and Flood Zone 'Incompatibility' (Flood Risk & Coastal Change PPG Table 2)

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required*	✗	✗	✗	✓*

Key

✓Exception Test is not required

✗ Development should not permitted

"†" In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

"" In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:*

- *remain operational and safe for users in times of flood;*
- *result in no net loss of floodplain storage;*
- *not impede water flows and not increase flood risk elsewhere.*

5.12 Site Specific Sequential Assessment of Flood Risk

5.12.1 Table 5-7 provides a breakdown of the percentage of each flood risk type that the Site is identified to be at risk from.

Table 5-7 – Sequential Approach Risk Rating

Flood Risk	% Site at Risk	% Proposed Built Development Area at Risk	Site Specific Assessment
Fluvial			
Flood Zone 2	0%	0%	

Flood Risk	% Site at Risk	% Proposed Built Development Area at Risk	Site Specific Assessment
Flood Zone 3	0%	0%	The Site lies wholly within Flood Zone 1 and as such fluvial flood risk is considered to be very low.
Tidal	0%	0%	The Site is situated inland and therefore is not at risk from Tidal Flooding.
Surface Water			
1 in 30-year Event	2.03%	0.1%	The proposed development areas at the Site are shown to be at surface water flood risk during the 1 in 30-Year (0.1%), 1 in 100-Year (0.5%), and 1 in 1,000-Year (2.8%) events. A sustainable surface water drainage strategy will be implemented at the Site to alleviate surface water flood risk to the proposed development. It should be noted hydraulic modelling has been undertaken which demonstrates that overland flow routes will be retained and controlled within the landscape corridors, public open spaces, and strategic SuDS network throughout the proposed development. Further information is contained inAppendix L.
1 in 100-year Event	2.81%	0.5%	
1 in 1,000-year Event	7.13%	2.8%	
Groundwater	N/A	N/A	Appendix A of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east. From a review of the BGS Geoindex, there are no public borehole records identified within the Site at St Albans. The nearest trail pit (TL10NW38) is situated approximately 1.3km to the west of the Site and was dug to approximately 2.0m below ground level (bgl). The records demonstrate that no groundwater was encountered at this location as part of the exploration. Groundwater monitoring has been undertaken across the Site. This has demonstrated that the majority of the site is at a low to medium risk.
Sewer	N/A	N/A	Thames Water asset mapping indicates that an existing 225mm diameter foul water sewer bisects the Site to the north west before flowing south westerly along Harpenden Road.

Flood Risk	% Site at Risk	% Proposed Built Development Area at Risk	Site Specific Assessment
			Sewer asset mapping indicates an existing 300mm diameter surface water sewer is situated to the west of the Site along Harpenden Road. The Level 1 SFRA states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode.
Reservoir	0%	0%	The Site is situated outside of the maximum extent of flooding from reservoirs.
Canal	0%	0%	The Site is not situated within the vicinity of a canal.

5.13 Site-Specific Measures

5.13.1 The key site-specific measures comprise:

- Steering all proposed development to be located outside corridors and areas shown to be affected by surface water flood flooding i.e., proposed surface water drainage channel;
- Through the site specific hydraulic modelling, it has been demonstrated that the majority of the proposed development is outside of areas of flood risk, therefore, the raising of finished floor levels by a minimum of 150mm above surrounding ground levels is considered to be suitable for the majority of the Site;
- Implementation of a surface water drainage strategy which positively and sustainably manages surface water runoff from the Proposed Development up to and including the 1 in 100 year +40% climate change event; and
- A hydraulic modelling exercise has been undertaken to demonstrate how existing surface water flow routes have been managed through conveyance features and contained within the green-blue corridors. Further information is contained within the Hydraulic Modelling report in Appendix L.

5.14 Site-Specific Sequential Test

5.14.1 Woollam Park, St Albans is a draft allocation within the Draft St Albans City & District Council (Regulation 19) Local Plan 2041 under Strategic Policy SP1-B1. After a review of the Level 2 Strategic Flood Risk Assessment, it is noted that the Site was not taken forward to the Sequential Test stage by St Albans City & District Council.St Albans City & District Council published a Flood Risk

Addendum in July 2025 which provides additional context for how Sites had been selected for sequential and exception tests. The Level 2 SFRA sets out the criteria for the screening of the Sites and lists that Sites were not subjected to a level 2 assessment if they were considered to be at 'low risk.' The following criteria set the benchmark for what 'low risk' is:

- Site is within FZ1
- Site is not within FZ3a +CC
- Site is <10% at risk of SW flooding in 1000yr event
- Site is <10% within highest risk category of JBA Groundwater Map
- Site is not within Historic Flood Map
- Site is not at risk of reservoir flooding
- Site is not at risk of breach from canal flooding
- Site does not contain an Ordinary Watercourse.

5.14.2 In the response the Council stated that Surface Water Flood Risk is a 'factor to be managed on-Site'.

5.14.1 The recent updates to the PPG in September 2025 within Paragraph 27 provide a proportionate approach to the sequential test, stating '*Where a site-specific flood risk assessment demonstrates clearly that the proposed layout, design, and mitigation measures would ensure that occupiers and users would remain safe from current and future surface water flood risk for the lifetime of the development (therefore addressing the risk identified e.g. by Environment Agency flood risk mapping), without increasing flood risk elsewhere, then the sequential test need not be applied*.'

5.14.2 Through the site-specific hydraulic modelling which has been undertaken, it has been *clearly demonstrated* that the proposed development remains safe from current and future flood risk for the lifetime of the development, without increasing flood risk elsewhere. Given this, site-specific sequential test is not required.

6 Surface Water Drainage Strategy

6.1.1 A Surface Water Drainage Strategy outlining the means of surface water management and disposal from the proposed development Site has been produced largely in line with the latest guidance as follows:

- National Standards for Sustainable Drainage Systems (19th June 2025)
- CIRIA C753 "The SuDS Manual", (CIRIA, 2015);
- CIRIA document C522 Sustainable Drainage Systems – design manual for England and Wales;
- CIRIA document C635 Designing for exceedance in urban drainage;
- Rainfall Runoff Management for Developments – SC030219 (Environment Agency, 2013);
- Environment Agency's pollution prevention guidelines (PPGs); and
- Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

6.1.2 The proposed Surface Water Drainage Strategy aims to sustainably manage surface water runoff without increasing flood risk to on- or off-Site, nor adversely impacting on water quality through the use of Sustainable Drainage Systems (SuDS).

6.1.3 SuDS aim to mimic the natural processes of surface water drainage by allowing water to flow along natural flow routes ensuring that runoff rates and volumes during storm events are not increased. SuDS also aim to provide water treatment, biodiversity, and amenity benefits within blue and green corridors.

6.1.4 There are typically three design storm events which should be considered when designing the SuDS system and managing flows and volumes:

- 1 in 1 year storm event, on sloping Sites without basements, where surcharging above soffits of any surface water drainage pipework is not permitted.
- 1 in 30 year storm event, where surface water flooding of the site does not occur at this frequency.
- 1 in 100 year storm event with allowances for future climate change, where runoff from the site should be controlled using SuDS attenuation features to manage flows and volumes within the extents of the development Site.

6.1.5 Further to this, dedicated overland flow routes should be identified through the development to convey any exceedance flows in events greater than the 1 in 100-year plus climate change event or in the event of system failure.

6.2 Existing Surface Water Drainage Features

6.2.1 The Site is currently greenfield in nature, with existing surface water flows assumed to flow overground in accordance with the existing topography from west to east before infiltrating into the ground.

6.3 Discharge Hierarchy

6.3.1 In accordance with SuDS guidance, surface water should be sustainably managed and designed in accordance with the discharge hierarchy; collect for re-use; infiltrate to ground; discharge to watercourse; discharge to surface water sewer, highway drain or another drainage system; and lastly discharge to a combined sewer.

Table 6-1: Drainage Hierarchy

Discharge Location	Suitability	Comments
Collect for Re-Use	✓ / ×	Water butts and rainwater harvesting systems can collect rainwater for non-potable uses e.g. within gardens and other non-potable uses. The potential to incorporate rainwater harvesting and re-use measures may be assessed during the detailed design stage.
Infiltration	✓	Preliminary infiltration testing at the Site was undertaken by Geo Environmental Group in July 2024 to understand whether an infiltration-led surface water drainage strategy could be utilised. After a review of the preliminary infiltration results recorded by Geo Environmental Group, infiltration was viable on-Site at test locations IT01 and IT04, allowing surface water drainage from the proposed residential-led development and sports pitches to discharge via infiltration.
Watercourse	×	No hydrological features have been recorded within the Site with downstream connectivity. It is understood that existing surface water runoff is discharged via infiltration to the east, via the underlying chalk geology. The River Ver is located approximately 2.80km west of the Site.
Surface Water Sewer	×	An existing 300mm diameter surface water sewer is situated to the west of the Site along Harpenden Road. If this were to be utilised, surface water pumping from the east of the Site would need to be undertaken. As such, this has not been proposed.
Combined Sewer	×	There are no existing Thames Water combined sewers situated within the vicinity of the Site.

6.3.2 In accordance with the above search sequence, it is proposed to discharge surface water runoff via infiltration for the proposed residential-led development and sports pitches.

6.4 Infiltration Rates

6.4.1 Preliminary infiltration tests were undertaken in April 2018 by WSP (Ground Risk and Remediation). Within the six infiltration tests undertaken, two demonstrated that infiltration was viable and the

rate of 1.6 x 10^{-4} m/s was found at the outfall basin location. However, it is noted that these results are not recent.

6.4.2 Further infiltration testing at the Site was undertaken by Geo Environmental Group in 2024 and 2025 .

6.4.3 Seven trial pits across the Site were explored to understand infiltration rates. The preliminary infiltration results at IT01 to IT07 are shown in Table 3-2 and are available in Appendix B.

Table 6-2: Summary of Preliminary Infiltration Test Results

Location	Depth Range of Test (m)	Time	Infiltration Rate (m/s)
IT01	1.30-2.40	115	2.96X10-5
	1.05-2.08	132	2.63X10-5
	1.01-1.82	119	2.97X10-5
IT02	1.00-2.00	217	N/A
IT03	1.45-2.75	194	N/A
IT04	1.20-2.00	105	2.60X10-5
	1.00-1.75	165	1.88X10-5
IT05	1.40-2.40	201	N/A
IT06	1.80-2.80	195	N/A
IT07	1.40-2.50	183	N/A
IT08B	2.00-3.00	20	1.50 x10^{-4}
	1.90-2.80	25	2.62x10^{-3}
	1.75-2.70	25	2.67x10^{-3}

6.4.4 After a review of the preliminary infiltration results recorded by Geo Environmental Group, no infiltration results could be recorded at trial pits IT02, IT03, IT05, IT06 and IT07. It was noted that infiltration was viable on-Site at test locations IT01 and IT04.

6.4.5 Additional testing was undertaken at IT08B in February 2025, located adjacent to IT04, which produced three positive infiltration results. Given that the proposed infiltration basin is located between IT04 and IT08B, a conservative 'worst case' rate of 1.88x10^{-5}m/s has been utilised in the surface water drainage strategy.

6.4.6 As such, the use of traditional soakaways are considered to be a feasible means of surface water drainage at the Site at locations IT01, IT04 and IT08B. Please refer to Section 6.6 for further information in relation to the proposed surface water drainage strategy.

6.4.7 There has been extensive groundwater monitoring which has been undertaken across the Site as detailed in Section 5.6. Particular consideration should be given to groundwater monitoring which has been undertaken at WS01 and WS07/WS07A which are in close proximity to IT01, IT04 and

IT08B respectively, which demonstrate that both boreholes were dry up to a depth of 5.0m during the monitoring which took place between May 2024 – April 2025.

6.4.8 The groundwater monitoring demonstrates that the minimum distance of 1m between the base of the proposed infiltration basins and the groundwater is greater than 1m.

6.5 Climate Change Impact

6.5.1 In line with the climate change allowances recommended by the Environment Agency in their February 2016 guidance, updated May 2022, the impact of climate change on the peak rainfall intensities in urban drainage designs should be assessed by Management Catchment and increased accordingly.

6.5.2 The peak rainfall intensity allowances for the Colne Management Catchment has therefore been reviewed, as detailed for the 3.3% annual exceedance rainfall event in Table 6-3 and 1% in Table 6-4.

Table 6-3: 3.3% Peak Rainfall Allowances for the Colne Management Catchment

	Central Allowances	Upper End Allowances
2050s	20%	35%
2070s	25%	35%

6.5.3

Table 6-4: 1% Peak Rainfall Allowances for the Colne Management Catchment

	Central Allowances	Upper End Allowances
2050s	20%	40%
2070s	25%	40%

6.5.4 The proposed development and associated surface water drainage scheme has been designed to sustainably manage the run-off from the critical 1 in 100 year storm event (1%AEP) with a 40% allowance for climate change.

6.5.5 Consideration to the potential impact of climate change has been given in the proposed development, in particular regarding locating built development outside of the maximum flood extents in climate change scenarios and exceedance flow routing.

6.6 Standard 1: Runoff Destination

6.6.1 In accordance with SuDS guidance, surface water should be sustainably managed and designed in accordance with the discharge hierarchy; collect for re-use; infiltrate to ground; discharge to watercourse; discharge to surface water sewer, highway drain or another drainage system; and lastly discharge to a combined sewer.

6.6.2 In accordance with the search sequence in Table 6-1, it is proposed to discharge surface water runoff through infiltration within the Site boundary.

6.7 Standard 2: Management of Every Day Rainfall Events

6.7.1 Standard two requires a 'SuDS' approach to be applied so that at least the first 5mm of rainfall for the majority of rainfall events does not result in runoff from the site to surface waters or piped drainage systems.

The Proposed Development infiltrates entirely to the ground so no runoff leaves the development for storm events with a 1 in 1 or greater chance of occurring each month and therefore, the surface water drainage system is deemed compliant with Standard 2.

6.8 Proposed Surface Water Drainage Strategy – Site-wide

6.8.1 The proposed Surface Water Drainage Strategy is shown on the Indicative Surface Water Drainage Strategy drawing (Ref. 05920-WR-0525), included in Appendix F.

6.8.2 In accordance with the drainage hierarchy, as indicated previously, the Site is suitable for soakaway drainage via infiltration at IT04, situated to the east of the Site.

6.8.3 It is proposed that surface water runoff from the proposed residential-led development will be attenuated by multiple detention basins throughout the Site before entering the final infiltration basin to the east, situated at test location IT04 and IT08B at a conservative, worst case scenario rate of $1.88x10^{-5}$m/s.

6.8.4 The proposed Surface Water Drainage Strategy implements SuDS in the form of detention basins, infiltration basin and swales. The plot/parcel level drainage design will provide additional water quality treatment and conveyance to the wider strategic detention basins, infiltration basin and swales across the Site. Given the detailed nature of plot level design, this will be developed at the next design stage, however, a summary of the selection of SuDS features which has been provided/could be are outlined in Table 6-6.

Table 6-5: Summary of SuDS Feature Selection

Feature	Description	Selection
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation.	× Due to the proposed residential nature of the development, green roofs have not been proposed. The ability for the residential dwellings to incorporate green roofs will be limited as a significant proportion of the roof space will be occupied by PV panels.

Feature	Description	Selection
Filter Strips	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	✓ / × Due to the proposed residential nature of the development and required land take, filter strips have not been proposed at this stage, but may be considered at a later design stage.
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.	✓ / × Due to the proposed residential nature of the development, permeable paving has not been proposed at this stage. The inclusion of permeable surfaces will be reviewed at the next design stage.
Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff, and can infiltrate the water into the ground (if ground conditions allow).	✓ Conveyance features, such as swales have been incorporated within the surface water drainage strategy to convey water away from properties and towards the attenuation features.
Infiltration Basins	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the ground. They may also be landscaped to provide aesthetic and amenity value.	✓ Infiltration testing has been undertaken and demonstrates that an infiltration-led design is viable at test location IT04 to the east of the Site.
Basins / Ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment whereas basins are usually dry for a larger period of time outside storm events. They provide temporary storage for storm runoff. These features may provide amenity and wildlife benefits.	✓ Attenuation basins and ponds have been proposed for use on-Site. The exact wet / dry nature will be confirmed during the next phase of design.
Underground Attenuation	Underground attenuation structures are below-ground attenuation features. These are typically formed using crates which provide a high void space for attenuation and water quantity control.	× Underground attenuation have not been proposed for use within the proposed development .
Bioretention / raingardens	Bioretention systems or rain gardens are areas of vegetation into which rainwater and runoff can be directed. These are particularly affected at providing water quality improvements.	✓ / × Rain gardens have not been proposed for use within the proposed development at this design stage, however, they may be considered for inclusion at a plot/parcel design stage. .
Filter Drains	Filter drains are gravel filled trenches that collect and move water. They also treat pollution. The trench is filled with free draining gravel and often has a perforated pipe in the bottom to collect the water	✓ / × Conveyance features, such as filter drains may be incorporated within the surface water drainage strategy to convey water away from properties and towards the attenuation features. This will be decided at design design.
Water Butts	Water butts are water tanks which are used to collect and store rainwater runoff, typically from roof tops via pipes. Overflows will still enter the site surface water drainage system.	✓ / × Water Butts for individual residential dwellings will be considered at a later design stage.

6.8.5 The required storage volume for the attenuation of the 1 in 100 year event plus 40% climate change event has been calculated for each land parcel and discharge location, assuming a proportion of

impermeable surfacing based on the illustrative masterplan; the estimated contributing areas, proposed attenuation basins are shown together with their required capacity on the Indicative Surface Water Drainage Strategy drawing in Appendix F. A summary table for the proposed attenuation is provided in Table 6-7 which also identifies the impermeable area which has assumed each residential development parcel is 60% impermeable with an additional 10% for development creep, 80% for mixed-use development, 90% for commercial development, 100% for highways and attenuation basins and 50% for schools.

Table 6-6: SuDS Summary

Assumed Catchment	Proposed Discharge Rate (l/s)	Proposed Impermeable Area Including 10% Urban Creep [ha]	Proposed Attenuation Volume Required [m^3]
A	N/A	2.84	1,785
B	N/A	1.57	1,220
C	N/A	2.78	5,115
D	$1.88X10^{-5}$	2.54	4,825
E	N/A	0.66	2,165
F, G, I and J	N/A	7.48	4,145
H	N/A	1.44	4,015
K	N/A	2.01	4,010
L	N/A	0.90	5,000
TOTAL	N/A	**22.23**	**31,280**

6.8.6 The proposed attenuation basins have been designed as dry features at this stage however, some may be designed to have a permanently wetted pool below the existing drainage invert level, full details of this will be available at the detailed design stage.

6.8.7 As shown in the Causeway Flow calculations in Appendix G, the half drain time for the infiltration basin is not achieved within 24 hours at the infiltration basin. However, given a water depth of 0.654m is shown in the basin the 30-year storm duration, the basin has capacity to received back to back 30-year events within the 2.4m deep basin. The water volume contained within the attenuation basin is 1,500m^3 out of a storage capacity of 6,310m^3 (not including freeboard), resulting in the utilisation of only 24% of the attenuation volume. This demonstrates that despite not achieving a half drain time in 24 hours, the infiltration basin has sufficient capacity to handle subsequent storm events.

6.8.8 The SuDS features will aim to provide multiple functions as amenity and biodiversity assets, which may include additional proposed permanent wet features, particularly if such features are required to improve the Biodiversity Net Gain (BNG) scoring of the development and to provide a carbon store. Other aspects of the proposed strategy which reduce the developments carbon footprint compared to traditional drainage include:

- Reduced surface water pumping, wastewater pumping/treatment, leading to reduced energy use and associated carbon emissions;
- Embodied carbon (avoided) as a result of reduced consumption (e.g., due to rainwater harvesting); and
- Cooling/shading of buildings, leading to reduced energy use and associated carbon emissions. [5]

6.8.9 Water butts may be available for all households to provide an opportunity for water re-use. However, as the attenuation capacity for the water butts cannot be guaranteed during a rainfall event, these have not been accounted for within drainage strategy attenuation calculations.

6.8.10 Surface water run-off from roofs and hard surfaces across the development will drain to a new surface water drainage network incorporating SuDS components to control discharge to the receiving watercourses, provide attenuation storage on-Site and provide treatment to run-off. The surface water drainage system will be designed to convey the run-off from the critical 1 in 100 year (+40% climate change allowance) storm event without flooding. The proposed attenuation ponds are located at the natural low points of the proposed Site and sized to provide the required attenuation and treatment.

6.8.11 The proposed SuDS features have been sized in Flow to ensure that the proposed system will be capable of conveying run-off from the design storm event without flooding. Refer to Appendix G for the Flow model output. FEH 22 data has been utilised.

6.8.12 The design calculations confirm that the proposed surface water drainage system is capable of attenuating, and discharging in a controlled manner, the run-off from the design 1 in 100 year storm with a 40% allowance for climate change without flooding of the development.

6.8.13 The surface water drainage strategy is based upon the site masterplanning details at the time of production. Changes to the site development profile, impermeable areas across the site or other such aspects of the scheme will result in the need to revise the calculations.

6.9 Proposed Surface Water Drainage Strategy- Sports Pitch & Pavillion

Car Parking and Sports Pavillion Drainage Strategy

6.9.1 A full planning application has been submitted for the Sports Pitches within the Proposed Development. Surface water runoff from the proposed car parking areas and sports pavilion will be channelled through a filter trench to enhance water quality.

[5] https://www.susdrain.org/delivering-suds/using-suds/benefits-of-suds/Carbon-reduction-and-sequestration

6.9.2 The majority of the carpark access and pavilion have been assumed to be permeable, made from material such as gravel or grasscrete. There is a small area of disabled car parking bays and access which has been assumed to be 100% impermeable. The treated surface water runoff will then be discharged into an infiltration basin located south of the proposed sports pitches.

Sports Pitch Drainage Strategy

6.9.3 Furthermore, the proposed sports pitches will be drained via top drains, laterals and collector drains as designed by TGMS (in accordance with Sport England Guidance), discharging into the proposed infiltration basin. TGMS are specialist sports pitch designers and have designed the sports pitch drainage network in detail, including standard cross sections of the various drainage design elements, this is shown in Appendix H.

6.9.4 The outfall rate from the sports pitches was designed using the 'Loughborough Method' which assumes that 75% of the sports pitches impermeable area will be retained within the sports pitch drainage network, the remaining 25% impermeable area will be discharged from the pitch drainage network. The testing was undertaken on soils which had little to no infiltration capacity, which is reflective of the ground conditions confirmed in the Phase II Ground Investigation Report, for the Sports Pitches and Pavillion.

6.9.5 It is proposed that the sports pitch drainage will discharge into the wider drainage network and outfall into the proposed attenuation basin. The surface water attenuated within the basin will discharge via infiltration to ground at a rate of $2.63x10^{-5}$ m/s, which is infiltration rate established during the infiltration testing at IT01.

6.9.6 The attenuation basin has been designed to provide attenuation of the 1 in 100-year event plus 40% climate change event.

Table 6-7: Sports Pitch Attenuation Requirements

	Proposed Discharge Rate (l/s)	Proposed Development Area (ha)	Proposed Impermeable Area (ha)	Proposed Attenuation Volume Required (m^3)
A (Sports Pitch)	2.63×10^{-5}	4.20	1.05	1,890
B (Pavillion)		0.06	0.06	
C (Car park Access)		0.04	0.04	
TOTAL		**4.28**	**1.15**	

6.9.7 The proposed surface water drainage strategy (05920-WR-A-0503) is contained withinAppendix H Full network calculations are provided in Appendix I.

6.10 Development Creep

6.10.1 Over the lifetime of a development, it is possible that the overall impermeable area within the Site could increase by as much as 10% through the house buyers undertaking activities such as property extensions and introducing paved gardens.

6.10.2 An assessment of development creep is not required for the Proposed Sports Pitches.

6.10.3 Table 6-9 identifies the potential increase in impermeable area as a result of urban creep over the lifetime of the development. The impermeable areas which the urban creep values have been utilised in the Causeway Flow calculations.

Table 6-8: Development Creep Assessment

Catchment	Impermeable Area (ha)	Residential Only Impermeable Area (ha)	10% Creep (ha)	Total Impermeable Area (ha)
A	2.65	1.90	0.19	2.84
B	1.57	0.00	0.00	1.57
C	2.59	1.96	0.196	2.78
D	2.37	1.67	0.167	2.54
E	0.63	0.31	0.031	0.66
F, G, I and J	7.07	3.83	0.383	7.45
H	1.41	0.00	0.00	1.41
K	1.83	1.38	0.138	1.97
L	0.71	0.44	0.044	0.75
TOTAL	**20.83**	**11.49**	**1.149**	**21.97**

6.11 Water Quality

Principles of Water Quality Assessment

6.11.1 The general principles are to mitigate against adverse impacts on water quality in the receiving water environment is described in the CIRIA C753 "The SuDS Manual" (2015). This document recommends the following steps to determine the required water quality management for discharges to surface waters and groundwaters based on the risk posed:

3 Interception: Prevent runoff and associated pollutants from the Site to receiving surface waters for the majority of small rainfall events;

4 Determine the pollution hazard level associated with the given type of development;

5 Select a risk assessment approach based on receiving water environment and the pollution hazard level; and

6 Undertake a detailed risk assessment for each outfall or discharge point taking into account the pollution hazard level, the status of the receiving water environment and effectiveness of the proposed SuDS techniques.

6.11.2 The extent of the treatment required will depend on the water quality status of receiving watercourses, land use, the level of pollution prevention in the catchment and for groundwater, the natural protection afforded by underlying soil layers. The pollution hazard level of the development type should be identified.

6.11.3 Residential roofs are noted as having 'very low' pollution hazard level and require removal of gross solids and sediments only. Residential car parks, access roads, driveways and non-residential car parking with infrequent change (e.g., schools) are shown to present 'low' pollution hazard level.

6.11.4 Low pollution hazard levels require application of a 'simple index approach' for water quality risk assessment for discharges to surface and ground waters.

Existing Water Quality of the Proposed Receiving Watercourses

6.11.5 The proposed works fall into the Environment Agency's Thames River Basin District (RBD) which covers an area of 16,200km^2. It encompasses all of Greater London and extents from North Oxfordshire southwards to Surrey and from Gloucester in the west to the Thames Estuary, as well as Kent in the east.

6.11.6 The Thames River Basin has been divided into 20 Management Catchments, of which the Site falls into the Colne Management Catchment and then on a smaller scale, the Colne Operational Catchment.

6.11.7 Within the Colne Operational Catchment, the Site falls into the Upper Colne and Ellen Brook Water Body. This is identified not to be a designated artificial or heavily modified watercourse. The 2022 Classification Cycle identifies it has a 'Poor' ecological status and 'Fail' chemical status in 2019.

6.11.8 Reasons for not achieving 'good' status include:

- Groundwater Abstraction;
- Misconnections;
- Urbanisation;
- Transport drainage;
- Poor Soil Management;
- Reservoir / Impoundment.

6.11.9 As such the Environment Agency will be seeking improvements to the water quality of the local watercourse system to achieve a status of Good by 2027.

6.11.10 The principles of the SuDS Management Train should be incorporated into the proposed surface water drainage schemes for new development, to reduce the risk of further pollutants entering watercourses via run-off from roofs and paved areas.

6.11.11 SuDS components can reduce pollution in run-off through filtering out pollutants or reducing flow rates to encourage deposition of any contaminants. Suitable components could include:

- filter drains;
- swales;
- attenuation basins;
- wetlands; and
- proprietary treatment systems.

6.11.12 To protect biodiversity and amenity assets, polluted surface water run-off should not be discharged directly into permanent ponds but treated through an appropriate treatment train. Where possible, interception storage should be included as part of the treatment train to manage pollutants at source. Later stages of treatment in the train should incrementally reduce the level of pollution in run-off before discharge to the receiving water body.

6.12 Contamination and Water Quality

6.12.1 The proposed development will utilise SuDS Management Trains across each network to ensure treatment of run-off and removal of pollutants prior to discharge.

6.12.2 This is likely to include a mixture of components across the Site, specified according to the opportunities/constraints presented by:

- the likely pollution hazard of the run-off;
- the available surface space; and
- the proposed ground levels/falls across areas of hardstanding.

6.12.3 Treatment components within each SuDS Management Train may include:

- channel drains;
- catchpits;
- trapped gullies;
- attenuation basins incorporating pre-treatment (such as a sediment forebay) and low flow channels;
- bioretention areas in greenspace around the Site;

- swales and linear wetlands;
- filter drains bordering paved areas such as roads and yards; and
- proprietary treatment systems (such as downstream defenders).

6.12.4 The arrangement and composition of each management train will be confirmed at the detailed design stage.

6.12.5 The proposed uses at the Site will comprise residential roofs and individual driveways. Roofs are classified as a 'very low' pollution risk and individual driveways are classed as a 'low' pollution risk level in Table 26.2 of CIRIA C753 The SuDS Manual. While higher trafficked roads may be classed as a 'medium' pollution risk level. 'Low' and 'medium' hazard pollution levels require application of a 'simple index approach' for water quality risk assessment for discharge to surface and groundwaters. The "pollution hazard indices" for a low pollution hazard Site are given in Table 6-8 below.

Table 6-9: Pollution Hazard Indices

Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Low	0.5	0.4	0.4
Medium	0.7	0.6	0.7

6.12.6 The surface water drainage system should provide a sufficient level of water quality treatment to prevent pollution of the receiving waterbodies.

6.12.7 Table 6-11 provides the indicative SuDS mitigation indices for the proposed SuDS features for the Site. It demonstrates that the mitigation index for the basins, swale and filter strips are greater than the "*pollution hazard index*" for each pollutant type. Therefore, the strategy is deemed to comply with the water quality requirements of the SuDS standards.

Table 6-10: Indicative SuDS Mitigation Indices

SuDS component	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6
Swale	0.5	0.6	0.6
Filter Strip	0.4	0.4	0.4

6.12.8 The minimum number of treatment trains which surface water will discharge through before infiltrating to the ground is two, via an attenuation basin and a swale. Using the simple index approach this will result greater mitigation value than the medium pollution hazard level.

Table 6-11: Minimum Quantity of SuDS Treatment

	Mitigation Indices		
Swale	0.5	0.6	0.6
Detention basin (50% as second index)	0.25	0.25	0.3
Total SuDS mitigation index	0.75	0.85	0.9

6.12.9 The other catchments within the indicative surface water drainage strategy have additional treatment trains and therefore will have greater mitigation values than the medium pollution hazard level.

6.12.10 The sports pitch, associate car park and sports pavilion, would be considered to have a low pollution hazard level and therefore, the proposed detention basin provided sufficient mitigation.

6.13 Designing for Exceedance

6.13.1 During a rainfall event with a return period well in excess of that for which the surface water drainage system was designed (in this case a 1 in 100 year plus 40% climate change allowance), or in the event of a blockage, the capacity of the surface water drainage system may be exceeded, resulting in localised flooding in the areas affected. This is considered to be a residual risk.

6.13.2 However, the layout and landscaping of the proposed development should be designed and will be developed to ensure that exceedance flood flow paths are routed away from vulnerable development and toward landscaped areas, areas of open attenuation or surrounding green infrastructure. An exceedance flow plan is provided in Appendix K.

6.13.3 In line with Building Regulations Part C the finished floor levels of the properties will be set at least 150mm above the surrounding ground levels to prevent surface water ingress through doorways. Location of buildings in ground depressions will be avoided to prevent water ponding around dwellings.

6.13.4 Minor modifications to topography, the profile of the access road, footpath or kerb and strategically placed green infrastructure will be developed to ensure that exceedance flood flows are managed and there is little or no risk of property flooding or unacceptable ponding within the highway.

7 Foul Water Drainage Strategy

7.1.1 Thames Water are the statutory water authority for foul drainage in the area. Sewer asset mapping has been reviewed to understand the existing foul drainage network within the vicinity of the Site.

7.1.2 From a review of the existing Thames Water sewer asset mapping, an existing 225mm diameter foul water sewer bisects the Site to the north west before flowing south westerly along Harpenden Road.

7.2 Proposed Foul Water Drainage Strategy – Site-wide

7.2.1 A foul water drainage strategy has been prepared (Ref. 05920-WR-0526) which implements measures for foul flows to drain via gravity to the proposed pumping station within the Site. Foul water will be pumped from the proposed Type 3 pumping station (typically more than twenty dwellings), to the north west of the Site into Manhole MH8702.

7.2.2 Furthermore, a secondary foul water drainage strategy has been prepared (Ref. 05920-A-0503) for the proposed sports pavilion facilities which implements measures for foul flows to drain via gravity to the existing Thames Water foul water sewer at Manhole 101A.

7.2.3 A developer enquiry has been submitted to Thames Water to determine whether the existing public sewer network has capacity for the proposed development at St Albans. A response was received on the 5th April 2024 and states that the existing sewerage network will not have enough capacity for full development at this time.

7.2.4 Thames Water suggests that the Site should look to utilise Manhole 8702 situated to the north west of the Site at a pumped flow rate of 27.6 litres/second. In order to make the appropriate upgrades, modelling work will need to be undertaken to provide a design solution and to provide the necessary improvements. Once modelling has begun, Thames Water may need to contact the developer to discuss changing the proposed connection point for capacity reasons.

7.2.5 The cost of any upgrades to the surrounding Thames Water infrastructure will be covered by Thames Water and will be planned and delivered following approval of the outline planning permission.

7.3 Proposed Foul Water Drainage Strategy – Sports Pitch & Pavillion

7.3.1 The proposed foul water drainage connection from the Pavillion is shown in the Drainage Strategy drawing (05920-WR-A-0503). As shown in the foul water drainage strategy, it is proposed that the Pavillion will connect to the existing Thames Water Manhole 101A, which is to be confirmed by Thames Water.

8 Operation & Management

8.1 Surface Water Drainage System

8.1.1 Responsibility for the maintenance of the main surface water drainage networks and SuDS features may be offered to Thames Water for adoption under S104 of the Water Industry Act 1991. To meet the requirements for adoption, the proposed infrastructure must be designed and constructed according to Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

8.1.2 Alternatively, it is common for SuDS features to be operated and maintained by a third-party private maintenance company. Should this be necessary, a third-party management company would be established to maintain the features in perpetuity and an adoption agreement between the final Site developer and Maintenance Company would be largely based upon the CIRIA ICoP MA2 SuDS Maintenance Framework Agreement.

8.1.3 Drainage serving new roads to be offered for adoption by the Local Highway Authority will become highway drains, adopted as part of Section 38 agreements (Highways Act 1980).

8.1.4 In England it also appears increasingly likely that Schedule 3 of the Flood and Water Management Act will be enacted in England, with DEFRA currently recommending implementation of this in 2024. This legislation, when enacted, will require SuDS Approval Bodies (SABs) to be formed in England who will review the design of SuDS and will likely be responsible for the future operation and maintenance. As the layout of the development evolves it is recommended that the surface water drainage design seeks to comply with this legislation when it comes forward ensuring that the SuDS proposed are designed and built in accordance with the SAB's requirements and may be offered for adoption to the SAB if required.

8.1.5 A typical maintenance schedule of the attenuation basins, infiltration basins, swales and flow control devices proposed on Site are shown in Table 7-1 to Table 8-4.

Table 8-1: Attenuation Basin Indicative Maintenance Schedule

FREQUENCY	ACTION
Monthly	• Litter and debris removal. • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only). • Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)) (for 12 months following installation). • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.

FREQUENCY	ACTION
Six Monthly	• Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)).
Annually	• Remove all dead growth prior to the start of growing season. • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required. • Inspect and document the presence of wildlife. • Remove sediment from inlets, outlets and forebay. • Manage wetland plants, where required.
As Required	• Prune and trim trees and remove cuttings. • Remove sediment from forebay, when 50% full and from micropools if volume reduced by more than 25%. • Repair erosion or other damage by re-turfing or reseeding. • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period). • Remove and dispose of oils or petrol residues using safe standard practices.
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order.

Table 8-2: Infiltration Basin Indicative Maintenance Schedule

FREQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only) • Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)) (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015))
Annually	• Remove all dead growth prior to the start of growing season • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife
As Required	• Prune and trim trees and remove cuttings • Remove sediment from forebay, when 50% full and from micropools if volume reduced by more than 25% • Repair erosion or other damage by re-turfing or reseeding • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove sediment from pre-treatment system (e.g. forebays) when 50% full

FREQUENCY	ACTION
	• Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

Table 8-3: Swale Indicative Maintenance Schedule

FREQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only) • Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)) (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015))
Annually	• Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where required • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife
As Required	• Repair erosion or other damage by re-turfing, reseeding or replacing filter materials. • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove and replace top 300 – 500mm of gravel, clean and replace where required (typically every 60 month period) • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

Table 8-4: Flow Control (e.g. Hydrobrake) Indicative Maintenance Schedule

FREQUENCY	ACTION
Monthly	• Inspect and identify any areas that are not operating correctly. If required, take remedial action (for three months following installation).
Six Monthly	• Inspect and identified ant area that are not operating correctly. If required, take remedial actions. • Remove sediment from any pre-treatment structures.
Annually	• N/A

FREQUENCY	ACTION
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return the feature to full working order.

8.1.6 The proposed maintenance regimes for the devices should be largely in accordance with The SuDS Manual (CIRIA C753) and other best practice guidelines and in accordance with manufacturer's recommendations. This will ensure the design performance, structural integrity and where applicable- appearance of each feature is maintained throughout its lifetime.

8.1.7 Further details will be provided on the maintenance requirements of the proposed SuDS components across the development as the detailed design is developed. The details of the party responsible for maintenance of each feature should be confirmed prior to occupation of the proposed development.

8.2 Foul Water Drainage System

8.2.1 It is anticipated that the proposed foul sewer network may be offered to Thames Water for adoption under Section 104 of the Water Industry Act 1991. To meet the requirements for adoption, the proposed infrastructure must be designed and constructed according to Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

9 Conclusion & Recommendations

9.1 Conclusion

9.1.1 PJA has been commissioned by Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust to prepare a Flood Risk Assessment and Drainage Strategy for the proposed residential-led development of up to 1,000 dwellings with two form entry primary school, neighbourhood centre, recreational space, green infrastructure and 80 bed care home at Woollam Park, St Albans.

9.1.2 This Flood Risk Assessment has been undertaken in accordance with current national and local flood risk policy requirements. This report assesses the existing and future flood risk at the Site, including an assessment of the potential effects of the proposed development on flood risk on- and off-Site.

9.1.3 The assessment concludes that the Site is considered at either very low or low risk of flooding from fluvial, tidal, reservoirs, canals, and sewers.

9.1.4 It should be noted that high, medium and low surface water flood risk is present on-Site, however site-specific hydraulic modelling has been undertaken. This demonstrates that the proposed development is safe for its lifetime from current and future flood risk, and does not exacerbate existing flood risk off site.

9.1.5 Groundwater monitoring has been undertaken at the Site which clearly demonstrates that the 1m depth between the base of any infiltration basins and the groundwater level will be maintained.

9.1.6 In addition to the NPPF, the proposed surface water drainage strategy complies with local policy and Site-specific requirements.

9.1.7 A Surface Water Drainage Strategy has been prepared to demonstrate that a sustainable drainage solution can be provided for the proposed development. The Surface Water Drainage Strategy has been designed largely in accordance with current sustainable development best practice and meets the requirements of Hertfordshire County Council (as the LLFA).

9.1.8 The proposed surface water drainage systems aim to mimic the hydrological regime of the existing Site by infiltrating run-off to the north (Sports Pitches) and east (Residential-led Development) of the proposed development. Attenuation storage will be provided in the form of open SuDS features such as attenuation basins, infiltration basins, filter trenches, underground geocellular storage and swales. Water butts may be used to store water for re-use within feasible locations, but these have not been included within attenuation calculations as the capacity availability cannot be guaranteed.

9.1.9 SuDS Management Trains will provide suitable treatment of run-off by removing pollutants prior to discharge.

9.1.10 A foul water drainage strategy has been prepared (Ref. 05920-WR-0526) which implements measures for foul flows to drain via gravity to the proposed pumping station within the Site. Foul water will be pumped from the proposed Type 3 pumping station to the north west of the Site into Manhole MH8702.

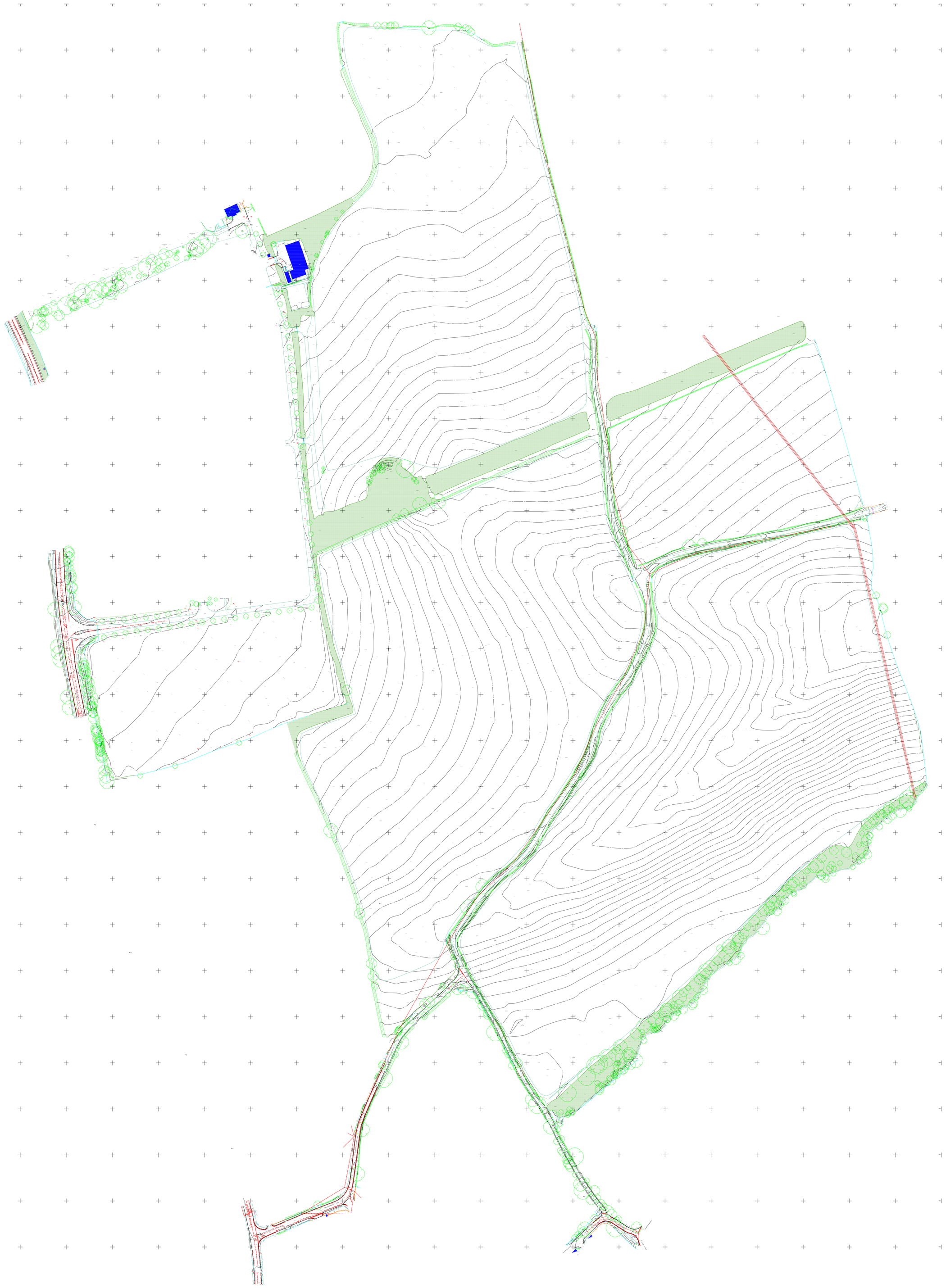
9.1.11 Furthermore, a secondary foul water drainage strategy has been included on drawing Ref. 05920-WR-A-0503-P02 for the proposed sports pavilion facilities which implements measures for foul flows to drain via gravity to the existing Thames Water foul water sewer located within the rugby club access road.

9.1.12 Safe access and egress will be available to and from the Site for events up to and including the 1 in 100 year plus climate change flood events

9.1.13 The responsibility for the operation and maintenance of each SuDS feature will be confirmed prior to the commencement of construction. The SuDS used on Site should be maintained in accordance with manufacturer's recommendations and current best practice and guidelines to ensure routine operation.

9.1.14 This report demonstrates that the proposed development may be undertaken in a sustainable manner without increasing the flood risk either at the Site or to any third-party land in line with NPPF requirements.

Appendix A Topographic Survey



Symbol & Abbreviation Key.

- BARBED WIRE FENCE
- POST & RAIL FENCE
- CLOSE BOARD FENCE
- RAILINGS
- CHAIN LINK FENCE
- OTHER FENCE
- KERB
- DROPPED KERB
- GULLY CHANNEL
- TOP / BOTTOM OF BANK
- FOLIAGE
- DITCH
- VERGE
- OVERHEAD CABLES
- GATE
- HEDGE
- TREE - BROAD LEAVED
- TREE - CONIFEROUS
- BUSH
- BUILDING
- BOREHOLE
- SURVEY STATION
- ORDNANCE SURVEY BENCH MARK

A/C	AIR CONDITIONING UNIT	KO	KERB OFFLET
AV	AIR VALVE	LC	LIGHTING COLUMN
BOL	BOLLARD	LP	LAMP POST
BH	BOREHOLE	NP	NAME PLATE
BL	BED LEVEL	NB	NOTICE BOARD
BM	BENCH MARK	PR	PIPE RISER
BT	BRITISH TELECOM	RP	RODDING POINT
CTV	CABLE TV	RS	ROAD SIGN
CL	COVER LEVEL	SP	SIGN POST
CR	CABLE RISER	SV	STOP VALVE
DP	DOWN PIPE	TL	TRAFFIC LIGHT
ER	EARTH ROD	TP	TELEGRAPH POLE
EP	ELECTRICITY POLE	TOF	TOP OF FENCE
EM	ELECTRICITY MARKER	TOH	TOP OF HEDGE
FB	FUSE BOX	TOR	TOP OF RAILINGS
FH	FIRE HYDRANT	TOS	SERVICE LEVEL
FP	FENCE POST	TOW	TOP OF WALL
FL	FLOOR LEVEL	UTL	UNABLE TO LIFT
GV	GAS VALVE	VM	VALVE MARKER
GM	GAS MARKER	VP	VENT PIPE
GU	GULLY	WL	WATER LEVEL
HM	HYDRANT MARKER	WM	WATER MARKER
IL	INVERT LEVEL	WO	WASH OUT

General.

This survey has been prepared with a scaling accuracy for a plot at a scale of 1:200.

All tree heights and spreads are approximate. We have tried to identify tree types, however if tree species are critical specialist advice should be gained.

Drainage pipe sizes have been measured from the surface. Chamber access has not been gained for safety reasons, therefore sizes should be regarded as approximate.

Some detail may have been omitted due to parked vehicles.

Notes.

Coordinates related to OS National Grid from ST10 by GPS.
Levels related to GPS. Scale factor: 0.99976403

INDICATIVE ONLY

Rev	Details of Revision	Drawn	Date
B	Road detail added.	AA	01/08/19
A	Additional area around school/field added.	AS	31/07/19

Surveyed	Drawn	Date	Checked	Date	Approved	Date
GD	AS	24/07/19	APK	24/07/19	APK	24/07/19

Interlocks Surveys Limited
St. Andrews House
Radford Semele
Leamington Spa
Warwickshire
CV31 1TF

T: 01926 330123
F: 01926 330120
E: info@interlocksurveys.co.uk

Client.

WSP GROUP
THE MAILBOX
LEVEL 2
100 WHARFSIDE STREET
BIRMINGHAM, B1 1RT

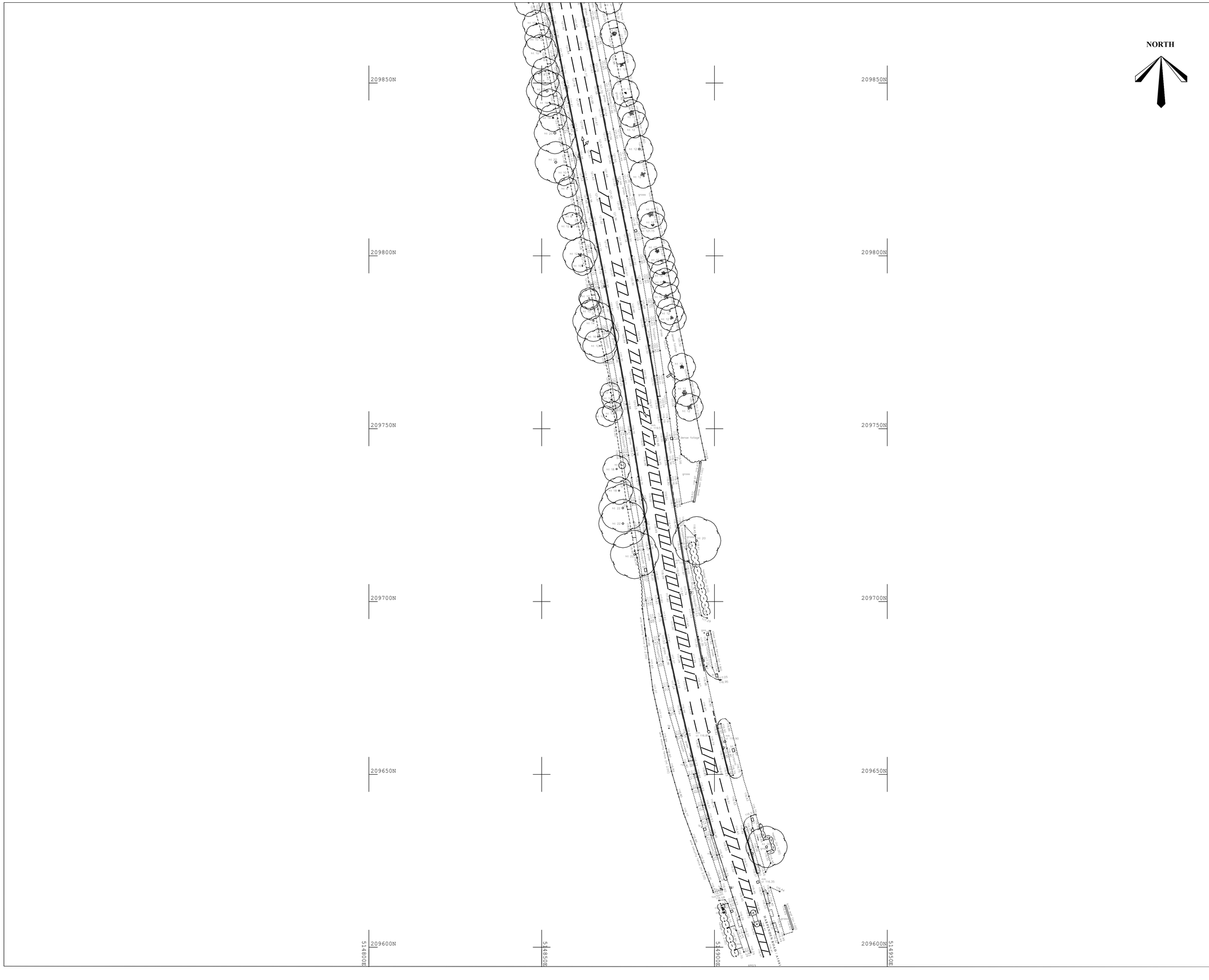
Title.

TOPOGRAPHICAL SURVEY

ST ALBANS
HERTFORDSHIRE
AL3 6JE

Dwg No. **190296** Sheet **1 of 1**

Scale NTS A0 Sheet Rev. B



NOTES

GENERAL NOTES :-

ALL LEVELS ARE IN METRES DERIVED FROM GPS TRANSFORMATION.

GRID COORDINATES ARE ORDNANCE SURVEY NATIONAL GRID DERIVED FROM GPS TRANSFORMATION. GPS COORDINATES AND LEVELS SET AT ST01 (NO SCALE FACTOR APPLIED)

THIS DRAWING HAS BEEN PRODUCED WITH A PLOT SCALE ACCURACY OF 1:500

SERVICE COVERS INDICATED WHERE VISIBLE. PIPE INVERTS / DETAILS SURVEYED FROM SURFACE INSPECTION ONLY. GENERALLY DAMAGED COVERS AND COVERS WITHIN HIGHWAYS WILL NOT BE LIFTED

TREE SPECIES SHOULD BE CONFIRMED BY TREE SPECIALIST IF CRITICAL.

OVERHEAD CABLES ARE INDICATED USING REMOTE SURVEY METHODS AND ARE SUBJECT TO SEASONAL VARIATION, AND SHOULD BE TREATED AS APPROXIMATE.

SERVICE COVERS LOCATED UNDER PARKED VEHICLES/MOBILE STRUCTURES MAYBE OMITTED.

BURIED SERVICE COVERS WILL NOT BE INDICATED.

TOPOGRAPHICAL SURVEY/UTILITY KEY :-

(ht) – height
ø – diameter
● – pea trap
a/g – above ground
a/r – assumed route
av – air valve
bb – bellsha beacon
bd – back drop
bl – bed level
boll – bollard
bos – bottom of shaft
bt – telecom
c/b fence – closeboard fence
c/box – control box
catv – cable television
cl – cover level
con – conifer
cr – cable riser
cws – combined water sewer
d/chan – drainage channel
ejb – electric junction box
elec – electric
eot – end of trace
ep – electric pole
er – earth rod
f/bed – flower bed
fh – fire hydrant
fl – floor level
fs – fire switch
fws – foul water sewer
g – gully
g/run – gully run
gr – gas riser
h/chestnut – horse chestnut
h/thorn – hawthorn
ic – inspection cover
il – invert level
ill – illuminated
int – interceptor
lp – lamp post
mh – manhole cover
mkr – marker
o/h – over head
ol – off let
osa – off survey area
OSBM – ordnance survey bench mark
p & r fence – post & rail fence
pd – pit depth
pr – pipe riser
ptg – pipe to ground
pts – pipe to surface
re – rodding eye
ret wall – retaining wall
rs – road sign
rwp – rain water pipe
s/birch – silver birch
s/p – safety paving
sap – sapling
sec fence – security fence
sfc – soil filled chamber
sl – spot light
sp – soil pipe
st – stop tap
sv – stop valve
svp – soil vent pipe
sws – storm water sewer
TBM – temporary bench mark
tfr – taken from records
tl – threshold level
toc – top of cap
top – top of pipe
tot – top of tank
tp – telecom pole
ts – traffic signal
t/s – trench scar
u/s – underside
utl – unable to lift
utr – unable to rod
uts – unable to survey
utt – unable to trace
vp – vent pipe
wfc – water filled chamber
wl – water level
wm – water meter
wp – waste pipe
wr – water riser

SURVEY CONTROL :-

STATION	EASTINGS	NORTHINGS	LEVEL
ST01	514841.565	210113.742	125.979
ST02	514842.239	209913.817	122.601
ST03	514910.816	209593.557	116.439

0 5 10 20 30 40 50

TAG SURVEYS
UNIT 1, ACCESS HOUSE,
SHERWOOD ROAD,
BROMSGROVE, B60 3DR
WWW.TAGSURVEYS.CO.UK
INFO@TAGSURVEYS.CO.UK

Client	PJA
Project	OLD ALBANIAN RFC, A1081, HARPENDEN ROAD, STALBANS
Title	TOPOGRAPHICAL SURVEY
Date	AUG 2023
Scale	1:500@A1
Dwg No	T0446 – 2
Surveyor	MA
Checked	SMc

Revisions

TOPOGRAPHICAL (LAND) SURVEYORS / UTILITY SURVEYORS
BUILDING MEASUREMENT SURVEYORS / 3D LASER SCANNING

Accredited Contractor
smas WORKSAFE

Appendix B Infiltration Testing and Groundwater Monitoring

GEG | Geo Environmental Group
Geotechnical, Environmental & Ecological Consultants

GEG House, 17 Graham Road, Malvern, WR14 2HR
Tel. 01684 212526 Fax 01684 576917 www.g-eg.co.uk

INFILTRATION TESTING & GROUNDWATER MONITORING

LAND AT CHEAPSIDE
HARPENDEN ROAD
ST ALBANS, HERTFORDSHIRE
AL3 6BB

APRIL 2025 (REV03)

Prepared for:

Hallam Land Management

PJA

Registered Company - GEG Ltd
Registered in England No 6469985
Registered Office: Granta Lodge, 71 Graham Rd, Malvern, WR14 2JS

Report Title:

INFILTRATION TESTING & GROUNDWATER MONITORING REPORT

Site Address:

Land at Cheapside
Harpenden Road
St Albans
Hertfordshire
AL3 6BB

Performed By:
Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

On Behalf of:
Hallam Land Management
c/o PJA
Park Point
High Street
Longbridge
Birmingham
B31 2UQ

Written by:

Matthew Perks
BSc(Hons) MSc FGS
Principal Geo-Environmental Consultant

Approved by:

Anthony Marriott
BSc(Hons) MRSC MIEnvSc FGS
Managing Director

Project Reference: GEG-24-821

Report Reference: GEG-24-821/IT

Issue Status: FINAL

Date of Issue:
Rev. 00: 23rd May 2024
Rev. 01: 22nd July 2024
Rev. 02: 24th October 2024
Rev. 03: 28th April 2025

TABLE OF CONTENTS *PAGE*

1. INTRODUCTION 1
1.1 General 1
1.2 Available Information 1
1.3 Proposed Site Development 1
1.4 Scope 1

2. SITE SETTING 1
2.1 Site Location 1
2.2 Site Description 2

3. GEOLOGY & HYDROGEOLOGY 2
3.1 Published Geology 2
3.2 Hydrogeology 3
3.2.1 Groundwater Designation 3
3.3 Potential Water Infiltration Properties of the Strata 3
3.4 Groundwater Source Protection Zone 3
3.5 Surface Water Flooding 3

4. INTRUSIVE INVESTIGATION 3
4.1 Site Works Overview 4
4.2 Scope of Works – Stage 1 4
4.2.1 Window Sample Holes 4
4.2.2 Trial Pits 4
4.3 Scope of Works – Stage 2 4
4.3.1 Window Sample Holes 4
4.3.2 Trial Pits 4
4.4 Scope of Works – Stage 3 5
4.4.1 Window Sample Holes 5
4.4.2 Trial Pits 5
4.5 Strata Encountered 5
4.5.1 Made Ground 5
4.5.2 Topsoil 5
4.5.3 Kesgrave Catchment Subgroup 5
4.5.4 Clay-with-Flints Formation 5
4.5.5 Lewes Nodular & Seaford Chalk Formations 5
4.5.6 Groundwater 6
4.5.7 Falling Head Permeability Tests 7
4.5.8 Stability of Trial Pits 8
4.5.9 Reinstatement 8
4.6 Infiltration Tests 8
4.7 Calculated Infiltration Rates 8

5. CONCLUSIONS 10
6. REFERENCES 10
7. LIMITATIONS 10

Title *Appendix*

FIGURES AND PLANS ..... A

Site Location Plan ..... Figure 1
Exploratory Hole Location Plan - Full ..... Figure 2A
Exploratory Hole Location Plan – Stage 3 ..... Figure 2B

PHOTOGRAPHIC RECORD ..... B
EXPLORATORY HOLE LOGS C
INFILTRATION TEST DATA ..... D
FALLING HEAD TESTS ..... E

1. INTRODUCTION

1.1 General

Geo Environmental Group (GEG) were commissioned by PJA on behalf of their client, Hallam Land Management (HLM), to undertake staged infiltration testing and groundwater monitoring at a site known as 'Land at Cheapside, St Albans,' for the purpose of determining infiltration rates of the underlying shallow strata and hence the suitability of the site for soakaway drainage.

1.2 Available Information

The following drawings was supplied by PJA:

- 'Potential GI Locations Plan,' PJA on behalf of HLM, Drawing No. 0100, Rev. P01, dated 27th September 2023.
- 'Indicative Surface Water Drainage Strategy – GI Plan,' PJA on behalf of HLM, Drawing No. 05920-GR-0534, Rev. P01, June 2024.
- 'Master Utilities Map,' WSP on behalf of HLM, Drawing No. 70039336, Rev. P01, dated January 2018.

1.3 Proposed Site Development

The site is being considered for residential development.

1.4 Scope

The works performed by GEG included:

- Trial pitting with infiltration testing in accordance with a specification supplied by PJA.
- Window sample boreholes with installation of standpipes.
- Calculation of infiltration rates, subject to ground conditions encountered.
- Groundwater monitoring with falling head tests of standpipes.

Limitations to the scope of the report are outlined in Section 7.

2. SITE SETTING

2.1 Site Location

The site is located on land approximately 3 km north of St Albans city centre, at the approximate National Grid Reference 515461E, 209983N. It lies on land adjacent to the west of Harpenden Road (A1081) and is bisected by Sandridgebury Lane, and covers an area of approximately 48 ha.

A section of the 1:25,000 Ordnance Survey (OS) map identifying the site location is shown in Figure 1 of Appendix A and a photographic record is provided in Appendix B.

2.2 Site Description

The site, which fell gently to the south east, comprised agricultural land across the majority with sports fields associated with the Old Albanian Rugby Club in the far eastern section.

3. GEOLOGY & HYDROGEOLOGY

3.1 Published Geology

Reference to the 1:50,000 scale British Geological Survey digital mapping of the area (solid and drift) indicates that the solid geology beneath the site comprises the Lewes Nodular Chalk and Seaford Chalk Formations (of the White Chalk Subgroup) of the Cretaceous period. The formations, which were formerly part of the Upper Chalk, are described individually as follows:

- Lewes Nodular Chalk Formation: *hard to very hard nodular chalks and hardgrounds with interbedded soft to medium hard chalks and marls. Nodular chalks are typically lumpy and iron-stained. Brash is rough and flaggy or rubbly, and tends to be dirty.*
- Seaford Chalk Formation: *firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Some flint nodules are large to very large.*

The solid geology is conjectured to be overlain by superficial deposits locally of Clay-with-Flints Formation across the north western margins, and the Kesgrave Catchment Subgroup is present locally centrally and along the south eastern margins of the site. The superficial deposits are described as follows:

- The Clay-with-Flints Formation: *a residual deposit formed from the dissolution, decalcification and cryoturbation of bedrock strata of the Chalk Group and Palaeogene formations. It is unbedded and heterogenous. The dominant lithology is orange-brown and red-brown sandy clay with abundant nodules and rounded pebbles of flint. The deposit locally includes bodies of yellow fine- to medium- grained sand, reddish brown clayey silt, and sandy clay with beds of well-rounded flint pebbles.*
- The Kesgrave Catchment Subgroup: *mainly gravels characterised by quartz and quartzite.*

No significant faults are conjectured to intersect the site at the surface.

3.2 Hydrogeology

3.2.1 Groundwater Designation

Environment Agency data indicates that the solid geology beneath the site is designated as a Principal Aquifer.

Principal Aquifers as assigned where geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers.

The superficial deposits of the Clay-with-Flints Formation are characterised as Unproductive strata and the Kesgrave Catchment Subgroup as a Secondary A Aquifer.

Secondary A Aquifers are defined as permeable layers capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Unproductive Strata - are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

3.3 Potential Water Infiltration Properties of the Strata

The Clay-with-Flints Formation is considered unlikely to be sufficiently permeable for soakaway drainage. Therefore, the solid geology chalk formations or the soils of the Kesgrave Catchment Subgroup were targeted for the soakaway testing (where encountered).

3.4 Groundwater Source Protection Zone

The site lies within the Total Catchment (Zone 3) of a currently defined Groundwater Source Protection Zone (GWSPZ), as such it is recommended that any specific Environment Agency requirements with respect to soakaways etc. are adhered to.

3.5 Surface Water Flooding

According to the Environment Agency online 'Flood Map for Planning', the site lies within Flood Zone 1, being land that lies outside the 1 in 1000 year (0.1%AEP) flood risk area and hence has a low probability of flooding.

4. INTRUSIVE INVESTIGATION

The following section outlines the scope of the intrusive investigation undertaken by GEG and details the ground conditions encountered and the infiltration testing carried out.

4.1 Site Works Overview

All works were carried out in accordance with current British Standard guidance (BS: 5930 and BS: 10175) and infiltration testing in general accordance with BRE Digest 365 (Soakaway Design).

The ground conditions were logged by an experienced geo-environmental engineer from GEG. The strata encountered, groundwater levels/seepages, and stability of excavations are recorded on the exploratory hole logs presented in Appendix C.

The locations of the exploratory holes are shown on Figure 2 presented in Appendix A.

4.2 Scope of Works – Stage 1

The Stage 1 intrusive investigation was undertaken from 10th and 11th April 2024 and comprised window sample boreholes, machine-excavated trial pitting, and infiltration testing.

4.2.1 Window Sample Holes

6 No. window sample boreholes (WS01-WS06) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 5.00 m. Continuous sampling was undertaken using a liner system.

All boreholes were installed with 50 mm diameter standpipes to the depth detailed on the exploratory hole log for subsequent groundwater monitoring.

4.2.2 Trial Pits

3 No. trial pits (IT01-IT03) were excavated using a JCB-3CX to depths of between 2.00 and 2.75 m to facilitate investigation of the near surface soils and undertake infiltration testing.

4.3 Scope of Works – Stage 2

The Stage 2 intrusive investigation was undertaken on 4th July 2024 and comprised additional window sample boreholes, machine-excavated trial pitting, and infiltration testing.

4.3.1 Window Sample Holes

4 No. window sample boreholes (WS07-WS10) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 6.00 m. Continuous sampling was undertaken using a liner system.

WS07 was installed with a 50 mm diameter standpipe to the depth detailed on the exploratory hole logs for subsequent groundwater monitoring.

4.3.2 Trial Pits

4 No. trial pits (IT04-IT07) were excavated using a JCB-3CX to depths of between 2.20 and 2.80 m to facilitate investigation of the near surface soils and undertake infiltration testing.

4.4 Scope of Works – Stage 3

The Stage 3 intrusive investigation was undertaken on 20th and 21st February 2025 and comprised additional window sample boreholes, machine-excavated trial pitting, and infiltration testing.

4.4.1 Window Sample Holes

4 No. window sample boreholes (WS07A & WS11-WS13) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 5.45 m. (WS7A was a replacement for the destroyed borehole WS07.) Continuous sampling was undertaken using a liner system.

All the boreholes were installed with 50 mm diameter standpipes to the depth detailed on the exploratory hole logs for subsequent groundwater monitoring.

4.4.2 Trial Pits

11 No. trial pits (IT08A-B, IT09A-E, IT10A-C & IT11) were excavated using a JCB-3CX to depths of between 2.50 and 4.00 m to facilitate investigation of the near surface soils and undertake infiltration testing.

4.5 Strata Encountered

The ground conditions encountered are described below and broadly confirmed the published geology.

4.5.1 Made Ground

Made Ground of reworked topsoil was encountered at 1 No. location (IT03) to a depth of 0.20 m and comprised soft to firm CLAY with occasional gravel-sized fragments of quartzite and ceramic.

4.5.2 Topsoil

Natural topsoil of soft to firm CLAY was encountered in the remaining locations to depths of between 0.20 and 0.30 m.

4.5.3 Kesgrave Catchment Subgroup

The Kesgrave Catchment Subgroup was not encountered during the investigation.

4.5.4 Clay-with-Flints Formation

The Clay-with-Flints Formation was encountered underlying the topsoil and Made Ground at all locations to depths (where proven) of between 1.35 and 5.50 m. It typically comprised firm to very stiff variably sandy gravelly CLAY locally with cobbles and boulders and locally medium dense to dense clayey gravelly to very gravelly SAND.

4.5.5 Lewes Nodular & Seaford Chalk Formations

The Lewes Nodular & Seaford Chalk Formations were encountered underlying the Clay-with-Flints Formation at 17 No. locations (WS01-WS03, WS06, WS07A,

WS08, WS10, WS11, WS13 IT01, IT04, IT07, IT08A-B, IT09C, IT09E & IT11) from depths of between 1.20 and 5.50 m to the base of the exploratory holes. It typically comprised structureless CHALK composed of variably gravelly SILT (Grades Dm to Dc).

It is noted that discernment of chalk grade from disturbed borehole samples is inherently difficult as drilling disrupts the natural structure of the chalk. As such, chalk grade boundaries may vary from those interpreted.

4.5.6 Groundwater

Groundwater was not encountered in any of the exploratory holes during the intrusive investigation.

Groundwater levels recorded in the boreholes during the subsequent monitoring visits are summarised in Table 1.

Table 1. Groundwater Levels Recorded During the Monitoring Visits

Borehole	Date	Depth of Installation (m)	Groundwater Depth (m)
WS01	09/05/24	5.00	(Damp at 5.00)
	11/06/24		(Damp at 5.00)
	04/07/24		Dry
	21/08/24		(Damp at 5.00)
	25/09/24		(Damp at 5.00)
	23/10/24		Dry
	20/02/25		Dry
	06/03/25		Dry
	15/04/25		Dry
WS02	09/05/24	5.00	Dry
	11/06/24		Dry
	04/07/24		Dry
	21/08/24		Dry
	25/09/24		Dry
	23/10/24		Dry
	20/02/25		Dry
	06/03/25		Dry
	15/04/25		Dry
WS03	09/05/24	5.00	Dry
	11/06/24		(Damp at 5.00)
	04/07/24		5.00
	21/08/24		Dry
	25/09/24		Dry
	23/10/24		1.01
	20/02/25		1.17
	06/03/25		1.11
	15/04/25		Dry

Borehole	Date	Depth of Installation (m)	Groundwater Depth (m)
WS04	09/05/24	2.00	0.53
	11/06/24		1.34
	04/07/24		1.90
	21/08/24		(Damp at 1.90)
	25/09/24		0.00
	23/10/24		0.52
	20/02/25		1.20
	06/03/25		Destroyed
	15/04/25		
WS05	09/05/24	1.80	Dry
	11/06/24		1.20
	04/07/24		1.58
	21/08/24		(Damp at 1.80)
	25/09/24		Dry
	23/10/24		(Damp at 1.80)
	20/02/25		(Damp at 1.80)
	06/03/25		Dry
	15/04/25		Dry
WS06	09/05/24	5.00	(Damp at 5.00)
	11/06/24		Dry
	04/07/24		Dry
	21/08/24		Dry
	25/09/24		(Damp at 5.00)
	23/10/24		Dry
	20/02/25		Dry
	06/03/25		Dry
	15/04/25		Dry
WS07	21/08/24	5.00	Dry
	25/09/24		Destroyed
	23/10/24		
WS07A	06/03/25	5.00	Dry
	15/04/25		Dry
WS11	06/03/25	5.00	Dry
	15/04/25		Dry
WS12	06/03/25	5.00	Dry
	15/04/25		Dry
WS13	06/03/25	5.00	Dry
	15/04/25		Dry

It should be noted that groundwater levels may vary due to seasonal and other effects.

4.5.7 Falling Head Permeability Tests

2 No. falling head tests were undertaken in borehole WS06. Clean water was dispensed from containers at a rapid rate to fill each borehole as quickly as possible.

4.5.7.1 Calculated Permeability Rates

The falling head test data and soakage rates were calculated based on guidance given in the Kent County Council Soakaway Design Guide (2000) and are presented in Appendix E.

The soakage rate calculated is summarised in Table 2 below.

Table 2. Borehole Soakage Rate

Location	Test No.	Date	Borehole Soakage Rates (l/m²/min)
WS06	1	09/05/24	2.65 [1]
	2	11/06/24	4.08 [1]
	3	-	-

[1] Approximately 75 litres of water was poured into the standpipe (at a rapid rate) in order to conduct the test at the depth indicated.

Please note that this value is considered relatively high and indicates that potential soakage within the chalk is a likely occurrence.

4.5.8 Stability of Trial Pits

The sides of the trial pit excavations were typically stable with the exception of slight instability below 2.20 m in IT03, below 1.50 m in IT04, below 0.40 m in IT05, and below 0.30 m in IT06.

4.5.9 Reinstatement

On completion of the measurements, the infiltration pits were emptied of residual water and backfilled with arisings.

4.6 Infiltration Tests

A total of 20 No. infiltration tests were undertaken in the 13 No. trial pits (IT01 to IT07, IT08B, IT09C, IT09E, IT10A, IT10B & IT11). The tests were undertaken in general accordance with BRE Digest 365.

Clean water was dispensed from a bowser at a rapid rate to fill each excavation as quickly as possible to the proposed depth of the invert levels and/or the most permeable strata. The excavations took less than 5 minutes to fill. Each test pit was filled to give a head of water of approximately 1.00m.

Measurements were then taken of the fall of water at suitable time increments to allow the infiltration rate to be calculated from the time taken for the water level to drop from 75% to 25% effective depth (where possible). If there was sufficient time, the tests were repeated a maximum of three times in accordance with BRE Digest 365.

On completion of the measurements, the infiltration pits were backfilled with arisings.

The water level measurements from the infiltration tests are tabulated and graphically depicted on Figures F-1 to F-20 in Appendix D.

4.7 Calculated Infiltration Rates

The effective depths reached during the tests and associated times are summarised in Table 3 below.

Table 3. Infiltration Test Results

Location	Depth Range of Test (m)	Test No.	Strata [1]	Effective Depth Reached	Time (mins)	Infiltration Rate (m/s)
IT01	1.30 – 2.40	1	CwF (C) / CHK	25%	115	2.96×10^{-5} [2]
	1.05 – 2.08	2			132	2.63×10^{-5}
	1.01 – 1.82	3			119	2.97×10^{-5} [2]
IT02	1.00 – 2.00	1	CwF (C)	97%	217	N/A
IT03	1.45 – 2.75	1	CwF (C) / CwF (G)	104%	194	N/A
IT04	1.20 – 2.00	1	CwF (C) / CHK	25%	105	2.60×10^{-5}
	1.00 – 1.75	2			165	1.88×10^{-5}
IT05	1.40 – 2.40	1	CwF (G)	95%	201	N/A
IT06	1.80 – 2.80	1	CwF (C/G)	101%	195	N/A
IT07	1.40 – 2.50	1	CwF (C) / CHK	96%	183	N/A
IT08B	2.00 – 3.00	1	CwF (C) / CHK	25%	20	1.50×10^{-4}
	1.90 – 2.80	2		25%	25	2.62×10^{-3}
	1.75 – 2.70	3		25%	25	2.67×10^{-3}
IT09C	1.70 – 2.70	1	CwF (C) / CHK	90%	189	N/A
IT09E	1.65 – 2.70	1	CwF (C) / CHK	25%	100	3.18×10^{-5}
	1.45 – 2.25	2		25%	120	2.79×10^{-5}
IT10A	2.20 – 3.20	1	CwF (C)	100%	127	N/A
IT10B	1.50 – 2.60	1	CwF (C)	99%	151	N/A
IT11	2.05 – 2.70	1	CwF (C) / CHK	25%	71	3.57×10^{-5}
	1.82 – 2.70	2		Trial pit became dry at 2.40 m due to slumping of base at 2.40 m during infiltration test. As such, no infiltration rate could be calculated.		

N/A=Not Applicable
[1] CwF=Clay with Flints Formation; CHK=Lewes Nodular and Seaford Chalk Formations; C=Cohesive; G=Granular.
[2] Based on extrapolated data (due to partial collapse of trial pit during the test).

5. CONCLUSIONS

The infiltration tests undertaken in IT01, which was extended into the underlying chalk, yielded infiltration rates of 2.63 x 10^{-5} to 2.97 x 10^{-5} m/s, albeit based on some extrapolated data (due to partial collapse of trial pit during the tests). Infiltration tests in IT04, IT08B, IT09E and IT11 (also onto the underlying chalk) yielded rates of 3.57 x 10^{-5} and 2.62 x 10^{-3} m/s. The falling head tests undertaken in the chalk strata of WS06 yielded a borehole soakage rate of 2.65 and 4.08 l/m²/min.

The water levels did not reach the 25% effective depth for infiltration tests in IT02, IT03 and IT05 to IT07, which were taken primarily within the typically cohesive strata of the Clay-with-Flints Formation, and consequently no infiltration rates could be calculated. No infiltration rates were also calculated for IT09C, IT10A and IT10B. However, the granular strata in IT03 and IT05 to IT07 (and the chalk encountered in IT07) proved relatively impermeable to infiltration, potentially due to the presence of a significant fines fraction clogging the pores.

Design and positioning of soakaways in chalk will require careful consideration to mitigate risks associated with potential erosion of infilled solution features (if present). All soakaways should be designed and constructed in accordance with BRE 365. Further guidance is also given by documents provided by Kent County Council (July 2000).

6. REFERENCES

1. British Standard Institute, BS 1377-Parts 1-9: 1990-2016. Methods of Tests for Soils for Civil Engineering Purposes.

2. British Standard Institute, BS 5930:2015 + A1:2020. Code of Practice for Site Investigations.

3. BRE Digest 365, 2016. Soakaway Design.

4. Kent County Council, 2000. The Soakaway Design Guide.

7. LIMITATIONS

As with all intrusive site investigations, there is a possibility that there are local variations in ground conditions not identified by the current investigation.

The conclusions and recommendations stated herein are based on information available at the time of production. These may not necessarily apply if the site is to be utilised for a more or less sensitive purpose in the future, or if operational procedures or management alter over time.

GEG maintain intellectual copyright of the contents of this report and grant exclusive use of the material contained herein to the client, the client's agents, the client's respective sub-contractors and the specific local authority. No unauthorised distribution shall be made to any third parties without the prior consent of both GEG and the Client.

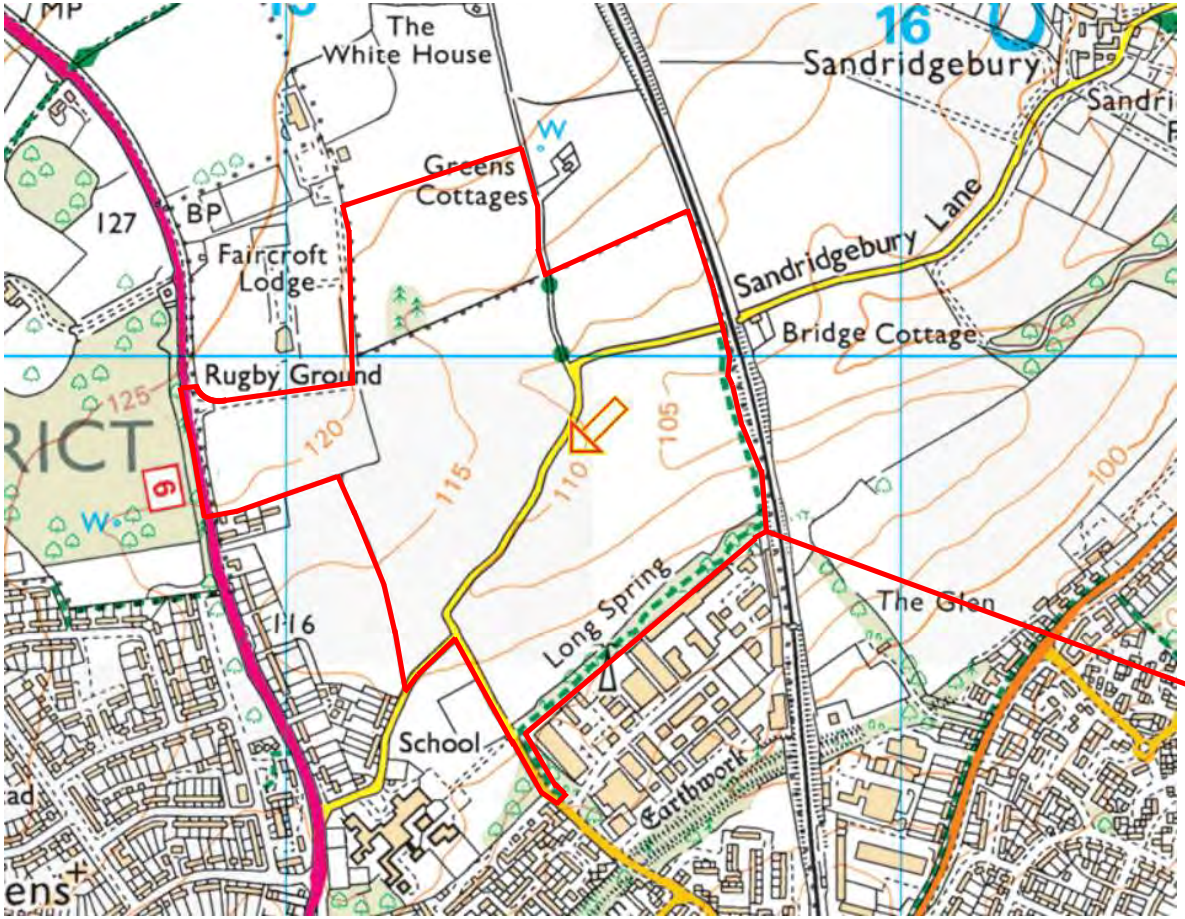
GEG shall not be liable by reason of any representation (unless fraudulent), or any implied warranty, condition or other term, or any duty at common law for any loss of profit or any indirect, special or consequential loss, damage, costs, expenses or other claims (whether caused by the negligence of the Supplier, its servants, sub-contractors or agents or otherwise) which arise out of or in connection with the provision of the Specified Service or their use by the Client.

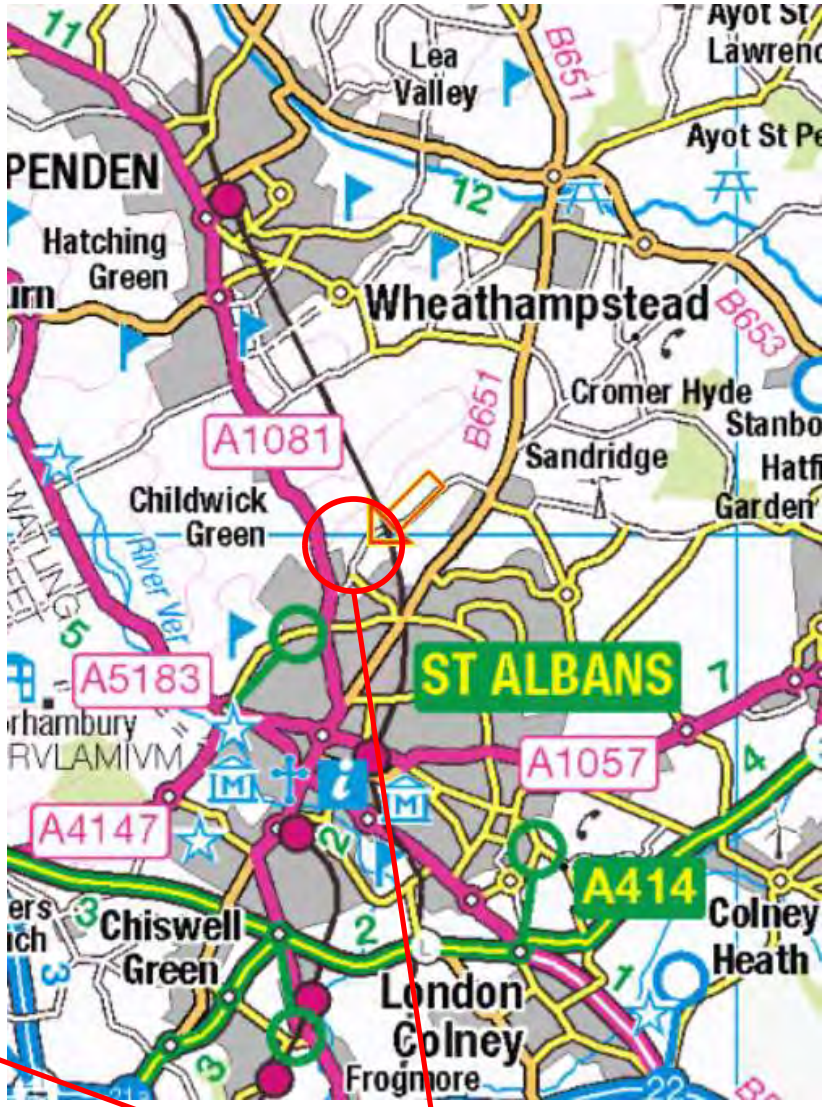
It should be noted that any warranty or liability offered or incurred by GEG, related to this report commences from the date of first issue of this report and is not altered by subsequent report revisions.

Whilst GEG may identify the presence of potential invasive plant species during the standard geo-environmental walkover and/or investigations, the Client should be aware that ecological issues including an invasive species surveys etc. are beyond the scope of the works and as such no associated liability is accepted by GEG.

APPENDIX A

FIGURES AND PLANS

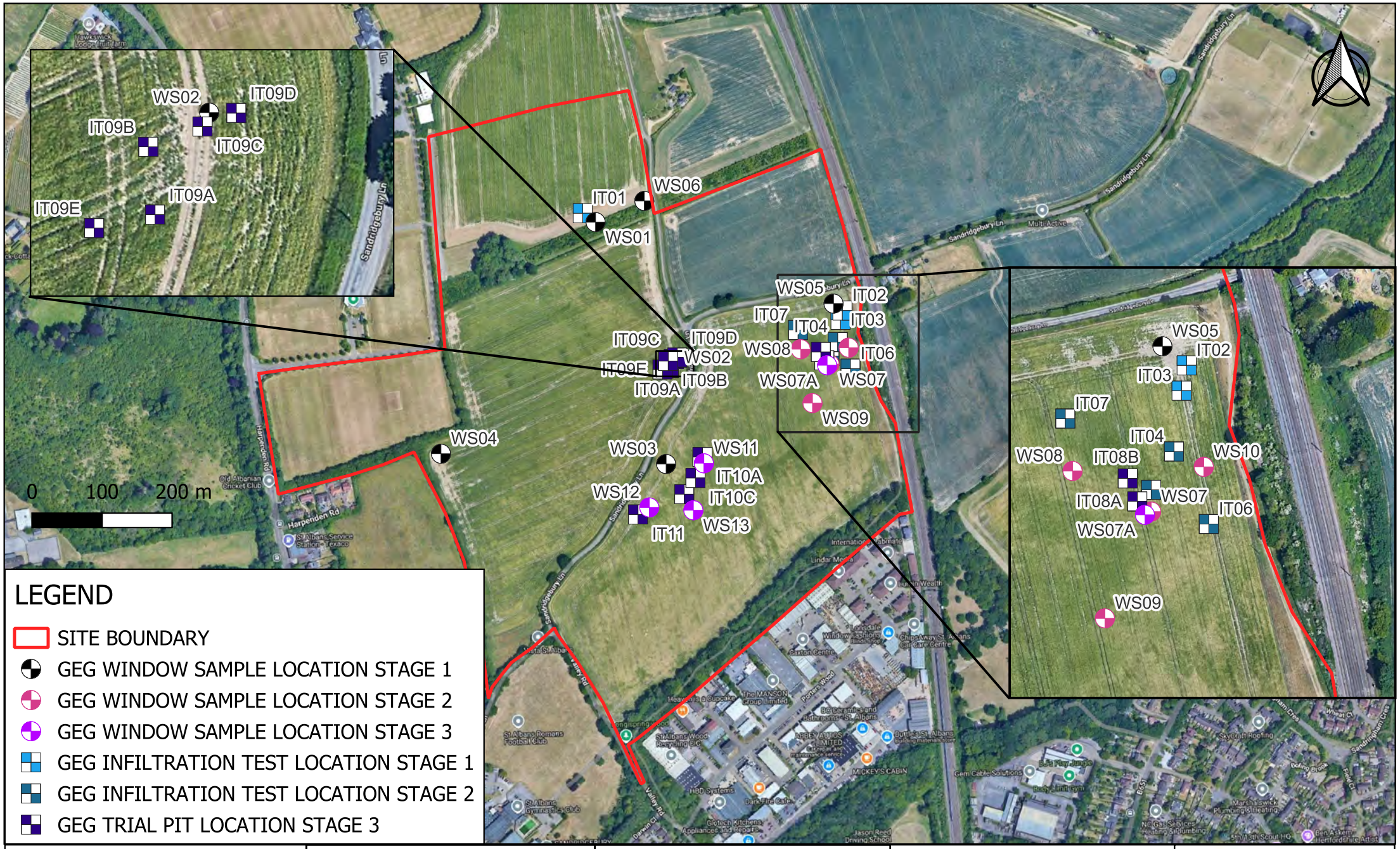




SITE LOCATION

Ordnance Survey © Crown Copyright 2024 All rights reserved. License number 100048258

TITLE: FIGURE 1: SITE LOCATION PLAN	**CLIENT:** PJA / HLM		**DRAWN/CHECKED:** EW / MP		GEG House, 17 Graham Road Malvern, WR14 2HR Tel. 01684 212526 Fax 01684 576917 admin@g-eg.co.uk, www.g-eg.co.uk Geo Environmental Group
SITE: LAND AT CHEAPSIDE, ST ALBANS	**PROJECT No.:** GEG-24-821	**SCALE:** NTS	**DATE:** 16/05/24	**REVISION:** A	



LEGEND

- SITE BOUNDARY
- GEG WINDOW SAMPLE LOCATION STAGE 1
- GEG WINDOW SAMPLE LOCATION STAGE 2
- GEG WINDOW SAMPLE LOCATION STAGE 3
- GEG INFILTRATION TEST LOCATION STAGE 1
- GEG INFILTRATION TEST LOCATION STAGE 2
- GEG TRIAL PIT LOCATION STAGE 3

FIGURE 2A EXPLORATORY HOLE LOCATION PLAN - FULL	CLIENT: HALLAM LAND MANAGEMENT / PJA		DRAWN/CHECKED: EW / MP	
SITE: LAND AT CHEAPSIDE, ST ALBANS	PROJECT NUMBER: GEG-24-821	SCALE: AS SHOWN	DATE: 02/04/25	REVISION: 0

GEG House, 17 Graham Road
Malvern, WR14 2HR
Tel. 01684 212516
Fax. 01684 576917
admin@g-eg.co.uk, www.g-eg.co.uk

Geo Environmental Group

FIGURE 2B EXPLORATORY HOLE LOCATION PLAN - STAGE 3	CLIENT: HALLAM LAND MANAGEMENT / PJA		DRAWN/CHECKED: EW / MP		GEG House, 17 Graham Road Malvern, WR14 2HR Tel. 01684 212516 Fax. 01684 576917 admin@g-eg.co.uk, www.g-eg.co.uk
SITE: LAND AT CHEAPSIDE, ST ALBANS	PROJECT NUMBER: GEG-24-821	SCALE: AS SHOWN	DATE: 02/04/25	REVISION: 0	Geo Environmental Group

APPENDIX B

PHOTOGRAPHIC RECORD

Photo 1: Excavation of trial pit IT01.

Photo 2: Arisings from trial pit IT01.

Photo 3: Excavation of trial pit IT02.

Photo 4: Arisings from trial pit IT02.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

Photo 5: Excavation of trial pit IT03.

Photo 6: Arisings from trial pit IT03.

Photo 7: Excavation of trial pit IT04.

Photo 8: Arisings from trial pit IT04.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

Photo 9: Excavation of trial pit IT05.

Photo 10: Arisings from trial pit IT05.

Photo 11: Excavation of trial pit IT06.

Photo 12: Arisings from trial pit IT06.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

Photo 13: Excavation of trial pit IT07.

Photo 14: Arisings from trial pit IT07.

Photo 15: Excavation of trial pit IT08A.

Photo 16: Arisings from trial pit IT08A.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management /PJA

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

Photo 17: Excavation of trial pit IT08B.

Photo 18: Arisings from trial pit IT08B.

Photo 19: Excavation of trial pit IT09A.

Photo 20: Arisings from trial pit IT09A.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

Photo 21: Excavation of trial pit IT09B.

Photo 22: Arisings from trial pit IT09B.

Photo 23: Excavation of trial pit IT09C.

Photo 24: Arisings from trial pit IT09C.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

Photo 25: Excavation of trial pit IT09D.

Photo 26: Arisings from trial pit IT09D.

Photo 27: Excavation of trial pit IT09E.

Photo 28: Arisings from trial pit IT09E.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

Photo 29: Excavation of trial pit IT10A.

Photo 30: Arisings from trial pit IT10A.

Photo 31: Excavation of trial pit IT10B.

Photo 32: Arisings from trial pit IT10B.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

Photo 33: Excavation of trial pit IT10C.

Photo 34: Arisings from trial pit IT10C.

Photo 35: Excavation of trial pit IT11.

Photo 36: Arisings from trial pit IT11.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

APPENDIX C

EXPLORATORY HOLE LOGS

EXPLORATORY HOLE LOG RECORDS:
Symbols & Abbreviations Legend

Geo Environmental Group

Sampling

B	Bulk disturbed sample.
BLK	Block sample.
C	Core run.
CR	Core cutter sample.
CS	Core sample taken from rotary core.
D	Small disturbed sample.
ES	Composite environmental soil sample.
EW	Environmental water sample.
L	Continuous percussive sample (plastic liner).
LB	Large disturbed sample.
U	Undisturbed driven tube sample (100 mm diameter, 450 mm long). No. of blows indicated in brackets.
W	Water sample.

In-situ Testing

HVP	Hand Vane Measurement. Value given as shear strength Su (in kPa).
PP	Pocket Penetrometer (Unconfined Compressuve Strength measured in kPa).
SPT	Standard Penetration Test using a split spoon sampler.
SPTC	Standard Penetration Test using a solid 60 degree cone.
N	The 'N' value is the No. of blows required to complete a test drive of 300 mm after a seating drive of 150 mm or 25 blows.
N = 50	Where the full test drive is not completed. A linearly extrapolated 'N' value can be derived.
PID	Photo Ionisation Detector reading in ppm.

Drilling Records

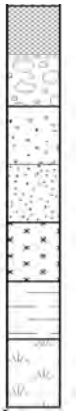
W	Water flush returns.
TCR	Total Core Recovery (%).
SCR	Solid Core Recovery (%).
RQD	Rock Quality Designation (% of intact core >100 mm).
FI	Fracture Index (Fractures/m).
NI	Non-intact core.
NR	No core recovery.

Water Column Symbols

Standing groundwater strike

Initial groundwater Level

Strata - Soil Legends



MADE GROUND

COBBLES & BOULDERS

GRAVEL

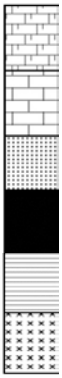
SAND

SILT

CLAY

PEAT

Strata - Rock Legends



CHALK

LIMESTONE

SANDSTONE

COAL

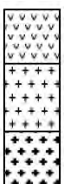
MUDSTONE

SILTSTONE

METAMORPHIC (Fine-grained)

METAMORPHIC (Medium-grained)

METAMORPHIC (Coarse-grained)



IGNEOUS (Fine-grained)

IGNEOUS (Medium-grained)

IGNEOUS (Coarse-grained)

Instrumentation & Backfilling

Plain standpipe.

Slotted standpipe.

Piezometer.

Granular filter (response zone).

Bentonite seal.

Backfill (arisings).

Backfill (cement grout).

Concrete.

NOTES:

[1] The logging of soils and rocks has been carried out in general accordance with BS 5930:2015.

[2] All lengths used to determine rock core mechanical propertoes taken along the centre line of the core. Obvious induced fractures have been ignored.

[3] All logs are avaiable in the AGS format.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT01
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515326.00 - 210142.00 Level: 116.29	Date 10/04/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.40	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Soft to firm dark brown slightly sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint. (TOPSOIL)
				0.30	115.99		Firm orangish brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint, with rare sub-angular boulders up to 15cm diameter. (CLAY WITH FLINTS FORMATION)
				2.10	114.19		Structureless CHALK composed of firm creamy white very gravelly sandy SILT. Gravel clasts are sub-angular very weak low density and white. (Grade Dm) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.40	113.89		End of Pit at 2.400m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT02
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515690.00 - 210010.00 Level: 106.21	Date 10/04/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.70 × 0.60 Depth 2.00	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Soft to firm dark brown slightly sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint. (TOPSOIL)
				0.30	105.91		Stiff orangish brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint, with frequent sub-angular boulders up to 20cm diameter. (CLAY WITH FLINTS FORMATION)
				2.00	104.21		End of Pit at 2.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT03
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515691.00 - 209994.00 Level: 105.35	Date 10/04/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.65 × 0.60 Depth 2.75	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			MADE GROUND - Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint and occasional ceramic. (REWORKED TOPSOIL)
				0.20	105.15		Stiff orangish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded flint, with frequent sub-angular boulders up to 20cm diameter. (CLAY WITH FLINTS FORMATION)
				1.00	104.35		Medium dense reddish and orangish brown clayey gravelly SAND. Gravel is sub-angular to sub-rounded flint, with frequent sub-angular boulders up to 20cm diameter. (CLAY WITH FLINTS FORMATION)
							2.20m Becoming very gravelly.
				2.75	102.60		End of Pit at 2.750m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slightly unstable below 2.20m

Geo Environmental Group

Trial Pit Log

TrialPit No **IT04** Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515672.00 - 209934.00 Level: 103.56	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.80 × 0.50 Depth 2.20	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint. (TOPSOIL)
				0.25	103.30		Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
				1.40	102.16		Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.20	101.36		End of Pit at 2.200m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slight collapse in chalk after 1.50m.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT05
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515671.00 - 209920.00 Level: 103.52	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.80 × 0.50 Depth 2.40	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint. (TOPSOIL)
				0.20	103.32		Medium dense yellowish brown gravelly clayey SAND with low boulder content. Gravel and boulders are rounded to sub-angular to angular greyish flint and with rare quartzite. (CLAY WITH FLINTS FORMATION)
							Becoming very clayey. 1.60-2.40m.
				2.40	101.12		End of Pit at 2.400m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slight collapse in sand repeatedly after 0.40m.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT06
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515689.00 - 209906.00 Level: 103.16	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.60 × 0.50 Depth 2.80	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint. (TOPSOIL)
				0.25	102.91		Medium dense yellowish brown gravelly clayey SAND with low boulder content. Gravel and boulders are rounded to sub-angular greyish flint and quartzite. (CLAY WITH FLINTS FORMATION)
				1.20	101.96		Firm orangish sandy gravelly CLAY. Gravel is rounded to sub-angular greyish flint and quartzite. (CLAY WITH FLINTS FORMATION)
				2.40	100.76		Medium dense reddish orangish brown gravelly clayey SAND with low cobble content. Gravel and cobbles are sub-rounded yellowish flint and quartzite. (CLAY WITH FLINTS FORMATION)
				2.80	100.36		End of Pit at 2.800m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slight collapse in sand repeatedly after 0.30m.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT07
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515629.00 - 209971.00 Level: 104.96	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.70 × 0.50 Depth 2.50	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			
				0.20	104.76		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
							Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
				2.10	102.86		Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.50	102.46		End of Pit at 2.500m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable.

Geo Environmental Group

Borehole Log

Borehole No.
WS01
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515345.00 - 210128.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	115.78mAOD	Scale 1:31
Client:	HLM / PJA		Date:	10/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	115.48		Soft to firm dark brown slightly sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint. (TOPSOIL)
									Firm to stiff orangish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=17 (2,3/4,5,4,4)					
						1.35	114.43		Structureless CHALK composed of firm creamy white slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are sub-angular extremely weak low density and white and occasionally flint. (Grade Dm) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		2.00	S	N=17 (3,3/4,4,4,5)					
		3.00	S	N=19 (3,4/5,4,5,5)		3.00	112.78		Structureless CHALK composed of stiff creamy white with yellow to brown thin vein discolourations slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are sub-angular extremely weak creamy low to medium density chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		4.00	S	N=14 (3,2/3,3,4,4)					
		5.00	S	N=18 (3,4/5,4,4,5)					
						5.45	110.33		End of borehole at 5.45 m

1 2 3 4 5 6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS02
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515457.00 - 209938.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	109.13mAOD	Scale 1:31
Client:	HLM / PJA		Date:	11/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	108.83		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Firm to stiff orangish brown very sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-angular flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=17 (3,4/5,4,4,4)					*1.20-2.10m Becoming stiff.*
		2.00	S	N=22 (3,5/5,6,5,6)		2.10	107.03		Structureless CHALK composed of soft creamy white with yellow and brown veins slightly gravelly with occasional cobbles. Gravel and cobble clasts are sub-angular extremely weak chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		3.00	S	N=8 (2,3/1,2,3,2)					*2.85m 7cm Band of grey flint.*
		4.00	S	N=11 (3,2/2,2,3,4)					
		5.00	S	N=19 (4,3/4,5,5,5)					
						5.45	103.68		End of borehole at 5.45 m

1 2 3 4 5 6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS03
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515444.00 - 209787.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	110.42mAOD	Scale 1:31
Client:	HLM / PJA		Date:	11/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	110.12		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Stiff orangish brown slightly sandy slightly gravelly with low boulder content CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=12 (2,3/2,3,3,4)					
		2.00	S	N=15 (3,4/4,4,3,4)		1.95	108.47		Structureless CHALK composed of firm to stiff creamy white with yellow and brown veins slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are fine to coarse sub-angular extremely weak low density chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		3.00	S	N=19 (4,5/4,5,6,4)					
		4.00	S	N=21 (4,5/5,5,5,6)					
		5.00	S	N=23 (3,4/6,6,5,6)					
						5.45	104.97		End of borehole at 5.45 m

1
2
3
4
5
6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS04
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515123.00 - 209799.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	117.47mAOD	Scale 1:31
Client:	HLM / PJA		Date:	10/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	117.17		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Firm to stiff orangish brown slightly sandy slightly gravelly low boulder content CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=17 (3,4/5,4,4,4)					*1.20-2.40m Becoming stiff.*
		2.00	S	N=50 (10,10/50 for 245mm)					*2.00-2.40m Becoming very stiff.*
									2.40m Flint boulder.
						2.40	115.07		End of borehole at 2.40 m

1 2 3 4 5 6

Remarks
1. No groundwater encountered. 2. 50mm standpipe installed to 2.00m. Response zone 1.00-.200m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Refusal on flint boulder.

Geo Environmental Group

Borehole Log

Borehole No.
WS05
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515684.00 - 210013.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level: 106.21mAOD	Scale 1:31
Client:	HLM / PJA		Date: 11/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	105.91		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Firm to stiff orangish brown with light grey webbed discolourations sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=39 (3,4/10,10,9,10)					*1.20-1.45m Becoming very stiff.*
						1.45	104.76		Dense reddish to orangish brown very clayey very gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.80	S	50 (10,10/50 for 205mm)					*1.80m Becoming very dense.*
						2.16	104.05		End of borehole at 2.16 m

Remarks
1. No groundwater encountered. 2. 50mm standpipe installed to 1.80m. Response zone 1.00-1.80m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Refusal on very dense sand.

Geo Environmental Group

Borehole Log

Borehole No.
WS06
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515414.00 - 210159.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	115.73mAOD	Scale 1:31
Client:	HLM / PJA		Date:	10/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	115.43		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Stiff orangish brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
						1.00	114.73		Stiff orangish brown slightly sandy slightly gravelly CLAY with dark organic discolouration. Gravel is fine to coarse sub-angular to sub-rounded flint with rare sub-angular boulders up to 15cm diameter. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=23 (3,5/6,5,6,6)					
		2.00	S	N=29 (4,7/6,8,8,7)		2.00	113.73		Firm to stiff orangish brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded flint and rare sub-angular boulders up to 15cm diameter. (CLAY WITH FLINTS FORMATION)
		3.00	S	N=12 (3,4/3,4,2,3)		2.90	112.83		Structureless CHALK composed of firm creamy white with yellow and brown veins slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are fine to coarse sub-angular low density chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		4.00	S	N=4 (1,2/1,1,1,1)					
		5.00	S	N=9 (2,3/2,2,3,2)					
						5.45	110.28		End of borehole at 5.45 m

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS07**

Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515678.00 - 209927.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level: 103.28mAOD	Scale 1:31
Client:	HLM / PJA		Date: 04/07/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.20	103.08		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
		1.20	C	N=20 (3,4/4,5,6,5)					Firm to stiff yellowish brown sandy gravelly CLAY with low boulder content, common gravel lenses and rare dark possible fossilised rootlets after 2.00m. Gravel and boulders are rounded to sub-angular to angular greyish flint with rare quartzite. (CLAY WITH FLINTS FORMATION)
		2.00	C	N=11 (3,3/3,4,2,2)					
		3.00	C	N=18 (4,4/8,4,3,3)					*Dense yellowish clayey SAND. 3.45-3.50m.*
		4.00	C	N=15 (4,4/4,4,3,4)					
		5.00	S	N=15 (1,2/3,3,4,5)					
						5.45	97.83		End of borehole at 5.45 m

1 2 3 4 5 6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS08
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515637.00 - 209948.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	104.24mAOD	Scale 1:31
Client:	HLM / PJA		Date:	04/07/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.20	104.04		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
		1.20	C	N=25 (4,6/6,8,6,5)					Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
		2.00	C	N=17 (3,4/5,4,3,5)					
		3.00	C	N=10 (2,3/2,3,2,3)					
		4.00	C	N=8 (2,2/2,2,2,2)					
		5.00	S	N=5 (1,1/1,1,2,1)					
						5.50	98.74		Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
						6.00	98.24		End of borehole at 6.00 m

Remarks

1. No groundwater encountered. 2. Equipment used: Competitor Dart WS rig. 3. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS09
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515654.00 - 209871.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	103.94mAOD	Scale 1:31
Client:	HLM / PJA		Date:	04/07/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.20	103.74		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
		1.20	C	N=17 (3,3/4,5,4,4)					Firm and stiff yellowish brown sandy gravelly CLAY with low boulder content, common gravel lenses and rare dark possible fossilised rootlets after 2.00m. Gravel and boulders are rounded to sub-angular to angular greyish flint with rare quartzite and common dark sand sized discolouration after 1.5m. Possible small chalk cobble at 4.95m could be flint fragments. (CLAY WITH FLINTS FORMATION)
		2.00	C	N=12 (3,3/3,3,3,3)					
		3.00	C	N=15 (2,2/2,3,5,5)					
		4.00	S	N=30 (2,7/8,9,8,5)					
		5.00	S	N=18 (1,2/6,5,4,3)					
						5.45	98.49		End of borehole at 5.45 m

1
2
3
4
5
6

Remarks
1. No groundwater encountered. 2. Equipment used: Competitor Dart WS rig. 3. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS10**

Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515706.00 - 209950.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level: 102.99mAOD	Scale 1:31
Client:	HLM / PJA		Date: 04/07/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.20	102.79		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
									Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
		1.20	C	N=8 (1,1/2,2,2,2)					
		2.00	C	N=7 (2,2/1,1,2,3)					
						2.40	100.59		Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		3.00	S	N=10 (3,1/1,1,4,4)					
		4.00	S	N=6 (1,2/1,2,1,2)					
									Flinty gravel band.
		5.00	S	N=8 (2,1/1,2,2,3)					
						5.45	97.54		End of borehole at 5.45 m

1
2
3
4
5
6

Remarks

1. No groundwater encountered. 2. Equipment used: Competitor Dart WS rig. 3. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT08A
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515671.00 - 209932.00 Level: 103.39	Date 20/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 4.00	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	103.09		Stiff light reddish brown slightly sandy gravelly CLAY with a high cobble and low boulder content. Gravel, cobbles and boulders are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				3.70	99.69		Structureless CHALK composed of medium dense white clayey GRAVEL. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				4.00	99.39		*3.70-3.90m - Becoming slightly chalky with occasional Dm chalk boulders.*
							End of Pit at 4.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. 3. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT08B
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515666.00 - 209944.00 Level: 103.49	Date 20/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 3.00	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	103.19		Stiff light reddish brown slightly sandy gravelly CLAY with a high cobble and low boulder content. Gravel, cobbles and boulders are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				1.70	101.79		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				3.00	100.49		End of Pit at 3.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No **IT09A** Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515449.00 - 209921.00 Level: 109.63	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.80	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	109.33		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.10	108.53		Firm light orangish brown slightly mottled sandy gravelly CLAY with moderate cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				1.80	107.83		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				2.80	106.83		End of Pit at 2.800m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. 3. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT09B
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515448.00 - 209931.00 Level: 109.31	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.70	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	109.01		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.90	107.41		Firm light orangish brown slightly mottled sandy gravelly CLAY with moderate cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				2.70	106.61		End of Pit at 2.700m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. 3. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No **IT09C**

Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515456.00 - 209934.00 Level: 109.10	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.70	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	108.80		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				2.20	106.90		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular slightly gravelly low density chalk and occasional flint. (GRADE Dm) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.70	106.40		End of Pit at 2.700m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT09D
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515461.00 - 209936.00 Level: 109.00	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 3.30	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	108.70		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				3.30	105.70		End of Pit at 3.300m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. . Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT09E
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515440.00 - 209919.00 Level: 109.87	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.70	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	109.57		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.70	108.17		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.70	107.17		End of Pit at 2.700m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT10A
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515497.00 - 209794.00 Level: 108.77	Date 20/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 3.20	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	108.47		Firm light orangish brown slightly sandy slightly gravelly CLAY with low cobble content. Gravel and cobbles are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.30	107.47		Firm light orangish brown slightly mottled sandy gravelly CLAY with a moderate cobble content and very rare dark possible potassium inclusions. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				3.20	105.57		End of Pit at 3.200m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT10B
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515471.00 - 209741.00 Level: 107.68	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.50	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	107.38		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				2.35	105.33		Firm light orangish brown slightly mottled sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				2.50	105.18		End of Pit at 2.500m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT10C
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515487.00 - 209764.00 Level: 108.04	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.60	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	107.74		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				2.60	105.44		End of Pit at 2.600m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. 3. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT11
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515405.00 - 209712.00 Level: 109.30	Date 20/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 3.00	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	109.00		Firm light brown slightly sandy slightly gravelly CLAY with low cobble content. Gravel and cobbles are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.40	107.90		Structureless CHALK composed of medium dense white slightly clayey GRAVEL. Clasts are low to medium density sub-rounded to sub-angular chalk and occasional flint. (GRADE Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				3.00	106.30		End of Pit at 3.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Borehole Log

Borehole No.
WS07A
FINAL
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515675.00 - 209925.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	103.28mbgl	Scale 1:35
Client:	HLM / PJA		Dates:	20/02/2025 -	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	102.98		Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
		1.00	S	N=13 (7,7/4,3,3,3)					Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and occasional bands of flint gravel. Gravel and cobbles are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
		2.00	S	N=22 (2,3/2,4,6,10)					
		3.00	S	N=17 (4,4/4,4,5,4)					
		4.00	S	N=9 (3,4/4,2,1,2)		4.05	99.23		Structureless CHALK composed of medium dense white clayey GRAVEL. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (Possible GRADE Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		5.00	S	N=12 (4,4/3,3,3,3)					
						5.45	97.83		End of borehole at 5.45 m

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart Window Sample rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS11
FINAL
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515499.00 - 209785.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level: 108.36mbgl	Scale 1:35
Client:	HLM / PJA		Dates: 20/02/2025 -	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	108.06		Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
		1.00	S	N=11 (2,2/2,2,4,3)					Firm light orangish brown slightly mottled sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
						1.20	107.16		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		2.00	S	N=17 (3,3/3,4,5,5)					
		3.00	S	N=7 (4,4/3,2,1,1)					
		4.00	S	N=8 (1,1/1,3,2,2)					
		5.00	S	N=12 (3,4/3,3,3,3)					
						5.45	102.91		End of borehole at 5.45 m

1
2
3
4
5
6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart Window Sample rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS12**
FINAL
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515421.00 - 209722.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	109.18mbgl	Scale 1:35
Client:	HLM / PJA		Dates:	20/02/2025 -	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	108.88		Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
		1.00	S	N=11 (2,2/2,3,3,3)					Firm light orangish brown slightly mottled slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
									1.20-3.80m - Becoming often stiff.
		2.00	S	N=18 (3,3/4,4,4,6)					
		3.00	S	N=14 (1,2/3,4,3,4)					
									3.80-5.00m - Becoming sandy.
		4.00	S	N=13 (2,2/1,4,3,5)					
		5.00	S	N=15 (2,3/4,4,3,4)					
						5.45	103.73		End of borehole at 5.45 m

Remarks
1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart Window Sample rig.

Geo Environmental Group

Borehole Log

Borehole No.
WS13
FINAL
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515484.00 - 209718.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	107.09mbgl	Scale 1:35
Client:	HLM / PJA		Dates:	20/02/2025 -	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	106.79		Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
		1.00	S	N=6 (1,2/1,2,1,2)					Firm light brown slightly mottled slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
						1.20	105.89		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and occasional bands of flint gravel. Gravel and cobbles are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
		2.00	S	N=26 (3,4/5,6,6,9)					
		3.00	S	N=26 (4,5/5,7,7,7)					
						3.10	103.99		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		4.00	S	N=9 (1,1/2,3,2,2)					
		5.00	S	N=13 (2,3/3,4,3,3)					
						5.45	101.64		End of borehole at 5.45 m

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart Window Sample rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

APPENDIX D

INFILTRATION TEST DATA

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	240	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	130	
Trial Pit:	**IT01**	Date of Test:	10 April 2024	
Test No.:	**Test 1 of 3**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	130	100.0%
1	129	100.9%
2	130	100.0%
3	132	98.2%
4	135	95.5%
5	136	94.5%
8	140	90.9%
39	167	66.4%
103	205	31.8%
115	212.5	25.0%
End of Test		

With Reference to: **Graph F-1**

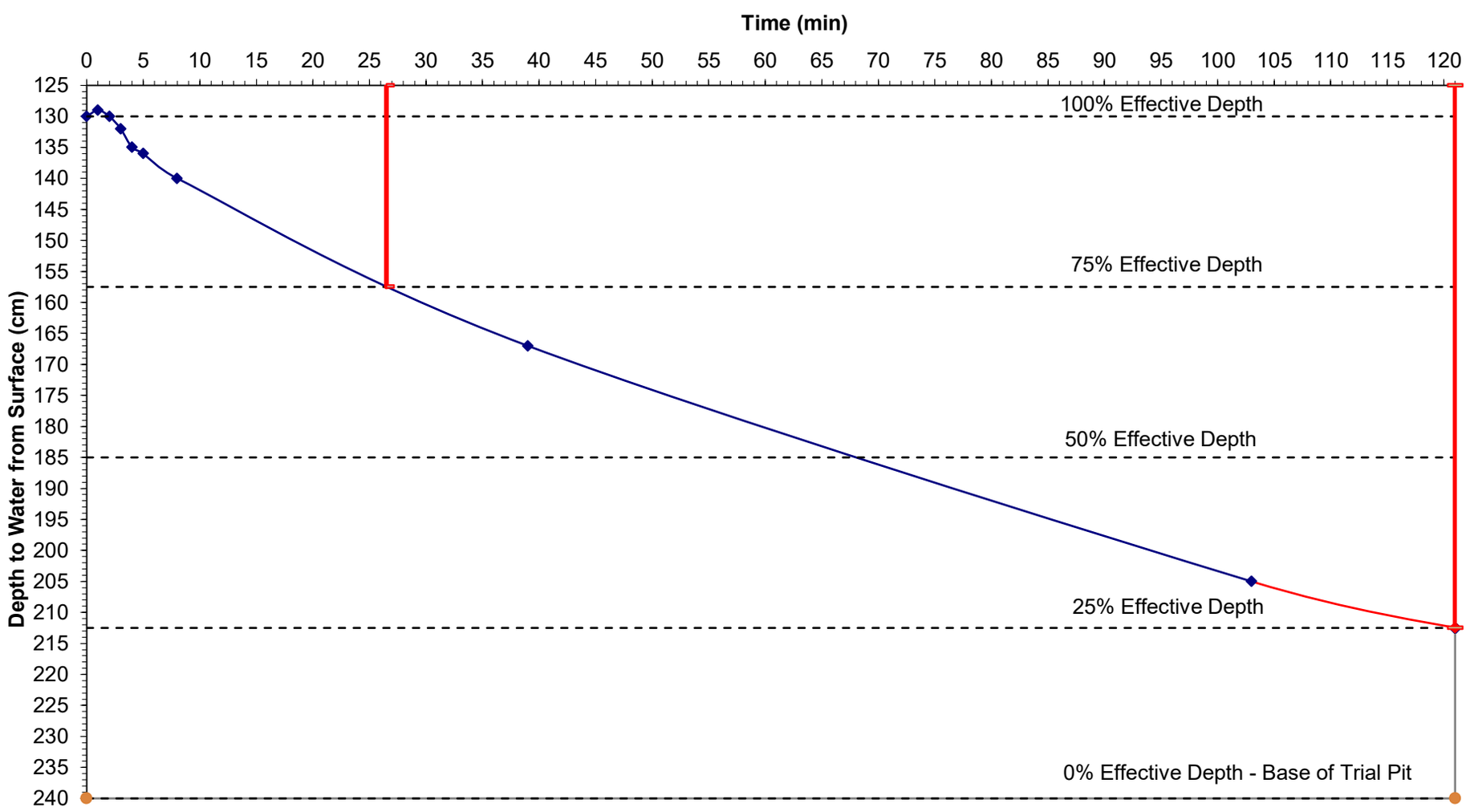
Notes:

[1] Base of trial pit collapsed to 2.08 m during the test; as such last data point extrapolated.

Parameter	Symbol	Calculation	Units	IT01
Effective Depth of Trial Pit	d_p		m	1.10
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.65
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.825
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.91
Time to reach 75% Effective Depth	$T_{p75\%}$		min	26.50
Time to reach 25% Effective Depth	$T_{p25\%}$		min	121.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	94.50
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.96E-05**

*To 50% Effective Depth (including base)

Graph F-1 **GEG-24-821 Land at Cheapside, St. Albans IT01 Test 1 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	208	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	105	
Trial Pit:	**IT01**	Date of Test:	10 April 2024	
Test No.:	**Test 2 of 3**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	105	100.0%
1	108	97.1%
2	110	95.1%
7	115	90.3%
14	120	85.4%
19	125	80.6%
23	128	77.7%
47	142	64.1%
74	155	51.5%
115	169	37.9%
132	182	25.2%
End of Test		

With Reference to: **Graph F-2**

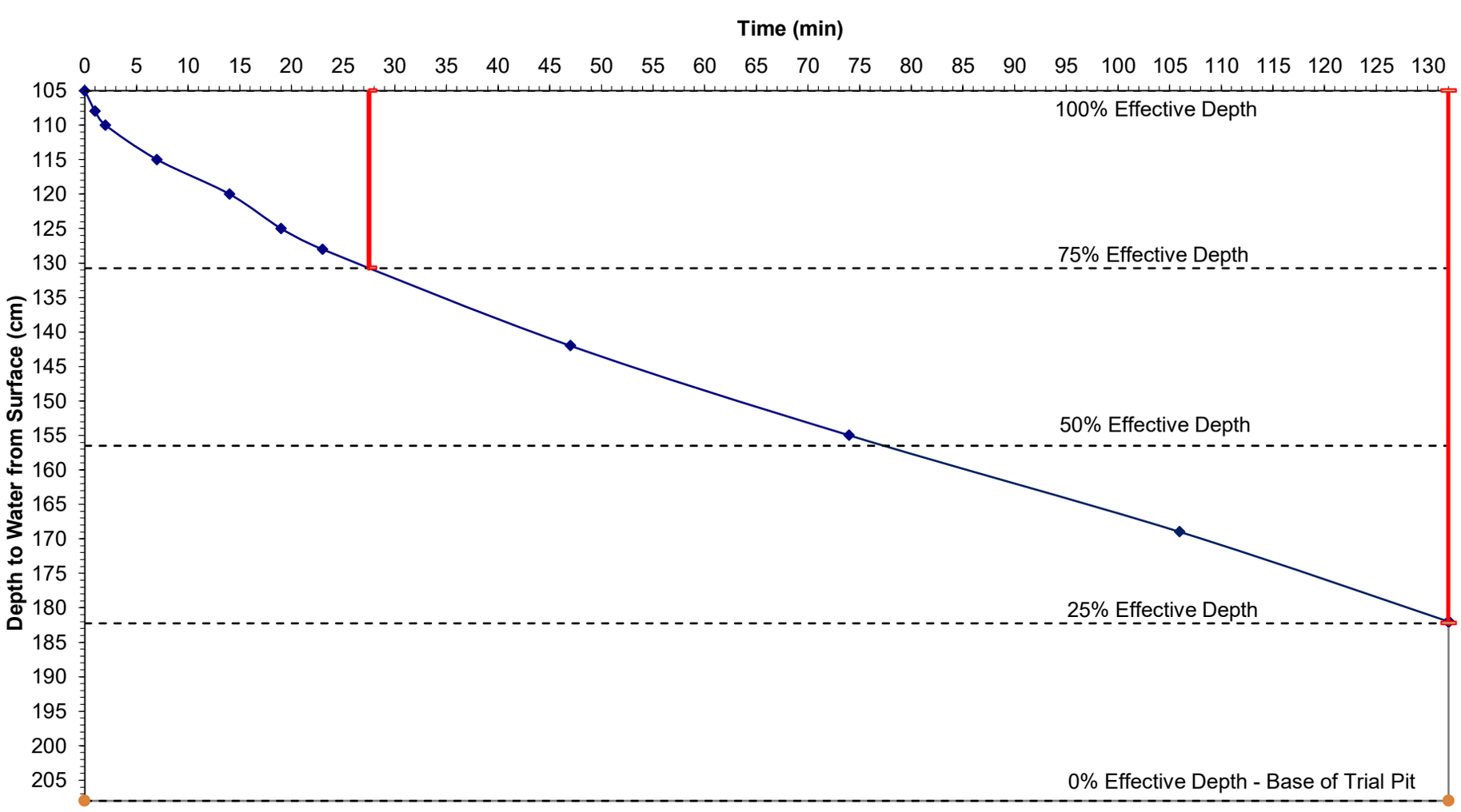
Notes:

[1] Base of pit at 2.08 m following slight collapse during Test 1.

Parameter	Symbol	Calculation	Units	IT01
Effective Depth of Trial Pit	d_p		m	1.03
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.55
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7725
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.69
Time to reach 75% Effective Depth	$T_{p75\%}$		min	27.50
Time to reach 25% Effective Depth	$T_{p25\%}$		min	132.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	104.50
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.63E-05**

*To 50% Effective Depth (including base)

Graph F-2 **GEG-24-821 Land at Cheapside, St. Albans IT01 Test 2 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	182	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	101	
Trial Pit:	**IT01**	Date of Test:	10 April 2024	
Test No.:	**Test 3 of 3**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	101	100.0%
2	103	97.5%
43	126	69.1%
62	134	59.3%
81	144	46.9%
101	155	33.3%
119	162	24.7%
End of Test		

With Reference to: **Graph F-3**

Notes:

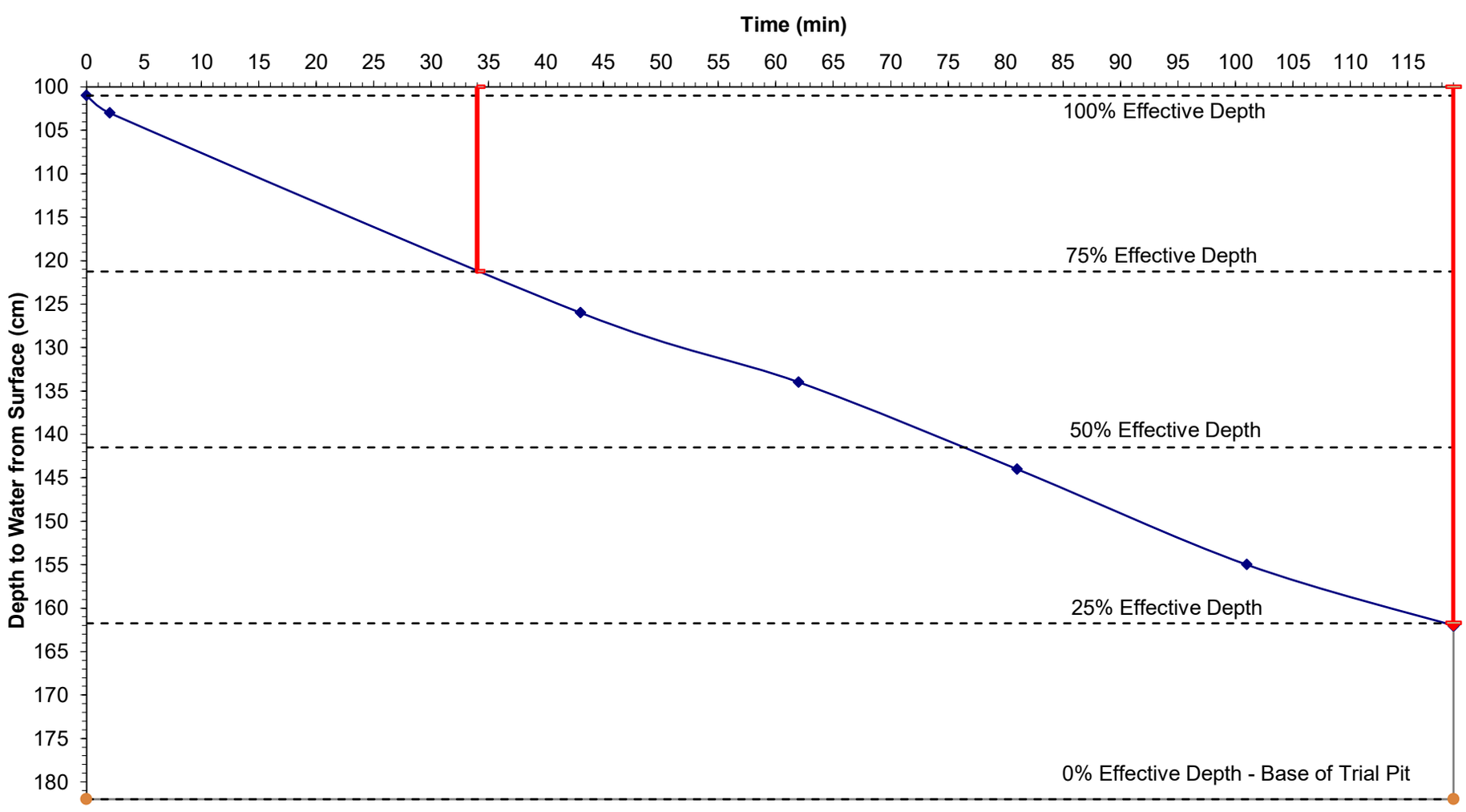
[1] Base of pit at 1.82 m following slight collapse during Test 2.

[2] Base of trial pit collapsed to 1.62 m during the test; as such last data point extrapolated.

Parameter	Symbol	Calculation	Units	**IT01**
Effective Depth of Trial Pit	d_p		m	0.81
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.22
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.6075
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.01
Time to reach 75% Effective Depth	$T_{p75\%}$		min	34.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	119.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	85.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.97E-05**

*To 50% Effective Depth (including base)

Graph F-3 **GEG-24-821 Land at Cheapside, St. Albans IT01 Test 3 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	200	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	100	
Trial Pit:	**IT02**	Date of Test:	10 April 2024	
Test No.:	**Test 1 of 1**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	100	100.0%
1	100	100.0%
2	100	100.0%
4	100	100.0%
26	100	100.0%
62	102	98.0%
157	102	98.0%
217	103	97.0%
End of Test		

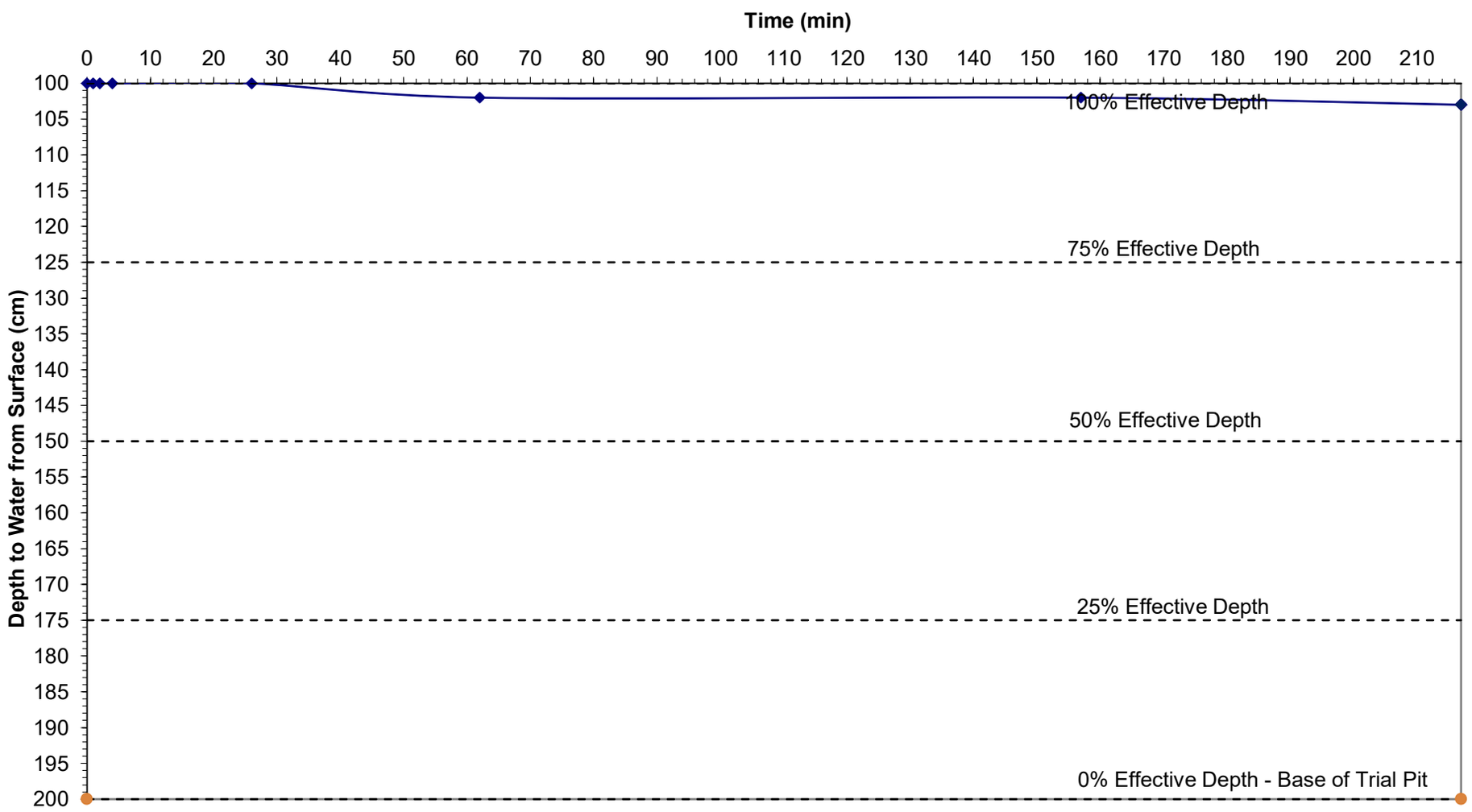
With Reference to: **Graph F-4**

Notes:

Parameter	Symbol	Calculation	Units	**IT02**
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.70
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.62
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.81
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.92
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-4 **GEG-24-821 Land at Cheapside, St. Albans IT02 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	275	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	145	
Trial Pit:	**IT03**	Date of Test:	10 April 2024	
Test No.:	**Test 1 of 1**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	145	100.0%
1	145	100.0%
2	143	101.5%
5	140	103.8%
41	145	100.0%
135	140	103.8%
194	140	103.8%
End of Test		

With Reference to: **Graph F-5**

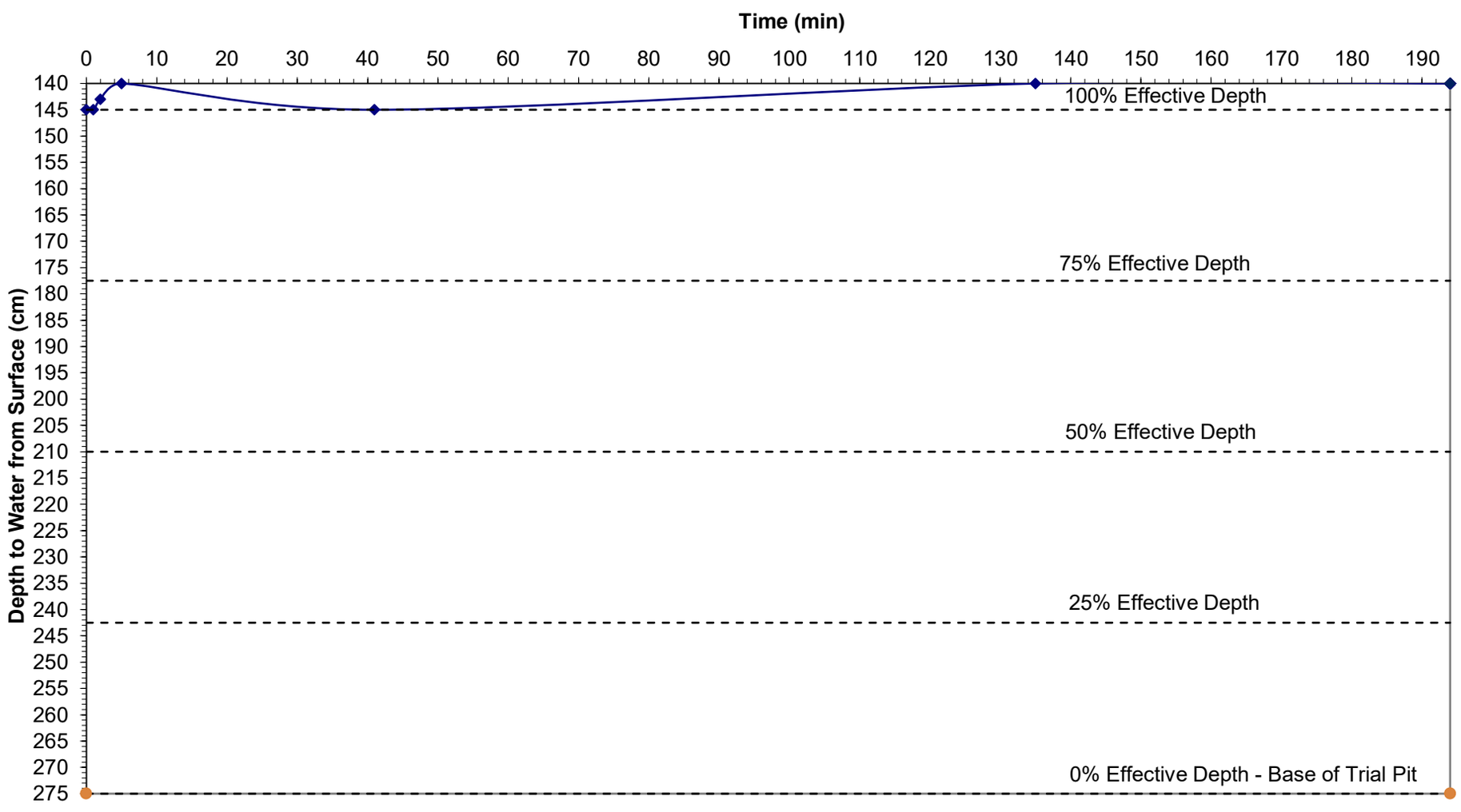
Notes:

[1] Groundwater level rose during test potentially due to instability of the trial pit sides.

Parameter	Symbol	Calculation	Units	**IT03**
Effective Depth of Trial Pit	d_p		m	1.30
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.65
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	2.07
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	1.0335
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	5.82
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-5 **GEG-24-821 Land at Cheapside, St. Albans IT03 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	200
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	120
Trial Pit:	**IT04**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 2**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	120	100.0%
1	125	93.8%
2	126	92.5%
3	130	87.5%
10	136	80.0%
29	148	65.0%
35	154	57.5%
45	160	50.0%
67	170	37.5%
81	175	31.3%
87	176	30.0%
118	183	21.3%
123	187	16.3%
129	190	12.5%
End of Test		

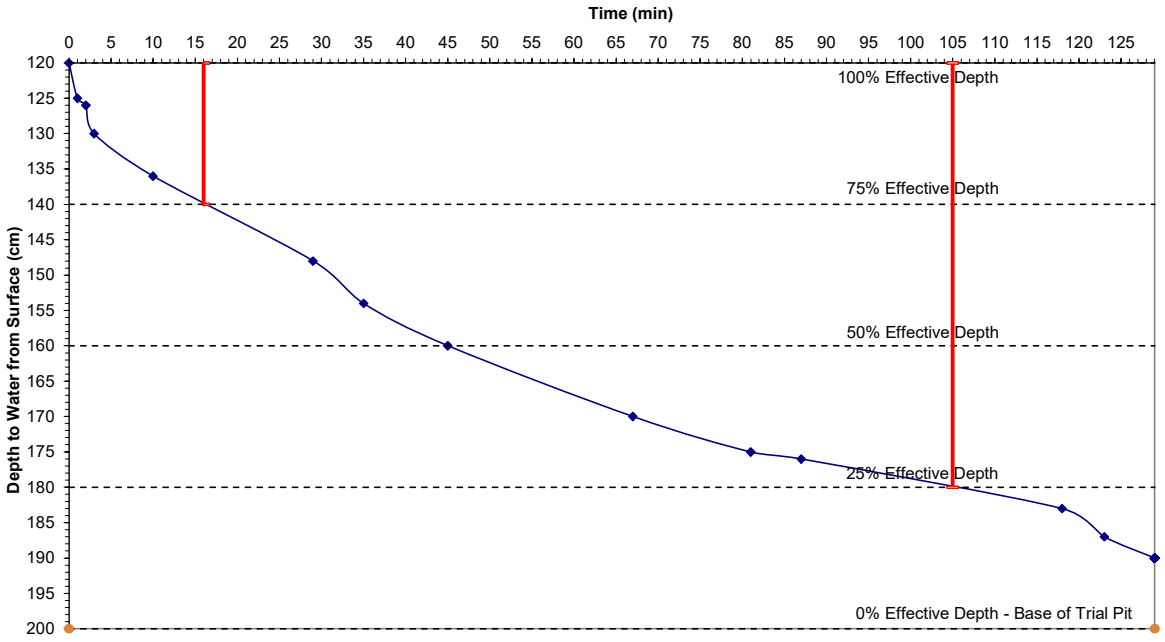
With Reference to: **Graph F-6**

Notes:

Parameter	Symbol	Calculation	Units	IT04
Effective Depth of Trial Pit	d_p		m	0.80
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.80
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.12
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.56
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.04
Time to reach 75% Effective Depth	$T_{p75\%}$		min	16.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	105.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	89.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.60E-05**

*To 50% Effective Depth (including base)

Graph F-6 **GEG-24-821 Land at Cheapside, St. Albans IT04 Test 1 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	175
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	100
Trial Pit:	**IT04**	Date of Test:	04 July 2024
Test No.:	**Test 2 of 2**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	100	100.0%
1	100	100.0%
6	103	96.0%
74	130	60.0%
105	140	46.7%
134	147	37.3%
160	155	26.7%
181	160	20.0%
End of Test		

With Reference to: **Graph F-7**

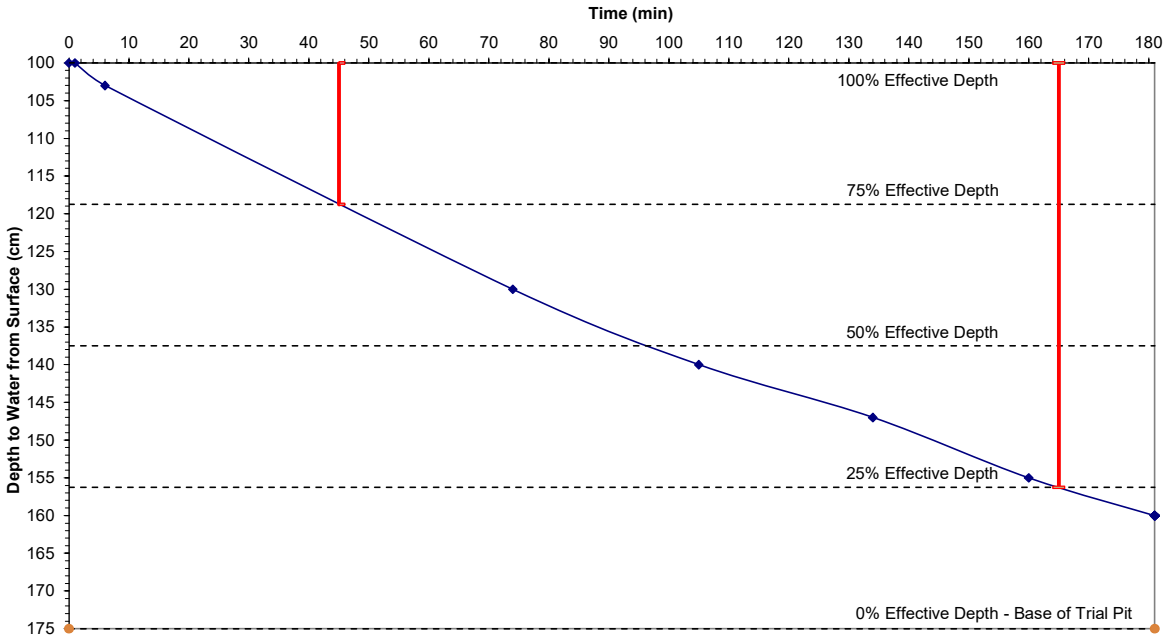
Notes:

[1] Base of pit at 1.75 m following slight collapse during Test 1.

Parameter	Symbol	Calculation	Units	IT04
Effective Depth of Trial Pit	d_p		m	0.75
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.80
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.05
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.525
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	3.88
Time to reach 75% Effective Depth	$T_{p75\%}$		min	45.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	165.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	120.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**1.88E-05**

*To 50% Effective Depth (including base)

Graph F-7 **GEG-24-821 Land at Cheapside, St. Albans IT04 Test 2 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	240	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	140	
Trial Pit:	**IT05**	Date of Test:	04 July 2024	
Test No.:	**Test 1 of 1**	Site Engineer:	KT	
		Drafted by:	EW	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	140	100.0%
1	143	97.0%
2	144	96.0%
4	146	94.0%
9	145	95.0%
29	146	94.0%
41	146	94.0%
82	146	94.0%
98	146	94.0%
171	145	95.0%
201	145	95.0%
End of Test		

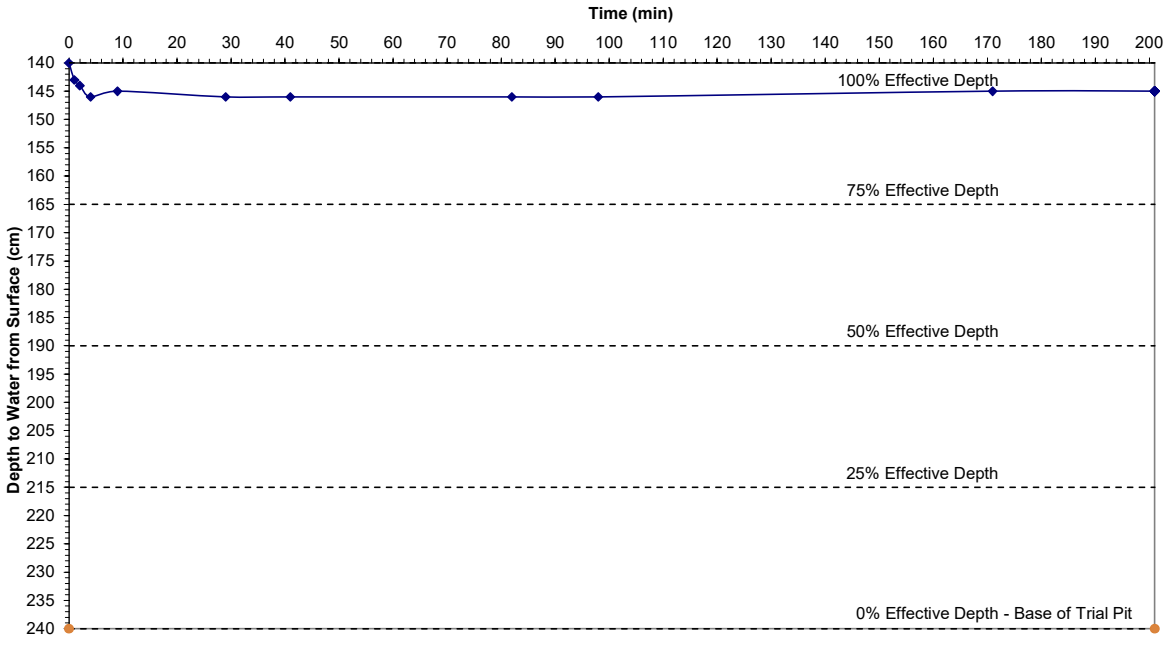
With Reference to: **Graph F-8**

Notes:

Parameter	Symbol	Calculation	Units	IT05
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.80
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.40
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.70
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-8 **GEG-24-821 Land at Cheapside, St. Albans IT05 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	280
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	180
Trial Pit:	**IT06**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	180	100.0%
1	180	100.0%
2	181	99.0%
3	181	99.0%
49	180	100.0%
64	179	101.0%
136	179	101.0%
166	179	101.0%
195	179	101.0%
End of Test		

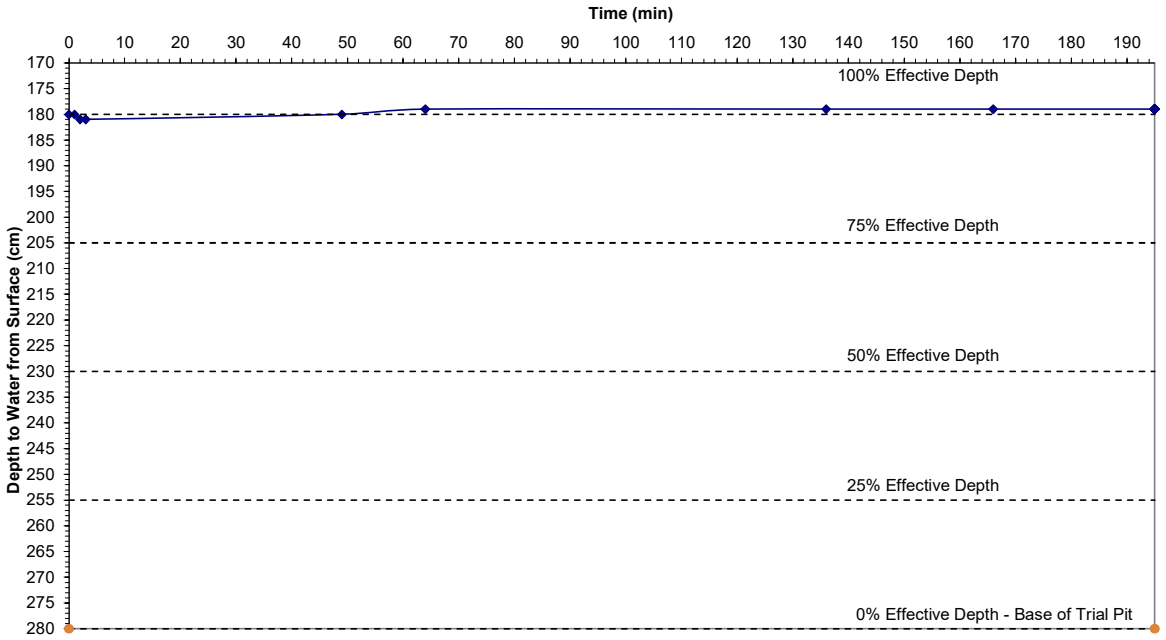
With Reference to: **Graph F-9**

Notes:

Parameter	Symbol	Calculation	Units	IT06
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.60
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.30
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.65
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.40
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-9 **GEG-24-821 Land at Cheapside, St. Albans IT06 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	250
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	140
Trial Pit:	**IT07**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	140	100.0%
1	141	99.1%
13	142	98.2%
26	142	98.2%
78	140	100.0%
119	143	97.3%
183	145	95.5%
End of Test		

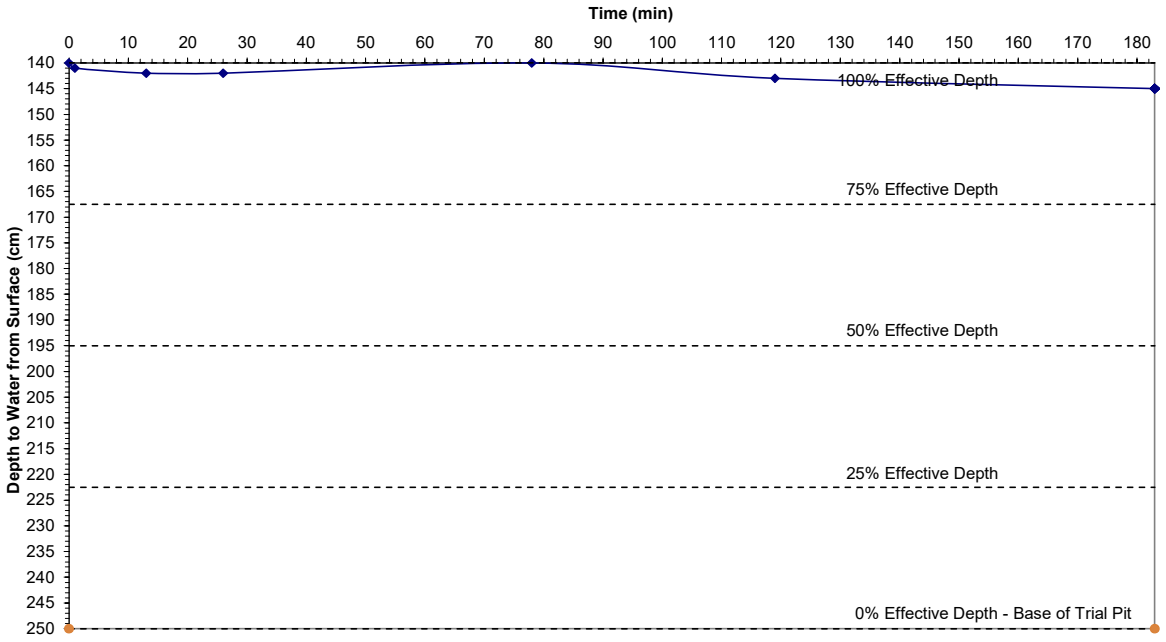
With Reference to: **Graph F-10**

Notes:

Parameter	Symbol	Calculation	Units	IT07
Effective Depth of Trial Pit	d_p		m	1.10
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.70
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.49
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7425
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.87
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-10 **GEG-24-821 Land at Cheapside, St. Albans IT07 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	300
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	200
Trial Pit:	**IT08B**	Date of Test:	20th February 2025
Test No.:	**Test 1 of 3**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	200	100.0%
0	208	92.0%
1	218	82.0%
2	226	74.0%
3	230	70.0%
4	234	66.0%
5	238	62.0%
6	241	59.0%
8	245	55.0%
9	249	51.0%
10	252	48.0%
12	257	43.0%
14	259	41.0%
16	263	37.0%
17	267	33.0%
19	271	29.0%
20	275	25.0%
21	278	22.0%
22	280	20.0%
End of Test		

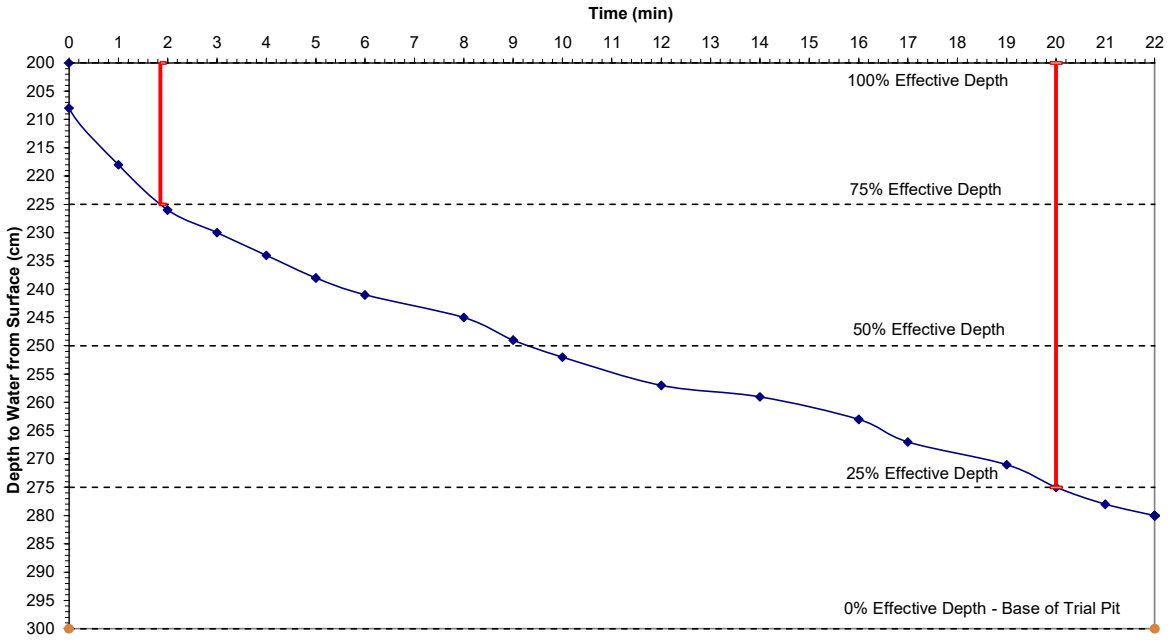
With Reference to: **Graph F-11**

Notes:

Parameter	Symbol	Calculation	Units	IT08B
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.50
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.75
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.60
Time to reach 75% Effective Depth	$T_{p75\%}$		min	1.85
Time to reach 25% Effective Depth	$T_{p25\%}$		min	20.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	18.15
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**1.50E-04**

*To 50% Effective Depth (including base)

Graph F-11 **GEG-24-821 Land at Cheapside, St. Albans IT08B Test 1 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	280
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	190
Trial Pit:	**IT08B**	Date of Test:	20th February 2025
Test No.:	**Test 2 of 3**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	190	100.0%
1	195	94.4%
1	197	92.2%
2	201	87.8%
3	206	82.2%
4	210	77.8%
5	214	73.3%
6	217	70.0%
7	220	66.7%
8	223	63.3%
9	227	58.9%
10	230	55.6%
12	232	53.3%
13	234	51.1%
15	239	45.6%
16	240	44.4%
18	243	41.1%
20	247	36.7%
21	250	33.3%
23	252	31.1%
25	257	25.6%
26	258	24.4%
End of Test		

With Reference to: **Graph F-12**

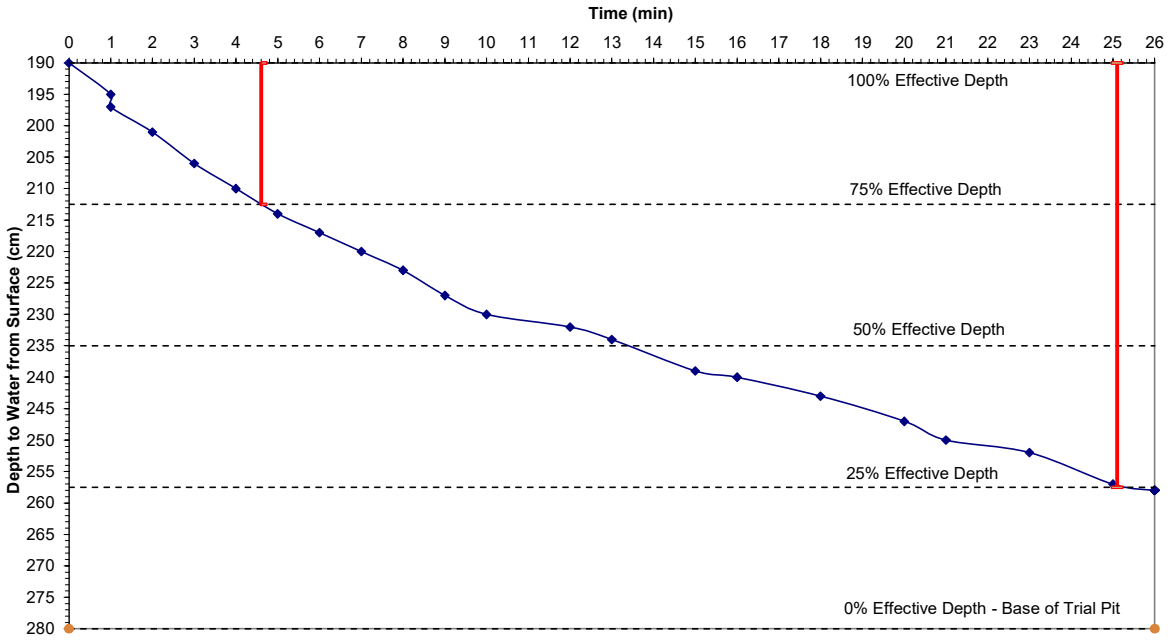
Notes:

[1] Trial pit collapsed to 2.80 m following previous test.

Parameter	Symbol	Calculation	Units	IT08B
Effective Depth of Trial Pit	d_p		m	0.90
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.35
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.675
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.29
Time to reach 75% Effective Depth	$T_{p75\%}$		min	4.60
Time to reach 25% Effective Depth	$T_{p25\%}$		min	25.10
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	1.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.62E-03**

*To 50% Effective Depth (including base)

Graph F-12 **GEG-24-821 Land at Cheapside, St. Albans IT08B Test 2 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	175
Trial Pit:	**IT08B**	Date of Test:	20th February 2025
Test No.:	**Test 3 of 3**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	175	100.0%
0	178	96.8%
1	185	89.5%
2	191	83.2%
2	193	81.1%
2	197	76.8%
3	198	75.8%
4	202	71.6%
5	208	65.3%
6	210	63.2%
7	214	58.9%
8	216	56.8%
9	218	54.7%
11	222	50.5%
13	226	46.3%
15	232	40.0%
17	234	37.9%
21	238	33.7%
24	243	28.4%
26	248	23.2%
27	249	22.1%
28	250	21.1%
End of Test		

With Reference to: **Graph F-13**

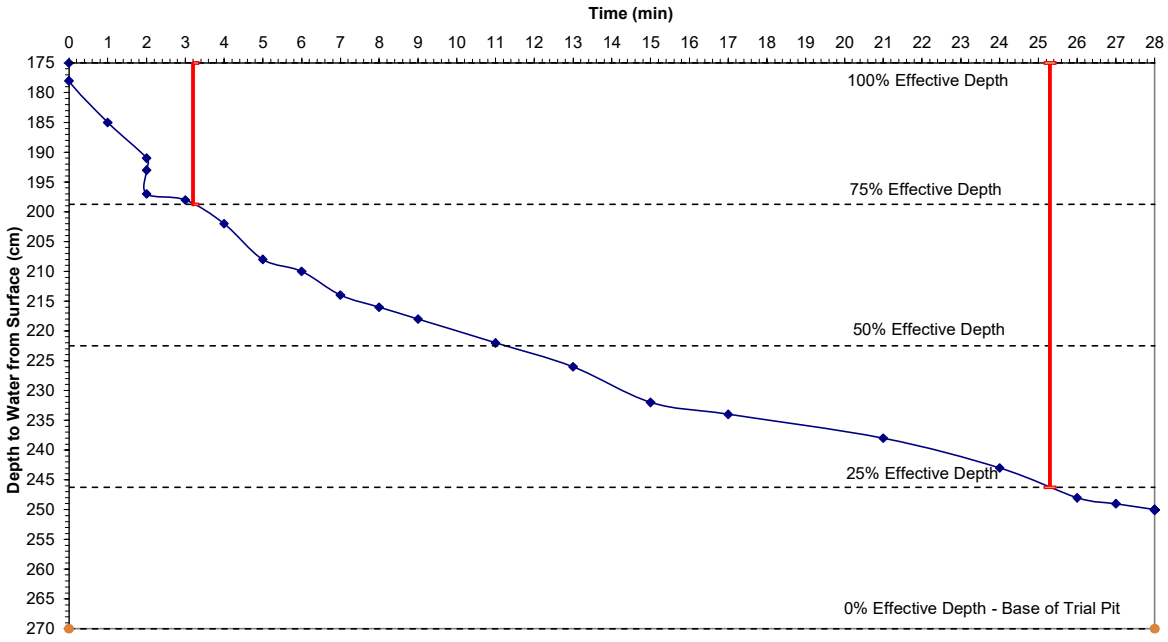
Notes:

[1] Trial pit collapsed to 2.70 m following previous test.

Parameter	Symbol	Calculation	Units	IT08B
Effective Depth of Trial Pit	d_p		m	0.95
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.43
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7125
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.45
Time to reach 75% Effective Depth	$T_{p75\%}$		min	3.20
Time to reach 25% Effective Depth	$T_{p25\%}$		min	25.30
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	1.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.67E-03**

*To 50% Effective Depth (including base)

Graph F-13 **GEG-24-821 Land at Cheapside, St. Albans IT08B Test 3 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	170
Trial Pit:	**IT09C**	Date of Test:	21st February 2025
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	170	100.0%
1	170	100.0%
2	170	100.0%
3	170	100.0%
4	170	100.0%
6	170	100.0%
91	175	95.0%
109	176	94.0%
149	178	92.0%
189	180	90.0%
End of Test		

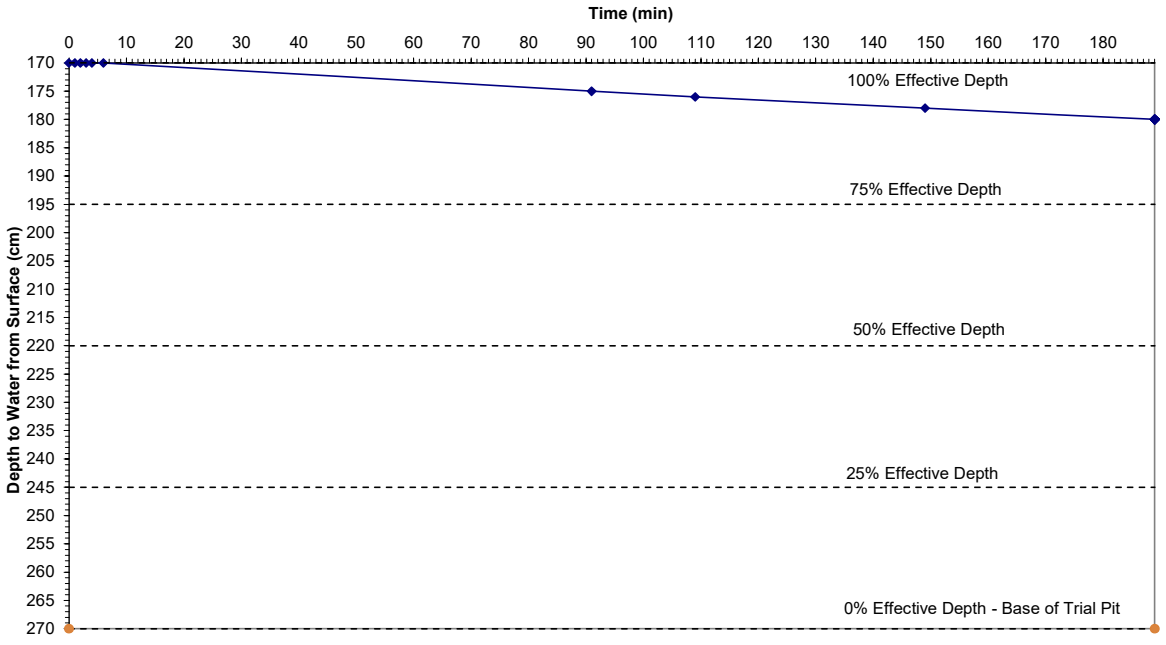
With Reference to: **Graph F-14**

Notes:

Parameter	Symbol	Calculation	Units	IT09C
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.50
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.75
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.60
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-14 **GEG-24-821 Land at Cheapside, St. Albans IT09C Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	165	
Trial Pit:	**IT09E**	Date of Test:	21st February 2025	
Test No.:	**Test 1 of 2**	Site Engineer:	KT	
		Drafted by:	MP	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	165	100.0%
0	166	99.0%
1	168	97.1%
2	172	93.3%
4	176	89.5%
5	178	87.6%
20	198	68.6%
61	222	45.7%
93	239	29.5%
97	242	26.7%
100	243.5	25.2%
End of Test		

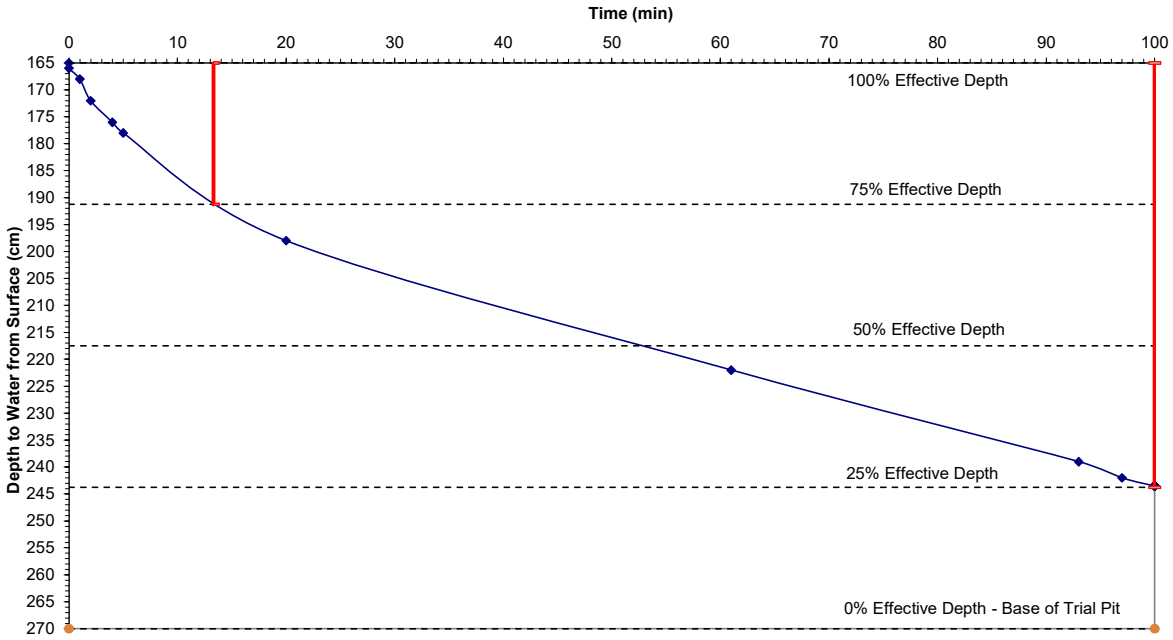
With Reference to: **Graph F-15**

Notes:

Parameter	Symbol	Calculation	Units	IT09E
Effective Depth of Trial Pit	d_p		m	1.05
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.58
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7875
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.76
Time to reach 75% Effective Depth	$T_{p75\%}$		min	13.30
Time to reach 25% Effective Depth	$T_{p25\%}$		min	100.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	86.70
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**3.18E-05**

*To 50% Effective Depth (including base)

Graph F-15 **GEG-24-821 Land at Cheapside, St. Albans IT09E Test 1 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	225
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	145
Trial Pit:	**IT09E**	Date of Test:	21st February 2025
Test No.:	**Test 2 of 2**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	145	100.0%
1	146	98.8%
8	151	92.5%
64	186	48.8%
83	192	41.3%
106	201	30.0%
120	205	25.0%
End of Test		

With Reference to: **Graph F-16**

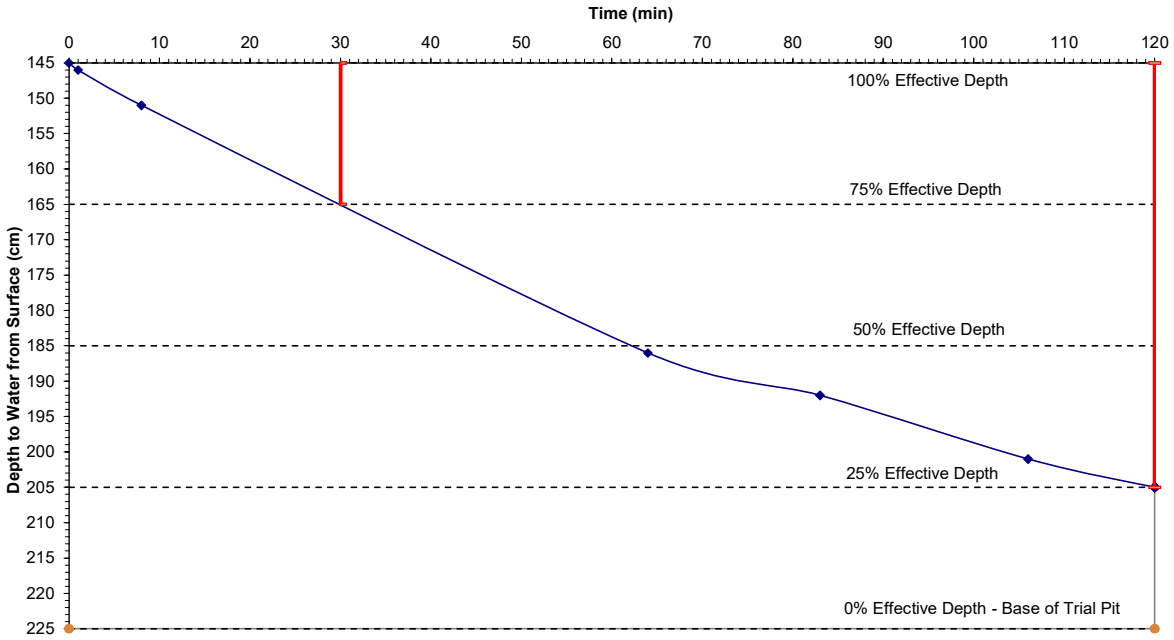
Notes:

[1] Trial pit collapsed to 2.25 m following previous test.

Parameter	Symbol	Calculation	Units	IT09E
Effective Depth of Trial Pit	d_p		m	0.80
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.20
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.6
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	3.98
Time to reach 75% Effective Depth	$T_{p75\%}$		min	30.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	120.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	90.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.79E-05**

*To 50% Effective Depth (including base)

Graph F-16 **GEG-24-821 Land at Cheapside, St. Albans IT09E Test 2 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	320
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	220
Trial Pit:	**IT10A**	Date of Test:	20th February 2025
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	220	100.0%
1	220	100.0%
2	222	98.0%
3	223	97.0%
6	223	97.0%
30	222	98.0%
69	223	97.0%
114	220	100.0%
127	220	100.0%
End of Test		

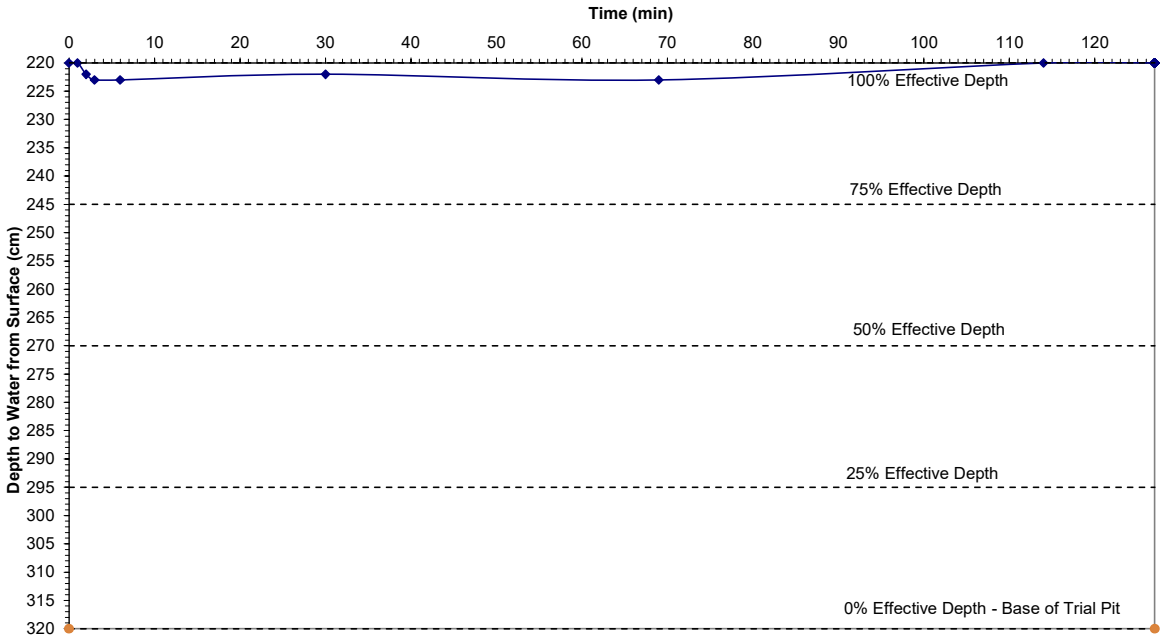
With Reference to: **Graph F-17**

Notes:

Parameter	Symbol	Calculation	Units	IT10A
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.50
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.75
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.60
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-17 **GEG-24-821 Land at Cheapside, St. Albans IT10A Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	260
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	150
Trial Pit:	**IT10B**	Date of Test:	21st February 2025
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	150	100.0%
1	151	99.1%
8	151	99.1%
45	151	99.1%
85	151	99.1%
147	151	99.1%
151	151	99.1%
End of Test		

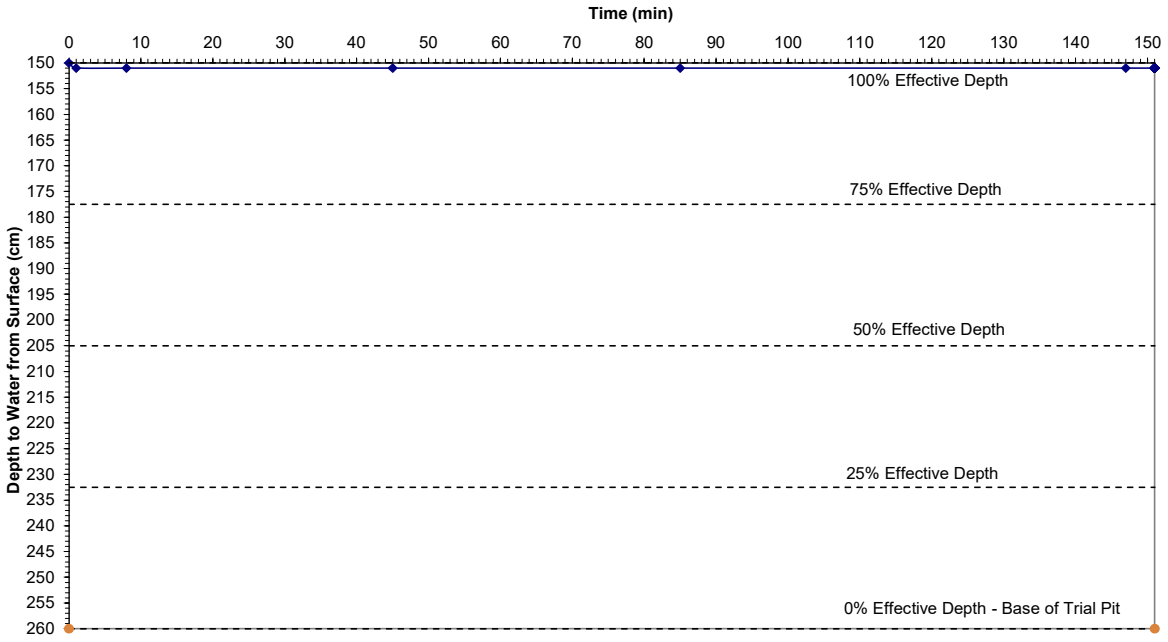
With Reference to: **Graph F-18**

Notes:

Parameter	Symbol	Calculation	Units	IT10B
Effective Depth of Trial Pit	d_p		m	1.10
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.65
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.825
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.91
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-18 **GEG-24-821 Land at Cheapside, St. Albans IT10B Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	205
Trial Pit:	**IT11**	Date of Test:	20th February 2025
Test No.:	**Test 1 of 2**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	205	100.0%
0	212	89.2%
1	215	84.6%
2	217	81.5%
4	218	80.0%
8	223	72.3%
14	228	64.6%
48	246	36.9%
95	260	15.4%
133	267	4.6%
End of Test		

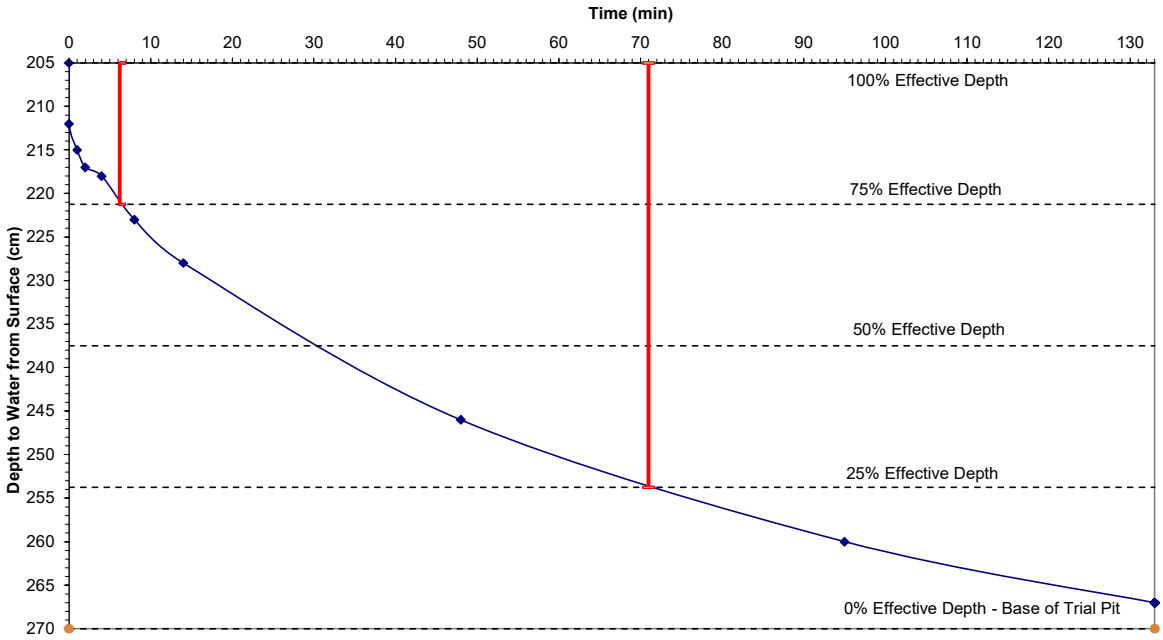
With Reference to: **Graph F-19**

Notes:

Parameter	Symbol	Calculation	Units	IT11
Effective Depth of Trial Pit	d_p		m	0.65
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	0.98
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.4875
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	3.52
Time to reach 75% Effective Depth	$T_{p75\%}$		min	6.20
Time to reach 25% Effective Depth	$T_{p25\%}$		min	71.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	64.80
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**3.57E-05**

*To 50% Effective Depth (including base)

Graph F-19 **GEG-24-821 Land at Cheapside, St. Albans IT11 Test 1 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	182	
Trial Pit:	**IT11**	Date of Test:	21st February 2025	
Test No.:	**Test 2 of 2**	Site Engineer:	KT	
		Drafted by:	MP	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	182	100.0%
1	185	96.6%
2	187	94.3%
4	188	93.2%
5	190	90.9%
16	202	77.3%
20	206	72.7%
80	216	61.4%
101	233	42.0%
164	240	34.1%
End of Test		

With Reference to: **Graph F-20**

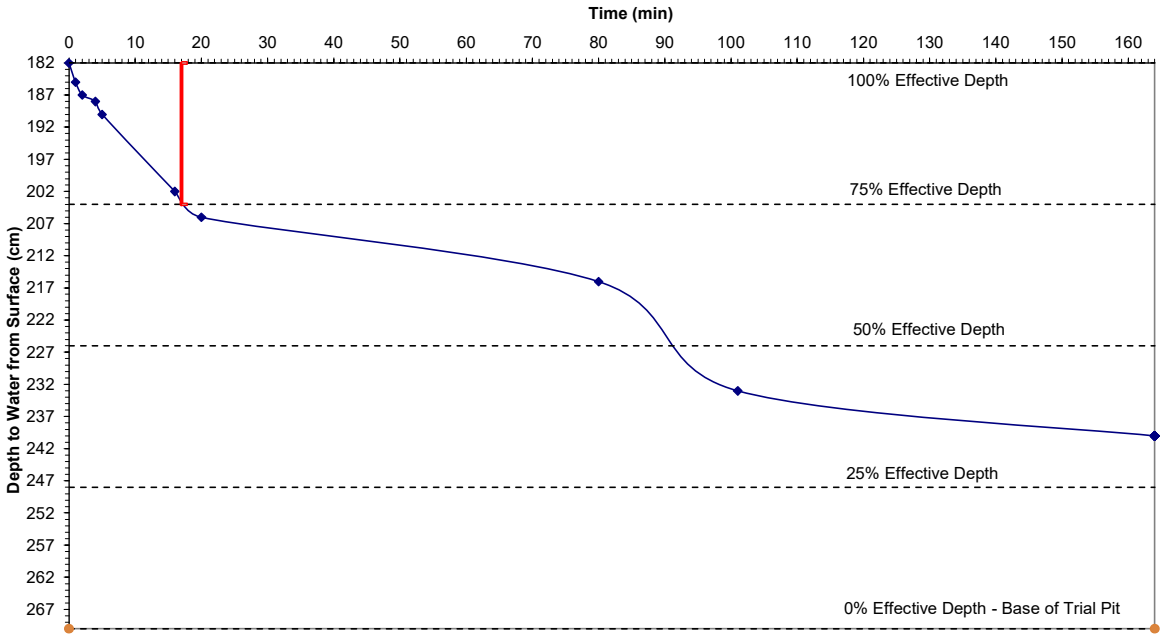
Notes:

[1] Trial pit dry at 2.40 m due to slumping of base at 2.40 m during infiltration test. As such, no infiltration rate could be calculated.

Parameter	Symbol	Calculation	Units	IT11
Effective Depth of Trial Pit	d_p		m	0.88
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.32
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.66
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.23
Time to reach 75% Effective Depth	$T_{p75\%}$		min	17.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-20 **GEG-24-821 Land at Cheapside, St. Albans IT11 Test 2 of 2**



Checked by: MP

APPENDIX E

FALLING HEAD TESTS

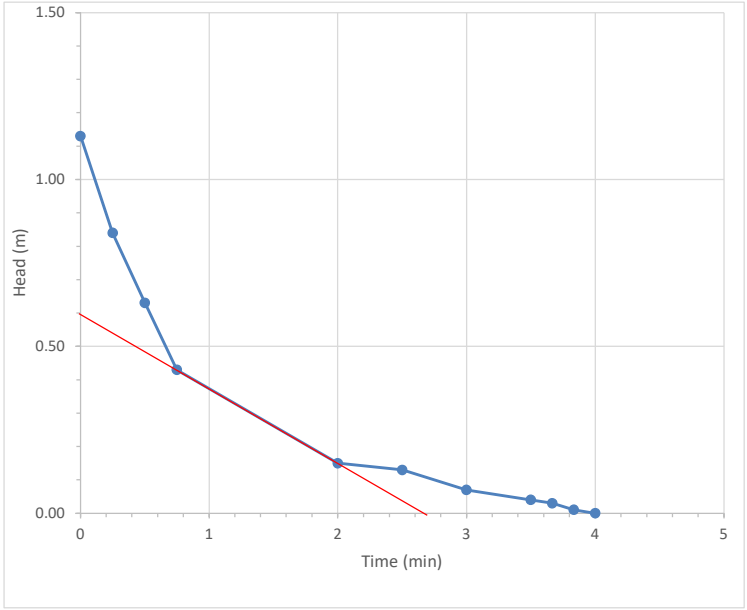
Falling Head Soakage Test Calculations - GEG-24-821

WS06 (Test 1 of 1)

Depth of borehole (m):			5.00
Time (sec)	**Time (min)**	**Depth from Surface (m)**	**Hp**
0	0	3.87	1.13
15	0.3	4.16	0.84
30	0.5	4.37	0.63
45	0.8	4.57	0.43
120	2.0	4.85	0.15
150	2.5	4.87	0.13
180	3.0	4.93	0.07
210	3.5	4.96	0.04
220	3.7	4.97	0.03
230	3.8	4.99	0.01
240	4.0	5.00	0.00

Date of Test: 09/05/2024

End of Test *KT / MP*



Notes:

Approximately 75 litres of water was poured into the standpipe (at a rapid rate) in order to conduct the test at the depth indicated.

WS06 (Test 1 of 1)

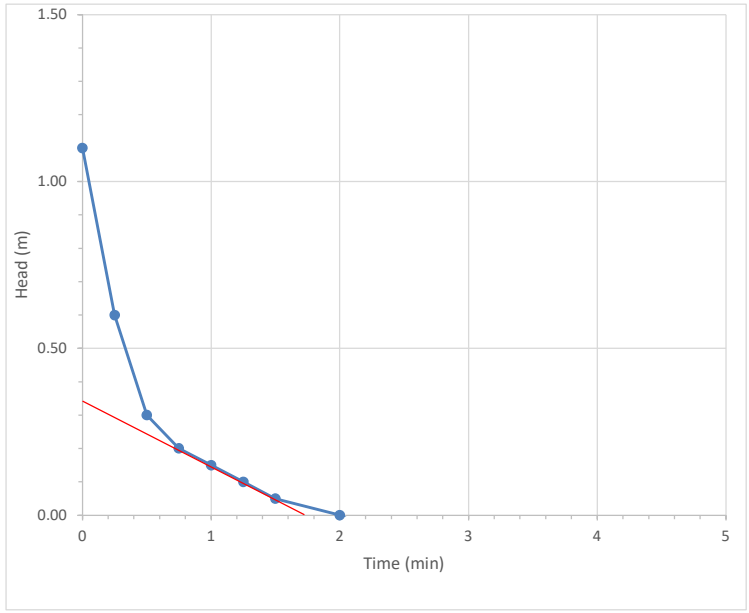
With Reference to Kent County Council - The Soakaway Design Guide, 2000

d	*Diameter of borehole*	0.10	m
D	*Diameter of base of borehole*	0.10	m
L	*Length of response zone*	2.10	m
Hp	*y intercept of tangent*	0.60	m
t_h	*x intercept of tangent*	2.70	min

Soakage = 250 Hp d^2 /D L t_h **2.65E+00** **l/m²/min**

Falling Head Soakage Test Calculations - GEG-24-821

WS06 (Test 2 of 2)			11/06/2024
Depth of borehole (m):			5.00
Time (sec)	**Time (min)**	**Depth from Surface (m)**	**Hp**
0	0	3.90	1.10
15	0.3	4.40	0.60
30	0.5	4.70	0.30
45	0.8	4.80	0.20
60	1.0	4.85	0.15
75	1.3	4.90	0.10
90	1.5	4.95	0.05
120	2.0	5.00	0.00
150	2.5	5.10	-0.10
160	2.7	5.12	-0.12
Date of Test:	09/05/2024		
End of Test			*KT / MP*



Notes:

Approximately 75 litres of water was poured into the standpipe (at a rapid rate) in order to conduct the test at the depth indicated.

WS06 (Test 2 of 2)			
With Reference to Kent County Council - The Soakaway Design Guide, 2000			
d	*Diameter of borehole*	0.10	m
D	*Diameter of base of borehole*	0.10	m
L	*Length of response zone*	2.10	m
Hp	*y intercept of tangent*	0.60	m
t_h	*x intercept of tangent*	1.75	min
Soakage	$= 250\ Hp\ d^2 / D\ L\ t_h$	4.08E+00	**l/m²/min**

GEG | Geo Environmental Group
Geotechnical, Environmental & Ecological Consultants

GEG House, 17 Graham Road, Malvern, WR14 2HR
Tel. 01684 212526 Fax 01684 576917 www.g-eg.co.uk

PHASE I REVIEW & PHASE II GEO-ENVIRONMENTAL ASSESSMENT

PROPOSED SPORTS PITCHES
LAND EAST OF HARPENDEN ROAD
NORTH OF ST ALBANS
HERTFORDSHIRE

OCTOBER 2025

Prepared for:

BROOKBANKS

Hallam Land

Registered Company - GEG Ltd
Registered in England No 6469985
Registered Office: Granta Lodge, 71 Graham Rd, Malvern, WR14 2JS

Report Title:

PHASE I REVIEW & PHASE II GEO-ENVIRONMENTAL ASSESSMENT

Site Address:

Proposed Sport Pitches
Land East of Harpenden Road
North of St Albans
Hertfordshire
AL3 6BZ

Performed by:
Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

On Behalf of:
Hallam Land
c/o Brookbanks
6150 Knights Court
Solihull Parkway
Birmingham
B37 7WY

Written by:

Matthew Perks
BSc(Hons) MSc FGS
Principal Geo-Environmental Consultant

Checked & Approved by:

Anthony Marriott
BSc(Hons) MRSC MIEnvSc FGS
Managing Director

Project Reference: GEG-25-889

Report Reference: GEG-25-889/PI_PII

Issue Status: FINAL

Date of Issue: Rev00: 3rd October 2025

TABLE OF CONTENTS *PAGE*

1. INTRODUCTION 1
1.1 General 1
1.2 Available Information 1
1.3 Proposed Site Development 1
1.4 Scope 1

2. SITE SETTING 2
2.1 Site Location 2
2.2 Site Description 2
2.3 Adjacent Land Uses 2

3. REVIEW OF AVAILABLE DESK STUDY INFORMATION 3
3.1 Landfills 3
3.2 Waste Management 3
3.3 Discharge Consents 3
3.4 Pollution Controls 3
3.5 Pollution Incidents 3
3.6 Hazardous Substances 3
3.7 Fuel Stations 3
3.8 Contemporary Trade Directories 3
3.9 Conservation 3
3.10 Ordnance 4
3.11 Historical Information 4
3.11.1 Site History 4
3.11.2 Site Surroundings 4
3.12 Geology 4
3.12.1 Published Geology 4
3.12.2 Mining and Quarrying 5
3.12.3 Potential Geo-Hazards 5
3.13 Hydrogeology 5
3.13.1 Groundwater Designation 5
3.13.2 Groundwater Source Protection Zone 5
3.13.3 Groundwater Abstractions 6
3.14 Hydrology 6
3.14.1 Nearest Watercourse 6
3.14.2 Surface Water Abstractions 6
3.14.3 Surface Water Flooding 6
3.15 Radon 6

4. PRELIMINARY RISK ASSESSMENT AND OUTLINE CONCEPTUAL MODEL 6
4.1 Potential Contaminants of Concern 6
4.1.1 Potential On-Site Contamination Sources 6
4.1.2 Potential Off-Site Contamination Sources 7
4.1.3 Potential Contaminants of Concern 7
4.2 Preliminary Human Health Conceptual Model 7
4.3 Preliminary Controlled Waters Conceptual Model 7
4.4 Preliminary Ground Gas Assessment 8

5. INTRUSIVE INVESTIGATION 8
5.1 Site Works Overview 8
5.2 Site Works 9
5.2.1 General 9
5.2.2 Window Sample Holes 9
5.2.3 Trial Pits 9
5.2.4 In Situ Testing 9
5.2.5 Rationale for the Exploratory Holes 10
5.2.6 In-situ CBR Testing 10
5.2.7 Infiltration Tests 10
5.2.8 Reinstatement 11
5.2.9 Sampling 11
5.3 Gas and Groundwater Monitoring 11
5.3.1 Rationale for Gas Monitoring 11
5.3.2 Gas Monitoring Programme 11
5.4 Geotechnical Laboratory Testing 12
5.5 Chemical Laboratory Testing 12

5.5.1 Schedule of Analysis 12
5.5.2 Scope of Analysis 13
5.6 Ground Conditions Encountered 13
5.6.1 Made Ground 13
5.6.2 Topsoil 13
5.6.3 Kesgrave Catchment Supergroup 13
5.6.4 Clay-With-Flints Formation 13
5.6.5 Lewes Nodular & Seaford Chalk Formations 14
5.6.6 Groundwater 14
5.6.7 Stability of Trial Pits 14
5.6.8 Visual and Olfactory Evidence of Contamination 14
6. GENERIC HUMAN HEALTH QUANTITATIVE RISK ASSESSMENT 15
6.1 Generic Human Health QRA 15
6.1.1 S4ULs 15
6.1.2 CLEA v.1.071 15
6.1.3 Other Assessment Criteria 15
6.1.4 PAH Profiling 16
6.1.5 Vapour Risk Associated with PAHs 16
6.2 Direct Screening of Soil Chemical Data 16
6.2.1 Natural Ground 16
6.3 Summary of Soil Contamination 17
7. GENERIC CONTROLLED WATERS QUANTITATIVE RISK ASSESSMENT ... 17
7.1 Identified Soil Contaminants 17
7.2 Identified Groundwater Contaminants 17
8. GROUND GAS RISK ASSESSMENT 17
9. GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS 18
9.1 Overview 18
9.1.1 Summary of Strata Encountered 18
9.1.2 Groundwater 18
9.1.3 Trial Pit Stability 18
9.1.4 Undrained Shear Strength 18
9.1.5 Chalk 19
9.1.6 Plasticity Indices (PI) 19
9.1.7 In-situ CBR Testing 20
9.1.8 Preliminary Equilibrium CBR Results from Plasticity Indices 20
9.1.9 Proposed Development 21
9.2 Identified Geotechnical & Other/Ground Constraints 21
9.3 Anticipated Foundation Types 22
9.4 Football Pitch Formation 22
9.5 Drainage 22
9.6 Potential Dissolution Features 22
9.7 Chemical Attack on Buried Concrete 22
9.8 Underground Plastic Services 23
9.9 Slope Stability and Retaining Walls 23
9.10 Excavations 23
9.11 Road Pavement Design 23
9.12 Loose/Soft Spots 23
10. ENVIRONMENTAL CONCLUSIONS & RECOMMENDATIONS 24
10.1 Revised Conceptual Model 24
10.1.1 Revised Human Health Conceptual Model 24
10.1.2 Revised Controlled Waters Conceptual Model 24
10.2 Ground Gases 24
10.3 Risks to Adjacent Land and Third Parties 24
10.4 Risks from Adjacent Land and Third Parties 25
10.5 Potential Geo-Environmental Liabilities 25
10.6 Waste Classification 25
10.7 Re-Use of Topsoil 25
10.8 Remediation 25
10.8.1 Human Health Remedial Measures 25
10.8.2 Protection of Controlled Waters 25
10.8.3 Unidentified Contamination 25
10.8.4 Unidentified Underground Structures 25
10.9 Further Assessment 25

11. REFERENCES 25
12. LIMITATIONS 28

Title	*Appendix*
FIGURES AND PLANS	**A**
Site Location Plan	Figure 1
Current Layout Plan - Aerial	Figure 2
Preliminary Conceptual Model	Figure 3
Exploratory Hole Location Plan	Figure 4
Proposed Site Layout Plan	Figure 5
Revised Conceptual Model (Existing)	Figure 6A
Revised Conceptual Model (Proposed)	Figure 6B
PHOTOGRAPHIC RECORD	**B**
ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY	**C**
EXPLORATORY HOLE LOGS	**D**
INFILTRATION TEST RESULTS	**E**
CHEMICAL ANALYSIS RESULTS	**F**
PAH PROFILING ASSESSMENT	**G**
CONTAMINATION ASSESSMENT TABLES	**H**
GEOTECHNICAL TESTING	**I**

EXECUTIVE SUMMARY

General

A Phase I Review & Phase II Geo-Environmental Assessment was required for the proposed usage of the site as sports pitches associated with a wider proposed residential development.

Site Location & Current Status

The site is located approximately 2.8 km northeast of St Albans city centre in Hertfordshire, at the approximate National Grid Reference 515258E, 210146N. It lies on land approximately 260 m east of Harpenden Road (A1081) and adjacent to the east of a private access road associated with the Old Albanian RFC, and covers an area of approximately 7.6 ha.

The site currently comprises the southern majority of a wider agricultural field. The southwestern margin of the site is utilised as grassed surfaced parking accessed via a gravel-surfaced track associated with the adjacent Rugby Club. The southeastern margins of the site consist of a fringe of existing planting.

Geology, Hydrogeology, Hydrology & Landfills

The solid geology beneath the site comprises the Lewes Nodular Chalk Formation and Seaford Chalk Formation (a Principal Aquifer). The solid geology is conjectured to be overlain by superficial deposits of the Clay-with-flints Formation (Unproductive strata) across the majority and a pocket of the Kesgrave Catchment Subgroup (a Secondary A Aquifer) with the central southeastern section.

The site does not lie within a currently defined Groundwater Source Protection Zone (GWSPZ) and there are no surface water abstractions identified within 250 m. There is 1 No. groundwater abstraction within 250 m of the site, located approximately 60 m northeast at Green Cottages.

The nearest watercourse is the River Ver located approximately 2.6 km south west of the site.

No records of historical landfill sites have been identified within 250 m of the site.

Flooding

The site lies within Flood Zone 1, and hence has a low probability of flooding.

Site History

The Desk Study indicates that since the pre-1900s the site has remained agricultural.

Intrusive Investigations

The intrusive investigation was undertaken on 19th August 2025 and comprised window sample boreholes, machine-excavated trial pitting, infiltration testing and in-situ CBR testing.

Ground Conditions

Typically firm CLAY topsoil was encountered across site to a depth of 0.30 m.

The Clay-with-flints Formation was encountered across the site underlying the topsoil at proven depths of between 1.90 and 4.60 m. It

typically comprised firm to stiff (occasionally very stiff) variably sandy gravelly (quartzite, chalk and flint) CLAY locally with low cobble and boulder content. Subordinate dense clayey GRAVEL with high cobble and boulder content was encountered from 0.70 to 1.20 m in IT02 and from 0.30 to 0.45 m in TP03.

The Lewes Nodular & Seaford Chalk Formations were encountered underlying the Clay-with-Flints Formation at 9 No. locations (WS01, WS02, WS04, TP02 & TP04-TP08) from depths of between 1.80 and 4.60 m to the base of the exploratory holes. It typically comprised structureless CHALK composed of variably gravelly SILT and GRAVEL (Grades Dm to Dc, respectively).

No groundwater was encountered in the majority of the exploratory holes during the intrusive investigation with the exception of seepages at 2.00 m in TP05, TP06 and TP08. No groundwater was encountered during the groundwater monitoring to date.

Proposed Development

The proposed layout comprises 3 No. Pitches across the majority of the site, with a pavilion building adjacent to the southwest, car parking along the southwestern margins, an attenuation basin along the southeastern margins and a new planting along the northwestern boundary.

Geotechnical Conclusions & Recommendations

Anticipated Foundation Types

It is recommended that foundation loads for the proposed pavilion are transferred onto the natural firm CLAY of the Clay-with-flints Formation utilising traditional strip/trench or pad foundations. An allowable bearing pressure of 50 kN/m² is recommended on the firm clay, such loads are anticipated to give total settlements of less than 25 mm for 0.60 m wide foundations. The relatively low allowable bearing pressure is due to the soft nature of the strata in the shallow interface between the Clay-with-flints Formation and the Chalk in the location of the proposed pavilion, less than a metre below the proposed founding depth. However, given the likely relatively light loading of the pavilion, it is assumed that a 50 kN/m² will be sufficient.

Foundations should be suitably reinforced due to the potential natural variation of the underlying CHALK & CHALK/Clay-with-flints Formation interface encountered.

Football Pitch Formation

The ground conditions encountered indicate that the formation of the sports pitches should be satisfactory for the proposed use, subject to suitable construction techniques.

The formation should be inspected for soft/loose spots by a suitably experienced geotechnical engineer. Soft spots if encountered should be removed and replaced with suitable well compacted natural material as deemed appropriate and consistent with the adjacent materials.

Care should be taken to avoid the formation softening during construction resulting from periods of heavy rain etc.

Other Considerations

It was not possible to calculate soil infiltration rates as infiltration in the trial pits was minimal. As such, it is considered that the site will require a suitably designed drainage system such as a granular/geotextile drainage layer and/or network of drainage pipes leading to the proposed attenuation pond.

No evidence of dissolution features or potential cavities has identified and there are overlying superficial deposits which reduces the risk of occurrence. However, given the known characteristics of CHALK it is recommended that a watching brief is undertaken during all groundworks and should be contacted if any dissolution features or cavities are encountered.

ACEC Class AC-1s (Design Class DS-1) conditions are indicated to prevail on site.

A CBR design value of 2%-4% is recommended for the near surface natural cohesive soils of the solid geology based on the in-situ testing and plasticity indices. A CBR design value of 10% is recommended for the granular soils (if encountered). On-site CBR testing and additional Atterberg Limit testing is recommended to confirm CBR values following confirmation of development layouts and prior to construction.

Environmental Risk Assessment & Liabilities

Risks to Site Users

Identified Sources: No significant contamination has been identified in the natural ground for the proposed end use by the chemical analyses undertaken to date.

Potential Risks: End users of the site and construction/maintenance workers are therefore not considered to be at significant risk from the site as no significant contaminant sources have been identified to date.

Risks to Controlled Waters

Potential Sources: No significant soil sources have been identified.

Potential Risks: Risks to Controlled Waters are unlikely to be significant based on the information available.

Ground Gases

According to BS8485, the site has been characterised as 'CS1' (based on preliminary monitoring data) and therefore no special gas protection measures are deemed necessary.

Basic radon measures are required for the site.

Remediation	**Human Health Remedial Measures** Based on the information available, no specific remedial measures are considered necessary to protect human health. **Protection of Controlled Waters** No specific remedial measures are considered necessary to protect Controlled Waters from the site itself, based on the information available.
Further Investigation Requirements	No further work is recommended at this stage.

This executive summary is intended to provide an outline of the site assessment concerning ground contamination and geotechnical parameters. It does not provide a definitive analysis of the information obtained.

1. INTRODUCTION

1.1 General

Geo Environmental Group (GEG) were commissioned by Brookbanks on behalf of Hallam Land (HL) (the Client) to undertake a Phase I Review & Phase II Geo-Environmental Assessment of a site known as 'Land at St Albans (Proposed Sports Pitches)', with respect to the proposed usage of the site as sports pitches associated with a wider proposed residential development.

The purpose of this report was to determine:

- Potential environmental risks and liabilities associated with any potential soil and shallow groundwater contamination in accordance with current UK Environment Agency guidance (LCRM) for a future residential end use.
- Geotechnical requirements for foundations, buried concrete, excavations, road pavement design, earthworks and slope stability with respect to the proposed development of the site.
- The potential for using storm water soakaway drainage.

1.2 Available Information

The following information was supplied by Brookbanks:

- 'Indicative Site Investigation Location Plan,' Brookbanks on behalf of HL, Drawing No. 11156-SI-01, Rev. B, dated 14th May 2025.
- 'Planning Proposal – Woollam Park, North St Albans,' on behalf of HL, Drawing No. DE-565_81, Rev. D, dated 2nd December 2024.
- 'Woollam Park, North St Albans – Geo-Environmental Phase 1 Desk Study,' Brookbanks on behalf of HL, St Albans School, and St Albans School Woollam Trust, Ref.: 11156/DS01, Rev. 04, dated 7th February 2025.
- Various utility company service drawings.

1.3 Proposed Site Development

The proposed layout comprises 3 No. rugby pitches (Pitch A 102 m x 60 m; Pitch B 120 m x 70 m; & Pitch C 115 m x 70 m) across the majority of the site, with a pavilion building adjacent to the southwest, car parking along the southwestern margins, an attenuation basin along the southeastern margins and new planting along the northwestern boundary.

1.4 Scope

The works performed by GEG included:

- A Phase I Geo-Environmental Assessment (desk study) review and a Phase II Geo-Environmental Assessment (intrusive investigation).

- Associated chemical analysis, geotechnical testing, and installation of standpipes for subsequent gas and groundwater monitoring.
- Generic quantitative human health and qualitative Controlled Waters environmental risk assessments, quantitative ground gas risk assessment, geotechnical assessment and recommendations for further investigation and/or remedial work (if required).

Limitations to the scope of the report are outlined in Section 12.

2. SITE SETTING

2.1 Site Location

The site is located approximately 2.8 km northeast of St Albans city centre in Hertfordshire, at the approximate National Grid Reference 515258E, 210146N. It lies on land approximately 260 m east of Harpenden Road (A1081) and adjacent to the east of a private access road associated with the Old Albanian RFC, and covers an area of approximately 7.6 ha.

A section of the 1:25,000 Ordnance Survey (OS) map identifying the site location is shown in Figure 1 of Appendix A. The site layout plan is presented in Figure 2 (Appendix A) and a photographic record is provided in Appendix B.

2.2 Site Description

The site currently comprises the southern majority of a wider agricultural (arable) field. The southwestern margin of the site is utilised as grassed surfaced parking accessed via a gravel-surfaced track associated with the adjacent Rugby Club. The southeastern margins of the site consist of a fringe of existing planting.

Topographically, the site is relatively level with a slight fall to the south east at an elevation of approximately 120 m AOD in the northwest to 115 m in the southeast.

The boundaries of the site are typically hedged with semi-mature deciduous trees typically along the southwestern and southeastern site boundaries. The northwestern boundary is open with the adjacent field.

2.3 Adjacent Land Uses

A summary of surrounding land-use in the immediate vicinity of the site is provided below.

Northwest	Agricultural land adjacent with existing sports pitches (the Woollam Playing Fields) 100 m northwest.
Northeast	Unnamed farm access lane adjacent followed by agricultural land (locally with a residential dwelling – 'Green Cottages') with a railway line 220 m northeast.
Southeast	Agricultural land.
Southwest	Sports pitches, parking, and facilities associated with

the Old Albanian RFC.

3. REVIEW OF AVAILABLE DESK STUDY INFORMATION

Available information relating to the history of the site, geology, hydrogeology and hydrology is summarised in the following sections extracted from the Phase I Desk Study Report undertaken by Brookbanks for a wider site boundary. As such, the information extracted below has been placed in the context of the current development area.

3.1 Landfills

No records of historical landfill sites have been identified within 250 m of the site.

3.2 Waste Management

No records of historical or operational waste treatment transfer or disposal sites have been identified within 250 m of the site.

3.3 Discharge Consents

No records of discharge consents have been identified on or within 250 m of the site.

3.4 Pollution Controls

No records of Integrated Pollution Controls (IPC) Authorisations have been identified within 250 m of the site.

3.5 Pollution Incidents

No records of Pollution Incidents to Controlled Waters have been identified within 250 m of the site.

3.6 Hazardous Substances

No records of Control of Major Accident Hazard (COMAH) or Notification of Installations Handling Hazardous Substances (NIHHS) sites have been identified within 500 m of the site.

3.7 Fuel Stations

No fuel station entries are recorded within 250 m of the site.

3.8 Contemporary Trade Directories

No records of potentially contaminative industrial sites have been identified within 250 m of the site.

3.9 Conservation

No records of Sites of Special Scientific Interest (SSSI) National Nature Reserves (NNR), Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), Special Protection Areas (SPA), Special Areas of Conservation (SAC),

Ancient Woodlands, Ramsar Sites or World Heritage Sites have been identified within 250 m of the site.

3.10 Ordnance

According to regional unexploded bomb risk maps provided by Zetica, the site falls within an area of low bomb risk and therefore no further action is required.

3.11 Historical Information

3.11.1 Site History

The Desk Study indicates that since the pre-1900s the site has remained agricultural.

3.11.2 Site Surroundings

The Desk Study indicates that by the pre-1900s the site surroundings were typically agricultural. Between 1999 and 2006, sports pitches were shown adjacent to the southwest of the site.

3.12 Geology

3.12.1 Published Geology

Reference to the 1:50,000 scale British Geological Survey digital mapping of the area (solid and drift) indicates that the solid geology beneath the site comprises the Lewes Nodular Chalk Formation and Seaford Chalk Formation (herein referred to as the Lewes Nodular & Seaford Chalk Formations) of the Cretaceous period. The formations are described individually as:

- Lewes Nodular Chalk Formation: *hard to very hard nodular chalks and hardgrounds with interbedded soft to medium hard chalks and marls. Nodular chalks are typically lumpy and iron-stained. Brash is rough and flaggy or rubbly, and tends to be dirty.*
- Seaford Chalk Formation: *firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Some flint nodules are large to very large.*

The solid geology is conjectured to be overlain by superficial deposits of the Clay-with-flints Formation across the majority and a pocket of the Kesgrave Catchment Subgroup with the central southeastern section. The superficial deposits are described as follows:

- The Clay-with-Flints Formation: *a residual deposit formed from the dissolution, decalcification and cryoturbation of bedrock strata of the Chalk Group and Palaeogene formations. It is unbedded and heterogenous. The dominant lithology is orange-brown and red-brown sandy clay with abundant nodules and rounded pebbles of flint. The deposit locally includes bodies of yellow fine- to medium- grained sand, reddish brown clayey silt, and sandy clay with beds of well-rounded flint pebbles.*

- The Kesgrave Catchment Subgroup: *mainly gravels characterised by quartz and quartzite.*

No significant faults are conjectured to intersect the site at the surface.

3.12.2 Mining and Quarrying

Reference to the Mining Remediation Authority interactive map viewer confirms that the site is not in a Coal Mining Reporting Area.

There are no BGS recorded mineral sites recorded within 250 m of the site.

3.12.3 Potential Geo-Hazards

A moderate risk of ground dissolution has been identified on site associated with the underlying chalk strata. The nearest natural cavities identified to the site are located approximately 700 m north of the site relating to 6 No. solution pipes and approximately 730 m south of the site relating to 5 No. sinkholes and 5 No. solution pipes.

No further significant potential geo-hazards such as underground workings, landslips, compressible deposits, running sands or swelling/shrinking clays are identified associated with the site in the desk study report.

3.13 Hydrogeology

3.13.1 Groundwater Designation

Environment Agency data indicates that the solid geology beneath the site is designated as a Principal Aquifer.

Principal Aquifers as assigned where geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers.

The superficial deposits of the Clay-with-Flints Formation are characterised as Unproductive strata and the Kesgrave Catchment Subgroup as a Secondary A Aquifer.

Secondary A Aquifers are defined as permeable layers capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Unproductive Strata - are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

3.13.2 Groundwater Source Protection Zone

The site lies within the Total Catchment (Zone 3) of a currently defined Groundwater Source Protection Zone (GWSPZ).

3.13.3 Groundwater Abstractions

According to the desk study report, there is 1 No. groundwater abstraction within 250 m of the site, located approximately 60 m northeast at Green Cottages.

3.14 Hydrology

3.14.1 Nearest Watercourse

The nearest watercourse is the River Ver located approximately 2.6 km south west of the site.

3.14.2 Surface Water Abstractions

According to the database search report, there are no surface water abstraction licences within 250 m of the site.

3.14.3 Surface Water Flooding

According to the Environment Agency online 'Flood Map for Planning', the site lies within Flood Zone 1, being land that lies outside the 1 in 1000 year (0.1%AEP) flood risk area and hence has a low probability of flooding.

3.15 Radon

According to the UK Health Security Agency online radon viewer, the maximum radon potential for the site is in an area where 3% to 5% of homes are estimated to be above the action level.

4. PRELIMINARY RISK ASSESSMENT AND OUTLINE CONCEPTUAL MODEL

A summary of the legislation and regulatory guidance used in the preparation of the environmental risk assessment presented in this report is provided in Appendix C.

4.1 Potential Contaminants of Concern

4.1.1 Potential On-Site Contamination Sources

Based on the historical and current usage of the site as agricultural land, the potential **on-site** contamination sources are likely to be associated with:

- Any localised spillages or leakages of fuel or oils from farm machinery/vehicles or parked vehicles along the southwestern margins of the site.
- Any historically imported contaminated Made Ground used to raise site levels/infill voids or fly-tipped material.
- Herbicides / pesticides.
- Ground gases (radon).

4.1.2 Potential Off-Site Contamination Sources

No potential significant **off-site** contamination sources have been identified associated with the site surroundings.

4.1.3 Potential Contaminants of Concern

The potential limited contaminants of concern associated with the current and historical land uses outlined above include:

- Petroleum hydrocarbons (TPH) and polyaromatic hydrocarbons (PAHs).
- Herbicides/pesticides (including aldrin, DDT, dieldrin and endrin).
- General contaminants including metals, semi-metals and non-metals, inorganic chemicals and organics.
- Ground gases (radon).

A diagrammatic illustration of the outline conceptual model is presented in Figure 3 of Appendix A.

4.2 Preliminary Human Health Conceptual Model

Potential Sources: Potential limited contamination associated with the historical and current usage of the site, as detailed in Section 4.1.

Potential Pathways: Dermal contact with soil and dust, inhalation of soil and dust, and the inhalation of indoor and outdoor vapours and ground gases. Potential combustion or explosion of ground gases in confined spaces.

Potential Receptors: Future site users of the playing fields, construction/maintenance workers and potential trespassers and adjacent residents.

4.3 Preliminary Controlled Waters Conceptual Model

Potential Sources: Potential limited localised contamination associated with the former usage of the site, as detailed in Section 4.1.

Potential Pathways: Infiltration of precipitation through the site's surface and leaching of potential contaminants and subsequent vertical migration to aquifers or lateral migration to watercourses.

Potential Receptors: Underlying groundwater in the Principal and Secondary A Aquifers and groundwater abstraction 60 m northeast (The remaining abstractions and the nearest surface water are too distant from the site to warrant further consideration, although it should be

noted that the site does lie within Zone III of a currently defined GWSPZ).

4.4 Preliminary Ground Gas Assessment

There are no records of any historical landfill sites within 250 m of the site and there is no evidence to suggest that there is a significant thickness of Made Ground on the site. Consequently, based on guidance given in Figure 6 of BS 8576:2013, the gas generation potential of the sources identified to the proposed pavilion are considered to be low at this stage. (Further assessment is presented in Section 10.2 following the intrusive investigation.)

As previously described, the site is in an area where the maximum radon potential is 3% to 5%; as such basic radon measures are required for the site.

4.5 Additional General Receptors

In addition, ecological systems (i.e. fauna and flora), together with future buildings/structures and construction materials (e.g. water supply pipes) have been considered.

5. INTRUSIVE INVESTIGATION

5.1 Site Works Overview

The following section outlines the scope of the intrusive investigation carried out by GEG in accordance with the Brookbanks' specification and details the ground conditions encountered and the chemical testing undertaken.

All work was undertaken in general accordance with British Standard guidance (BS:5930:2015 and BS:10175) and the ICE UK Specification for Ground Investigation (2nd Edition 2012) guidelines.

Prior to commencement of the works, utility service plans were viewed to investigate the location of all major services and each exploratory hole location screened with a cable avoidance tool.

The exploratory holes were logged and sampled by an experienced geo-environmental engineer from GEG. The ground conditions encountered were recorded on the exploratory hole logs (Appendix D). Where the sample is disturbed but some guidance as to the in-situ consistency can be sensibly given, the consistency term is given in brackets, in accordance with BS:5930:2015. In the absence of in-situ or laboratory tests, the relative density of coarse soils in trial pits and trenches is assessed visually in accordance with BS:5930 and placed in brackets on the exploratory hole logs.

Exploratory hole locations were surveyed using a handheld GPS surveying tool, no topographic information at the location of the exploratory holes has been provided to date.

The locations of the exploratory holes are shown on Figure 4 presented in Appendix A.

5.2 Site Works

5.2.1 General

The intrusive investigation was undertaken on 19th August 2025 and comprised window sample boreholes, machine-excavated trial pitting, infiltration testing and in-situ CBR testing.

5.2.1.1 Limitations of the Intrusive Investigation

There were no limitations to access across the site for the duration of the intrusive investigation.

5.2.2 Window Sample Holes

4 No. window sample boreholes (WS01-WS04) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 5.45 m. Each window sample hole was preceded by a hand excavated service avoidance pit to a maximum depth of 1.00 m bgl (below ground level).

Standard penetration testing SPT/SPT(C) was carried out at regular intervals in accordance with BS EN ISO 22476-3:2005+A1: 2011. A split barrel or a solid cone was used depending upon the materials encountered and the split barrel samples retained as small, disturbed samples. SPT results are summarised as uncorrected 'N' values on the borehole logs.

The uncorrected SPT 'N' Value has been used to assess the relative density in granular soils in accordance with BS5930:2015. The consistency of cohesive soils has been determined by hand pressures in accordance with Table 8 of BS5930:2015. The limitations of empirical relationships between SPT 'N' values and undrained shear strength of fine-grained soils (e.g. those determined by Stroud & Butler [1975] and Stroud [1989]) are acknowledged and as such are used for indicative purposes only.

All boreholes were installed with a 50 mm diameter standpipe to the depth detailed on the exploratory hole log for subsequent gas and groundwater monitoring.

5.2.3 Trial Pits

10 No. trial pits (IT01, IT02 & TP01-TP08) were excavated using a JCB-3CX to a maximum depth of 4.00 m to facilitate investigation of the near surface soils.

5.2.4 In Situ Testing

In situ hand vane measurements (HVP) were undertaken in the cohesive strata at select horizons within the trial pits. The hand vane records shear strength (S_u) in kPa. and are presented on the exploratory hole logs in Appendix D and summarised in Section 9.1.4. However, it should be noted that typically the granular component of the soils prohibited testing.

5.2.5 *Rationale for the Exploratory Holes*

The rationale for the exploratory locations, which was undertaken in accordance with the Brookbanks' specification, is given in Table 1 below. A plan showing the location of the exploratory holes is included as Figure 4.

Table 1. Rationale for the Exploratory Holes

Exploratory Hole	Rationale
WS01, WS03, TP01-TP03, TP05-TP08	General site coverage across the area of the proposed Pitches A-C.
WS02, WS04 & TP04	Targeting the location of the proposed pavilion.
IT01 & IT02	Targeting the location of the proposed attenuation pond.

5.2.6 *In-situ CBR Testing*

In-situ CBR testing was undertaken in 4 No. shallow exploratory holes targeting the area of the proposed car park in the southwestern margins of the site in accordance with BS 1377-9:1990. The results are presented in Section 9.1.7.

5.2.7 *Infiltration Tests*

2 No. infiltration tests were undertaken in 2 No. trial pits (IT01 & IT02) in general accordance with BRE Digest 365.

The trial pits were excavated to depths of 1.90 m and 1.70 m, respectively, and infiltration tests undertaken in the most permeable strata. Clean water was dispensed from a bowser at a rapid rate to fill each excavation as quickly as possible to the proposed depth of the invert levels and/or the most permeable strata. The excavations took less than 5 minutes to fill to the maximum capacity.

Measurements were then taken of the fall of water at suitable time increments to allow the infiltration rate to be calculated from the time taken for the water level to fall from 75% to 25% effective depth (where possible).

The infiltration test data and calculated infiltration rates are tabulated and graphically depicted on Figures F-1 and F-2 in Appendix E. The results are summarised in Table 2.

Table 2. Infiltration Test Results

Location	Depth Range of Test (m)	Test No.	Strata [1]	Effective Depth Reached	Time (mins)	Infiltration Rate (m/s)
IT01	0.90 – 1.90	1	CwF	100%	378	N/A
IT02	0.70 – 1.70	1	CwF	95%	361	N/A

N/A=Not Applicable
[1] CwF=Clay-with-flints Formation.

As shown in Table 2, the water levels in IT01 and IT02 showed very little or no infiltration and consequently no infiltration rates could be calculated.

Recommendations with respect to site drainage are presented in Section 9.5.

5.2.8 Reinstatement

The trial pits were backfilled with arisings and left slightly mounded to allow for future settlement. Boreholes installed with standpipes and lockable flush covers.

5.2.9 Sampling

Samples were taken from the exploratory holes for geotechnical and chemical testing, as described in Sections 5.4 and 5.5 respectively.

5.3 Gas and Groundwater Monitoring

5.3.1 Rationale for Gas Monitoring

The ground conditions encountered in the exploratory holes confirmed that Made Ground appeared absent across the site. This is considered consistent with the low gas generation potential identified in the Preliminary Ground Gas Assessment (Section 5.4). Consequently, in accordance with Figure 6 of BS8576:2013, gas monitoring is not necessarily a requirement; however, 3 No. initial visits were undertaken for confirmatory purposes, as detailed below.

5.3.2 Gas Monitoring Programme

Gas and groundwater monitoring to date was undertaken in September 2025 targeting periods of falling atmospheric pressure where possible. The standpipes were monitored for peak concentrations of methane and carbon dioxide, oxygen, hydrogen sulphide, and the associated gas flow rate using a GMF gas analyser. Atmospheric pressure and trend was also recorded. Further monitoring is ongoing based on a monthly programme.

Table 3. Gas Monitoring Results

Borehole	Date	Atmospheric Pressure	Atmospheric Pressure Trend	CH_4	CO_2	O_2	H_2S	Borehole Flow
		mb		*% Vol.*			*ppm*	*l/hr*
WS01	02/09/25	987	Steady	0.0	0.9	18.4	0	0.0
WS02	02/09/25	986	Steady	0.0	0.0	19.6	0	0.0
WS03	02/09/25	987	Steady	0.0	0.8	18.7	0	0.0

Borehole	Date	Atmospheric Pressure	Atmospheric Pressure Trend	CH_4	CO_2	O_2	H_2S	Borehole Flow
		mb		*% Vol.*			*ppm*	*l/hr*
WS04	02/09/25	986	Steady	0.0	1.9	17.7	0	0.0

Notes: CH_4=methane; CO_2=carbon dioxide; O_2=oxygen; H_2S=hydrogen sulphide.

The gas monitoring results to date recorded methane concentrations of 0.0% and carbon dioxide concentrations of 0.0% to 1.9% with a maximum borehole flow rate 0.0 l/hr. Hydrogen sulphide levels were all 0 ppm.

The water levels were monitored using a dip meter; results are presented in Section 5.6.6.

5.4 Geotechnical Laboratory Testing

Selected samples were dispatched to Geo Site and Testing Services Ltd and scheduled for geotechnical testing. The schedule of testing comprised:

- 24 No. natural moisture contents (BS1377: Part 2: 1990: 3.2).
- 12 No. liquid and plastic limits (BS1377: Part 2: 1990: 4.2-4.4 & 5.2-5.4).
- 12 No. particle size distribution wet sieve method (BS EN ISO 17892-4 : 5.1).
- 12 No. sedimentation by pipette carried out with wet sieve (BS EN ISO 17892-4 : 5.4).

The results of the geotechnical testing are presented in Appendix I.

12 No. water soluble sulphate and pH determinations were also undertaken on the natural soils as part of the chemical testing (Section 5.5).

5.5 Chemical Laboratory Testing

5.5.1 Schedule of Analysis

Representative samples of natural ground were dispatched to I2 Analytical for chemical analysis. All soil analysis was MCerts accredited where possible. The results of the chemical testing are presented in Appendix F.

Soils

Metals:	Cadmium, chromium (total, III and VI), copper, lead, nickel, zinc, mercury, antimony.
Semi-Metals and Non-Metals:	Arsenic, boron, selenium.
Inorganic Chemicals:	Cyanide (total and free), sulphate (soluble), sulphide.

Others:	pH, soil organic matter.
Organics:	Total phenols, TPH aliphatic/aromatic split, speciated polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCP)*, organophosphorus pesticides (OPP)*, BTEX (benzene, toluene, ethylbenzene & xylene), MTBE (methyl tert-butyl ether).

** Selected samples only*

5.5.2 Scope of Analysis

The scope of the chemical testing as outlined in Section 5.5.1 is summarised in Table 4 below.

Table 4. Scope of Natural Ground Chemical Testing

Sample Type	Analyses	No.	Rationale
Natural Ground	General Suite	12	General site coverage
	Pesticides (OCP & OPP)	3	

5.6 Ground Conditions Encountered

The ground conditions encountered are described below and broadly confirmed the published geology. The strength/relative density of the strata is detailed further in the geotechnical assessment in Section 9.1.

5.6.1 Made Ground

No Made Ground was encountered in the exploratory holes.

5.6.2 Topsoil

Typically firm CLAY topsoil was encountered across site to a depth of 0.30 m.

5.6.3 Kesgrave Catchment Supergroup

No definitive representation of the Kesgrave Catchment Supergroup were encountered in the exploratory holes.

5.6.4 Clay-With-Flints Formation

The Clay-with-flints Formation was encountered across the site underlying the topsoil at proven depths of between 1.90 and 4.60 m. It typically comprised firm to stiff (occasionally very stiff) variably sandy gravelly (quartzite, chalk and flint) CLAY locally with low cobble and boulder content. Subordinate dense clayey GRAVEL with high cobble and boulder content was encountered from 0.70 to 1.20 m in IT02 and from 0.30 to 0.45 m in TP03.

5.6.5 *Lewes Nodular & Seaford Chalk Formations*

The Lewes Nodular & Seaford Chalk Formations were encountered underlying the Clay-with-Flints Formation at 9 No. locations (WS01, WS02, WS04, TP02 & TP04-TP08) from depths of between 1.80 and 4.60 m to the base of the exploratory holes. It typically comprised structureless CHALK composed of variably gravelly SILT and GRAVEL (Grades Dm to Dc, respectively).

It is noted that discernment of chalk grade from disturbed borehole samples is inherently difficult as drilling disrupts the natural structure of the chalk. As such, chalk grade boundaries may vary from those interpreted.

5.6.6 *Groundwater*

No groundwater was encountered in the majority of the exploratory holes during the intrusive investigation with the exception of seepages at 2.00 m in TP05, TP06 and TP08.

Groundwater levels recorded in the boreholes during the subsequent monitoring visits are summarised in Table 5.

Table 5. Groundwater Levels Recorded During the Monitoring Visits

Borehole	Date	Depth of Installation (m)	Groundwater Depth (m)
WS01	02/09/25	5.00	Dry
WS02	02/09/25	5.00	Dry
WS03	02/09/25	3.00	Dry
WS04	02/09/25	5.00	Dry

Groundwater levels may vary due to seasonal and other effects, including the relatively short time periods for which the trial pits remained open.

5.6.7 *Stability of Trial Pits*

The sides of all trial pit excavations were stable.

5.6.8 *Visual and Olfactory Evidence of Contamination*

No visual or olfactory evidence of contamination was encountered in any of the exploratory holes undertaken.

6. GENERIC HUMAN HEALTH QUANTITATIVE RISK ASSESSMENT

6.1 Generic Human Health QRA

6.1.1 S4ULs

The LQM/CIEH 'Suitable 4 Use Levels' (S4ULs), where available, have been used in the generic human health quantitative risk assessment (*copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3911*). The S4ULs are available for a range of generic land uses and Soil Organic Matter (%SOM) contents. In this case, the most applicable land use is the 'POS Residential' scenario with (where applicable) a SOM of 1%.

Where no S4ULs are available, reference has been made to DEFRA Category 4 Screening Levels (C4SLs) in accordance with EA LCRM Stage 1 Risk Assessment Guidance have been used in the generic human health quantitative risk assessment, or in-house Generic Assessment Criteria (GACs) derived in CLEA v.1.071, as detailed below, or the now withdrawn Soil Guideline Values (SGVs) used as a screening tool only.

6.1.2 CLEA v.1.071

In house GACs were derived in CLEA v.1.071, assuming a 'sand' soil type of pH 7 and SOM of 1%. The closest pathway, the 'residential without home grown produce' for a semi-detached property, has been used in the assessment as this is the most sensitive generic land use and building type in the CLEA model applicable to the most sensitive end use of the proposed development.

The exposure pathways used in the CLEA model were:

- Ingestion of soil and dust
- Dermal contact with soil and dust
- Inhalation of soil and dust
- Inhalation of vapours outdoors
- Inhalation of vapours indoors

6.1.3 Other Assessment Criteria

EIC/AGS/CL:AIRE GAC have been used where available for organic compounds not covered by the CLEA Model. In the absence of these, the Risk Based Corrective Action (RBCA) Toolkit has been used.

A GEG in-house GAC for total cyanide (for all end uses) has been derived based on acute toxicity and a one-time soil ingestion event.

Sulphate and sulphide were not assessed as these contaminants are not generally considered to represent a significant risk to human health unless at extremely high levels.

6.1.4 *PAH Profiling*

Methodology

Public Health England (2017) has recommended benzo(a)pyrene as a surrogate marker for the assessment of the risks posed by genotoxic PAH compounds where sufficiently similar to the 2 No. coal tar mixtures investigated by Culp *et al.* (1998).

Using a PAH profiling tool, it is possible to assess how closely the ratio of benzo(a)pyrene correlates to the standard mixtures of PAHs. If the mean results are within ±x10 of the 2 No. coal tar mixtures then it is possible to use benzo(a)pyrene as a surrogate PAH marker.

Assessment

The assessment is presented in Appendix G and confirms that samples which recorded PAH levels above the laboratory detection limit showed PAH profiles sufficiently similar to the Culp coal tar profiles to allow benzo(a)pyrene to be used as a surrogate marker. The majority of positive results were found to be within ±x2.5 and all were within or close to the HPA limit of ±x10 the coal tar profiles. The following samples were classified as containing coal tar PAHs:

- IT02 (0.20 m)
- TP06 (0.20 m)
- WS03 (0.20 m)
- WS04 (0.20 m)

PAH concentrations recorded in the above sample were therefore assessed using benzo(a)pyrene as a surrogate marker. The PAHs recorded for the other samples were screened individually against the respective critical concentrations, as detailed in the following sections.

6.1.5 *Vapour Risk Associated with PAHs*

PAHs (including benzo(a)pyrene) are typically of low volatility. However, selected compounds including naphthalene and to a lesser extent dibenzo(ah)anthracene, benzo(a)anthracene, and ideno(123-cd)pyrene are of higher volatility. Consequently, GEG consider that the benzo(a)pyrene surrogate marker approach could potentially not fully characterise vapour risks for PAHs, particularly if mixtures are present containing for example naphthalene. As such GEG screen individual PAHs against inhalation health criteria values (IHCV) derived in CLEA to assess these risks (as detailed in the following sections).

6.2 Direct Screening of Soil Chemical Data

6.2.1 *Natural Ground*

6.2.1.1 *General Contaminants*

The natural ground chemical analyses were screened directly against the critical concentrations in Table A (Appendix H) (12 No. samples).

All determinands from the natural ground were below the relevant critical concentrations including:

- Metals (arsenic, cadmium, chromium VI, chromium III, copper, lead, mercury, nickel, zinc and antimony).
- Semi-metals and non-metals (boron and selenium).
- Inorganic chemicals (total and free cyanide).
- Organics (total phenols, TPH aliphatic/aromatic split, coal tar PAHs, USEPA 16 polycyclic aromatic hydrocarbons [naphthalene, acenaphthylene, acenaphthene, fluorine, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(123-cd)pyrene, dibenzo(ah)anthracene and benzo(ghi)perylene], BTEX, and MTBE.

The recorded levels of individual PAHs were screened against the CLEA derived inhalation health criteria value (IHCV) in Table B. No samples were found to be above the relevant criteria and as such are not considered to represent a potential vapour risk via the inhalation pathway.

6.2.1.2 Pesticides

No organochlorine and organophosphorus pesticides were identified in the 3 No. samples of natural ground analysed.

6.3 Summary of Soil Contamination

No elevated soil contaminants have been identified.

7. GENERIC CONTROLLED WATERS QUANTITATIVE RISK ASSESSMENT

7.1 Identified Soil Contaminants

No significant sources of contamination have been identified by the soil analyses undertaken.

7.2 Identified Groundwater Contaminants

No groundwater analyses were undertaken as part of this investigation.

8. GROUND GAS RISK ASSESSMENT

The preliminary gas monitoring results recorded has been assessed against guidance presented in BS8485 (2015+A1:2019) for 'Assessing risks posed by hazardous ground gas to buildings' for 'Situation A - all development types except low rise houses with gardens' for school (public building) use to reflect the proposed development. Using a maximum concentrations of methane and carbon dioxide of 0.0% and 0.0%, respectively, and the maximum recorded borehole flow

rate of 0.0 l/hr, this corresponds to gas screening values (GSV) of 0.000 l/hr and 0.000 l/hr, respectively. Therefore, for school/public buildings, according and Table 2 of BS8485, using the GSV the site is provisionally characterised as 'CS1'. However, further monthly ground gas monitoring is underway and the final characterisation will be provided on completion of the monitoring.

As previously described, the maximum radon potential for the site is in an area where 3% to 5% of homes are estimated to be above the action level; as such basic radon measures are required for the site.

9. GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

9.1 Overview

9.1.1 Summary of Strata Encountered

Typically firm CLAY topsoil was encountered across site to a depth of 0.30 m.

The Clay-with-flints Formation was encountered across the site underlying the topsoil at proven depths of between 1.90 and 4.60 m. It typically comprised firm to stiff (occasionally very stiff) variably sandy gravelly (quartzite, chalk and flint) CLAY locally with low cobble and boulder content. Subordinate dense clayey GRAVEL with high cobble and boulder content was encountered from 0.70 to 1.20 m in IT02 and from 0.30 to 0.45 m in TP03.

The Lewes Nodular & Seaford Chalk Formations were encountered underlying the Clay-with-Flints Formation at 9 No. locations (WS01, WS02, WS04, TP02 & TP04-TP08) from depths of between 1.80 and 4.60 m to the base of the exploratory holes. It typically comprised structureless CHALK composed of variably gravelly SILT and GRAVEL (Grades Dm to Dc, respectively).

9.1.2 Groundwater

No groundwater was encountered in the majority of the exploratory holes during the intrusive investigation with the exception of seepages at 2.00 m in TP05, TP06 and TP08. No groundwater was encountered during the groundwater monitoring to date.

9.1.3 Trial Pit Stability

The sides of all trial pit excavations were stable.

9.1.4 Undrained Shear Strength

9.1.4.1 Undrained Shear Strength (s_u) Derived from Hand Vane Measurements

The results of the hand shear vane tests are presented in Graph 1 of Appendix I for the Clay-with-flints Formation. Undrained strength classifications are quoted in accordance with Table 9 of BS5930:2015 with the former terminology in brackets.

In-situ hand shear vane tests recorded undrained shear strengths of 106 to 269 kN/m² from 0.60 to 1.80 m in the cohesive strata. This indicates an undrained strength classification of high (stiff) to very high (very stiff).

9.1.4.2 *Standard Penetration Tests (SPT) 'N' Values – Shear Strength*

The results of the SPTs are presented in Graph 2 of Appendix I of the Clay-with-flints Formation.

8 No. SPTs undertaken in the natural cohesive recorded 'N' values of 9 to 27 at depths of 1.00 to 4.00 m, which based on the relationship: $s_u = f1 \times N$ after Stroud 1974, where f1 is assumed as 4.5, indicates undrained shear strengths (s_u) of 41 to 122 kN/m^2, respectively.

1 No. SPT/CPT was undertaken in the cohesive soils, which recorded an 'N' value >50 (WS03 at 3.00 m). This has been interpreted as very stiff.

9.1.4.3 *Geotechnical Laboratory Testing*

The results of the undrained triaxial testing is currently outstanding and will be included with a later revision of this report.

9.1.5 *Chalk*

A total of 9 No. standard penetration tests (SPTs) 'N' values recorded in the Chalk ranged from 4 to 19 at depths of 2.00 to 5.00 m. However, it should be noted that SPTs are unreliable in CHALK and are therefore only used as an indication of density/strength. Furthermore, discernment of chalk grade from recovered samples of chalk in the boreholes is difficult as the drilling typically disrupts the natural structure of the chalk due to in-situ disturbance during drilling.

9.1.6 *Plasticity Indices (PI)*

The Modified Plasticity Indices and Volume Change Potential of the natural clay are presented in Table 6 below in accordance with NHBC Standards Chapter 4.2.

Table 6. Volume Change Potential

Location / Depth (m)	Strata [1]	Plasticity Index (Ip) (%)	Fraction <0.425mm (%)	Modified Plasticity Index (I'p) [2] (%)	Volume Change Potential
IT01 / 0.70	CwF	27	76	21	Medium
IT01 / 1.80	CwF	29	88	26	Medium
IT02 / 0.60	CwF	32	93	30	Medium
TP01 / 0.90	CwF	30	90	27	Medium
TP02 / 0.70	CwF	34	96	33	Medium
TP02 / 2.30	CHK	25	100	25	Medium
TP03 / 0.70	CwF	31	90	28	Medium
TP04 / 0.80	CwF	34	94	32	Medium

Location / Depth (m)	Strata [1]	Plasticity Index (Ip) (%)	Fraction <0.425mm (%)	Modified Plasticity Index (I'p) [2] (%)	Volume Change Potential
TP05 / 0.80	CwF	36	87	31	Medium
TP06 / 0.80	CwF	35	90	32	Medium
TP07 / 1.00	CwF	37	97	36	Medium
TP08 / 0.90	CwF	29	92	27	Medium

[1] CwF=Clay-with-flint Formation; CHK=Lewes Nodular & Seaford Chalk Formations.
[2] Modified Plasticity Index (I'p) = Plasticity Index (Ip) x (% <0.425mm/100)

9.1.7 In-situ CBR Testing

In-situ CBR test results and calculated subgrade surface modulus (in accordance with CD225) are presented in Table 7 below.

Table 7. In-situ CBR Test Results & Estimated Subgrade Surface Modulus

Exploratory Hole / Depth (m)	On-Site Testing Laboratory's Description	Strata [1]	In Situ CBR Value [3]	Estimated Subgrade Surface Modulus (E) (MPa) [2]
CBR01 / 0.35	Fine gravelly silty CLAY	CwF	4.9%	49
CBR02 / 0.35	Fine gravelly silty CLAY	CwF	4.8%	48
CBR03 / 0.35	Fine gravelly silty CLAY	CwF	3.6%	40
CBR04 / 9.7	Fine to medium gravelly silty CLAY	CwF	9.7%	75

[1] CwF=Clay-with-flints Formation.
[2] Based on $E = 17.6(CBR)^{0.64}$ [Valid for CBR values in the range 2-12%]
[3] These results should be viewed with caution due to the gravel content of the soils.

9.1.8 Preliminary Equilibrium CBR Results from Plasticity Indices

In addition to the in-situ CBR testing, preliminary equilibrium CBR values of the cohesive strata have been determined based on plasticity index tests in accordance with CD225 and TRL LR1132 to determine long term values. The subgrade surface modulus has also been estimated from the preliminary equilibrium CBR results. These are presented below in Table 8.

Table 8. Preliminary Equilibrium CBR Values & Subgrade Surface Modulus

Location / Depth (m)	Strata [1]	Plasticity Index (%)	Equilibrium CBR Value % [2]	Estimated Subgrade Surface Modulus (E) (MPa) [3]	
				Min	Max
IT01 / 0.70	CwF	27	2.5 - 3.5	32	39
IT02 / 0.60	CwF	32	2.5 - 3.5	32	39
TP01 / 0.90	CwF	30	2.5 - 3.5	32	39
TP02 / 0.70	CwF	34	2.5 - 3.5	32	39
TP03 / 0.70	CwF	31	2.5 - 3.5	32	39
TP04 / 0.80	CwF	34	2.5 – 3.5	32	39
TP05 / 0.80	CwF	36	2.0 – 3.5	27	39
TP06 / 0.80	CwF	35	2.0 – 3.5	27	39
TP07 / 1.00	CwF	37	2.0 – 3.5	27	39
TP08 / 0.90	CwF	29	2.5 - 3.5	32	39

[1] CwF=Clay-with-flints Formation.
[2] Assumes high water table and thin layer construction.
[3] Based on $E = 17.6(CBR)^{0.64}$ [Valid for CBR values in the range 2-12%]

9.1.9 Proposed Development

As previously described, the proposed layout comprises 3 No. Pitches across the majority of the site, with a pavilion building adjacent to the southwest, car parking along the southwestern margins, an attenuation basin along the southeastern margins and a new planting along the northwestern boundary.

9.2 Identified Geotechnical & Other/Ground Constraints

The following potential geotechnical/ground constraints have been identified:

Chalk

- Variability in the density of the Grade Dm/Dc CHALK.
- Potential dissolution features in the CHALK.

Groundwater

- Localised minor seepages groundwaters in at 2.00 m in TP05, TP06 and TP08.

Other Considerations

- Potential desiccation of the cohesive strata with respect to localised existing trees along the site boundaries.
- Soft surface conditions in particular in winter months following periods of heavy rain including potential drainage issues associated with the identified low infiltration.

9.3 Anticipated Foundation Types

It is recommended that foundation loads for the proposed pavilion are transferred onto the natural firm CLAY of the Clay-with-flints Formation utilising traditional strip/trench or pad foundations. An allowable bearing pressure of 50 kN/m² is recommended on the firm clay, such loads are anticipated to give total settlements of less than 25 mm for 0.60 m wide foundations. The relatively low allowable bearing pressure is due to the soft nature of the strata in the shallow interface between the Clay-with-flints Formation and the Chalk in the location of the proposed pavilion, less than a metre below the proposed founding depth. However, given the likely relatively light loading of the pavilion, it is assumed that a 50 kN/m² will be sufficient.

Foundations should be suitably reinforced due to the potential natural variation of the underlying CHALK & CHALK/Clay-with-flints Formation interface encountered.

Based on NHBC Chapter 4.2 and the ground conditions encountered a minimum foundation depth of 0.90 m is recommended for the cohesive strata (based on medium volume change potential) deepened below any soft layers/pockets.

9.4 Football Pitch Formation

The ground conditions encountered indicate that the formation of the sports pitches should be satisfactory for the proposed use, subject to suitable construction techniques.

The formation should be inspected for soft/loose spots by a suitably experienced geotechnical engineer. Soft spots if encountered should be removed and replaced with suitable well compacted natural material as deemed appropriate and consistent with the adjacent materials.

Care should be taken to avoid the formation softening during construction resulting from periods of heavy rain etc.

9.5 Drainage

It was not possible to calculate soil infiltration rates as infiltration in the trial pits was minimal. As such, it is considered that the site will require a suitably designed drainage system such as a granular/geotextile drainage layer and/or network of drainage pipes leading to the proposed attenuation pond.

9.6 Potential Dissolution Features

As previously described, no evidence of dissolution features or potential cavities has identified and there are overlying superficial deposits which reduces the risk of occurrence. However, given the known characteristics of CHALK it is recommended that a watching brief is undertaken during all groundworks and should be contacted if any dissolution features or cavities are encountered.

9.7 Chemical Attack on Buried Concrete

On the basis of the maximum soil soluble sulphate concentration for the site of 39 mg/l, and most acidic pH of 6.2 (excluding the topsoil which is to be stripped),

ACEC Class AC-1s (Design Class DS-1) conditions are indicated to prevail on site as defined in BRE Special Digest 1 (2005) for buried concrete, based on natural ground locations and static groundwater conditions.

9.8 Underground Plastic Services

Special precautions with respect to the protection of underground plastic water mains are not considered necessary for this site based on the information available.

9.9 Slope Stability and Retaining Walls

Based on current ground levels, slope stability is not considered an issue on this site. However, should significant cut/fill be proposed, further assessment is recommended.

Any proposed retaining walls, slopes or significant changes in site profiles would need to be designed by a suitably experienced engineer.

9.10 Excavations

Dewatering of shallow excavations is unlikely to be required except during periods of heavy precipitation or if excavations are to remain open for prolonged periods.

In general shallow excavations are likely to be stable for short periods of time. However, in deeper excavations and/or where shallow groundwater is encountered, excavations are likely to be less stable and will locally require shoring; particularly where excavations extend beyond 1.20 m depth. In accordance with current Health and Safety Requirements, shoring or battering back of excavations is required in all cases where access for personnel is required to enter those excavations whenever there is a risk that collapse of the excavation could occur.

9.11 Road Pavement Design

Recorded in-situ CBR values and associated estimated subgrade surface moduli (E), respectively, were 3.6% to 9.7% and 40 to 75 MPa for the Clay-with-flint Formation (as detailed in Section 9.1.7).

Preliminary equilibrium CBR values based on Atterberg Limit testing (albeit for slightly deeper strata) and associated minimum and maximum estimated subgrade surface moduli, respectively, were: 2.0% to 3.5% and 27 to 39 MPa for the Clay-with-flint Formation (as detailed in Section 9.1.8).

A CBR design value of 2%-4% is recommended for the near surface natural cohesive soils of the solid geology based on the in-situ testing and plasticity indices. A CBR design value of 10% is recommended for the granular soils (if encountered). On-site CBR testing and additional Atterberg Limit testing is recommended to confirm CBR values following confirmation of development layouts and prior to construction.

9.12 Loose/Soft Spots

The formation should be inspected for soft/loose spots by a suitably experienced engineer. Soft spots (e.g. soils typically with an undrained shear strength less than

30 kN/m²) if encountered should be removed and replaced with suitable well compacted granular material/lean mix concrete as deemed appropriate. Soft spots beneath roads may also require the use of additional geotextiles. Any loose soils at formation level may need to be proof rolled to increase their relative density.

10. ENVIRONMENTAL CONCLUSIONS & RECOMMENDATIONS

Following the findings of the intrusive investigation and generic quantitative risk assessment, the preliminary conceptual site model has been revised as detailed below in Sections 10.1.1 and 10.1.2 and as illustrated in Figures 6A and 6B of Appendix A.

10.1 Revised Conceptual Model

10.1.1 Revised Human Health Conceptual Model

Identified Sources: No significant contamination has been identified in the natural ground for the proposed end use by the chemical analyses undertaken to date.

Potential Risks: End users of the site and construction/maintenance workers are therefore not considered to be at significant risk from the site as no significant contaminant sources have been identified to date.

10.1.2 Revised Controlled Waters Conceptual Model

Potential Sources: No significant soil sources have been identified.

Potential Risks: Risks to Controlled Waters are unlikely to be significant based on the information available.

10.2 Ground Gases

According to BS8485, the site has been characterised as 'CS1' (based on preliminary monitoring data) and therefore no special gas protection measures are deemed necessary. As such, based on the carbon dioxide and methane readings obtained to date and the maximum recorded borehole flow rates, gas protection measures are not required. However, further monthly ground gas monitoring is underway and although the conclusions are unlikely to change, the final characterisation can only be provided on completion of the monitoring.

Should any significant quantities of biodegradable materials be encountered beneath the proposed properties during development, specific investigation or construction (backfilled ponds etc.), these should be removed and replaced with inert material.

As previously described, basic radon measures are required for the site.

10.3 Risks to Adjacent Land and Third Parties

The information available indicates that risks to adjacent land from the area investigated are not considered to be significant.

10.4 Risks from Adjacent Land and Third Parties

Risks from adjacent land are not considered to be significant based on the information available.

10.5 Potential Geo-Environmental Liabilities

Potential geo-environmental liabilities under Pt2A of the Environmental Protection Act (1990) and the Groundwater Regulations (GWR) 2009, relating to the site in its current condition are not anticipated to be significant.

10.6 Waste Classification

The chemical analysis undertaken indicates that the future soil arisings from the site are likely to be classified as inert/non-hazardous waste.

10.7 Re-Use of Topsoil

The chemical analysis undertaken indicates that the topsoil present on site is chemically suitable for re-use.

10.8 Remediation

10.8.1 Human Health Remedial Measures

Based on the information available, no specific remedial measures are considered necessary to protect human health.

10.8.2 Protection of Controlled Waters

No specific remedial measures are considered necessary to protect Controlled Waters from the site itself, based on the information available.

10.8.3 Unidentified Contamination

GEG should be contacted if any unidentified contamination is encountered as part of any future ground works, with a view to its assessment and removal.

10.8.4 Unidentified Underground Structures

GEG should be contacted if any underground structures are encountered such as tanks or wells to determine further requirements.

10.9 Further Assessment

No further work is recommended at this stage.

11. REFERENCES

1. British Standard Institute (1990) BS: 1377 Parts 1-9. Methods of Tests for Soils for Civil Engineering Purposes.

2. British Standard Institute (2015) BS: 5930 Code of Practice for Site Investigations. BSI, London.

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

4. British Standard Institute (2011) BS: 10175 Code of Practice for Investigation of Potentially Contaminated Sites. BSI, London.

5. BRE Report 414 (2001). Protective measures for housing on gas-contaminated land. BRE Press, Berkshire.

6. BRE Digest 412 (February 1996). Desiccation in clay soils.

7. BRE SD1 (2005): Special Digest 1:2005. Concrete in Aggressive Ground.

8. CIRIA Publication C665 (2007): Assessing risks posed by hazardous ground gases to buildings.

9. CIEH and CL:AIRE (May 2008). Comparing Soil Concentration Data with a Critical Concentration.

10. CL:AIRE (Feb 2021). Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration. Version 1.1 19th February 2021.

11. Culp, S., Gaylor, D., Sheldon, W., Goldstein, L. and Beland, F. (1998) A comparison of the tumours induced by coal tar and benzo(a)pyrene in a 2-year bioassay. *Carcinogenesis, 19 (1) 117-124*

12. DEFRA (July 2008). Guidance on the Legal Definition of Contaminated Land.

13. DEFRA (2002b*) Model Procedures for the Management of Contaminated Land, Report CLR 11.*

14. DEFRA. SP1010: (December 2014) *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.

15. Driscoll (1983) The Influence of Vegetation on the Swelling and Shrinking of Soils in Britain. Geotechnique Vol. 33 No.2.

16. DRMB CD 225 Design for New Pavement Foundations. Revision 1. Highway England, Transport Scotland, Welsh Government & Department for Infrastructure.

17. Driscoll (1983) The Influence of Vegetation on the Swelling and Shrinking of Soils in Britain. Geotechnique Vol. 33 No.2.

18. Edwards, P. & Fleming, P. (2013). The LWD Best Practice Guide Draft 10. Pavement Foundations Working Group.

19. Environment Agency. *Environmental Quality Standards*.

20. Environment Agency 2009. *Human health toxicological assessment of contaminants in soil (Science Report Final SC050021/SR2).*

21. Environment Agency 2021. *Land Contamination Risk Assessment (LCRM).*

22. Environment Agency 2009. *Updated technical background to the CLEA model (Science Report Final SC050021/SR3).*

23. Environment Agency, 2009. Science Reports SC050021: arsenic SGV, nickel SGV, mercury SGV, selenium SGV, cadmium SGV, benzene SGV, toluene SGV, ethylbenzene SGV, xylene SGV, dioxins, furans and dioxin-like PCBs SGV and phenol SGV.

24. Environment Agency, 2009. Science Reports SC050021 Supplementary Information for the derivation of arsenic SGV, nickel SGV, mercury SGV, selenium SGV, cadmium SGV, benzene SGV, toluene SGV, ethylbenzene SGV, xylene SGV, dioxins, furans and dioxin-like PCBs SGV and phenol SGV.

25. Environment Agency, Scottish Environment Protection Agency, Environment and Heritage Centre, Technical Guidance WM3. January 2021. Guidance on the classification and assessment of waste (1st Edition v1.1.GB).

26. Geological Society Engineering Group Working Party Report, 1970. The logging of rock cores for engineering purposes. Quarterly Journal of Engineering Geology 3, 1-24 (24 pages).

27. Highway England (2020) CD225 Design for New Pavement Foundations.

28. ICE Publishing (2012) UK Specification for Ground Investigation – Second Edition. Site Investigation Steering Group.

29. Land Quality Press, Nottingham. The LQM/CIEH S4ULs for Human Health Risk Assessment. Nathanail, C.P.; McCaffrey, C.; Gillett, A.G.; Ogden, R.C. & Nathanail, J.F. 2015.

30. NHBC Standards Chapter 4.2. (2011). Building Near Trees.

31. NHBC and RSK Group (2007) *Guidance on Evaluation of Development Proposals on Sites Where Methane and carbon Dioxide are Present*. 10627-R01(04).

32. Scotland and Northern Ireland Forum for Environment Research (2003) *Method for Deriving Site-Specific Human Health Assessment Criteria for Contaminants in Soil.*

33. Stroud, M.A. (1974). The Standard Penetration Test in Insensitive Clays and Soft Rocks. Proceedings of the European Symposium on Penetration Testing, Stockholm, Vol. 2.2 pp 367-375.

34. Stroud, M.A. and Butler, FG, (1975). The Standard Penetration Test and the Engineering Properties of Glacial Materials. Proceedings of the Symposium on the Engineering Behaviour of Glacial Materials, University of Birmingham.

35. Thomlinson, M.J. (2001) Foundation Design and Construction, Seventh Edition, Table 2.11, page 77.

36. Total Petroleum Hydrocarbon Criteria Working Group Series (1998) Volume 5. *Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach.*

37. TRL. Powell, W.D., Potter, J.F., Mayhew, H.C. & Nunn, M.E. LR1132, The Structural Design of Bituminous Roads.

38. Wilson, S. & Card, G. CIRIA/Environmental Protection UK Ground Gas Seminar – 22nd June 2011 and 13th September 2011. A pragmatic approach to ground gas risk assessment for the 21st Century.

12. LIMITATIONS

As with all intrusive site investigations, there is a possibility that localised contamination 'hotspots'/geotechnical features remain undetected on the site. Therefore, as with standard practices, this report does not provide a warranty to cover limited localised contamination 'hotspots'/geotechnical features or any post-investigation importation of contamination.

The conclusions and recommendations stated herein are based on information available at the time of production. These may not necessarily apply if the site is to be utilised for a more or less sensitive purpose in the future, or if operational procedures or management alter over time.

GEG maintain intellectual copyright of the contents of this report and grant exclusive use of the material contained herein to the client, the client's agents, the client's respective sub-contractors and the specific local authority. No unauthorised distribution shall be made to any third parties without the prior consent of both GEG Ltd and the Client.

GEG shall not be liable by reason of any representation (unless fraudulent), or any implied warranty, condition or other term, or any duty at common law for any loss of profit or any indirect, special or consequential loss, damage, costs, expenses or other claims (whether caused by the negligence of the Supplier, its servants, sub-contractors or agents or otherwise) which arise out of or in connection with the provision of the Specified Service or their use by the Client.

It should be noted that any warranty or liability offered or incurred by GEG, related to this report commences from the date of first issue of this report and is not altered by subsequent report revisions.

Whilst GEG may identify the presence of potential invasive plant species during the standard geo-environmental walkover and/or investigations, the Client should be aware that ecological issues including an invasive species surveys etc. are beyond the scope of the works and as such no associated liability is accepted by GEG.

Appendix C Thames Water Asset Mapping

Asset location search

Thames Water Property Searches

PJA Engineering
LONGBRIDGE
B31 2UQ

Search address supplied

O A Sports
Old Albanian Sports Club
160
Harpenden Road
St. Albans
AL3 6BB

Your reference 05920 - St Albans

Our reference ALS/ALS Standard/2023_4892519

Search date 10 October 2023

Notification of Price Changes

From 1st April 2023 Thames water Property Searches will be increasing the prices of its CON29DW, CommercialDW Drainage & Water Enquiries and Asset Location Searches. Historically costs would rise in line with RPI but as this currently sits at 14.2%, we are capping it at 10%.

Customers will be emailed with the new prices by January 1st 2023.

Any orders received with a higher payment prior to the 1st April 2023 will be non-refundable. For further details on the price increase please visit our website at www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Asset location search

Property Searches

Search address supplied: O A Sports, Old Albanian Sports Club, 160, Harpenden Road, St. Albans, AL3 6BB

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset location search

Thames Water Property Searches

Waste Water Services

Please provide a copy extract from the public sewer map.

Following examination of our statutory maps, Thames Water has been unable to find any record of public sewerage within this area. However, there may be other sewerage pipework within the area that is not owned by the company. You may be able to obtain records of such pipework from the building control department of your local authority, from property deeds or from neighbouring landowners.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Following examination of our statutory maps, Thames Water has been unable to find any plans of water mains within this area. If you require a connection to the public water supply system, please write to:

New Connections / Diversions
Thames Water
Network Services Business Centre
Brentford
Middlesex
TW8 0EE

Tel: 0845 850 2777
Fax: 0207 713 3858
Email: developer.services@thameswater.co.uk

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.

- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

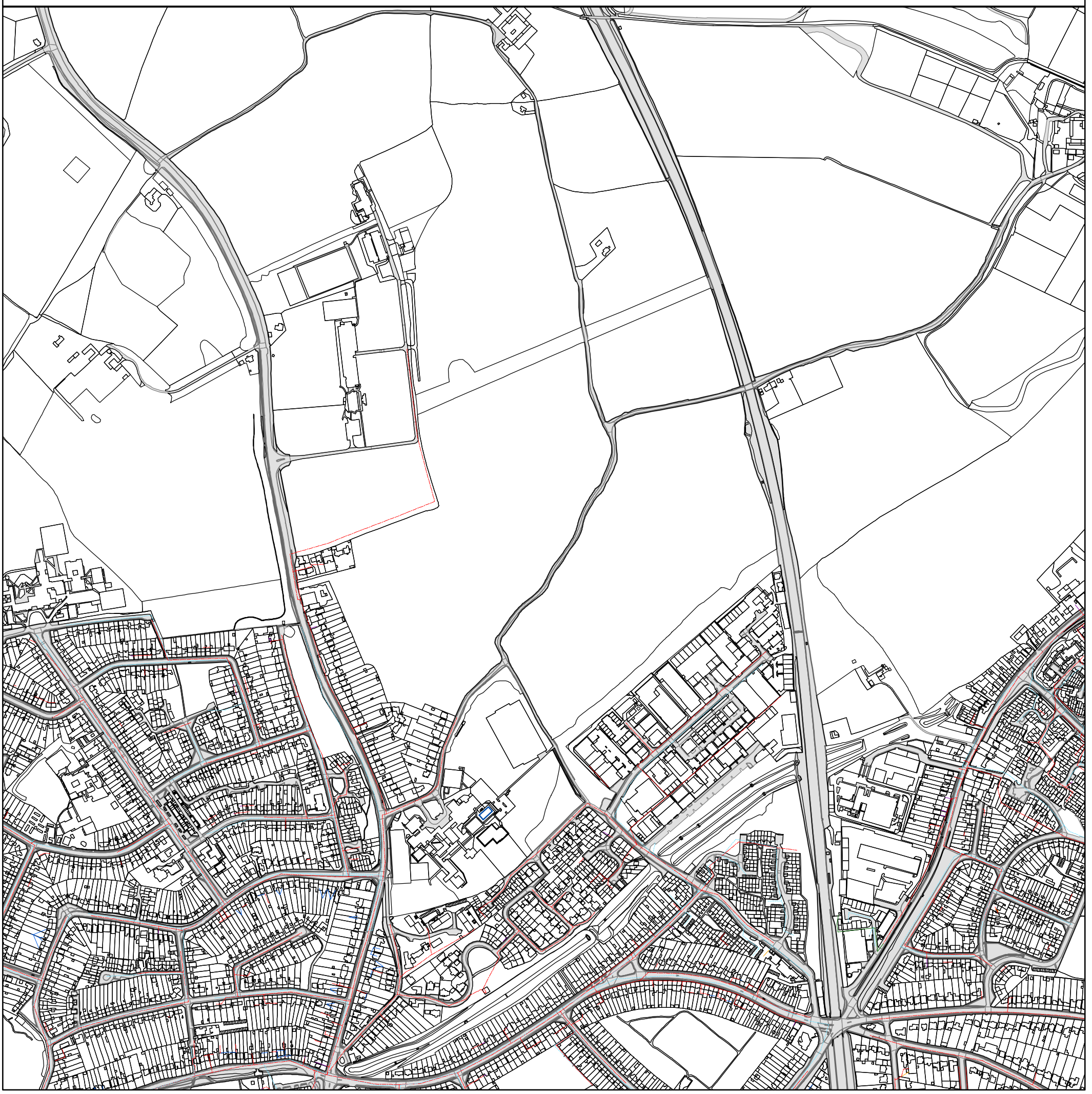
Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



0 45 90 180 270 360
Meters

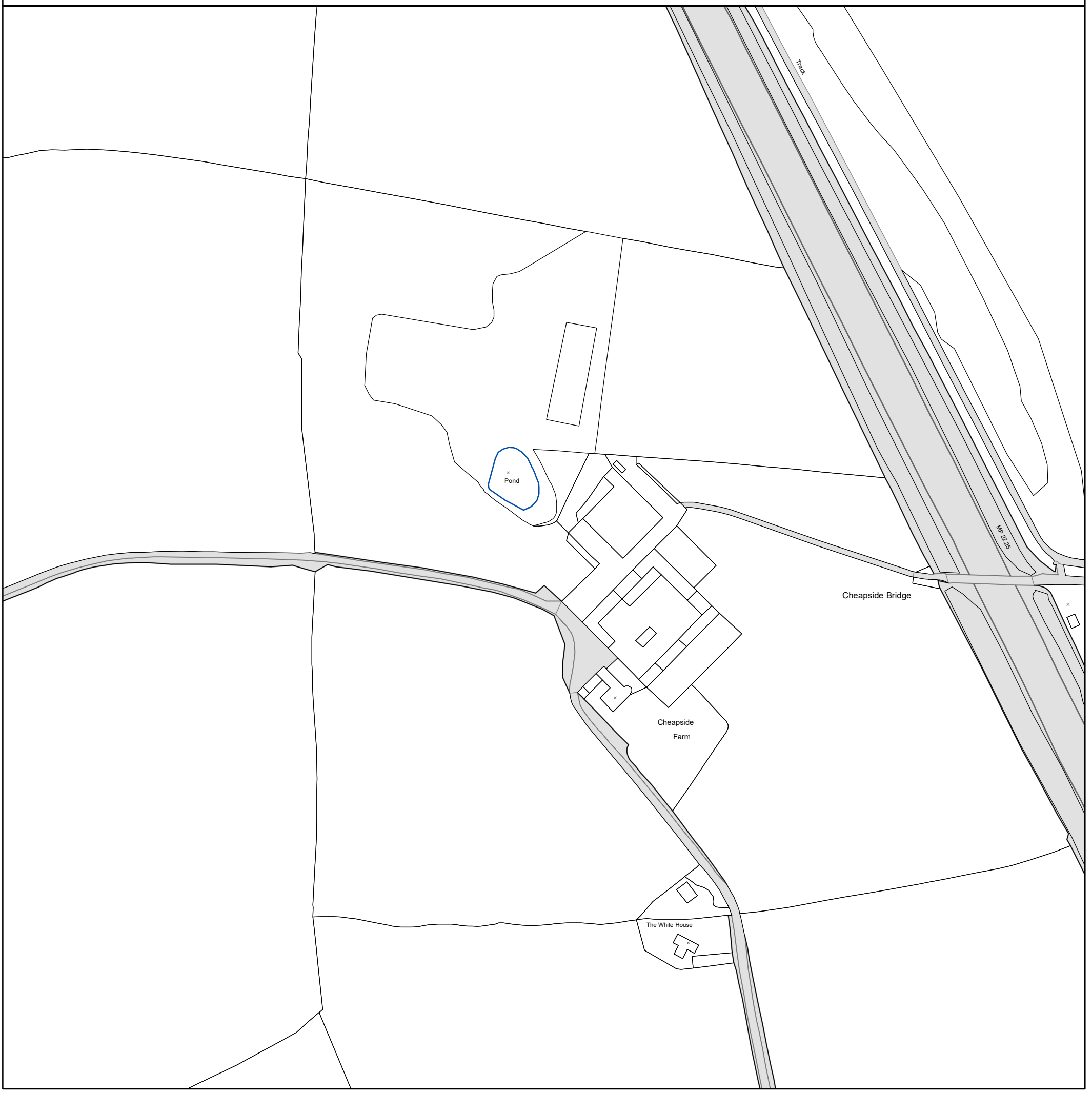
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:7160
Width:	2000m
Printed By:	ASuji
Print Date:	10/10/2023
Map Centre:	515353,209754
Grid Reference:	TL1509NW

Comments:

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



0 10 20 40 60 80
Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515250,210750
Grid Reference:	TL1510NW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

0 10 20 40 60 80
Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515750,210750
Grid Reference:	TL1510NE

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

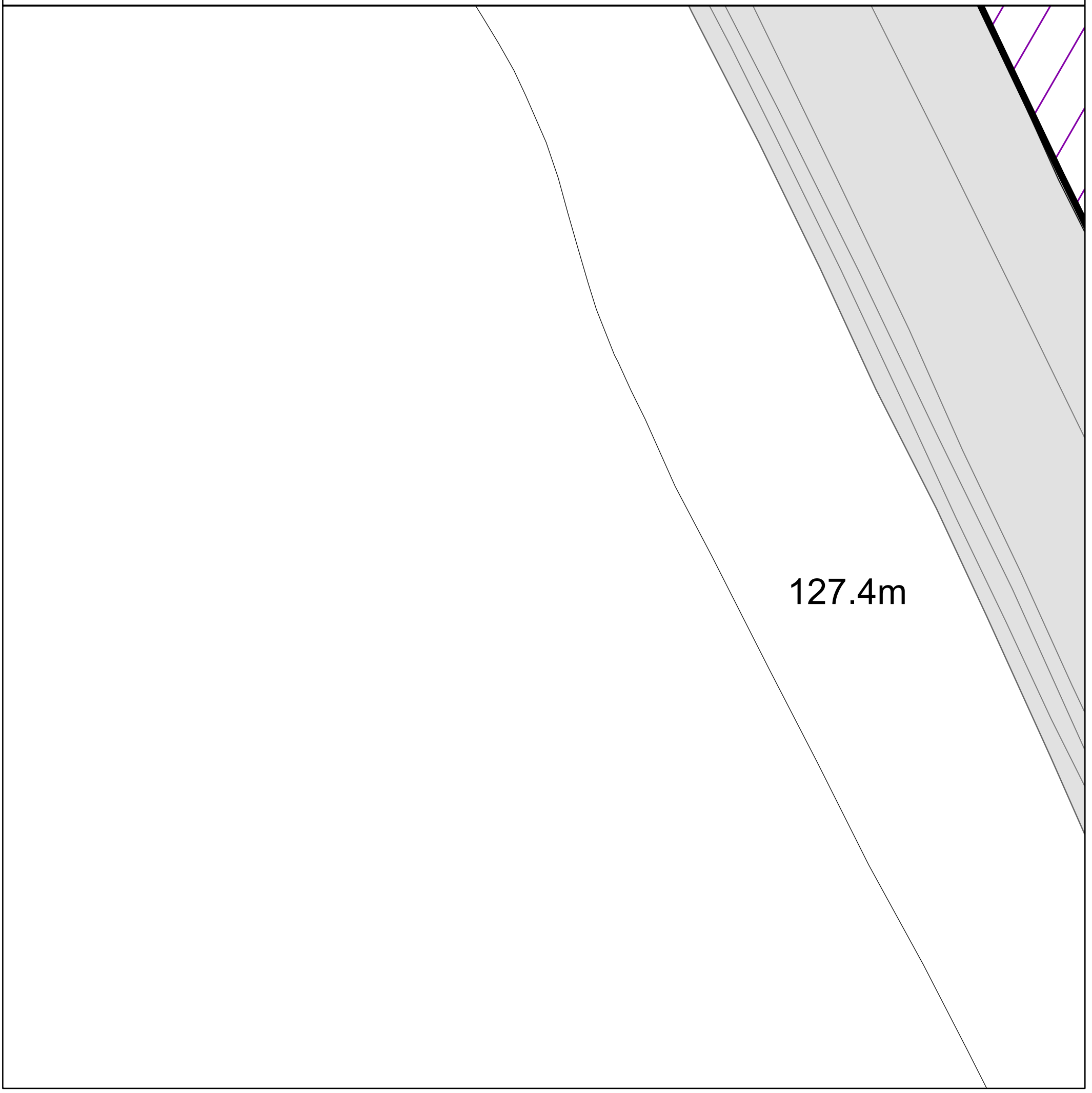
REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



0 2 4 8 12 16
Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:324
Width:	91m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	514750,210250
Grid Reference:	TL1410SE

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

0 10 20 40 60 80
Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515250,210250
Grid Reference:	TL1510SW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
111A	120.89	119

REFERENCE	COVER LEVEL	INVERT LEVEL
101A	119.91	118.18

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

0 10 20 40 60 80
Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515750,210250
Grid Reference:	TL1510SE

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

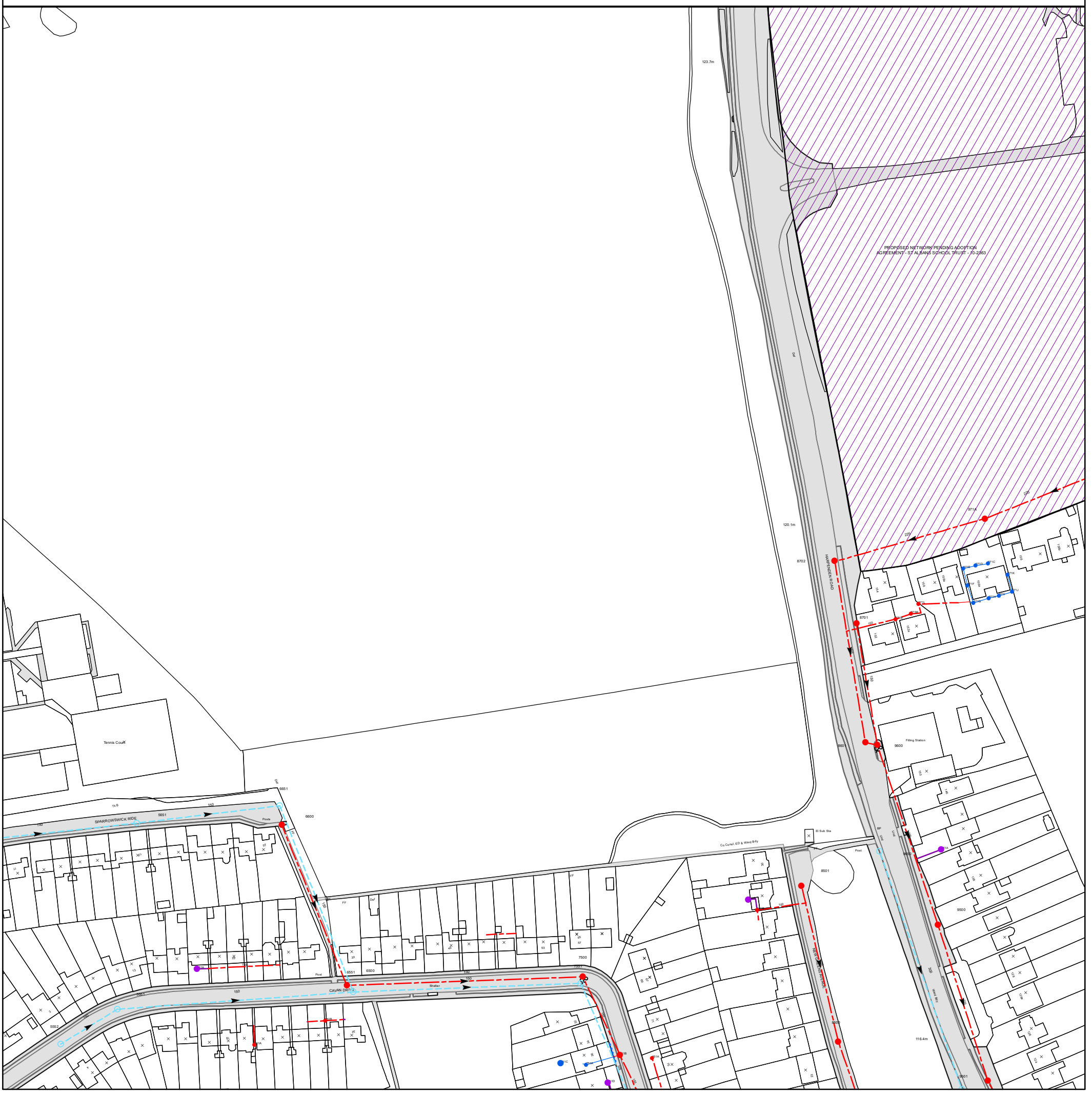
REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	514750,209750
Grid Reference:	TL1409NE

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

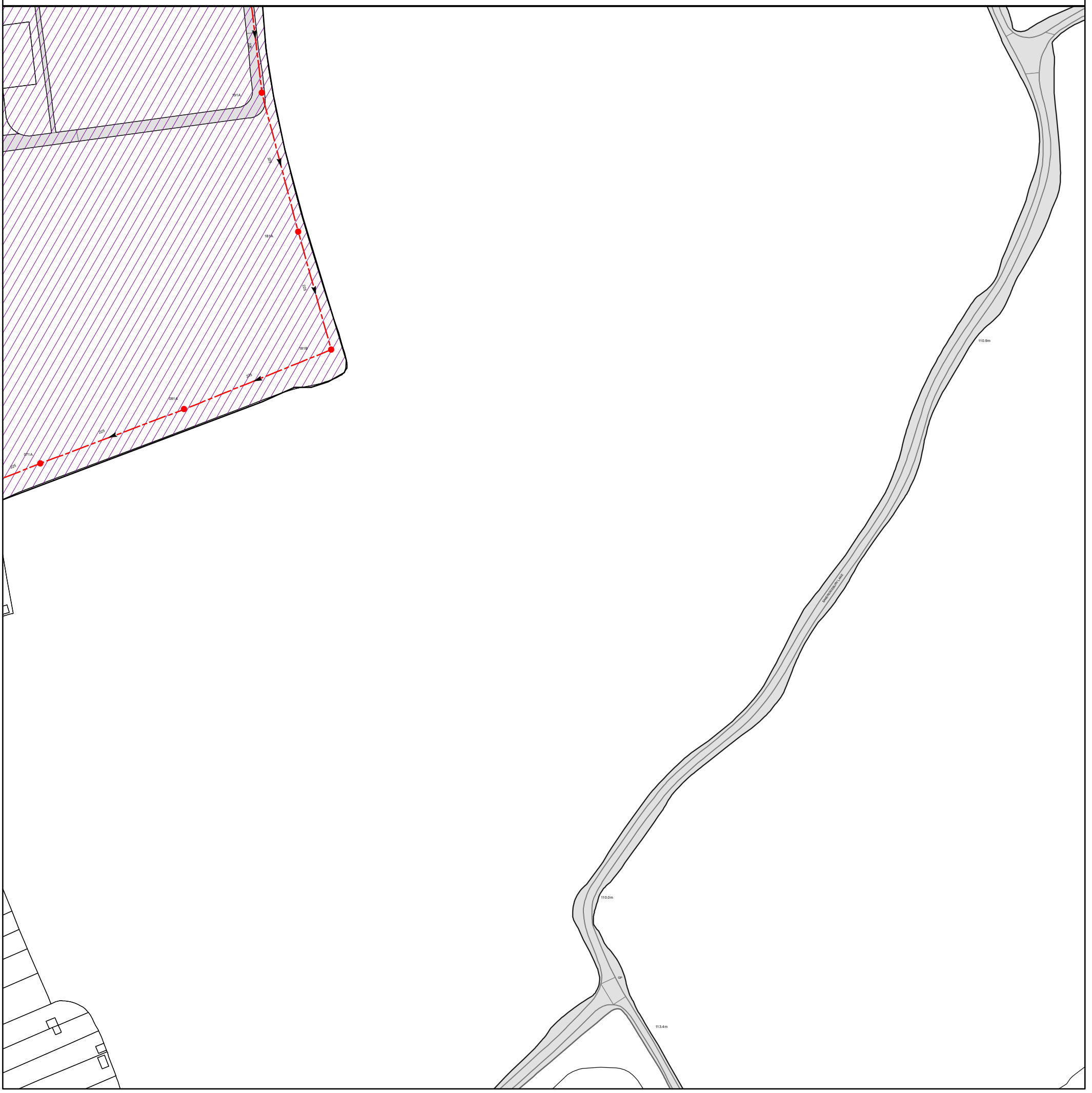
REFERENCE	COVER LEVEL	INVERT LEVEL
6551	123.77	122.13
5552	126.4	124.95
5651	125.51	124.07
9501	116.41	113.6
9550	116.54	114.82
8500	118.12	116.34
8601	116.93	114.55
7551	121.29	119.79
8701	119.64	114.93
6600	124.03	122.91
9500	116.47	114.01
961A		
751A		
751C		
851B		
971C		
971E		
971D		
971M		
971J		
971H		
651B		

REFERENCE	COVER LEVEL	INVERT LEVEL
971A	120.2	115.35
6500	123.8	121.91
6651	123.99	122.89
8501	118.15	117.17
9600	116.78	114.42
9650	116.49	115.17
8702	119.61	115.26
7500	121.3	119.5
5551	125.98	124.6
971B		
851A		
551A		
751B		
651A		
851C		
971K		
971F		
971L		
971I		
971G		
751D		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



0 10 20 40 60 80
Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515250,209750
Grid Reference:	TL1509NW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

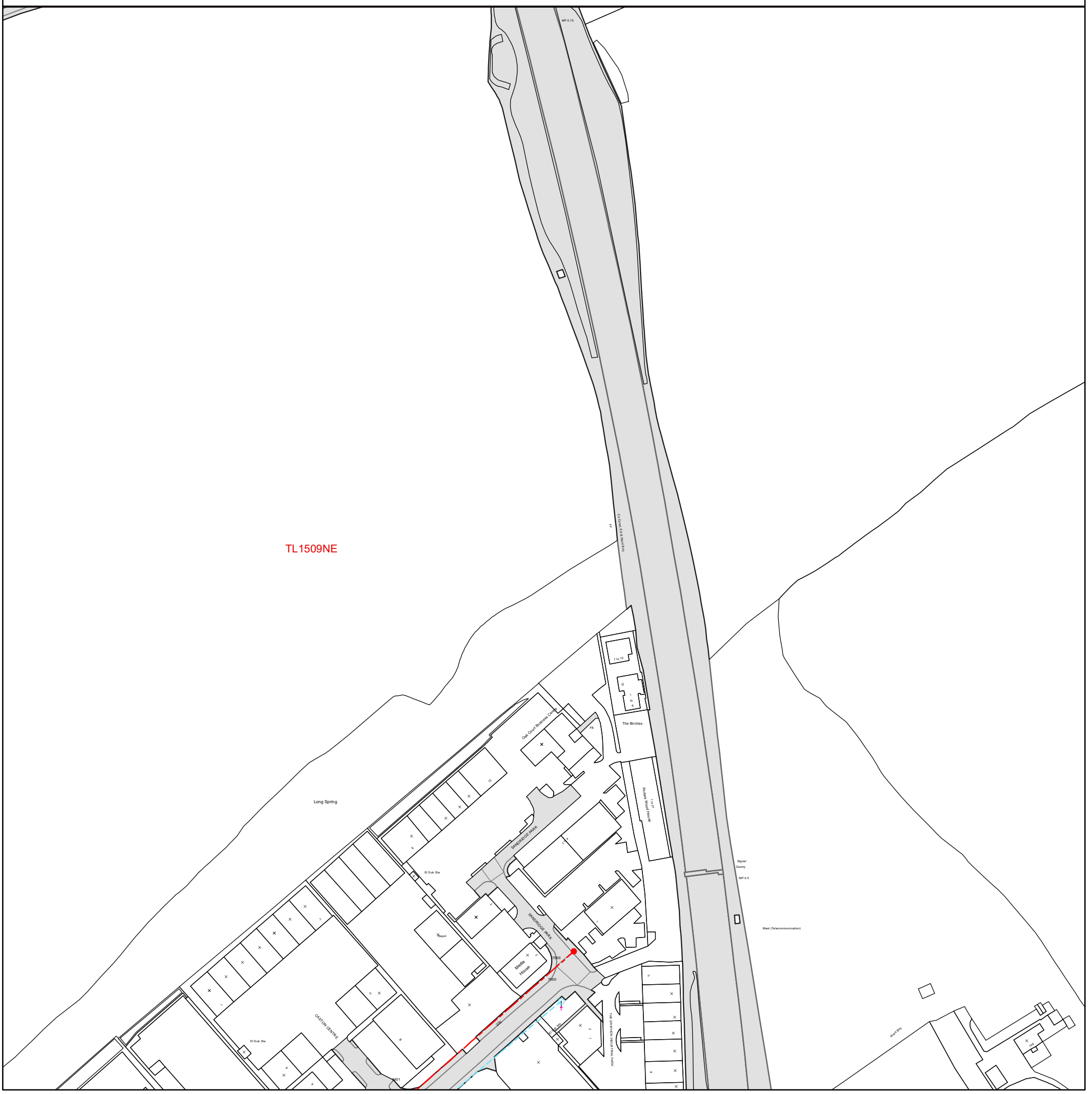
REFERENCE	COVER LEVEL	INVERT LEVEL
071A	120	116.2
081A	119.2	116.55
181A	119.25	117.55

REFERENCE	COVER LEVEL	INVERT LEVEL
181B	118.5	116.9
191A	120.14	117.86

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

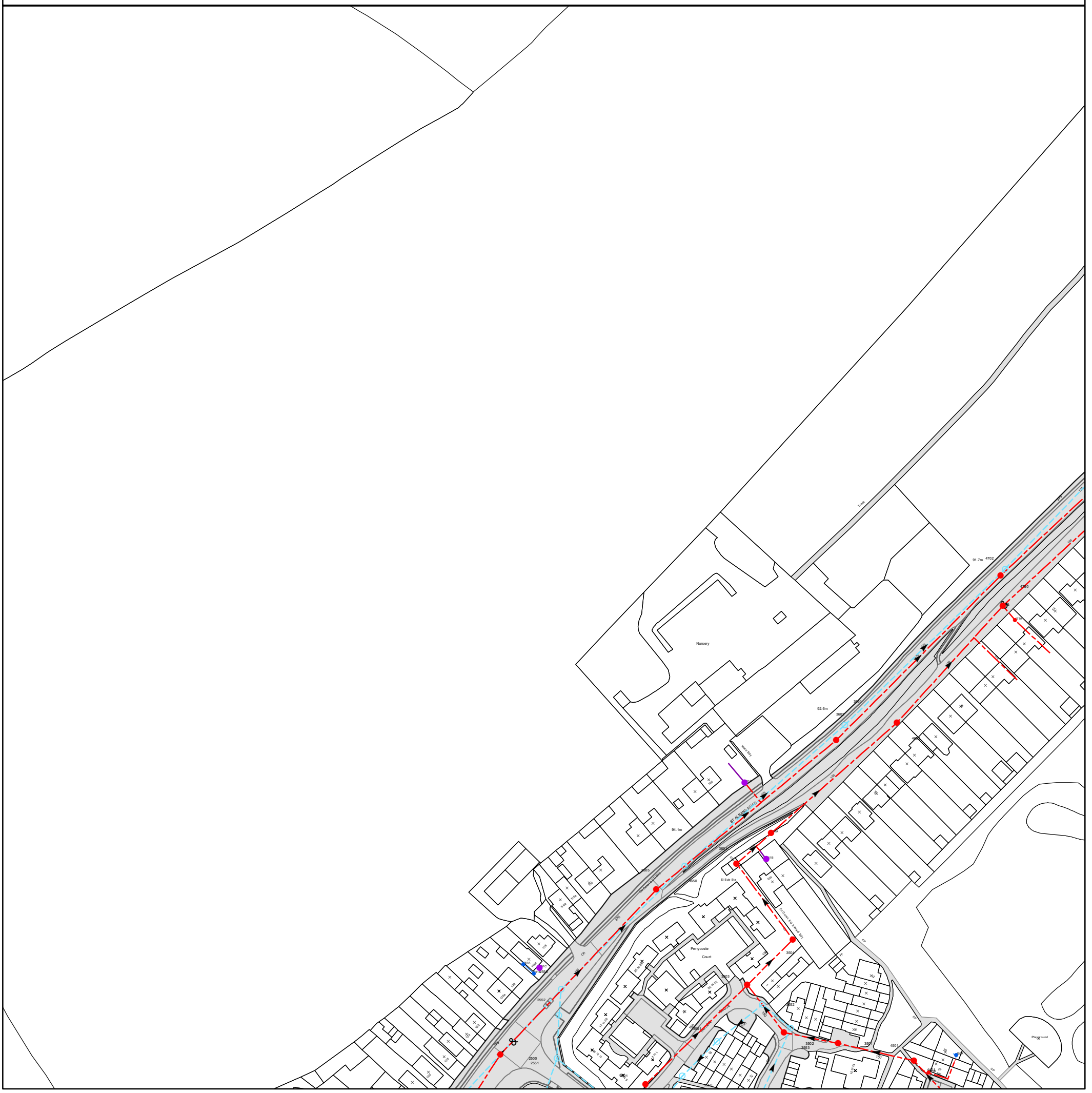
REFERENCE	COVER LEVEL	INVERT LEVEL
7500	110.33	108.87

REFERENCE	COVER LEVEL	INVERT LEVEL
7550	110.01	108.47

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
4501	104.6	102.67
2551	96.34	94.79
2501	100.37	97.95
3650	94.36	92.53
2552	95.45	94.67
4750	91.75	89.98
3501	102.75	100.45
3502	101.94	99.25
3504	99.97	96.9
3601	97.23	96.48
4601	96.25	94.78
3602	92.98	91.27
471A		
251B		
361B		
451B		

REFERENCE	COVER LEVEL	INVERT LEVEL
4702	91.82	90.09
2500	95.93	94.13
3550	100.49	97.79
3551		
2550	95.42	93.59
3505	94.57	92.83
3503	100.19	97.23
3553	101.76	99.64
3552	100.73	98.71
361A		
3651	92.84	91.03
4701	94.59	92.85
251A		
251C		
451A		
361C		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	514750,209250
Grid Reference:	TL1409SE

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

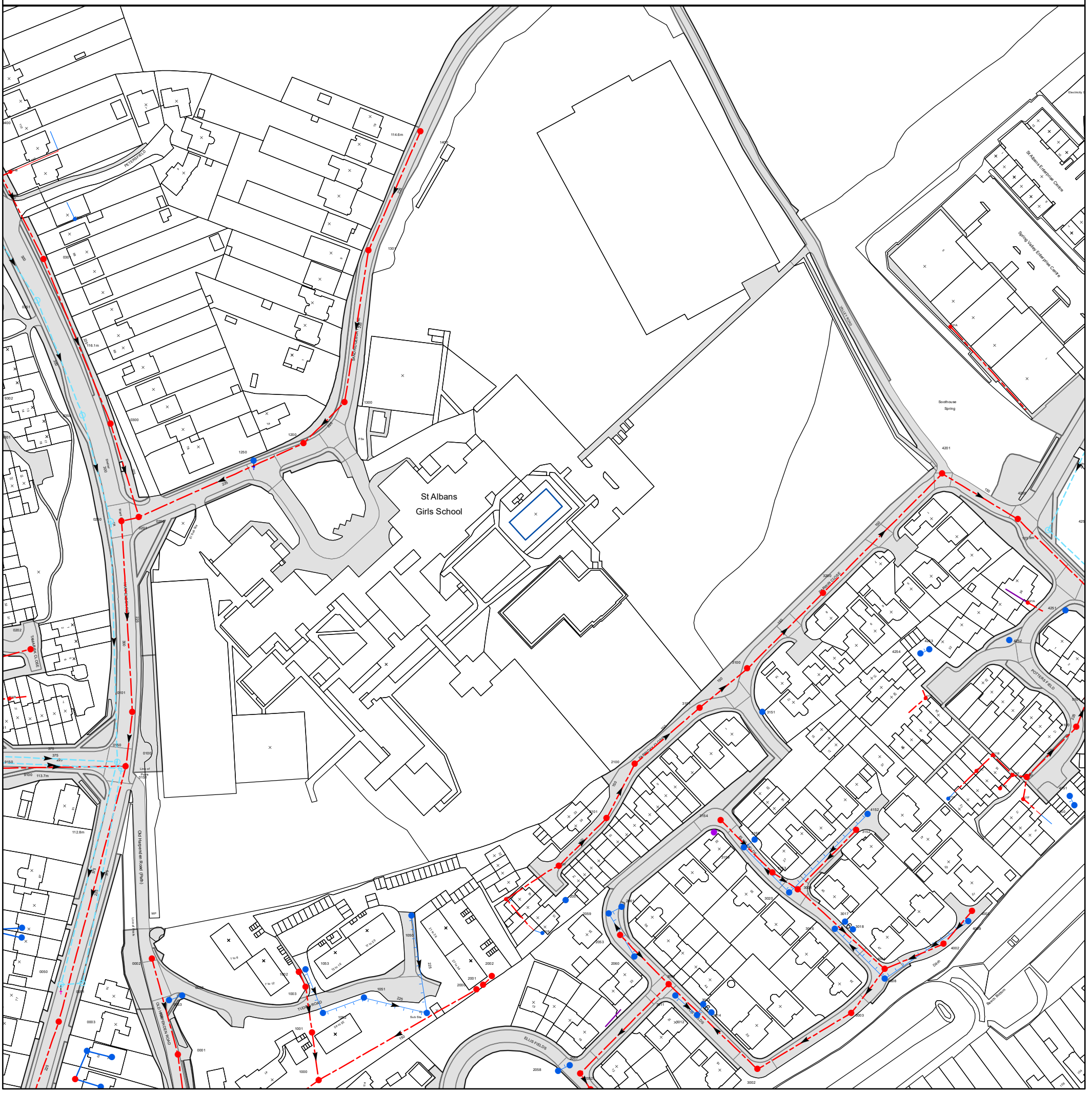
REFERENCE	COVER LEVEL	INVERT LEVEL
7250	120.42	
7300	122.22	120.38
5400	126.83	123.83
5051	118.45	116.77
5052	120.35	
5000	118.56	116.48
5100	123.96	121.67
6250	122.99	121.2
5300	125.78	122.97
7051	114.09	112.54
81AB		
9201	115.88	113.93
7050	114.39	112.26
81AC		
70AC		
91AD		
81BA		
9350	117.56	115.83
9300	117.54	114.61
9401	117.64	115.23
91AF		
9152	111.01	109.07
9101	112.27	110.24
91AC		
70AD		
9200	114.93	112.7
9450	117.69	116.11
9202	115.6	113.92
8450	120.28	118.82
8300	119.72	117.64
81AD		
9301	115.81	114.07
9302	116.22	114.5
9203	115.51	113.37
9100	111.6	108.56
831A		
7001	114.1	111.39
5150	123.96	122.21
9151	111.52	109.35
721A		
5450	126.82	125
6200	123.06	120.51
841B		
911A		
931B		
931C		
641B		
841D		
721C		
841E		
701B		
701D		
511A		
701F		
701G		
701J		
921A		

REFERENCE	COVER LEVEL	INVERT LEVEL
6001	112.38	110.19
7100	119.5	117.32
6350	123.47	121.99
6300	124.67	122.35
7350	122.16	120.68
5001	120.26	
6000	114.5	111.69
6051	114.47	
7150	119.43	117.7
8250	118.72	117.21
8350	119.78	118.29
6450	122.94	121.5
7000	114.42	111.08
8151	114.5	111.79
81AJ		
8200	118.09	115.82
8152	114.52	112.03
9451		
91AH		
81AI		
7400	120.47	118.37
8101	114.55	110.7
8451	117.95	116.59
70AB		
9250	114.93	113.18
91AE		
9251	115.6	114.26
7450		
8150	113.65	111.63
8000	107.71	105.35
9000	107.91	105.53
9102	112.51	110.55
9400	116.69	113.22
9303	116.64	114.9
9351		
8100	113.85	110.25
5350	125.75	124.08
91AG		
9103	111.06	108.71
541A		
9150	111.52	108.93
841A		
9001		
601A		
931A		
641A		
841C		
721B		
721D		
701A		
701C		
701E		
821A		
701I		
701H		
741A		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515250,209250
Grid Reference:	TL1509SW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
3020		
4152		
0002	109.15	107.55
2052		
4002		
0201	115.48	
0101	114.49	
3101	111.41	108.31
3013		104.5
2053		
0003	108.93	
0001	107.51	
2059		
4200	104.71	102.29
09BH		
4151	103.32	102.28
3154		
0200	115.57	112.21
3011		
2060		
4253	104.94	103.87
4008		
4250	104.18	102.51
0202	113.21	111.45
00AF		
0350	115.78	114.08
00AE		
1003	112.69	110.34
1001	110.81	108.37
4003		
3159		
2057		
00BA		
0250	115.72	113.87
00AC		
4251		
2058	105.98	104.27
3014	105.33	104.25
3018	104.7	102.75
3151		
4254		
0150	113.26	
2101	111.32	109.14
1054		
3012		
2000	109.79	107.97
431A		
411C		
411B		
411E		
201A		
201B		
041B		

REFERENCE	COVER LEVEL	INVERT LEVEL
3003		
4100	102.96	101.96
1400	114.6	113.74
4201	106.68	104.68
0151	113.25	
0100	113.26	
0052	109.36	108.03
1250	116.36	
3152		
00BB		
0050	108.93	106.52
3016		
2002	109.75	108.05
3002		
1301	115.6	113.44
3017		103
3153		
3001		
0301	116.4	112.83
2100	111.6	108.85
3200	108.18	106.23
4004		
1000	110.3	106.86
0351	115.95	114.95
0051	109	
1050	113.25	112
1200	116.23	112.95
1053	112.68	111.15
4009		
2001	109.73	108.04
3100	110.57	107.74
1051	111.42	110.05
1300	116.06	113.07
0300	115.81	112.43
041A		
4150		
4252		
2051		
3160	107.68	103.8
2061	109.22	105.84
0053		
3004		
1002	112.92	110.52
421A		
1052	111.62	110.53
011B		
411A		
4101	103.58	102.13
411D		
411F		
2102	110.99	109.32
411F		
311A		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

Kenburn House
Reynolds House
Fellech House
Uzeno House
Childrens Nursery
Porters Wood House
1 to 21 Porters House
Gavel Centre
Beech Industrial Centre
Stenia Business Centre
Woodland Court
Unit 1
Unit 2
Fleet House
Builders Yard
Line of Poels
Post
Ditch
PORTERS WOOD
PARKWAY
SOOTHOUSE SPRING
Beech Bottom
Soothouse Spring
Kiln Farm Roundabout
Kiln Farm Roundabout
Kiln Farm Roundabout

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

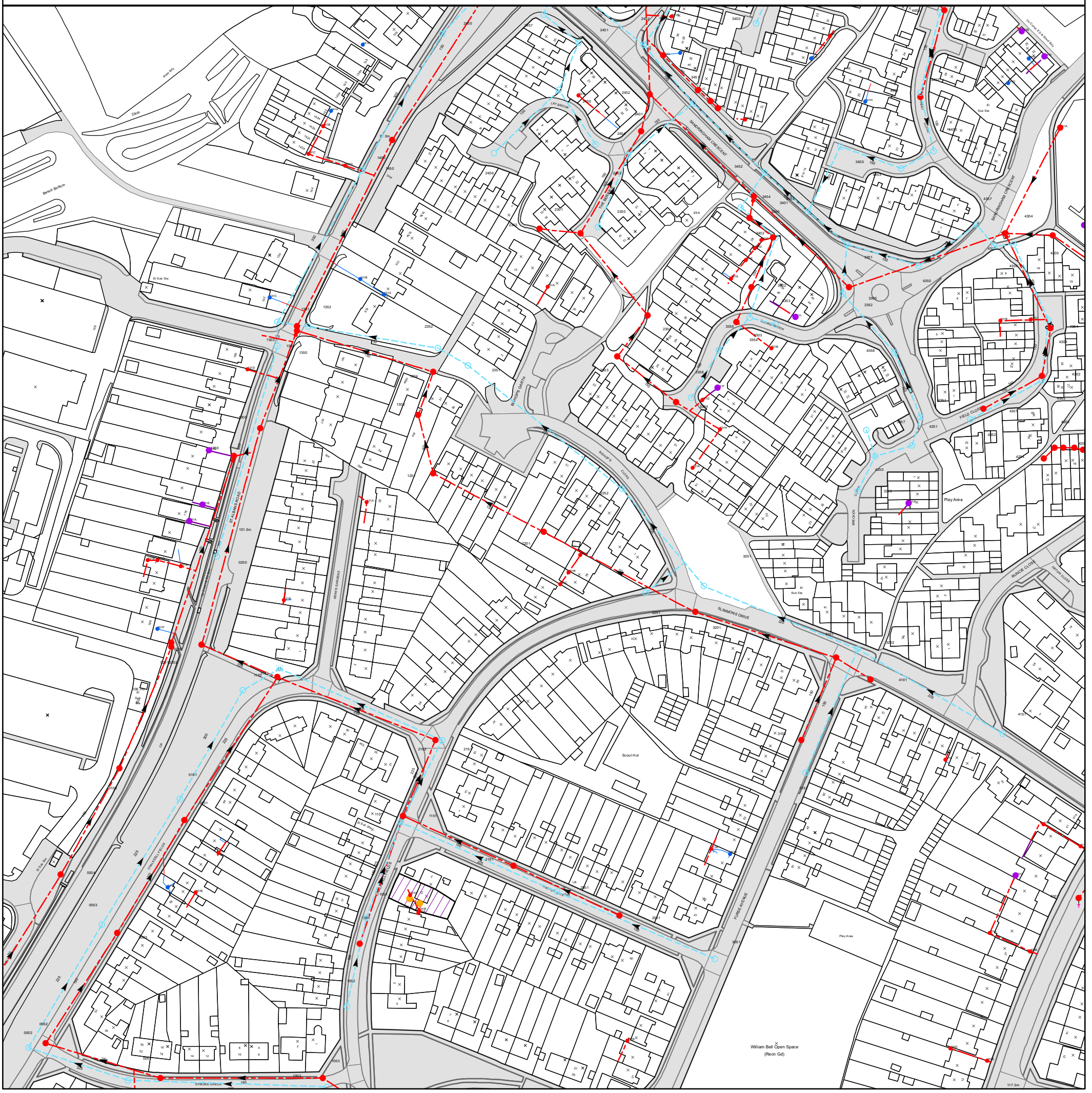
REFERENCE	COVER LEVEL	INVERT LEVEL
6054		
5203		
7152	108.48	
5100	102.77	101.31
8050	112.18	111.29
7400		
6152	103.12	
6450	108.98	107.5
7155	104.7	103.01
7202	104.31	102.8
7056	111.63	110.77
6100	104.12	101.8
7151	108.89	106.79
5002	103.92	101.85
5000	104.59	101.23
7052	110.79	108.71
7201	103.23	101.58
5400	112.76	111.25
5351	106.64	105.11
7252	102.98	101.98
7200	102.91	101.51
7055	111	109.85
5200	103.13	101.69
6401	109.4	107.65
5301	107.7	105.83
6153	103.4	101.75
5101	103.14	101.91
6400	108.54	106.43
7250	104.23	102.56
9055	112.4	111.73
9053	112.31	111.37
9054		
5202	103.32	101.83
6300		
5001	103.65	100.66
501F		
501B		
801A		
901B		
801C		
711A		
601E		
601F		

REFERENCE	COVER LEVEL	INVERT LEVEL
5051	103.6	101.33
5151	102.45	101.98
6051	104.3	103.12
6052	104.3	103.12
7051	108.62	106.88
7050	108.24	
6101	103.23	101.03
6155	102.58	101.89
5250	103.47	
7000	111.34	108.66
8051	110.92	107.93
7401		
7153	107.28	105.56
5201		
5350	107.39	105.91
7251	103.14	102.19
5153		
6053	103.76	102.6
6151	104.15	
7154	103.86	102.43
7001	108.23	105.44
6451	108.05	106.54
5300	107.57	105.54
5152	103.05	102.07
6103	102.79	101.26
6102	103.54	101.23
6154	102.73	101.81
8100	105.57	104.43
9050	112.37	111.64
9051	112.34	111.66
9056		
9052		
7053	111	110.23
501D		
501A		
501E		
501C		
801B		
901C		
9000	111.73	110.21
601D		
601C		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	516250,209250
Grid Reference:	TL1609SW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
1153		
3454	106.01	102.48
4350	107.94	106.47
4402	106.69	105.32
4201	112.66	111.1
2454	101.7	100.18
2351	102.45	101.2
2101	113.09	111.38
2455	101.52	98.87
3051	116.16	114.97
3402	106.6	103.84
3401	104.4	101.42
2151	110.1	108.74
4151	116.08	114.28
0201	105.69	104.56
2302	102.41	100.77
2452	99.29	96.75
2304	105.35	102.88
0052	112.56	111.23
1304		
2453	102.73	100.24
3250	112.62	110.96
3355	107.53	106.12
0101	107.48	105.76
1300	99.74	98.09
3151	115.07	113.13
3352	107.49	105.74
0151	107.26	106.16
1053	114.22	113.47
1151	110.93	109.72
2252	108.12	106.27
1350	99.03	97.69
1200	101.19	98.69
4353	111.46	109.91
4204	112.65	111.38
3351	106.41	104.63
2303	105.77	104.21
2457	99.78	96.94
0053	109.89	108.63
3455	106.32	103.89
4303	110.78	109.31
4200	112.67	111.01
0004	109.53	108.17
2451	100.39	97.55
1001	111.33	109.51
3452	104.02	102.25
3350	107.23	103.93
4452	105.55	104.53
1302	98.95	96.53
0100	107.38	106.46
0250	101.19	99.42
3301	107.19	104.28
021D		
231A		
3303	107.38	105.31
4354	110.74	109.3
141A		
401B		
411A		
1101	111.03	108.6
4101	113.7	111.83
131A		
421A		
341A		
331C		
401E		
341B		
241A		
141B		
341J		
021B		
3305	107.26	105.19
121B		
311A		
131D		
331A	10	9.4
1301	98.89	96.49
141E		
431C		
331F		
321A		

REFERENCE	COVER LEVEL	INVERT LEVEL
3201	110.91	109.56
4251	112.03	110.06
4351		
4451	106.6	104.19
4001	117.29	113.76
2350	102.85	101.09
4202	112.63	111.14
2051	113.96	112.9
3450	102.84	100.95
3354	107.47	104.75
3302	107.42	104.86
4358		
2450	96.46	95.06
0202	105.82	104.66
2456	100.73	98.88
2402	102.23	99.38
2251	110.28	108.73
2401	100.81	98.32
1201	103.69	101.81
2102	110.18	108.22
3252	113.64	111.83
0002	112.33	110.67
3357	112.43	111.29
0200	102.92	100.9
3102	114.35	112.74
3453	105.2	103.34
4301	111.71	110.03
1002	114	111.86
3251	110.75	109.04
2001	115.2	112.56
1102	105.92	104.25
0001	114.05	111.24
1152	105.75	103.69
4302	111.49	109.63
3304	107.48	105.41
1352	99.05	98.17
2201	105.27	103.39
4352	111.68	110.51
3356	107.15	105.34
4250	112.12	110.67
4203	112.62	111.22
1052	112.19	110.69
3101	113.09	111.55
2301	102.52	100.42
1450	97.7	96.03
3353	108.96	105.41
2352		
4401	105.36	103.5
0003	109.97	108.15
0051	113.84	112.44
441B		
021C		
1351	98.98	
4450	107.66	104.06
1051	111.14	110.22
4453	107.23	103.92
401A		
401C		
411B		
3451	101.45	99.6
1303		
131B		
121A		
021A		
401D		
341D		
341C		
141D		
141C		
341H		
201B		
131C		
311B		
331B		
021E		
1400	97.43	95.64
331E		
431B		
331D		
331G		
331H		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
4356	109.41	108.13
4304	109.33	106.32
4305	110.15	108.06
431A		
341I		
021F		
341M		
221A		
221C		
011A		
411D		
101C		
101A		
441D		

REFERENCE	COVER LEVEL	INVERT LEVEL
4357	109.16	107.62
4355	110.06	108.3
441A		
341K		
021G		
341L		
441C		
221B		
001A		
001B		
331I		
101B		
441E		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	514750,208750
Grid Reference:	TL1408NE

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

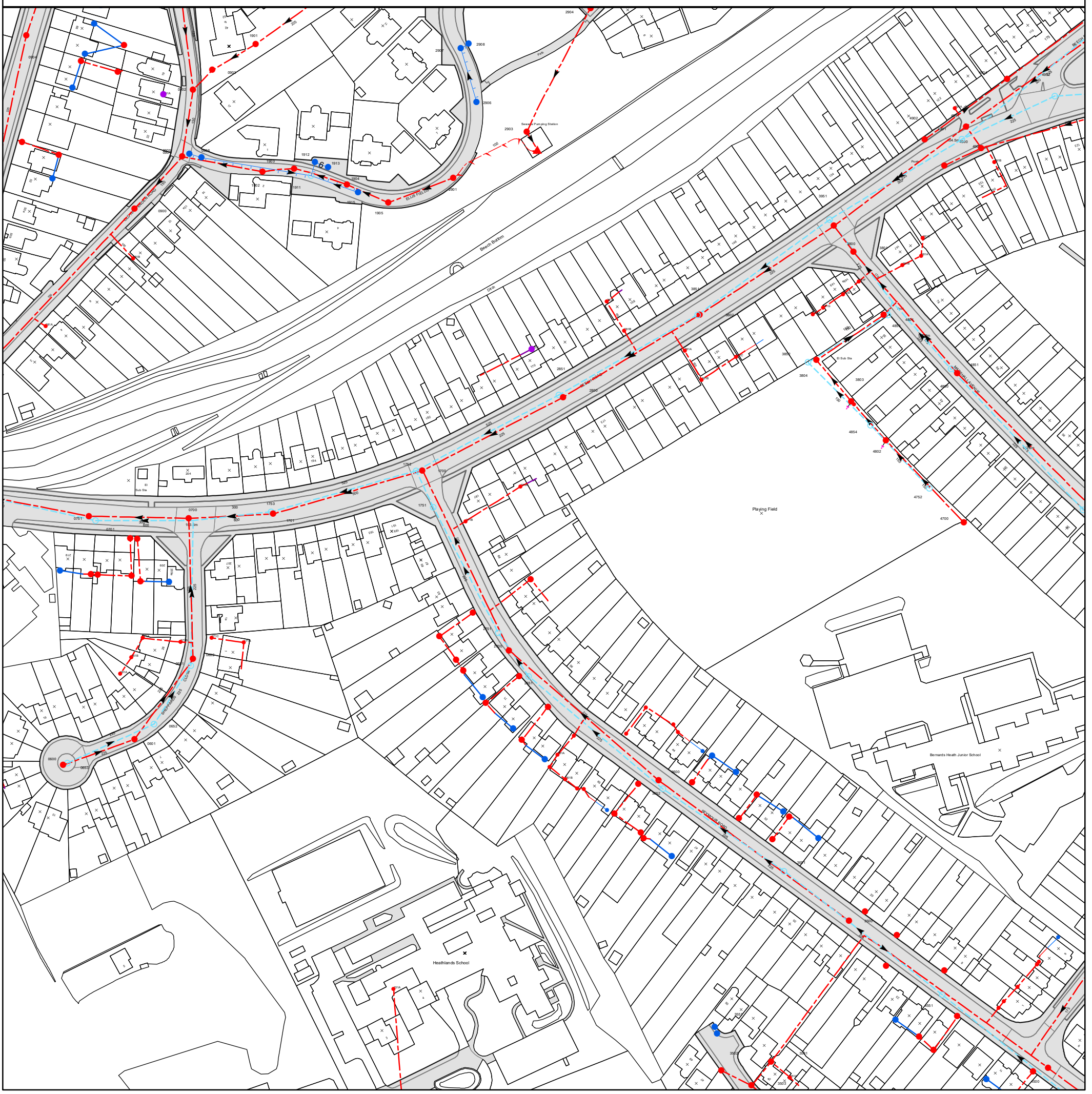
REFERENCE	COVER LEVEL	INVERT LEVEL
6552	111.98	110.67
6901	109.93	108.34
55AC		
6902	111.79	109.54
56AB		
5851	107.05	104.38
5951		
57AE		
5552	109.75	106.45
7801	100.59	99.1
6500	113.24	110.91
7800	100.16	98.74
7700	99.46	95.88
5500	108.49	106.49
6800	107.38	103.52
6953	106.4	104.89
5800		
57AF		
6900	110.12	108.28
5651	101.19	100.51
7951	106.07	103.87
57AC		
9752	102.44	
98AB		
78AH		
8651	105.07	104.07
98BC		
8851	101.79	97.58
9751	102.18	97.78
7752	100.48	97.03
99BF		
9800	102.37	100.31
7952	105.8	103.83
99AI		
78AD		
7900	105.94	103.39
88AB		
9951	103.94	101.95
8750	101.13	99.72
891A		
5751	97.61	94.92
6502	105.31	102.9
98BD		
6651	101.48	99.29
6951	111.63	109.44
9651	104.98	103.6
891B		
891E		
99BH		
57AD		
751A		
981A		
781A		
78BJ		
77AB		
78CA		
561A		
651A		
561B		
661A		
981B		
98AG		
791A		
98AI		
88BA		
88BG		
88AI		
781B		
561C		
871A		
881C		
891I		
971B		
971C		
961B		
961C		
561D		

REFERENCE	COVER LEVEL	INVERT LEVEL
6700	98.43	94.97
6904	106.4	104.31
57BE		
5700	97.17	93.86
57AG		
5501	109.4	104.87
6501	111.61	109.74
6600	101.43	99.26
57BD		
6553	113.55	111.69
5551	108.91	107.57
7802	102.67	101.5
7751	99.46	96.6
6903	111.91	109.79
6952	109.67	108.08
57CC		
57CD		
57BB		
5502		
6551	105.73	103.97
55AD		
99BA		
99AJ		
7953	108.01	106.4
78AF		
9753	102.15	99.96
98AC		
9701	103.24	101.34
7701		
99BE		
9851	102.86	100.2
9702	102.73	
8800	101.89	97.07
9700	102.06	100.31
9900	104.07	
78AC		
7901	105.76	103.08
9852		
99BG		
8951	105.07	102.88
57CA		
99AH		
7902	106.67	104.37
9754	103.24	102.18
8900	104.91	102.06
57CB		
891D		
57AB		
88BH		
751B		
751C		
971A		
78AE		
78BI		
7702	100	98.15
78AG		
891G		
651B		
681A		
99AD		
981C		
98AH		
981D		
881A		
88AJ		
88BJ		
88BI		
7803	100.86	99.31
57BC		
881B		
891H		
891C		
981E		
061C		
961A		
561E		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515250,208750
Grid Reference:	TL1508NW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
1911		
26DC		
35AG		
26AI		
4800	108.92	107.03
0906		
1752	104.82	
27AC		
1753	104.12	98.9
2651	110.73	109.29
2904		
45AF		
09BD		
0601	107.22	105.05
07BC		
0700	103.76	97.93
3802	105.4	99.08
1901	108.46	
2907		
3852		
09BJ		
1905		
45AJ		
1903		
26EB		
45BC		
36BC		
07BD		
07BE		
3803	107.92	106.17
3501	122.34	120.65
07AJ		
45CD		
36BI		
4802	109.57	108.45
0602	105.41	103.25
09BI		
3951	105.15	
4500	122.47	119.77
09AF		
09BC		
4903	104.64	99.78
2851	105.07	99.33
26BB		
4900	104.64	101.84
45CE		
1751	105.27	103.29
2906		
36BD		
2800	105.12	
4751	114.98	113.23
09CA		
0904	106.09	
0600	108.33	106.55
1913	105.06	102.75
26CG		
3800	105.17	99.47
45AB		
36BB		
45BB		
3552		
4902	104.49	102.93
351A		
381B		
061B		
071A		
4854		
2901		
3651	120.36	118.21
281A		
081A		
481B		
091A		
381D		
381F		
271B		
261A		
26BJ		
26CA		
151A		
45DC		

REFERENCE	COVER LEVEL	INVERT LEVEL
2700	109.68	107.45
36AF		
4752		
26BA		
0701	103.15	97.84
0652	107.21	105.47
26CH		
45BA		
2903		
2752		
4551	122.33	120
4901	104.55	102.98
07BA		
0900	103.61	102.13
0901	104.51	103.04
0905		
09AH		
26CI		
3851	105.35	
3801	105.5	103.04
07BG		
4853		
45BH		
26DJ		
4851	108.76	107.15
36CA		
4952	104	100.7
09BB		
3500	121.67	120.43
1700	104.9	98.42
36AG		
36DD		
3502	122.44	121.38
3804	106.8	105.72
0651	105.55	103.74
0902	105.45	103.91
36AE		
1902		
0653	108.29	106.78
09AG		
3600	116.61	114.54
1912		103.04
1915		
3652	116.73	115.09
36BJ		
26BC		
27AB		
26DD		
3503	122.69	121.22
4700		
0903	107.93	
1904		
1701	104.13	98.1
07BF		
2908	105.36	103.86
3551	122.2	121.02
26DE		
4951	104.55	
2751	108.87	107.26
26EA		
4904	104.85	102.21
491A		
381A		
381C		
061A		
071B		
07BB		
0751	103.14	
4801	106.81	105.42
281B		
481A		
481C		
491B		
381E		
381G		
261B		
26CD		
26CC		
26CB		
45DD		
45DB		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
45CI		
45DA		
26AB		
36CG		
081B		
281C		
071C		

REFERENCE	COVER LEVEL	INVERT LEVEL
45CJ		
26AC		
36CI		
36CF		
271A		
171A		

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

A feature in a sewer that changes or divects the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Inlet
- Outfall
- Undefined End

Other Symbols

Symbols used on maps which do not fall under other general categories.

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement — Ducts may contain high voltage cables. Please check with Thames Water.
- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement.

If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

Payment Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment within 14 days of the date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service or will be held to be invalid.
4. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
5. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
6. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800.

If you are unhappy with our service, you can speak to your original goods or customer service provider. If you are still not satisfied with the outcome provided, we will refer the matter to a Senior Manager for resolution who will provide you with a response.

If you are still dissatisfied with our final response, and in certain circumstances such as you are buying a residential property or commercial property within certain parameters, The Property Ombudsman will investigate your case and give an independent view. The Ombudsman can award compensation of up to £25,000 to you if he finds that you have suffered actual financial loss and/or aggravation, distress, or inconvenience because of your search not keeping to the Code. Further information can be obtained by visiting www.tpos.co.uk or by sending an email to admin@tpos.co.uk.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0300 034 2222 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**
Please Call **0800 009 4540** quoting your invoice number starting CBA or ADS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number

Appendix D Green and Blue Infrastructure Parameter Plan

HERTFORDSHIRE WAY

HERTFORDSHIRE WAY

RAILWAY LINE

RELOCATED OLD ALBANIAN
SPORTS PITCHES,
AS PER DRAWING DE_565_81

SANDRIDGEBURY LANE

SANDRIDGEBURY LANE

HARPENDEN ROAD

PROPOSED
SEWELL PARK
DEVELOPMENT

VALLEY ROAD

NEW GREENS AVENUE

CARNEGIE ROAD

HIGH OAKS

PARTRIDGE ROAD

GREEN LANE

HARPENDEN ROAD

VALLEY ROAD

GREEN AND BLUE INFRASTRUCTURE PARAMETER PLAN

LEGEND

- Planning application site boundary
- Green infrastructure
  Including routes, access, play areas, drainage, natural and semi-natural green spaces, amenity green space, parks and gardens, landscaping, drainage, pedestrian/cycle links, allotments and food growing zones, landscaping, and associated infrastructure
- Longspring Wood
- Buffer planting
- Indicative location for neighbourhood greens and open spaces

Indicative location for play areas:

- NEAP
- LEAP
- LAP
- Teenage area

- Indicative zone for drainage infrastructure
  Including attenuation basins, infiltration basin, and swales
- Indicative location for allotments and grow zones.
  Additional food growing and production opportunities will be provided within open space and residential areas
- Alignment protected for surface water drainage
- Area reserved for relocation of Old Albanian Sports Pitches and associated facilities as per drawing DE_565_81
- Alignment of primary streets

Notes:

1. All features and areas are subject to a lateral tolerance of +/- 10m within application boundary, subject to site constraints;

2. All the road widths and alignments are indicative and subject to detailed design.

Define.

0m 10 20 30 50 100

N

Scale	1:2,500@A1
Date	05/09/2025
Drawn By	TA
Revision	E

Hallam Land Management Limited	Client
Woollam Park, North St Albans	Project
Parameter Plan - Green and Blue Infrastructure	Title
DE_565_74	Ref.

Appendix E Pre-Application Correspondence

From:	Chalk, Laurence
To:	Samantha Furey; Charlotte Turner
Cc:	Rumble, John; Marsili, Alessandro; Planning
Subject:	RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration
Date:	19 June 2024 16:36:30
Attachments:	image001.png image002.png image004.png image006.png image007.png image008.png image009.png image011.png

Good Afternoon Samantha and Charlotte,

We appreciate you getting in contact with us.

Due to the location of the proposal outside of SPZ2, we would have no particular requirements to advise on from our own water abstraction for supply perspective. We would only recommend best practice to protect the water quality in the environment and suggest you contact the Environment Agency for further advise and specifications on this, if you haven't done so already.

Thank you again for checking.

Kind regards

Laurence Chalk
Catchment Adviser
Catchment Management

Affinity Water Limited
Tamblin Way, Hatfield, Hertfordshire AL10 9EZ
Email: laurence.chalk@affinitywater.co.uk
For Catchment Management: catchmentmanagment@affinitywater.co.uk
For Planning Applications: planning@affinitywater.co.uk
www.affinitywater.co.uk || www.facebook.com/affinitywater || www.twitter.com/affinitywater || www.linkedin.com/company/affinity-water

From: Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>
Sent: Wednesday, June 19, 2024 4:25 PM
To: Chalk, Laurence <Laurence.Chalk@affinitywater.co.uk>; Planning <planning@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>; Rigby, Alex <alex.rigby@affinitywater.co.uk>; Rumble, John <john.rumble@affinitywater.co.uk>
Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

@Chalk, Laurence,

As discussed

From: Samantha Furey <samantha.furey@pja.co.uk>
Sent: Wednesday, June 19, 2024 4:23 PM
To: Charlotte Turner <Charlotte.turner@pja.co.uk>; Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>;

Planning <planning@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>; Rigby, Alex <alex.rigby@affinitywater.co.uk>; Rumble, John <john.rumble@affinitywater.co.uk>
Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Good afternoon,

Would you be able to advise when this request will be investigated as we would be grateful if a response could be provided as soon as possible.

If you have any queries, please do not hesitate to contact me.

Best wishes,
Samantha

PJA
transport • engineering • placemaking

Samantha Furey
Senior Engineer
T. 0121 387 4004
Park Point, High Street, Longbridge, Birmingham, B31 2UQ, UK
www.pja.co.uk

From: Charlotte Turner <Charlotte.turner@pja.co.uk>
Sent: Thursday, June 6, 2024 8:20 AM
To: Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>; Planning <planning@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>; Rigby, Alex <alex.rigby@affinitywater.co.uk>; Rumble, John <john.rumble@affinitywater.co.uk>; Samantha Furey <samantha.furey@pja.co.uk>
Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Hi Alessandro,

Thank you very much for passing our query onto the planning team.

Would you be able to advise when this request will be investigated as we would be grateful if a response could be provided as soon as possible.

If you have any queries, please do not hesitate to contact me.

Kind regards,

Charlotte Turner

PJA
transport • engineering • placemaking

Charlotte Turner
Flood Risk & Drainage Engineer
T. 0121 387 7923
Park Point, High Street, Longbridge, Birmingham, B31 2UQ, UK
www.pja.co.uk

From: Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>
Sent: Tuesday, May 28, 2024 7:12 AM
To: Charlotte Turner <Charlotte.turner@pja.co.uk>; Planning <planning@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>; Rigby, Alex <alex.rigby@affinitywater.co.uk>; Rumble, John <john.rumble@affinitywater.co.uk>

Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Hello Charlotte,

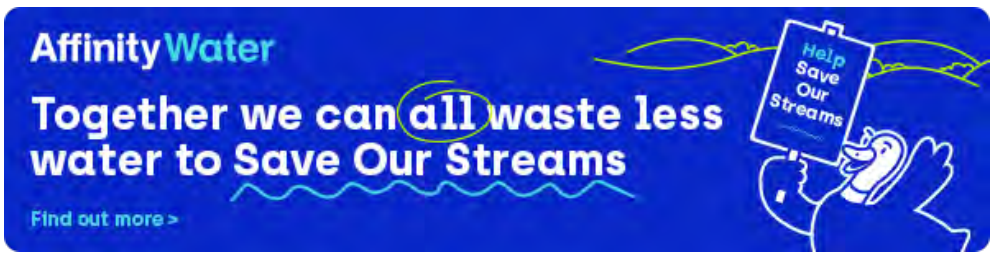
Thank you for reaching us regarding the proposal to infiltrate (via soakaway?) surface water in the detailed development. I cc the planning team who will advise about the condition for infiltrations.

Kind regards

Alessandro Marsili
MSc FGS CGeol
Senior Asset Manager – Hydrogeology Team
Asset Strategy and Capital Delivery Directorate

Affinity Water Limited
Registered Office Tamblin Way, Hatfield, Herts, AL10 9EZ
m +44 (0)7557 579431
alessandro.marsili@affinitywater.co.uk
www.affinitywater.co.uk

affinitywater.co.uk || facebook.com/affinitywater || twitter.com/affinitywater || linkedin.com/company



From: Asset Information Team Mailbox <ait@affinitywater.co.uk>
Sent: Friday, May 24, 2024 1:30 PM
To: Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>
Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Hi Alessandro & Michail,

Is this enquiry from PJA re groundwater protection something you could take on and reply to please?

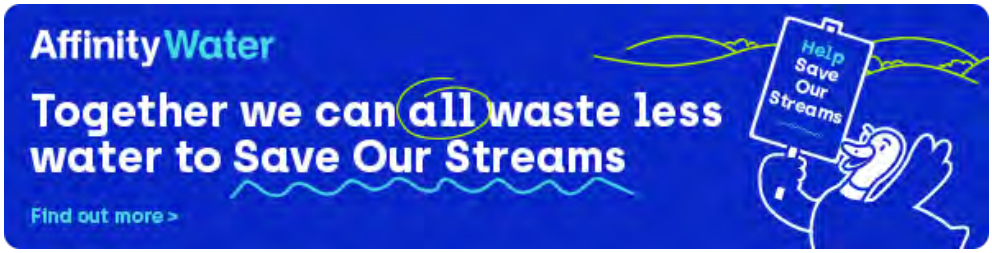
Or should it go to the Planning Team and then to Catchment Protection to respond to? Thanks.

Regards

Alex Rigby
Asset Manager GIS
Asset Information Team

Affinity Water Limited
Tamblin Way, Hatfield, Hertfordshire AL10 9EZ
Mobile: 07725 069389

Email: alex.rigby@affinitywater.co.uk www.affinitywater.co.uk || www.facebook.com/affinitywater || www.twitter.com/affinitywater || www.linkedin.com/company/affinity-water



From: Development Experience (inbox) <dx@affinitywater.co.uk>
Sent: Friday, May 24, 2024 12:04 PM
To: Asset Information Team Mailbox <ait@affinitywater.co.uk>
Cc: Development Experience (inbox) <dx@affinitywater.co.uk>
Subject: FW: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Good morning, Asset Management team,

Please could you assist with a response to the email below?

I'm not certain if this needs to be addressed to Thames Water for surface water infiltration.

Kind Regards

Maya Fernandes

Contact Centre Support Agent
Development Experience

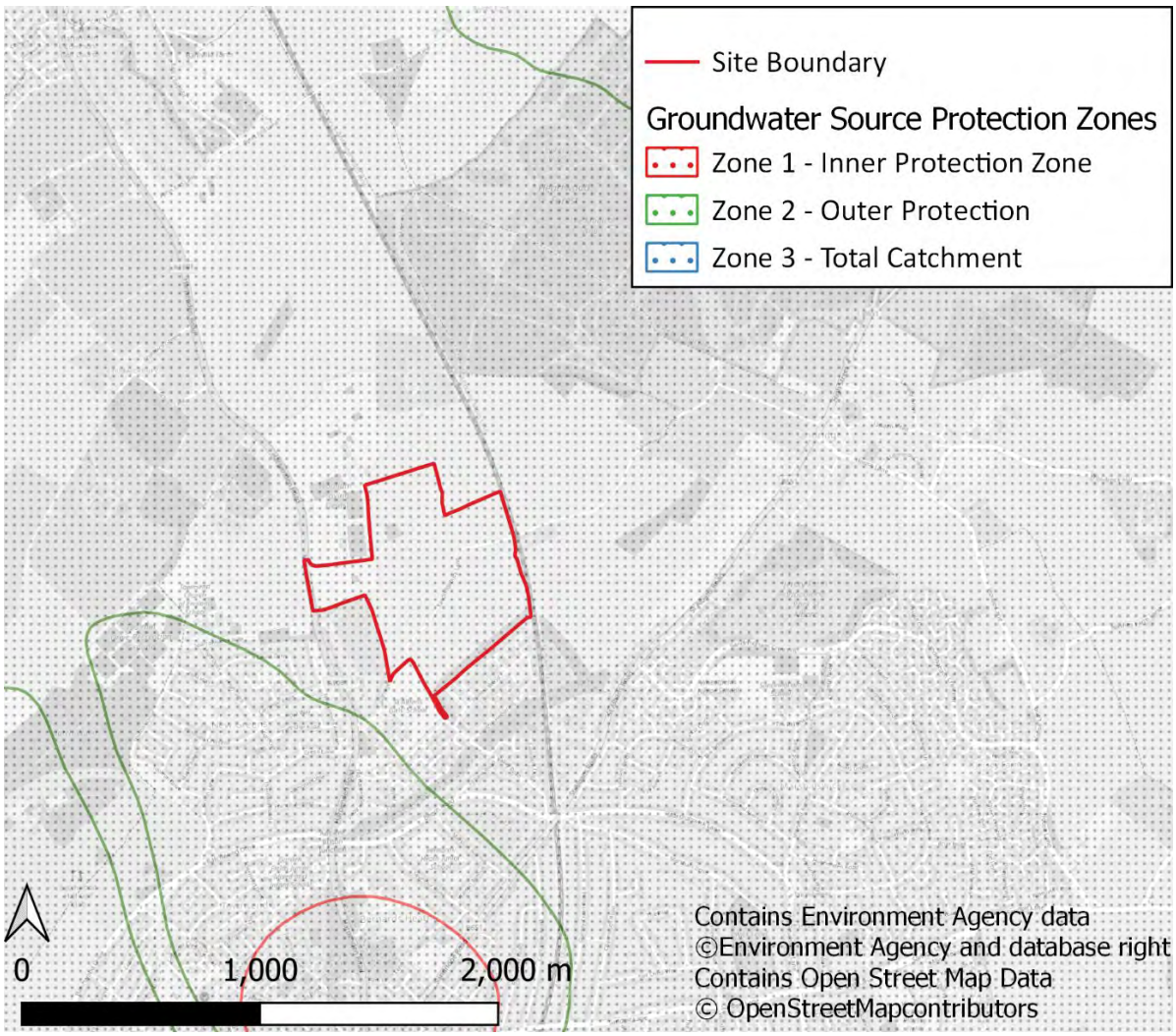
_____
Affinity Water Limited
Tamblin Way, Hatfield, Hertfordshire AL10 9EZ
Tel: 03453 572 428
Email: dx@affinitywater.co.uk
www.affinitywater.co.uk | | www.facebook.com/affinitywater | | www.twitter.com/affinitywater | | www.linkedin.com/company/affinity-water

From: Charlotte Turner <Charlotte.turner@pja.co.uk>
Sent: Thursday, May 23, 2024 4:03 PM
To: Development Experience (inbox) <dx@affinitywater.co.uk>
Cc: Samantha Furey <samantha.furey@pja.co.uk>
Subject: [PJA: 05920] - Information Request - Water Extraction and Infiltration

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hello,

PJA have been appointed to provide flood risk and drainage advice in relation to a development at St Albans. OS Co-ordinates: 515288 , 209785. Please find a Site Location Plan below:



It is our understanding that the Site is situated within Zone 3 – Total Catchment, assumed to be associated with the Principal Aquifer underlying the Site within the bedrock geology.

Infiltration testing in accordance with BRE Digest 365 Design Guidance has been undertaken at the Site, demonstrating that surface water attenuated on-Site could be discharged via infiltration methods. As the Site is situated within a source protection zone, we would be grateful if Affinity Water could advise on the level of treatment required to the attenuated surface water on-Site before discharging via infiltration.

Furthermore, it is our understanding that Affinity Water currently extract water from the Principal Aquifer underlying the Site. As such, we would welcome any additional thoughts or comments you may have in relation to surface water discharging from the Site via infiltration.

If you have any queries, please do not hesitate to contact me.

Kind regards,

Charlotte Turner

Charlotte Turner
Flood Risk & Drainage Engineer
T. 0121 387 7923
Park Point, High Street, Longbridge, Birmingham, B31 2UQ, UK
www.pja.co.uk

Sign up here to receive news from PJA

Registered Office Address: Park Point, 17 High Street, Longbridge, Birmingham, West Midlands, B31 2UQ
Registered in England. Phil Jones Associates Limited, No. 04685684 & PJA Civil Engineering Limited, No. 10412152

_____ This e-mail (including any attachments) is confidential and may also be legally privileged or otherwise protected from disclosure. If you are not the intended recipient of this e-mail or any parts of it please notify us by reply e-mail or by telephone on 01707 268 111 immediately on receipt and then delete the message from your system. You should not disclose the contents to any other person, nor take copies nor use it for any purposes and to do so could be unlawful. The presence of this footnote indicates: this email message has been tested for the presence of known computer viruses, unless the email has been encrypted (in part or full) wherein the email will not be checked for computer viruses. All incoming and outgoing emails may be monitored in line with current legislation. Affinity Water Limited (Company Number 02546950) is registered in England and Wales having their registered office, at Tamblin Way, Hatfield, Hertfordshire, AL10 9EZ. www.affinitywater.co.uk

_____

_____ This e-mail (including any attachments) is confidential and may also be legally privileged or otherwise protected from disclosure. If you are not the intended recipient of this e-mail or any parts of it please notify us by reply e-mail or by telephone on 01707 268 111 immediately on receipt and then delete the message from your system. You should not disclose the contents to any other person, nor take copies nor use it for any purposes and to do so could be unlawful. The presence of this footnote indicates: this email message has been tested for the presence of known computer viruses, unless the email has been encrypted (in part or full) wherein the email will not be checked for computer viruses. All incoming and outgoing emails may be monitored in line with current legislation. Affinity Water Limited (Company Number 02546950) is registered in England and Wales having their registered office, at Tamblin Way, Hatfield, Hertfordshire, AL10 9EZ. www.affinitywater.co.uk

_____

Hertfordshire

Samantha Furey – PJA
Park Point
17 High Street
Birmingham
B31 2UQ

Lead Local Flood Authority
Post Point CHN 215
Hertfordshire County Council
County Hall, Pegs Lane
HERTFORD SG13 8DN
www.hertfordshire.gov.uk

Contact Flood Risk Management Team
Email FRMConsultations@hertfordshire.gov.uk

Date 20 August 2024

Dear Ms Furey,

PRE/2024/SADC/02 – Land North of St Albans (Woollam Park), East of Harpenden Road, St Albans

Thank you for your request for pre application advice, received 24 June 2024, relating to the proposed development of around 1000 dwellings on Greenfield Land to the North of St Albans.

We would like to offer some guidance in relation to the flood risk and surface water drainage that may concern the proposed site.

- The site is at high flood risk from surface water in the high-risk scenario (more than 3.33% chance of flooding each year) showing 30cm-90cm of flooding from two distinct surface water flow paths travelling west to east (see Figure 1). It is unknown if there is a risk of groundwater flooding. We assume that a sequential test has been undertaken at this location that considers all sources of flooding.
- We expect the application to provide a suitable Flood Risk Assessment, in proportion to the risks of flooding at this location. The FRA will be required to include surface water flow path modelling to inform development areas available and how the drainage strategy should be developed. Groundwater monitoring (at least covering February, March and April) and overview of the long-term regional groundwater level maximum should be included in an FRA. The FRA should also consider the drainage from the railway line, whilst on an embankment, a drainage channel may exist along the toe of it. The existing roads should be considered at 100% impermeable area and assume to have no drainage, in a surface water model, to show if this creates its own flood risk.
- The current outline drainage strategy for the surface water runoff from the proposed development (Technical Note dated 31 May 2024), identifies the surface water flow

path but does not include the risk of flooding into the drainage strategy for the development of the site. The SuDS discharge hierarchy must be explored fully, and an evidenced sustainable drainage solution provided. Shallow infiltration must be explored first over proposed deep infiltration systems. An assessment of ground stability and potential subsidence may also need to be required, although the Local Planning Authority would need to have a specific professional to assess any potential solution features and subsidence (the LLFA cannot technically assess this issue). Any deep infiltration boreholes must be assessed to make sure they will not create an artificial spring line further downgradient in the site.

Figure 1: Overlay of the development preliminary surface water drainage strategy (May 2024) and the long term risk from surface water flooding (Environment Agency).

- We are aware that the site to the west of this one is yet to be completed but has planning permission to manage the surface water flow path through the site and exiting onto this application site boundary at the same location as shown on the Environment Agency Surface Water Flood Risk Map. It should be noted that the 0.1% AEP flood outline is a proxy for the 1% plus 40% climate change flood outline until site specific modelling is provided. All development must be removed from the areas at risk of flooding and safe access and egress provided at all design flood events, to show how the development will be safe for its lifetime. This may include assessment of how proposals will not increase the number of people living and working in areas of

flood risk and if there is any additional burden placed on the emergency services (see www.adeptnet.org.uk for guidance on development, flood risk and the emergency services).

- The development access roads will need to be located outside any flood extent and where this is not possible, it will need to be demonstrated in accordance with the flood risk assessment guidance for new developments and the hazard calculations in FD2320. (NPPF PPG Paragraph 005). If roads or footways are crossing or located with the flow paths or crossing watercourses, it will need to be demonstrated that these will not increase food risk to the site itself or the surrounding area through the loss of flood storage or through causing a blockage to the flow of surface water across the site or within the channel.
- The drainage strategy and the type / location of SuDS should be considered at an early stage of the planning process and included in any urban spatial typologies that may be developed (e.g., inclusion of enhanced tree pits). The drainage system is expected to comply with the four pillars of sustainable urban drainage systems (SuDS) of Water Quality, Water Quantity, Amenity and Biodiversity.
- We understand that infiltration testing has been undertaken in 2018 and the results are variable across the site. Whilst one location has been proven to infiltrate well (SK106), the use of one trial pit result to BRE365 standard must be expanded to locations needed for infiltration structures (at the proposed location and depth of the structures).
- If the intention is to manage all surface water flow paths within the site drainage infrastructure, then modelling of the proposed drainage network must be sized accordingly to accept the volume of water from the whole offsite catchment (even at an outline planning stage). If the flow paths are to be managed separately, then evidence must be provided to show how it will be avoided in the first instance and development kept out of these areas. Development must be shown to be safe for its lifetime.
- The site is in the Environment Agency Source Protection Zones III, Total Catchment. The regulations of the Source Protection Zone (SPZ III) is required to be considered in the proposed drainage for the site and additional treatment steps be implemented where necessary (refer to the EA guidance if required). This would include how unknown pollution potential from off-site runoff may need to be treated. Accepting runoff generated offsite may affect the adopting bodies of the SuDS. This should be explored at an early stage.
- We would expect that investigation into infiltration to be undertaken in accordance with the BRE 365 methods (or equivalent) as not all the previous tests were undertaken to this standard. The worst infiltration rate calculated must be used in all drainage supporting calculations. Groundwater monitoring will be required to demonstrate the seasonally high groundwater level in the area and at least 1m of unsaturated zone be provided to the base of the infiltration structure.
- If infiltration is not favourable or there is high groundwater levels, the submitted surface water drainage discharge should not exceed the predevelopment greenfield

QBAR rate for all storms (or provide a complex control with long term storage). It should be noted that we do not see another possible discharge location as there are no ordinary watercourses or surface water sewers downgradient of this site. Source control SuDS must be included in any drainage design to limit the reliance on regional attenuation / infiltration basins.

- A detailed surface water drainage assessment should be carried out to demonstrate that the proposed development will not create an increased risk of flooding from surface water to the development site and surrounding area for the critical storm up to and including the 1% AEP plus climate change event. This should be done in accordance with the national Planning Policy Framework (NPPF) and Planning Policy Guidelines (PPG) along with the Hertfordshire LLFA guidance.
- 1% AEP rainfall events plus climate change shall not leave the application boundary or flood any part of a building, utility plant susceptible to water within the development boundary.
- 3.33 % AEP rainfall event plus climate change shall not flood outside the drainage network which is designed to hold water.
- FEH rainfall data should be used in calculations and CV values of 1 should be applied. Urban creep should be applied to storage volume calculations where applicable.
- The site is located within the Upper and Bedford Ouse Management Catchments Environment Agency Climate Change Allowances) and therefore the Peak rainfall allowances that should be used for the 1 in 30 (3.33%) and the 1 in 100(1% AEP) are 35% and 40% retrospectively.
- Exceedance flow paths need to be submitted as part of the application and these should take into consideration the layout of the development and any ground levels to ensure these events are safely managed and minimise impacts for flooding.
- It appears that this large site will be phased, it should be made clear how phasing would work alongside any drainage strategy, i.e. each phase must be able to connect to the drainage outfall and each parcel have its own drainage layout / strategy that can be completed independently from each other. The proposal must include source control rather than propose a single regional sized attenuation structure. Temporary flow controls may be required alongside other temporary measures during the duration of the build out. A temporary drainage strategy should be included in any masterplan of the site.
- The school site may not be developed by the same team as the rest of the site. Allowance must be made for the school site to connect to the wider drainage network and have a positive drainage outfall from the site if infiltration is not proven to be possible within the school outline boundary. The school site must also be shown that above ground SuDS can be incorporated but still provide essential educational needs e.g. play space. Source control and multifunction SuDS such as permeable surfaces may need to be included.
- We would highlight that the greenfield runoff rates that have been provided rely on a user defined BFI value. As the area is likely to be groundwater dominated, we would

request how this value (0.6) has been derived. QBAR of 1.7l/s/ha may need to be reduced down as far as 1/l/s/ha in line with the SUDS Manual guidance.

- Management and Maintenance easements should be included on all SuDS features – an overview of the land take required to provide maintenance access should be considered at an outline stage (e.g. maintenance strips around ponds).

Informative

For further advice on what we expect to be contained within the FRA to support an planning application, please refer to our information and checklists on our website https://www.hertfordshire.gov.uk/services/recycling-waste-and-environment/water/surface-water-drainage/surface-water-drainage.aspx This link also includes HCC's policies on SuDS in Hertfordshire.

The summary above contains a note of the issues discussed at the pre app / urban design meeting with the LPA / LLFA and applicant on the 20 August 2024. If there is further information or meetings required please contact the Flood Risk Management Team. We would welcome the LPA's suggestion of including SuDS land requirements, for e.g. swales along roads, on parameter plans.

This pre application advice will only be valid for 12 months or unless there is a major update of policy, guidance or technical standards during that time.

Yours sincerely,

Elaine

Elaine Simpson

SuDS and Watercourses Support Officer
Growth and Environment

Annex

The following documents have been reviewed, which have been submitted to support the application;

- Technical Note – Preliminary Surface Water Drainage Strategy for the proposed development at Land North of St Albans, Harpenden Road, prepared by PJA, 31 May 2024, REF 05920-P0-SF-AC version P0.
- Drawing: Local Centre Location Options including the preferred option
- Document: Woollam Park Spatial Typologies
- Drawing: Placemaking Plan – dated 15 August 2024 (by Define reference: DE-565_029)
- Drawing: Tree Hedgerow Plan - dated 15 August 2024 (by Define reference: DE-565_L_400)
- Drawing: Landscape Framework and Illustrative Site Sections (By Define reference: DE_565_NSA_L_100 to 104.

From:	NET Enquiries
To:	Charlotte Turner
Subject:	HNL 363800 JH - RE: 240603/msr05 - [PJA: 05920] - Groundwater Source Protection Zone and Aquifer Information Request
Date:	20 June 2024 15:34:45

Dear Charlotte,

Enquiry regarding: [PJA: 05920] - Groundwater Source Protection Zone and Aquifer Information

Thank you for your enquiry which was received on 23 May 2024.

We respond to requests for information that we hold under the Freedom of Information Act 2000 (FOIA) and Environmental Information Regulations 2004 (EIR).

Please find below our technical teams response:

You have correctly identified that the site is located within groundwater source protection zone 3 (SPZ3) and that it is underlain by the Chalk Principal Aquifer. SPZ3, also referred to as “total catchment” is the area around abstraction points where it is presumed that infiltrated water will ultimately end up at the abstraction. More information about source protection zones can be found:

Groundwater source protection zones (SPZs) - GOV.UK (www.gov.uk)

The SPZ are periodically updated and the current SPZ mapping can be found on the DEFRA Magic website:

Magic Map Application (defra.gov.uk)

The SPZ mapping and drinking water safeguard zones can be found under: Designations -> land-based designations -> non-statutory

With respect to the infiltration of surface water at this location. We note that no details regarding the development or the site history have been provided, the soil horizon where the infiltration tests were conducted, or what form of infiltration the applicant had in mind so, we can only provide general guidance. But assuming that the surface water is predominantly rainfall draining from roofs and areas of hardstanding, and that the site does not have a history of contaminative land use, we would not object to proposals for surface water infiltration at this location assuming the following:

- Infiltration sustainable drainage systems (SuDS) are suitably designed.
- Infiltration SuDS meet the Governments non-statutory technical guidance for SuDS Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (publishing.service.gov.uk). The CIRIA SuDS manual is (C753) is also a useful resource and is available Item Detail (ciria.org)
- The surface water drainage scheme incorporates a SuDS management treatment train - that is, use drainage components in series to achieve a robust surface water management system that does not pose an unacceptable risk of pollution to groundwater
- The surface water is from areas where no potentially contaminative activities have occurred and is free from hazardous substances as per the current JAGDAG list

of confirmed hazardous substances to groundwater (2018 01 31 Confirmed hazardous substances list_0.pdf (wfduk.org)). Please note that surface water discharges from heavily trafficked areas and areas where vehicles are stored may contain hazardous substances and the expectation is that the SuDS scheme for the site will incorporate pollution control features that would prevent hazardous contaminants entering the infiltration point (see bullet point above).

- **The discharge point cannot be direct to groundwater** (i.e. via a borehole that penetrates to water table). The applicant will need to provide confidence that the infiltration point has been designed to be as shallow as possible to retain the beneficial filtration effects of soils in the unsaturated zone above the permanent water table.

Given that the above can be satisfied we do not feel that an environmental permit for infiltration of surface water would be required at this location.

We do note that the geological mapping for the area (available GeoIndex - British Geological Survey (bgs.ac.uk)) indicates the potential for "clay with flints" beneath the site that may prevent the use of some forms of infiltration drainage. Please note our final bullet point above – if a borehole soakaway is to be proposed it cannot penetrate the water table and the applicant must ensure that infiltration point is as shallow as possible and that pollution at the water table cannot occur.

Please refer to the Open Government Licence which explains the permitted use of this information.

Most of our data is being made available to the public via the Defra Data Services Platform. You will need to register to obtain access.
If you are not satisfied you can contact us within 2 calendar months to ask for our decision to be reviewed.
If you require any further assistance please contact me.
Kind regards

James Hammett
Customers and Engagement Officer
Direct dial 0203 0259058 / 9210
Mobile 07769 365347
Direct email HNLenquiries@environment-agency.gov.uk

Address: Environment Agency, Hertfordshire and North London
Alchemy, Bessemer Road, Welwyn Garden City, Hertfordshire, AL7 1HE

Pronouns: he/him/his (why is this here?)
Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else. We have checked this email and its attachments for viruses. But you should still check any attachment before opening it. We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.

From:	NET Enquiries
To:	Charlotte Turner
Subject:	HNL343550/AS - [PJA: 05920] - St Albans Product 4 Request TL 15256 09761
Date:	24 January 2024 13:27:21
Attachments:	image014.png image016.png image017.png image018.png image019.png

---

Dear Charlotte

Thank you for your enquiry which was received on 16 January 2024.

Please note that this information is already freely available online at the links below.

The information on Flood Zones in the area relating to site in St Albans at NGR 515256,209761 is as follows:

The property is in an area located within Flood Zone 1 shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named site is in and is not specific to the property/proposed development itself.

Because this site does not fall within an area at risk of flooding from rivers or the sea, we do not hold any detailed flood modelling data that would impact your site. As such we are unable to provide a flood risk product.

This address is within an area at High risk of surface water flooding.

Following the Flood and Water Management Act 2010, Lead Local Flood Authorities are responsible for the management of groundwater and surface water flooding. They also maintain a register of property flooding incidents. You may want to seek further advice from the Lead Local Flood Authority Hertfordshire County Council, who may have further information.

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments

https://www.gov.uk/planning-applications-assessing-flood-risk
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

You can also view and print surface water flood maps online at:
http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=ufmfsw#x=357683&y=355134&scale=2

Here is the link to the climate change allowances:
https://www.gov.uk/government/publications/peak-river-flow-climate-change-allowances-by-management-catchment

This information is provided subject to the Open Government Licence, which you

should read.

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

Data Available Online

Many of our flood datasets are available online:

- **You can view and download flood risk maps from our website at:** http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=357683&y=355134&scale=2

- **Flood Map For Planning** (Flood Zone 2, Flood Zone 3, Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)

- Here is the link to the climate change allowances: https://www.gov.uk/government/publications/peak-river-flow-climate-change-allowances-by-management-catchment
- Risk of Flooding from Rivers and Sea

- Historic Flood Map

- Assets and Defences

- Current Flood Warnings

- Open data

- Groundwater data Hydrology Data Explorer

- Reservoir flood risk Reservoir flood maps: when and how to use them - GOV.UK (www.gov.uk)

- Details of aquifers are online - https://data.gov.uk/search?q=aquifer&filters%5Bpublisher%5D=Environment+Agency&filters%5Btopic%5D=&filters%5Bformat%5D=&sort=best

Please use the following link for details of reports for known problems regarding groundwater flooding issues https://www.gov.uk/government/collections/groundwater-current-status-and-flood-risk If there is not one for your site then we have no reports of any problems there in our records.

Groundwater level data can be found as open data here: https://data.gov.uk/search?q=groundwater+levels alternatively a public database is available from https://www.bgs.ac.uk/information-hub/borehole-records/

I hope that we have correctly interpreted your request. If you are not satisfied with our response to your request for information you can contact us within 2 calendar

months to ask for our decision to be reviewed.

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 and the associated Environmental Information Regulations 2004.

This information is provided subject to the Open Government Licence, which you should read.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely

Annette Smith
Customers and Engagement Officer
Environment Agency, Hertfordshire and North London
Alchemy, Bessemer Road, Welwyn Garden City, Hertfordshire, AL7 1HE
Direct dial 0203 0258975
Direct email HNLenquiries@environment-agency.gov.uk

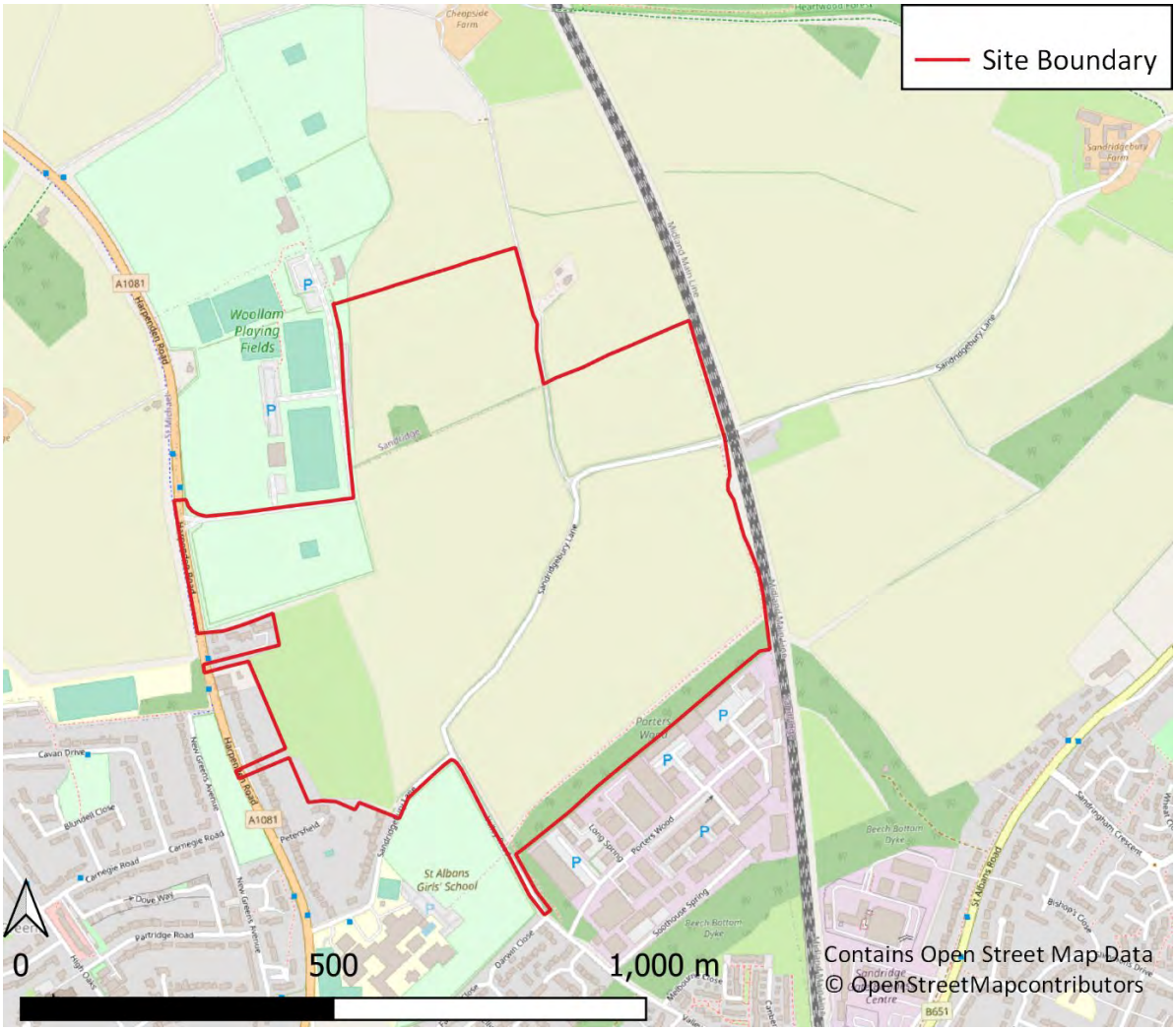
My usual working hours are 8.30am to 3pm, Mondays to Wednesdays

---

From: Charlotte Turner <Charlotte.turner@pja.co.uk>
Sent: 16 January 2024 09:14
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Cc: Samantha Furey <samantha.furey@pja.co.uk>
Subject: 240117/AG07 [PJA: 05920] - St Albans Product 4 Request TL 15256 09761

Hello,

PJA have been appointed to provide flood risk and drainage advice for a proposed development at St Albans. OS Co-ordinates: 515256 , 209761. A Site Location Plan is available below:



We are aware that the Site is situated within Flood Zone 1 after a review of the Flood Map for Planning.

As such, we would be grateful if you could provide Product 4 data that is associated with this.

In addition, we would be grateful for any data you hold on flood defences, surface water, ground water or reservoir flood risk within the vicinity of the Site.

Furthermore, we would be grateful if you could provide any information or comments in relation to the Principal Aquifer situated within the vicinity of the Site.

We would welcome any additional thoughts or comments you may have in relation to this.

Kind regards,

Charlotte Turner

Charlotte Turner
Flood Risk & Drainage Engineer
T. 0121 387 7923
Park Point, High Street, Longbridge, Birmingham, B31 2UQ, UK
www.pja.co.uk

Sign up here to receive news from PJA

Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else. We have checked this email and its attachments for viruses. But you should still check any attachment before opening it. We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.

Appendix F Sitewide Drainage Strategy Drawings

A1 1:2000 0 20 40 60 80 100 120 140

Basin	Developable Area [ha]	Assumed Impermeable Area [ha]	Assumed Impermeable Area including 10% Urban Creep [ha]	Indicative Attenuation Volume [m3]
Catchment A	3.35	2.65	2.84	1,785
Catchment B	2.41	1.57	1.57	1,220
Catchment C	3.46	2.59	2.78	5,115
Catchment D	3.00	2.37	2.54	2,110
Catchment E	0.62	0.63	0.66	2,165
Catchment F, I, G and J	9.63	7.10	7.48	4,145
Catchment H	1.11	1.44	1.44	4,015
Catchment K	2.42	1.87	2.01	3,010
Catchment L	0.75	0.86	0.90	5,000
Total	**26.75**	**21.08**	**22.23**	**28,565**

KEY:

- Site Boundary
- Catchment A
- Catchment B
- Catchment C
- Catchment D
- Catchment E
- Catchment F
- Catchment G
- Catchment H
- Catchment I
- Catchment J
- Catchment K
- Catchment L
- Indicative Location of Attenuation Basin with 3m maintenance strip
- Indicative Location of Infiltration Basin with 3m maintenance strip
- Location of Infiltration Testing Location IT04
- Indicative Location of Low proposed Flow Channel
- Indicative Location of proposed Conveyance Feature
- Indicative Location of proposed Headwall
- Indicative Location of Railway Line
- Indicative Easement of 21m from the Railway Line (TBC)
- Indicative Location of Proposed Surface Water Sewer
- Indicative Surface Water Flow Route
- Indicative Location of Proposed Foul Water Pumping Station with and Storage Compound
- Indicative Location of Proposed Surface Water Flow Routing Channel (0.5m deep with 1:3 side slopes - 3.5m wide)
- Indicative Location of Proposed Surface Water Swale (1.0m deep, 0.5m base width with 1:4 side slopes)
- Indicative Location of Proposed Orifice Plate
- Indicative Location of Proposed Flow Control

Proposed sports pitch drainage to be designed by others

Proposed SuDS feature to provide attenuation for sports pitch drainage in separate drainage strategy (Ref. 05920-A-0503)

Catchment A:
CL: 117.25mAOD
IL: 115.95mAOD
Depth: 1.3m
Side Slopes: 1:4
Indicative Attenuation Storage Area: 2,465m²
Indicative Storage Volume: 1,785m³
Discharge Rate: 70.0l/s

Catchment B - Swale 1.001 and Swale 1.002:
Depth: 1.0m (including 300mm freeboard)
Side Slopes: 1:4
A check dam will be integrated within the feature to slow the flow of water.

Catchment B - Swale 1.004 and 1.005:
Depth: 1.0m (including 300mm freeboard)
Side Slopes: 1:4
A check dam will be integrated within the feature to slow the flow of water

Catchment B - Basin 3:
CL: 111.00mAOD
IL: 109.50mAOD
Depth: 1.5m
Side Slopes: 1:4
Indicative Storage Area: 1,615m²
Indicative Storage Volume: 1,220m³
Discharge Rate: 80.0 l/s

Catchment E:
CL: 107.50mAOD
IL: 105.20mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1:5
Indicative Storage Area: 2,130m²
Indicative Storage Volume: 2,165m³
Discharge Rate: 49.7l/s

Catchment C:
CL: 106.50mAOD
IL: 104.00mAOD
Depth: 2.5m
Side Slopes: 1:3 / 1:5
Indicative Storage Area: 4,305m²
Indicative Storage Volume: 5,115m³
Discharge Rate: 27.5l/s

Catchment D:
CL: 104.00mAOD
IL: 101.60mAOD
Depth: 2.4m (including Platform)
Side Slopes: 1:4 / 1:5
Indicative Storage Area: 4,605m²
Attenuation Storage: 2,110m³
Infiltration Rate: 1.88x10⁻⁵

IT04

Catchment L:
CL: 105.70mAOD
IL: 103.40mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 3,975m²
Attenuation Storage Volume: 5,000m³
Discharge Rate: 34.0l/s

Catchment K:
CL: 107.00mAOD
IL: 104.70mAOD
Depth: 2.3m (Including Platform)
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 3,675m²
Attenuation Storage Volume: 3,010m³
Discharge Rate: 47.0 l/s

Catchment H:
CL: 108.00mAOD
IL: 105.70mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 4,285m²
Attenuation Storage Volume: 4,015m³
Discharge Rate: 51.0 l/s

Catchment F, I, G and J:
CL: 108.525mAOD
IL: 106.225mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 3,415m²
Attenuation Storage Volume: 4,145m³
Discharge Rate: 235.0 l/s

PS

RISK ITEM No. 1

RISK ITEM No. 2

RISK ITEM No. 3

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. This Drawing is not to be reproduced in any part or form without the consent of PJA Civil Engineering Ltd. All copyright reserved.
2. No assessment of earthworks has been undertaken at this stage.
3. No assessment of surcharged outfall has been undertaken at this stage.
4. No utilities and arbor-cultural consideration has been undertaken at this stage.
5. Drawing should be read in conjunction with all other relevant scheme drawings.
6. Drawing Includes:
   - 6.1. Blue Green Infrastructure Plan provided by Define in September 2025 (Drawing No: DE_565_74_REV_E).
   - 6.2. Proposed Levels produced by PJA in September 2025(Drawing no. 05920-WR-A-0530)
   - 6.3. Tree Survey provided by FPCR dated December 2023 (8575-T-01)
   - 6.4. An infiltration rate of 1.88x10^{-5}m/s from location IT04 was used from the 2024 Geo Environmental Group Infiltration Testing.
7. Indicative Surface Water Drainage Strategy based on:
   - 7.1. Attenuation Basin A is 1.3m deep with 1:4 side slopes (including 300mm freeboard)
   - 7.2. Attenuation Basin B3 is 1.5m deep with 1:4 side slopes (including 300mm freeboard).
   - 7.3. Attenuation Basins FIGJ, H, and K are 2.3m deep with platform to facilitate planting. Staged basin is 1m deep with 1:3 side slopes. From the proposed platform, the basin utilises 1:5 side slopes and is 1.3m in depth.
   - 7.4. Attenuation Basins L and E are 2.3m deep with platform to facilitate planting. Staged basin is 0.8m deep with 1:3 side slopes. From the proposed platform, the basin utilises 1:5 side slopes and is 1.5m in depth.
   - 7.4. Attenuation Basin C is 2.5m deep with platform to facilitate planting. Staged basin is 1m deep with 1:3 side slopes. From the proposed platform, the basin utilises 1:5 side slopes and is 1.5m in depth.
   - 7.5. Attenuation Basin D is 2.4m deep with platform to facilitate planting. Staged basin is 1.4m deep with 1:4 side slopes.From the proposed platform, the basin utilises 1:5 side slopes and is 1m in depth.
   - 7.6. Volume within conveyance features has not been included within the attenuation calculations at this stage.
   - 7.7. Discharge limited to an infiltration rate of 1.88x10^{-5}m/s in accordance with the Geo Environmental Group Infiltration Testing.
   - 7.8. FEH 22 Data.
   - 7.9. Cv Values of 1.
8. Impermeable Area Assumptions:
   - 8.1. 60% impermeable for all residential development with an additional 10% for urban creep.
   - 8.2. 100% impermeable for all highways.
   - 8.3. 100% impermeable for all attenuation basins.
   - 8.4. 50% for all educational facilities.
   - 8.5. 80% for mixed used development
   - 8.6. 90% for commercial development.
9. Further consideration of utilities, arboricultural and ecological constraints should be undertaken prior to detailed design.
10. Indicative surface water drainage design based on masterplanning at the time of production and impermeable areas may result in changes to the drainage strategy.
11. Further ground investigation to confirm infiltration rates, seasonal groundwater levels and detail of the underlying chalk solubility is required.

RISK ITEMS:

Risk Item 1: Indicative Surface Water Drainage Strategy is subject to proposed development hydraulic modelling to refine surface water flood extents across the Site.

Risk Item 2: Indicative Surface Water Drainage Strategy is subject to a detailed earthworks and levels assessment.

REV	DATE	REVISION NOTE	BY
P11	26/09/2025	REVISED MASTERPLAN	AB
P10	20/08/2025	UPDATES TO HYDRAULIC MODELLING	SF
P09	04/12/2024	UPDATING RED LINE BOUNDARY	JJG
P08	04/11/2024	REVISED DRAINAGE STRATEGY	CT
P07	23/10/2024	LANDSCAPE STRATEGY UPDATED	GD
P06	16/10/2024	REVISED DRAINAGE STRATEGY	CT
P05	15/10/2024	REVISED DRAINAGE STRATEGY	CT
P04	07/10/2024	REVISED DRAINAGE STRATEGY	CT
P03	20/09/2024	REVISED DRAINAGE STRATEGY	CT
P02	19/08/2024	REVISED DRAINAGE STRATEGY	CT
P01	27/11/2023	DRAFT FOR COMMENT	GD

PJA
Seven House - High Street
Longbridge - Birmingham
B31 2UQ - Tel: 0121 475 0234
Birmingham - Bristol
Exeter - London - Reading
pja.co.uk

CLIENT
Hallam Land Management Limited and St Albans School

PROJECT
Woollam Park, St Albans

DRAWING TITLE
Surface Water Drainage Strategy

DRAWING ISSUE STATUS
PLANNING

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05920	-WR-	0525	-P11

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@2,000	CT	AC	Sept 2025

Copyright © PJA Civil Engineering Ltd. All rights reserved

A1 1:2000 0 20 40 60 80 100 120 140

Proposed Connection
Location - Manhole 8702:
Cover Level: 119.61mAOD
Invert Level: 115.26mAOD
RISK ITEM No. 1

Location of Proposed Foul Water Pumping Station (Type 3) with Deep Wet Well (Depth TBC)
Indicative Pumping Rate:27.6l/s
RISK ITEM No. 1

Indicative Additional Foul Water Storage: 168m³

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. This Drawing is not to be reproduced in any part or form without the consent of PJA Civil Engineering Ltd. All copyright reserved.
2. No assessment of earthworks has been undertaken at this stage.
3. No assessment of surcharged outfall has been undertaken at this stage.
4. No utilities and arbor-cultural consideration has been undertaken at this stage.
5. Drawing should be read in conjunction with all other relevant scheme drawings.
6. Drawing Includes:
   - 6.1. Blue Green Infrastructure Plan provided by Define in September 2025 (Drawing No: DE_565_74_REV_E).
   - 6.2. Proposed Levels produced by PJA in September 2025(Drawing no. 05920-WR-A-0530)
   - 6.3. Tree Survey provided by FPCR dated December 2023 (8575-T-01)
7. Foul Water Drainage Strategy is indicative and subject to agreement with Thames Water.
8. Exact details of pumping station to be confirmed at the detailed design stage, including the depth of the wet well. Access to pumping station to be achieved by adoptable highway.
9. Foul Water Drainage Strategy based on information available at the time of writing and is subject to masterplanning information and Thames Water Correspondence.

RISK ITEMS: RISK ITEM No. 1

Risk Item 1: A gravity-led solution is proposed to the foul water pumping station situated to the south west of the Site. Foul water will then be pumped to the existing Thames Water foul water sewer, situated along Harpenden Road at Manhole 8702 in accordance with pre-development enquiry guidance (ref. DS6111499 - October 2024). It should be noted that modelling work will need to be undertaken by Thames Water to ensure there is enough capacity within the existing network.

KEY:

- Site Boundary
- Indicative Easement of 21m from the Railway Line (TBC)
- Indicative Foul Water Flow Route
- Existing Severn Trent Water Foul Water Sewer
- Indicative Route of Proposed Foul Water Rising Main
- Indicative Location of Proposed Foul Water Pumping Station with 20m Cordon Sanitaire and Storage Compound

REV	DATE	REVISION NOTE	BY
P02	26/09/2025	REVISED MASTERPLAN	AB
P01	04/12/2024	REVISED RED LINE BOUNDARY	JJG
P0	08/10/2024	DRAFT FOR COMMENT	CT

PJA
Seven House - High Street
Longbridge - Birmingham
B31 2UQ - Tel: 0121 475 0234
Birmingham - Bristol
Exeter - London - Reading
pja.co.uk

CLIENT
Hallam Land Management Limited and St Albans School

PROJECT
Woollam Park, St Albans

DRAWING TITLE
Indicative Foul Water Drainage Strategy

DRAWING ISSUE STATUS
DRAFT

PJA JOB No.	SUB-CODE	DRAWING NO	REVISION
05920	- WR -	0526	- P02

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@2,000	AB	AC	Sept 2025

Copyright PJA Civil Engineering Ltd

Appendix G Sitewide Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Catchment D	2.540	5.00	104.000	98.253	80.022	2.400
Catchment A	2.840	5.00	117.250	13.925	56.994	1.300
Catchment B3	0.785	5.00	111.000	58.383	72.719	1.500
Catchment E	0.660	5.00	107.500	77.143	83.971	2.300
Catchment C	2.780	5.00	106.500	88.772	82.843	2.500
Catchments F, I, G and J	7.480	5.00	108.525	57.010	39.556	2.300
Catchment H	1.440	5.00	108.000	69.595	51.421	2.300
Catchment k	2.010	5.00	107.000	80.954	63.623	2.300
Catchment L	0.900	5.00	105.700	96.320	64.984	2.300
1	0.000	5.00	103.000	105.085	80.027	2.500
Swale 1A	0.000	5.00	116.500	24.494	59.275	1.000
Swale 1.1			115.575	31.280	60.532	1.000
Swale 1.2			114.650	38.399	61.973	1.000
Swale 2	0.785	5.00	113.575	45.634	63.546	1.000
Swale 2.1			112.650	49.186	65.155	1.000
Swale 2.2			111.725	53.172	67.234	1.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.007	Catchment B3	Catchment E	75.000	0.600	109.500	105.200	4.300	17.4	900	7.32	43.8
1.008	Catchment E	Catchment C	30.000	0.600	105.200	104.000	1.200	25.0	900	7.40	43.6
1.009	Catchment C	Catchment D	25.000	0.600	104.000	101.600	2.400	10.4	900	7.44	43.5
2.000	Catchments F, I, G and J	Catchment H	25.000	0.600	106.225	105.700	0.525	47.6	750	5.10	50.0
2.003	Catchment L	Catchment D	30.000	0.600	103.400	101.600	1.800	16.7	750	5.34	50.0
1.010	Catchment D	1	10.000	0.600	101.600	100.500	1.100	9.1	1725	7.45	43.4
2.001	Catchment H	Catchment k	25.000	0.600	105.700	104.700	1.000	25.0	750	5.18	50.0
2.002	Catchment k	Catchment L	30.000	0.600	104.700	103.400	1.300	23.1	750	5.26	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.007	7.520	4784.1	698.6	0.600	1.400	4.410	0.0
1.008	6.279	3994.6	798.9	1.400	1.600	5.070	0.0
1.009	9.735	6193.1	1233.4	1.600	1.500	7.850	0.0
2.000	4.061	1794.0	1351.6	1.550	1.550	7.480	0.0
2.003	6.873	3036.4	2137.7	1.550	1.650	11.830	0.0
1.010	15.523	36278.8	3488.6	0.675	0.775	22.220	0.0
2.001	5.609	2478.2	1611.8	1.550	1.550	8.920	0.0
2.002	5.839	2579.6	1975.1	1.550	1.550	10.930	0.0

Flow+ v10.7 Copyright © 1988-2025 Causeway Technologies Ltd

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Catchment A	Swale 1A	36.000	0.600	115.950	115.500	0.450	80.0	450	5.26	50.0
1.001	Swale 1A	Swale 1.1	37.000	0.035	115.500	114.575	0.925	40.0	500	5.48	50.0
1.002	Swale 1.1	Swale 1.2	37.000	0.035	114.575	113.650	0.925	40.0	500	5.69	49.3
1.003	Swale 1.2	Swale 2	43.000	0.035	113.650	112.575	1.075	40.0	450	6.37	46.9
1.004	Swale 2	Swale 2.1	37.000	0.035	112.575	111.650	0.925	40.0	500	6.58	46.2
1.005	Swale 2.1	Swale 2.2	37.000	0.035	111.650	110.725	0.925	40.0	500	6.79	45.5
1.006	Swale 2.2	Catchment B3	35.000	0.035	110.725	109.650	1.075	32.6	750	7.15	43.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	2.274	361.7	513.2	0.850	0.550	2.840	0.0
1.001	2.901	13053.0	513.2	0.000	0.000	2.840	0.0
1.002	2.901	13053.0	506.4	0.000	0.000	2.840	0.0
1.003	1.053	167.4	481.4	0.550	0.550	2.840	0.0
1.004	2.901	13053.0	605.0	0.000	0.000	3.625	0.0
1.005	2.901	13053.0	595.6	0.000	0.000	3.625	0.0
1.006	1.640	724.7	563.3	0.250	0.600	3.625	0.0

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)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320
30	120	240	480	720	1440	2880	

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

Node Catchment A Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.000	Sump Available	✓
Replaces Downstream Link	x	Product Number	CTL-SHE-0340-7000-0950-7000
Invert Level (m)	116.000	Min Outlet Diameter (m)	0.375
Design Depth (m)	0.950	Min Node Diameter (mm)	2100
Design Flow (l/s)	70.0		

Node Catchment B3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	109.500	Product Number	CTL-SHE-0357-8000-1200-8000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	80.0	Min Node Diameter (mm)	2100

Flow+ v10.7 Copyright © 1988-2025 Causeway Technologies Ltd

Node Catchment E Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	105.200	Product Number	CTL-SHE-0281-4970-2000-4970
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	49.7	Min Node Diameter (mm)	2700

Node Catchment C Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	104.000	Product Number	CTL-SHE-0211-2750-2200-2750
Design Depth (m)	2.200	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	27.5	Min Node Diameter (mm)	2100

Node Catchments F, I, G and J Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	2.000	Sump Available	✓
Replaces Downstream Link	x	Product Number	CTL-SHE-0550-2350-2000-2350
Invert Level (m)	106.225	Min Outlet Diameter (m)	
Design Depth (m)	2.000	Min Node Diameter (mm)	
Design Flow (l/s)	235.0		

Node Catchment D Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	101.810	Product Number	CTL-SHE-0012-1000-1900-1000
Design Depth (m)	1.900	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.1	Min Node Diameter (mm)	1200

Node Catchment L Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	2.003	Sump Available	✓
Replaces Downstream Link	x	Product Number	CTL-SHE-0236-3400-2000-3400
Invert Level (m)	103.400	Min Outlet Diameter (m)	0.300
Design Depth (m)	2.000	Min Node Diameter (mm)	1800
Design Flow (l/s)	34.0		

Node Catchment H Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	2.001	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0284-5100-2000-5100
Invert Level (m)	105.700	Min Outlet Diameter (m)	0.300
Design Depth (m)	2.000	Min Node Diameter (mm)	2100
Design Flow (l/s)	51.0		

Flow+ v10.7 Copyright © 1988-2025 Causeway Technologies Ltd

Node Catchment k Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	2.002	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0274-4700-2000-4700
Invert Level (m)	104.700	Min Outlet Diameter (m)	0.300
Design Depth (m)	2.000	Min Node Diameter (mm)	2100
Design Flow (l/s)	47.0		

Node Swale 1.1 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	x	Diameter (m)	0.225
Downstream Link	1.002	Invert Level (m)	114.575	Discharge Coefficient	0.600

Node Swale 1.1 Online Weir Control

Flap Valve	x	Invert Level (m)	115.275	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	4.500		

Node Swale 2.1 Online Orifice Control

Flap Valve	x	Invert Level (m)	111.650	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.750		

Node Swale 2.1 Online Weir Control

Flap Valve	x	Invert Level (m)	112.350	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	4.500		

Node Catchment D Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.06768	Safety Factor	1.5	Invert Level (m)	101.600
Side Inf Coefficient (m/hr)	0.06768	Porosity	1.00	Time to half empty (mins)	1710

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	2033.0	2033.0	1.400	3170.0	10365.0	1.401	3393.0	10365.0	2.400	4605.0	10365.0

Node Catchment A Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	115.950
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	248

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1510.0	0.0	1.300	2465.0	0.0

Node Catchment B3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	109.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	315

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	625.0	0.0	1.500	1615.0	0.0

Flow+ v10.7 Copyright © 1988-2025 Causeway Technologies Ltd

Node Catchment E Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	105.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	510

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	515.0	0.0	0.800	800.0	0.0	0.801	935.0	0.0	2.300	2125.0	0.0

Node Catchment C Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	104.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	2460

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	1285.0	0.0	1.000	1930.0	0.0	1.001	2160.0	0.0	2.500	4100.0	0.0

Node Catchments F, I, G and J Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	106.225
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	736

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	1450.0	0.0	1.000	1940.0	0.0	1.001	2120.0	0.0	2.300	3415.0	0.0

Node Catchment H Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	105.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	1245

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	515.0	0.0	1.000	970.0	0.0	1.001	2720.0	0.0	2.300	4285.0	0.0

Node Catchment k Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	104.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	1500

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	165.0	0.0	1.000	490.0	0.0	1.001	2090.0	0.0	2.300	3675.0	0.0

Node Catchment L Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	103.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	1620

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	1610.0	0.0	0.800	2070.0	0.0	0.801	2270.0	0.0	2.300	3975.0	0.0

Flow+ v10.7 Copyright © 1988-2025 Causeway Technologies Ltd

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	Catchment D	1920	102.254	0.654	88.1	1502.5280	0.0000	OK
240 minute summer	Catchment A	168	116.499	0.549	360.1	939.9086	0.0000	SURCHARGED
240 minute summer	Catchment B3	244	110.183	0.683	231.2	580.6724	0.0000	OK
600 minute summer	Catchment E	675	106.465	1.265	115.8	1046.7030	0.0000	SURCHARGED
1440 minute summer	Catchment C	1500	105.502	1.502	126.3	2853.5850	0.0000	SURCHARGED
180 minute summer	Catchments F, I, G and J	128	107.417	1.192	1127.8	2120.9450	0.0000	SURCHARGED
480 minute winter	Catchment H	480	107.111	1.411	223.4	1960.7600	0.0000	SURCHARGED
2160 minute winter	Catchment k	2160	106.307	1.607	77.3	1820.0530	0.0000	SURCHARGED
4320 minute winter	Catchment L	4380	104.655	1.255	52.8	2622.6080	0.0000	SURCHARGED
2880 minute winter	1	1920	100.500	0.000	0.1	0.0000	0.0000	OK
240 minute summer	Swale 1A	168	115.601	0.101	69.4	0.0000	0.0000	OK
240 minute summer	Swale 1.1	200	115.116	0.541	69.4	0.0000	0.0000	OK
180 minute winter	Swale 1.2	188	113.873	0.223	69.0	0.0000	0.0000	OK
15 minute summer	Swale 2	10	112.795	0.220	359.0	0.0000	0.0000	OK
15 minute summer	Swale 2.1	11	112.141	0.491	354.5	0.0000	0.0000	OK
15 minute summer	Swale 2.2	12	111.081	0.356	332.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute winter	Catchment D	1.010	1	0.1	0.000	0.000	0.0014	11.0
2880 minute winter	Catchment D	Infiltration		72.2				
240 minute summer	Catchment A	1.000	Swale 1A	69.4	2.034	0.192	1.2363	
240 minute summer	Catchment B3	1.007	Catchment E	80.0	0.658	0.017	24.7818	
600 minute summer	Catchment E	1.008	Catchment C	73.1	0.310	0.018	11.3859	
1440 minute summer	Catchment C	1.009	Catchment D	27.5	1.066	0.004	6.0943	
180 minute summer	Catchments F, I, G and J	2.000	Catchment H	261.0	0.981	0.145	11.0030	
480 minute winter	Catchment H	Hydro-Brake®	Catchment k	50.9				
2160 minute winter	Catchment k	Hydro-Brake®	Catchment L	46.9				
4320 minute winter	Catchment L	2.003	Catchment D	34.0	1.666	0.011	6.2832	
240 minute summer	Swale 1A	1.001	Swale 1.1	69.4	0.235	0.005	28.3493	
240 minute summer	Swale 1.1	1.002	Swale 1.2	69.2	0.386	0.005	7.3803	
180 minute winter	Swale 1.2	1.003	Swale 2	69.0	1.342	0.412	2.3144	
15 minute summer	Swale 2	1.004	Swale 2.1	354.5	0.652	0.027	27.8784	
15 minute summer	Swale 2.1	1.005	Swale 2.2	332.2	0.785	0.025	17.9929	
15 minute summer	Swale 2.2	1.006	Catchment B3	321.4	1.592	0.443	7.0673	

Flow+ v10.7 Copyright © 1988-2025 Causeway Technologies Ltd

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Catchment D	930	102.483	0.883	182.8	2111.4540	0.0000	OK
240 minute summer	Catchment A	212	116.909	0.959	625.4	1785.7290	0.0000	SURCHARGED
720 minute winter	Catchment B3	705	110.695	1.195	161.5	1218.1500	0.0000	SURCHARGED
1440 minute winter	Catchment E	1440	107.172	1.972	101.2	2166.0050	0.0000	SURCHARGED
2160 minute winter	Catchment C	2280	106.196	2.196	161.3	5113.6350	0.0000	SURCHARGED
180 minute summer	Catchments F, I, G and J	152	108.170	1.945	1965.0	4143.7920	0.0000	SURCHARGED
600 minute winter	Catchment H	630	107.693	1.993	324.6	4033.8570	0.0000	SURCHARGED
2880 minute winter	Catchment k	3180	106.695	1.994	86.0	3007.3230	0.0000	SURCHARGED
4320 minute winter	Catchment L	6060	105.396	1.996	53.5	4999.9320	0.0000	SURCHARGED
1440 minute summer	1	930	100.500	0.000	0.1	0.0000	0.0000	OK
120 minute winter	Swale 1A	270	115.602	0.102	70.0	0.0000	0.0000	OK
1440 minute summer	Swale 1.1	900	115.126	0.551	70.0	0.0000	0.0000	OK
600 minute winter	Swale 1.2	645	113.875	0.225	69.9	0.0000	0.0000	OK
15 minute summer	Swale 2	10	112.859	0.284	634.4	0.0000	0.0000	OK
15 minute summer	Swale 2.1	11	112.352	0.701	627.6	0.0000	0.0000	OK
15 minute summer	Swale 2.2	13	111.231	0.506	582.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute summer	Catchment D	1.010	1	0.1	0.000	0.000	0.0016	17.3
1440 minute summer	Catchment D	Infiltration		89.9				
240 minute summer	Catchment A	1.000	Swale 1A	70.0	2.038	0.194	1.2434	
720 minute winter	Catchment B3	1.007	Catchment E	80.0	0.502	0.017	24.7818	
1440 minute winter	Catchment E	1.008	Catchment C	82.3	0.299	0.021	19.0132	
2160 minute winter	Catchment C	1.009	Catchment D	27.5	1.029	0.004	7.8524	
180 minute summer	Catchments F, I, G and J	2.000	Catchment H	235.9	0.925	0.132	11.0030	
600 minute winter	Catchment H	Hydro-Brake®	Catchment k	50.9				
2880 minute winter	Catchment k	Hydro-Brake®	Catchment L	47.0				
4320 minute winter	Catchment L	2.003	Catchment D	34.0	1.626	0.011	6.8140	
120 minute winter	Swale 1A	1.001	Swale 1.1	70.0	0.250	0.005	29.1904	
1440 minute summer	Swale 1.1	1.002	Swale 1.2	70.0	0.381	0.005	7.4559	
600 minute winter	Swale 1.2	1.003	Swale 2	69.9	1.348	0.418	2.4679	
15 minute summer	Swale 2	1.004	Swale 2.1	627.6	0.709	0.048	51.3415	
15 minute summer	Swale 2.1	1.005	Swale 2.2	582.9	0.846	0.045	31.7610	
15 minute summer	Swale 2.2	1.006	Catchment B3	557.5	1.855	0.769	10.5157	

Flow+ v10.7 Copyright © 1988-2025 Causeway Technologies Ltd

Appendix H Sports Pitch and Pavillion Drainage Strategy Drawings

A1 1:750 10 20 30 40 50

N W E S

Assumed car parking bays are permeable

Proposed sports pitch drainage design by TGMS

Rugby Pitch A
102m x 60m

Rugby Pitch B
102m x 70m

Rugby Pitch C
115m x 70m

Cricket Pitch

FW01
CL: 120.010
IL: 119.250

Pavillion
CL: 119.732
IL: 116.050

SW01
CL:119.700
IL:118.100

FW02
CL: 119.900
IL: 119.100

SW02
CL:118.800
IL:117.500

SW03
CL:118.200
IL:116.700

SW04
CL: 119.588
IL: 115.750

SW05
CL: 117.256
IL: 115.420

SW06
CL: 116.420
IL: 115.020

SW07
CL: 116.800
IL: 115.800

SW08
CL: 116.900
IL: 115.300

SW09
CL: 117.500
IL: 115.000

SW10
CL: 118.200
IL: 114.800

IT01

WS01

225mmØ
300mmØ
375mmØ

RISK ITEM ⚠ No. 1

RISK ITEM ⚠ No. 2

Infiltration Basin A-A
Basin IL: 114.150
Design water level: 114.650
Basin CL: 115.675
Attenuation Volume: 1,890m³
Storage Area: 2,220m²
Side Slopes: 1:3
Infiltration Rate: 2.63 x10^{-5} m/s

Proposed connection to sport pitch 160mmØ collector drain (designed by others)

Proposed connection to sport pitch 160mmØ collector drain (designed by others)

Inspection Chamber (proposed by TGMS)
CL: 116.689
IL Out: 116.139

Connection to existing Thames Water Manhole 101A
CL: 119.91
IL: 118.18
To be confirmed through survey

SURFACE WATER DRAINAGE STRATEGY

CATCHMENT	TYPE	ASSUMED PROPOSED DEVELOPMENT AREA (HA)	ASSUMED PROPOSED IMPERMEABLE AREA (ha)
A	Sports Pitch	4.20	1.05
B	Pavillion	0.06	0.06
C	Car park Access Area	0.04	0.04
TOTAL		4.30	1.15

KEY:

- Site Boundary
- Catchment A
- Catchment B
- Catchment C
- Indicative Location of Attenuation Basin & indicative Earthworks Buffer (1:3 Side Slopes)
- Indicative Location of Low Flow Channel
- Indicative Location of Proposed Surface Water Sewer and Manhole
- Infiltration Test location
- Window Sample location
- Proposed headwall
- Indicative Location of Proposed Surface Water Filter Drain
- Root protection zone
- Existing Thames Water Foul Water Sewer
- Indicative Location of Proposed Conveyance Swale
- Indicative Location of Proposed Water Foul Water Sewer
- Indicative Location of Proposed Gully

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. This Drawing is not to be reproduced in any part or form without the consent of PJA Environment Ltd. All copyright reserved.
2. No assessment of earthworks has been undertaken at this stage.
3. No utilities, ecological and arbor-cultural consideration.
4. Drawing should be read in conjunction with all other relevant scheme drawings.
5. Drawing Includes:
   - 5.1. Masterplan provided by Define in October 2025 (Drawing No: DE-565).
   - 5.2. Contour lines (0.5m) taken from Topographic Survey (not formally issued)
   - 5.3. Contour lines (1m) produced using 1m DTM LiDAR from the Environment Agency April 2022.
   - 5.4. OS Mapping (not formally issued)
   - 5.5. An infiltration rate of 2.63x10^{-5}m/s from location IT01 was used from the 2024 Geo Environmental Group Infiltration testing and ground water monitoring report (GEG-24-821/1T).
6. Surface Water Drainage Strategy based on:
   - 6.1. Attenuation Basin is 1.525m deep.
   - 6.2. Attenuation features to have a minimum 300mm freeboard.
   - 6.3. The proposed attenuation infiltrates through the base of the attenuation basin only.
   - 6.4. Drainage for sports pitches designed by others.
   - 6.5. Outfall rate from the sports pitch has been designed to the Loughborough Method, which assumes that 25% of the pitch area is impermeable.
   - 6.6. Assumed 100% impermeable for car park access areas and Pavillion..
   - 6.7. Assumed permeable surfacing for car park bays, to be made from material such as gravel or grasscrete.
   - 6.8. FEH-22 Rainfall Data used with CV 1.0 for Summer and Winter.
7. Woolams Playing field Proposed levels drawings [Ref:TGMS1284.4-1] provided by specialist consultant TGMS. Received 11th July 2024.
8. Tree Survey Plan [Ref:8575-T-01 Tree Survey Plan.pdf] and subsequent Root Protection zone (RPZ) indicatively shown on plan received from Hallam Land on 22nd January 2024.

RISK ITEM ⚠ No.

Risk Item 1: No allowance has been made for additional inflows outside of the Loughborough method calculation from the sports pitch to enter proposed drainage network into the attenuation feature.

Risk Item 2: Proposed location of attenuation feature is in close proximity to existing Root Protection Zones (RPZ) and Ecology Buffer zone. The basin dimensions required to attenuate surface water are based on the accuracy of Topographical survey data.

REV	DATE	REVISION NOTE	BY
P06	22/10/2025	REVISED MASTERPLAN	SF
P05	23/09/2025	INFILTRATION RATE AND SWALE ADDED	AB
P04	19/03/2025	REVISED SWDS	SF
P03	04/12/2024	UPDATING RED LINE BOUNDARY	JJG
P02	15/11/2024	REVISED DRAINAGE STRATEGY	SF
P01	23/08/2024	DRAFT FOR COMMENT	NER

PJA
Seven House - High Street
Longbridge - Birmingham
B31 2UQ - Tel: 0121 475 0234
Birmingham - Bristol
Exeter - London - Reading
pja.co.uk

CLIENT
Hallam Land Management Limited and St Albans School

PROJECT
Woollam Park, St Albans

DRAWING TITLE
Indicative
Drainage Strategy
Sports Pitch Area

DRAWING ISSUE STATUS
INFORMATION

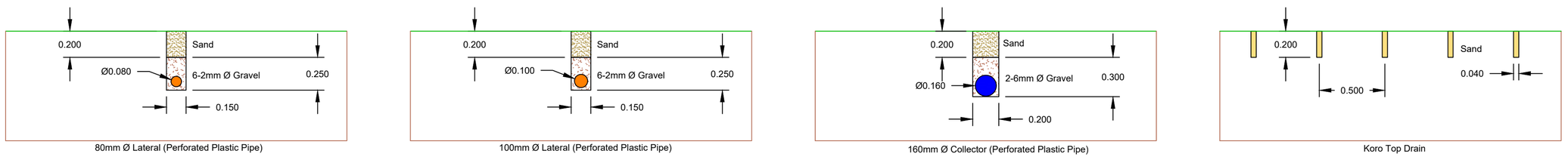
PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05920	A	0503	P06

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@750	NER	GD	AUG 2024

© PJA Environment Ltd. All rights reserved. Copyright in the drawings and information is the property of PJA Environment Ltd.



Scale 1:25 @A2

NOTES:-

1) Plateau = 43538m²

2) Earthworks Volumes

Topsoil Strip
46836m² (Earthworks Area) x 0.30m (Topsoil Depth) = 14051m³

Formation Level Earthworks Volumes
Cut = 18123m³, Fill = 18123m³, Net = 0m³ (Balanced)

Topsoil Replacement
46836m² (Earthworks Area) x 0.30m (Topsoil Depth) = 14051m³

Revisions				
Rev	Date	Description	Drawn By	Checked By
1	19/09/2024	160mm Ø Collector moved 2m North. Laterals amended to fit. ICH levels recalculated.	OM	MY
2	23/04/2025	Pitch layout amended.	OM	MY
3	30/10/2025	Background mapping updated.	OM	MY

LEGEND:-

Proposed Drainage Features
- 80mm Ø Laterals @ 5m Intervals
- 100mm Ø Lateral
- 160mm Ø Collector
- Indicative Koro Top Drain @ 0.5m Intervals
- Inspection Chamber

Proposed Irrigation Features
- 63mm Ø Water Supply Pipe
- Irrigation Hydrant

- Major Contours - 5m Intervals
- Minor Contours - 1m Intervals
- 1:3 Fill Batter Slope
- 1:3 Cut Batter Slope
- Proposed Gradient
- Graded Plateau (43538m²)

0m 25m 50m
Scale bar @ 1:1,000

TGMS SPORTS SURFACE CONSULTANTS
TGMS, 4 Doolittle Mill, Froghall Road, Ampthill, Bedfordshire, MK45 2ND
Tel: 01525 307060 Web: www.tgms.co.uk Email: enquires@tgms.co.uk
TGMS and PSD Agronomy are trading names of Labosport Limited.
Company number: 05186905.
Registered Office: Unit 3 Aerial Way, Hucknall, Nottingham, NG15 6DW.
Directors: Dr.Kathryn Severn and David Rigby.

Drawing Title
Drainage Design

NORTH (INDICATIVE ONLY)

Project :	Woollams Playing Field Extension		
Client :	Hallam Land Management		
Consultant :	Matt Young		
Date :	08/07/2024	Drawing Status :	Design
Scale :	1:1000	Paper Size :	A2
Drawn by : OM	Checked by : MY	Approved by : MY	

Drawing Number
TGMS1284.4-3

Revision
3

Data copyright © PSD (NW) Ltd 2025

Appendix ISports Pitch and Pavillion Drainage Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Inverts
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
ICH 3	0.525	5.00	117.689	1350	515326.702	210149.294	0.500	117.189
SW03			118.200	1200	515152.983	210090.560	1.500	116.700
Pavillion	0.060	5.00	119.732	1200	515157.288	210112.225	3.682	116.050
SW04			119.588	1200	515165.331	210108.156	3.838	115.750
SW05			117.256	1200	515176.602	210115.641	1.836	115.420
SW06			116.420	1200	515211.575	210120.164	1.400	115.020
ICH 4	0.525	5.00	116.689	1200	515409.892	210167.813	0.550	116.139
SW07			116.800	1200	515410.776	210165.762	1.000	115.800
SW08			116.900	1350	515388.084	210156.053	1.600	115.300
SW09			117.500	1200	515327.030	210147.068	2.500	115.000
SW10			118.200	1200	515287.456	210141.244	3.400	114.800
Pond Storage			115.675	1500	515284.858	210110.910	1.525	114.150
Dummy MH			116.250	1200	515317.065	210113.746	2.050	114.200
SW02			118.800	1200	515133.676	210089.461	1.300	117.500
SW01	0.040	5.00	119.700	1200	515127.151	210105.368	1.600	118.100

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
15	ICH 3	SW09	2.250	0.600	117.189	117.000	0.189	11.9	375	5.01	50.0
1.002	SW03	SW04	66.589	0.030	116.700	115.750	0.950	70.1	300	6.76	50.0
2.000	Pavillion	SW04	9.014	0.600	116.050	115.750	0.300	30.0	225	5.06	50.0
1.003	SW04	SW05	32.344	0.030	115.750	115.420	0.330	98.0	300	7.67	50.0
1.004	SW05	SW06	39.438	0.030	115.420	115.020	0.400	98.6	300	8.77	50.0
1.005	SW06	Pond Storage	36.509	0.030	115.020	114.150	0.870	42.0	300	9.43	50.0
3.000	ICH 4	SW07	2.281	0.600	116.139	115.800	0.339	6.7	375	5.01	50.0
3.001	SW07	SW08	24.682	0.600	115.800	115.300	0.500	49.4	375	5.16	50.0
3.002	SW08	SW09	61.712	0.600	115.300	115.000	0.300	205.7	375	5.98	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
15	5.275	582.6	132.8	0.125	0.125	0.525	0.0	121	4.309
1.002	0.708	50.1	10.1	1.200	3.538	0.040	0.0	92	0.555
2.000	2.395	95.2	15.2	3.457	3.613	0.060	0.0	60	1.761
1.003	0.599	42.3	25.3	3.538	1.536	0.100	0.0	167	0.626
1.004	0.597	42.2	25.3	1.536	1.100	0.100	0.0	167	0.624
1.005	0.915	64.7	25.3	1.100	1.225	0.100	0.0	130	0.859
3.000	7.021	775.4	132.8	0.175	0.625	0.525	0.0	104	5.303
3.001	2.584	285.4	132.8	0.625	1.225	0.525	0.0	180	2.540
3.002	1.259	139.1	132.8	1.225	2.125	0.525	0.0	295	1.425

Flow+ v16.0 Copyright © 1988-2025 Causeway Technologies Ltd

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.003	SW09	SW10	40.000	0.600	115.000	114.800	0.200	200.0	375	6.50	50.0
3.004	SW10	Pond Storage	30.280	0.600	114.800	114.150	0.650	46.6	375	6.69	50.0
1.006	Pond Storage	Dummy MH	51.688	0.030	114.150	114.200	-0.050	-1033.8	80	30.00	50.0
1.001	SW02	SW03	19.338	0.600	117.500	116.700	0.800	24.2	300	5.20	50.0
1.000	SW01	SW02	17.193	0.600	118.100	117.500	0.600	28.7	300	5.10	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
3.003	1.277	141.1	265.6	2.125	3.025	1.050	0.0	375	1.294
3.004	2.660	293.8	265.6	3.025	1.150	1.050	0.0	281	2.994
1.006	0.002	0.0	290.9	1.445	1.970	1.150	0.0	80	0.000
1.001	3.211	226.9	10.1	1.000	1.200	0.040	0.0	42	1.635
1.000	2.948	208.4	10.1	1.300	1.000	0.040	0.0	45	1.550

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	5 year (l/s)	122.9
Rainfall Events	Singular	Drain Down Time (mins)	240	10 year (l/s)	148.5
Summer CV	1.000	Additional Storage (m³/ha)	0.0	30 year (l/s)	203.8
Winter CV	1.000	Starting Level (m)		Check Discharge Volume	x
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	FEH	Growth Factor 100 year	2.48
Positively Drained Area (ha)	50.000	Betterment (%)	0
SAAR (mm)	683	QMed	92.2
Host	1	QBar	102.4
BFIHost	0.616	Q 1 year (l/s)	
Region	1	Q 30 year (l/s)	
QBar/QMed conversion factor	1.111	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Node ICH 3 Time-Area Diagram

Overrides Design Area	✓	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to All storms

Flow+ v16.0 Copyright © 1988-2025 Causeway Technologies Ltd

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-15	0.339	15-30	0.185

Node ICH 4 Time-Area Diagram

Overrides Design Area	✓	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to All storms

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-15	0.186	15-30	0.185

Node Dummy MH Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	114.200	Product Number	CTL-CHE-0015-1000-3021-1000
Design Depth (m)	3.021	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.1	Min Node Diameter (mm)	1200

Node Pond Storage Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.09468	Safety Factor	2.0	Invert Level (m)	114.150
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	200

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1110.0	1100.0	1.525	2220.0	1100.0

Flow+ v16.0 Copyright © 1988-2025 Causeway Technologies Ltd

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	ICH 3	25	117.327	0.138	83.8	0.1980	0.0000	OK
15 minute summer	SW03	11	116.822	0.122	18.1	0.1382	0.0000	OK
15 minute summer	Pavillion	9	116.134	0.084	27.5	0.0948	0.0000	OK
15 minute summer	SW04	12	115.995	0.244	43.6	0.2765	0.0000	OK
15 minute summer	SW05	12	115.663	0.243	41.2	0.2748	0.0000	OK
15 minute summer	SW06	12	115.245	0.225	40.1	0.2547	0.0000	OK
30 minute winter	ICH 4	30	116.220	0.081	52.7	0.0913	0.0000	OK
30 minute summer	SW07	30	115.908	0.108	52.7	0.1226	0.0000	OK
15 minute summer	SW08	12	115.621	0.321	41.0	0.4589	0.0000	OK
15 minute summer	SW09	12	115.603	0.603	139.2	0.6823	0.0000	SURCHARGED
15 minute summer	SW10	10	115.479	0.679	150.3	0.7680	0.0000	SURCHARGED
180 minute winter	Pond Storage	180	114.414	0.264	96.2	319.2238	0.0000	SURCHARGED
180 minute winter	Dummy MH	180	114.413	0.213	0.2	0.2407	0.0000	OK
15 minute summer	SW02	10	117.557	0.057	18.2	0.0644	0.0000	OK
15 minute summer	SW01	10	118.163	0.063	18.3	0.0708	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	ICH 3	15	SW09	83.8	2.870	0.144	0.0661	
15 minute summer	SW03	1.002	SW04	17.3	0.388	0.346	2.9389	
15 minute summer	Pavillion	2.000	SW04	27.4	1.228	0.288	0.2381	
15 minute summer	SW04	1.003	SW05	41.2	0.680	0.972	1.9828	
15 minute summer	SW05	1.004	SW06	40.1	0.680	0.950	2.3240	
15 minute summer	SW06	1.005	Pond Storage	41.5	1.518	0.641	1.0708	
30 minute winter	ICH 4	3.000	SW07	52.7	2.423	0.068	0.0499	
30 minute summer	SW07	3.001	SW08	52.6	1.512	0.184	0.8637	
15 minute summer	SW08	3.002	SW09	66.3	0.814	0.477	6.5005	
15 minute summer	SW09	3.003	SW10	150.3	1.627	1.066	4.4119	
15 minute summer	SW10	3.004	Pond Storage	161.2	3.428	0.549	1.7172	
180 minute winter	Pond Storage	1.006	Dummy MH	0.2	0.050	18.461	0.2588	
180 minute winter	Pond Storage	Infiltration		14.5				
180 minute winter	Dummy MH	Hydro-Brake®		0.1				1.1
15 minute summer	SW02	1.001	SW03	18.1	1.175	0.080	0.3489	
15 minute summer	SW01	1.000	SW02	18.2	1.831	0.087	0.1713	

Flow+ v16.0 Copyright © 1988-2025 Causeway Technologies Ltd

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	ICH 3	25	117.351	0.162	106.9	0.2322	0.0000	OK
15 minute summer	SW03	11	116.840	0.140	22.8	0.1581	0.0000	OK
15 minute summer	Pavillion	12	116.159	0.109	34.7	0.1238	0.0000	OK
15 minute summer	SW04	12	116.144	0.394	55.1	0.4457	0.0000	SURCHARGED
15 minute summer	SW05	13	115.711	0.291	47.0	0.3293	0.0000	OK
15 minute summer	SW06	12	115.268	0.248	46.1	0.2809	0.0000	OK
30 minute summer	ICH 4	30	116.233	0.094	67.3	0.1068	0.0000	OK
15 minute summer	SW07	12	115.944	0.144	51.7	0.1633	0.0000	OK
15 minute summer	SW08	12	115.935	0.635	80.3	0.9091	0.0000	SURCHARGED
15 minute summer	SW09	11	115.892	0.892	166.0	1.0088	0.0000	SURCHARGED
15 minute summer	SW10	11	115.710	0.910	171.9	1.0296	0.0000	SURCHARGED
180 minute winter	Pond Storage	184	114.491	0.341	119.7	421.3239	0.0000	SURCHARGED
180 minute winter	Dummy MH	188	114.489	0.289	0.2	0.3268	0.0000	OK
15 minute summer	SW02	10	117.564	0.064	23.0	0.0722	0.0000	OK
15 minute summer	SW01	10	118.171	0.071	23.1	0.0800	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	ICH 3	15	SW09	106.9	2.999	0.183	0.0807	
15 minute summer	SW03	1.002	SW04	22.0	0.399	0.440	3.4149	
15 minute summer	Pavillion	2.000	SW04	34.6	1.296	0.363	0.2656	
15 minute summer	SW04	1.003	SW05	47.0	0.698	1.111	2.2683	
15 minute summer	SW05	1.004	SW06	46.1	0.701	1.092	2.6021	
15 minute summer	SW06	1.005	Pond Storage	47.7	1.518	0.738	1.1870	
30 minute summer	ICH 4	3.000	SW07	67.3	2.523	0.087	0.0611	
15 minute summer	SW07	3.001	SW08	56.1	1.503	0.197	1.8433	
15 minute summer	SW08	3.002	SW09	74.0	0.863	0.532	6.8067	
15 minute summer	SW09	3.003	SW10	171.9	1.729	1.218	4.4119	
15 minute summer	SW10	3.004	Pond Storage	182.4	3.538	0.621	1.7416	
180 minute winter	Pond Storage	1.006	Dummy MH	0.2	0.053	19.955	0.2588	
180 minute winter	Pond Storage	Infiltration		14.5				
180 minute winter	Dummy MH	Hydro-Brake®		0.1				1.2
15 minute summer	SW02	1.001	SW03	22.8	1.230	0.101	0.4146	
15 minute summer	SW01	1.000	SW02	23.0	1.951	0.110	0.2028	

Flow+ v16.0 Copyright © 1988-2025 Causeway Technologies Ltd

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	ICH 3	25	117.393	0.204	149.7	0.2913	0.0000	OK
15 minute summer	SW03	12	116.881	0.181	32.0	0.2043	0.0000	OK
15 minute summer	Pavillion	12	116.742	0.692	48.5	0.7831	0.0000	SURCHARGED
15 minute summer	SW04	12	116.674	0.924	73.9	1.0452	0.0000	SURCHARGED
15 minute summer	SW05	13	116.037	0.617	56.1	0.6978	0.0000	SURCHARGED
15 minute summer	SW06	12	115.303	0.283	55.7	0.3196	0.0000	OK
15 minute summer	ICH 4	11	116.582	0.442	72.4	0.5005	0.0000	FLOOD RISK
15 minute summer	SW07	11	116.564	0.764	74.4	0.8644	0.0000	FLOOD RISK
15 minute summer	SW08	12	116.516	1.216	102.3	1.7405	0.0000	SURCHARGED
15 minute summer	SW09	11	116.449	1.449	219.7	1.6386	0.0000	SURCHARGED
15 minute summer	SW10	11	116.058	1.258	222.0	1.4228	0.0000	SURCHARGED
240 minute winter	Pond Storage	244	114.650	0.500	138.7	646.2668	0.0000	SURCHARGED
240 minute winter	Dummy MH	248	114.647	0.447	0.2	0.5052	0.0000	OK
15 minute summer	SW02	10	117.576	0.076	32.2	0.0855	0.0000	OK
15 minute summer	SW01	10	118.185	0.085	32.3	0.0957	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	ICH 3	15	SW09	149.7	3.188	0.257	0.1060	
15 minute summer	SW03	1.002	SW04	31.0	0.493	0.619	3.8196	
15 minute summer	Pavillion	2.000	SW04	44.6	1.368	0.468	0.3585	
15 minute summer	SW04	1.003	SW05	56.1	0.797	1.326	2.2776	
15 minute summer	SW05	1.004	SW06	55.7	0.791	1.320	2.7454	
15 minute summer	SW06	1.005	Pond Storage	57.0	1.447	0.882	1.4152	
15 minute summer	ICH 4	3.000	SW07	74.4	2.587	0.096	0.2516	
15 minute summer	SW07	3.001	SW08	83.1	1.623	0.291	2.7224	
15 minute summer	SW08	3.002	SW09	88.2	0.927	0.634	6.8067	
15 minute summer	SW09	3.003	SW10	222.0	2.013	1.573	4.4119	
15 minute summer	SW10	3.004	Pond Storage	233.4	3.558	0.794	1.9326	
240 minute winter	Pond Storage	1.006	Dummy MH	0.2	0.043	16.417	0.2588	
240 minute winter	Pond Storage	Infiltration		14.5				
240 minute winter	Dummy MH	Hydro-Brake®		0.1				1.8
15 minute summer	SW02	1.001	SW03	32.0	1.305	0.141	0.5459	
15 minute summer	SW01	1.000	SW02	32.2	2.134	0.154	0.2594	

Flow+ v16.0 Copyright © 1988-2025 Causeway Technologies Ltd

Appendix JThames Water Developer Enquiry

Miss Shannon Warr
Brookbanks Consulting Ltd
6150 Knights Court
Solihull Parkway
Birmingham Business Park
B37 7WY

Wastewater pre-planning
Our ref **DS6110431**

05 April 2024

Pre-planning enquiry: Capacity concerns

Site: Land At St Albans, St. Albans, AL3 6JE – (nearest postcode)

Dear Miss Warr,

Thank you for Pre-planning application for the construction of 683 residential dwellings, 278 residential flats, 14500sqm of Local Centre, 80 bed Care Home, 444 No. of max capacity student Primary School & 8000sqm Retirement Living Facility.

We have completed the assessment of the foul water flows based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

We've assessed your foul proposals and concluded that our sewerage network **will not** have enough capacity for full development at this time.

Foul Water

Proposed foul water to discharge via pumped flow at **21.19 litres/sec** into an existing manhole chamber referenced TL1409 **8702** on an existing 225mm foul water sewer.

Surface Water

Site is to follow SuDS therefore no direct or indirect discharge of surface water into a Thames Water sewer.

In order to ensure we make the appropriate upgrades – or 'off-site reinforcement' – to serve the remainder of your development, we'll need to carry out modelling work, design a solution and build the necessary improvements. This work is done at our cost.

Once we've begun modelling, we may need to contact you to discuss changing the connection point for capacity reasons. Please note that we'll pay the cost of covering any extra distance if the connection needs to be made at a point further away than the nearest practicable point of at least the same diameter.

How long could modelling and reinforcement take?

Typical timescales for a development of your size are:

Modelling: 8 months
Design: 6 months
Construction: 6 months
Total: 20 months

If the time you're likely to take from planning and construction through to first occupancy is longer than this, we'll be able to carry out the necessary upgrades in time for your development. If it's shorter, please contact me on the number below to discuss the timing of our activities.

Surface Water Hierarchy

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.

The disposal hierarchy being:

1. store rainwater for later use.
2. use infiltration techniques where possible.
3. attenuate rainwater in ponds or open water features for gradual release.
4. attenuate rainwater by storing in tanks or sealed water features for gradual release.
5. discharge rainwater direct to a watercourse.
6. discharge rainwater to a surface water sewer/drain.
7. discharge rainwater to the combined sewer.
8. discharge rainwater to the foul sewer

Where connection to the public sewerage network is still required to manage surface water flows we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

Please see the attached 'Planning your wastewater' leaflet for additional information.

What do I need to do next?

If you've satisfied the points above, then you should compare your own timeline with the typical timescales we've suggested for our activities. If the time you're likely to take from planning and construction through to first occupancy is **more** than the total time we're likely to take, we'll be able to carry out the necessary upgrades in time for your development.

If it's **less** than this, you might want to ask us to start modelling earlier – in which case we'll require you to underwrite the cost, as noted above. ***- (We currently do not provide this service)***

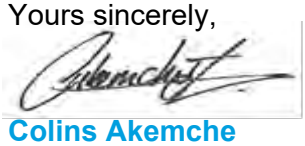
What do you need to tell us before we start modelling?

We will only carry out modelling once we're confident that your development will proceed. In order to have this confidence, we'll need to know that you **own the land and have either outline or full planning permission**. Please email this information to us as soon as you have it.

If the modelling shows we need to carry out reinforcement work, then before we start construction we'll need you to supply us with notification that you've confirmed your F10 – Notification of construction project - submission to the Health and Safety Executive.

If you've any further questions, please do not hesitate to contact me.

Yours sincerely,



Colins Akemche
Clean & Waste Pre-Planning Engineer
Adoption Team - Service Delivery

Thames Water - Developer Services - Ground Floor West - Clearwater Court - Vastern Road
Reading -Berkshire - RG1 8DB - Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk - Web: www.developerservices.co.uk

Outlook

RE: [PJA: 05920] St Albans Pre-development Enquiry ref DS6110431

From DEVELOPER.SERVICES@THAMESWATER.CO.U <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
Date Wed 08/10/25 5:25 PM
To Amy Bennett <amy.bennett@pja.co.uk>
Cc Samantha Furey <samantha.furey@pja.co.uk>

3 attachments (389 KB)
pastedImage1; 11127 - St Albans Free Pre-planning-Request.pdf; DS6110431_Capacity concerns for Land At St Albans.pdf;

Hi Amy,

We have previously established that there is capacity concern at **21.19 litres/sec** so increaseing the flow rate will not change the verdict. Modelling will need to be undertaken once you can provide us with the planning permission, proof of site ownership and build programme of your site.

Kind regards,

Nathanael Bryant Sanjaya
Developer Services – Adoptions Engineer

Office: 0800 009 3921
Mobile: 07747642636
Nathanaelbryant.sanjaya@thameswater.co.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB

From: Amy Bennett <amy.bennett@pja.co.uk>
To: DEVELOPER.SERVICES@THAMESWATER.CO.U <developer.services@thameswater.co.uk>
CC: Samantha Furey <samantha.furey@pja.co.uk>
Sent: 01.10.25 15:48:46
Subject: [PJA: 05920] St Albans Pre-development Enquiry ref DS6110431

This e-mail originated from outside of Thames Water. Do not click links, open attachments or reply, unless you recognise the sender's e-mail address and know the content is safe. If in doubt, contact the Digital Service Desk. Report Phishing via the Report Message option.

Hello,

A pre-development enquiry was submitted to yourselves in April 2024, associated with a new residential led development in St Albans (Land At St Albans, St. Albans, AL3 6JE). Please find the developer enquiry response attached, ref DS6110431.

Since this developer enquiry was submitted, the Proposed Development description has changed. The development now proposed to include the following:

- Up to 1000 dwellings
- 80 Bed Carehome
- Local cente- 2,230 sqm
- Primary School - two form entry

Following this, the pump rate has been revisited and calculated to be 27.6 l/s based on Sewer Sector Guidance and British Water, Flows and Loads. The pump station is proposed to store 168m3 of additional storage. The proposals still remain to pump the entire Site to manhole TL1409 8702.

Please could you provide us with an update on the status of this enquiry? Is there sufficient capacity in the network to accommodate the Proposed Development? If not, please could you provide a programme of the necessary upgrades required.

Please let me know if you have any queries on this.

Kind regards,
Amy

Amy Bennett
Flood Risk and Drainage Engineer
Birmingham
T. 0121 387 4007
Park Point, High Street, Longbridge, Birmingham, B31 2UQ, UK
www.pja.co.uk

Sign up here to receive news from PJA

Registered Office Address: Park Point, 17 High Street, Longbridge, Birmingham, West Midlands, B31 2UQ
Registered in England. Phil Jones Associates Limited, No. 04685684 & PJA Civil Engineering Limited, No. 10412152

Visit us online www.thameswater.co.uk , follow us on twitter www.twitter.com/thameswater or find us on www.facebook.com/thameswater. We're happy to help you 24/7.
Thames Water Limited (company number 2366623) and Thames Water Utilities Limited (company number 2366661) are companies registered in England and Wales, both are registered at Clearwater Court, Vastern Road, Reading, Berkshire RG1 8DB. This email is confidential and is intended only for the use of the person it was sent to. Any views or opinions in this email are those of the author and don't necessarily represent those of Thames Water Limited or its subsidiaries. If you aren't the intended recipient of this email, please don't copy, use, forward or disclose its contents to any other person – please destroy and delete the message and any attachments from your system.

Appendix K Flow Exceedance Plan

A1 1:2000 0 20 40 60 80 100 120 140

KEY:

- Site Boundary
- Catchment A
- Catchment B
- Catchment C
- Catchment D
- Catchment E
- Catchment F
- Catchment G
- Catchment H
- Catchment I
- Catchment J
- Catchment K
- Catchment L
- Indicative Location of Attenuation Basin with 3m maintenance strip
- Indicative Location of Infiltration Basin with 3m maintenance strip
- Location of Infiltration Testing Location IT04
- Indicative Location of Low proposed Flow Channel
- Indicative Location of proposed Conveyance Feature
- Indicative Location of proposed Headwall
- Indicative Location of Railway Line
- Indicative Easement of 21m from the Railway Line (TBC)
- Indicative Location of Proposed Surface Water Sewer
- Indicative Surface Water Flow Route
- Indicative Location of Proposed Foul Water Pumping Station with and Storage Compound
- Indicative Location of Proposed Surface Water Flow Routing Channel
- Indicative Location of Proposed Surface Water Swale
- Indicative Location of Proposed Orifice Plate
- Indicative Location of Proposed Flow Control
- 0.5m Contours

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. This Drawing is not to be reproduced in any part or form without the consent of PJA Environment Ltd. All copyright reserved.
2. No assessment of earthworks has been undertaken at this stage.
3. No assessment of surcharged outfall has been undertaken at this stage.
4. No utilities and arbor-cultural consideration has been undertaken at this stage.
5. Drawing should be read in conjunction with all other relevant scheme drawings.
6. Drawing Includes:
   - 6.1. Blue Green Infrastructure Plan provided by Define in September 2025 (Drawing No: DE_565_74_REV_E).
   - 6.2. Proposed Levels produced by PJA in September 2025(Drawing no. 05920-WR-A-0530)
   - 6.3. Tree Survey provided by FPCR dated December 2023 (8575-T-01)
   - 6.4. An infiltration rate of 1.88×10^{-5}m/s from location IT04 was used from the 2024 Geo Environmental Group Infiltration Testing.
7. For water drainage strategy information see drawing reference (05920-WR-A-0525).
8. Further consideration of utilities, arboricultural and ecological constraints should be undertaken prior to detailed design.
9. Indicative flow exceedance plan based on masterplanning at the time of production and impermeable areas may result in changes to the drainage strategy.
10. Further ground investigation to confirm infiltration rates, seasonal groundwater levels and detail of the underlying chalk solubility is required.

REV	DATE	REVISION NOTE	BY
P1	23/09/2025	REVISED DRAINAGE/LEVELS	AB
P0	04/12/2025	DRAFT	JJG

PJA
Seven House - High Street
Longbridge - Birmingham
B31 2UQ - Tel: 0121 475 0234
Birmingham - Bristol
Exeter - London - Reading
pja.co.uk

CLIENT

Hallam Land Management Limited and St Albans School

PROJECT

Woollam Park, St Albans

DRAWING TITLE

Indicative Exceedance Flow Plan

DRAWING ISSUE STATUS

PLANNING

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05920	- WR -	0527	- P1

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@2,000	JJG	SF	DEC 2024

Copyright © PJA Group Holdings Ltd | PJA Environment Ltd

Appendix L Hydraulic Modelling Report

Hallam Land Management Limited, St Albans School, and St Albans School Woollam Trust

Woollam Park, Land at North St Albans

Hydraulic Modelling Report

October 2025

Project Code: 05920

Document Ref: 05920-WR-HMR-01

PJA
pja.co.uk

Version Control and Approval

Version	Date	Main Contributor	Issued by	Approved by
P0	10 October 2025	SM / BHO	AC	AC
P1	2nd October 2025	SF	SF	SF
P2	29th October	SF	SF	SF

Purpose

This document has been prepared for Hallam Land Management Limited, St Albans School, and St Albans School Woollam Trust.

PJA Civil Engineering Limited accepts no responsibility or liability for any use that is made of this document other than by Hallam Land Management Limited, St Albans School, and St Albans School Woollam Trust for the purposes for which it was originally commissioned and prepared.

The conclusions and recommendations contained herein are limited by the availability of background information and the planned use for the Site.

Third party information has been used in the preparation of this report, which PJA Civil Engineering Limited, by necessity assumes is correct at the time of writing. Whilst all reasonable checks have been made on data sources and the accuracy of the data, PJA Civil Engineering Limited accepts no liability for same.

PJA Civil Engineering Limited. has no liability regarding the use of this report except to Hallam Land Management Limited, St Albans School, and St Albans School Woollam Trust.

CDM

The Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force in April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance Hallam Land Management Limited, St Albans School, and St Albans School Woollam Trust, is made aware of their duties under the CDM Regulations.

Copyright

© PJA Civil Engineering Limited 2025.

Contents

Section		Page
1	Executive Summary	1
2	Introduction	2
3	Site Context	4
4	Hydrology	11
5	Climate Change	15
6	Baseline Model Build	16
7	Baseline Model Results	19
8	Post Development Model Build	24
9	Post Development Model Results	29
10	Baseline and Post-Development Comparison	33
11	Conclusion	37

Appendices

Appendix A Interlocks Surveys topographic survey (2019) .....

Appendix B Geo Environmental Group Infiltration Testing (2024) .....

Appendix C Flood Estimation Calculation Record.....

Appendix D Surface Water Drainage Strategy .....

1 Executive Summary

1.1.1 PJA has undertaken site-specific hydraulic modelling to enhance understanding of potential existing surface water flood risk to the Site at Woollam Park, St Albans and enhance understanding of the potential impact, if any, of the proposed development.

1.1.2 The publicly available Flood Map for Planning shows the Site to be located wholly within Flood Zone 1.

1.1.3 The publicly available Long-Term Flood Risk Information, Flood Risk from Surface Water Map identifies the majority of the Site to be at 'very low' surface water risk. There is a significant surface water flow route crossing the Site from west to east, with areas of medium to high surface water flood risk. This is particularly pertinent at the eastern edge where the Site is bound by a railway line embankment, which generates a significant area of high surface water flood risk is identified.

1.1.4 The site-specific hydraulic modelling aims to enhance understanding of the existing surface water flood risk, through creation of a *'Baseline Model,'* and determine what, if any, potential impact the proposed development may have to the existing surface water flood risk, using a '*Post Development Model'.*

1.1.5 The Baseline Model provides a more refined understanding of surface water flood risk when compared to the publicly available Long Term Flood Risk Information.

1.1.6 The Post Development Model incorporates a representation of the proposed development levels, surface water drainage strategy, and the proposed hydraulic structures within the Site. The Post Development Model indicates that the proposals do not have any off-site impact to existing flood risk, with notable reductions to existing maximum peak flood depths identified within the Site in the vicinity of the existing railway embankment.

2 Introduction

2.1.1 PJA was commissioned by Hallam Land Management Limited, St Albans School, and St Albans School Woollam Trust, to construct a site-specific direct rainfall TUFLOW hydraulic model of the Site, and upstream contributing catchment, at Woollam Park, St Albans.

2.1.2 The development proposals largely comprise the following:

1 Relocation and replacement of existing playing fields and erection of pavilion annex; and

2 Construction of up to 1,000 new homes (Use Class C3) to include a mix of market housing, affordable housing, age restricted specialist accommodation for the elderly, adult disability service units; a care home (Use Class C2); a local centre (Use Classes E and F); a primary school (Use Class F); the laying out of green infrastructure including habitat creation; drainage infrastructure; earthworks; pedestrian and cycle routes; new means of access and alterations to existing accesses.

2.1.3 The aim of these works is to enhance understanding of the existing identified surface water flood risk to the Site, as shown on publicly available mapping. This site-specific hydraulic model has been used to enhance understanding of the potential impact, if any, of the development proposals to existing identified surface water flood risk.

2.1.4 This Report has been prepared for Hallam Land Management Limited, St Albans School, and St Albans School Woollam Trust to summarise the hydraulic modelling works undertaken to date and should be read in conjunction with all other relevant documents.

2.2 Limitations

2.2.1 Third party information has been used in the preparation of this Report which PJA, by necessity, assumes is correct at the time of writing. Whilst all reasonable checks have been made on data sources and the accuracy of the data, PJA accepts no liability for same. PJA has no liability regarding the use of this report except to Hallam Land Management Limited.

2.2.2 The general limitations of this assessment are:

- Flooding of all forms is a natural process, which is inherently random. As such, the outputs produced by this model, cannot be considered to be a definitive representation of a single flood event, nor flood mechanism.
- Fluid flow within watercourses and/or on floodplains is governed by a set of complex physical processes. Hydraulic modelling requires the necessary simplification of these processes into mathematical models, thereby it may only be considered to be a simplified representation of a single flood event and/or mechanism and should not be conclusively relied upon.

- The hydraulic modelling undertaken assesses the potential flood risk associated with surface water flood risk only.
- A number of third-party sources of information have been used to compile this report, which PJA has relied upon; PJA is unable to guarantee the accuracy of the information that has been provided by others.
- The hydraulic modelling set out within this Report comprises concept modelling only. Future design and model refinement may be necessary to understand the exact nature, scope and extent of any proposed works.

3 Site Context

3.1.1 The Site comprises an irregular shaped parcel of approximately 50ha. The Site is mostly greenfield in nature and is predominantly used for agricultural purposes. It is located to the north of St Albans, Hertfordshire. A small percentage of the Site, adjacent to Harpenden Road, is currently used as Rugby Football playing fields.

3.1.2 The Site is bound to the A1081 (Harpenden Road) to the west, beyond which lies existing residential development. Agricultural fields bound the Site to the north, with an existing railway line running on embankment forming the eastern boundary of the Site. Existing commercial development is situated to the south of the Site, beyond which lies existing residential development.

3.1.3 A Site location plan is provided in Figure 3-1.

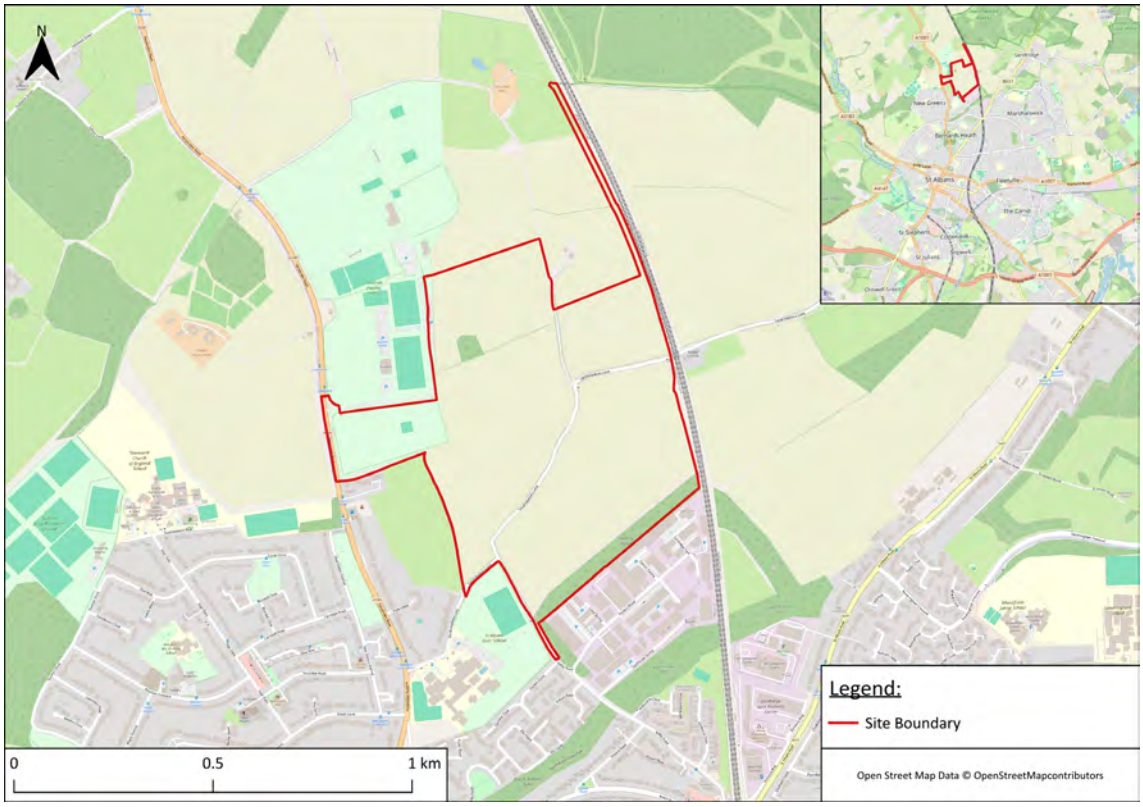


Figure 3-1: Site Location Plan

3.2 Site Topography

3.2.1 From a review of publicly available Site topographic data, the Site generally falls from northwest to southeast. The highest elevation within the Site is approximately 124.9 mAOD and is situated to the northwest of the development. The lowest elevation within the Site is approximately

102.45 mAOD and is situated to the southeast of the development adjacent to the existing railway embankment

3.2.2 A representation of the Site topography is illustrated in Figure 3-2 utilising the publicly available 1m Digital Terrain Model (DTM) LiDAR.

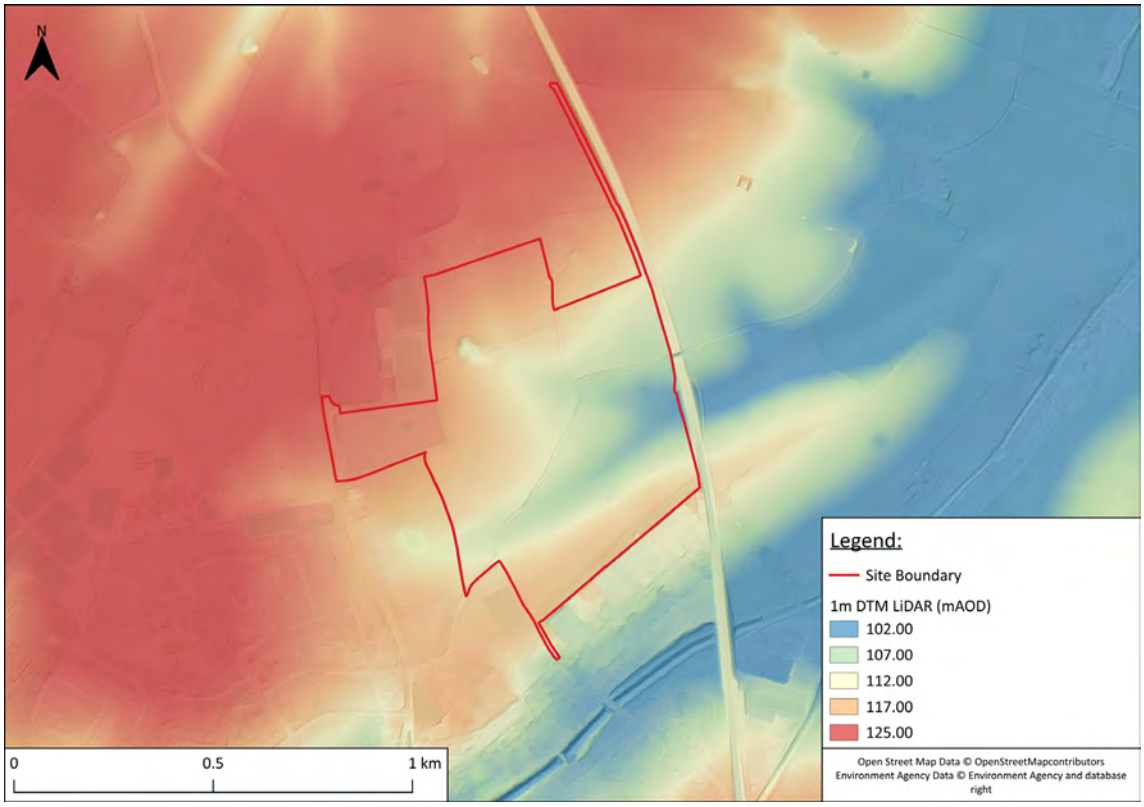


Figure 3-2: LiDAR 1m DTM Extract

3.2.3 Site-specific topographic survey has been used to supplement the publicly available 1m Digital Terrain Model (DTM) LiDAR elevation data where available. Topographic survey was undertaken by Interlocks Surveys Limited in August 2019 (Drawing number 190296 Rev B), a copy of which is provided within Appendix A. The surface has also been digitised, using a 0.7m grid. Figure 3-3 illustrates ground levels provided by the Site-specific topographic survey elevation data.

3.2.4 When comparing the 1m DTM LiDAR data with the levels captured in the topographical survey, the levels are shown to be consistent across the Site. In some areas there are small (approximate 75mm) difference in ground levels, but generally the ground levels are consistent.

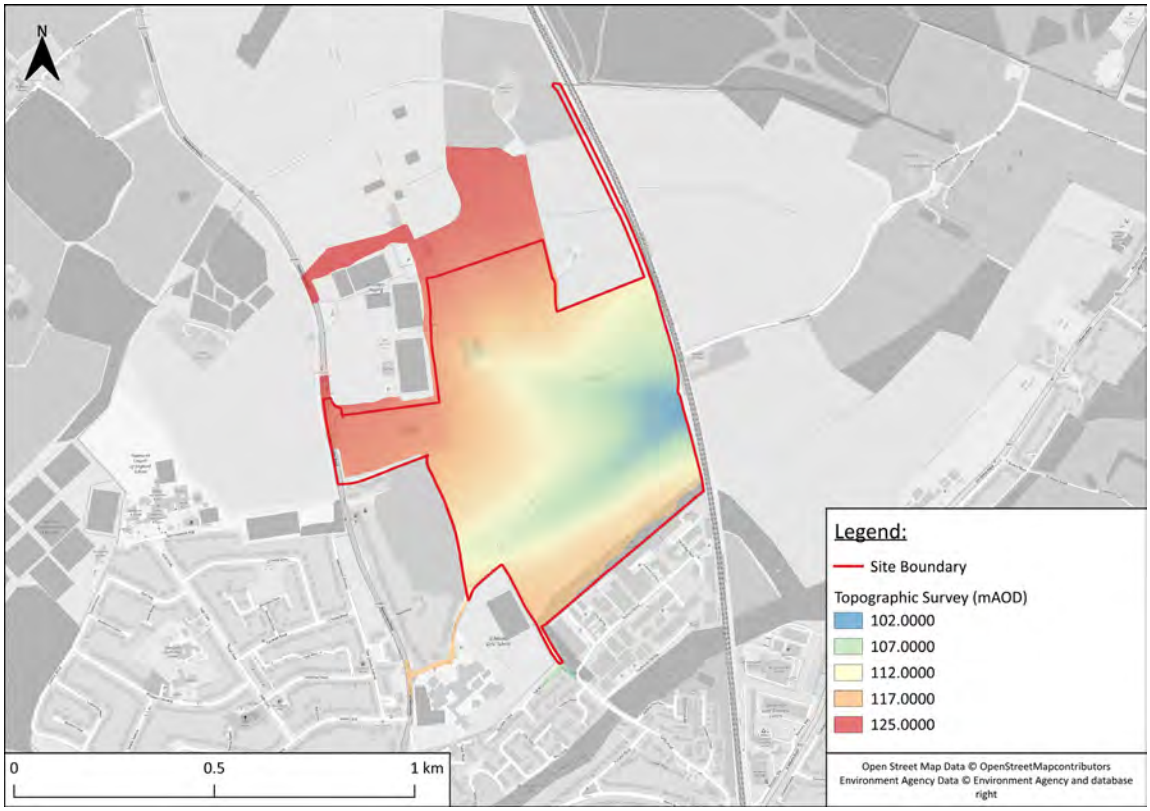


Figure 3-3: Site-specific topographic survey

3.3 Ground Conditions

British Geological Survey Mapping

3.3.1 From a review of the publicly available British Geological Survey (BGS) Geology of Britain Viewer[1], the Site is identified to be underlain by a bedrock geology of Lewes Nodular Chalk Formation and Seaford Chalk Formation (Undifferentiated) – Chalk.

3.3.2 Furthermore, the Site is underlain by two types of superficial deposits. Kesgrave Catchment Subgroup – Sand and Gravel is situated to the north, west and south of the Site, with Clay with Flints Formation - Clay, Silt, Sand and Gravel situated to the northwest. An extract of the BGS Superficial Geology is illustrated within Figure 3-4.

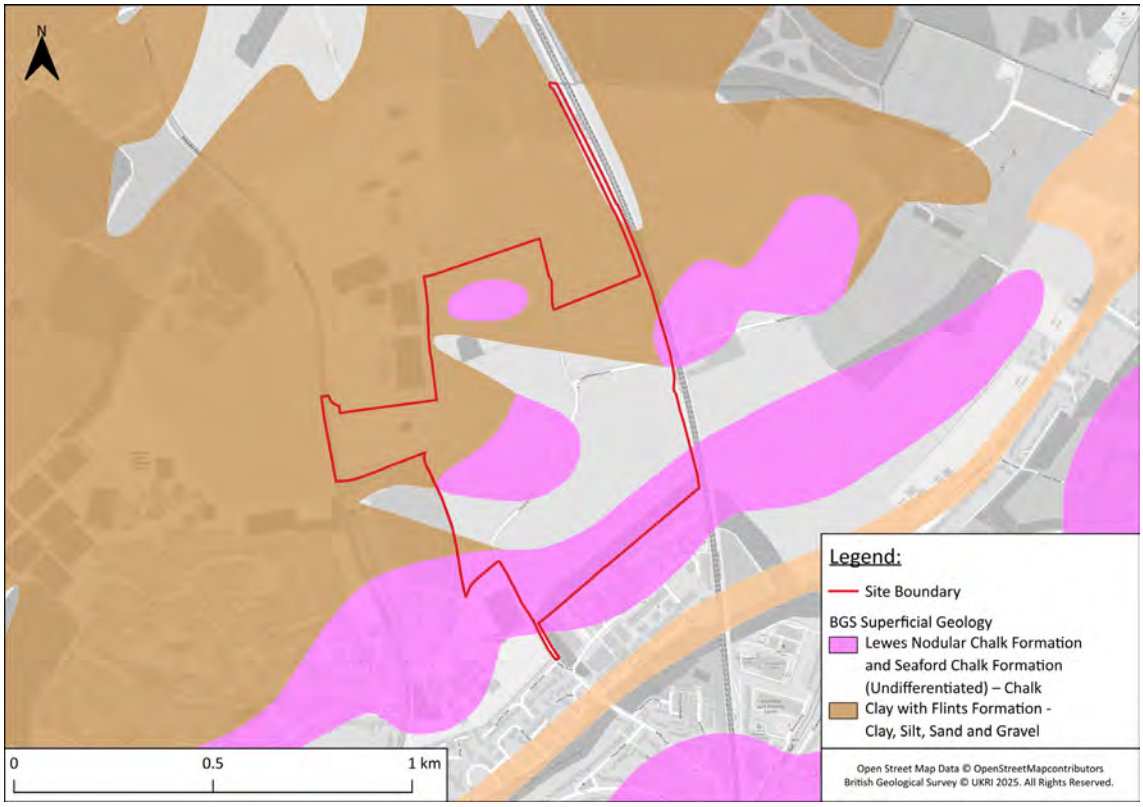


Figure 3-4: BGS Superficial Geology

Site Specific Ground Investigation

3.3.3 Infiltration testing was undertaken in 2018 and 2024 by WSP and Geo Environmental Group respectively.

3.3.4 The Geo Environmental Group 2024 investigation utilised trial pits located across the Site to understand the potential infiltration rates. The locations of the Geo Environmental Group trial pits within the Site are included in Appendix B. The preliminary infiltration results at IT01 to IT08 are shown in Table 3-1 .

Table 3-1: Summary of Infiltration Test Results

Location	Depth Range of Test (m)	Time (Mins)	Infiltration Rate (m/s)
IT01	1.30-2.40	115	**$2.96X10^{-5}$**
	1.05-2.08	132	**$2.63X10^{-5}$**
	1.01-1.82	119	**$2.97X10^{-5}$**
IT02	1.00-2.00	217	N/A
IT03	1.45-2.75	194	N/A
IT04	1.20-2.00	105	**$2.60X10^{-5}$**
	1.00-1.75	165	**$1.88X10^{-5}$**
IT05	1.40-2.40	201	N/A
IT06	1.80-2.80	195	N/A

Location	Depth Range of Test (m)	Time (Mins)	Infiltration Rate (m/s)
IT07	1.40-2.50	183	N/A
IT08B	2.00-3.00	20	1.50×10^{-4}
	1.90-2.80	25	2.62×10^{-3}
	1.75-2.70	25	2.67×10^{-3}

3.3.5 Infiltration was identified at trial pits IT01, located to the north of the site, and IT04 and IT08B, located adjacent to the existing railway line.

3.3.6 Additional testing was undertaken at IT08B, located adjacent to IT04, which produced three positive infiltration results. Given that the proposed infiltration basin is located between IT04 and IT08B, the most conservative rate of 1.88×10^{-5} m/s (obtained in IT04) has been utilised in the surface water drainage strategy.

3.3.7 Given the underlying ground conditions, two infiltration regions have been incorporated within the site-specific hydraulic model:

- An infiltration rate of 2.63×10^{-5} m/s (IT01, 1.05-2.08m depth) was adopted to allow for infiltration in the north of the Site.
- An infiltration rate of 1.88×10^{-5} m/s (IT04, 1-1.75m depth) was adopted for the hydraulic modelling to allow for infiltration upstream of the railway line.

3.3.8 The infiltration regions are not incorporated for the baseline model due to the depth of excavation required to achieve the infiltration rate. The proposed earthworks with the drainage strategy targets the areas for infiltration and will excavate to achieve the required depth.

3.4 Existing Hydrological Regime

3.4.1 Following a review of the existing hydrological regime at the Site, no hydrological features have been recorded within the Site. The River Ver is located approximately 2.80 km west of the Site.

3.5 Fluvial Flood Risk

3.5.1 The Site is identified in the publicly available Flood Map for Planning as located wholly within Flood Zone 1, demonstrating that the fluvial flood risk is considered to have <0.1% Annual Exceedance Probability (AEP).

3.6 Surface Water Flood Risk

3.6.1 The publicly available Long-Term Flood Risk Information, Flood Risk from Surface Water map identifies that the majority of the Site is at very low flood risk from surface water flooding. There is a surface water flow route crossing the Site from west to east with sections of medium to high

surface water flood risk. At the eastern edge, where the Site is bound by a railway line embankment, a significant area of high surface water flood risk is identified.

3.6.2 Finally, there are localised areas of low- high risk of surface water flooding identified with the Site which are understood to be associated with localised low points in the surrounding topography.

3.6.3 An extract of the Long-Term Flood Risk Information, Flood Risk from Surface Water map is available in Figure 3-5.

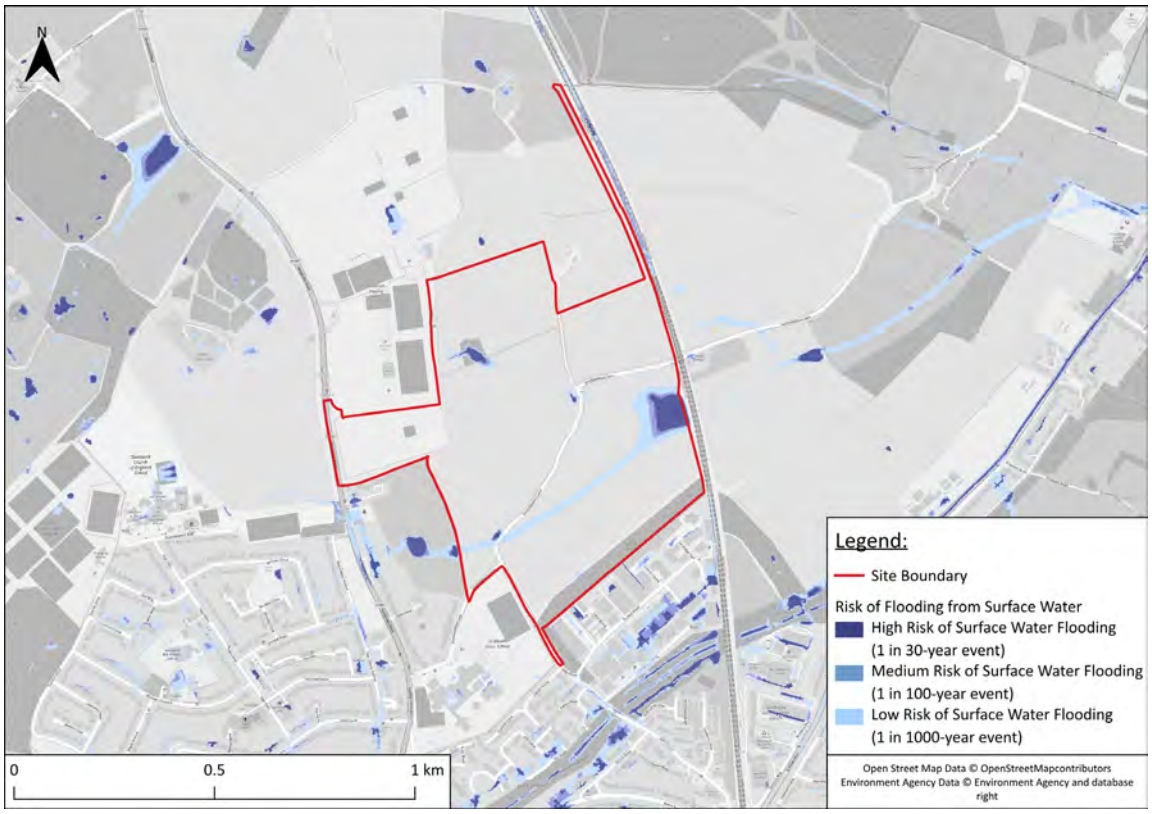


Figure 3-5: Long-Term Flood Risk Information, Flood Risk and Surface Water Extract

3.6.4 The surface water mapping was updated in January 2025.The production of this mapping has been undertaken using national scale modelling and enhanced using compatible locally produced modelling from LLFAs (where available) to provide the generation of surface water flood risk mapping. The previous generations were primarily developed for regulator use as the approach and risk was refined. For example, the first did not include any allowance for sewers, whilst the second incorporated a national loss coefficient.

3.6.5 The current dataset presents the risk which takes account of the climate change allowances based on the latest UK Climate Projections (UKCP18) from the Met Office, using the Representative Concentration Pathway (RCP) 8.5.

3.6.6 Although through the production of this mapping, LLFAs were approached for culvert asset datasets to be incorporated within the national scale model, these data sets may not be fully comprehensive. A 2m DTM has also been utilised in the national scale model, whilst this better represents topography in comparison to previous versions of the mapping, there is still opportunity for refinement on a local-scale where finer DTM LiDAR data is available couple with site-specific topographic data.

3.7 Site Proposals

3.7.1 As set out within paragraph 2.1.2, the development proposals comprise of the following:

1 Relocation and replacement of existing playing fields and erection of pavilion annex; and

2 Construction of up to 1,000 new homes (Use Class C3) to include a mix of market housing, affordable housing, age restricted specialist accommodation for the elderly, adult disability service units; a care home (Use Class C2); a local centre (Use Classes E and F); a primary school (Use Class F); the laying out of green infrastructure including habitat creation; drainage infrastructure; earthworks; pedestrian and cycle routes; new means of access and alterations to existing accesses.

3.7.2 Hydraulically, the proposed development will generate a change to existing ground levels across the Site, with incorporation of a formal surface water management system and associated culverts underneath potential access crossings.

4 Hydrology

4.1 Hydrological Understanding

4.1.1 The primary mechanism of flood risk at the Site is from surface water. A hydrological analysis was undertaken at the Site, using the ReFH2 method to derive rainfall hyetographs to further understand potential flood risk to the Site under the existing (baseline) conditions.

4.1.2 Figure 4-1 illustrates the hydrological catchment at the Sites which utilises a direct rainfall approach within the model.

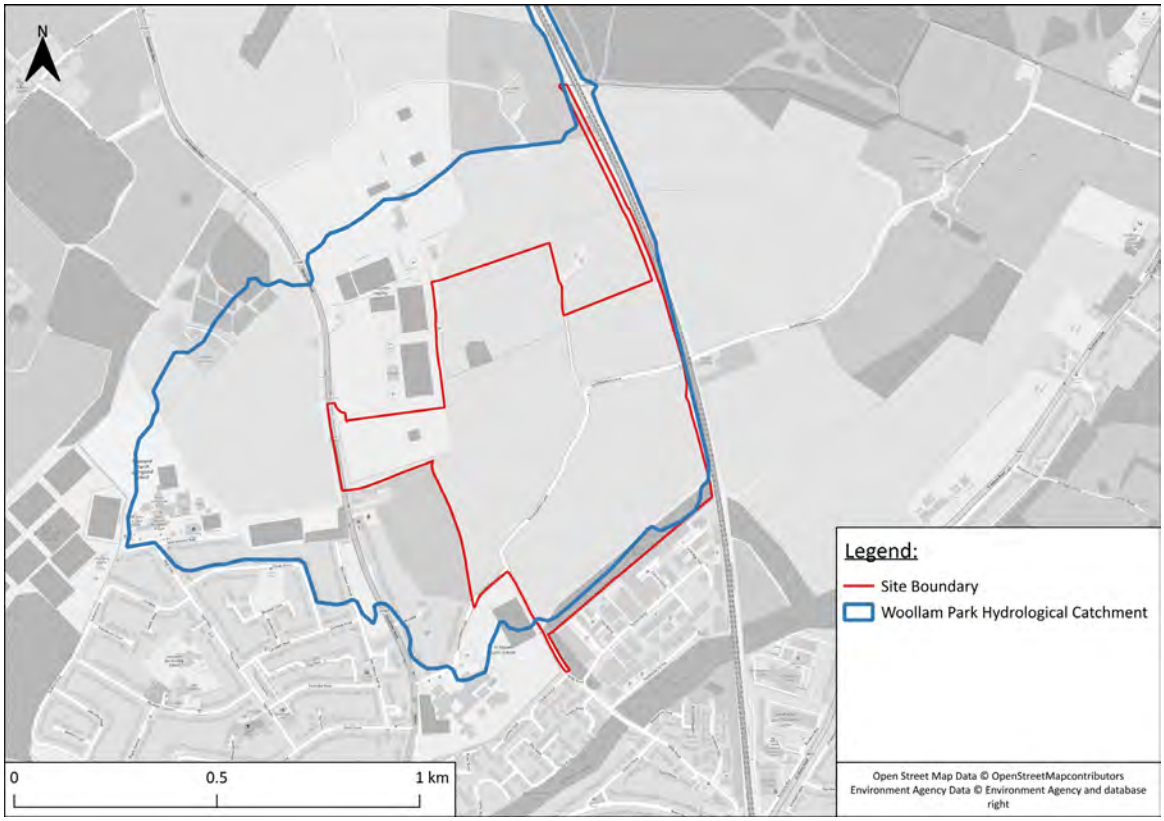


Figure 4-1: Woollam Park hydrological catchment

4.1.3 The rainfall hyetographs have been derived using FEH22 and the ReFH2.3 model to calculate losses. The urbanisation has been set to zero. BFIHOST 19 has also been applied across all catchments.

4.1.4 From a review of the ReFH hydrology, the 6.25-hour storm duration using the winter rainfall profile was identified to be the critical storm. The following return periods have been derived for the 6.25-hour storm duration using the winter rainfall profile duration:

- 1 in 30-year

- 1 in 100-year plus climate change
- 1 in 1,000-year

4.1.5 In accordance with current best practice, allowances have been made within the associated hydrological inputs to enable representation of infiltration or other associated losses (e.g. evaporation or interception). This is applied as the net rainfall across the catchment.

4.1.6 A full hydrology report is available in Appendix C.

4.2 Post Development Hydrology

4.2.1 To account for the Site's proposed Surface Water Drainage Strategy (Drawing References: 05920-A-0503 (rev P06) and 05920-WR-0525 (rev P11)) the rainfall inputs were adapted to account for the development parcels, or areas served by a proposed positive surface water drainage system, and point inflows were incorporated to account for the outfalls from the proposed drainage strategy.

4.2.2 The proposed development parcel rainfall was reduced by 60%, in line with the assumption that 60% will be positively managed and the remaining 40% remains as permeable. The point inflows were derived using Causeway Flow. A consistent 6-hour storm duration was adopted for the Causeway Flow calculations.

4.2.3 The sports pitch drainage strategy (Drawing References: 05920-A-0503 (rev P06)), demonstrates that this area is entirely managed by the proposed surface water drainage strategy up to the 1 in 100 year plus climate change event, therefore, in line with the above approach has assumed to be 100% impermeable.

4.3 Post Development Hydrology: 1 in 1,000-year Event

4.3.1 The surface water drainage strategy was designed to manage surface water up to the 100-year plus climate change event.

4.3.2 In the 1,000-year event for the areas of the Site managed within the surface water drainage strategy, 40% of the net rainfall remains added to the development parcel, in line with the approach for other events to account for green space within the parcel. An additional allowance was added to account for the exceedance of the surface water drainage strategy. The additional rainfall input is 60% (to account for the developed area of the parcel) of the difference between the 100-year plus climate change and the 1,000-year design rainfall.

4.3.3 In the 1,000-year event for the sports pitches, similarly to the approach adopted for the other events, the 100-year plus climate change event rainfall has been subtracted from the 1,000-year

design rainfall event, as it is assumed the surface water drainage strategy manages all flows up to and including the 100-year plus climate change event.

4.4 Hydrology Application Summary

4.4.1 Table 4-1 provides a summary of the rainfall approach and inflow points used, and the locations they are applied in the Baseline and Post Development Models.

4.4.2 Further details of the hydrological analysis which has been undertaken is included within the Flood Estimation Report in Appendix C.

4.4.3 The Site's proposed Surface Water Drainage Strategy drawings (Drawing References: 05920-A-0503 and 05920-WR-0525) are included in Appendix D.

Table 4-1: Model hydrology application summary

Sub-Catchment	Proposed Model Inflow Location	
	Baseline	Design
Net rainfall (accounting for losses)	Natural undeveloped catchment	Natural undeveloped catchment
Design Rainfall (assuming no losses)	-	Infiltration regions at downstream basin and pitch basin
Development areas rainfall	-	Areas of the site managed within the outline planning surface water drainage strategy: 40% of net rainfall for each development parcel (assuming 40% of each development parcel remains unmanaged) For the 1,000-year only, an additional 60% of the difference between the 100yrCC and 1,000yr design rainfall to account for the exceedance.
	-	Sports pitch areas: 0% of net rainfall for each development parcel (assumed to be 100% impermeable) For the 1,000-year only, the 1000-year plus climate change design rainfall has been subtracted from the 1,000-year event to account for the exceedance.
Drainage Strategy Inflow 1	-	Downstream basin (Catchment C) north inflow (05920-WR-0525, Appendix D), derived using Causeway Flow
Drainage Strategy Inflow 2	-	Downstream basin (Catchment L) south inflow (05920-WR-0525, Appendix D), derived using Causeway Flow

Sub-Catchment	Proposed Model Inflow Location	
	Baseline	Design
Drainage Strategy Inflow 3	-	Pitch basin (Infiltration Basin A-A) west inflow (05920-A-0503, Appendix D), derived using Causeway Flow
Drainage Strategy Inflow 4	-	Pitch basin (Infiltration Basin A-A) east inflow (05920-A-0503, Appendix D), derived using Causeway Flow

5 Climate Change

5.1.1 In accordance with the NPPF, it should be demonstrated how flood risk will be managed now and over the development's lifetime, considering climate change. As the Site-specific hydraulic modelling is specific to surface water flood risk, the peak rainfall intensity allowances have been utilised to inform an assessment of climate change. Table 5-1 shows the peak rainfall intensity allowances for the Colne Management Catchment in which the Site is situated.

Table 5-1: Climate Change Allowances for the Colne Management Catchment

	Central Allowance	Upper End Allowance
2050s	20%	40%
2070s	25%	40%

5.1.2 In accordance with the climate change allowances recommended by the Environment Agency, the impact of climate change on the peak rainfall intensities in urban drainage designs should be assessed by increasing them by 40% (upper end) when designing for the '2070s' scenario (2061-2125).

6 Baseline Model Build

6.1 Existing Available Modelling

6.1.1 No existing site-specific model data is available for re-use or enhancement. A new site-specific model has therefore been constructed.

6.2 Model Software

6.2.1 TUFLOW (2025.0.2) software has been utilised to undertake the Site-specific hydraulic modelling. The modelling approach utilises TUFLOW sub-grid sampling.

6.3 Third Party Data

6.3.1 The following third-party information has been used in the preparation of the hydraulic model:

- 1m Digital Terrain Model (DTM) LiDAR
- Topographic survey by Interlock Surveys (2019)

6.4 2D Model Representation

6.4.1 Publicly available 1m DTM LiDAR data and site-specific topographic survey has been used to form the 2D domain of the hydraulic model. The 2D domain reflects the contributing catchment to the Site plus a buffer to allow, where required, water to flow across the catchment watershed.

6.4.2 The 2D model extent is illustrated within Figure 6-1. This includes the active 2D domain, the extent of the net rainfall boundary condition, the extent of the design rainfall and the downstream boundary condition.

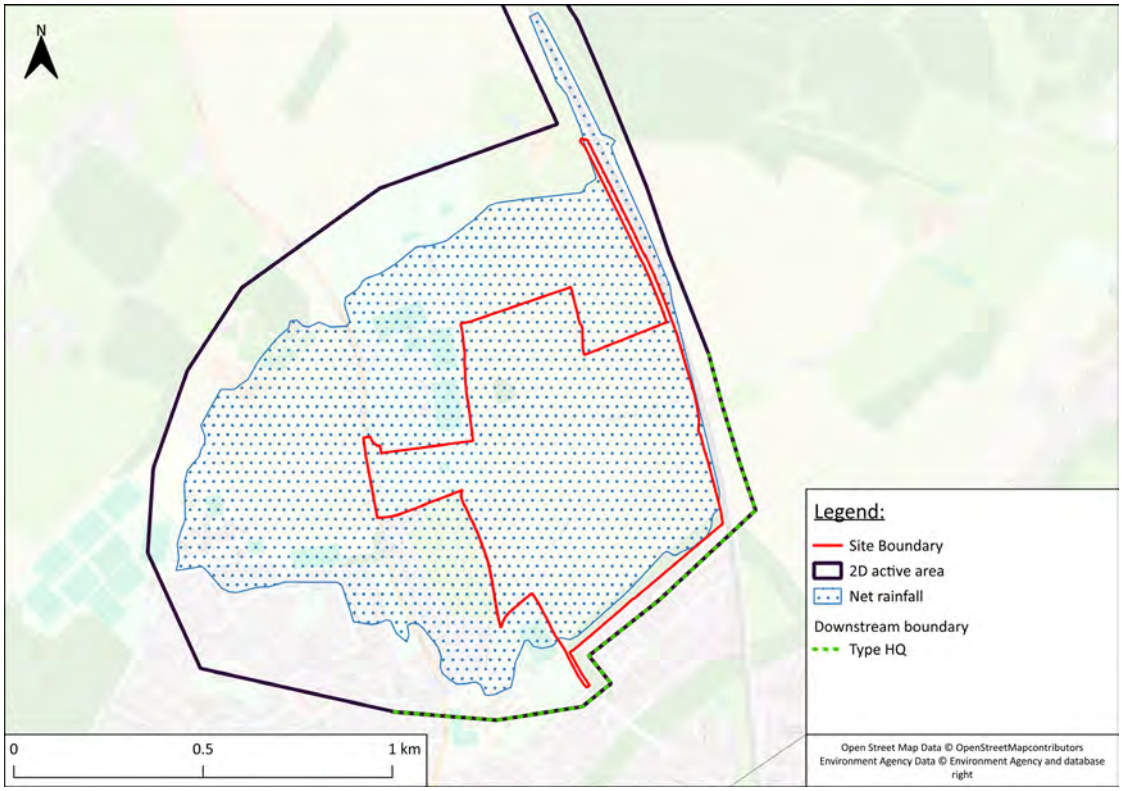


Figure 6-1: Baseline Model Representation

6.4.3 The resolution of the model is 4m. The model adopts sub-grid sampling, which captures the detail for the model simulations and maps the modelling results to the resolution of the underlying topographic data while retaining manageable model run times.

6.5 Boundary Conditions

Rainfall

6.5.1 Net rainfall is applied to the whole contributing catchment upstream. Losses are accounted for as part of the hydrological approach.

Downstream boundary

6.5.2 A normal depth downstream boundary is applied at the edge of the model domain based on the gradient of the downstream catchment to allow flow to exit the model at the boundary.

6.6 Surface Roughness

6.6.1 Surface roughness Manning's n values have been utilised within the hydraulic model to represent the different types of features situated within the catchment.

6.6.2 A base roughness value of 0.05 (natural surface) was applied to the site.

6.6.3 Different polygons were digitalised for the different land uses on the Site. The roughness values contained in Table 1 were utilised based on the identified land use.

Table 1: Manning's n Values

Land Use	Manning's n Value
Channel	0.03
Dense trees	0.08
Inland Water	0.02
Natural Ground	0.05
Urban (e.g. buildings, fences, gardens)	0.08
Rural/scrub	0.06
Roads	0.02
Building (explicit building outline)	0.3
Railway	0.08
Highways and Verges combined	0.03

7 Baseline Model Results

7.1.1 The baseline hydraulic model identifies the existing surface water flow routes present at the Site. Due to the direct rainfall approach, all peak water depths of less than 75 mm have not been shown within the figures produced. This approach is in line with the publicly available Long Term Flood Risk Information, Flood Risk from Surface Water Mapping.

7.2 Baseline Model Results and Analysis

Baseline Model Extents

7.2.1 The results of the baseline model have been analysed for the 1 in 30-year, 1 in 100-year plus 40% climate change and 1 in 1,000-year events.

7.2.2 The maximum peak baseline flood extent for each of these events is illustrated in Figure 7-11.

7.2.3 Within this section, a comparison between the Baseline Model Extents will be made against the flood extents accounting for climate change from the publicly available Long Term Flood Risk Information, Flood Risk from Surface Water Map.

7.2.4 The Baseline Model provides a more refined understanding of existing potential surface water flood risk to the Site when compared to the publicly available Flood Map for Planning and Long Term Flood Risk Information, Flood Risk from Surface Water Map. These refinements within the Baseline Model generate slightly larger extents within the Site, immediately adjacent to the existing railway embankment, than those shown in the public mapping for the equivalent return period.

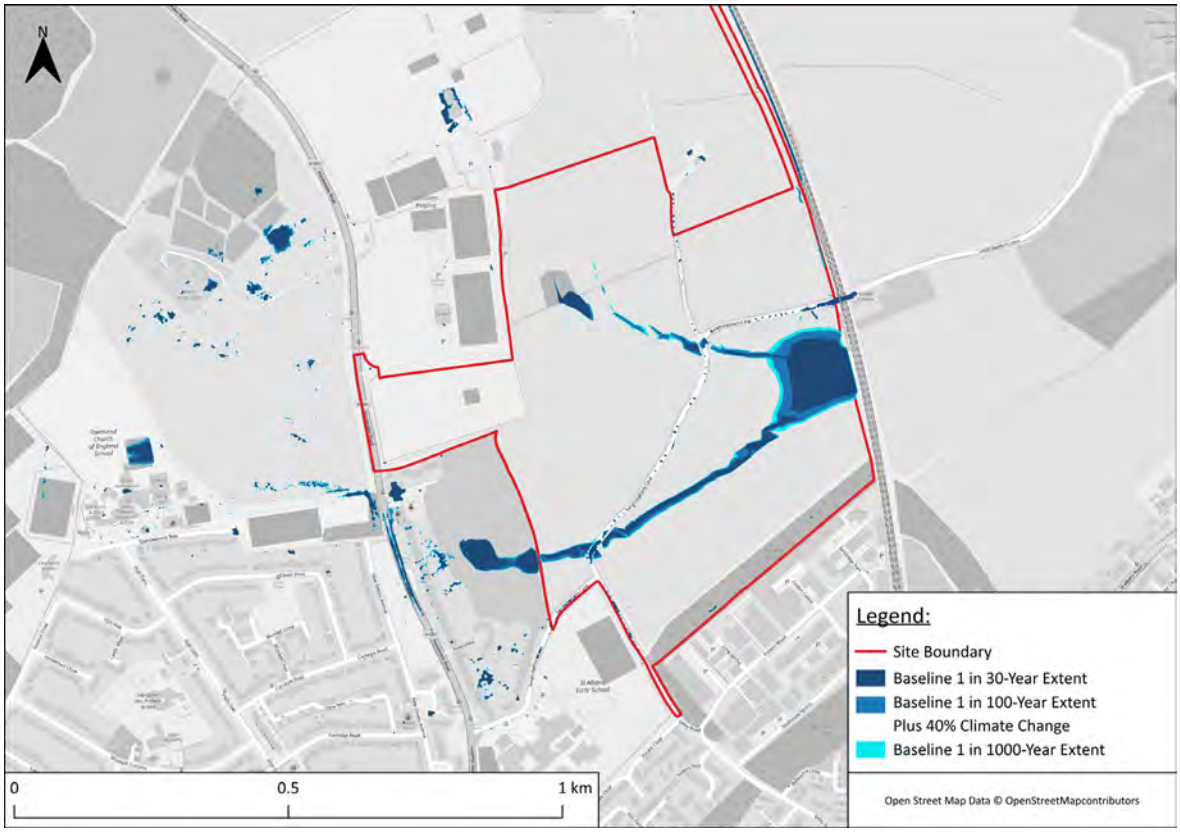


Figure 7-11: Baseline Model Flood Extents

Baseline Model Maximum Peak Depths

7.2.5 Figure 7-2-1 illustrates the maximum peak flood depths for the 1 in 30-year event. The peak water level within the Site, adjacent to the existing railway embankment, is approximately 104.59 m, which equates to a maximum peak flood depth of approximately 2.1 m.

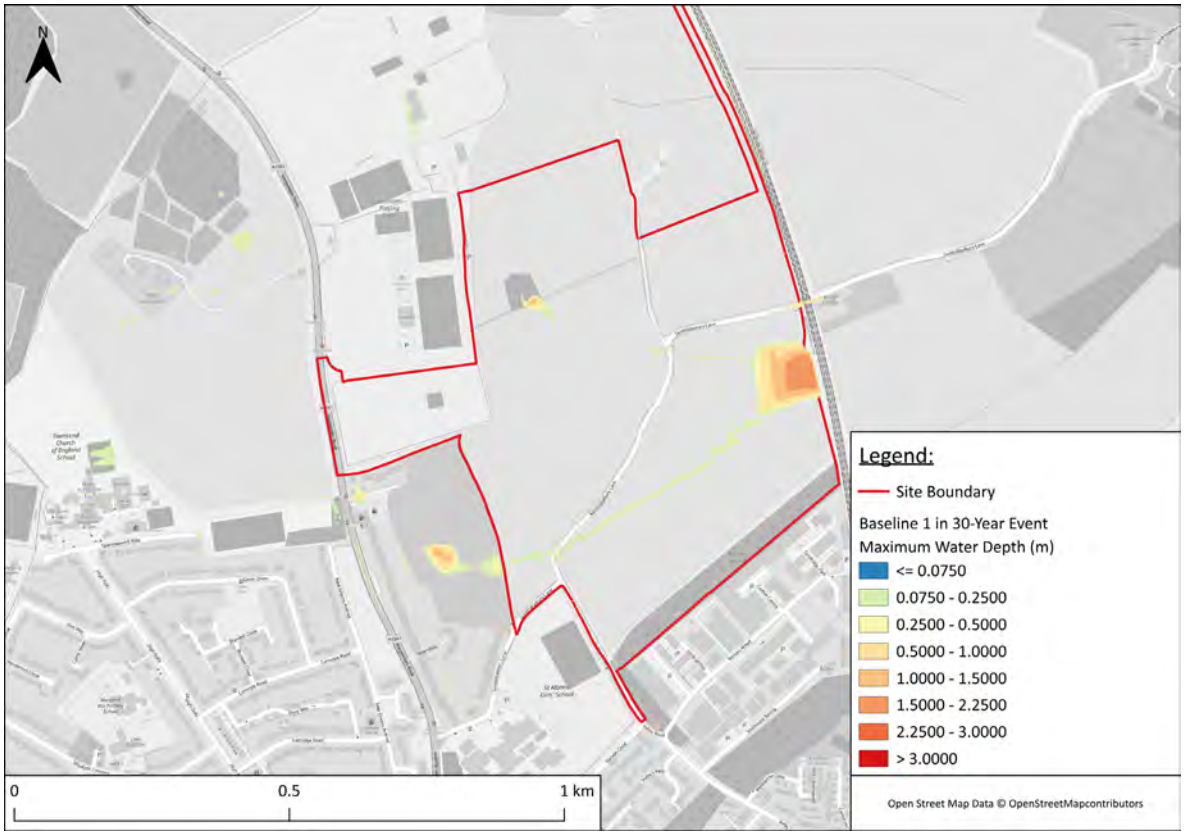


Figure 7-2: 30-year Baseline Model Flood Depths

7.2.6 Figure 7-3 illustrates the maximum peak flood depths for the 1 in 100-year plus climate change event. The peak water level within the Site, adjacent to the existing railway embankment, is approximately 105.33 m, which equates to a maximum peak flood depth of approximately 2.8 m.

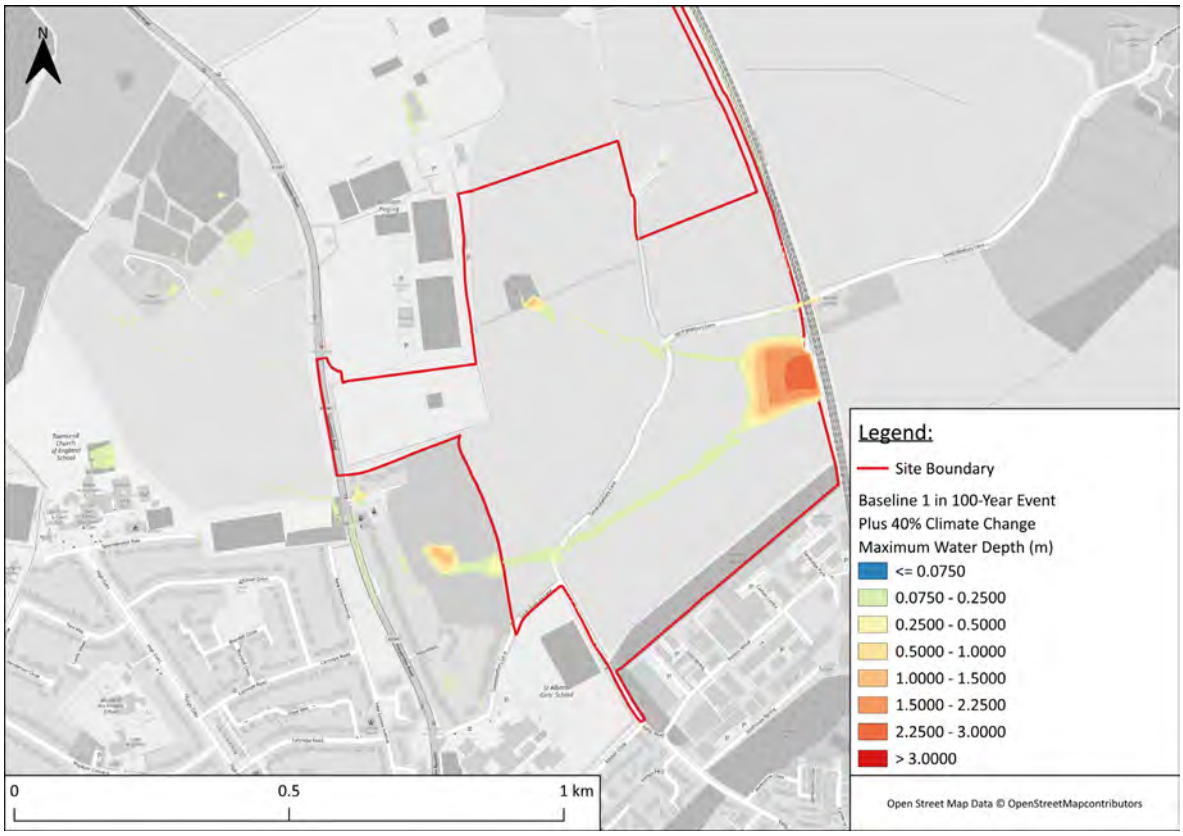


Figure 7-3: 100-year plus climate change Baseline Model Flood Depths

7.2.7 Figure 7-4 illustrates the maximum peak flood depths for the 1 in 1,000-year event. The peak water level within the Site, adjacent to the existing railway embankment, is approximately 105.61 m, which equates to a maximum peak flood depth of approximately 3.1 m.

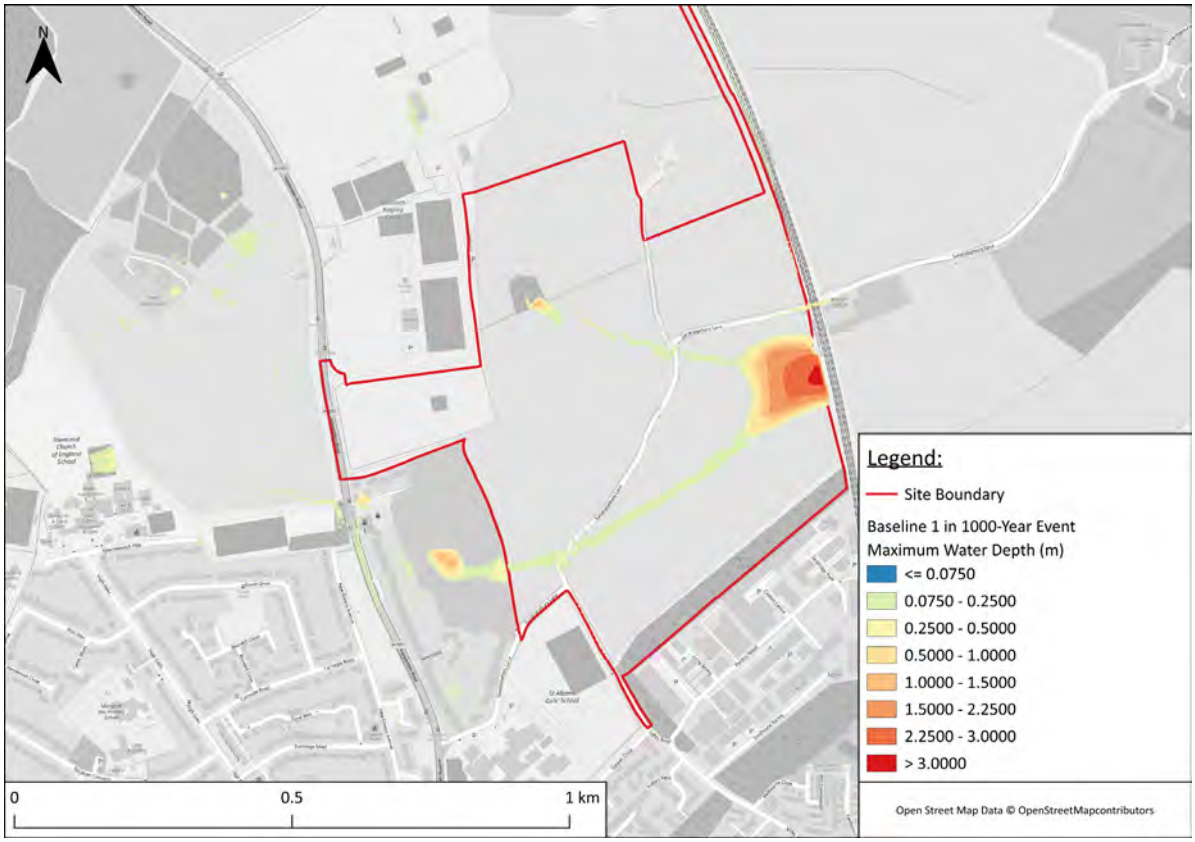


Figure 7-4: 1,000-year Baseline Model Flood Depths

8 Post Development Model Build

8.1.1 The post development model is summarised in Figure 8-1. The post development model includes representation of the proposed extent of the development parcels, proposed primary roads, surface water drainage strategy and the locations of the inflows from the proposed surface water drainage strategy, alongside representation of the potential proposed ground levels.

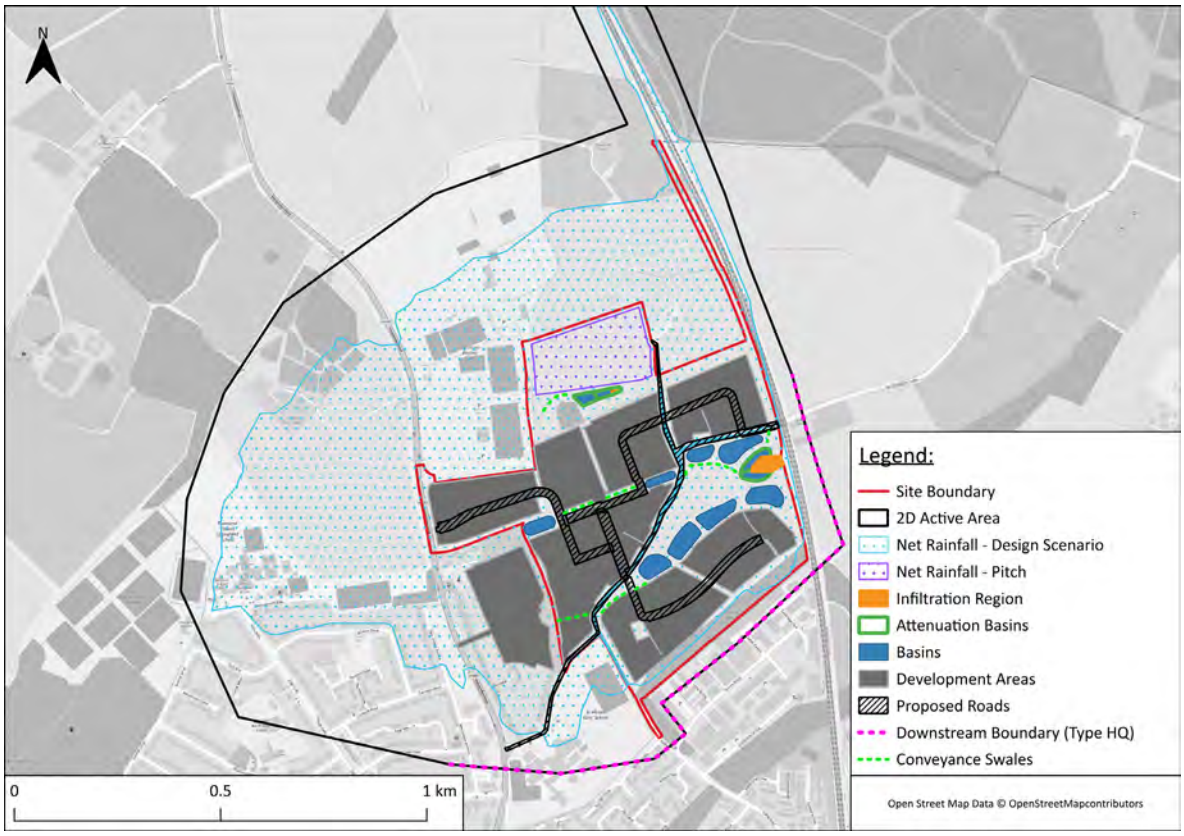


Figure 8-1: Post Development Model Representation

8.2 Proposed Surface Water Drainage Strategy

8.2.1 A surface water drainage strategy has been prepared for the Proposed Development.

8.2.2 The surface water drainage strategy has been designed in accordance with the current sustainable development best practices and aims to mimic the existing hydrological regime by infiltrating run-off to the north (Sports Pitches) and east (residential-led development). Attenuation storage will be provided in the form of open SuDS features throughout the Site, including attenuation basins, swales and infiltration basins. The proposed surface water drainage strategy is documented in

drawing references 05920-A-0503 (rev P06) and 05920-WR-0525 (P11) and included in Appendix D.

8.3 Post Development model

8.3.1 The Post Development Model utilises the Baseline Model, incorporating the following key elements:

- Proposed Earthworks
- Structures
- Post-development rainfall
- Infiltration regions
- Proposed surface water drainage strategy inflows
- Surface roughness (Manning's n)
- Storage feature water levels
- Basin design levels

8.3.2 All other aspects remain the same as in the Baseline Model.

Proposed earthworks

8.3.3 The indicative preliminary earthwork levels are shown in drawing reference 05920-WR-A-0530 (P04). This is included in Appendix E. These preliminary earthworks include representation of the proposed surface water attenuation basins, conveyance swales, development parcel extents, and proposed potential primary roads. The preliminary levels are illustrated in Figure 8-2.

Figure 8-2: Post-Development Preliminary Levels

Structures

8.3.4 Five culverts are incorporated into the model where highway crossings are proposed as part of the post-development and earthworks design. These culverts are embedded 1D elements with standard (0.02) roughness coefficients and losses to capture the appropriate flow constriction.

Post-development rainfall

8.3.5 Net rainfall, as per the baseline model, is continued to be applied to the catchment outside of the Site, across areas not identified as development parcels. Losses are accounted for as part of the hydrological approach.

8.3.6 Rainfall inputs are removed from the area served by the pitch drainage as this area is exclusively managed by the proposed surface water drainage strategy up to the 1 in100-year event plus climate change.

8.3.7 The rainfall for the development parcels has been refined and applied to the hydraulic model in line with the approach outlined in section 4.2.

Infiltration regions

8.3.8 A small infiltration region has been applied upstream of the existing railway embankment (Catchment D, as shown in drawing 05920-WR-0525 (rev P11). An infiltration rate of $1.88.X10^{-5}$ m/s (IT04, 1.00-1.75m depth) has been applied.

8.3.9 A second small infiltration region is applied to the pitch basin (Infiltration Basin A-A). An infiltration rate of $2.63X10^{-5}$ m/s (IT01, 1.05-2.08m depth) has been applied.

8.3.10 The design rainfall profile has been applied to these small, localised regions (as shown in Figure 8-1) draining through infiltration. This is to conservatively assume that there is no double counting of losses, and all losses are represented in the hydraulic model as opposed to as part of the hydrology estimation.

Proposed surface water drainage strategy inflows

8.3.11 Four surface water drainage strategy inflows, derived using Causeway Flow, have been applied; 1no. into the pitch infiltration basin (Infiltration Basin A-A) and 3no. into the infiltration area adjacent to the existing railway embankment (Catchment D).

8.3.12 The outfall hydrographs have been incorporated to enable the representation of the post-development surface water drainage strategy, incorporating the flows generated within the proposed development areas. Whilst retaining representation of the surface water runoff from the undeveloped areas.

8.3.13 The outfall hydrographs are incorporated into the model using source area polygons (2d_sa) linked to flow-time (QT) tables.

Surface roughness (Manning's n)

8.3.14 The surface roughness has been updated, in line with the submitted illustrative framework plan ref. DE_565_105, to capture the development parcels as urban areas and the roads and verges as an averaged Manning's n to account for proposed paved areas.

Storage feature water levels

8.3.15 Initial water levels have been applied to the proposed basins, as 'zpt' polygons, to represent the design level from the surface water drainage strategy. This proposes a conservative approach to available storage within the Site, ensuring that the design storage within these basins is available for the surface water from the proposed development in all events, up to and including the 1 in 100 year plus climate change event. The remaining storage capacity is the freeboard, within which there is capacity for additional runoff. For the conveyance swales, where the design level is a

gradient across the swale, this is represented using a sloping z-shape to remove the available storage in the conveyance feature.

8.3.16 For the infiltration basin adjacent to the existing railway embankment (Catchment D) and the pitch drainage infiltration basin, a design water level is not applied to avoid double counting of flood volume and storage volume within the Post Development Model. This is because these basins provide a positive outfall within the surface water drainage strategy, draining via infiltration.

8.3.17 The available storage in the infiltration basin adjacent to the existing railway embankment is reduced by increasing the invert level of the basin by 652mm to account for the runoff from Catchment D, which outfalls directly to this basin.

Basin cover levels

8.3.18 Basin cover levels are represented in the Post Development model using z-lines in line with the proposed earthworks and requirements of the surface water drainage strategy. For all attenuation basins the cover levels are set to the 'maximum design water level' as required by the surface water drainage strategy, allowing for representation of the minimum freeboard of 300 mm in each feature.

9 Post Development Model Results

9.1.1 The Post Development Model was simulated for the 1 in 30-year, 1 in 100-year plus climate change and 1 in 1,000-year design events.

9.1.2 Figure 9-1 illustrates the surface water flood extents for each of these events for the Post Development Model.

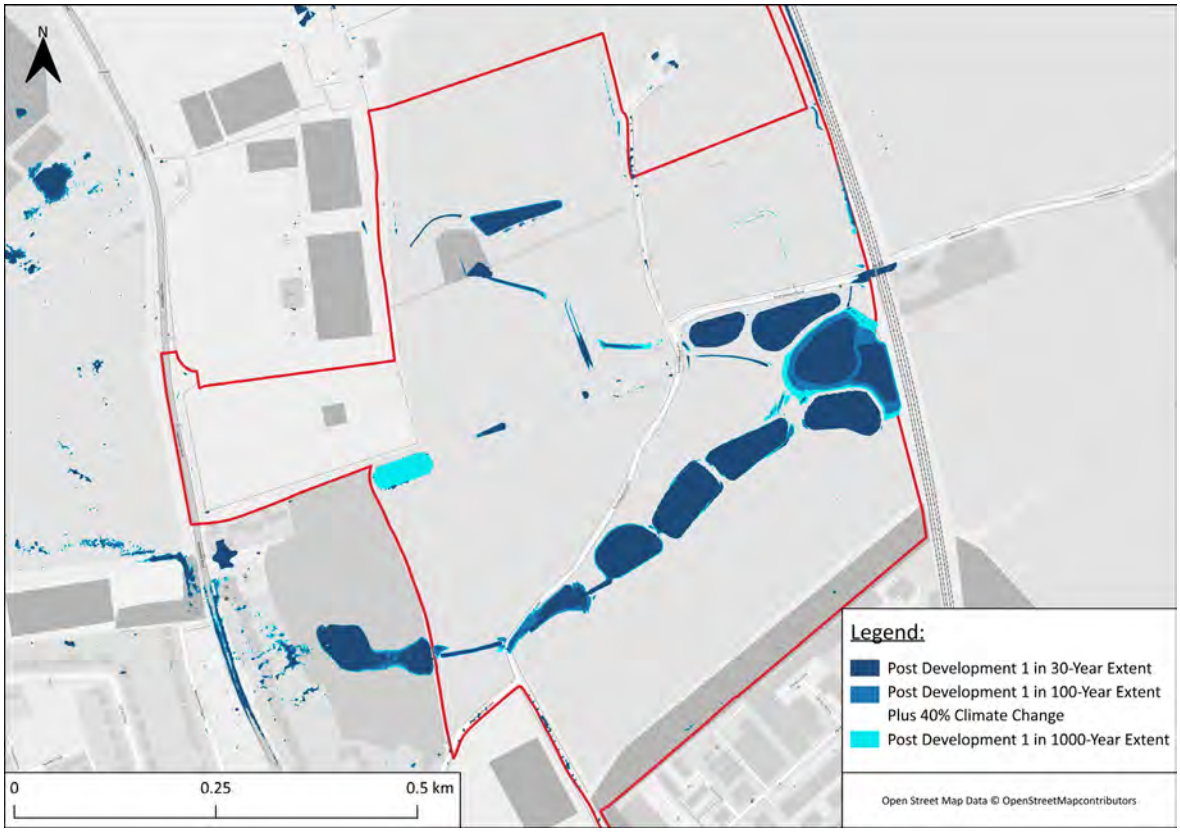


Figure 9-1: Post Development Model Flood Extents

9.1.3 The post-development model extents illustrate changes to existing, identified overland flow routes within the Site. The overland flow routes have been formalised by a series of conveyance features and storage basins, which reduce the previously identified maximum flood levels adjacent to the existing railway embankment. The preliminary proposed levels aim to direct and channel overland surface water runoff away from the proposed development parcels. In the Post Development Model, only minimal localised flooding is identified in some of the highways associated with the proposed development. It should be noted that no representation of the proposed positive surface water drainage system within the development parcels or proposed

highways is included within the model and as such it is considered that the minimal localised areas of flooding identified within the proposed highway is highly conservative.

9.2 Post Development Model Results

1 in 30-year event

9.2.1 Figure 9-2 illustrates the maximum peak flood depths for the Post Development Model for the 1 in 30-year event. The peak water level within the Site, adjacent to the existing railway embankment, is approximately 103.48mAOD, which equates to a maximum peak flood depth of approximately 0.99m.

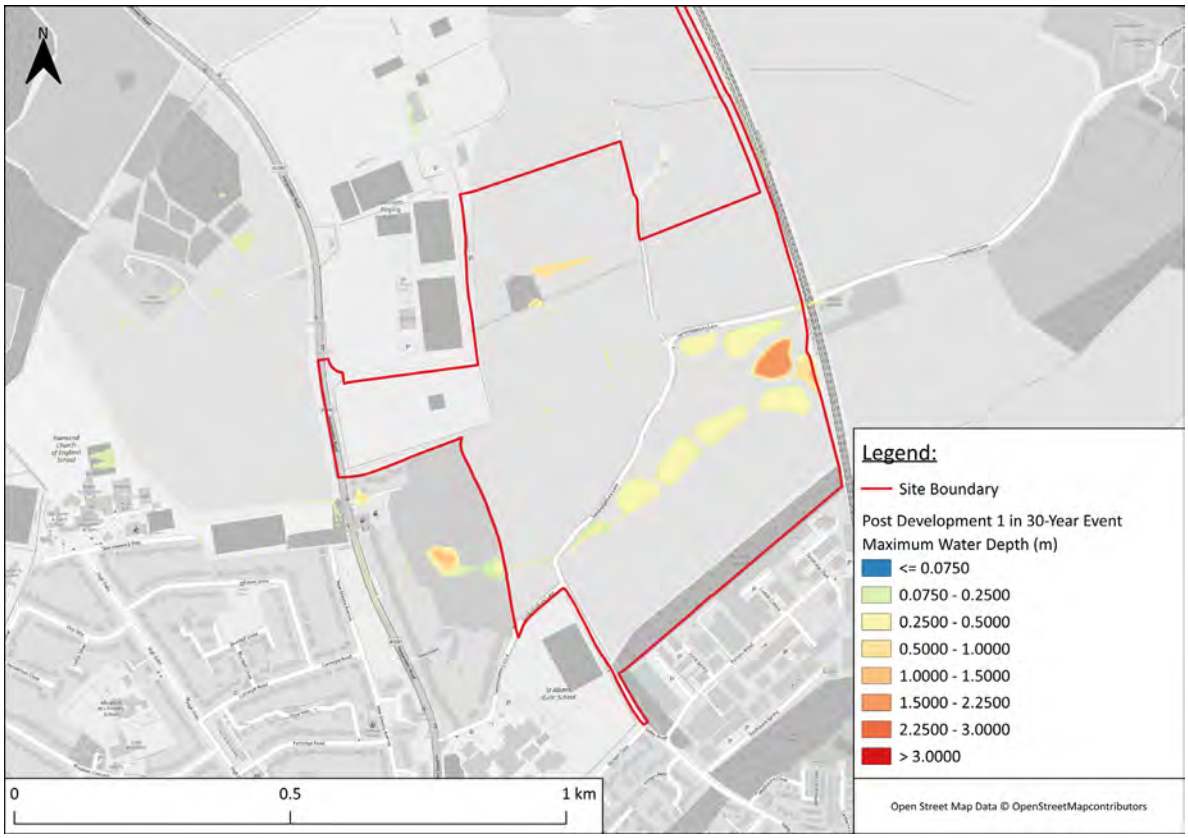


Figure 9-2: Post Development 1 in 30-year Peak Maximum Flood Depth

1 in 100-year plus climate change event

9.2.2 Figure 9-3 illustrates the maximum peak flood depths for the Post Development Model for the 1 in 100-year plus climate change event. The peak water level within the Site, adjacent to the existing railway embankment, is approximately 104.7mAOD, which equates to a maximum peak flood depth of approximately 2.17m.

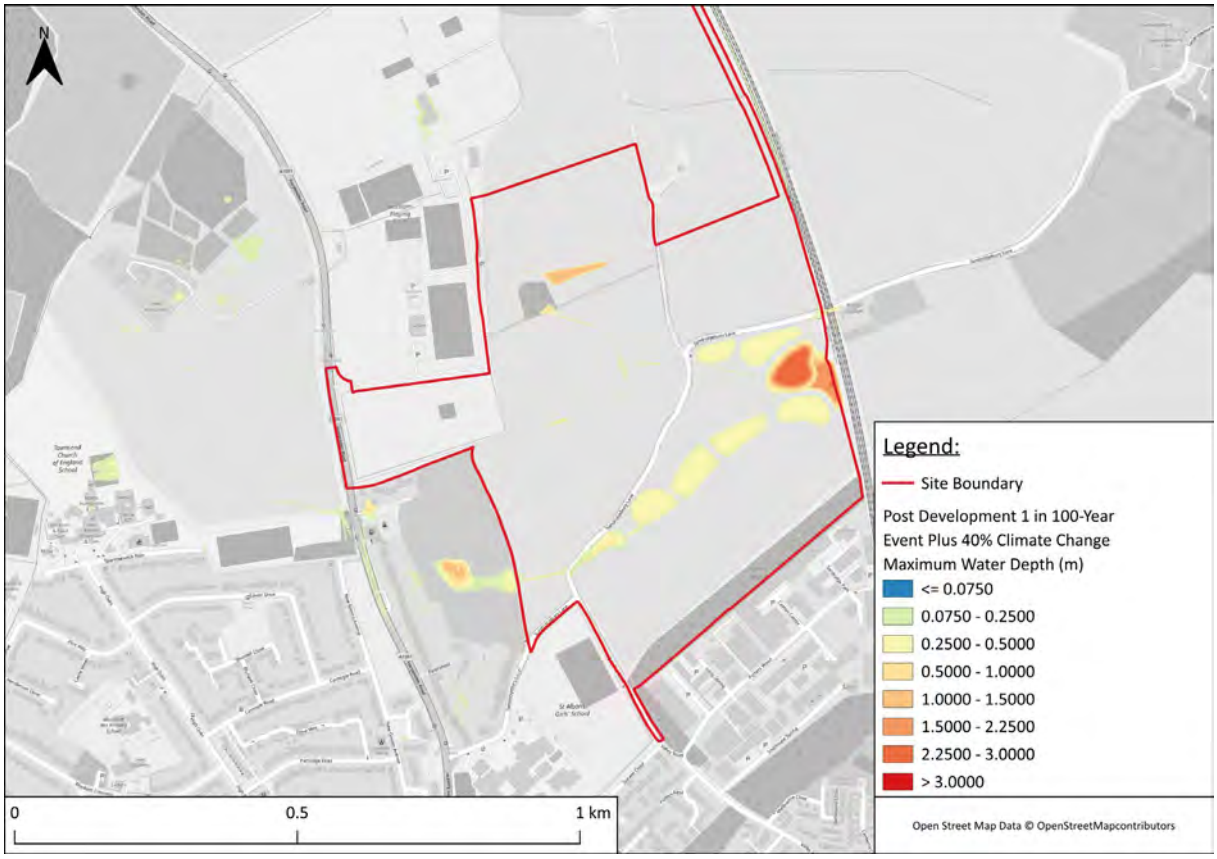


Figure 9-3: Post Development 1 in 100-year plus 40% Climate Change Peak Maximum Flood Depth

1 in 1,000-Year Event

9.2.3 Figure 9-4 illustrates the maximum peak flood depths for the Post Development Model for the 1 in 1,000-year event. The peak water level within the Site, adjacent to the existing railway embankment, is approximately 105.33mAOD, which equates to a maximum peak flood depth of approximately 2.82m.

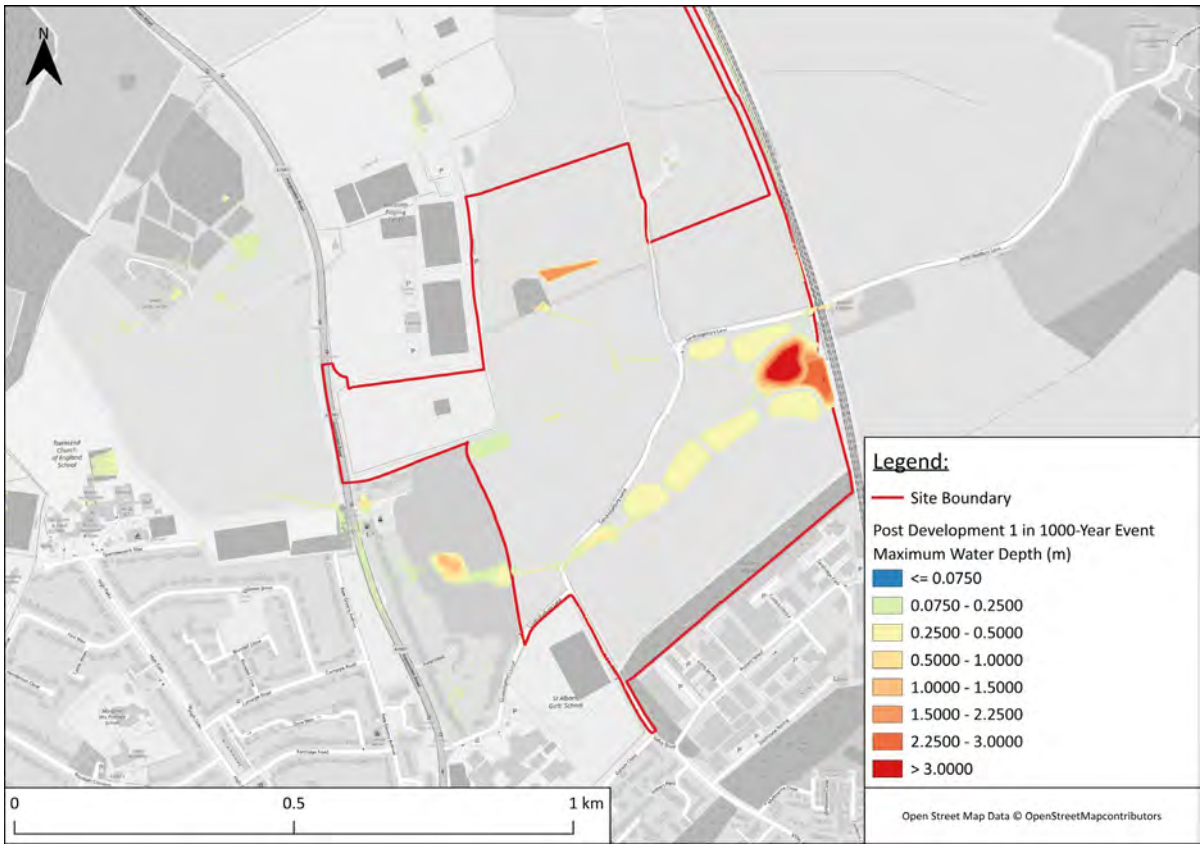


Figure 9-4: Post Development 1 in 1000-year Peak Maximum Flood Depth

10 Baseline and Post-Development Comparison

10.1 Comparison of peak water levels

10.1.1 Table 10-1 shows a comparison of peak water levels within the Site adjacent to the existing railway embankment between the baseline and post-development scenarios for the 1 in 30-year, 1 in 100-year plus climate change, and 1 in 1,000-year events.

Table 10-1: Peak water levels within the Site adjacent to the existing railway embankment for the baseline and post-development scenarios

	Baseline (mAOD)	Post-development (mAOD)	Difference (mm)
1 in 30-year	104.59	103.48	-1,110
1 in 100-year plus climate change	105.33	104.70	-630
1 in 1,000-year	105.61	105.35	-260

10.2 Impact mapping

10.2.1 Figure 10-1 illustrates the change in water level between the baseline and post-development scenarios for the 100-year plus climate change event where the extents of flooding in each modelled event crossover.

10.2.2 As shown, there are localised areas of increase within the Site which typically align with the proposed surface water drainage strategy.

10.2.3 It should be noted that there are no identified detriments outside of the Site, and there are areas of noted betterments observed within the vicinity of the railway embankment and in three areas within Sandridgebury Lane.

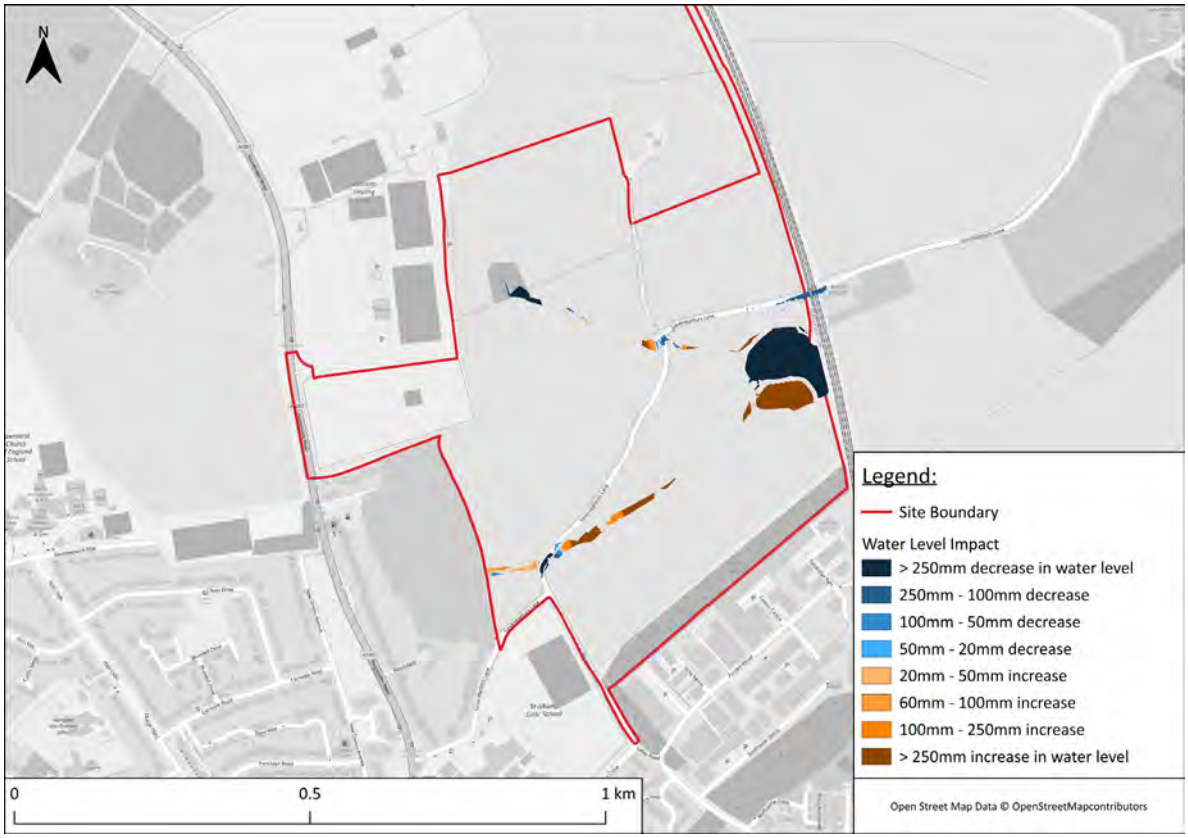


Figure 10-1: Impact map for 1 in 100-year plus climate change event

10.3 Key Observations

10.3.1 The key observations from the modelling undertaken are as follows:

- The proposed development will manage and mitigate potential surface water flooding in any event up to and including the 1 in 1,000-year.
- The proposed surface water drainage strategy and proposed development levels redirect and manage surface water runoff within the Site via blue-green corridors, which incorporate attenuation basins and conveyance features.
- The proposed development will generate a reduction in maximum peak water levels adjacent to the existing railway embankment, as compared to existing conditions, in all events up to and including the 1 in 1,000-year.
- The proposed development will generate a reduction in maximum peak water depths within three locations on Sandridgebury Lane, as compared to existing conditions, in all events up to and including the 1 in 1,000-year.

10.4 Key Assumptions

10.4.1 The site-specific hydraulic model allows for a highly robust and conservative representation of the current and future potential surface water flood risk at the Site. The following key assumptions have been summarised to aid in understanding the level of conservativeness within the hydraulic modelling undertaken to date.

Upstream Catchment

10.4.2 Limited allowance of existing formal drainage within highways and built development has been made within the 'net rainfall.' Typically, existing formal drainage will accommodate all flows up to and including the 1 in 30 year event; however, a high level allowance for 'losses' within the net rainfall has been applied which is likely to underestimate the capacity of the existing formal drainage system.

10.4.3 No allowance for the potential improvement to the existing, unmanaged runoff from the adjacent proposed development Site (Sewell Park) has been made.

10.4.4 No allowance has been made for the existing sports pitches to the north of the proposed sports pitches within the Site, which have a positive drainage system.

Proposed Surface Water Drainage Strategy

10.4.5 The infiltration basin in the east, adjacent to the railway line has a conservative, worst case infiltration rate applied to the attenuation basin of $1.88x10^{-5}$ m/s (extracted from IT04). Further testing was undertaken in an additional trial pit which identified a significantly higher infiltration rate, however the lower infiltration rate has been applied.

10.4.6 Based on the geology present at the Site, infiltration may occur in a number of the proposed surface water drainage features or other permeable areas (e.g. gardens, green space, verges etc.) within the Site. No allowance for infiltration has been made within the hydraulic modelling, other than the final infiltration basins.

10.4.7 The representation of the surface water drainage in the hydraulic model, assumes that the attenuation basins remain at the maximum water level during all rainfall events (100-year plus climate change maximum water level). In practise, the water level will vary within these features throughout these events and as such greater capacity is likely to be available than that currently allowed for within the hydraulic model.

10.4.8 No allowance for on-Site pipe network and/or additional parcels level features within the Surface Water Drainage Strategy, which is represented within the hydraulic model, has been made. Only representation of the attenuation basins and outflow hydrographs has been made, presenting a

likely ‘worst case scenario’ in terms of times of concentration, peak flows and available capacity within the upstream network.

11 Conclusion

11.1.1 PJA has undertaken site-specific direct rainfall modelling of the Site, and proposed development, at Woollam Park, St Albans, with the aim of enhancing the understanding of potential surface water flood risk and the potential impact, if any, of the proposed development.

11.1.2 The site-specific hydraulic model is a conservative representation of the potential surface water flood risk in existing (Baseline) and post development conditions, for current and future rainfall events.

11.1.3 The Baseline Model provides a more enhanced understanding of the existing, potential surface water flood risk within the Site and the wider catchment when compared to the publicly available Long Term Flood Risk Information, Flood Risk from Surface Water Map.

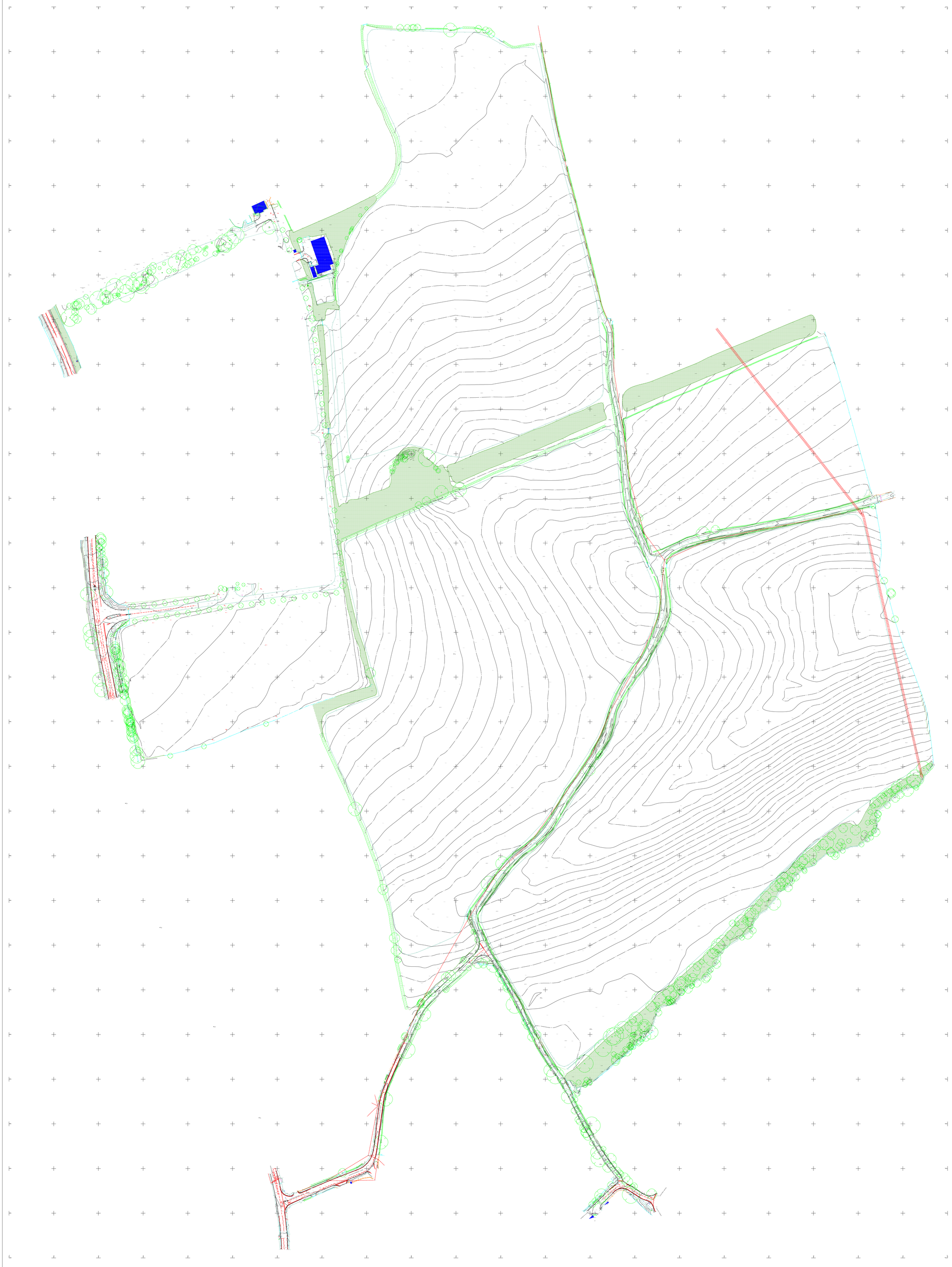
11.1.4 The Post Development Model incorporates a representation of the proposed development which comprises:

- Proposed Earthworks
- Structures
- Post-development rainfall
- Infiltration regions
- Proposed surface water drainage strategy inflows
- Surface roughness (Manning's n)
- Storage feature water levels
- Basin design levels

11.1.5 The Post Development Model confirms that:

- The proposed development will manage and mitigate potential surface water flooding in any event up to and including the 1 in 1,000-year.
- The proposed surface water drainage strategy and proposed development levels redirect and manage surface water runoff within the Site via blue-green corridors, which incorporate attenuation basins and conveyance features.
- The proposed development will generate a reduction in maximum peak water levels adjacent to the existing railway embankment, as compared to existing conditions, in all events up to and including the 1 in 1,000-year.
- The proposed development will generate a reduction in maximum peak water depths within three locations on Sandridgebury Lane, as compared to existing conditions, in all events up to and including the 1 in 1,000-year.

Appendix A Interlocks Surveys topographic survey (2019)



Symbol & Abbreviation Key.

- BARBED WIRE FENCE
- POST & RAIL FENCE
- CLOSE BOARD FENCE
- RAILINGS
- CHAIN LINK FENCE
- OTHER FENCE
- KERB
- DROPPED KERB
- GULLY CHANNEL
- TOP / BOTTOM OF BANK
- FOLIAGE
- DITCH
- VERGE
- OVERHEAD CABLES
- GATE
- HEDGE
- TREE - BROAD LEAVED
- TREE - CONIFEROUS
- BUSH
- BUILDING
- BOREHOLE
- SURVEY STATION
- ORDNANCE SURVEY BENCH MARK

A/C	AIR CONDITIONING UNIT	KO	KERB OFFLET
AV	AIR VALVE	LC	LIGHTING COLUMN
BOL	BOLLARD	LP	LAMP POST
BH	BOREHOLE	NP	NAME PLATE
BL	BED LEVEL	NB	NOTICE BOARD
BM	BENCH MARK	PR	PIPE RISER
BT	BRITISH TELECOM	RP	RODDING POINT
CTV	CABLE TV	RS	ROAD SIGN
CL	COVER LEVEL	SP	SIGN POST
CR	CABLE RISER	SV	STOP VALVE
DP	DOWN PIPE	TL	TRAFFIC LIGHT
ER	EARTH ROD	TP	TELEGRAPH POLE
EP	ELECTRICITY POLE	TOF	TOP OF FENCE
EM	ELECTRICITY MARKER	TOH	TOP OF HEDGE
FB	FUSE BOX	TOR	TOP OF RAILINGS
FH	FIRE HYDRANT	TOS	SERVICE LEVEL
FP	FENCE POST	TOW	TOP OF WALL
FL	FLOOR LEVEL	UTL	UNABLE TO LIFT
GV	GAS VALVE	VM	VALVE MARKER
GM	GAS MARKER	VP	VENT PIPE
GU	GULLY	WL	WATER LEVEL
HM	HYDRANT MARKER	WM	WATER MARKER
IL	INVERT LEVEL	WO	WASH OUT

General.

This survey has been prepared with a scaling accuracy for a plot at a scale of 1:200.

All tree heights and spreads are approximate. We have tried to identify tree types, however if tree species are critical specialist advice should be gained.

Drainage pipe sizes have been measured from the surface. Chamber access has not been gained for safety reasons, therefore sizes should be regarded as approximate.

Some detail may have been omitted due to parked vehicles.

Notes.

Coordinates related to OS National Grid from ST10 by GPS.
Levels related to GPS. Scale factor: 0.99976403

INDICATIVE ONLY

Rev	Details of Revision	Drawn	Date
B	Road detail added.	AA	01/08/19
A	Additional area around school/field added.	AS	31/07/19

Surveyed	Drawn	Date	Checked	Date	Approved	Date
GD	AS	24/07/19	APK	24/07/19	APK	24/07/19

Interlocks Surveys Limited
St. Andrews House
Radford Semele
Leamington Spa
Warwickshire
CV31 1TF

T: 01926 330123
F: 01926 330120
E: info@interlocksurveys.co.uk

Client.

WSP GROUP
THE MAILBOX
LEVEL 2
100 WHARFSIDE STREET
BIRMINGHAM, B1 1RT

Title.

TOPOGRAPHICAL SURVEY

ST ALBANS
HERTFORDSHIRE
AL3 6JE

Dwg No. **190296** Sheet **1 of 1**

Scale NTS A0 Sheet Rev. B

Appendix B Geo Environmental Group Infiltration Testing (2024)

GEG | Geo Environmental Group
Geotechnical, Environmental & Ecological Consultants

GEG House, 17 Graham Road, Malvern, WR14 2HR
Tel. 01684 212526 Fax 01684 576917 www.g-eg.co.uk

INFILTRATION TESTING & GROUNDWATER MONITORING

LAND AT CHEAPSIDE
HARPENDEN ROAD
ST ALBANS, HERTFORDSHIRE
AL3 6BB

APRIL 2025 (REV03)

Prepared for:

Hallam Land Management

PJA

Registered Company - GEG Ltd
Registered in England No 6469985
Registered Office: Granta Lodge, 71 Graham Rd, Malvern, WR14 2JS

Report Title:

INFILTRATION TESTING & GROUNDWATER MONITORING REPORT

Site Address:

Land at Cheapside
Harpenden Road
St Albans
Hertfordshire
AL3 6BB

Performed By:
Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

On Behalf of:
Hallam Land Management
c/o PJA
Park Point
High Street
Longbridge
Birmingham
B31 2UQ

Written by:

[redacted]

Matthew Perks
BSc(Hons) MSc FGS
Principal Geo-Environmental Consultant

Approved by:

[redacted]

Anthony Marriott
BSc(Hons) MRSC MIEnvSc FGS
Managing Director

Project Reference: GEG-24-821

Report Reference: GEG-24-821/IT

Issue Status: FINAL

Date of Issue:

Rev. 00: 23rd May 2024
Rev. 01: 22nd July 2024
Rev. 02: 24th October 2024
Rev. 03: 28th April 2025

TABLE OF CONTENTS *PAGE*

1. INTRODUCTION 1
1.1 General 1
1.2 Available Information 1
1.3 Proposed Site Development 1
1.4 Scope 1

2. SITE SETTING 1
2.1 Site Location 1
2.2 Site Description 2

3. GEOLOGY & HYDROGEOLOGY 2
3.1 Published Geology 2
3.2 Hydrogeology 3
3.2.1 Groundwater Designation 3
3.3 Potential Water Infiltration Properties of the Strata 3
3.4 Groundwater Source Protection Zone 3
3.5 Surface Water Flooding 3

4. INTRUSIVE INVESTIGATION 3
4.1 Site Works Overview 4
4.2 Scope of Works – Stage 1 4
4.2.1 Window Sample Holes 4
4.2.2 Trial Pits 4
4.3 Scope of Works – Stage 2 4
4.3.1 Window Sample Holes 4
4.3.2 Trial Pits 4
4.4 Scope of Works – Stage 3 5
4.4.1 Window Sample Holes 5
4.4.2 Trial Pits 5
4.5 Strata Encountered 5
4.5.1 Made Ground 5
4.5.2 Topsoil 5
4.5.3 Kesgrave Catchment Subgroup 5
4.5.4 Clay-with-Flints Formation 5
4.5.5 Lewes Nodular & Seaford Chalk Formations 5
4.5.6 Groundwater 6
4.5.7 Falling Head Permeability Tests 7
4.5.8 Stability of Trial Pits 8
4.5.9 Reinstatement 8
4.6 Infiltration Tests 8
4.7 Calculated Infiltration Rates 8

5. CONCLUSIONS 10
6. REFERENCES 10
7. LIMITATIONS 10

Title *Appendix*

FIGURES AND PLANS ..... A

Site Location Plan ..... Figure 1
Exploratory Hole Location Plan - Full ..... Figure 2A
Exploratory Hole Location Plan – Stage 3 ..... Figure 2B

PHOTOGRAPHIC RECORD ..... B
EXPLORATORY HOLE LOGS C
INFILTRATION TEST DATA ..... D
FALLING HEAD TESTS ..... E

1. INTRODUCTION

1.1 General

Geo Environmental Group (GEG) were commissioned by PJA on behalf of their client, Hallam Land Management (HLM), to undertake staged infiltration testing and groundwater monitoring at a site known as 'Land at Cheapside, St Albans,' for the purpose of determining infiltration rates of the underlying shallow strata and hence the suitability of the site for soakaway drainage.

1.2 Available Information

The following drawings was supplied by PJA:

- 'Potential GI Locations Plan,' PJA on behalf of HLM, Drawing No. 0100, Rev. P01, dated 27th September 2023.
- 'Indicative Surface Water Drainage Strategy – GI Plan,' PJA on behalf of HLM, Drawing No. 05920-GR-0534, Rev. P01, June 2024.
- 'Master Utilities Map,' WSP on behalf of HLM, Drawing No. 70039336, Rev. P01, dated January 2018.

1.3 Proposed Site Development

The site is being considered for residential development.

1.4 Scope

The works performed by GEG included:

- Trial pitting with infiltration testing in accordance with a specification supplied by PJA.
- Window sample boreholes with installation of standpipes.
- Calculation of infiltration rates, subject to ground conditions encountered.
- Groundwater monitoring with falling head tests of standpipes.

Limitations to the scope of the report are outlined in Section 7.

2. SITE SETTING

2.1 Site Location

The site is located on land approximately 3 km north of St Albans city centre, at the approximate National Grid Reference 515461E, 209983N. It lies on land adjacent to the west of Harpenden Road (A1081) and is bisected by Sandridgebury Lane, and covers an area of approximately 48 ha.

A section of the 1:25,000 Ordnance Survey (OS) map identifying the site location is shown in Figure 1 of Appendix A and a photographic record is provided in Appendix B.

2.2 Site Description

The site, which fell gently to the south east, comprised agricultural land across the majority with sports fields associated with the Old Albanian Rugby Club in the far eastern section.

3. GEOLOGY & HYDROGEOLOGY

3.1 Published Geology

Reference to the 1:50,000 scale British Geological Survey digital mapping of the area (solid and drift) indicates that the solid geology beneath the site comprises the Lewes Nodular Chalk and Seaford Chalk Formations (of the White Chalk Subgroup) of the Cretaceous period. The formations, which were formerly part of the Upper Chalk, are described individually as follows:

- Lewes Nodular Chalk Formation: *hard to very hard nodular chalks and hardgrounds with interbedded soft to medium hard chalks and marls. Nodular chalks are typically lumpy and iron-stained. Brash is rough and flaggy or rubbly, and tends to be dirty.*
- Seaford Chalk Formation: *firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Some flint nodules are large to very large.*

The solid geology is conjectured to be overlain by superficial deposits locally of Clay-with-Flints Formation across the north western margins, and the Kesgrave Catchment Subgroup is present locally centrally and along the south eastern margins of the site. The superficial deposits are described as follows:

- The Clay-with-Flints Formation: *a residual deposit formed from the dissolution, decalcification and cryoturbation of bedrock strata of the Chalk Group and Palaeogene formations. It is unbedded and heterogenous. The dominant lithology is orange-brown and red-brown sandy clay with abundant nodules and rounded pebbles of flint. The deposit locally includes bodies of yellow fine- to medium- grained sand, reddish brown clayey silt, and sandy clay with beds of well-rounded flint pebbles.*
- The Kesgrave Catchment Subgroup: *mainly gravels characterised by quartz and quartzite.*

No significant faults are conjectured to intersect the site at the surface.

3.2 Hydrogeology

3.2.1 Groundwater Designation

Environment Agency data indicates that the solid geology beneath the site is designated as a Principal Aquifer.

Principal Aquifers as assigned where geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers.

The superficial deposits of the Clay-with-Flints Formation are characterised as Unproductive strata and the Kesgrave Catchment Subgroup as a Secondary A Aquifer.

Secondary A Aquifers are defined as permeable layers capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Unproductive Strata - are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

3.3 Potential Water Infiltration Properties of the Strata

The Clay-with-Flints Formation is considered unlikely to be sufficiently permeable for soakaway drainage. Therefore, the solid geology chalk formations or the soils of the Kesgrave Catchment Subgroup were targeted for the soakaway testing (where encountered).

3.4 Groundwater Source Protection Zone

The site lies within the Total Catchment (Zone 3) of a currently defined Groundwater Source Protection Zone (GWSPZ), as such it is recommended that any specific Environment Agency requirements with respect to soakaways etc. are adhered to.

3.5 Surface Water Flooding

According to the Environment Agency online 'Flood Map for Planning', the site lies within Flood Zone 1, being land that lies outside the 1 in 1000 year (0.1%AEP) flood risk area and hence has a low probability of flooding.

4. INTRUSIVE INVESTIGATION

The following section outlines the scope of the intrusive investigation undertaken by GEG and details the ground conditions encountered and the infiltration testing carried out.

4.1 Site Works Overview

All works were carried out in accordance with current British Standard guidance (BS: 5930 and BS: 10175) and infiltration testing in general accordance with BRE Digest 365 (Soakaway Design).

The ground conditions were logged by an experienced geo-environmental engineer from GEG. The strata encountered, groundwater levels/seepages, and stability of excavations are recorded on the exploratory hole logs presented in Appendix C.

The locations of the exploratory holes are shown on Figure 2 presented in Appendix A.

4.2 Scope of Works – Stage 1

The Stage 1 intrusive investigation was undertaken from 10th and 11th April 2024 and comprised window sample boreholes, machine-excavated trial pitting, and infiltration testing.

4.2.1 Window Sample Holes

6 No. window sample boreholes (WS01-WS06) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 5.00 m. Continuous sampling was undertaken using a liner system.

All boreholes were installed with 50 mm diameter standpipes to the depth detailed on the exploratory hole log for subsequent groundwater monitoring.

4.2.2 Trial Pits

3 No. trial pits (IT01-IT03) were excavated using a JCB-3CX to depths of between 2.00 and 2.75 m to facilitate investigation of the near surface soils and undertake infiltration testing.

4.3 Scope of Works – Stage 2

The Stage 2 intrusive investigation was undertaken on 4th July 2024 and comprised additional window sample boreholes, machine-excavated trial pitting, and infiltration testing.

4.3.1 Window Sample Holes

4 No. window sample boreholes (WS07-WS10) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 6.00 m. Continuous sampling was undertaken using a liner system.

WS07 was installed with a 50 mm diameter standpipe to the depth detailed on the exploratory hole logs for subsequent groundwater monitoring.

4.3.2 Trial Pits

4 No. trial pits (IT04-IT07) were excavated using a JCB-3CX to depths of between 2.20 and 2.80 m to facilitate investigation of the near surface soils and undertake infiltration testing.

4.4 Scope of Works – Stage 3

The Stage 3 intrusive investigation was undertaken on 20th and 21st February 2025 and comprised additional window sample boreholes, machine-excavated trial pitting, and infiltration testing.

4.4.1 Window Sample Holes

4 No. window sample boreholes (WS07A & WS11-WS13) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 5.45 m. (WS7A was a replacement for the destroyed borehole WS07.) Continuous sampling was undertaken using a liner system.

All the boreholes were installed with 50 mm diameter standpipes to the depth detailed on the exploratory hole logs for subsequent groundwater monitoring.

4.4.2 Trial Pits

11 No. trial pits (IT08A-B, IT09A-E, IT10A-C & IT11) were excavated using a JCB-3CX to depths of between 2.50 and 4.00 m to facilitate investigation of the near surface soils and undertake infiltration testing.

4.5 Strata Encountered

The ground conditions encountered are described below and broadly confirmed the published geology.

4.5.1 Made Ground

Made Ground of reworked topsoil was encountered at 1 No. location (IT03) to a depth of 0.20 m and comprised soft to firm CLAY with occasional gravel-sized fragments of quartzite and ceramic.

4.5.2 Topsoil

Natural topsoil of soft to firm CLAY was encountered in the remaining locations to depths of between 0.20 and 0.30 m.

4.5.3 Kesgrave Catchment Subgroup

The Kesgrave Catchment Subgroup was not encountered during the investigation.

4.5.4 Clay-with-Flints Formation

The Clay-with-Flints Formation was encountered underlying the topsoil and Made Ground at all locations to depths (where proven) of between 1.35 and 5.50 m. It typically comprised firm to very stiff variably sandy gravelly CLAY locally with cobbles and boulders and locally medium dense to dense clayey gravelly to very gravelly SAND.

4.5.5 Lewes Nodular & Seaford Chalk Formations

The Lewes Nodular & Seaford Chalk Formations were encountered underlying the Clay-with-Flints Formation at 17 No. locations (WS01-WS03, WS06, WS07A,

WS08, WS10, WS11, WS13 IT01, IT04, IT07, IT08A-B, IT09C, IT09E & IT11) from depths of between 1.20 and 5.50 m to the base of the exploratory holes. It typically comprised structureless CHALK composed of variably gravelly SILT (Grades Dm to Dc).

It is noted that discernment of chalk grade from disturbed borehole samples is inherently difficult as drilling disrupts the natural structure of the chalk. As such, chalk grade boundaries may vary from those interpreted.

4.5.6 Groundwater

Groundwater was not encountered in any of the exploratory holes during the intrusive investigation.

Groundwater levels recorded in the boreholes during the subsequent monitoring visits are summarised in Table 1.

Table 1. Groundwater Levels Recorded During the Monitoring Visits

Borehole	Date	Depth of Installation (m)	Groundwater Depth (m)
WS01	09/05/24	5.00	(Damp at 5.00)
	11/06/24		(Damp at 5.00)
	04/07/24		Dry
	21/08/24		(Damp at 5.00)
	25/09/24		(Damp at 5.00)
	23/10/24		Dry
	20/02/25		Dry
	06/03/25		Dry
	15/04/25		Dry
WS02	09/05/24	5.00	Dry
	11/06/24		Dry
	04/07/24		Dry
	21/08/24		Dry
	25/09/24		Dry
	23/10/24		Dry
	20/02/25		Dry
	06/03/25		Dry
	15/04/25		Dry
WS03	09/05/24	5.00	Dry
	11/06/24		(Damp at 5.00)
	04/07/24		5.00
	21/08/24		Dry
	25/09/24		Dry
	23/10/24		1.01
	20/02/25		1.17
	06/03/25		1.11
	15/04/25		Dry

Borehole	Date	Depth of Installation (m)	Groundwater Depth (m)
WS04	09/05/24	2.00	0.53
	11/06/24		1.34
	04/07/24		1.90
	21/08/24		(Damp at 1.90)
	25/09/24		0.00
	23/10/24		0.52
	20/02/25		1.20
	06/03/25		Destroyed
	15/04/25		
WS05	09/05/24	1.80	Dry
	11/06/24		1.20
	04/07/24		1.58
	21/08/24		(Damp at 1.80)
	25/09/24		Dry
	23/10/24		(Damp at 1.80)
	20/02/25		(Damp at 1.80)
	06/03/25		Dry
	15/04/25		Dry
WS06	09/05/24	5.00	(Damp at 5.00)
	11/06/24		Dry
	04/07/24		Dry
	21/08/24		Dry
	25/09/24		(Damp at 5.00)
	23/10/24		Dry
	20/02/25		Dry
	06/03/25		Dry
	15/04/25		Dry
WS07	21/08/24	5.00	Dry
	25/09/24		Destroyed
	23/10/24		
WS07A	06/03/25	5.00	Dry
	15/04/25		Dry
WS11	06/03/25	5.00	Dry
	15/04/25		Dry
WS12	06/03/25	5.00	Dry
	15/04/25		Dry
WS13	06/03/25	5.00	Dry
	15/04/25		Dry

It should be noted that groundwater levels may vary due to seasonal and other effects.

4.5.7 Falling Head Permeability Tests

2 No. falling head tests were undertaken in borehole WS06. Clean water was dispensed from containers at a rapid rate to fill each borehole as quickly as possible.

4.5.7.1 Calculated Permeability Rates

The falling head test data and soakage rates were calculated based on guidance given in the Kent County Council Soakaway Design Guide (2000) and are presented in Appendix E.

The soakage rate calculated is summarised in Table 2 below.

Table 2. Borehole Soakage Rate

Location	Test No.	Date	Borehole Soakage Rates (l/m²/min)
WS06	1	09/05/24	2.65 [1]
	2	11/06/24	4.08 [1]
	3	-	-

[1] Approximately 75 litres of water was poured into the standpipe (at a rapid rate) in order to conduct the test at the depth indicated.

Please note that this value is considered relatively high and indicates that potential soakage within the chalk is a likely occurrence.

4.5.8 Stability of Trial Pits

The sides of the trial pit excavations were typically stable with the exception of slight instability below 2.20 m in IT03, below 1.50 m in IT04, below 0.40 m in IT05, and below 0.30 m in IT06.

4.5.9 Reinstatement

On completion of the measurements, the infiltration pits were emptied of residual water and backfilled with arisings.

4.6 Infiltration Tests

A total of 20 No. infiltration tests were undertaken in the 13 No. trial pits (IT01 to IT07, IT08B, IT09C, IT09E, IT10A, IT10B & IT11). The tests were undertaken in general accordance with BRE Digest 365.

Clean water was dispensed from a bowser at a rapid rate to fill each excavation as quickly as possible to the proposed depth of the invert levels and/or the most permeable strata. The excavations took less than 5 minutes to fill. Each test pit was filled to give a head of water of approximately 1.00m.

Measurements were then taken of the fall of water at suitable time increments to allow the infiltration rate to be calculated from the time taken for the water level to drop from 75% to 25% effective depth (where possible). If there was sufficient time, the tests were repeated a maximum of three times in accordance with BRE Digest 365.

On completion of the measurements, the infiltration pits were backfilled with arisings.

The water level measurements from the infiltration tests are tabulated and graphically depicted on Figures F-1 to F-20 in Appendix D.

4.7 Calculated Infiltration Rates

The effective depths reached during the tests and associated times are summarised in Table 3 below.

Table 3. Infiltration Test Results

Location	Depth Range of Test (m)	Test No.	Strata [1]	Effective Depth Reached	Time (mins)	Infiltration Rate (m/s)
IT01	1.30 – 2.40	1	CwF (C) / CHK	25%	115	2.96×10^{-5} [2]
	1.05 – 2.08	2			132	2.63×10^{-5}
	1.01 – 1.82	3			119	2.97×10^{-5} [2]
IT02	1.00 – 2.00	1	CwF (C)	97%	217	N/A
IT03	1.45 – 2.75	1	CwF (C) / CwF (G)	104%	194	N/A
IT04	1.20 – 2.00	1	CwF (C) / CHK	25%	105	2.60×10^{-5}
	1.00 – 1.75	2			165	1.88×10^{-5}
IT05	1.40 – 2.40	1	CwF (G)	95%	201	N/A
IT06	1.80 – 2.80	1	CwF (C/G)	101%	195	N/A
IT07	1.40 – 2.50	1	CwF (C) / CHK	96%	183	N/A
IT08B	2.00 – 3.00	1	CwF (C) / CHK	25%	20	1.50×10^{-4}
	1.90 – 2.80	2		25%	25	2.62×10^{-3}
	1.75 – 2.70	3		25%	25	2.67×10^{-3}
IT09C	1.70 – 2.70	1	CwF (C) / CHK	90%	189	N/A
IT09E	1.65 – 2.70	1	CwF (C) / CHK	25%	100	3.18×10^{-5}
	1.45 – 2.25	2		25%	120	2.79×10^{-5}
IT10A	2.20 – 3.20	1	CwF (C)	100%	127	N/A
IT10B	1.50 – 2.60	1	CwF (C)	99%	151	N/A
IT11	2.05 – 2.70	1	CwF (C) / CHK	25%	71	3.57×10^{-5}
	1.82 – 2.70	2		Trial pit became dry at 2.40 m due to slumping of base at 2.40 m during infiltration test. As such, no infiltration rate could be calculated.		

N/A=Not Applicable
[1] CwF=Clay with Flints Formation; CHK=Lewes Nodular and Seaford Chalk Formations; C=Cohesive; G=Granular.
[2] Based on extrapolated data (due to partial collapse of trial pit during the test).

5. CONCLUSIONS

The infiltration tests undertaken in IT01, which was extended into the underlying chalk, yielded infiltration rates of 2.63 x 10^{-5} to 2.97 x 10^{-5} m/s, albeit based on some extrapolated data (due to partial collapse of trial pit during the tests). Infiltration tests in IT04, IT08B, IT09E and IT11 (also onto the underlying chalk) yielded rates of 3.57 x 10^{-5} and 2.62 x 10^{-3} m/s. The falling head tests undertaken in the chalk strata of WS06 yielded a borehole soakage rate of 2.65 and 4.08 l/m²/min.

The water levels did not reach the 25% effective depth for infiltration tests in IT02, IT03 and IT05 to IT07, which were taken primarily within the typically cohesive strata of the Clay-with-Flints Formation, and consequently no infiltration rates could be calculated. No infiltration rates were also calculated for IT09C, IT10A and IT10B. However, the granular strata in IT03 and IT05 to IT07 (and the chalk encountered in IT07) proved relatively impermeable to infiltration, potentially due to the presence of a significant fines fraction clogging the pores.

Design and positioning of soakaways in chalk will require careful consideration to mitigate risks associated with potential erosion of infilled solution features (if present). All soakaways should be designed and constructed in accordance with BRE 365. Further guidance is also given by documents provided by Kent County Council (July 2000).

6. REFERENCES

1. British Standard Institute, BS 1377-Parts 1-9: 1990-2016. Methods of Tests for Soils for Civil Engineering Purposes.

2. British Standard Institute, BS 5930:2015 + A1:2020. Code of Practice for Site Investigations.

3. BRE Digest 365, 2016. Soakaway Design.

4. Kent County Council, 2000. The Soakaway Design Guide.

7. LIMITATIONS

As with all intrusive site investigations, there is a possibility that there are local variations in ground conditions not identified by the current investigation.

The conclusions and recommendations stated herein are based on information available at the time of production. These may not necessarily apply if the site is to be utilised for a more or less sensitive purpose in the future, or if operational procedures or management alter over time.

GEG maintain intellectual copyright of the contents of this report and grant exclusive use of the material contained herein to the client, the client's agents, the client's respective sub-contractors and the specific local authority. No unauthorised distribution shall be made to any third parties without the prior consent of both GEG and the Client.

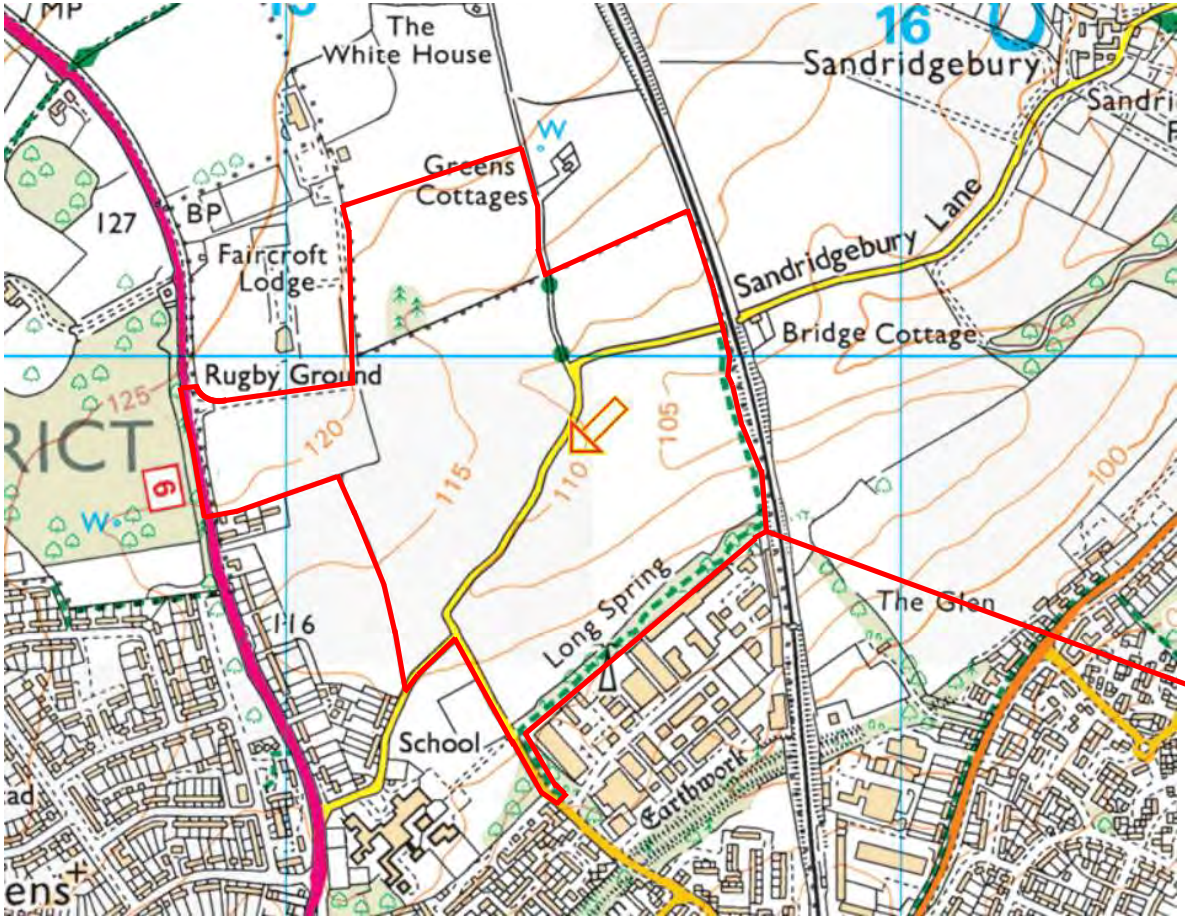
GEG shall not be liable by reason of any representation (unless fraudulent), or any implied warranty, condition or other term, or any duty at common law for any loss of profit or any indirect, special or consequential loss, damage, costs, expenses or other claims (whether caused by the negligence of the Supplier, its servants, sub-contractors or agents or otherwise) which arise out of or in connection with the provision of the Specified Service or their use by the Client.

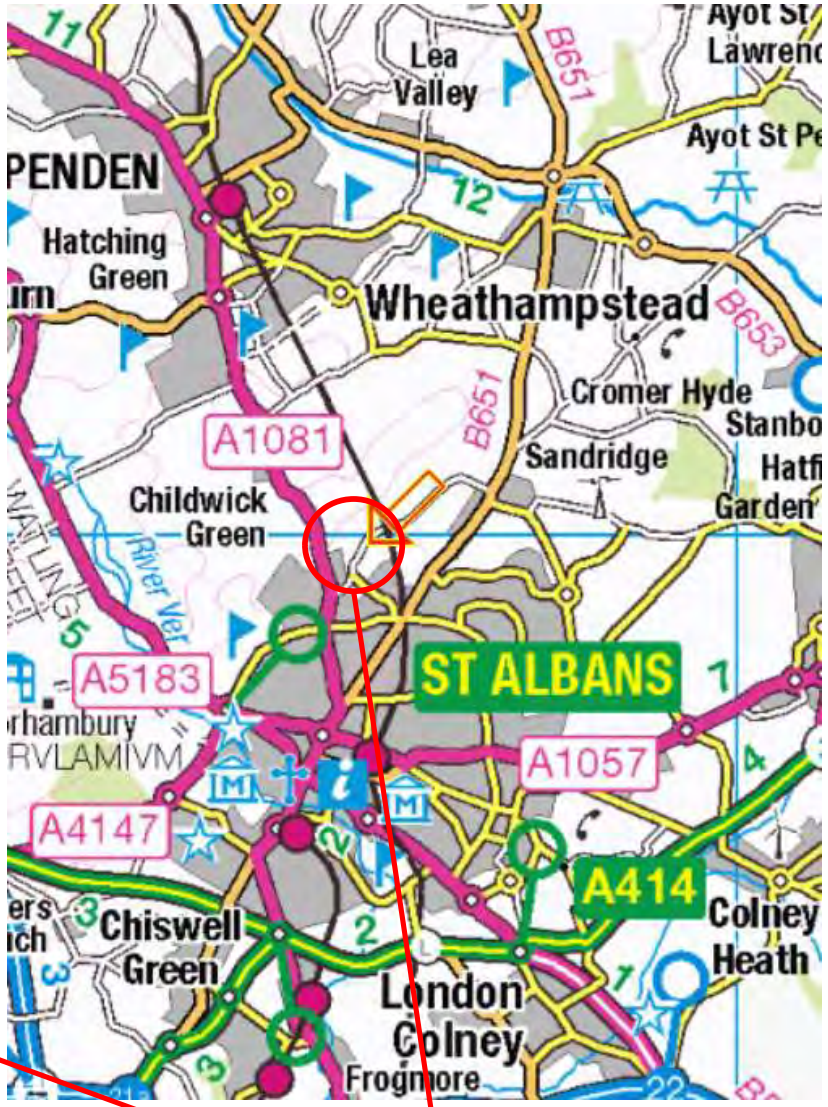
It should be noted that any warranty or liability offered or incurred by GEG, related to this report commences from the date of first issue of this report and is not altered by subsequent report revisions.

Whilst GEG may identify the presence of potential invasive plant species during the standard geo-environmental walkover and/or investigations, the Client should be aware that ecological issues including an invasive species surveys etc. are beyond the scope of the works and as such no associated liability is accepted by GEG.

APPENDIX A

FIGURES AND PLANS

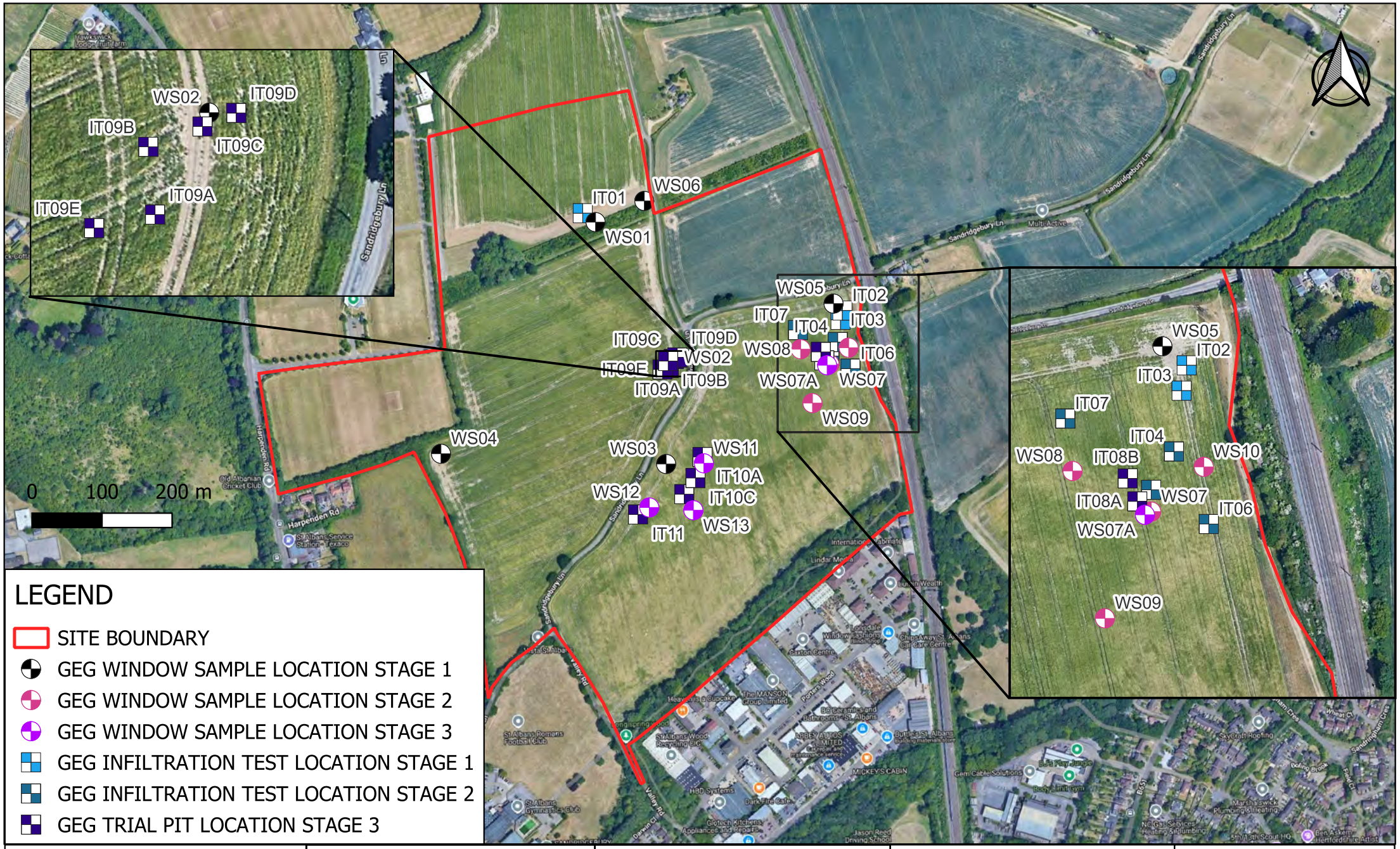




SITE LOCATION

Ordnance Survey © Crown Copyright 2024 All rights reserved. License number 100048258

TITLE: FIGURE 1: SITE LOCATION PLAN	**CLIENT:** PJA / HLM		**DRAWN/CHECKED:** EW / MP		GEG House, 17 Graham Road Malvern, WR14 2HR Tel. 01684 212526 Fax 01684 576917 admin@g-eg.co.uk, www.g-eg.co.uk Geo Environmental Group
SITE: LAND AT CHEAPSIDE, ST ALBANS	**PROJECT No.:** GEG-24-821	**SCALE:** NTS	**DATE:** 16/05/24	**REVISION:** A	



LEGEND

- SITE BOUNDARY
- GEG WINDOW SAMPLE LOCATION STAGE 1
- GEG WINDOW SAMPLE LOCATION STAGE 2
- GEG WINDOW SAMPLE LOCATION STAGE 3
- GEG INFILTRATION TEST LOCATION STAGE 1
- GEG INFILTRATION TEST LOCATION STAGE 2
- GEG TRIAL PIT LOCATION STAGE 3

FIGURE 2A EXPLORATORY HOLE LOCATION PLAN - FULL	CLIENT: HALLAM LAND MANAGEMENT / PJA		DRAWN/CHECKED: EW / MP	
SITE: LAND AT CHEAPSIDE, ST ALBANS	PROJECT NUMBER: GEG-24-821	SCALE: AS SHOWN	DATE: 02/04/25	REVISION: 0

GEG House, 17 Graham Road
Malvern, WR14 2HR
Tel. 01684 212516
Fax. 01684 576917
admin@g-eg.co.uk, www.g-eg.co.uk

Geo Environmental Group

FIGURE 2B EXPLORATORY HOLE LOCATION PLAN - STAGE 3	CLIENT: HALLAM LAND MANAGEMENT / PJA		DRAWN/CHECKED: EW / MP		GEG House, 17 Graham Road Malvern, WR14 2HR Tel. 01684 212516 Fax. 01684 576917 admin@g-eg.co.uk, www.g-eg.co.uk
SITE: LAND AT CHEAPSIDE, ST ALBANS	PROJECT NUMBER: GEG-24-821	SCALE: AS SHOWN	DATE: 02/04/25	REVISION: 0	Geo Environmental Group

APPENDIX B

PHOTOGRAPHIC RECORD

Photo 1: Excavation of trial pit IT01.

Photo 2: Arisings from trial pit IT01.

Photo 3: Excavation of trial pit IT02.

Photo 4: Arisings from trial pit IT02.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

Photo 5: Excavation of trial pit IT03.

Photo 6: Arisings from trial pit IT03.

Photo 7: Excavation of trial pit IT04.

Photo 8: Arisings from trial pit IT04.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

Photo 9: Excavation of trial pit IT05.

Photo 10: Arisings from trial pit IT05.

Photo 11: Excavation of trial pit IT06.

Photo 12: Arisings from trial pit IT06.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

Photo 13: Excavation of trial pit IT07.

Photo 14: Arisings from trial pit IT07.

Photo 15: Excavation of trial pit IT08A.

Photo 16: Arisings from trial pit IT08A.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management /PJA

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

Photo 17: Excavation of trial pit IT08B.

Photo 18: Arisings from trial pit IT08B.

Photo 19: Excavation of trial pit IT09A.

Photo 20: Arisings from trial pit IT09A.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

Photo 21: Excavation of trial pit IT09B.

Photo 22: Arisings from trial pit IT09B.

Photo 23: Excavation of trial pit IT09C.

Photo 24: Arisings from trial pit IT09C.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

Photo 25: Excavation of trial pit IT09D.

Photo 26: Arisings from trial pit IT09D.

Photo 27: Excavation of trial pit IT09E.

Photo 28: Arisings from trial pit IT09E.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

Photo 29: Excavation of trial pit IT10A.

Photo 30: Arisings from trial pit IT10A.

Photo 31: Excavation of trial pit IT10B.

Photo 32: Arisings from trial pit IT10B.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

Photo 33: Excavation of trial pit IT10C.

Photo 34: Arisings from trial pit IT10C.

Photo 35: Excavation of trial pit IT11.

Photo 36: Arisings from trial pit IT11.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: Hallam Land Management / PJA

Project: Land at Cheapside, St Albans

Project No.: GEG-24-821

APPENDIX C

EXPLORATORY HOLE LOGS

EXPLORATORY HOLE LOG RECORDS:
Symbols & Abbreviations Legend

Geo Environmental Group

Sampling

B	Bulk disturbed sample.
BLK	Block sample.
C	Core run.
CR	Core cutter sample.
CS	Core sample taken from rotary core.
D	Small disturbed sample.
ES	Composite environmental soil sample.
EW	Environmental water sample.
L	Continuous percussive sample (plastic liner).
LB	Large disturbed sample.
U	Undisturbed driven tube sample (100 mm diameter, 450 mm long). No. of blows indicated in brackets.
W	Water sample.

In-situ Testing

HVP	Hand Vane Measurement. Value given as shear strength Su (in kPa).
PP	Pocket Penetrometer (Unconfined Compressuve Strength measured in kPa).
SPT	Standard Penetration Test using a split spoon sampler.
SPTC	Standard Penetration Test using a solid 60 degree cone.
N	The 'N' value is the No. of blows required to complete a test drive of 300 mm after a seating drive of 150 mm or 25 blows.
N = 50	Where the full test drive is not completed. A linearly extrapolated 'N' value can be derived.
PID	Photo Ionisation Detector reading in ppm.

Drilling Records

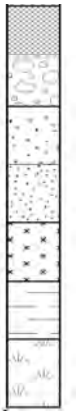
W	Water flush returns.
TCR	Total Core Recovery (%).
SCR	Solid Core Recovery (%).
RQD	Rock Quality Designation (% of intact core >100 mm).
FI	Fracture Index (Fractures/m).
NI	Non-intact core.
NR	No core recovery.

Water Column Symbols

Standing groundwater strike

Initial groundwater Level

Strata - Soil Legends



MADE GROUND

COBBLES & BOULDERS

GRAVEL

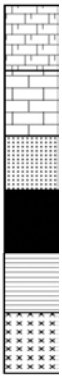
SAND

SILT

CLAY

PEAT

Strata - Rock Legends



CHALK

LIMESTONE

SANDSTONE

COAL

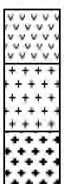
MUDSTONE

SILTSTONE

METAMORPHIC (Fine-grained)

METAMORPHIC (Medium-grained)

METAMORPHIC (Coarse-grained)



IGNEOUS (Fine-grained)

IGNEOUS (Medium-grained)

IGNEOUS (Coarse-grained)

Instrumentation & Backfilling

Plain standpipe.

Slotted standpipe.

Piezometer.

Granular filter (response zone).

Bentonite seal.

Backfill (arisings).

Backfill (cement grout).

Concrete.

NOTES:

[1] The logging of soils and rocks has been carried out in general accordance with BS 5930:2015.

[2] All lengths used to determine rock core mechanical propertoes taken along the centre line of the core. Obvious induced fractures have been ignored.

[3] All logs are avaiable in the AGS format.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT01
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515326.00 - 210142.00 Level: 116.29	Date 10/04/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.40	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Soft to firm dark brown slightly sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint. (TOPSOIL)
				0.30	115.99		Firm orangish brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint, with rare sub-angular boulders up to 15cm diameter. (CLAY WITH FLINTS FORMATION)
				2.10	114.19		Structureless CHALK composed of firm creamy white very gravelly sandy SILT. Gravel clasts are sub-angular very weak low density and white. (Grade Dm) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.40	113.89		End of Pit at 2.400m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT02
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515690.00 - 210010.00 Level: 106.21	Date 10/04/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.70 × 0.60 Depth 2.00	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Soft to firm dark brown slightly sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint. (TOPSOIL)
				0.30	105.91		Stiff orangish brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint, with frequent sub-angular boulders up to 20cm diameter. (CLAY WITH FLINTS FORMATION)
				2.00	104.21		End of Pit at 2.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT03
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515691.00 - 209994.00 Level: 105.35	Date 10/04/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.65 × 0.60 Depth 2.75	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			
				0.20	105.15		MADE GROUND - Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint and occasional ceramic. (REWORKED TOPSOIL)
							Stiff orangish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded flint, with frequent sub-angular boulders up to 20cm diameter. (CLAY WITH FLINTS FORMATION)
				1.00	104.35		Medium dense reddish and orangish brown clayey gravelly SAND. Gravel is sub-angular to sub-rounded flint, with frequent sub-angular boulders up to 20cm diameter. (CLAY WITH FLINTS FORMATION)
							2.20m Becoming very gravelly.
				2.75	102.60		End of Pit at 2.750m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slightly unstable below 2.20m

Geo Environmental Group

Trial Pit Log

TrialPit No **IT04** Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515672.00 - 209934.00 Level: 103.56	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): Depth 2.20 (2.80 × 0.50)	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint. (TOPSOIL)
				0.25	103.30		Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
				1.40	102.16		Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.20	101.36		End of Pit at 2.200m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slight collapse in chalk after 1.50m.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT05
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515671.00 - 209920.00 Level: 103.52	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.80 × 0.50 Depth 2.40	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			
				0.20	103.32		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint. (TOPSOIL)
							Medium dense yellowish brown gravelly clayey SAND with low boulder content. Gravel and boulders are rounded to sub-angular to angular greyish flint and with rare quartzite. (CLAY WITH FLINTS FORMATION)
							Becoming very clayey. 1.60-2.40m.
				2.40	101.12		End of Pit at 2.400m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slight collapse in sand repeatedly after 0.40m.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT06
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515689.00 - 209906.00 Level: 103.16	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.60 × 0.50 Depth 2.80	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint. (TOPSOIL)
				0.25	102.91		Medium dense yellowish brown gravelly clayey SAND with low boulder content. Gravel and boulders are rounded to sub-angular greyish flint and quartzite. (CLAY WITH FLINTS FORMATION)
				1.20	101.96		Firm orangish sandy gravelly CLAY. Gravel is rounded to sub-angular greyish flint and quartzite. (CLAY WITH FLINTS FORMATION)
				2.40	100.76		Medium dense reddish orangish brown gravelly clayey SAND with low cobble content. Gravel and cobbles are sub-rounded yellowish flint and quartzite. (CLAY WITH FLINTS FORMATION)
				2.80	100.36		End of Pit at 2.800m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slight collapse in sand repeatedly after 0.30m.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT07
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515629.00 - 209971.00 Level: 104.96	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.70 × 0.50 Depth 2.50	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			
				0.20	104.76		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
							Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
				2.10	102.86		Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.50	102.46		End of Pit at 2.500m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable.

Geo Environmental Group

Borehole Log

Borehole No.
WS01
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515345.00 - 210128.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	115.78mAOD	Scale 1:31
Client:	HLM / PJA		Date:	10/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	115.48		Soft to firm dark brown slightly sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint. (TOPSOIL)
									Firm to stiff orangish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=17 (2,3/4,5,4,4)					
						1.35	114.43		Structureless CHALK composed of firm creamy white slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are sub-angular extremely weak low density and white and occasionally flint. (Grade Dm) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		2.00	S	N=17 (3,3/4,4,4,5)					
		3.00	S	N=19 (3,4/5,4,5,5)		3.00	112.78		Structureless CHALK composed of stiff creamy white with yellow to brown thin vein discolourations slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are sub-angular extremely weak creamy low to medium density chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		4.00	S	N=14 (3,2/3,3,4,4)					
		5.00	S	N=18 (3,4/5,4,4,5)					
						5.45	110.33		End of borehole at 5.45 m

1 2 3 4 5 6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS02
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515457.00 - 209938.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	109.13mAOD	Scale 1:31
Client:	HLM / PJA		Date:	11/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	108.83		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Firm to stiff orangish brown very sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-angular flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=17 (3,4/5,4,4,4)					*1.20-2.10m Becoming stiff.*
		2.00	S	N=22 (3,5/5,6,5,6)		2.10	107.03		Structureless CHALK composed of soft creamy white with yellow and brown veins slightly gravelly with occasional cobbles. Gravel and cobble clasts are sub-angular extremely weak chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		3.00	S	N=8 (2,3/1,2,3,2)					*2.85m 7cm Band of grey flint.*
		4.00	S	N=11 (3,2/2,2,3,4)					
		5.00	S	N=19 (4,3/4,5,5,5)					
						5.45	103.68		End of borehole at 5.45 m

1 2 3 4 5 6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS03
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515444.00 - 209787.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	110.42mAOD	Scale 1:31
Client:	HLM / PJA		Date:	11/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	110.12		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Stiff orangish brown slightly sandy slightly gravelly with low boulder content CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=12 (2,3/2,3,3,4)					
		2.00	S	N=15 (3,4/4,4,3,4)		1.95	108.47		Structureless CHALK composed of firm to stiff creamy white with yellow and brown veins slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are fine to coarse sub-angular extremely weak low density chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		3.00	S	N=19 (4,5/4,5,6,4)					
		4.00	S	N=21 (4,5/5,5,5,6)					
		5.00	S	N=23 (3,4/6,6,5,6)					
						5.45	104.97		End of borehole at 5.45 m

1
2
3
4
5
6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS04
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515123.00 - 209799.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	117.47mAOD	Scale 1:31
Client:	HLM / PJA		Date:	10/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	117.17		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Firm to stiff orangish brown slightly sandy slightly gravelly low boulder content CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=17 (3,4/5,4,4,4)					*1.20-2.40m Becoming stiff.*
		2.00	S	N=50 (10,10/50 for 245mm)					*2.00-2.40m Becoming very stiff.*
									2.40m Flint boulder.
						2.40	115.07		End of borehole at 2.40 m

1 2 3 4 5 6

Remarks
1. No groundwater encountered. 2. 50mm standpipe installed to 2.00m. Response zone 1.00-.200m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Refusal on flint boulder.

Geo Environmental Group

Borehole Log

Borehole No.
WS05
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515684.00 - 210013.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	106.21mAOD	Scale 1:31
Client:	HLM / PJA		Date:	11/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	105.91		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Firm to stiff orangish brown with light grey webbed discolourations sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=39 (3,4/10,10,9,10)					*1.20-1.45m Becoming very stiff.*
						1.45	104.76		Dense reddish to orangish brown very clayey very gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.80	S	50 (10,10/50 for 205mm)					*1.80m Becoming very dense.*
						2.16	104.05		End of borehole at 2.16 m

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 1.80m. Response zone 1.00-1.80m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Refusal on very dense sand.

Geo Environmental Group

Borehole Log

Borehole No.
WS06
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515414.00 - 210159.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	115.73mAOD	Scale 1:31
Client:	HLM / PJA		Date:	10/04/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	115.43		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
									Stiff orangish brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
						1.00	114.73		Stiff orangish brown slightly sandy slightly gravelly CLAY with dark organic discolouration. Gravel is fine to coarse sub-angular to sub-rounded flint with rare sub-angular boulders up to 15cm diameter. (CLAY WITH FLINTS FORMATION)
		1.20	S	N=23 (3,5/6,5,6,6)					
		2.00	S	N=29 (4,7/6,8,8,7)		2.00	113.73		Firm to stiff orangish brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded flint and rare sub-angular boulders up to 15cm diameter. (CLAY WITH FLINTS FORMATION)
		3.00	S	N=12 (3,4/3,4,2,3)		2.90	112.83		Structureless CHALK composed of firm creamy white with yellow and brown veins slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are fine to coarse sub-angular low density chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		4.00	S	N=4 (1,2/1,1,1,1)					
		5.00	S	N=9 (2,3/2,2,3,2)					
						5.45	110.28		End of borehole at 5.45 m

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS07**

Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515678.00 - 209927.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level: 103.28mAOD	Scale 1:31
Client:	HLM / PJA		Date: 04/07/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.20	103.08		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
		1.20	C	N=20 (3,4/4,5,6,5)					Firm to stiff yellowish brown sandy gravelly CLAY with low boulder content, common gravel lenses and rare dark possible fossilised rootlets after 2.00m. Gravel and boulders are rounded to sub-angular to angular greyish flint with rare quartzite. (CLAY WITH FLINTS FORMATION)
		2.00	C	N=11 (3,3/3,4,2,2)					
		3.00	C	N=18 (4,4/8,4,3,3)					*Dense yellowish clayey SAND. 3.45-3.50m.*
		4.00	C	N=15 (4,4/4,4,3,4)					
		5.00	S	N=15 (1,2/3,3,4,5)					
						5.45	97.83		End of borehole at 5.45 m

1 2 3 4 5 6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS08
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515637.00 - 209948.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	104.24mAOD	Scale 1:31
Client:	HLM / PJA		Date:	04/07/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.20	104.04		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
		1.20	C	N=25 (4,6/6,8,6,5)					Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
		2.00	C	N=17 (3,4/5,4,3,5)					
		3.00	C	N=10 (2,3/2,3,2,3)					
		4.00	C	N=8 (2,2/2,2,2,2)					
		5.00	S	N=5 (1,1/1,1,2,1)					
						5.50	98.74		Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
						6.00	98.24		End of borehole at 6.00 m

Remarks

1. No groundwater encountered. 2. Equipment used: Competitor Dart WS rig. 3. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS09
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515654.00 - 209871.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	103.94mAOD	Scale 1:31
Client:	HLM / PJA		Date:	04/07/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.20	103.74		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
		1.20	C	N=17 (3,3/4,5,4,4)					Firm and stiff yellowish brown sandy gravelly CLAY with low boulder content, common gravel lenses and rare dark possible fossilised rootlets after 2.00m. Gravel and boulders are rounded to sub-angular to angular greyish flint with rare quartzite and common dark sand sized discolouration after 1.5m. Possible small chalk cobble at 4.95m could be flint fragments. (CLAY WITH FLINTS FORMATION)
		2.00	C	N=12 (3,3/3,3,3,3)					
		3.00	C	N=15 (2,2/2,3,5,5)					
		4.00	S	N=30 (2,7/8,9,8,5)					
		5.00	S	N=18 (1,2/6,5,4,3)					
						5.45	98.49		End of borehole at 5.45 m

1
2
3
4
5
6

Remarks
1. No groundwater encountered. 2. Equipment used: Competitor Dart WS rig. 3. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS10**

Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515706.00 - 209950.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level: 102.99mAOD	Scale 1:31
Client:	HLM / PJA		Date: 04/07/2024	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.20	102.79		Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
									Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
		1.20	C	N=8 (1,1/2,2,2,2)					
		2.00	C	N=7 (2,2/1,1,2,3)					
						2.40	100.59		Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		3.00	S	N=10 (3,1/1,1,4,4)					
		4.00	S	N=6 (1,2/1,2,1,2)					
									Flinty gravel band.
		5.00	S	N=8 (2,1/1,2,2,3)					
						5.45	97.54		End of borehole at 5.45 m

1
2
3
4
5
6

Remarks

1. No groundwater encountered. 2. Equipment used: Competitor Dart WS rig. 3. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Trial Pit Log

TrialPit No **IT08A** Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515671.00 - 209932.00 Level: 103.39	Date 20/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 4.00	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	103.09		Stiff light reddish brown slightly sandy gravelly CLAY with a high cobble and low boulder content. Gravel, cobbles and boulders are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				3.70	99.69		Structureless CHALK composed of medium dense white clayey GRAVEL. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				4.00	99.39		*3.70-3.90m - Becoming slightly chalky with occasional Dm chalk boulders.*
							End of Pit at 4.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. 3. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT08B
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515666.00 - 209944.00 Level: 103.49	Date 20/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 3.00	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	103.19		Stiff light reddish brown slightly sandy gravelly CLAY with a high cobble and low boulder content. Gravel, cobbles and boulders are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				1.70	101.79		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				3.00	100.49		End of Pit at 3.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No **IT09A** Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515449.00 - 209921.00 Level: 109.63	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.80	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	109.33		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.10	108.53		Firm light orangish brown slightly mottled sandy gravelly CLAY with moderate cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				1.80	107.83		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				2.80	106.83		End of Pit at 2.800m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. 3. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT09B
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515448.00 - 209931.00 Level: 109.31	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.70	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	109.01		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.90	107.41		Firm light orangish brown slightly mottled sandy gravelly CLAY with moderate cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				2.70	106.61		End of Pit at 2.700m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. 3. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No **IT09C** Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515456.00 - 209934.00 Level: 109.10	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.70	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	108.80		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				2.20	106.90		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular slightly gravelly low density chalk and occasional flint. (GRADE Dm) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.70	106.40		End of Pit at 2.700m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT09D
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515461.00 - 209936.00 Level: 109.00	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 3.30	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	108.70		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				3.30	105.70		End of Pit at 3.300m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. . Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT09E
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515440.00 - 209919.00 Level: 109.87	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.70	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	109.57		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.70	108.17		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.70	107.17		End of Pit at 2.700m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT10A
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515497.00 - 209794.00 Level: 108.77	Date 20/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 3.20	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	108.47		Firm light orangish brown slightly sandy slightly gravelly CLAY with low cobble content. Gravel and cobbles are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.30	107.47		Firm light orangish brown slightly mottled sandy gravelly CLAY with a moderate cobble content and very rare dark possible potassium inclusions. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				3.20	105.57		End of Pit at 3.200m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT10B
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515471.00 - 209741.00 Level: 107.68	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.50	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	107.38		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				2.35	105.33		Firm light orangish brown slightly mottled sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
				2.50	105.18		End of Pit at 2.500m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT10C
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515487.00 - 209764.00 Level: 108.04	Date 21/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.60	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	107.74		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and low boulder content. Gravel, cobbles and boulders are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				2.60	105.44		End of Pit at 2.600m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. On completion backfilled with arisings. 3. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT11
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515405.00 - 209712.00 Level: 109.30	Date 20/02/2025
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 3.00	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
				0.30	109.00		Firm light brown slightly sandy slightly gravelly CLAY with low cobble content. Gravel and cobbles are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
				1.40	107.90		Structureless CHALK composed of medium dense white slightly clayey GRAVEL. Clasts are low to medium density sub-rounded to sub-angular chalk and occasional flint. (GRADE Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				3.00	106.30		End of Pit at 3.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Borehole Log

Borehole No.
WS07A
FINAL
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515675.00 - 209925.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	103.28mbgl	Scale 1:35
Client:	HLM / PJA		Dates:	20/02/2025 -	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	102.98		Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
		1.00	S	N=13 (7,7/4,3,3,3)					Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and occasional bands of flint gravel. Gravel and cobbles are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
		2.00	S	N=22 (2,3/2,4,6,10)					
		3.00	S	N=17 (4,4/4,4,5,4)					
		4.00	S	N=9 (3,4/4,2,1,2)		4.05	99.23		Structureless CHALK composed of medium dense white clayey GRAVEL. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (Possible GRADE Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		5.00	S	N=12 (4,4/3,3,3,3)					
						5.45	97.83		End of borehole at 5.45 m

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart Window Sample rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS11
FINAL
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515499.00 - 209785.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level: 108.36mbgl	Scale 1:35
Client:	HLM / PJA		Dates: 20/02/2025 -	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	108.06		Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
		1.00	S	N=11 (2,2/2,2,4,3)					Firm light orangish brown slightly mottled sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
						1.20	107.16		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		2.00	S	N=17 (3,3/3,4,5,5)					
		3.00	S	N=7 (4,4/3,2,1,1)					
		4.00	S	N=8 (1,1/1,3,2,2)					
		5.00	S	N=12 (3,4/3,3,3,3)					
						5.45	102.91		End of borehole at 5.45 m

1
2
3
4
5
6

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart Window Sample rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS12**
FINAL
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515421.00 - 209722.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	109.18mbgl	Scale 1:35
Client:	HLM / PJA		Dates:	20/02/2025 -	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	108.88		Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
		1.00	S	N=11 (2,2/2,3,3,3)					Firm light orangish brown slightly mottled slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
									1.20-3.80m - Becoming often stiff.
		2.00	S	N=18 (3,3/4,4,4,6)					
		3.00	S	N=14 (1,2/3,4,3,4)					
									3.80-5.00m - Becoming sandy.
		4.00	S	N=13 (2,2/1,4,3,5)					
		5.00	S	N=15 (2,3/4,4,3,4)					
						5.45	103.73		End of borehole at 5.45 m

Remarks
1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart Window Sample rig.

Geo Environmental Group

Borehole Log

Borehole No.
WS13
FINAL
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords:	515484.00 - 209718.00	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	107.09mbgl	Scale 1:35
Client:	HLM / PJA		Dates:	20/02/2025 -	Logged By KT

Well	Water Strikes	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	Information				
						0.30	106.79		Firm dark brown slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded to sub-angular yellowish to greyish flint with rare sub-rounded quartzite. (TOPSOIL)
		1.00	S	N=6 (1,2/1,2,1,2)					Firm light brown slightly mottled slightly sandy gravelly CLAY with low cobble content. Gravel and cobbles are sub-rounded occasionally sub-angular grey to yellowish flint. (CLAY WITH FLINTS FORMATION)
						1.20	105.89		Stiff orangish brown slightly sandy gravelly CLAY with moderate cobble content and occasional bands of flint gravel. Gravel and cobbles are sub-angular to sub-rounded greyish flint. (CLAY WITH FLINTS FORMATION)
		2.00	S	N=26 (3,4/5,6,6,9)					
		3.00	S	N=26 (4,5/5,7,7,7)					
						3.10	103.99		Structureless CHALK composed of firm white gravelly CLAY. Clasts are sub-rounded to sub-angular low to medium density chalk and occasional flint. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		4.00	S	N=9 (1,1/2,3,2,2)					
		5.00	S	N=13 (2,3/3,4,3,3)					
						5.45	101.64		End of borehole at 5.45 m

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart Window Sample rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

APPENDIX D

INFILTRATION TEST DATA

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	240	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	130	
Trial Pit:	**IT01**	Date of Test:	10 April 2024	
Test No.:	**Test 1 of 3**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	130	100.0%
1	129	100.9%
2	130	100.0%
3	132	98.2%
4	135	95.5%
5	136	94.5%
8	140	90.9%
39	167	66.4%
103	205	31.8%
115	212.5	25.0%
End of Test		

With Reference to: **Graph F-1**

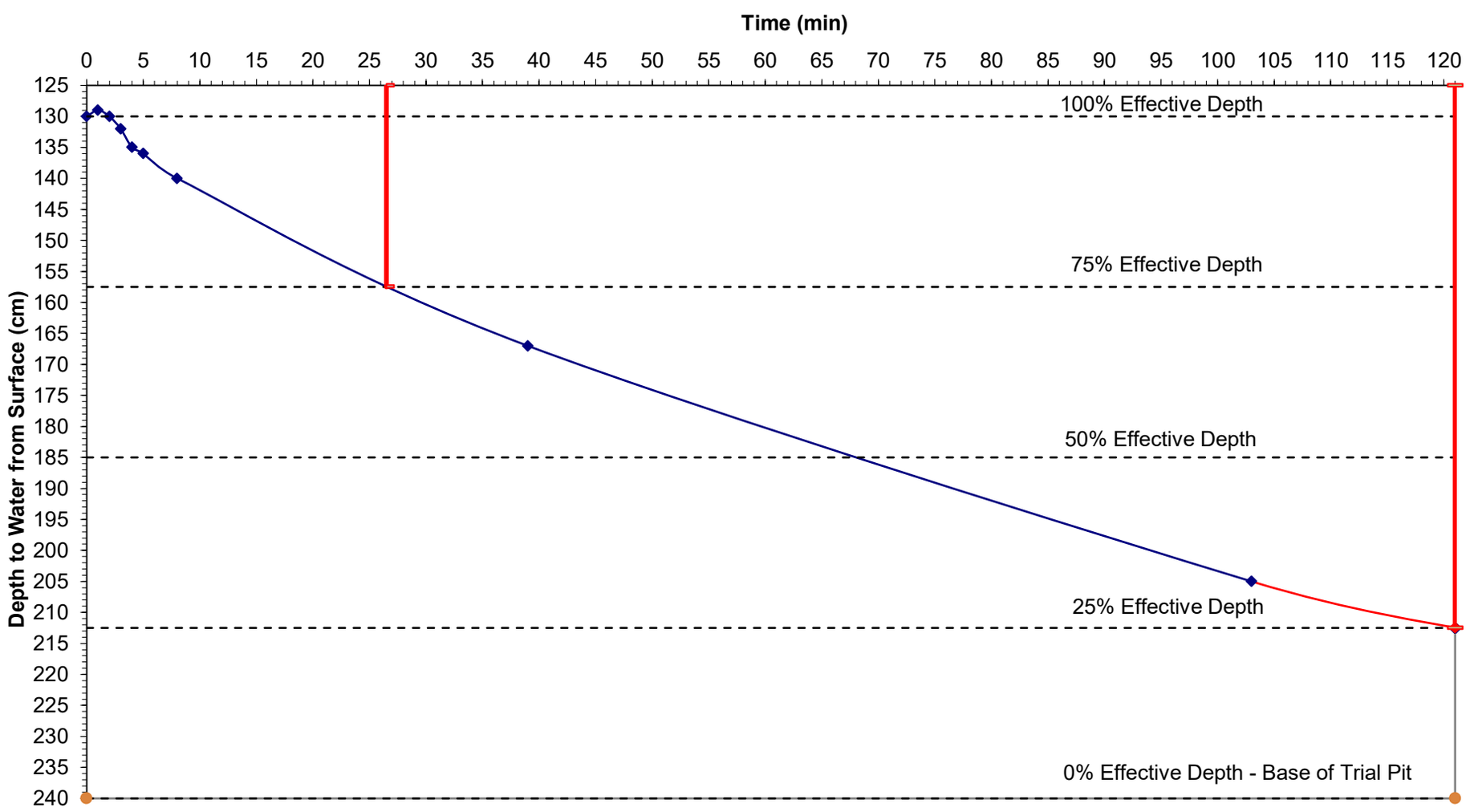
Notes:

[1] Base of trial pit collapsed to 2.08 m during the test; as such last data point extrapolated.

Parameter	Symbol	Calculation	Units	IT01
Effective Depth of Trial Pit	d_p		m	1.10
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.65
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.825
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.91
Time to reach 75% Effective Depth	$T_{p75\%}$		min	26.50
Time to reach 25% Effective Depth	$T_{p25\%}$		min	121.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	94.50
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.96E-05**

*To 50% Effective Depth (including base)

Graph F-1 **GEG-24-821 Land at Cheapside, St. Albans IT01 Test 1 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	208	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	105	
Trial Pit:	**IT01**	Date of Test:	10 April 2024	
Test No.:	**Test 2 of 3**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	105	100.0%
1	108	97.1%
2	110	95.1%
7	115	90.3%
14	120	85.4%
19	125	80.6%
23	128	77.7%
47	142	64.1%
74	155	51.5%
115	169	37.9%
132	182	25.2%
End of Test		

With Reference to: **Graph F-2**

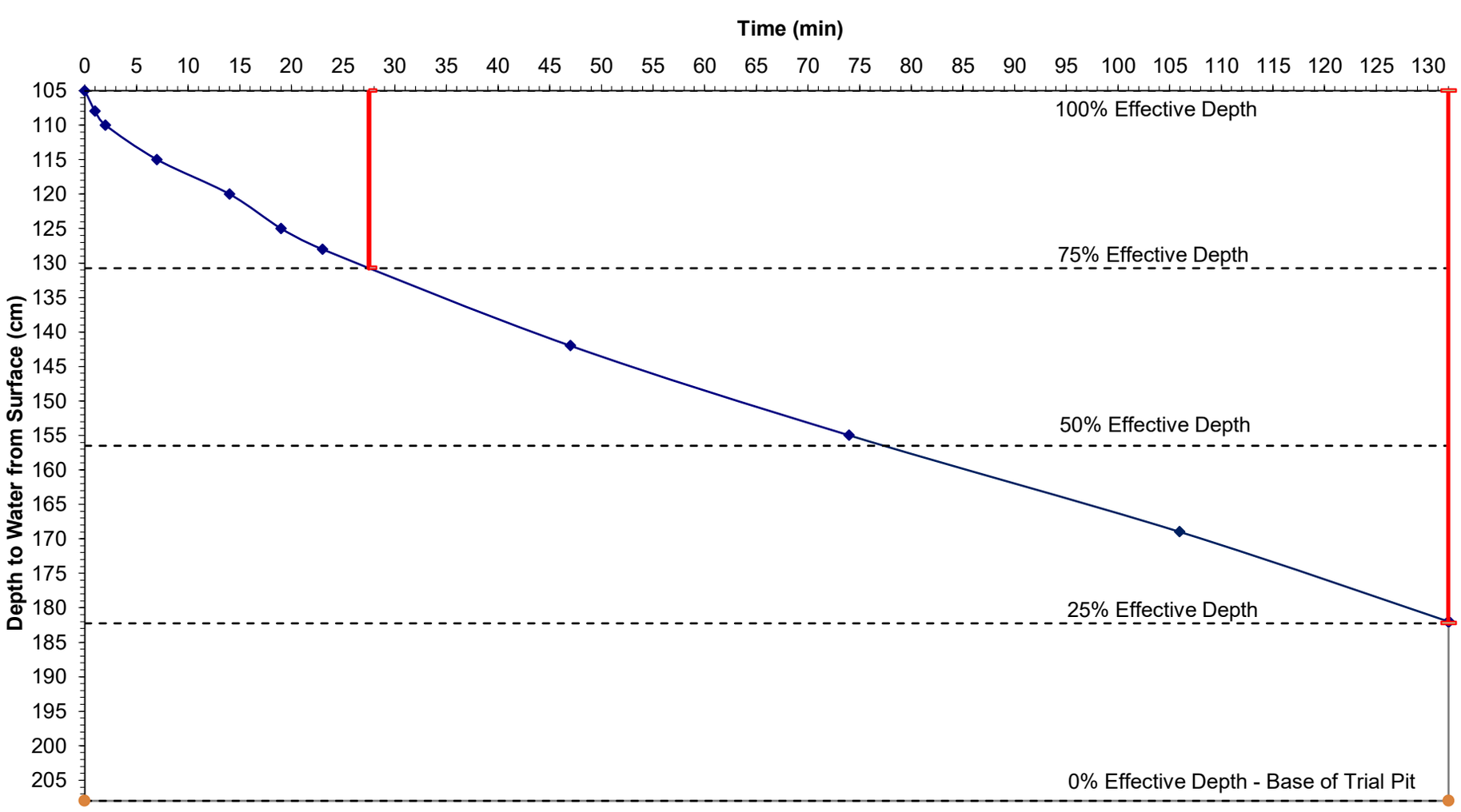
Notes:

[1] Base of pit at 2.08 m following slight collapse during Test 1.

Parameter	Symbol	Calculation	Units	IT01
Effective Depth of Trial Pit	d_p		m	1.03
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.55
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7725
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.69
Time to reach 75% Effective Depth	$T_{p75\%}$		min	27.50
Time to reach 25% Effective Depth	$T_{p25\%}$		min	132.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	104.50
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.63E-05**

*To 50% Effective Depth (including base)

Graph F-2 **GEG-24-821 Land at Cheapside, St. Albans IT01 Test 2 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	182	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	101	
Trial Pit:	**IT01**	Date of Test:	10 April 2024	
Test No.:	**Test 3 of 3**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	101	100.0%
2	103	97.5%
43	126	69.1%
62	134	59.3%
81	144	46.9%
101	155	33.3%
119	162	24.7%
End of Test		

With Reference to: **Graph F-3**

Notes:

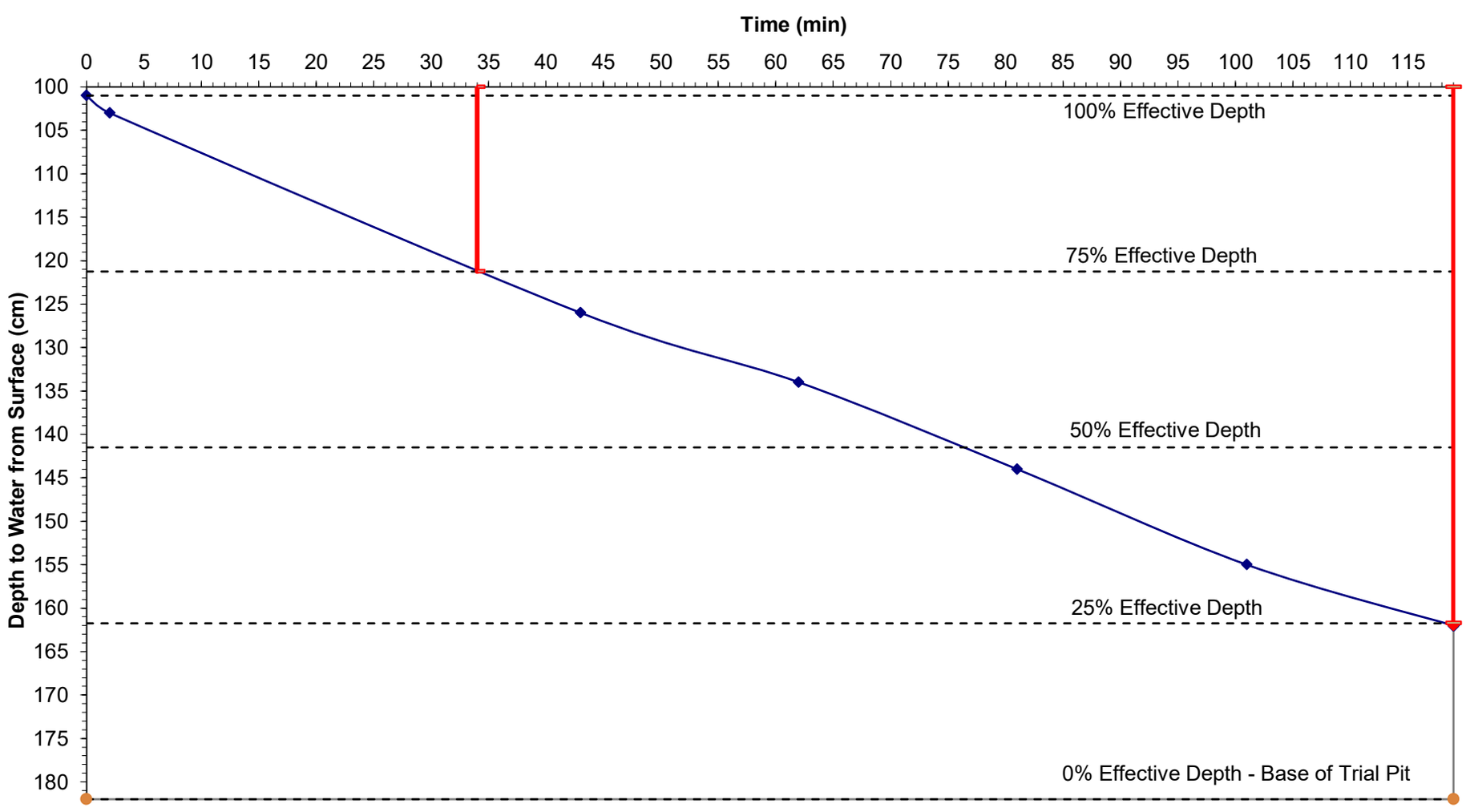
[1] Base of pit at 1.82 m following slight collapse during Test 2.

[2] Base of trial pit collapsed to 1.62 m during the test; as such last data point extrapolated.

Parameter	Symbol	Calculation	Units	**IT01**
Effective Depth of Trial Pit	d_p		m	0.81
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.22
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.6075
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.01
Time to reach 75% Effective Depth	$T_{p75\%}$		min	34.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	119.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	85.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.97E-05**

*To 50% Effective Depth (including base)

Graph F-3 **GEG-24-821 Land at Cheapside, St. Albans IT01 Test 3 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	200	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	100	
Trial Pit:	**IT02**	Date of Test:	10 April 2024	
Test No.:	**Test 1 of 1**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	100	100.0%
1	100	100.0%
2	100	100.0%
4	100	100.0%
26	100	100.0%
62	102	98.0%
157	102	98.0%
217	103	97.0%
End of Test		

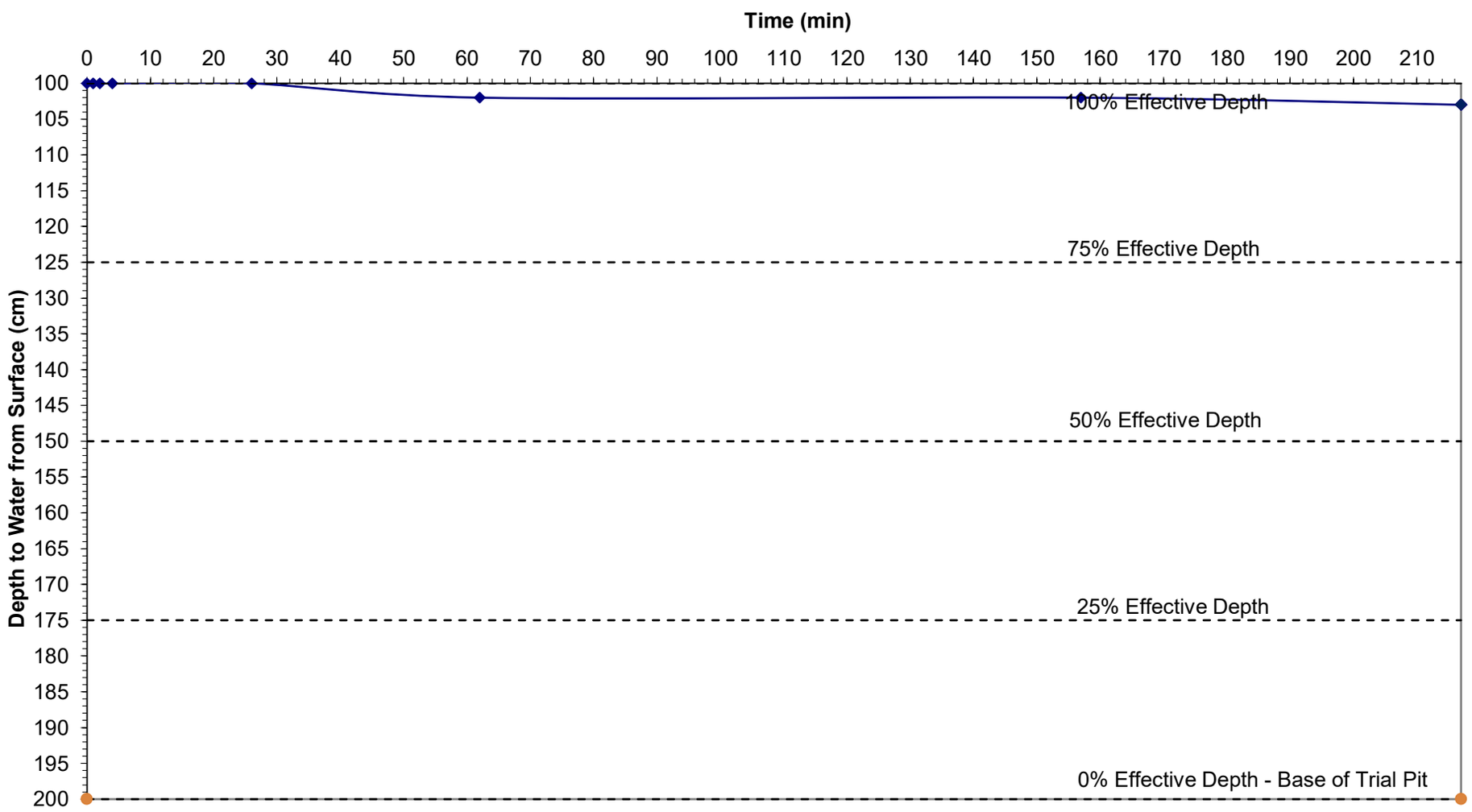
With Reference to: **Graph F-4**

Notes:

Parameter	Symbol	Calculation	Units	**IT02**
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.70
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.62
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.81
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.92
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-4 **GEG-24-821 Land at Cheapside, St. Albans IT02 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	275	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	145	
Trial Pit:	**IT03**	Date of Test:	10 April 2024	
Test No.:	**Test 1 of 1**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	145	100.0%
1	145	100.0%
2	143	101.5%
5	140	103.8%
41	145	100.0%
135	140	103.8%
194	140	103.8%
End of Test		

With Reference to: **Graph F-5**

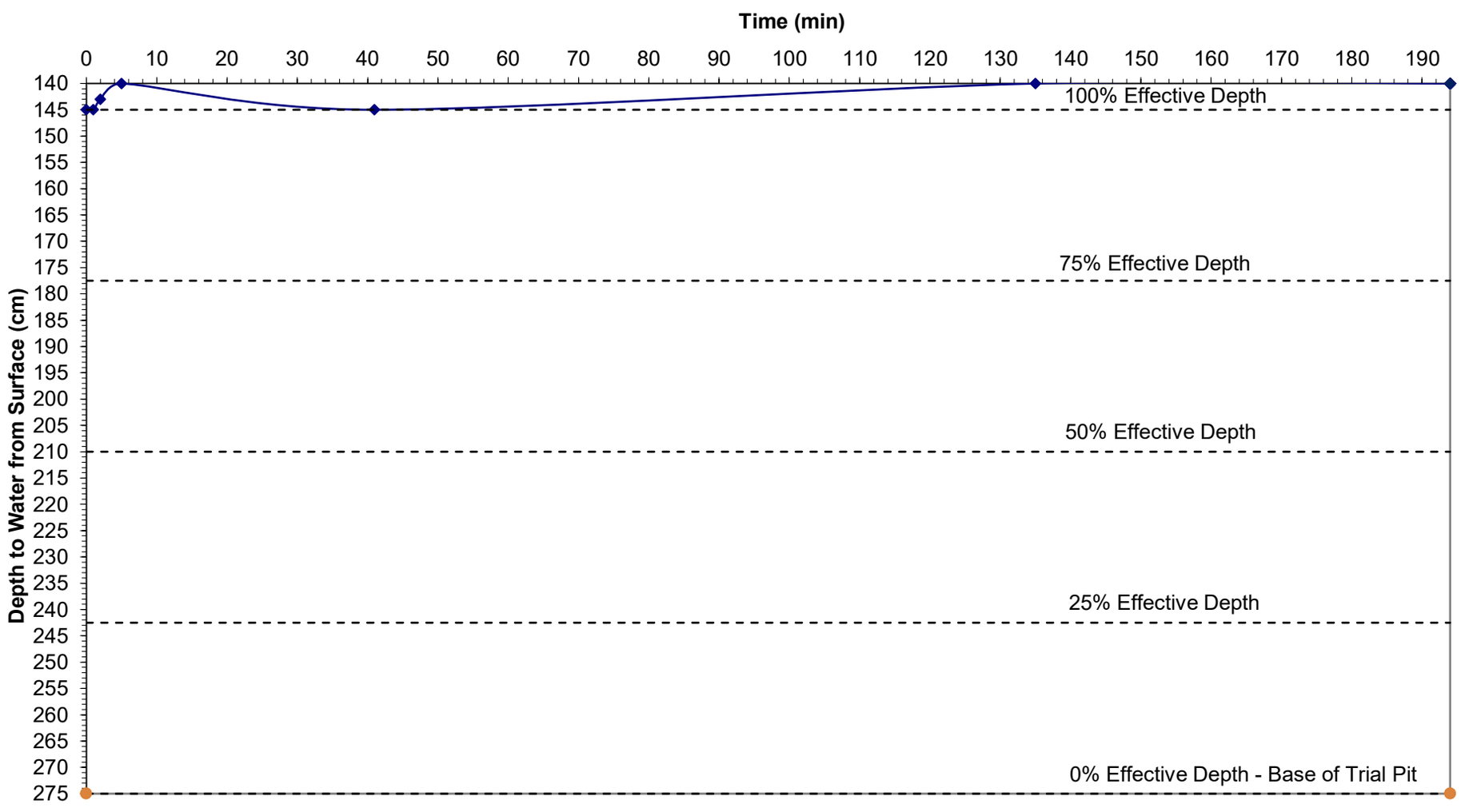
Notes:

[1] Groundwater level rose during test potentially due to instability of the trial pit sides.

Parameter	Symbol	Calculation	Units	**IT03**
Effective Depth of Trial Pit	d_p		m	1.30
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.65
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	2.07
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	1.0335
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	5.82
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-5 **GEG-24-821 Land at Cheapside, St. Albans IT03 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	200
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	120
Trial Pit:	**IT04**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 2**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	120	100.0%
1	125	93.8%
2	126	92.5%
3	130	87.5%
10	136	80.0%
29	148	65.0%
35	154	57.5%
45	160	50.0%
67	170	37.5%
81	175	31.3%
87	176	30.0%
118	183	21.3%
123	187	16.3%
129	190	12.5%
End of Test		

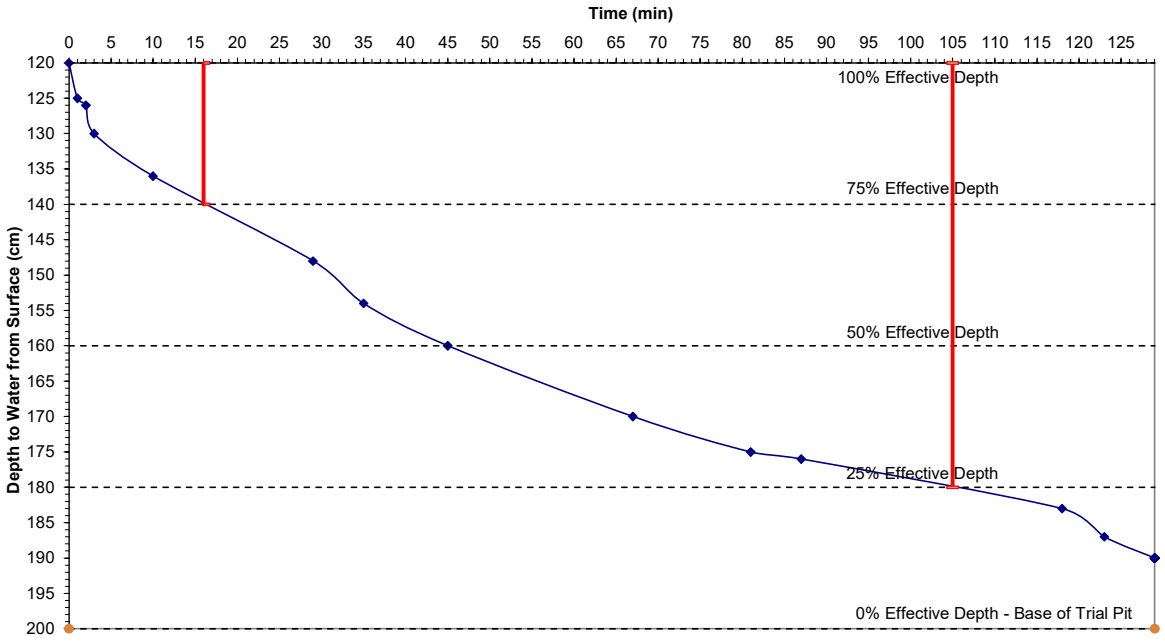
With Reference to: **Graph F-6**

Notes:

Parameter	Symbol	Calculation	Units	IT04
Effective Depth of Trial Pit	d_p		m	0.80
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.80
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.12
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.56
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.04
Time to reach 75% Effective Depth	$T_{p75\%}$		min	16.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	105.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	89.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.60E-05**

*To 50% Effective Depth (including base)

Graph F-6 **GEG-24-821 Land at Cheapside, St. Albans IT04 Test 1 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	175
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	100
Trial Pit:	**IT04**	Date of Test:	04 July 2024
Test No.:	**Test 2 of 2**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	100	100.0%
1	100	100.0%
6	103	96.0%
74	130	60.0%
105	140	46.7%
134	147	37.3%
160	155	26.7%
181	160	20.0%
End of Test		

With Reference to: **Graph F-7**

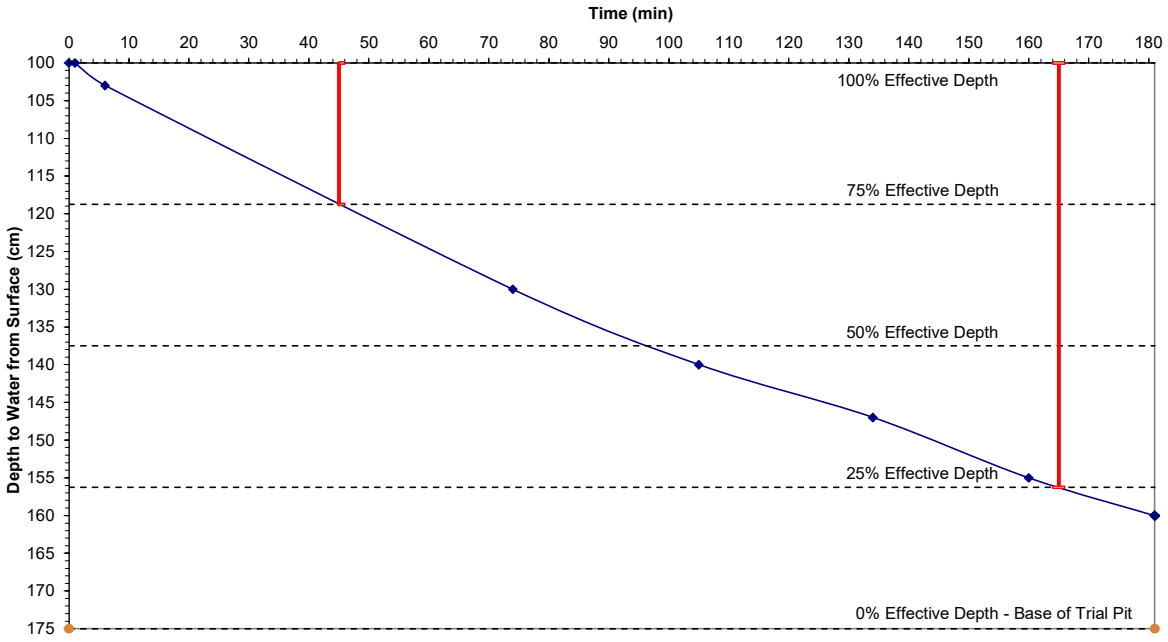
Notes:

[1] Base of pit at 1.75 m following slight collapse during Test 1.

Parameter	Symbol	Calculation	Units	IT04
Effective Depth of Trial Pit	d_p		m	0.75
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.80
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.05
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.525
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	3.88
Time to reach 75% Effective Depth	$T_{p75\%}$		min	45.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	165.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	120.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**1.88E-05**

*To 50% Effective Depth (including base)

Graph F-7 **GEG-24-821 Land at Cheapside, St. Albans IT04 Test 2 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	240	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	140	
Trial Pit:	**IT05**	Date of Test:	04 July 2024	
Test No.:	**Test 1 of 1**	Site Engineer:	KT	
		Drafted by:	EW	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	140	100.0%
1	143	97.0%
2	144	96.0%
4	146	94.0%
9	145	95.0%
29	146	94.0%
41	146	94.0%
82	146	94.0%
98	146	94.0%
171	145	95.0%
201	145	95.0%
End of Test		

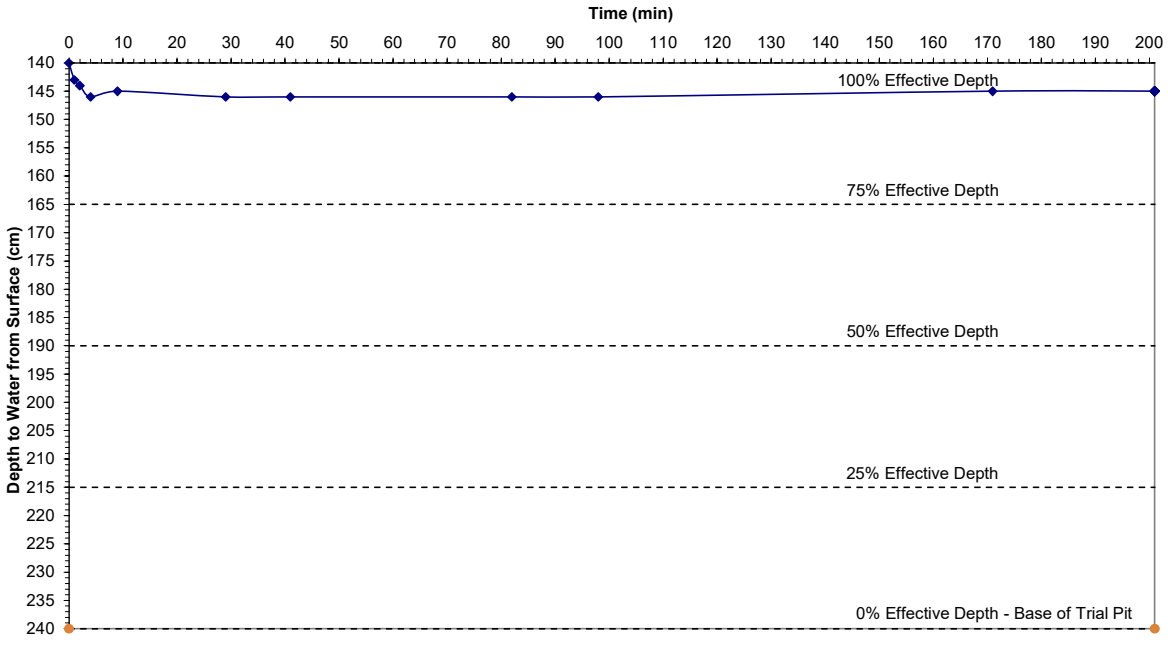
With Reference to: **Graph F-8**

Notes:

Parameter	Symbol	Calculation	Units	IT05
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.80
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.40
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.70
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-8 **GEG-24-821 Land at Cheapside, St. Albans IT05 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	280
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	180
Trial Pit:	**IT06**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	180	100.0%
1	180	100.0%
2	181	99.0%
3	181	99.0%
49	180	100.0%
64	179	101.0%
136	179	101.0%
166	179	101.0%
195	179	101.0%
End of Test		

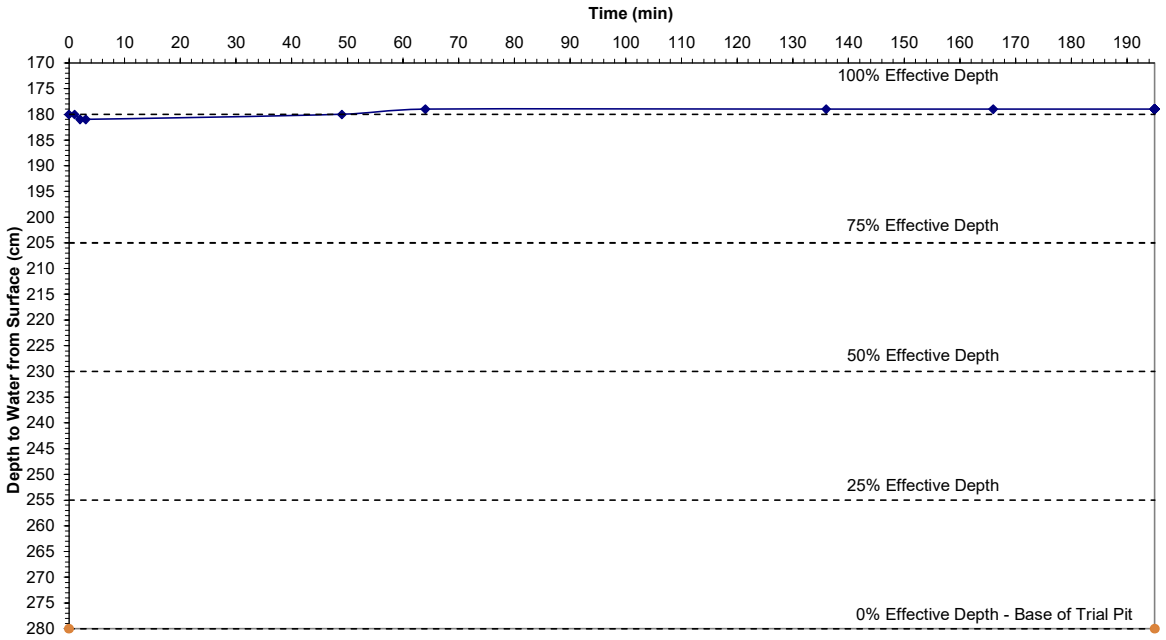
With Reference to: **Graph F-9**

Notes:

Parameter	Symbol	Calculation	Units	IT06
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.60
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.30
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.65
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.40
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-9 **GEG-24-821 Land at Cheapside, St. Albans IT06 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	250
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	140
Trial Pit:	**IT07**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	140	100.0%
1	141	99.1%
13	142	98.2%
26	142	98.2%
78	140	100.0%
119	143	97.3%
183	145	95.5%
End of Test		

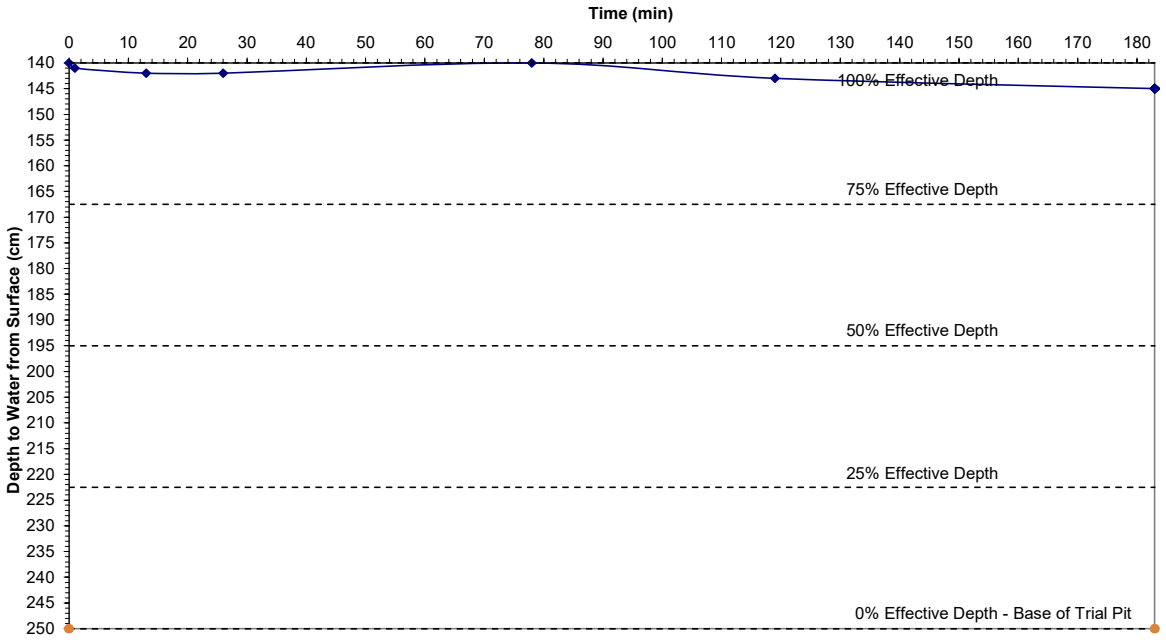
With Reference to: **Graph F-10**

Notes:

Parameter	Symbol	Calculation	Units	IT07
Effective Depth of Trial Pit	d_p		m	1.10
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.70
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.49
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7425
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.87
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-10 **GEG-24-821 Land at Cheapside, St. Albans IT07 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	300
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	200
Trial Pit:	**IT08B**	Date of Test:	20th February 2025
Test No.:	**Test 1 of 3**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	200	100.0%
0	208	92.0%
1	218	82.0%
2	226	74.0%
3	230	70.0%
4	234	66.0%
5	238	62.0%
6	241	59.0%
8	245	55.0%
9	249	51.0%
10	252	48.0%
12	257	43.0%
14	259	41.0%
16	263	37.0%
17	267	33.0%
19	271	29.0%
20	275	25.0%
21	278	22.0%
22	280	20.0%
End of Test		

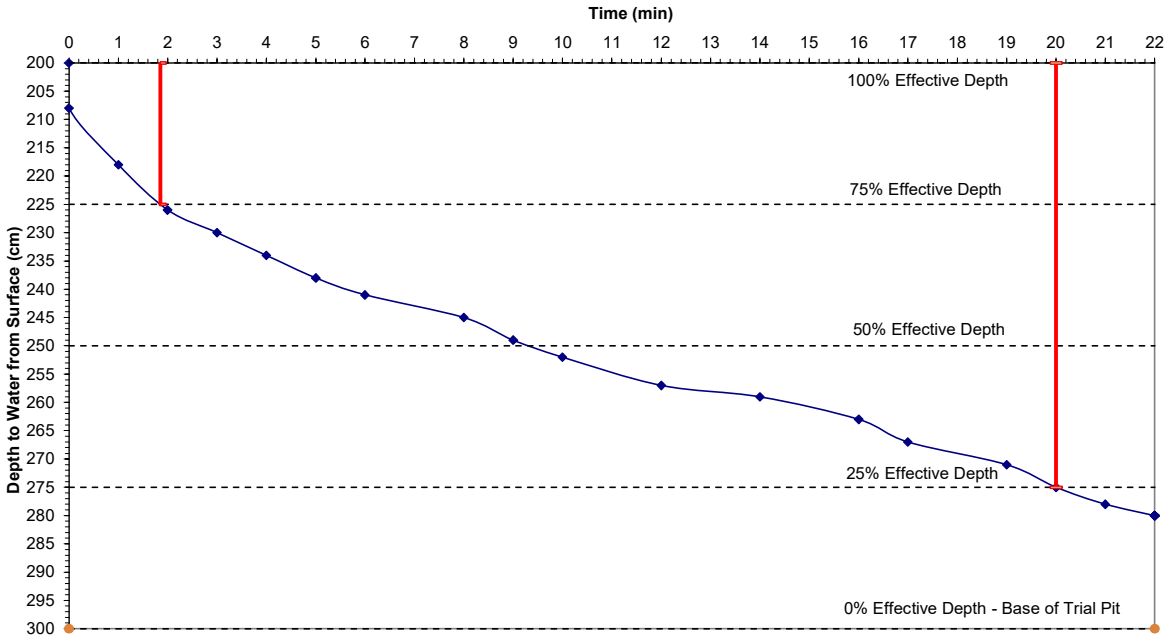
With Reference to: **Graph F-11**

Notes:

Parameter	Symbol	Calculation	Units	IT08B
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.50
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.75
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.60
Time to reach 75% Effective Depth	$T_{p75\%}$		min	1.85
Time to reach 25% Effective Depth	$T_{p25\%}$		min	20.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	18.15
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**1.50E-04**

*To 50% Effective Depth (including base)

Graph F-11 **GEG-24-821 Land at Cheapside, St. Albans IT08B Test 1 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	280
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	190
Trial Pit:	**IT08B**	Date of Test:	20th February 2025
Test No.:	**Test 2 of 3**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	190	100.0%
1	195	94.4%
1	197	92.2%
2	201	87.8%
3	206	82.2%
4	210	77.8%
5	214	73.3%
6	217	70.0%
7	220	66.7%
8	223	63.3%
9	227	58.9%
10	230	55.6%
12	232	53.3%
13	234	51.1%
15	239	45.6%
16	240	44.4%
18	243	41.1%
20	247	36.7%
21	250	33.3%
23	252	31.1%
25	257	25.6%
26	258	24.4%
End of Test		

With Reference to: **Graph F-12**

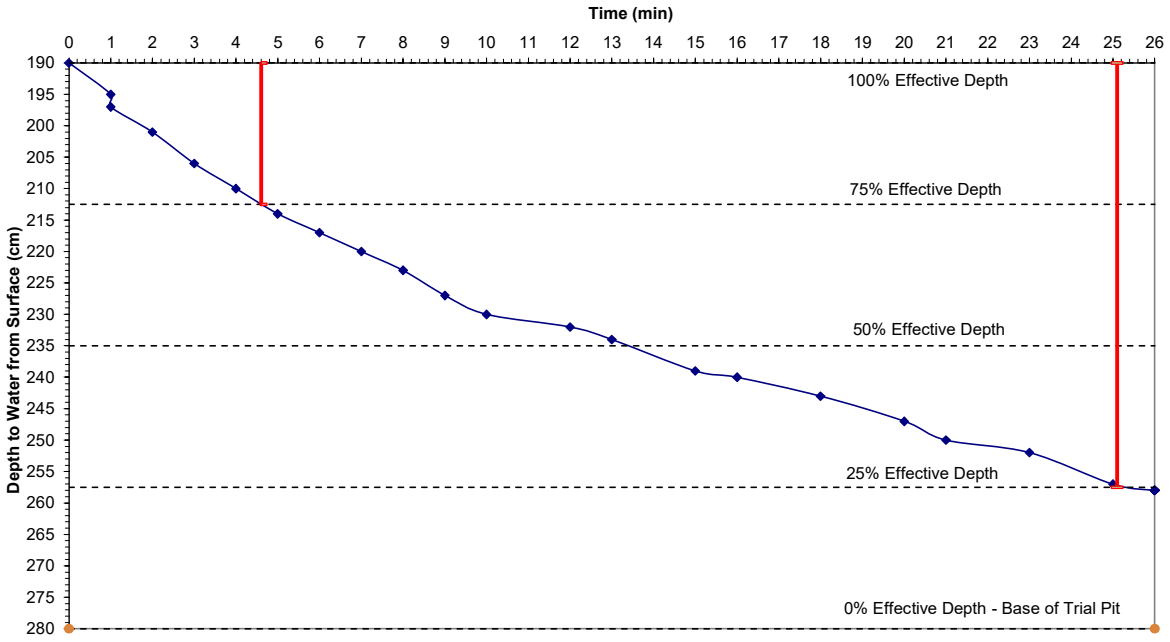
Notes:

[1] Trial pit collapsed to 2.80 m following previous test.

Parameter	Symbol	Calculation	Units	IT08B
Effective Depth of Trial Pit	d_p		m	0.90
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.35
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.675
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.29
Time to reach 75% Effective Depth	$T_{p75\%}$		min	4.60
Time to reach 25% Effective Depth	$T_{p25\%}$		min	25.10
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	1.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.62E-03**

*To 50% Effective Depth (including base)

Graph F-12 **GEG-24-821 Land at Cheapside, St. Albans IT08B Test 2 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	175
Trial Pit:	**IT08B**	Date of Test:	20th February 2025
Test No.:	**Test 3 of 3**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	175	100.0%
0	178	96.8%
1	185	89.5%
2	191	83.2%
2	193	81.1%
2	197	76.8%
3	198	75.8%
4	202	71.6%
5	208	65.3%
6	210	63.2%
7	214	58.9%
8	216	56.8%
9	218	54.7%
11	222	50.5%
13	226	46.3%
15	232	40.0%
17	234	37.9%
21	238	33.7%
24	243	28.4%
26	248	23.2%
27	249	22.1%
28	250	21.1%
End of Test		

With Reference to: **Graph F-13**

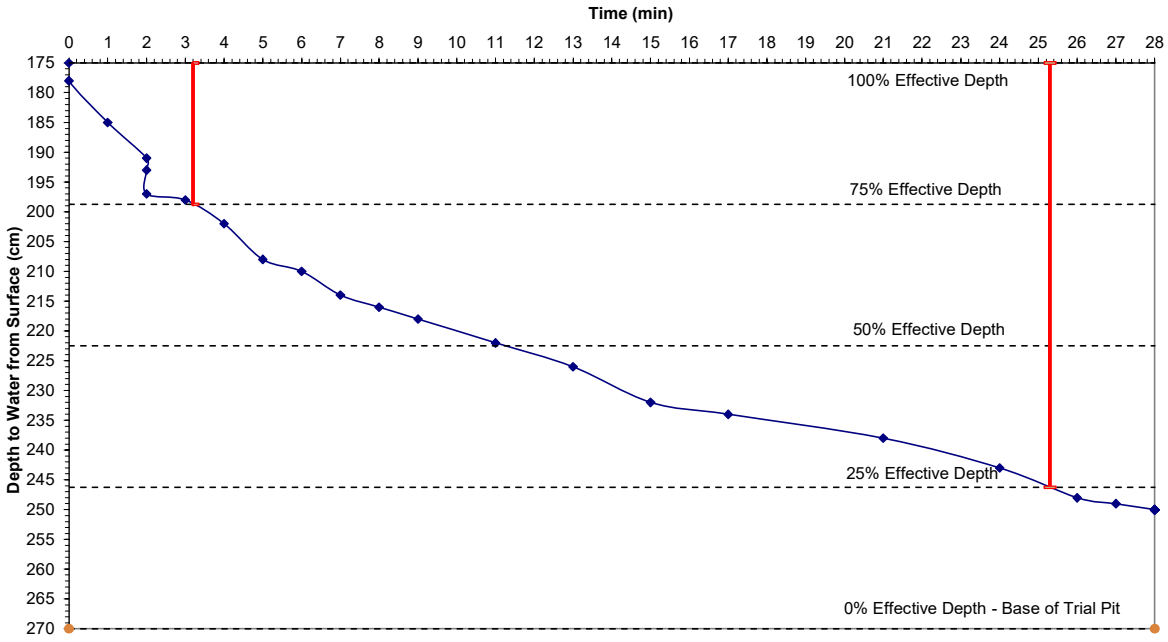
Notes:

[1] Trial pit collapsed to 2.70 m following previous test.

Parameter	Symbol	Calculation	Units	IT08B
Effective Depth of Trial Pit	d_p		m	0.95
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.43
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7125
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.45
Time to reach 75% Effective Depth	$T_{p75\%}$		min	3.20
Time to reach 25% Effective Depth	$T_{p25\%}$		min	25.30
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	1.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.67E-03**

*To 50% Effective Depth (including base)

Graph F-13 **GEG-24-821 Land at Cheapside, St. Albans IT08B Test 3 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	170
Trial Pit:	**IT09C**	Date of Test:	21st February 2025
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	170	100.0%
1	170	100.0%
2	170	100.0%
3	170	100.0%
4	170	100.0%
6	170	100.0%
91	175	95.0%
109	176	94.0%
149	178	92.0%
189	180	90.0%
End of Test		

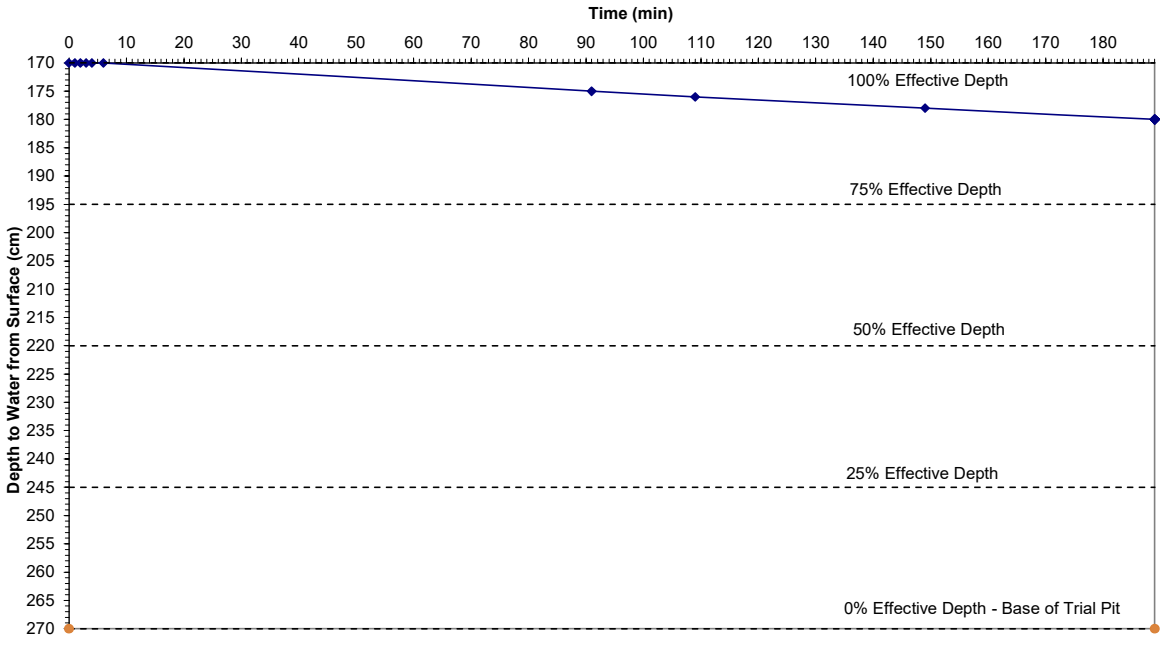
With Reference to: **Graph F-14**

Notes:

Parameter	Symbol	Calculation	Units	IT09C
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.50
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.75
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.60
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-14 **GEG-24-821 Land at Cheapside, St. Albans IT09C Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	165	
Trial Pit:	**IT09E**	Date of Test:	21st February 2025	
Test No.:	**Test 1 of 2**	Site Engineer:	KT	
		Drafted by:	MP	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	165	100.0%
0	166	99.0%
1	168	97.1%
2	172	93.3%
4	176	89.5%
5	178	87.6%
20	198	68.6%
61	222	45.7%
93	239	29.5%
97	242	26.7%
100	243.5	25.2%
End of Test		

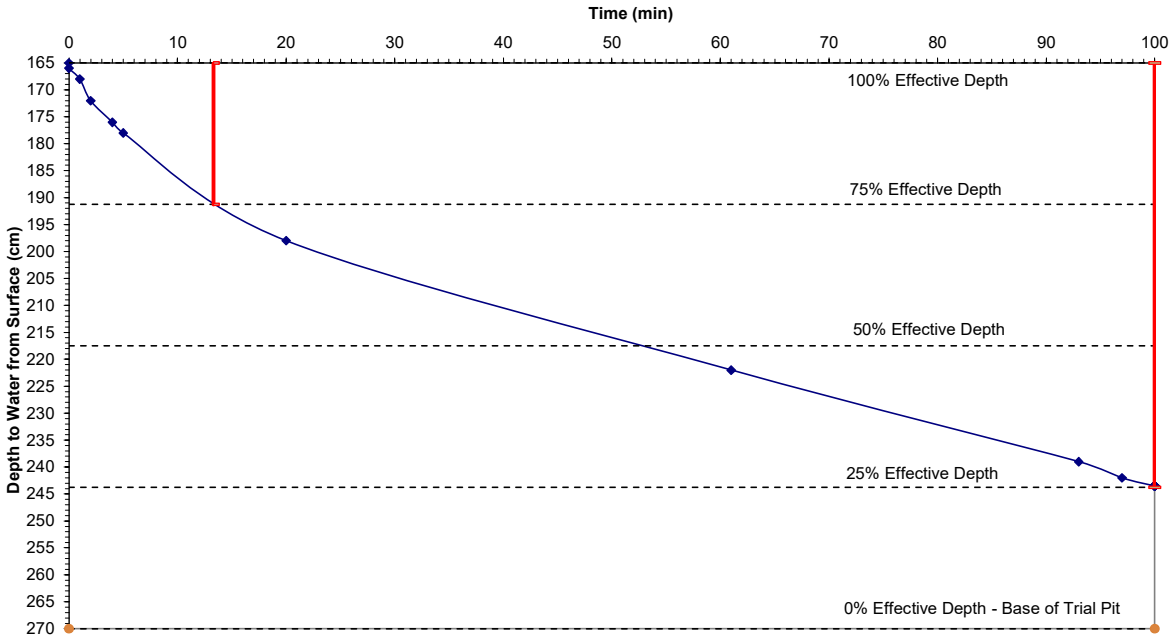
With Reference to: **Graph F-15**

Notes:

Parameter	Symbol	Calculation	Units	IT09E
Effective Depth of Trial Pit	d_p		m	1.05
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.58
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7875
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.76
Time to reach 75% Effective Depth	$T_{p75\%}$		min	13.30
Time to reach 25% Effective Depth	$T_{p25\%}$		min	100.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	86.70
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**3.18E-05**

*To 50% Effective Depth (including base)

Graph F-15 **GEG-24-821 Land at Cheapside, St. Albans IT09E Test 1 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	225
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	145
Trial Pit:	**IT09E**	Date of Test:	21st February 2025
Test No.:	**Test 2 of 2**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	145	100.0%
1	146	98.8%
8	151	92.5%
64	186	48.8%
83	192	41.3%
106	201	30.0%
120	205	25.0%
End of Test		

With Reference to: **Graph F-16**

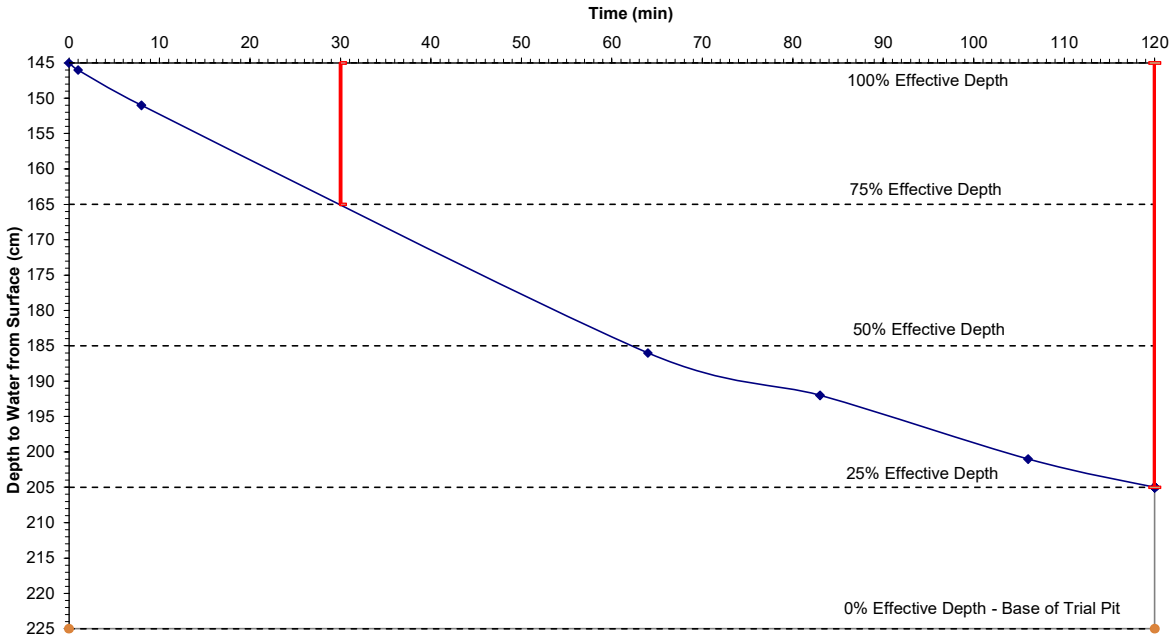
Notes:

[1] Trial pit collapsed to 2.25 m following previous test.

Parameter	Symbol	Calculation	Units	IT09E
Effective Depth of Trial Pit	d_p		m	0.80
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.20
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.6
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	3.98
Time to reach 75% Effective Depth	$T_{p75\%}$		min	30.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	120.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	90.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.79E-05**

*To 50% Effective Depth (including base)

Graph F-16 **GEG-24-821 Land at Cheapside, St. Albans IT09E Test 2 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	320
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	220
Trial Pit:	**IT10A**	Date of Test:	20th February 2025
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	220	100.0%
1	220	100.0%
2	222	98.0%
3	223	97.0%
6	223	97.0%
30	222	98.0%
69	223	97.0%
114	220	100.0%
127	220	100.0%
End of Test		

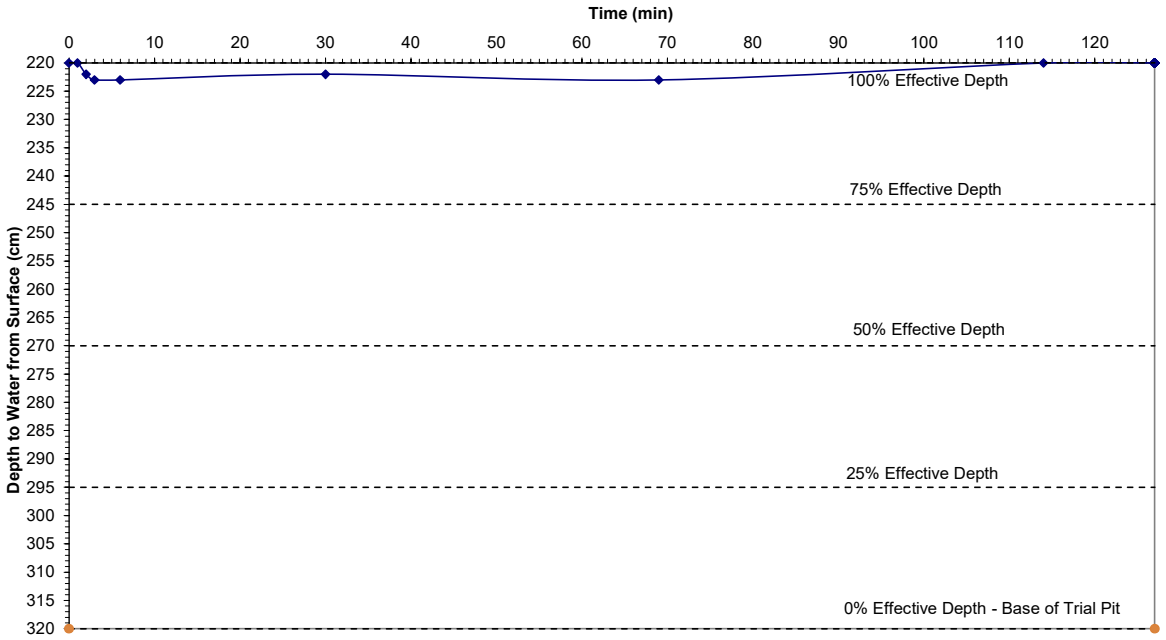
With Reference to: **Graph F-17**

Notes:

Parameter	Symbol	Calculation	Units	IT10A
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.50
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.75
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.60
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-17 **GEG-24-821 Land at Cheapside, St. Albans IT10A Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	260
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	150
Trial Pit:	**IT10B**	Date of Test:	21st February 2025
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	150	100.0%
1	151	99.1%
8	151	99.1%
45	151	99.1%
85	151	99.1%
147	151	99.1%
151	151	99.1%
End of Test		

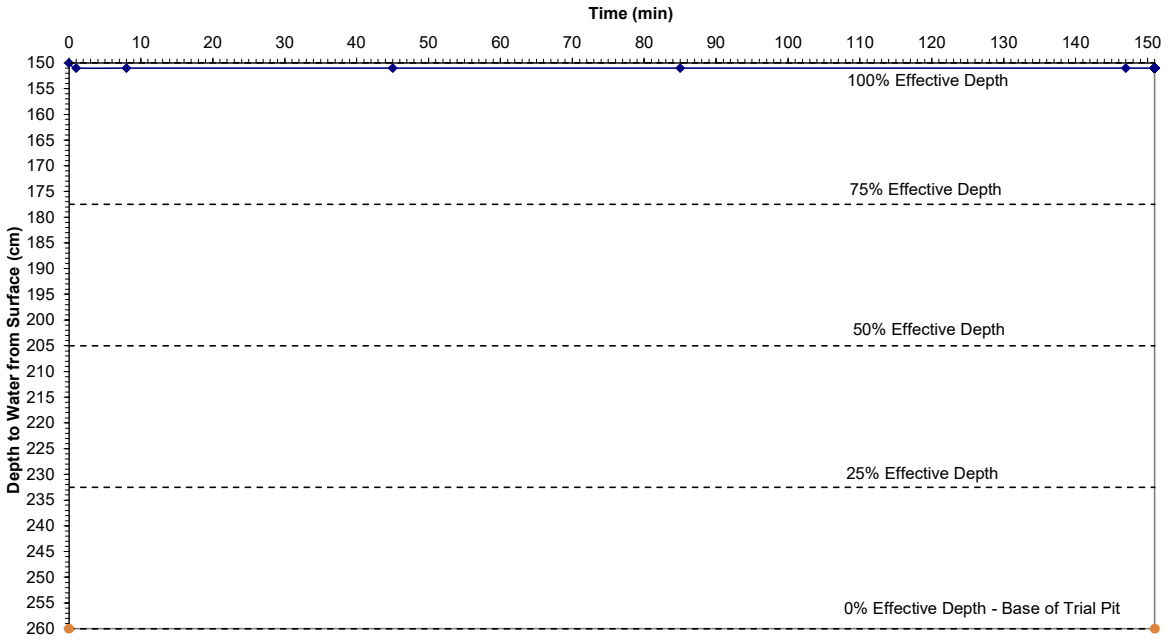
With Reference to: **Graph F-18**

Notes:

Parameter	Symbol	Calculation	Units	IT10B
Effective Depth of Trial Pit	d_p		m	1.10
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.65
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.825
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.91
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-18 **GEG-24-821 Land at Cheapside, St. Albans IT10B Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	205
Trial Pit:	**IT11**	Date of Test:	20th February 2025
Test No.:	**Test 1 of 2**	Site Engineer:	KT
		Drafted by:	MP

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	205	100.0%
0	212	89.2%
1	215	84.6%
2	217	81.5%
4	218	80.0%
8	223	72.3%
14	228	64.6%
48	246	36.9%
95	260	15.4%
133	267	4.6%
End of Test		

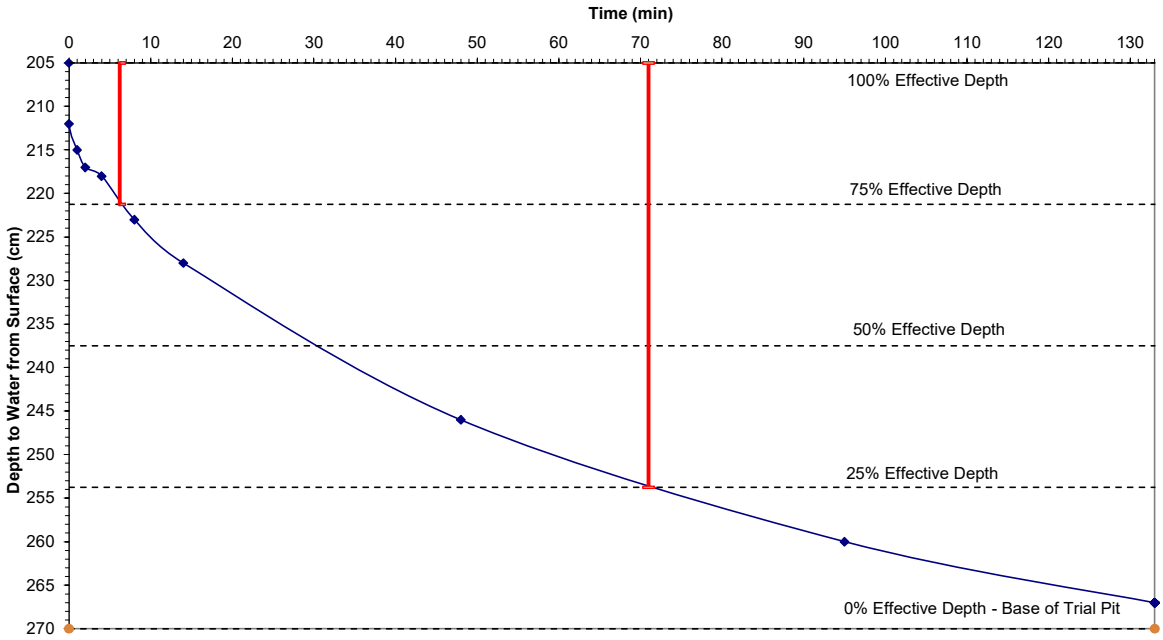
With Reference to: **Graph F-19**

Notes:

Parameter	Symbol	Calculation	Units	IT11
Effective Depth of Trial Pit	d_p		m	0.65
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	0.98
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.4875
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	3.52
Time to reach 75% Effective Depth	$T_{p75\%}$		min	6.20
Time to reach 25% Effective Depth	$T_{p25\%}$		min	71.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	64.80
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**3.57E-05**

*To 50% Effective Depth (including base)

Graph F-19 **GEG-24-821 Land at Cheapside, St. Albans IT11 Test 1 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	270	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	182	
Trial Pit:	**IT11**	Date of Test:	21st February 2025	
Test No.:	**Test 2 of 2**	Site Engineer:	KT	
		Drafted by:	MP	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	182	100.0%
1	185	96.6%
2	187	94.3%
4	188	93.2%
5	190	90.9%
16	202	77.3%
20	206	72.7%
80	216	61.4%
101	233	42.0%
164	240	34.1%
End of Test		

With Reference to: **Graph F-20**

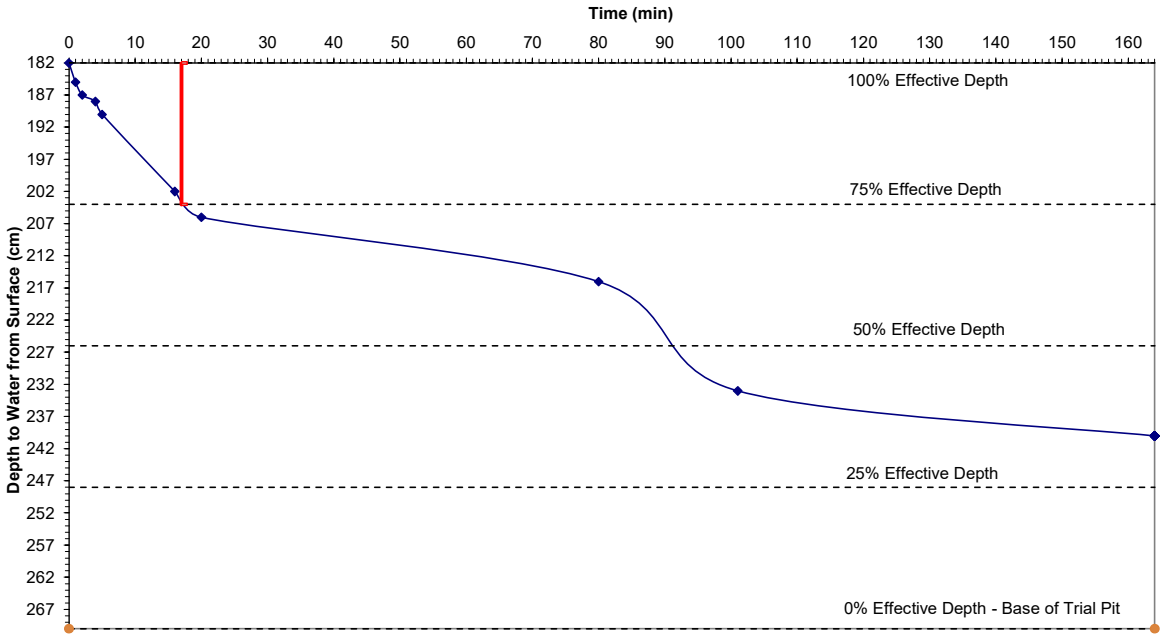
Notes:

[1] Trial pit dry at 2.40 m due to slumping of base at 2.40 m during infiltration test. As such, no infiltration rate could be calculated.

Parameter	Symbol	Calculation	Units	IT11
Effective Depth of Trial Pit	d_p		m	0.88
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.32
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.66
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.23
Time to reach 75% Effective Depth	$T_{p75\%}$		min	17.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-20 **GEG-24-821 Land at Cheapside, St. Albans IT11 Test 2 of 2**



Checked by: MP

APPENDIX E

FALLING HEAD TESTS

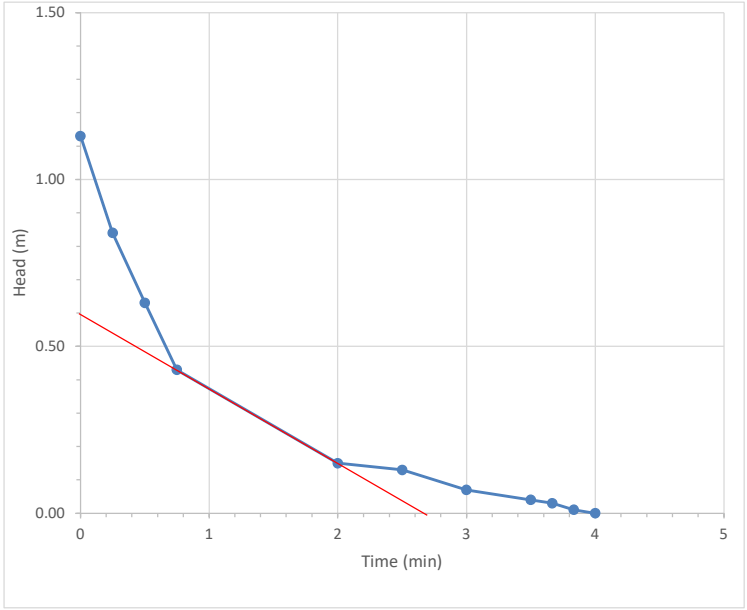
Falling Head Soakage Test Calculations - GEG-24-821

WS06 (Test 1 of 1)

Depth of borehole (m):			5.00
Time (sec)	**Time (min)**	**Depth from Surface (m)**	**Hp**
0	0	3.87	1.13
15	0.3	4.16	0.84
30	0.5	4.37	0.63
45	0.8	4.57	0.43
120	2.0	4.85	0.15
150	2.5	4.87	0.13
180	3.0	4.93	0.07
210	3.5	4.96	0.04
220	3.7	4.97	0.03
230	3.8	4.99	0.01
240	4.0	5.00	0.00

Date of Test: 09/05/2024

End of Test *KT / MP*



Notes:

Approximately 75 litres of water was poured into the standpipe (at a rapid rate) in order to conduct the test at the depth indicated.

WS06 (Test 1 of 1)

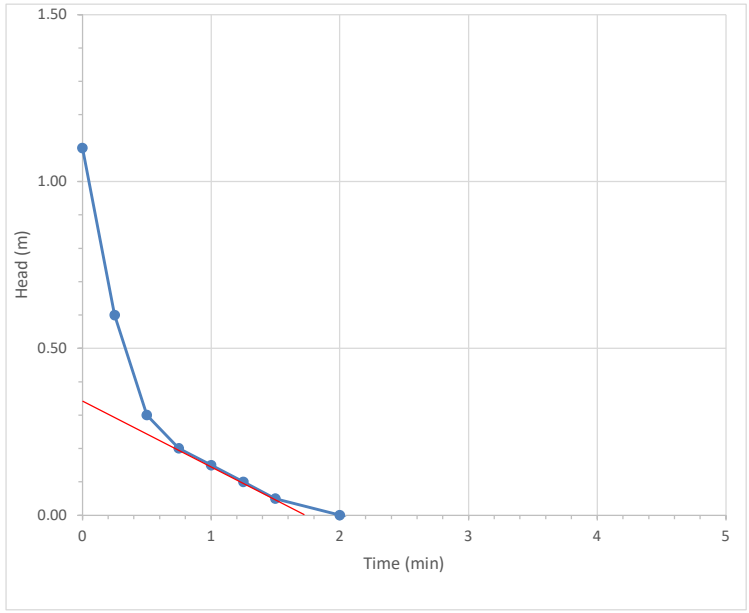
With Reference to Kent County Council - The Soakaway Design Guide, 2000

d	*Diameter of borehole*	0.10	m
D	*Diameter of base of borehole*	0.10	m
L	*Length of response zone*	2.10	m
Hp	*y intercept of tangent*	0.60	m
t_h	*x intercept of tangent*	2.70	min

Soakage = 250 Hp d^2 /D L t_h **2.65E+00** **l/m²/min**

Falling Head Soakage Test Calculations - GEG-24-821

WS06 (Test 2 of 2)			11/06/2024
Depth of borehole (m):			5.00
Time (sec)	**Time (min)**	**Depth from Surface (m)**	**Hp**
0	0	3.90	1.10
15	0.3	4.40	0.60
30	0.5	4.70	0.30
45	0.8	4.80	0.20
60	1.0	4.85	0.15
75	1.3	4.90	0.10
90	1.5	4.95	0.05
120	2.0	5.00	0.00
150	2.5	5.10	-0.10
160	2.7	5.12	-0.12
Date of Test:	09/05/2024		
End of Test			*KT / MP*



Notes:

Approximately 75 litres of water was poured into the standpipe (at a rapid rate) in order to conduct the test at the depth indicated.

WS06 (Test 2 of 2)			
With Reference to Kent County Council - The Soakaway Design Guide, 2000			
d	*Diameter of borehole*	0.10	m
D	*Diameter of base of borehole*	0.10	m
L	*Length of response zone*	2.10	m
Hp	*y intercept of tangent*	0.60	m
t_h	*x intercept of tangent*	1.75	min
Soakage	$= 250\ Hp\ d^2 / D\ L\ t_h$	4.08E+00	**l/m²/min**

Appendix C Flood Estimation Calculation Record

North St Albans

Hydrology Technical Note

November 2024

Hydrogreen Consulting Ltd
E: admin@hydrogreenconsulting.co.uk
M: 07943 457570

© Hydrogreen Consulting Ltd 2024

Document history

North St Albans

This document has been issued and amended as follows:

Version	Date	Description	Created by	Verified and Approved by
1.0	06/11/2024	Issued to client	M Green BEng, MSc, CEng, MCIWEM, C.WEM	M Green BEng, MSc, CEng, MCIWEM, C.WEM

Contents

Introduction 2

Objective 2

Data Availability 2

Subject site and catchment 2

Methodology 4

Applying losses to calculate net rainfall 5

Design Net Rainfall Results 7

Allowances for Climate Change 7

Assumptions and Limitations 7

Introduction

Hydrogreen Consulting Ltd were approached by PJA Civil Engineering Ltd to undertake a hydrological analysis for a proposed development site north of St Albans in order to derive design rainfall boundaries for input to a hydraulic model.

Objective

To derive rainfall boundaries for the catchment in the vicinity of the proposed development site shown in Figure 1 for the following return periods: 1 in 30 year, 1 in 30 year plus climate change, 1 in 100 year, 1 in 100 year plus climate change and 1 in 1000 year.

Data Availability

The data available for this study was as follows.

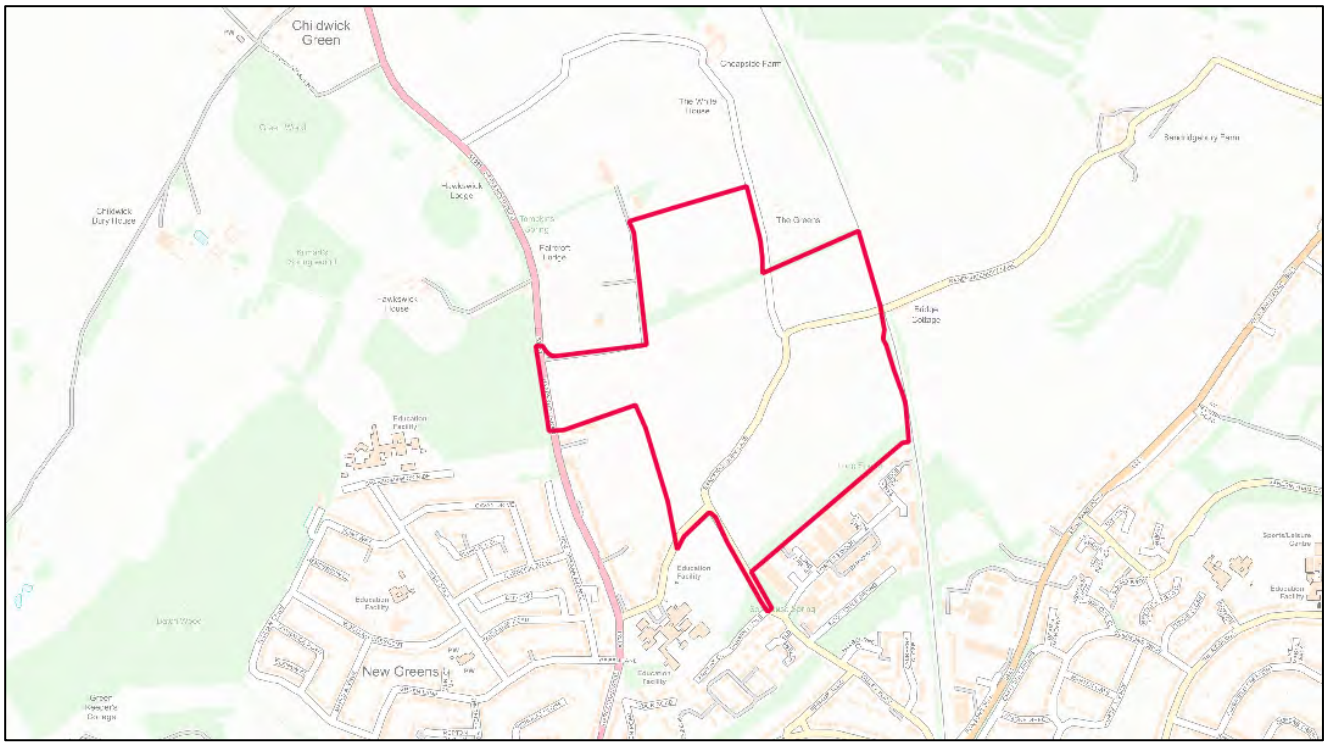
- Ordnance Survey (OS) Open Data.
- LiDAR Digital Terrain Model (DTM) data.
- Flood Estimation Handbook (FEH) web service catchment data (from website).
- Soils and geological data (from websites).

There are no useful gauges in the vicinity of the catchment and no dataset was available for calibration or verification of the hydrology.

Subject site and catchment

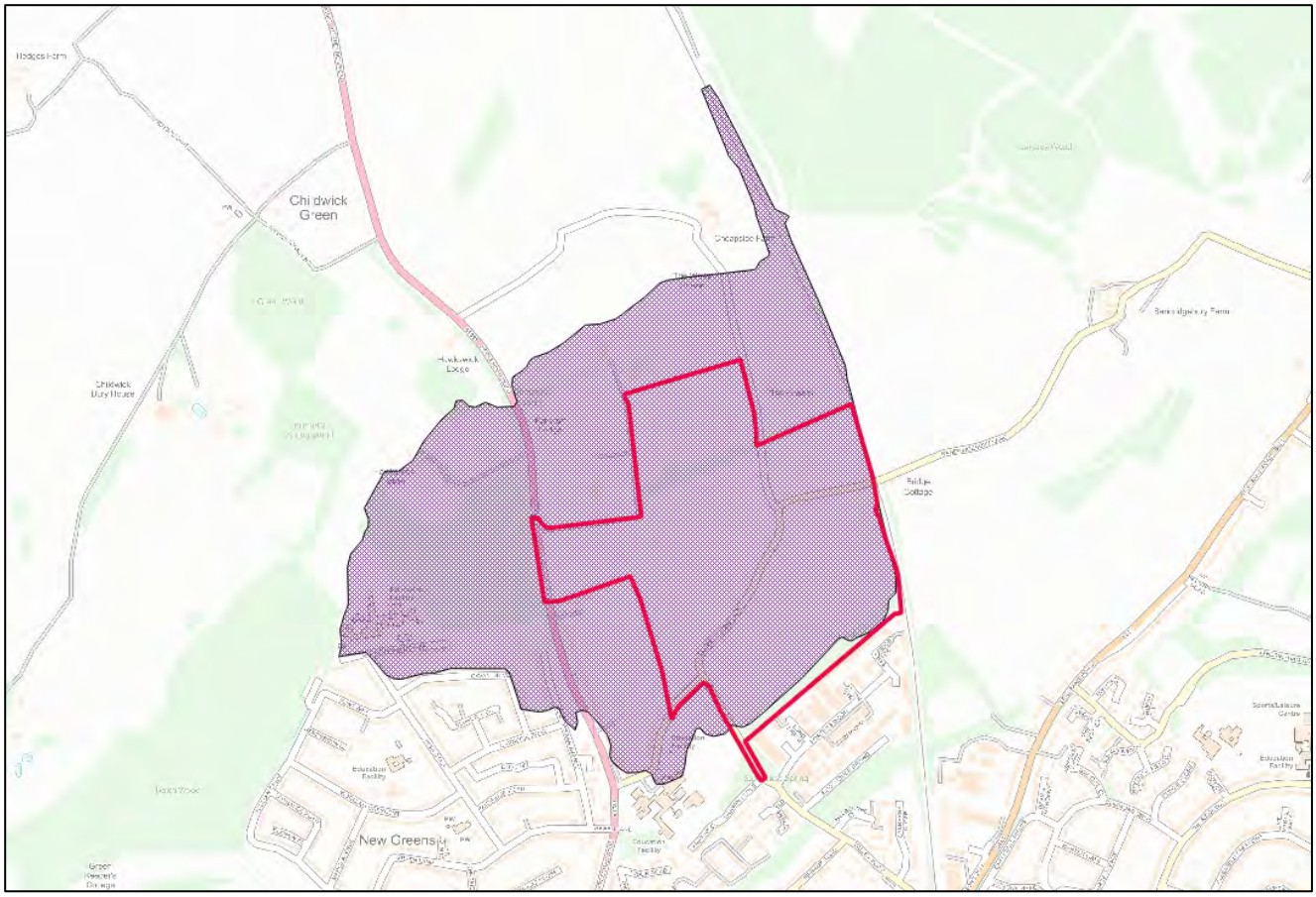
The catchment in the vicinity of the site is shown in Figure 2. The catchment boundary was derived using LiDAR DTM data and GRASS tools to accurately delineate the catchment. The nearest FEH catchment used to retrieve representative catchment descriptors from the FEH Web Service is shown in Figure 3. This was very similar to the subject catchment in terms of bedrock, soil types, degree of urbanisation and slope and was therefore a suitable donor to use for the catchment descriptors.

The catchment is small, rural and relatively shallow. Although it is underlain by chalk bedrock, overlying this is Clay-with-Flints Formation superficial deposits (for much of the catchment) and slightly acid loamy and clayey soils with impeded drainage. The default catchment descriptors from the FEH web service and any values updated as part of this study are given in Table 1. The values of URBEXT2000 were updated by means of calculating the urban area from the OS data using GIS.



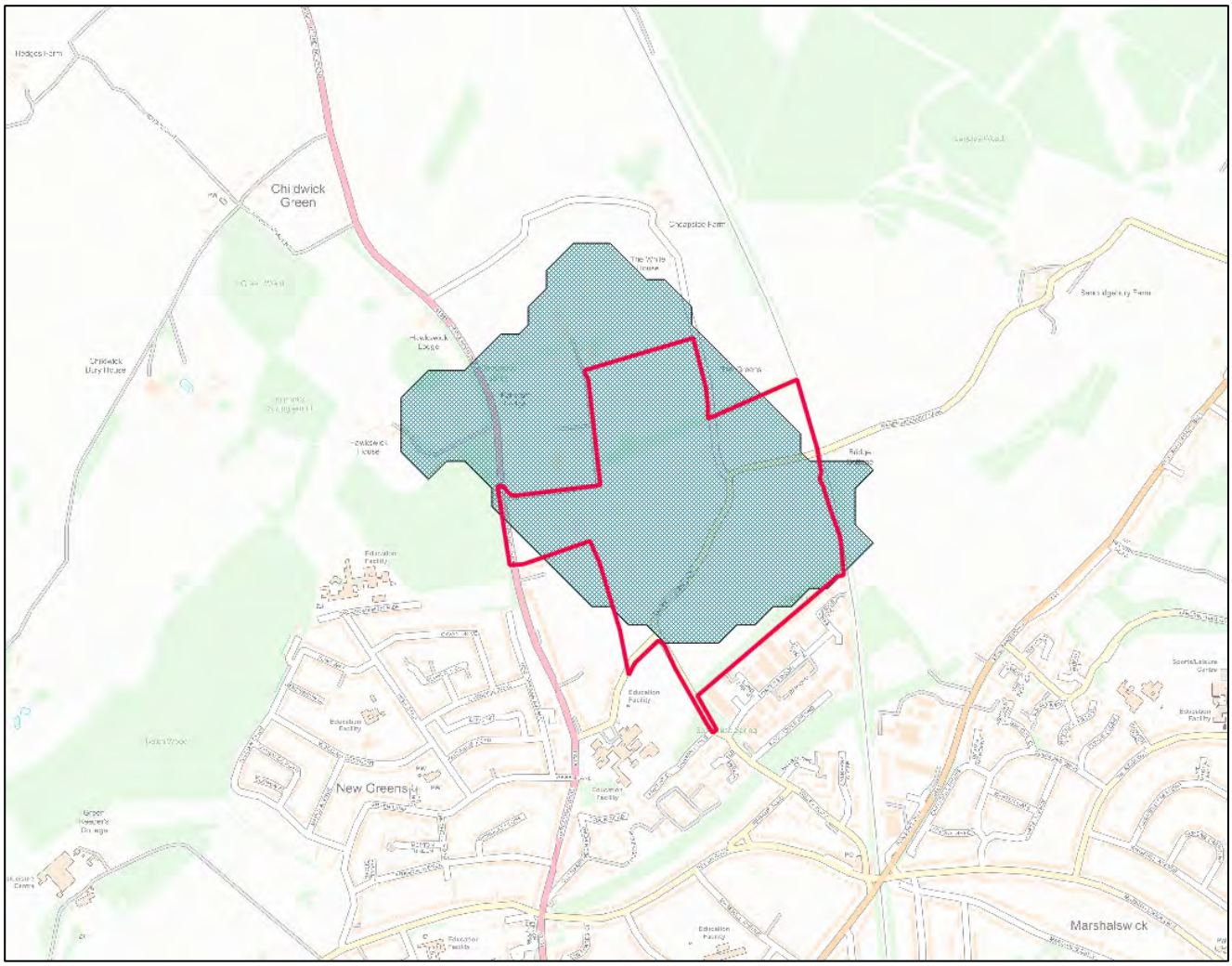
Contains OS data © Crown copyright and database right 2024

Figure 1: Proposed development site north of St Albans (shown with a red boundary)



Contains OS data © Crown copyright and database right 2024

Figure 2: Catchment near the proposed development site (shown shaded)



Contains OS data © Crown copyright and database right 2024

Figure 3: Nearest the FEH web service to the subject catchment (shaded)

Methodology

The Flood Estimation Handbook (FEH) is the current industry standard for fluvial flood estimation in the UK.

The main choices for deriving design net rainfall data within FEH are as follows.

- FEH 99 or FEH13 or FEH22 Depth Duration Frequency (DDF) rainfall models.
- FEH Standard Percentage Runoff (SPR), or ReFH 2.3 (Revitalised Flood Hydrograph) losses models.
- Whether to include sewer losses.

The most up-to-date FEH method for deriving rainfall and calculating losses when this analysis was undertaken was the FEH 22 DDF rainfall model and the ReFH 2.3 losses model, and these should normally be used unless there is good reason not to since there have a number of improvements

compared with previous methods (such as the FEH 99 DDF rainfall model and the FEH rainfall-runoff or ReFH1 losses models).[1]

Applying losses to calculate net rainfall

If the total design rainfall values for a given return period event are applied directly to a 2D hydraulic model then, unless instructed to do otherwise, the model will assume that 100% of the rainfall runs off the surface. In practice there will be some losses into the soil, the sewer network and, potentially, some evaporation. It is therefore necessary to consider these losses prior to applying event rainfall in the model in order to calculate the 'net rainfall' (rainfall which runs off the surface, with losses removed from the rainfall totals).

In urban environments, the main losses are twofold: infiltration losses and losses into the drainage network.

1. Infiltration losses into the soils

Infiltration losses are accounted for by applying a percentage runoff (PR) figure to the gross or observed rainfall. The ReFH2.3 model was initially used to calculate the percentage runoff and net rainfall based on the catchment soil types and the degree of urbanisation. This, however, resulted in an unrealistically low percentage runoff due to the high BFIHOST19 value of 0.64 for the catchment. This catchment has a high BFIHOST value (due to the underlying chalk) but also a relatively high SPRHOST value due to the clay soils. The ReFH2 model uses BFIHOST to calculate net rainfall which resulted in an underestimation of the net rainfall for this catchment. The SPRHOST value was therefore used instead for the percentage runoff by multiplying the total rainfall by the SPRHOST value to derive the net rainfall. The resultant total rainfall, net rainfall and percentage runoff values for the design events are shown in Table 2 below.

2. Losses into the drainage network

In urban environments it is also necessary to consider losses into the drainage network. These can be calculated by the model, if all sewers and drains (including highway drains) are included in the model, or an assumed figure can be used, in mm/hr, being taken away by the drainage network. 12 mm/hr is considered the typical drainage removal rate across catchments in England and Wales and was used by the Environment Agency in developing its national surface water mapping.

There was no data available regarding the sewer capacity in this catchment, and therefore the rainfall totals in Table 2 do not include the potential sewer capacity. This is a conservative assumption.

[1] See ReFH2 Technical Guidance, Wallingford Hydrosolutions 2016.

Table 1: Catchment descriptors for the catchment in the vicinity of the development site

Catchment descriptor name	From FEH web service	Value adopted (if different)	Comments	Units
AREA	0.7975	1.25	Updated using LiDAR	km^2
ALTBAR	117		Checked against OS contour and LiDAR data	mASL
ASPBAR	108			
ASPVAR	0.64			
BFIHOST	0.619		Checked against soil and bedrock data	
BFIHOST19	0.64		Checked against soil and bedrock data	
DPLBAR	0.76	0.97	Updated using equation 7.1 in FEH Vol. 5 p. 68.	km
DPSBAR	21		Checked against contour and LiDAR data	m/km
FARL	1		Checked against OS data	
FPEXT	0.0313			
FPDBAR	0.116			
FPLOC	0.485			
LDP	1.47			km
PROPWET	0.3			
RMED-1H	10.7			mm
RMED-1D	30.4			mm
RMED-2D	36.9			mm
SAAR	683			mm
SAAR4170	657			mm
SPRHOST	37.71		Checked against soil and bedrock data	%
URBCONC1990	0.808			
URBEXT1990	0.1912			
URBLOC1990	0.837			
URBCONC2000	-			
URBEXT2000	0	0.108	Updated based on OS data and google maps	
URBLOC2000	-			

Urbanisation was accounted for in the ReFH2.3 model by entering the urbanised area of 21.2 hectares directly into the ReFH2 software.

Design Net Rainfall Results

Different storm durations and profiles were run through the ReFH2.3 model and it was found that the critical scenario (that which produced the highest peak flow for the 1 in 100 year event) was the 6.25 hour storm duration using the winter rainfall profile – this was therefore adopted for the design model runs.

The resulting flood outlines, assuming no losses into the drainage network, were comparable with those found in the Environment Agency's (EA's) published surface water mapping in the area. In the absence of any further historical flooding information, or any known challenges to the EA's published surface water mapping in this area, this comparison was used to help in validating the model and hydrology. The final design net rainfall values, taken from the urbanised ReFH 2.3 model, are given in Table 2.

Allowances for Climate Change

The catchment falls within the Colne management catchment so the peak rainfall allowances for climate change used in this analysis are +35% for the 1 in 30 year return period and +40% for the 1 in 100 year return period (using the 2070s 'epoch').

Assumptions and Limitations

The net rainfall values have been derived for the purposes of this study and it is recommended that they are reviewed prior to use in future studies.

It has been assumed that the nearest FEH catchment is suitable to use as a donor for deriving the FEH catchment descriptors for the subject catchment. Inspection of the characteristics of both the subject catchment and the nearest 'donor' from the FEH web service suggests that the catchments are very similar, and this is therefore a reasonable assumption.

Table 2: Final design net rainfall (mm) values and corresponding percentage runoff figures

Time (min)	1 in 30 year			1 in 30 year +35%CC			1 in 100 year			1 in 100 year +40%CC			1 in 1000 year		
	Total Rain (mm)	**Net Rain (mm)**	% Runoff	Total Rain (mm)	**Net Rain (mm)**	% Runoff	Total Rain (mm)	**Net Rain (mm)**	% Runoff	Total Rain (mm)	**Net Rain (mm)**	% Runoff	Total Rain (mm)	**Net Rain (mm)**	% Runoff
0	0.30	**0.11**	38%	0.40	**0.15**	38%	0.37	**0.14**	38%	0.52	**0.20**	38%	0.63	**0.24**	38%
15	0.38	**0.14**	38%	0.51	**0.19**	38%	0.46	**0.18**	38%	0.65	**0.25**	38%	0.79	**0.30**	38%
30	0.47	**0.18**	38%	0.64	**0.24**	38%	0.58	**0.22**	38%	0.82	**0.31**	38%	0.99	**0.37**	38%
45	0.59	**0.22**	38%	0.80	**0.30**	38%	0.73	**0.28**	38%	1.02	**0.39**	38%	1.24	**0.47**	38%
60	0.74	**0.28**	38%	1.00	**0.38**	38%	0.92	**0.35**	38%	1.28	**0.48**	38%	1.55	**0.59**	38%
75	0.93	**0.35**	38%	1.25	**0.47**	38%	1.15	**0.43**	38%	1.61	**0.61**	38%	1.94	**0.73**	38%
90	1.16	**0.44**	38%	1.56	**0.59**	38%	1.43	**0.54**	38%	2.01	**0.76**	38%	2.43	**0.92**	38%
105	1.44	**0.54**	38%	1.95	**0.73**	38%	1.79	**0.67**	38%	2.51	**0.94**	38%	3.03	**1.14**	38%
120	1.80	**0.68**	38%	2.43	**0.91**	38%	2.23	**0.84**	38%	3.12	**1.18**	38%	3.77	**1.42**	38%
135	2.23	**0.84**	38%	3.01	**1.14**	38%	2.76	**1.04**	38%	3.87	**1.46**	38%	4.68	**1.76**	38%
150	2.75	**1.04**	38%	3.72	**1.40**	38%	3.41	**1.29**	38%	4.78	**1.80**	38%	5.78	**2.18**	38%
165	3.36	**1.27**	38%	4.53	**1.71**	38%	4.16	**1.57**	38%	5.83	**2.20**	38%	7.05	**2.66**	38%
180	3.77	**1.42**	38%	5.09	**1.92**	38%	4.68	**1.76**	38%	6.55	**2.47**	38%	7.91	**2.98**	38%
195	3.36	**1.27**	38%	4.53	**1.71**	38%	4.16	**1.57**	38%	5.83	**2.20**	38%	7.05	**2.66**	38%
210	2.75	**1.04**	38%	3.72	**1.40**	38%	3.41	**1.29**	38%	4.78	**1.80**	38%	5.78	**2.18**	38%
225	2.23	**0.84**	38%	3.01	**1.14**	38%	2.76	**1.04**	38%	3.87	**1.46**	38%	4.68	**1.76**	38%
240	1.80	**0.68**	38%	2.43	**0.91**	38%	2.23	**0.84**	38%	3.12	**1.18**	38%	3.77	**1.42**	38%
255	1.44	**0.54**	38%	1.95	**0.73**	38%	1.79	**0.67**	38%	2.51	**0.94**	38%	3.03	**1.14**	38%
270	1.16	**0.44**	38%	1.56	**0.59**	38%	1.43	**0.54**	38%	2.01	**0.76**	38%	2.43	**0.92**	38%
285	0.93	**0.35**	38%	1.25	**0.47**	38%	1.15	**0.43**	38%	1.61	**0.61**	38%	1.94	**0.73**	38%
300	0.74	**0.28**	38%	1.00	**0.38**	38%	0.92	**0.35**	38%	1.28	**0.48**	38%	1.55	**0.59**	38%
315	0.59	**0.22**	38%	0.80	**0.30**	38%	0.73	**0.28**	38%	1.02	**0.39**	38%	1.24	**0.47**	38%
330	0.47	**0.18**	38%	0.64	**0.24**	38%	0.58	**0.22**	38%	0.82	**0.31**	38%	0.99	**0.37**	38%
345	0.38	**0.14**	38%	0.51	**0.19**	38%	0.46	**0.18**	38%	0.65	**0.25**	38%	0.79	**0.30**	38%
360	0.30	**0.11**	38%	0.40	**0.15**	38%	0.37	**0.14**	38%	0.52	**0.20**	38%	0.63	**0.24**	38%

Hydrogreen Consulting Ltd
E: admin@hydrogreenconsulting.co.uk
M: 07943 457570

© Hydrogreen Consulting Ltd 2024

Appendix D Surface Water Drainage Strategy

A1 1:750 10 20 30 40 50

N W E S

Assumed car parking bays are permeable

Proposed sports pitch drainage design by TGMS

Rugby Pitch A
102m x 60m

Rugby Pitch B
120m x 70m

Rugby Pitch C
115m x 70m

Cricket Pitch

Pavillion
CL: 119.732
IL: 116.050

FW01
CL: 120.010
IL: 119.250

SW01
CL:119.700
IL:118.100

FW02
CL: 119.900
IL: 119.100

SW02
CL:118.800
IL:117.500

SW03
CL:118.200
IL:116.700

SW04
CL: 119.588
IL: 115.750

SW05
CL: 117.256
IL: 115.420

SW06
CL: 116.420
IL: 115.020

SW07
CL: 116.800
IL: 115.800

SW08
CL: 116.900
IL: 115.300

SW09
CL: 117.500
IL: 115.000

SW10
CL: 118.200
IL: 114.800

FW03
CL: 119.100
IL: 118.400

225mmØ
300mmØ
375mmØ

IT01

WS01

RISK ITEM No. 1

RISK ITEM No. 2

Infiltration Basin A-A
Basin IL: 114.150
Design water level: 114.650
Basin CL: 115.675
Attenuation Volume: 1,890m³
Storage Area: 2,220m²
Side Slopes: 1:3
Infiltration Rate: 2.63 x10^{-5} m/s

Proposed connection to sport pitch 160mmØ collector drain (designed by others)

Proposed connection to sport pitch 160mmØ collector drain (designed by others)

Inspection Chamber (proposed by TGMS)
CL: 116.689
IL Out: 116.139

Connection to existing Thames Water Manhole 101A
CL: 119.91
IL: 118.18
To be confirmed through survey

SURFACE WATER DRAINAGE STRATEGY

CATCHMENT	TYPE	ASSUMED PROPOSED DEVELOPMENT AREA (HA)	ASSUMED PROPOSED IMPERMEABLE AREA (ha)
A	Sports Pitch	4.20	1.05
B	Pavillion	0.06	0.06
C	Car park Access Area	0.04	0.04
TOTAL		4.30	1.15

KEY:

- Site Boundary
- Catchment A
- Catchment B
- Catchment C
- Indicative Location of Attenuation Basin & indicative Earthworks Buffer (1:3 Side Slopes)
- Indicative Location of Low Flow Channel
- Indicative Location of Proposed Surface Water Sewer and Manhole
- Infiltration Test location
- Window Sample location
- Proposed headwall
- Indicative Location of Proposed Surface Water Filter Drain
- Root protection zone
- Existing Thames Water Foul Water Sewer
- Indicative Location of Proposed Conveyance Swale
- Indicative Location of Proposed Water Foul Water Sewer
- Indicative Location of Proposed Gully

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. This Drawing is not to be reproduced in any part or form without the consent of PJA Environment Ltd. All copyright reserved.
2. No assessment of earthworks has been undertaken at this stage.
3. No utilities, ecological and arbor-cultural consideration.
4. Drawing should be read in conjunction with all other relevant scheme drawings.
5. Drawing Includes:
   - 5.1. Masterplan provided by Define in October 2025 (Drawing No: DE-565).
   - 5.2. Contour lines (0.5m) taken from Topographic Survey (not formally issued)
   - 5.3. Contour lines (1m) produced using 1m DTM LiDAR from the Environment Agency April 2022.
   - 5.4. OS Mapping (not formally issued)
   - 5.5. An infiltration rate of 2.63x10^{-5}m/s from location IT01 was used from the 2024 Geo Environmental Group Infiltration testing and ground water monitoring report (GEG-24-821/1T).
6. Surface Water Drainage Strategy based on:
   - 6.1. Attenuation Basin is 1.525m deep.
   - 6.2. Attenuation features to have a minimum 300mm freeboard.
   - 6.3. The proposed attenuation infiltrates through the base of the attenuation basin only.
   - 6.4. Drainage for sports pitches designed by others.
   - 6.5. Outfall rate from the sports pitch has been designed to the Loughborough Method, which assumes that 25% of the pitch area is impermeable.
   - 6.6. Assumed 100% impermeable for car park access areas and Pavillion..
   - 6.7. Assumed permeable surfacing for car park bays, to be made from material such as gravel or grasscrete.
   - 6.8. FEH-22 Rainfall Data used with CV 1.0 for Summer and Winter.
7. Woolams Playing field Proposed levels drawings [Ref:TGMS1284.4-1] provided by specialist consultant TGMS. Received 11th July 2024.
8. Tree Survey Plan [Ref:8575-T-01 Tree Survey Plan.pdf] and subsequent Root Protection zone (RPZ) indicatively shown on plan received from Hallam Land on 22nd January 2024.

RISK ITEM No.

Risk Item 1: No allowance has been made for additional inflows outside of the Loughborough method calculation from the sports pitch to enter proposed drainage network into the attenuation feature.

Risk Item 2: Proposed location of attenuation feature is in close proximity to existing Root Protection Zones (RPZ) and Ecology Buffer zone. The basin dimensions required to attenuate surface water are based on the accuracy of Topographical survey data.

REV	DATE	REVISION NOTE	BY
P06	22/10/2025	REVISED MASTERPLAN	SF
P05	23/09/2025	INFILTRATION RATE AND SWALE ADDED	AB
P04	19/03/2025	REVISED SWDS	SF
P03	04/12/2024	UPDATING RED LINE BOUNDARY	JJG
P02	15/11/2024	REVISED DRAINAGE STRATEGY	SF
P01	23/08/2024	DRAFT FOR COMMENT	NER

PJA
Seven House - High Street
Longbridge - Birmingham
B31 2UQ - Tel: 0121 475 0234
Birmingham - Bristol
Exeter - London - Reading
pja.co.uk

CLIENT
Hallam Land Management Limited and St Albans School

PROJECT
Woollam Park, St Albans

DRAWING TITLE
Indicative
Drainage Strategy
Sports Pitch Area

DRAWING ISSUE STATUS
INFORMATION

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05920	A	0503	P06

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@750	NER	GD	AUG 2024

© PJA Environment Limited. Copyright in this drawing and its contents is the property of PJA Environment Limited. Do not scale from this drawing.

A1 1:2000 0 20 40 60 80 100 120 140

Basin	Developable Area [ha]	Assumed Impermeable Area [ha]	Assumed Impermeable Area including 10% Urban Creep [ha]	Indicative Attenuation Volume [m3]
Catchment A	3.35	2.65	2.84	1,785
Catchment B	2.41	1.57	1.57	1,220
Catchment C	3.46	2.59	2.78	5,115
Catchment D	3.00	2.37	2.54	2,110
Catchment E	0.62	0.63	0.66	2,165
Catchment F, I, G and J	9.63	7.10	7.48	4,145
Catchment H	1.11	1.44	1.44	4,015
Catchment K	2.42	1.87	2.01	3,010
Catchment L	0.75	0.86	0.90	5,000
Total	**26.75**	**21.08**	**22.23**	**28,565**

KEY:

- Site Boundary
- Catchment A
- Catchment B
- Catchment C
- Catchment D
- Catchment E
- Catchment F
- Catchment G
- Catchment H
- Catchment I
- Catchment J
- Catchment K
- Catchment L
- Indicative Location of Attenuation Basin with 3m maintenance strip
- Indicative Location of Infiltration Basin with 3m maintenance strip
- Location of Infiltration Testing Location IT04
- Indicative Location of Low proposed Flow Channel
- Indicative Location of proposed Conveyance Feature
- Indicative Location of proposed Headwall
- Indicative Location of Railway Line
- Indicative Easement of 21m from the Railway Line (TBC)
- Indicative Location of Proposed Surface Water Sewer
- Indicative Surface Water Flow Route
- Indicative Location of Proposed Foul Water Pumping Station with and Storage Compound
- Indicative Location of Proposed Surface Water Flow Routing Channel (0.5m deep with 1:3 side slopes - 3.5m wide)
- Indicative Location of Proposed Surface Water Swale (1.0m deep, 0.5m base width with 1:4 side slopes)
- Indicative Location of Proposed Orifice Plate
- Indicative Location of Proposed Flow Control

Proposed sports pitch drainage to be designed by others

Proposed SuDS feature to provide attenuation for sports pitch drainage in separate drainage strategy (Ref. 05920-A-0503)

Catchment A:
CL: 117.25mAOD
IL: 115.95mAOD
Depth: 1.3m
Side Slopes: 1:4
Indicative Attenuation Storage Area: 2,465m²
Indicative Storage Volume: 1,785m³
Discharge Rate: 70.0l/s

Catchment B - Swale 1.004 and 1.005:
Depth: 1.0m (including 300mm freeboard)
Side Slopes: 1:4
A check dam will be integrated within the feature to slow the flow of water

Catchment B - Swale 1.001 and Swale 1.002:
Depth: 1.0m (including 300mm freeboard)
Side Slopes: 1:4
A check dam will be integrated within the feature to slow the flow of water.

Catchment B - Basin 3:
CL: 111.00mAOD
IL: 109.50mAOD
Depth: 1.5m
Side Slopes: 1:4
Indicative Storage Area: 1,615m²
Indicative Storage Volume: 1,220m³
Discharge Rate: 80.0 l/s

Catchment E:
CL: 107.50mAOD
IL: 105.20mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1:5
Indicative Storage Area: 2,130m²
Indicative Storage Volume: 2,165m³
Discharge Rate: 49.7l/s

Catchment C:
CL: 106.50mAOD
IL: 104.00mAOD
Depth: 2.5m
Side Slopes: 1:3 / 1:5
Indicative Storage Area: 4,305m²
Indicative Storage Volume: 5,115m³
Discharge Rate: 27.5l/s

Catchment D:
CL: 104.00mAOD
IL: 101.60mAOD
Depth: 2.4m (including Platform)
Side Slopes: 1:4 / 1:5
Indicative Storage Area: 4,605m²
Attenuation Storage: 2,110m³
Infiltration Rate: 1.88x10⁻⁵

IT04

Catchment L:
CL: 105.70mAOD
IL: 103.40mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 3,975m²
Attenuation Storage Volume: 5,000m³
Discharge Rate: 34.0l/s

Catchment K:
CL: 107.00mAOD
IL: 104.70mAOD
Depth: 2.3m (Including Platform)
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 3,675m²
Attenuation Storage Volume: 3,010m³
Discharge Rate: 47.0 l/s

Catchment H:
CL: 108.00mAOD
IL: 105.70mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 4,285m²
Attenuation Storage Volume: 4,015m³
Discharge Rate: 51.0 l/s

Catchment F, I, G and J:
CL: 108.525mAOD
IL: 106.225mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 3,415m²
Attenuation Storage Volume: 4,145m³
Discharge Rate: 235.0 l/s

PS

RISK ITEM No. 1

RISK ITEM No. 2

RISK ITEM No. 3

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. This Drawing is not to be reproduced in any part or form without the consent of PJA Civil Engineering Ltd. All copyright reserved.
2. No assessment of earthworks has been undertaken at this stage.
3. No assessment of surcharged outfall has been undertaken at this stage.
4. No utilities and arbor-cultural consideration has been undertaken at this stage.
5. Drawing should be read in conjunction with all other relevant scheme drawings.
6. Drawing Includes:
   - 6.1. Blue Green Infrastructure Plan provided by Define in September 2025 (Drawing No: DE_565_74_REV_E).
   - 6.2. Proposed Levels produced by PJA in September 2025(Drawing no. 05920-WR-A-0530)
   - 6.3. Tree Survey provided by FPCR dated December 2023 (8575-T-01)
   - 6.4. An infiltration rate of 1.88x10⁻⁵m/s from location IT04 was used from the 2024 Geo Environmental Group Infiltration Testing.
7. Indicative Surface Water Drainage Strategy based on:
   - 7.1. Attenuation Basin A is 1.3m deep with 1:4 side slopes (including 300mm freeboard)
   - 7.2. Attenuation Basin B3 is 1.5m deep with 1:4 side slopes (including 300mm freeboard).
   - 7.3. Attenuation Basins FIGJ, H, and K are 2.3m deep with platform to facilitate planting. Staged basin is 1m deep with 1:3 side slopes. From the proposed platform, the basin utilises 1:5 side slopes and is 1.3m in depth.
   - 7.4. Attenuation Basins L and E are 2.3m deep with platform to facilitate planting. Staged basin is 0.8m deep with 1:3 side slopes. From the proposed platform, the basin utilises 1:5 side slopes and is 1.5m in depth.
   - 7.4. Attenuation Basin C is 2.5m deep with platform to facilitate planting. Staged basin is 1m deep with 1:3 side slopes. From the proposed platform, the basin utilises 1:5 side slopes and is 1.5m in depth.
   - 7.5. Attenuation Basin D is 2.4m deep with platform to facilitate planting. Staged basin is 1.4m deep with 1:4 side slopes.From the proposed platform, the basin utilises 1:5 side slopes and is 1m in depth.
   - 7.6. Volume within conveyance features has not been included within the attenuation calculations at this stage.
   - 7.7. Discharge limited to an infiltration rate of 1.88x10⁻⁵m/s in accordance with the Geo Environmental Group Infiltration Testing.
   - 7.8. FEH 22 Data.
   - 7.9. Cv Values of 1.
8. Impermeable Area Assumptions:
   - 8.1. 60% impermeable for all residential development with an additional 10% for urban creep.
   - 8.2. 100% impermeable for all highways.
   - 8.3. 100% impermeable for all attenuation basins.
   - 8.4. 50% for all educational facilities.
   - 8.5. 80% for mixed used development
   - 8.6. 90% for commercial development.
9. Further consideration of utilities, arboricultural and ecological constraints should be undertaken prior to detailed design.
10. Indicative surface water drainage design based on masterplanning at the time of production and impermeable areas may result in changes to the drainage strategy.
11. Further ground investigation to confirm infiltration rates, seasonal groundwater levels and detail of the underlying chalk solubility is required.

RISK ITEMS:

Risk Item 1: Indicative Surface Water Drainage Strategy is subject to proposed development hydraulic modelling to refine surface water flood extents across the Site.

Risk Item 2: Indicative Surface Water Drainage Strategy is subject to a detailed earthworks and levels assessment.

REV	DATE	REVISION NOTE	BY
P11	26/09/2025	REVISED MASTERPLAN	AB
P10	20/08/2025	UPDATES TO HYDRAULIC MODELLING	SF
P09	04/12/2024	UPDATING RED LINE BOUNDARY	JJG
P08	04/11/2024	REVISED DRAINAGE STRATEGY	CT
P07	23/10/2024	LANDSCAPE STRATEGY UPDATED	GD
P06	16/10/2024	REVISED DRAINAGE STRATEGY	CT
P05	15/10/2024	REVISED DRAINAGE STRATEGY	CT
P04	07/10/2024	REVISED DRAINAGE STRATEGY	CT
P03	20/09/2024	REVISED DRAINAGE STRATEGY	CT
P02	19/08/2024	REVISED DRAINAGE STRATEGY	CT
P01	27/11/2023	DRAFT FOR COMMENT	GD

PJA
Seven House - High Street
Longbridge - Birmingham
B31 2UQ - Tel: 0121 475 0234
Birmingham - Bristol
Exeter - London - Reading
pja.co.uk

CLIENT
Hallam Land Management Limited and St Albans School

PROJECT
Woollam Park, St Albans

DRAWING TITLE
Surface Water Drainage Strategy

DRAWING ISSUE STATUS
PLANNING

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05920	-WR-	0525	-P11

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@2,000	CT	AC	Sept 2025

Copyright © PJA Civil Engineering Ltd

Appendix E Indicative proposed earthworks

A1 1:2000 40 60 80 100 120 140

Proposed Levels designed by TGMS in drawing Ref. TGMS1284.4 3 Rev 1)

CDM Note

These drawings have been produced with reference to the CDM Regulations 2015.
Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9.

Notes

1. Do not scale from this drawing.
2. All Dimensions in metres unless stated otherwise.
3. No utilities, ecological and arbor-cultural consideration.
4. Drawing should be read in conjunction with all other relevant scheme drawings.
5. Blue Green Infrastructure Plan provided by Define in September 2025 (Drawing No: DE_565_74_REV_E).
6. No assessment of surface water drainage attenuation requirements have been considered within the proposed earthworks.
7. No consideration has been made for the sports pitch earthworks.
8. Levels are in meters (above Ordnance Datum) unless otherwise noted.
9. The proposed level information in this drawing is in indicative and has been used to inform sit specific post development hydraulic modelling only. A detailed assessment of levels will be required at the next design stage.
10. This drawing is for information purposes only and should not be used for construction purposes. The indicative levels shown within this drawing have been produced to inform Hydraulic modelling requirements and the second iteration of a sitewide earthworks cut/fill strategy. Level information is subject to refinement and updates as more information is made available for the scheme and as the development site progresses through to detailed design.
11. The spine road alignments within this drawing are based upon the main highway links shown within the latest masterplan referenced above.
12. There are a series of existing Thames Water assets crossing the development site with associated easements. Depth information is required for these assets; however, indicative levels have been designed to be at existing level or above within the easement footprint of these assets.
13. Outside the extent of earthworks boundary shown on this drawing, the levels are to remain at existing.
14. Levels are in meters (above Ordnance Datum) unless otherwise noted.

Rev	Date	Revision Note	Drw	Chk	App
P05	26/09/25	REVISED MASTERPLAN	AB	SF	AC
P04	09/09/25	UPDATED TO REVISED SWDS	SF	AC	AC
P03	04/12/24	RED LINE BOUNDARY UPDATE	JJG	SF	SF
P02	22/10/24	SITE LAYOUT UPDATED	SRW		
P0	28/02/24	FIRST ISSUE	SF	AC	AC

PJA
transport • engineering • placemaking
Birmingham | Bristol | Cambridge | London | Manchester | Reading
Melbourne | Perth
pja.co.uk | pja.com.au

Client
Hallam Land

Project
Woollam Park, St Albans

Title
Indicative Proposed Levels

Drawing Issue Status
Draft

PJA Ref
05920

Scale @ A1
1:2000

Date
Sept 2025

Drawing No.
05920-WR-A-0530

Revision
P05

Primary Contact
alison.caldwell@pja.co.uk

Copyright © Phil Jones Associates Ltd / PJA Civil Engineering Ltd. Ordnance Survey License Number: xxxxx

File name:C:\USERS\AMY BENNETT\ONEDRIVE - PHIL JONES ASSOCIATES\SHAREDDATA - 05920 NORTH ST ALBANS\A- ENG\2 - DESIGN\DRAWINGS\CURRENT\05920-WR-A-0530-P05 PROPOSED LEVELS.DWG, printed on 01/10/2025 09:49:47, by Amy Bennett